# TONG (JOY) LU

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## EDUCATION

**University of Pennsylvania**, Philadelphia, PA – May 2018 (Expected)
Ph.D. in *Marketing*, Dual A.M. in *Statistics*, The Wharton School
Dissertation Co-Advisors: Eric T. Bradlow and J. Wesley Hutchinson
Other Committee Members: Robert J. Meyer, David R. Bell, and Colin F. Camerer

**California Institute of Technology**, Pasadena, CA – June 2013
B.S. in *Economics* and in *Engineering & Applied Science (Computation & Neural Systems)*

## RESEARCH INTERESTS

Mathematical models of consumer behavior, media consumption, bounded rationality, information processing, product search

## PUBLICATION AND PAPERS UNDER REVIEW

Hutchinson, J. Wesley, **Joy Lu**, and Evan Weingarten (2016), "Visual Attention in Consumer Settings," In *International Handbook of Consumer Psychology*, eds. Cathrine Janssen-Boyd and Magdalena Zawisza.

**Lu, Joy**, Uma Karmarkar, and Vinod Venkatraman, "Planning to Binge: How Consumers Choose to Allocate Time to View Sequential Versus Independent Media Content," under review at *Journal of Marketing Research.*

Colas, Jaron T., and **Joy Lu**, "Learning Where to Look for High Value Improves Decision Making Asymmetrically," under review at *Frontiers in Psychology*.

## WORKING PAPERS

**Lu, Joy**, Eric T. Bradlow, and J. Wesley Hutchinson, "Binge Consumption of Online Content."

**Lu, Joy**, and J. Wesley Hutchinson, "Split-Second Decisions During Online Information Search: Static vs. Dynamic Decision Thresholds for Making the First Click."

**Lu, Joy**, and Liangbin Yang, "Keep Winning or Stop Losing? The Effects of Consumption Outcomes on Customer Engagement in Experiential Products," data awarded by the Wharton Customer Analytics Initiative (WCAI)

Yildirim, Pinar, Yanhao Wei, and **Joy Lu**, "Social Networks for Nudges: Optimal Design of Communities to Motivate Consumer Behavior."

## SELECTED RESEARCH IN PROGRESS

**Lu, Joy**, Pinar Yildirim, Yanhao Wei, and Szu-chi Huang, "Behavioral Evidence of the Effects of Network Design on Peer Influence."

Hutchinson, J. Wesley, **Joy Lu**, and Colin Camerer, "Behavioral Game Theory as a Model of Consumer Behavior."

## CONFERENCE PRESENTATIONS

**Lu, Joy**, and Liangbin Yang (June 2017), "Keep Winning or Stop Losing? The Effects of Consumption Outcomes on Customer Engagement in Experiential Products." *ISMS Marketing Science Conference,* Los Angeles, CA.

**Lu, Joy**, and J. Wesley Hutchinson (March 2017), "Split-Second Decision Making During Online Information Search: Static vs. Dynamic Stopping Rules," *Frank M. Bass UTD FORMS Conference,* Dallas, TX.

**Lu, Joy**, and Liangbin Yang (February 2017), "Keep Winning or Stop Losing? The Effects of Consumption Outcomes on Customer Engagement in Experiential Products." *Society for Consumer Psychology,* San Francisco, CA.

**Lu, Joy**, and J. Wesley Hutchinson (September 2015, Poster), "From Web to Wardrobe: Joint Modeling of Eye Movements and Decisions." *Society for Neuroeconomics Annual Meeting,* Miami, FL.

**Lu, Joy**, and Liangbin Yang (June 2015), "Keep Winning or Stop Losing? The Effects of Consumption Outcomes on Customer Engagement in Experiential Products." *WCAI Research Symposium,* San Francisco, CA.

**Lu, Joy**, and J. Wesley Hutchinson (June 2015), "From Web to Wardrobe: Joint Modeling of Eye Movements and Decisions." *ISMS Marketing Science Conference,* Baltimore, MD.

**Lu, Joy**, and J. Wesley Hutchinson (May 2015), "From Web to Wardrobe: Joint Modeling of Eye Movements and Decisions." *Interdisciplinary Symposium on Decision Neuroscience,* Boston, MA.

**Lu, Joy**, and J. Wesley Hutchinson (March 2015), "From Web to Wardrobe: Joint Modeling of Eye Movements and Decisions." *Mid-Atlantic Marketing Doctoral Symposium,* Philadelphia, PA.

## GRANTS AND AWARDS

Patty and Jay H. Baker Ph.D. Fellowship 2014-2015, 2017 ($10,000)
Russell Ackoff Doctoral Student Fellowship 2015 ($1,500)
Mack Institute Grant 2015 ($1,500)
David M. Grether Prize in Social Science 2013

**TEACHING EXPERIENCE**

Teaching Assistant, Consumer Neuroscience, Spring 2017 (Instructor: J. Wesley Hutchinson)
Teaching Assistant, Marketing Research, Spring 2017 (Instructor: Gideon Nave)
Guest Lecturer, Design Fundamentals and Applications in Business, Spring 2016
(Instructor: Cathy Schrand)
Teaching Assistant, Marketing Research, Fall 2015 (Instructor: Young-Hoon Park)
Teaching Assistant, Marketing Research, Spring 2015 (Instructor: Qiaowei Shen)
Teaching Assistant, Consumer Behavior, Fall 2014 (Instructor: Gizem Saka)

**RELEVANT COURSEWORK**

Microeconomic Theory (Mallesh Pai)
Research Methods in Marketing (Wes Hutchinson)
Judgment and Decision Making Perspectives on Consumer Behavior (Gal Zauberman)
Applied Econometrics I (Paul Shaman)
Empirical Models in Marketing (Eric Bradlow)
Measurement and Data Analysis in Marketing (Christophe Van den Bulte)
Applied Econometrics II (Paul Shaman)
Game Theory & Applications (Yuichi Yamamoto)
Information Processing Perspectives in Consumer Behavior (Patti Williams)
Bayesian Methods & Computation (Shane Jensen)
Cognitive Neuroscience: Seminar fMRI Data Analysis (Russell Epstein)
Statistical Methodology (Andreas Buja)
Experimental Economics (Jeremy Tobacman)
Economic/OR Models in Marketing (Jagmohan Raju, Ron Berman)
Observational Studies (Dylan Small)
Empirical Methods in Industrial Organization (Holger Sieg)
Probabilistic Models of Perception and Cognition (Alan Stocker)
Modern Regression (Richard Berk)

**REFERENCES**

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**APPENDIX I: DISSERTATION OVERVIEW**

**Title: Essays on Dynamic Updating of Consumer Preferences**

**Essay 1: Split-Second Decisions During Online Information Search: Static vs. Dynamic Decision Thresholds for Making the First Click**

      Just like the physical entrance of a brick-and-mortar store, the landing page of an online retailer serves to draw people deeper into the website. As with most sequential behaviors, landing page decisions are likely to have important downstream consequences. Our objective is to explore the internal decision processes and external characteristics of the shopping environment that determine how extensively shoppers search on the landing page. Using eye-tracking data collected during an incentive-compatible online shopping experiment, we build a sequential sampling model that captures how product information is acquired through "split-second" eye fixation decisions. The model assumes that the shopper clicks on a fixated link when the perceived value of that link crosses a decision threshold; otherwise, the shopper continues to search the landing page. First, we investigate whether this decision threshold varies over time, either in a "next-step" way that takes into account the potential gains of continuing search with one more fixation, or in a "whole-search" way that heuristically accounts for how the value of search changes over time. We find that whole-search dynamics better fit the data compared to next-step dynamics and the static threshold. Second, through counterfactual simulations, we demonstrate that under the assumptions of our model, the length of search changes significantly if products are ordered by individual shopper preferences on the page (i.e., worst-first or best-first), and then verify these predictions empirically in a follow-up incentive-compatible experiment. Our work contributes to the emerging stream of research that treats eye fixations as endogenous decisions and provides implications for how retailers should position products within the layout of an online store.

**Essay 2: Keep Winning or Stop Losing? The Effect of Consumption Outcomes on Variety-Seeking in Online Video Games**

      As consumers engage in experiential products, they may exhibit variety-seeking behavior by switching frequently between different options within the same category, or exhibit inertial behavior by consistently choosing the same option. The prior literature identifies three main reasons why consumers may be variety-seeking: external situations, satiation, and future preference uncertainty. We propose that consumers may also become variety-seeking in response to consumption outcomes, which indicate the quality of the consumer's experience for a specific consumption occasion. We predict that positive consumption outcomes lead to inertial preferences, while negative consumption outcomes lead to variety-seeking. We test our hypothesis within the novel context of an online video game, in which players choose between different map environments for each round of play and consumption outcomes can be measured objectively by a player's performance during the round. In our preliminary model, we extend upon classic models of variety-seeking that view the choices made between consumption occasions as a first order Markov process. We allow variety-seeking to be a function of time-varying factors, including satiation and consumption outcomes. We observe the effects of consumption outcomes on variety-seeking to be consistent with our hypothesis, which suggests in our context that firms should place players in a familiar environment in the next round of play if they are performing well, and introduce variety if they are performing poorly.

**Essay 3: Binge Consumption of Online Content (Job Market Paper)**

Binge consumption of online content has emerged as a trending phenomenon with the increasing popularity of online streaming services. Online content can range from pure entertainment to pure education, with various content providers spanning the spectrum. Here, we specifically focus on binging within an online education setting, using a clickstream dataset from Coursera (one of the world's most popular online education platforms) in which we observe individual-level lecture and quiz consumption patterns across multiple courses. We extend the literature by distinguishing between "temporal binging" where individuals consume multiple pieces of content in a single sitting, and "content binging" where individuals consume content from the same course in succession.

First, we structurally endogenize binging as an outcome of utility maximization using a mathematical model of the decision processes of individual consumers. The key feature of our model is the tension between the contemporaneous utility of consumption (i.e., enjoyment and efficiency of the learning experience) and the long-run accumulation of knowledge (i.e., memory and usage of acquired facts). Within an online learning setting, individuals have specific attainable goals (i.e., passing the course, learning) and we have a concrete measure of their knowledge (i.e., quiz scores). Our model is able to endogenously capture binging behavior, including which course people choose to consume, whether they consume a lecture or a quiz, and whether they take breaks of different lengths. Second, we compare the performance of our model under the assumption that individuals are either myopic or forward-looking in a boundedly-rational way. Third, we conduct counterfactual simulations to determine how the timing of content release, a question of great firm interest, affects binge consumption, cross-course consumption, and knowledge accumulation. We verify these predictions using data obtained after a ``natural experiment'' policy change when the Coursera platform went from sequential to simultaneous course content release.

**APPENDIX II: SELECTED RESEARCH ABSTRACTS**

**Planning to Binge: How Consumers Choose to Allocate Time to View Sequential Versus Independent Media Content**

As streaming media online has become more common, several firms have embraced the phenomenon of "binge-watching" by offering their customers entire seasons of a television-style series at one time instead of releasing individual episodes weekly. However, the popularity of binge-watching seems to conflict with prior research suggesting that consumers prefer to savor enjoyable experiences by delaying them or spreading them out. Here we demonstrate how to reconcile these issues using both experimental studies and field data. We examine binge-watching preferences both when people are planning to consume, and in the moment of consumption. Our studies show that binge-watching is more likely to be preferred when individual episodes are perceived to be sequential and connected, as opposed to when events are independent with points of closure. Furthermore, this pattern may occur because consumers experience increased utility from completing sequential content. These findings have implications for how firms might frame or divide up their content in ways that allow them to tailor their promotion and pricing to a range of consumer preferences.

**Behavioral Evidence of the Effects of Network Design on Peer Influence**

Social-norms marketing campaigns and several online social networking sites are designed to communicate information to individuals about the behavior of others in the community to nudge or motivate them towards desired behaviors. However, these programs are susceptible to the "boomerang" effect, or conformity, where low performing individuals are pulled up (the desired effect) but high performing individuals are also pulled down towards the group average, which cancels out the intended benefits of information sharing. Across 5 lab experiments, we examine how people's choices regarding donations and gambles uare influenced by the information they receive about others' behavior. Rather than disclosing the average behavior of the community, we allow participants in our studies to directly communicate with specific individuals within both pair and group settings. Within the group setting, individuals are able to pick and choose what information about others' behavior they pay attention to, and we use various process tracing measures (MouseLab and eye-tracking) to look at the relationship between attention and behavioral changes. We observe that individuals actually conform asymmetrically to each other's behavior such that high regulatory individuals (generous donators or safe gamblers) are pulled down more than low regulatory individuals (stingy donators or risky gamblers) are pulled up. We test the dispersion group information and group size as potential moderators of this effect.