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Research Spotlights

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Mitigating Traffic Congestion: The Role of Intelligent Transportation Systems (p. 653)

Zhi (Aaron) Cheng, Min-Seok Pang, Paul A. Pavlou

While massive investments in transportation infrastructure, traffic congestion remains a major societal and public policy problem. Intelligent transportation systems (ITS) have been proposed as a potential solution to this challenge, but their effectiveness has remained unclear. To examine whether and how ITS affect traffic congestion, we study traffic congestion and the deployment of a large federally supported ITS program in the United States—511 systems—in 99 urban areas between 1994 and 2014. We find that the adoption of 511 systems is associated with a significant decrease in traffic congestion, saving over \$4.7 billion and 175 million hours in travel time annually in U.S. cities. 511 systems also reduce about 53 million gallons of fossil fuel consumption and over 10 billion pounds of CO₂ emissions. We show abundant evidence that ITS help individual commuters to make better travel decisions, and that ITS help local governments to develop an urban traffic management capability. We also observe that the traffic-reducing effect of ITS is larger with more actual usage of the online services and when state and local governments incorporate more informative functionalities into the 511 systems. This study informs policymakers of ITS as a cost-effective means to mitigating traffic congestion.

Eye-Tracking-Based Classification of Information Search Behavior Using Machine Learning: Evidence from Experiments in Physical Shops and Virtual Reality Shopping Environments (p. 675)

Jella Pfeiffer, Thies Pfeiffer, Martin Meißner, Elisa Weiß

How can we tailor assistance systems, such as recommender systems or decision support systems, to consumers' individual shopping motives? How can companies unobtrusively identify shopping motives without explicit user input? We demonstrate that eye movement data allow building reliable prediction models for identifying goal-directed and exploratory shopping motives. Our approach is validated in a real supermarket and in an immersive virtual reality supermarket. Several managerial implications of using

gaze-based classification of information search behavior are discussed: First, the advent of virtual shopping environments makes using our approach straightforward, as eye movement data are readily available in next-generation virtual reality devices. Virtual environments can be adapted to individual needs once shopping motives are identified and can be used to generate more emotionally engaging customer experiences. Second, identifying exploratory behavior offers opportunities for marketers to adapt marketing communication and interaction processes. Personalizing the shopping experience and profiling customers' needs based on eye movement data promises to further increase conversion rates and customer satisfaction. Third, eye movement-based recommender systems do not need to interrupt consumers and thus do not take away attention from the purchase process. Finally, our paper outlines the technological basis of our approach and discusses the practical relevance of individual predictors.

Optimizing Two-Sided Promotion for Transportation Network Companies: A Structural Model with Conditional Bayesian Learning (p. 692)

Jinyang Zheng, Fei Ren, Yong Tan, Xi Chen

This research investigates the economic value of the new and essential features of transportation network companies (TNCs) and the effectiveness of running a two-sided sales promotion to help introduce those new features. We estimate the marginal economic values generated by the features of passenger matching, order cancellation, and online pay, thus shedding light on the TNC app attributions and designs. We further find that drivers underperceive the values of those features initially and need more usage experience to correct the bias. This finding demonstrates the significant role of usage experience in alleviating bias from uncertainty and supports the common industry practice of enhancing usage experience during product introduction. Our study also shows that the substantial value of early promotion not only encourages current usage but also fosters learning that sustains drivers' continued use of the app. Additional insights that, for example, cashback for passengers affects the decisions of drivers, and platform subsidy and bids from passengers might signal low quality of service can help the managers of

newly introduced products better design sales promotions in a more effective way.

When Online Lending Meets Real Estate: Examining Investment Decisions in Lending-Based Real Estate Crowdfunding (p. 715)

Yang Jiang, Yi-Chun (Chad) Ho, Xiangbin Yan, Yong Tan

Lending-based real estate crowdfunding, which involves the use of real estate to secure loans, has emerged as a promising alternative with lower risk than peer-to-peer lending. This study provides insights into understanding how lenders' investment behavior is shaped by various information in such an emerging market. Using a data set from a large platform over 17 months, the authors find that lenders as a whole prefer loans secured by a borrower's house to those secured by a mortgage, as reflected in quicker and larger lending transactions. Experienced lenders tend to invest more aggressively, in both time and amount, but exhibit a weaker preference for loans secured by a borrower's house. A rise in housing prices is associated with quicker lending decisions, and this association is found to be stronger for loans secured by a borrower's house. When stock market volatility is large, lenders tend to slow down their investments; such a tendency is attenuated for loans secured by a mortgage. The authors suggest that lender heterogeneity in responding to different collateral types should be incorporated into the platform's design of an automatic transaction or a recommender system. Moreover, platform managers should consider economic conditions at the macro level when deploying their marketing strategy.

Finding Useful Solutions in Online Knowledge Communities: A Theory-Driven Design and Multilevel Analysis (p. 731)

Xiaomo Liu, G. Alan Wang, Weiguo Fan, Zhongju Zhang

In this study, we utilize a kernel theory of knowledge adoption model and propose a novel text analytic framework to classify the usefulness of solutions in online knowledge communities. The study combines multiple disciplines (behavioral, empirical, design science, and technical) to tackle an important and relevant business problem: how to effectively manage an online knowledge repository and identify useful solutions. Our framework can be implemented in online knowledge communities to improve users' experience of searching for useful knowledge. The proposed framework has the potential to guide the development of customer-facing chatbots, which understand human-language questions and return helpful answers immediately.

A Switch in Time Saves the Dime: A Model to Reduce Rental Cost in Cloud Computing (p. 753)

Leila Hosseini, Shaojie Tang, Vijay Mookerjee, Chelliah Sriskandarajah

With the rapid growth of cloud computing, firms face a dizzying array of choices and pricing structures for performing their computing tasks on the cloud. Unlike captive computing resources, cloud computing occurs as a pay-as-you-go contract, similar to the provision of electricity. We develop a method to reduce the rental cost of completing a given computing task with a certain deadline. The current practice is to use a single computing resource that can get the task done in the cheapest possible manner. Instead, costs can be significantly reduced if the task is switched between multiple resources, some more powerful and others less powerful. We apply our method to a real computing task at Cidewalk and show that costs can be significantly reduced.

Video Killed the Radio Star? Online Music Videos and Recorded Music Sales (p. 776)

Tobias Kretschmer, Christian Peukert

We study how online video platforms affect the sales volume and sales distribution of recorded music. To do so, we study two events that removed and then partially restored access to online music videos for consumers in Germany. Because of a legal dispute, virtually all music videos were blocked from YouTube, which led to a decrease in record sales of about 5%–10%. When the dedicated platform Vevo entered a few years later, record sales increased again by a similar amount. This effect can be attributed to user-generated content (fan videos and cover versions) as much as to official music videos. Record sales of newcomer artists and mainstream music benefit disproportionately. We discuss the implications for debates on the reform of compulsory licensing rules and copyright.

Unemployment and Digital Public Goods Contribution (p. 801)

Michael Kummer, Olga Slivko, Xiaoquan (Michael) Zhang

Economic crises have a harmful effect on employment. However, whereas the resulting loss of jobs has been shown to have many negative consequences for the affected individuals, it may also push them into new activities, such as provision of service to their communities. In this paper, we show how individuals engage in socially useful activities after an increase in unemployment. Specifically, we document increased online content generation at Wikipedia, the world's largest user-generated knowledge repository. Leveraging German district-level

and European country-level unemployment data, we analyze the relationship between the economic crisis in 2008–2010 and contributions to Wikipedia. We find increased socially valuable activity in the form of knowledge acquisition and contributions to Wikipedia. For German districts, we observe an increase in the rate of content generation on Wikipedia in more severely affected districts. These effects are even stronger at the European country level. Our findings suggest that public goods provision increases as a positive side effect of economic crises. We stress that similar patterns could apply to other digital content platforms. Under the backdrop that the potential value of the outcome of online volunteering and its societal impact is expected to grow drastically in the next years, we show that platforms could benefit from negative economic conditions in attracting volunteers. Moreover, in the coming years, the rapid development of artificial intelligence will call for a rise of online volunteering platforms. Therefore, the potential value of the outcome of online volunteering and its societal impact is expected to grow drastically in the next years.

Examining the Heterogeneous Impact of Ride-Hailing Services on Public Transit Use (p. 820)

Yash Babar, Gordon Burtch

Over the past 10 years, app-enabled ride-hailing services such as Uber and Lyft have permeated several geographies, fundamentally changing the transit landscape. Ride-hailing services deliver an on-demand, door-to-door transport service that has the potential to interact with other preexisting modes of transport, potentially serving as a complement (e.g., expanding the geographic coverage of a transit mode) or as a replacement. In this study, the authors explore these effects on various modes of public transit across 200 cities in the United States, paying particular attention to the features of a transit mode and the local operating context. The study demonstrates that, on average, Uber has tended to displace city bus services while complementing commuter rail services. Further, the study demonstrates the importance of local context, in that the average effect on a particular transit mode is found to depend on a variety of surrounding factors, including weather patterns, rates of violent crime, gas prices, and the overall quality of the public transit services. This work offers actionable insights for policymakers, public-transit managers, and ride-hailing service operators. Estimates of the annual profit (cost) impacts that ride-hailing services have had on particular cities' transit services are provided.

When Loyalty Goes Mobile: Effects of Mobile Loyalty Apps on Purchase, Redemption, and Competition (p. 835)

Yoonseock Son, Wonseok Oh, Sang Pil Han, Sungho Park

This research investigates how a shift from traditional loyalty cards to mobile-driven loyalty apps affects consumers' reward redemption patterns, purchase behaviors, and store-level competition. The findings indicate that loyalty app adoption is associated with increased expenditure and purchase frequency as well as more active point redemption. In a multi-vendor loyalty program (MVLN) context, the use of loyalty apps is associated with spillover effects in which case customers visit more stores that they had not previously considered and exhibit diminished allegiance to their focal shop after they adopt a loyalty app. Finally, the adoption of loyalty apps is related to deal-prone behaviors because informed consumers tend to selectively purchase highly discounted products. Our findings provide several valuable implications for managers and platform owners who are considering launching mobile loyalty programs (LPs) and participating in an MVLN market. Although the merits of loyalty app adoption are apparent, we caution against potential downsides at individual store levels. Many customers are likely to succumb to deals, selectively purchasing highly discounted products with low margins through loyalty apps. The thrust of LPs should be directed toward fostering a strong connection with a brand, going beyond the promise of deals and promotions.

Cloud Services vs. On-Premises Software: Competition Under Security Risk and Product Customization (p. 848)

Zan Zhang, Guofang Nan, Yong Tan

Because of its on-demand feature and flexible pay-as-you-go mechanism, cloud service dramatically reduces the up-front information technology expenses that may deter many clients from implementing on-premises software. The associated security risks and low customization capability, however, create challenges for the adoption of cloud service. We study the competitive implications of security risks and customization capability on consumer purchase choices and vendors' pricing and investment strategies. Although cloud services are perceived to be more vulnerable to cyberattack, our results demonstrate that in

high-security-loss environments, using cloud service yields a lower average expected loss for consumers as compared with on-premises software. By endogenizing vendors' investment decisions, our investigation highlights that the cloud vendor does not necessarily economically benefit from investing in addressing cloud security, especially in low-security-loss environments. We also find that the on-premises vendor's security and customization investments act as strategic substitutes in low-security-loss environments and, under certain conditions, complement in high-security-loss environments. We further examine welfare-maximizing security investments and find that the socially optimal investment requires greater effort to improve cloud security in low-security-loss environments and to improve on-premises software security in high-security-loss environments.

Matching Mobile Applications for Cross-Promotion (p. 865)

Gene Moo Lee, Shu He, Joowon Lee,
Andrew B. Whinston

As the mobile app market grows rapidly, with millions of apps and billions of users, search costs are increasing tremendously. Similar to the case of recommender systems, the challenge is how apps can be recommended to the right users and how consumers can find the right apps. This paper studies a new mobile app ad framework, cross-promotion (CP), which is to promote new "target" apps within other "source" apps. With unique random matching experiment data, we empirically test the important determinants of ad effectiveness. We then propose a machine-learning-based framework to optimally match source apps to target apps to improve ad effectiveness in terms of app downloads and postdownload usages. The simulation results show that app analytics capability is essential in building accurate prediction models and in increasing ad effectiveness of CP campaigns and that, at the expense of privacy, individual user data can further improve the matching performance. The paper has important managerial implications because it provides direct guidance to better utilize CP for app developers and to leverage data analytics and machine-learning models for platform managers. It also provides policy implications on the trade-off between utility and privacy in the growing data economy.

Different but Equal? A Field Experiment on the Impact of Recommendation Systems on Mobile and Personal Computer Channels in Retail (p. 892)

Dongwon Lee, Anandasivam Gopal, Sung-Hyuk Park

The use of the mobile device has become increasingly common in retail settings as a way to interact with

retailers and as a channel for mobile commerce. Most retailers have chosen to extend the use of recommendation systems, commonly deployed on personal computer (PC)-based sites, to the mobile channel as well. However, do such recommendation systems provide the same functionality and efficacy on the mobile channel as they do on the PC channel? This remains unclear, because the mobile device presents users with more opportunities for purchases, thanks to its ubiquity and personal nature, as well as difficulties, because of the smaller form factor and compact screen sizes. In this paper, we study this specific question using field experiments conducted in collaboration with a South Korean retailer. Our results show that recommendation systems are more effective in mobile settings, all else being equal, suggesting that the higher search costs that are imposed by the mobile device's physical constraints can be somewhat offset by the recommendation system that allows users to explore related products in an interactive manner. Our work shows that any investments that retailers make in implementing recommendation systems for the mobile channel are likely to be well received and worth the investment.

More than Words in Medical Question-and-Answer Sites: A Content-Context Congruence Perspective (p. 913)

Chih-Hung Peng, Dezhi Yin, Han Zhang

Given the popularity and prevalence of medical question-and-answer (Q&A) services, it is increasingly important to understand what constitutes a helpful answer in the medical domain. Whereas prior studies have focused primarily on the independent impacts of content and source characteristics, we propose a content-context congruence perspective with a focus on the role of congruence between an answer's content and the answer's contextual cues. Using a unique data set from WebMD Answers, we find that an answer is perceived as more helpful if the language attributes of the answer's content are congruent with those of the preceding question, and if they are congruent with the disease's acuteness. Most user-generated content platforms offer guidelines for content contributors to guide their writing in ways more conducive to being helpful, and these guidelines typically prescribe a simplistic formula centered around characteristics of the "ideal" content without regard to context. Instead, we advise Q&A sites to educate content contributors about the pitfalls of following simple formulas and the diversity of readers looking for answers of different questions.

Developing and Testing a Theoretical Path Model of Web Page Impression Formation and Its Consequence (p. 929)

Xuhong Ye, Xixian Peng, Xinwei Wang,
Hock-Hai Teo

Impressions at first glance matter in the digital world in that they could lead to a lasting impact on credibility perceptions, usage intention, and user satisfaction. This research investigates how different forms of visual aesthetics (i.e., classical vs. expressive aesthetics) influence web page impression formation. We explicate a theoretical model of web page impression formation with a temporal sequence of processing stages: automatic visual processing, attentive visual processing, and impression formation, which in turn affects approach-avoidance tendencies. Our findings show the importance of web page impression at first glance, as it can significantly influence the approach tendency toward a web page. In addition, whether a web page can impress users positively depends on the arousal and attention induced by visual aesthetical elements under different time conditions. Our research also suggests that website designers and testers should attach importance to the balance between conservative and innovative designs to maximize their effects on web page impression formation.

A Tangled Web: Should Online Review Portals Display Fraudulent Reviews? (p. 950)

Uttara M. Ananthakrishnan, Beibei Li, Michael D. Smith

Consumers rely on review platforms when deciding where to stay, where to eat, what movies to watch, or even which doctor to use. This is great for consumers, but it has makes online review platforms a target for fraud. Review platforms have responded by developing tools and algorithms to identify potentially fraudulent reviews. But the question remains: What should platforms do with fraudulent reviews *after* detecting them? Our research answers this question using randomized experiments and large-scale data analysis from Yelp's review platform. Our results show that after detecting fraudulent reviews, platforms should keep them on their platforms, but should display them with a flag that identifies them as potentially fraudulent. Doing so will increase consumers' trust in the platform by demonstrating that the platform takes fraud serious and will also penalize dishonest businesses. Together, these results provide strong managerial and policy guidance to developing truthful, transparent, and accountable online ecosystems. Our research topic is particularly timely given the presence of misinformation on technology platforms, the incentives of actors to exploit anonymity to manipulate consumer beliefs, and the influence these actions can have on consumer trust.

Does Telemedicine Reduce Emergency Room Congestion? Evidence from New York State (p. 972)

Shujing Sun, Susan F. Lu, Huaxia Rui

Overcrowding in emergency rooms (ERs) is a common yet nagging problem. It not only is costly for hospitals but also compromises care quality and patient experience. Our paper provides solid evidence that telemedicine can significantly improve ER care delivery, especially in the presence of demand and supply fluctuations. We believe such findings are critical for ERs, due to the special setting of unscheduled arrivals leading to high unpredictability of patient traffic. Additional evidence suggests that the efficiency gained from telemedicine does not come at the expense of lower care quality or higher medical expenditure, which points to telemedicine as a feasible solution to the ER overcrowding problem. For healthcare practitioners, our paper highlights the general applicability of telemedicine through the "hub and spoke" architecture. Besides increasing patients' access to more immediate care from specialists who were not available otherwise, telemedicine enables flexible resource allocation for any hospitals, regardless of where hospitals are located. Our research also provides ground for policymakers to incentivize hospitals to adopt telemedicine in ER, which we believe is critical given the relatively low adoption rate, the lack of direct evidence on its effectiveness, and the current inflexibility of reimbursement policies regarding the application of ER telemedicine.

Appealing to Sense and Sensibility: System 1 and System 2 Interventions for Fake News on Social Media (p. 987)

Patricia L. Moravec, Antino Kim, Alan R. Dennis

Disinformation on social media—commonly called "fake news"—has become a major concern around the world, and many fact-checking initiatives have been launched in response. However, if the presentation format of fact-checked results is not persuasive, fact-checking may not be effective. For instance, Facebook tested the idea of flagging dubious articles in 2017, but concluded that it was ineffective and removed the feature. We conducted three experiments with social media users to investigate two different approaches to implementing a fake news flag—one designed to be most effective when processed by automatic cognition (System 1) and the other designed to be most effective when processed by deliberate cognition (System 2). Both interventions were effective, and an intervention that combined both approaches was about twice as effective. The awareness training on the meaning of the flags increased the effectiveness of the System 2 intervention but not the System 1 intervention. Believability influenced the extent to which users would

engage with the article (e.g., read, like, comment, and share). Our results suggest that both theoretical routes can be used—separately or together—in the presentation of fact-checking results in order to reduce the influence of fake news on social media users.

Data-Driven Promotion Planning for Paid Mobile Applications (p. 1007)

Manqi (Maggie) Li, Yan Huang, Amitabh Sinha

In this paper, we propose a two-step data-analytic approach to the promotion planning for mobile applications (apps). In the first step, we use historical sales data to estimate the app demand model and quantify the effect of price promotions on download volume. The estimation results reveal two interesting

characteristics of the relationship between price promotion and download volume of mobile apps: (1) the magnitude of the direct immediate promotion effect is declining within a multiday promotion; and (2) due to the visibility effect (i.e., apps ranked high on the download chart are more visible to consumers), a price promotion also has an indirect effect on download volume by affecting app rank, and this effect can persist after the promotion ends. Based on the empirically estimated demand model, we propose a moving planning window heuristic to construct a promotion policy. Our heuristic promotion policy consists of shorter and more frequent promotions. We show that the proposed policy can increase the app lifetime revenue by around 10%.