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### Research Spotlights

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### Handling Missing Values in Information Systems Research: A Review of Methods and Assumptions (p. 5)

Jiaxu Peng, Jungpil Hahn, Ke-Wei Huang

Data have never been more essential to the success of decision making. However, data are often messy. A perennial data challenge is missing values, which frequently occur in real-world data, such as unreported data items in public firms' financial statements and skipped product ratings from consumers. What is the influence of missing values and how should they be handled? Although we are in a big data era, missing values are not ignorable if data are missing for nonrandom reasons. In the case of product ratings, if only people who favor the product provide ratings while others put aside the product and do not respond, then even a simple mean estimation of the product rating would be significantly biased. Such bias challenges the validity of data analysis, and it cannot be eliminated simply by increasing the sample size of the data. To correct the bias arising from nonrandom missing values, it is necessary to examine and model what causes the missing values. We propose and demonstrate the superior performance of a Monte Carlo likelihood approach to correct the bias. Overall, we recommend well-designed data collection processes with documentation of the possible reasons for missing values, cautious adoption of missing value handling methods, and structured missing value reporting practices.

### Could Gamification Designs Enhance Online Learning Through Personalization? Lessons from a Field Experiment (p. 27)

Alvin Chung Man Leung, Radhika Santhanam, Ron Chi-Wai Kwok, Wei Thoo Yue

Online learning is of growing importance to institutions and learners, and the COVID-19 pandemic has underscored its importance even more. Because learner autonomy is relatively high in these online environments, they must engage in self-regulated learning processes to achieve successful learning outcomes, but studies show that most learners are not able to do so. Hence, in this longitudinal field experiment, using a massively open online course (MOOCs), a type of online learning environment, we investigate whether gamified

interventions through the learning platform can foster learners to engage in self-regulated learning processes and improve their learning outcomes. We find that gamification interventions are indeed useful, but for these gamification interventions to succeed, they must be designed to provide personalized feedback to learners that match with their learning goal-orientation. Overall, our findings point to the fact that gamification designs in online learning platforms can enhance learners' engagement and learning outcomes, but they must be personalized. A one-size-fits-all approach to gamification design in online learning just does not work and may even backfire to reduce the engagement of some learners.

### Self-Regulation and External Influence: The Relative Efficacy of Mobile Apps and Offline Channels for Personal Weight Management (p. 50)

Hyeokkoo Eric Kwon, Sanjeev Dewan, Wonseok Oh, Taekyung Kim

On the basis of a novel panel data set on customers enrolled in an actual weight loss program that delivers services through a mobile app and offline stores, this study shows that use of the mobile app is positively associated with weight management by both free and paid users. For paid users, who have access to the mobile app and office visits, usage of both channels is associated with short-term weight loss. Furthermore, the two channels function as substitutes for one another, with users able to compensate for infrequent offline store visits through more intense mobile app usage. In the long term, however, only mobile app usage (and not offline store visits) contributes to the *sustainability* of weight loss. Additional empirical analyses further reveal that frequency and granularity of mobile app usage are positively associated with weight loss. We also find that individuals exposed to low performance pressure benefit more fully from mobile app usage. Overall, the empirical results, together with qualitative evidence gleaned from interviews with actual customers, suggest that mobile app usage and the self-regulation that it enables exert a relatively greater impact on personal weight management compared with the external influence stemming from human experts in offline channels.

### Identification of Causal Mechanisms from Randomized Experiments: A Framework for Endogenous Mediation Analysis (p. 67)

Jing Peng

Experimental research often focuses on the overall treatment effect and the heterogeneity therein. Whereas this type of research allows us to understand the strength and direction of the treatment effect under different conditions, it does not directly speak to the generative mechanisms, namely, *why* and *how* the effect arises. A standard procedure to identify the mechanisms underlying a treatment effect is mediation analysis, but extant mediation analysis frameworks either have no causal interpretation or require the mediators to be unconfounded. Because mediators typically cannot be preassigned beforehand, their endogeneity remains a serious concern even in randomized experiments. This paper presents a flexible *endogenous mediation analysis* framework that still has causal interpretation when the mediator is endogenous. We discuss the identification conditions for different types of endogenous mediators, including unobserved or partially observed ones, under this framework. We show that endogenous mediation models can be parametrically identified without an instrumental variable when the generating process of the mediator is nonlinear. We further examine how the identification strengths of these models vary with a series of factors. Finally, we provide guidelines on when and how to use endogenous mediation analysis. We offer an R package that implements the proposed models.

### The Path to Hedonic Information System Use Addiction: A Process Model in the Context of Social Networking Sites (p. 85)

Isaac Vaghefi, Bogdan Negoita, Liette Lapointe

Addiction to hedonic information systems yields significant negative consequences for users. Although we know about the causes of addictions, particularly those related to individual differences, recent evidence suggests that addiction evolves gradually over time and is rooted in shared characteristics of users and technology. This paper provides a longitudinal perspective over how and why hedonic information systems (IS) use addiction develops. Based on our analysis, we break down this process into three phases characterized by different types of use, whether nominal, compulsive, or addicted. Each phase highlights salient psychological needs that motivate, technology features that enable, and affordances that are actualized into each type of use. We also provide a detailed account of individuals' self-control mechanisms, explaining how deficiencies in sensing, comparing, or regulating behavior facilitate one's transition toward addiction. These insights are applicable to other hedonic IS that are similar in terms of ubiquity and constant access through mobile apps.

They point to heterogeneous (preventive or intervening) strategies that can be used to help people regain their control over use, depending on where they are in their trajectory toward addicted use. Our findings carry implications for the design of systems and features that can help reduce the likelihood of addiction development.

### Are You What You Tweet? The Impact of Sentiment on Digital News Consumption and Social Media Sharing (p. 111)

Hyelim Oh, Khim-Yong Goh, Tuan Q. Phan

This study examines the impact of news content sentiment on digital news readership and social media sharing. Using econometric analyses and models estimated with rich clickstream data on online news readership and social media sharing data collected from Twitter, we find a differential effect of sentiment on news readership and sharing behaviors. Specifically, individuals are likely to read news articles with negative headline sentiment on the news website but tend to share articles with positive article sentiment on Twitter. Upon decomposition of news article sentiment, we find a contrasting positive author sentiment effect and a negative news topic valence effect on news readership. Interestingly, we uncover that an increase in a Twitter user's followers leads to an increase in the Twitter user's propensity to share positive-sentiment news articles. Overall, our findings affirm the cooperative but complementary relationship between news websites and social media platforms. Our results also guide publishers to better craft their news content and manage social media presence to improve audience engagement and readership outcomes while preserving the agenda-setting ability of news media. Importantly, given the dichotomy between news reading and sharing behaviors, predicting individual behaviors based on social media opinions may need to be viewed with prudence.

### sDTM: A Supervised Bayesian Deep Topic Model for Text Analytics (p. 137)

Yi Yang, Kunpeng Zhang, Yangyang Fan

This study proposes a novel supervised deep topic modeling approach for effective text analysis. This approach leverages the auxiliary data associated with text, such as ratings in consumer reviews or categories of posts in online forums, to enhance the discovery of latent topics in text. The proposed approach can effectively improve topic modeling performance in several ways. First, the learned latent topics are more meaningful and distinguishable, which helps text data exploration. Second, the latent topics discovered by the novel supervised deep topic model are more accurate, which improves the performance of downstream econometrics and predictive analytics that utilize latent topics as inputs. Given the

prevalence of auxiliary data in real-world text analysis tasks and the wide adoption of topic modeling in business research and practice, the study offers an effective solution for extracting insights from text data.

**Augmenting Password Strength Meter Design Using the Elaboration Likelihood Model: Evidence from Randomized Experiments** (p. 157)

Warut Khern-am-nuai, Matthew J. Hashim, Alain Pinsonneault, Weining Yang, Ninghui Li

In this research, we study an effective method to encourage users to generate stronger passwords. Specifically, we propose a novel design of password strength meters that incorporates contextual information to help users digest the message generated by the password strength meter. We evaluate our design by leveraging three independent and complementary methods: a survey-based experiment using students to evaluate the saliency of our conceptual design (proof of concept), a controlled laboratory experiment conducted on Amazon Mechanical Turk to test the effectiveness of the proposed design (proof of value), and a randomized field experiment conducted in collaboration with an online forum in Asia to establish proof of use. In each study, we observe that users exposed to the proposed password strength meter are more likely to change their passwords, leading to a new password that is significantly stronger. Our findings suggest that the proposed design of augmented password strength meters is an effective method for promoting secure password behavior among end users. Our design also requires minimal computational resources and technical capabilities.

**The Impact of Social Reputation Features in Innovation Tournaments: Evidence from a Natural Experiment** (p. 178)

Swanand J. Deodhar, Samrat Gupta

With firms increasingly relying on external knowledge resources for solving complex problems, the role of digital platforms, which make this external search efficient, has become significant. For such platforms, of which Kaggle is an example, a perennial challenge is to elicit high-quality solutions from their voluntary contributors. To this end, our work underscores the importance of platform-wide design decisions for the quality of solutions that the platform's users generate. We show that a social feature that offers reputational gain may lead to significant quality improvements. Therefore, we recommend that platforms should view such features more favorably and include them. In addition, our work also suggests that firms that are using digital platforms to engage with external knowledge sources should time their activities, keeping in mind platform-wide design changes given that such changes can directly impact the firm's surplus.

**Getting Personal: A Deep Learning Artifact for Text-Based Measurement of Personality** (p. 194)

Kai Yang, Raymond Y. K. Lau, Ahmed Abbasi

Analysts, managers, and policymakers are interested in predictive analytics capable of offering better foresight. It is generally accepted that in forecasting scenarios involving organizational policies or consumer decision making, personal characteristics, including personality, may be an important predictor of downstream outcomes. The inclusion of personality features in forecasting models has been hindered by the fact that traditional measurement mechanisms are often infeasible. Text-based personality detection has garnered attention due to the public availability of digital textual traces, however state-of-the-art models proposed by IBM, Google, Facebook, and academic research are not accurate enough to be used for downstream real-world forecasting tasks. We propose a novel text-based personality measurement approach that improves detection of personality dimensions by 10–20 percentage points relative to the best existing methods developed in industry and academia. Using case studies in the finance and health domains, we show that more accurate text-based personality detection can translate into significant improvements in downstream applications such as forecasting future firm performance or predicting pandemic infection rates. Our findings have important implications for managers focused on enabling, producing, or consuming predictive analytics for enhanced agility in decision making.

**Digital Multisided Platforms and Women's Health: An Empirical Analysis of Peer-to-Peer Lending and Abortion Rates** (p. 223)

Gorkem Turgut Ozer, Brad N. Greenwood, Anandasiyam Gopal

Access to short-term capital remains a pressing problem for many people, especially those facing medical emergencies or needing immediate care. Peer-to-peer lending platforms have the ability to resolve these capital constraints by providing access to small to medium sums of money in an environment that is private and protective of personal information. In this study, we consider how the introduction of P2P lending platforms, and the resulting access to capital, influences local abortion rates, a medical procedure characterized by significant financial barriers and social stigma. We find that the entry of the P2P platform LendingClub is associated with an increase in the rate at which women choose to not carry to term. We argue that the availability of capital through these platforms, when combined with privacy protections, is able to reduce the financial barriers women face when accessing abortion services. This observed effect is stronger in more religious areas and areas with lower levels of education, indicating that

social frictions and stigma may be higher in these areas, and also showing where providing an additional channel for funding is more influential.

**Excessive Mobile Use and Family-Work Conflict: A Resource Drain Theory Approach to Examine Their Effects on Productivity and Well-Being** (p. 253)

Massimo Magni, Manju K. Ahuja, Chiara Trombini

Given the pervasiveness of mobile technologies, it is important for organizations to gain a better understanding of the potential benefits and unexpected negative consequences of mobile use. Recent research outlined that 76% of employees in the United States handled work-related e-mails during nonwork time, and this phenomenon has been further amplified by the COVID-19 pandemic, which emphasized the pivotal role of constant connectivity and distributed work arrangements. Our research aims at providing a better understanding of why individuals engage in excessive use of mobile devices for work purposes during nonwork time and to elucidate the effects of such behavior. Our results show that investing time and energy in family demands during work time reduces individuals' ability to fulfill job demands and leads to excessive mobile use during nonwork time. Such excessive use increases the individual perception productivity, but it comes at a cost in terms of physiological, psychological, and relational well-being because it prevents individuals to restore their energies. Our results show also that a competitive climate within the organization exacerbates such negative effects on well-being, thus elucidating the pivotal role of organizational policies and interventions in supporting a responsible use of mobile technologies.

**Moving Consumers from Free to Fee in Platform-Based Markets: An Empirical Study of Multiplayer Online Battle Arena Games** (p. 275)

Le Wang, Paul Benjamin Lowry, Xin (Robert) Luo, Han Li

Companies in platform-based business markets have widely embraced freemium business models, in which profit is primarily determined by a minority of paying customers. However, the key challenge of these models is transitioning participants from free users to paying consumers. To encourage paid consumption, companies often rely on product differentiation such as providing consumers who pay for products or services with enhanced features. Product differentiation can be broadly classified into two categories: taste differentiation and quality differentiation. The authors demonstrate that extending the magnitude of taste differentiation is an effective differentiation strategy. Quality differentiation, however, is a double-edged sword and should be used with care. Increasing product differentiation leads to greater perceived value of the service, but undermines fairness perceptions.

**The Hidden Costs and Benefits of Monitoring in the Gig Economy** (p. 297)

Chen Liang, Jing Peng, Yili Hong, Bin Gu

Monitoring is ubiquitous in the gig economy wherein the workforce is geographically dispersed. However, workers are often reluctant to be monitored because of privacy concerns, resulting in a hidden economic cost for employers as workers demand higher wages for monitored jobs. We investigate how three common dimensions of monitoring affect workers' willingness to accept monitored jobs through online experiments on two gig economy platforms. The three dimensions of monitoring are *intensity* (how much information is collected), *transparency* (whether the monitoring policy is disclosed to workers), and *control* (whether workers can remove sensitive information). We find that, as the monitoring intensity increases, workers become less willing to accept monitoring because of elevated privacy concerns. Furthermore, being transparent about the monitoring policy increases workers' willingness to accept monitoring only when the monitoring intensity is low. Interestingly, providing control over high-intensity monitoring does not significantly reduce workers' privacy concerns, rendering this well-intentioned policy ineffective. Finally, females are more willing to accept monitored jobs than males as they perceive higher payment protection from monitoring and have lower privacy concerns. On average, the hourly wage compensation required for gig workers to accept monitoring is 1.6~1.8 dollars, which amounts to roughly 28.6%~37.5% of their average hourly wage.

**Effects of Managerial Response to Negative Reviews on Future Review Valence and Complaints** (p. 319)

T. Ravichandran, Chaoqun Deng

This paper develops a framework to classify negative reviews and managerial responses and examines how the fit between the complaints and responses shapes the customers' complaining behavior in the future. We focus on the mix of rational and emotional cues in exploring the fit of managerial responses to negative reviews. When the complaints pertain to the service delivery process such as speed and flexibility, managers should explain the reasons for the service failure and the steps taken to address such failures. When customers complain only about the nature of their interactions or along with grievances about the services not aligning with their needs, managers should apologize and provide emotional gratification to customers. When customers complain that they were discriminated against, they were not getting what they deserve, or the service did not meet their requirements, managers should respond with both rational cues that explain the discrepancy between actions and expected outcomes and emotional cues that satisfy the customer need for emotional gratification. Firms are increasingly using template responses

to customer complaints. A more deliberate approach of carefully tailoring the responses to negative reviews is beneficial in online review forums. A data-driven approach of extracting and classifying the nature of complaints according to our proposed framework, using machine-written skeletons (using generative AI) in their responses to target some specific reviews and tailoring such responses could allow firms to deal with the large review volumes in a more effective manner.

**Going Beyond Deterrence: A Middle-Range Theory of Motives and Controls for Insider Computer Abuse** (p. 342)

A. J. Burns, Tom L. Roberts, Clay Posey, Paul Benjamin Lowry, Bryan Fuller

Reports indicate that employees are willing to share sensitive information under certain circumstances, and one-third to half of security breaches are tied to insiders. These statistics reveal that organizational security efforts, which most often rely on deterrence-based sanctions to address the insider threats to information security, are insufficient. Thus, insiders' computer abuse (ICA)—unauthorized and deliberate misuse of organizational information resources by organizational insiders—remains a significant issue for industry. We present a motive–control theory of ICA that distinguishes among instrumental and expressive motives and internal and external controls. Specifically, we show that organizational deterrents (e.g., sanctions) do not create motives for ICA, but weaken existing motives (e.g., financial benefits). Conversely, financial benefits and psychological contract violations create motives to perform ICA, and insiders' self-control diminishes the influence of these motives. The implications for practice are threefold: (1) organizations should make efforts to reduce psychological contract breach for employees by increasing the congruence between expectations and reality to reduce expressive motives for ICA;

(2) organizations should seek maintain personnel with adequate self-control to diminish the impact of harmful ICA motives should they arise; and (3) organizations should develop targeted sanctions for committing ICA to control the harmful influence of financial motives.

**When More Can Be Less: The Effect of Add-On Insurance on the Consumption of Professional Services** (p. 363)

Hongfei Li, Jing Peng, Xinxin Li, Jan Stallaert

The emergence of online platforms for professional services (e.g., cosmetic procedures) represents a natural progression of e-commerce from search and experience goods to credence goods. Because of the deeply consequential nature of professional services and the large information asymmetries between customers and service providers, designing effective risk-reduction strategies is crucial for facilitating digital transactions of professional services. This paper studies whether and how the introduction of a novel risk-reduction strategy, the add-on insurance covering the potential cost of negative consequences (e.g., complications and unsatisfactory outcomes), affects the demand for professional services in online platforms. We leverage a policy change in an online platform for cosmetic procedures, which started to offer the add-on insurance for a subset of procedures in 2016. Our empirical analysis shows that the introduction of insurance increases the sales of low-risk procedures, but not those of high-risk ones. More importantly, the insurance has a negative spillover effect on uninsured competitors, regardless of their risk levels. The negative spillover effect on high-risk procedures is noteworthy because it hurts the sales of their uninsured competitors without increasing their own sales, reducing the overall demand. Our findings have important implications for platforms to design, deploy, and evaluate their risk-reduction strategies.