Research as Leisure: Experimental Evidence on Voluntary Contributions to Science

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Research Question and Motivation: The purpose of this project is to examine what motivates people to contribute to scientific discovery. Given the role of scientific discovery in economic growth and productivity (e.g. Azoulay et al, 2011), understanding the motivations for participation in science has critical implications for policy in public and private organizations. In order to study motivations for scientific contribution, we will run of series of natural field experiments (Harrison & List, 2004) that will allow us to test why people make voluntary contributions to science in the absence of pecuniary benefits. We will examine whether different incentives and tasks impact participation, the effort exerted, and the outcomes of scientific contribution.

We will run a series of experiments on Zooniverse (www.zooniverse.org), which is the largest voluntary crowd science platform in the world.[1] Individuals from around the world join Zooniverse in order to assist professional scientists clean and classify data with the understanding that they will not be paid or formally acknowledged for their assistance in these projects. Similar to platforms like Wikipedia, participants are investing time that could otherwise be spent on paid work or leisure into voluntary scientific research.[2] While the fact that certain types of people may be willing to give up economic rewards for science is not a new insight[3], how these voluntary scientists differ from the general population, and how to increase the intensity and quality of their contributions are open questions.

Identification and Research Methodology: We will post several real scientific research projects on the Zooniverse platform. The projects will all have the same scientific content but will vary in how they are presented to participants. Participants will not be aware that these projects are being used to investigate questions related to the economics of science in addition to the publically stated objective of the projects.

The main empirical challenge is that certain types of people may select into a particular project based on their ability, knowledge, or other unobservable characteristics. To eliminate concerns about participant selection into a particular project based on an experimental treatment, and to ensure participants are not aware that there are several versions of the same project (i.e., different experimental treatments), each version will be emailed to a randomly selected subset of Zooniverse participants who will be invited to contribute to the projects. [4] The total population of participants who will be emailed is 30,000. Each participant will receive one version of the project. We will control for participant characteristics by administering a short survey on participant age, gender, employment status, educational level, and career goals before they contribute to the project.

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[1] A sample Zooniverse project asks participants to identify and classify whales and dolphins in photos to help understand the ecology and population trends of marine mammals. (https://www.zooniverse.org/projects/tedcheese/snapshots-at-sea)

[2] Survey data provided by Zooniverse shows that that the majority of platform contributors have at least a Bachelor's degree, are employed full time, and contribute during their spare time while at home.

[3] For instance, some R&D firms offer employees the opportunity to spend time on their own research program in exchange for lower pay (Stern, 2004).

[4] Selection into a project based on the treatments would be problematic in these experiments because we are unable to observe the characteristic of people who decided *not* to participate in a project because of an experimental treatment. As a result of this unobserved selection, causal identification of the effect of the treatment on participation would not be possible. Therefore, it is critical that we control the sample of potential participants so that we can determine whether those who choose to participate are different from those who choose not to and how this self-selection differs across treatments (e.g. Angrist & Pischke, 2009).

These experimental treatments are motivated by existing theory and observational evidence on knowledge creation, public goods provision, and behavioral economics. They are summarized below:

Creative Treatment: One explanation for why people may voluntarily contribute to scientific discovery is because it offers them a creative outlet that they derive utility from (Eisenman & Robinson, 1967). To test whether a desire to engage in a creative activity influences people's desire to contribute to science, one of the projects will be designed such that the participant task is more complex than the control task, and therefore, requires more creativity to be completed.

Reputational Treatment: A third explanation for voluntary contributions to science is that people derive social rewards for doing so either within the Zooniverse community or in their broader social networks (e.g., Rege & Telle, 2004; Wasko & Faraj, 2005). To test whether social rewards increase people's willingness to contribute to science, one project page will offer participants the chance to be acknowledged in a research report that comes out of the research project. The page will specify that participants who make substantial contributions to the project will be mentioned in a report. This reputational reward will indicate to the participants' social network that they have contributed meaningfully to scientific discovery. We will also separately examine whether incremental acknowledgements (e.g., announcement of top contributor every week) differentially impacts effort and outcomes compared to one significant acknowledgement at the end of the project.

Scientific Framing Treatment: The final explanation for voluntary contributions to science that we will test in this project is that people may derive utility from the belief that they are contributing to a welfare enhancing public good (e.g., Bergstrom et al, 1986; Stiglitz, 1999). To test this explanation, the scientific contribution of the research project will be emphasized on one of the project pages.

The control group will be sent a version of the project with a basic description and with none of the treatments described above.

Data Collection and Analysis: The data on platform pages will include information on both the intensity and quality of participation. The main estimation equation will be:

$$Participation_i = \alpha + \beta_1 CreativeTreatment_i + \beta_2 ReputationalTreatment_i + \beta_3 ScientificTreatment_i + \varepsilon_i$$

where $Participation_i$ is a measure of participation (either intensity or quality) of participant , and the βs are the estimated effects of the respective treatments on participation relative to the control project page. We will run similar regressions to investigate how the treatments affect the characteristics of participants to determine if different types of people are affected by different motivators.

Impact: This project allows us to gain a better understanding of the types of people who have a desire to participate in science and the conditions under which they are more or less willing to do so. To the extent that effective incentive schemes can target individuals without scientific backgrounds to have a meaningful impact on scientific outcomes is salient for both science and technology policy. Investigating these research questions on a digital crowd sourcing platform also has implications for how digitization contributes to productivity.

Timeline and Budget*:* We have already established cooperation with Zooniverse on this project. We will complete the ethics approval process in May and complete the survey and experimental design in June. We expect to complete the designing and building of the Zooniverse research project pages by the end of this summer and execute the experiment through September to November. We will collect and analyze data in December 2016 to February 2017 with the goal of completing a draft available for circulation by May 2016. The primary use of the grant will be to hire research assistants to help us build the project page on

Zooniverse, program the various treatments, and help us collect the data from the platform. The remaining budget will assist us in presenting our research at conferences.

References:

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Azoulay, Pierre, Joshua S. Graff Zivin, and Gustavo Manso. "Incentives and creativity: evidence from the academic life sciences." *The RAND Journal of Economics* 42.3 (2011): 527-554.

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Harrison, Glenn W., and John A. List. "Field experiments." *Journal of Economic Literature* 42.4 (2004): 1009-1055.

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Rege, Mari, and Kjetil Telle. "The impact of social approval and framing on cooperation in public good situations." *Journal of Public Economics* 88.7 (2004): 1625-1644.

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Stiglitz, Joseph E. "Knowledge as a global public good." Global public goods 1.9 (1999): 308-326.

Wasko, Molly McLure, and Samer Faraj. "Why should I share? Examining social capital and knowledge contribution in electronic networks of practice." *MIS quarterly* (2005): 35-57.

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Academic Appointment

Ivey Business School, Western University
Assistant Professor of Management, July 2014 - present

Education

Rotman School of Management, University of Toronto
Ph.D., Strategic Management, 2014
- Dissertation: "Essays on Digitization and the Market for Intangibles: Evidence from Creative and Technology Settings."
- Committee: Ajay Agrawal (chair), Avi Goldfarb, Joshua Gans, Joanne Oxley

University of Toronto
Bachelor of Commerce (with distinction), Commerce/Economics, 2007

Research Interests

Areas: strategy and innovation, competition and digitization, intellectual property, market for ideas, entrepreneurship
Industries: creative industries, high technology

Publications & Working Papers

Deals Not Done: Sources of Failure in the Market for Ideas (with Ajay Agrawal and Iain Cockburn)
Strategic Management Journal; 36(7); 2015; Pages 976-986.

- Presented at NBER Summer Institute, Boston MA (July 2013)
- Presented at DRUID, Barcelona, Spain (June 2013)
- Presented at Academy of Management Conference, Boston MA (August 2012)
- Presented at NBER Productivity Spring Seminar, Boston MA (April 2012)

Intellectual Property Strategy and the Long Tail: Evidence from the Recorded Music Industry
(Under second-round R&R at *Management Science*)

- Presented at Searle Roundtable on the Law and Economics of Digital Markets, Northwestern University, Chicago, IL (October 2014)
- Presented at NBER Summer Institute, Boston, MA (July 2014)
- Presented at Academy of Management Conference, Lake Buena Vista, FL (August 2013)
- Presented at the Consortium for Cooperation and Competition, Kansas City, MI (March 2013)

Work in Progress

High on Innovation: The Impact of Liberalization Policies on Creative Outcomes (with Keyvan Vakili)
Finalist for Best Paper Award, TIM Division

- Presented at Academy of Management, TIM Division, Vancouver B.C. (August 2015)
- Presented at DRUID, Rome, Italy (June, 2015)
- Presented at International Society for New Institutional Economics (ISNIE) Conference, Boston MA (June 2015)
- Presented at NBER Productivity Spring Seminar, Boston MA (April 2015)

Do Entrepreneurship Incubators Lead to Entrepreneurship? (with Liz Lyons)
(Under review)

- Presented at DRUID, Rome, Italy (June, 2015)
- Presented at Rotman Strategy Brownbag, University of Toronto (April 2015)

Teaching Experience

Instructor
Strategy (Ivey-HBA, 2015 - present)
Society, Organizations, and Technology (Master of Biotechnology, University of Toronto, 2011)

Teaching Assistant
Corporate Strategy (MBA, 2011-2014), Prof. Ajay Agrawal
Foundations of Strategy (MBA, 2012-2013), Profs. Joanne Oxley & Brian Silverman
Integrating Models and Data (MBA, 2013), Profs. Avi Goldfarb & Matt Mitchell
Management of Technological Innovation (M. Biotech, 2012), Prof. Nicola Lacetera
Emerging Markets Strategy (MBA, 2012), Prof. Will Mitchell
Foundations of Strategic Management (MBA, 2011), Prof. Mara Lederman
Game Theory and Competitive Strategy (MBA, 2010), Prof. Joel Baum
Strategic Change and Implementation (MBA, 2010), Prof. Bill McEvily

Honors, Awards, & Fellowships

Best Dissertation Award Winner, Academy of Management, TIM Division (2015)
Best Paper Award Finalist, Academy of Management, TIM Division (2015)
David. G. Burgoyne Teaching Award Finalist (2015)
Doctoral Completion Award (2013, 2014)
Nominated for the Best Paper Prize, Strategic Management Society Conference (2013)
NBER Economics of Digitization and Copyright Initiative Research Grant (2012)
SGS Conference Grant, University of Toronto (2012)
Best Reviewer Award, Academy of Management, TIM Division (2011)
Doctoral Fellowship, University of Toronto (2011, 2012)
Rotman Open Fellowship, University of Toronto (2008-2012)

Professional Activities

Invited Seminar and Conferences:
2015: Academy of Management (Vancouver), NBER Summer Institute, ISNIE, DRUID, NBER Productivity Lunch, Rotman brownbag, Industry Canada
2014: Northwestern University (Searle), NBER Summer Institute, Copenhagen Business School, London Business School, Harvard Business School (Strategy), Illinois-Urbana-Champaign, Western-Ivey, Temple, Georgetown
2013: NBER Summer Institute, Academy of Management (Lake Buena Vista), DRUID Conference, Consortium for Cooperation and Competition
2012: NBER Productivity Lunch, Academy of Management (Boston)

Refereeing:
Industrial and Corporate Change, Information Economics and Policy, International Journal of Industrial Organization, Management Science, Marketing Science, Strategic Management Journal

Professional Affiliations:
Academy of Management (BPS and TIM divisions), American Economic Association

Professional Service:
Academy of Management TIM Doctoral Research Development Workshop 2016, Organizer

University Service:
Western Ivey (General Management) PhD Oral Examination Committee 2015

Non-Academic Experience

Creative Destruction Lab, University of Toronto (2013-2014)
Research Assistant, Bank of Canada, Ottawa, ON, Canada (2007-2008)

Media Coverage

Intellectual Property Strategy and the Long Tail: Evidence from the Recorded Music Industry
- *Forbes*, January 27, 2014
- *Billboard, PC Mag, ecoustics, ITProportal, and IBNLive (India), Gizmodo (Australia), Slash Gear, Digital Spy, Der Standard (Austria)*, December 2, 2013
- *Boing Boing*, December 1, 2013
- *TorrentFreak*, November 30, 2013

Last updated: April 22, 2016