University of California, Irvine
Institute for Mathematical Behavioral Sciences

2015 – 2016
Annual Report

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DIRECTOR'S MESSAGE

Dear Colleagues and Administrators,

Writing reports will never rank high among my favorite pastimes. A rare exception is the IMBS annual activity report. The reason is that the strength of any research institute derives from the activities, new insights, and efforts of its members. As such, and even though most of us have some sense of what others have been doing during the year, an enjoyable part of putting together this annual report is the opportunity to review "who has done what" during the last year.

A considerable amount has been accomplished! Indeed, I recommend that the reader start with the overview given in Section II-D (pages 7 – 21), which demonstrates the variety and impact of the kinds of research being done. Research ranges from the mathematical/game theoretic modeling of religion to cognitive processes to concerns about visions and color to decisions (both in theory and in practice) and the modeling of interactions with games. Jeff Barrett, for instance, describes how the complexity of self-assembling games can be better understood through a game's composition of simpler games, while Michael Lee's work on modeling higher-order cognitive processes is helping to understand issues such as Alzheimer's disease and related disorders. In a very different direction, let me mention Bernie Grofman's work with a panel of three federal judges to draw a congressional map for the State of Virginia. In a more theoretical direction is Hongkai Zhao's work in resolving some of the computational complexities in creating models for 3-D shapes.

Beyond measuring contributions through the publications of members (pages 55 – 73), the large number of invited talks (pages 75 – 90), and extramural funding (pages 40 – 46), is the way in which new directions are explored through our several study groups (pages 21 – 23), two weekly colloquia (see pages 36 – 38 for list of speakers), and our several conferences and workshops (see pages 29 – 33 for topics and the agendas). As an example of how presentations can promote new directions, Steve Frank's colloquium presentation about patterns in nature created such interest that several extra sessions were organized (with graduate students and faculty) to further explore these notions. Similarly, to exploit the interdisciplinary nature of our program, graduate students, from several disciplines, would meet on Tuesday nights to examine new ideas.

As a sampler of the many awards and recognitions that have been received by IMBS members, let me call attention to Kim Romney receiving the "Outstanding Emeritus Award;" Kim, only 91, usually is the first in the office and always full of new research ideas. Then, Simon Levin, an IMBS member from Princeton who normally spends January with us in Irvine, received the President's Medal for Science. Robin Keller received the highest award of the Decision

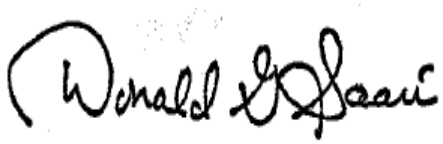
Analysis Society of INFORMS, and Kimberly Jameson's cutting edge research of vision and color is receiving considerable press coverage including BBC, Vogue, etc., and then Rein Taagepera received another major international award recognizing his contributions to mathematical political science: the Karl Deutsch Award from the International Political Science Association.

Our graduate program, directed by Louis Narens, remains strong. Beyond those graduate students directly enrolled in our program are the many students who play an active role in IMBS activities, but who are officially students in some other program (pages 97 – 98). A prime example of this is Michael Sacks who, for several years, directed our Friday lunch discussion series (pages 25 – 26) and our annual graduate student conference (pages 26 – 27). Michael also is the recipient of this year's Jean-Claude Falmagne Award for his PhD thesis. This division, where several students receive a Master's degree from our program, reflects our recognition that several areas prefer to hire only students receiving a degree from that discipline.

As always, my warm thanks to Joanna Kerner for her extraordinary contributions to, well, everything we do at the IMBS! Thanks to her, conferences, colloquia, working group facilities, visitors, and everything moves smoothly.

An active and successful year! We are looking forward to 2016 – 17.

Sincerely,



Donald G. Saari
Director, IMBS

I. ORGANIZATION AND ADMINISTRATION

A. Administration

The Director of the Institute for Mathematical Behavioral Sciences is Professor Donald G. Saari. He reports both to the Dean of the School of Social Sciences and to the Vice-Chancellor for Research. An Executive Committee for consultation and decision-making regarding the long-term direction of the Institute assists the Director, (section B below).

The staff of the Director's office consists of an Administrator, Joanna Kerner. Presently, some bookkeeping and personnel matters are being taken care of by the School of Social Sciences.

Director:	Donald G. Saari, 2003-present
Previous Directors:	R. Duncan Luce, Founding Director, 1989-1998
	William H. Batchelder, 1999-2003
Graduate Director:	Louis Narens
Administrator:	Joanna Kerner

B. Executive Committee 2015-16

Carter Butts, Professor of Sociology
Michelle Garfinkel, Professor of Economics
Geoff Iverson, Professor of Cognitive Sciences
Michael D. Lee, Professor of Cognitive Sciences
Mark Machina, Professor of Economics, UC San Diego
Brian Skyrms, Professor of Logic and Philosophy of Science
Hongkai Zhao, Professor of Mathematics

II. RESEARCH

A. Current Research Programs

There are 65 members of the Institute for Mathematical Behavioral Sciences (IMBS) and their research interests are listed in Appendix A.

The IMBS is roughly partitioned into five research clusters. These are listed below and should be considered as informal intellectual groupings, rather than formal structures.

***Measurement Theory, Foundational Issues, and Scaling Models*:**
Barrett, Batchelder, Burton, Falmagne, Johnson, Lefebvre, Maddy, Narens, Romney, Skyrms, and Weatherall

***Statistical Modeling**:*

***Cognitive**:* Baldi, Batchelder, Dosher, Eppstein, Falmagne, Iverson, Lee, Pearl, Romney, Smyth, Steyvers, and Yellott
Economic: Brownstone, Poirier, and Saari
Sociological/Anthropological: Boyd, Butts, Faust, Freeman, and White

***Individual Decision Making**:* Birnbaum, Keller, Machina, Narens, and Saari

Perceptions and Psychophysics:

***Vision**:* Braunstein, Chubb, D'Zmura, Hoffman, Iverson, Palais, Romney, Sperling, Srinivasan, Wright, Xin, Yellott, and Zhao
***Psychophysics and Response Times*:** Brownstone, Falmagne, Iverson, Jameson, Narens, and Yellott

Social and Economic Phenomena:

***Economics and Game Theory*:** Branch, Brownstone, Brueckner, Burton, Carvalho, Duffy, Frank, Garfinkel, Komarova, Kopylov, Levin, McBride, O'Connor, Poirier, Saari, Skaperdas, and Skyrms
***Public Choice*:** Carvalho, Cohen, Glazer, Grofman, Kaminski, Keller, McGann, Taagepera, and Uhlaner
***Social Networks*:** Batchelder, Boyd, Butts, Faust, Freeman, Noymer, Romney, and White
Social Dynamics and Evolution: Butts, Frank, Huttegger, Johnson, Narens, Romney, Saari, Skyrms, Smyth, Stern, and White

B. Publications

The members who have replied report a total of 188 journal publications (published or in press) for the current academic year. These are listed in Appendix B.

The IMBS has a technical report series that is available to all members and qualified graduate students who are submitting a paper to a refereed journal or book. The series editor is Donald Saari. Appendix C lists the technical reports issued during the academic year. Technical reports since 1993 can be found under "printed resources" on the Institute's web site at http://www.imbs.uci.edu/research/technical.php.

C. Public Talks and Colloquia

IMBS members actively participated in numerous off-campus research seminars and conferences. The members who replied gave a total of 187 talks listed in Appendix D. Their awards and achievements for this year can be found in Appendix E.

D. Summaries of Research Findings

An important aspect of the Institute is the research conclusions developed by its members. What follows is a sample of what has happened this year.

Measurement Theory, Foundational Issues, and Scaling Models

Jeff Barrett

This year there have been three main areas of research. First, Brian Skyrms and I have been working on self-assembling games. Game theorists model various types of interaction by way of games. We show how such games might form from simple actions of the agents that become ritualized. We then show how complex games may form by way of the modular composition of simpler games. Second, we have extended the notion of self-assembling games to show how social networks may similarly self-assemble. I have also been studying how such composite games might allow for the evolution of truth predicates and probabilities in a language. Third, I have been working with a small research group to study the relationship between various evolutionary games and the learning dynamics that perform best for each type of game. Specifically, we have found hybrid learning dynamics that do extremely well in the context of signaling games, orders of magnitude better than the competition. These hybrid dynamics combine the virtues of reinforcement learning with trial-and-error learning yet are nevertheless very simple.

Bill Batchhelder

I am continuing work on my three main areas of research: (1) Cognitive Psychometrics, (2) Cultural Consensus Theory, and (3) Multinomial Processing Tree Models. All three of these areas involve the creation and application of parametric statistical models for cognitive processes. It is with great pleasure that others, especially in the United States and Europe, have added ideas and research in these three areas.

Michael Burton

I have been developing statistical models to explain why some households in Micronesia maintain health, locally-produced foods to a great extent than others. These ideas are tested against data from household surveys that my colleagues and I did about 20 years ago.

My most recent work is with James A. Egan and Karen L. Nero, and is about the organization of farming and fishing labor in two of the four states (Yap and Kosrae) of a single nation – the Federated States of Micronesia. We find greater levels of collective labor in one of these states than the other, and are now working out the explanation for those differences. This is one small piece of a more extensive set of chapters that we will write about these two societies.

Louis Narens

During the last academic year my research has focused on four areas: (1) Modeling how context influence behavioral phenomena; (2) studying through computer simulations how concepts evolve in a communicating society; (3) using evolutionary dynamics to demonstrate that interpersonal comparisons of value are illusory; and (4) incorporating psychological concepts into utilitarianism and showing the limits of such theories.

(1) Context is a tricky problem for science. In psychology context is usually dealt with by attempting to eliminate it by adding conditions that fixing it or adding parameters to a mathematical model. Such methods can only account for a limited kind of context effects. What is needed are theories for different kinds of contexts and how contexts of a kind are related. This has been successful accomplished in quantum mechanics. I have pursued a new approach to context---one that develops a more general form of probability theory that is applicable to context problems found in the behavioral sciences.

(2) Working with IMBS members Sean Tauber, Kimberly A. Jameson and Natalia Komarova and mathematics PhD candidate Nicole Fider and Computer Science Junior Jungkyu Park, new mathematical and simulation models of the evolution of color categorization terminology have been developed and some of these have been tested on data from 110 languages and over 2,000 subjects from isolated non-technological societies.

(3) Working with IMBS member Brian Skyrms, new dynamic modeling theory and techniques have been for describing how people might obtain joint perceptions of just distributions. The theory and modeling inherent in this work will be tested later through crowd sourcing experimentation.

(4) (3) deals with a longstanding problem of how to legitimately compare values (utilities) across people. This has some formal and mathematical similarities with the psychophysical problem of comparing perceived intensities within an individual across different modalities (e.g., comparing the perceived ratios of the brightness of lights (or stars) with the perceived ratios of loudness of tones). Such psychological comparisons give rise to psychophysical laws. Working with IMBS member Brian Skyrms, it is investigated how the psychological methods of intermodal comparisons within an individual might apply to the economic and philosophic issue of proper interpersonal comparisons of value across people.

Statistical Modeling

Michael Lee

My work continues to focus on modeling higher-order cognitive processes, especially through the application of Bayesian methods and real-world data. Highlights for this year have included two papers based on industry collaborations. One involves cognitive modeling to understand and

measure how semantic memory deteriorates with Alzheimer's disease and related disorders, and involved analyzing large clinical databases. The other involved wisdom-of-the-crowd applications of cognitive models to crowd-sourced ranking data, and involved collaboration with the Ranker Company.

Lisa Pearl

One set of findings concerns how the cognitively immature minds of children solve the various tasks involved in native language learning (called *language acquisition*). Pearl & Sprouse (2015) and Pearl & Goldwater (2016) discuss how computational and mathematical modeling are invaluable tools for scientists who want to understand the language acquisition strategies that children use. This is because modeling provides a way to concretely realize a theory about a learning strategy, apply that strategy to realistic language data, and see the results of the learning strategy. This approach can be used for a wide range of linguistic phenomena and offers insights that cannot be found by using theoretical or experimental methods alone.

Both Pearl, Ho, & Detrano (in press) and Pearl (in press) demonstrate this more concretely with a case study in English *metrical phonology*, which concerns the stress patterns that words have (e.g., *emphasis* has stress on the first syllable: *EMphasis*). While there are systematic patterns that English speakers unconsciously internalize and use, there's also a lot of "noise" — that is, English stress patterns that buck the normal trend and which English speakers effectively have to memorize. The noise in the input makes the process of acquiring English stress patterns a big challenge, and yet every typically developing English child gets it right. A current theory for why English children can manage this feat is that children come innately equipped with ideas about how human language stress systems operate. By taking this idea seriously, we can then investigate if the different proposals for the innate stress biases children have actually do make the acquisition of the English stress system possible. Both Pearl et al. (in press) and Pearl (in press) describe mathematical analyses of the input English children encounter that illuminate which innate stress representations are more helpful, when, and (most importantly) why. One interesting theoretical result is that many current proposals for the target stress knowledge of English would benefit from small changes that make this knowledge more easily learnable from the English data children actually encounter. If we don't make these changes, it's ridiculously hard to learn the "right" English stress knowledge from English data.

Another set of findings in this vein concern the acquisition of structural knowledge about language (called *syntax*). In Pearl & Mis (2016), we examine how toddlers learn the correct interpretation for the pronoun *one* in English (e.g., "Look - an important finding! Here's another *one*!", with *one* referring to another important finding rather than just any old finding). Experimental data suggests that English 18-month-olds share this interpretation with adults, and so must have learned it by this point in development. Our mathematical modeling of the acquisition process suggests that this rapid acquisition is possible if toddlers are leveraging broader sets of data to make the syntactic generalizations that lead to their observed behavior — in this case, learning about how to interpret *one* by leveraging data about how other pronouns like

it, her, and *him* are typically interpreted. This contrasts with many previous theories that stated infants needed to learn from restricted input sets (e.g., only some of the input data using *one* as a pronoun).

In Pearl & Sprouse (2015) and Pearl (in press), we find a similar learning story for the structure of linguistic dependencies, such as "What do you think ___ convinced them?", where "what" seems to be understood as the subject of the embedded clause "convinced them". In particular, previous theories about how children learn about acceptable dependencies in their language assumed children learned from restricted data sets. These theories relied on very specific innate, linguistic knowledge to explain how children could learn the appropriate knowledge about dependencies from those restricted data sets. In contrast, our mathematical model leveraged a broader data set to generate the appropriate knowledge, and so did not require that very specific innate, linguistic knowledge. This suggests that children's syntactic knowledge about dependencies may rely on more general learning procedures, rather than the very specific ones that target dependencies alone.

Studies by Phillips & Pearl (2015) and Pearl & Phillips (in press) use computational modeling to investigate the task of speech segmentation, which is the process of identifying individual units like words in fluent speech. As anyone who has ever listened to a foreign language knows, there are rarely any overt markers of word boundaries - it often sounds like one long stream of sounds. Instead, listeners who know the language unconsciously impose boundaries to identify the words being spoken. Infants typically are able to do this for their native language as early as six month old. In our studies, we examine two speech segmentation strategies proposed for infant use, implement these strategies concretely via mathematical formalizations, and apply them to realistic language data that infants would hear. One interesting problem concerns the evaluation of these segmentation strategies — given how young children are segmenting speech (six months), it seems unlikely they would achieve perfect adult segmentation immediately. In fact, we know that segmentation errors persist for several years after (ex: undersegmentation errors like "That's a" segmented as a single word "thatsa", and oversegmentation errors like "behave" segmented as "be" and "have"). So how do we tell if a segmentation strategy is generating good enough segmentations (and importantly, the kind a six-month-old might generate)? We discuss assessing the utility of the generated output, with the idea that language acquisition is a process that unfolds over several years. So, the output of one process is the input to the next. Using various ideas for what segmented output might be used for later on in acquisition, we discover that segmentation strategies that produce more adult-like segmentations may not be the best ones for infants to have. Instead, strategies that generate undersegmentation errors may actually be preferable to ones that generate oversegmentation errors, irrespective of which strategy generates a more adult-like segmentation.

This idea that adult-like knowledge is not necessarily what children want to achieve immediately is also pursued in Bar-Sever & Pearl (in press). Here, we use a simple mathematical model of syntactic categorization, where children attempt to put individual words like *kitty, penguin*, and *idea* into categories like "noun" that capture how these words are used by the speakers in the

language. For example, nouns can be preceded by words like "some" and can often be pluralized (e.g., *kitties*). As adults, we have syntactic categories of many different kinds, which we learned from our native language input. In Bar-Sever & Pearl (in press), we implement a proposed categorization strategy called *frequent frames* (FFs) which is intended for the very beginning stages of syntactic categorization occurring around twelve months, and test this strategy on both English and American Sign Language. Irrespective of whether the language is spoken or signed, we find that FFs often don't do a very good job of recovering adult categories. However, by implementing a mathematical definition of category utility derived from the information-theoretic concept of perplexity, we find that FFs always generate more useful categories for an infant learner with immature knowledge of language structure. Put simply, there seems to be a synergy between immature syntactic category knowledge and immature structural knowledge for the language.

A finding in the area of natural language processing concerns the automatic identification of character identity in novels. In Pearl, Lu, & Haghighi (2016), we investigate a famous epistolary novel which involves multiple characters writing letters to each other. Of course, the author of the novel writes all the character letters, but intends for the characters to be as distinct from each other as individual authors typically are. We investigate whether the author is successful at this by using an authorship identification technique first presented in Pearl & Steyvers (2012) that uses simple mathematical techniques to make distinctive author linguistic features stand out. This technique is very successful at distinguishing authors when the authors are in fact distinct. Using this technique, we find that the major characters in the epistolary novel aren't as distinct as true authors are, though the characters do have distinct *writeprints* (writing fingerprints) that the author clearly manipulated in order to try to distinguish them. Notably, the linguistic features manipulated in these character writeprints don't include the features typically used in author writeprints — instead, they are features that are easier to consciously manipulate. So, an author's writeprint features, which are harder to consciously manipulate, are likely to remain consistent across different characters even when the author is trying to distinguish those characters.

Sociological/Anthropological

John Boyd

I'm just finishing page proofs on the chapter "Network analysis" with William H. Batchelder. It will appear as Chapter 4 pp. 194—273 in the *New Handbook of Mathematical Psychology Vol. 1.* Eds. William H. Batchelder, Hans Colonius, Ehtibar Dzhafarov, and Jay Myung, published by the Cambridge University Press. This chapter maintains a high level of modesty in that neither I nor my co-authors cites himself. Of course, we are very proud of this achievement. I have also refereed articles for the Journal of Social Networks, rejecting one.

Individual Decision-Making

Robin Keller

Working as a research team with two UCI doctoral alumni (Yitong Wang of the University Technology Sydney and Liangyan Wang of Shanghai Jiao Tong University), we conducted a laboratory experiment addressing the descriptive challenge to normative discounting models that decision makers in general do not obey discounted utility theory because their discount rates (using actual time lengths) are context dependent. Recent literature incorporates decision makers' subjective perception of time into the classic discounted utility model and finds relatively constant discount rates over subjectively perceived time lengths. In addition to replicating previous work, we investigated the missing component – the magnitude effect, provided a holistic view via a more comprehensive experiment including multiple anomalies, and found that subjective time perception was able to explain most of the anomalies simultaneously in a single scenario.

Citation: "Discounting over Subjective Time: Subjective Time Perception Helps Explain Multiple Discounted Utility Anomalies", International Journal of Research in Marketing, 32 (2015), pp. 445–448, http://dx.doi.org/10.1016/j.ijresmar.2015.08.006.

Perception and Psychophysics

Kimberly A. Jameson

During 2015-2016 I continued research along six related areas of empirical investigation and basic research and development.

1) Discovery Eye Foundation Funded empirical and theoretical work on Adult Macular Degeneration (AMD) and color photopigment opsin genetics in collaboration with Maria Cristina Kenney MD PhD at the Gavin Herbert Eye Institute in UC Irvine Medical School.

2) I collaborated with A. Kimball Romney and Tim Satalich, IMBS, on developing novel psychophysical investigations of color perception metameric relations, and supervised related research for a campus wide honors thesis by Kirbi Joe (Math. and Econ. undergraduate).

3) Collaborated with Vladimir Bochko (Vaasa University, Finland) and Keith Goldfarb (Blackthorn Media, Los Angeles, CA) on the development of image processing algorithms and filters for depicting color scene processing variations across observers with dissimilar photopigment opsin phenotypes.

4) National Science Foundation funded research into the mathematical modeling of color category evolution among communicating artificial agents (with Louis Narens Sean Tauber, and Natalia

Komarova, IMBS) which yielded an IMBS technical report, and two research manuscripts in-progress. With Komarova (as doctoral thesis chair), and Narens, I assisted and advised Department of Mathematics Graduate Student Nicole Fider on thesis research which has now developed into manuscripts in-progress for submission to peer-reviewed journals in Summer 2016.

5) Ran the cognitive research lab (imbs.uci.edu/colorcoglab/ColorCognitionLab.html) consisting of Psychology and Social Behavior undergraduates and Sponsored IMBS Junior Specialists, Prutha Deshpande, on empirical investigations into individual variation and universals in human color cognition, color naming and categorization. During 2015-2016 the group empirically investigated the ways bilingual individuals name and conceptualize color. This color categorization project produced novel research that was presented in an oral presentation by 3 students at the Undergraduate Research Opportunity (UROP) Conference 2016, and is the basis for two new co-authored manuscript by the research group to be submitted for publication in Summer 2016.

6) Also for NSF funded research, I directed a large research group, assisted by Sergio Gago PhD, in *Calit2* for the NSF funded project. This group includes two Computer Science Undergraduates carrying out machine-learning convolution algorithms in Optical Character Recognition research for transcribing archival data, two Informatics Undergraduates working on developing interfaces and backend software for conducting online crowdsourcing research for transcribing archival data, three Computer Science Undergraduates building both front-end and back-end software for a public-access research archive platform and wiki. And two IMBS associates working on building data handling and analytics for the public-access platform and basic research analyses into aggregation of novel crowd-sourced data.

George Sperling

Recently we have been developing an efficient new method to study visual selective attention to features, as contrasted to selective attention to a location in space or to an interval in time, which was described in previous reports. The method, centroid judgments, enables the measurement of a human attention filter: i.e., the precise amount of attention in a brief visual display allocated to each of the attended features as well as the precise amount of unavoidable attention spillover to each of the unattended features. Publications include an outreach methodology paper that contains examples and computer code and is designed to enable others to use the method, an article that describes an unexpected inability of humans to selective attend to a particular feature (absolute orientation), as well as talk abstracts and articles in press that describe other applications of the centroid procedure to new measurements of feature attention.

Jack Xin

The first project is on non-convex sparse optimization methods with applications in compressed sensing, computer vision and finance.

The second project is on analysis and computation of extended trajectories in three dimensional Arnold-Beltrami-Childress flows with applications to flame speeds of advection-reaction-diffusion equations. Also a spectral variational principle is developed for effective diffusion in space-time periodic flows.

Hongkai Zhao

My research focus is on developing efficient computational models and methods for problems arising from science and engineering. For examples, (1) geometric modeling of 3D shapes and surfaces, (2) data analysis, such as understanding geometric structure and statistical inferences from big data; (3) medical imaging, such as cone beam CT reconstruction using low-rank matrix factorization; (4) numerical simulation of physical and biological systems.

Social and Economic Phenomena

Bill Branch

In a recent paper, "Heterogeneous Beliefs and Trading Efficiencies" joint with Bruce McGough, we construct a model of trade where the two parties in the trade, i.e. buyers and sellers, have different beliefs about the value of money and inflation. In the model, buyers and sellers are randomly matched, the buyer makes a take-it-or-leave it offer to the seller for some quantity of goods in exchange for a certain amount of money. To the seller, whether they accept the buyer's offer depends on their expectations about inflation, or the purchasing power of the money that they receive from the buyer. We show that if beliefs are not common knowledge to buyers and sellers, then buyers will behave like a Bayesian and place a prior on the sellers' beliefs. By explicitly taking into account that the seller might reject an offer if buyer's are much more optimistic about inflation than the seller, this builds in caution into the offer that they make to sellers; a willingness to accept fewer goods for the amount of money that they hand over. We show that our framework can explain experimental puzzles that find a high rate of rejections and low average trades in monetary laboratory experiments. The results also have implications for the negative effects of uncertainty and inflation volatility on the macro economy.

David Brownstone

Professor Michael McBride and I are building an experimental platform to examine drivers' route choice behavior in a laboratory setting where we can control the information they receive. Our setup allows us to vary information about congestion on the road ahead as well as real-time toll pricing. By varying the endowments of the experimental subjects we can also control their value of time, and this allows us to test current theories about road pricing with heterogeneous values of time. Our preliminary results show that drivers do respond to credible information about road conditions, but their response is not optimal. This suggests that we can design information and tolling systems that will improve the performance of our highway networks.

Jan K. Brueckner

Researchers have long studied the effect of various types of land-use restrictions on housing markets, usually finding a positive effect on prices. But, with the exception of one method, little work has been done to measure the *stringency* of land-use regulations, namely, the extent to which they cause a divergence from free-market outcomes. A recent paper with three coauthors attempts to measure the stringency of building-height regulations in China using a remarkable data set containing thousands of land-lease transactions. The data include the allowed building height for an undeveloped parcel along with the selling price per square foot. Loosening the regulated height should raise the selling price of the parcel, but theory shows in addition that the elasticity of the effect increases with the stringency of the regulation (the ratio of the free-market and regulated heights). Using the data, the paper estimates city-specific elasticities of transaction prices with respect to regulated building heights, and those cities with bigger elasticities have tighter height regulations. Exploiting data for a single big city (Beijing), the method shows how regulatory stringency depends on site characteristics. The results show that the most stringent height regulations exist around the historical area of Tiananmen Square.

Carter Butts

For decades, public warning messages have been relayed via broadcast information channels, including radio and television; more recently, risk communication channels have expanded to include social media sites, where messages can be easily amplified by user retransmission. In work published in *PNAS,* my group and the team of Jeannette Sutton (UKY) examine the factors that predict the extent of retransmission for official hazard communications disseminated via Twitter. Using data from events involving five different hazards, we identity three types of attributes—local network properties, message content, and message style—that jointly amplify and/or attenuate the retransmission of official communications under imminent threat. We find that the use of an agreed-upon hashtag and the number of users following an official account positively influence message retransmission, as does message content describing hazard impacts or emphasizing cohesion among users. By contrast, messages directed at individuals, expressing gratitude, or including a URL were less widely disseminated than similar messages without these features. Our findings suggest that some measures commonly taken to convey additional information to the public (e.g., URL inclusion) may come at a cost in terms of message amplification; on the other hand, some types of content not traditionally emphasized in guidance on hazard communication may enhance retransmission rates.

Online social networks (OSNs) enable time-resolved measurement of communication behavior during disasters, making it possible to probe the mechanisms by which messages are amplified or suppressed with precision unattainable by traditional data sources. To our knowledge, this research provides the first systematic study of the factors predicting the social amplification of risk communication in OSNs by examining the retransmission of official messages across five hazards. Our findings demonstrate the respective impacts of sender characteristics, message

content, and message style in determining whether an official message will be passed on during an emergency, as well whether these vary across hazards. These results contribute to the evidence base for policies guiding the delivery by emergency management organizations of lifesaving information to the public.

In collaboration with the lab of Rachel Martin (UCI), my group has produced two forthcoming papers on the genome of the Cape sundew (*Drosera Capensis*), a widely cultivated carnivorous plant. Our sequencing of *D. Capensis* marks the first published genome in the family Caryophyllales, and the third carnivorous plant ever to be sequenced. In our forthcoming work, we identify and model a large number of novel proteases from the Capensis genome, identifying promising targets for biotechnological applications such as the preparation of samples for mass spectrometry or attacking bacterial biofilms on sensitive medical devices. We have also identified a new "enzyme within an enzyme" with potential uses as an antifungal agent. In the spirit of UCI's growing commitment to *convergnce science*, this research fuses state-of-the-art computational methods (including structure prediction, docking, and molecular dynamics), methods adapted from social network analysis, and traditional genomic and biophysical techniques to move from genomic "source code" to useful biomolecules in a fraction of the time and cost of conventional approaches. Our work is forthcoming at *Proteins* and the *Computational and Structural Biotechnology Journal*.

Jean-Paul Carvalho

Thanks to an IMBS Seed Grant I visited the Department of Economics at New York University from 11-17 November. I attended seminars and met several key people in my field who I had either not met or met very briefly in the past, including Alberto Bisin, Debraj Ray, Raquel Fernandez, Suresh Naidu, Hannah Halaburda and Shankar Satyanath. This has led to future invitations and possible research collaborations. I am very grateful for the support.

John Duffy

I have been working on the question of whether and how a social norm of cooperative behavior in a social dilemma game can emerge and be sustained among randomly matched agents from a finite population of strangers. The method of analysis is theoretical and experimental. Theoretically, I showed that an implication of rational choice theory is that cooperative behavior should be easiest to sustain if the matching group of agents is a large as possible (equal to the population size) as this case effectively amounts to full public monitoring of the activity of others. Experimentally, however, this prediction does not find much support; free riding is pervasive in such large matching groups, as each agent perceives themselves to be a small actor relative to the larger population and punishment mechanisms only hurt cooperative types. Results from this project are reported in the paper "Group Size and Cooperation Among Strangers" with Huan Xie, published in the Journal of Economic Behavior and Organization, April 2016. Further research on this topic is ongoing, including a new working paper examining the impact of history or precedent for coordination on social norms of cooperation, "Equilibrium Selection in Similar Repeated Games: Experimental Evidence on the Role of Precedents," with Dietmar Fehr.

Steve Frank

In my article “Common probability patterns arise from simple invariances” I showed that a few simple assumptions about conservation and invariance lead to a nearly complete framework for understanding the commonly observed probability patterns in nature. In particular, the conservation of total probability plus the assumption that, on the proper scale for measurement, pattern remains conserved with respect to shift and stretch provide a simple geometric way to understand the common results of statistical mechanics and maximum entropy.

In my article “D'Alembert's direct and inertial forces acting on populations: the Price equation and the fundamental theorem of natural selection,” the abstract summarizes the key results:

I develop a framework for interpreting the forces that act on any population described by frequencies. The conservation of total frequency, or total probability, shapes the characteristics of force. I begin with Fisher’s fundamental theorem of natural selection. That theorem partitions the total evolutionary change of a population into two components. The first component is the partial change caused by the direct force of natural selection, holding constant all aspects of the environment. The second component is the partial change caused by the changing environment. I demonstrate that Fisher’s partition of total change into the direct force of selection and the forces from the changing environmental frame of reference is identical to d’Alembert’s principle of mechanics, which separates the work done by the direct forces from the work done by the inertial forces associated with the changing frame of reference. In d’Alembert’s principle, there exist inertial forces from a change in the frame of reference that exactly balance the direct forces. I show that the conservation of total probability strongly shapes the form of the balance between the direct and inertial forces. I then use the strong results for conserved probability to obtain general results for the change in any system quantity, such as biological fitness or energy. Those general results derive from simple coordinate changes between frequencies and system quantities. Ultimately, d’Alembert’s separation of direct and inertial forces provides deep conceptual insight into the interpretation of forces and the unification of disparate fields of study.

Bernie Grofman

Working as a Special Master for a three judge panel of federal judges I was asked to draw the congressional map for the State of Virginia to remedy a previously found constitutional violation in the way in which CD3 had been drawn by the legislature. I proposed two plans to the Court as ones that best fit the constitutional guidelines and between which I had no particular preference. I provided a 70 page report justifying the proposed plans and indicating why plans proposed by other parties did not fully or appropriately address the needed remedy for the constitutional violation. After a public hearing, the Court chose one of my two proposed plans for adoption. The Court’s line of reasoning was appealed to the U.S. Supreme Court in early 2016, but the Supreme Court declined to reverse the lower court, and so the plan is being implemented for the 2016 election, and will continue to be used for the rest of the decade unless and until the governor (now

a Democrat) and the state legislature (now under Republican control) agree on a plan. This activity took up much of my research time.

Marek Kaminski

Most of my recent work has been connected to the topic of electoral reform that has been floating in Polish politics since 2014. I have given several lectures and presentations for top Polish politicians, wrote an introductory paper, and, most recently, completed a book (forthcoming in October 2016) that was intended to provide the main source of references on electoral reform introducing single-member districts. In the book, I discuss both empirical findings on SMDs and the formal properties of voting methods in the context of Polish politics.

Igor Kopylov

This year I have worked on several projects ranging from highly abstract to experimental.

First, I have characterized a new class of canonical utility representations that have a constructive definition and exist whenever preferences have any utility representations at all This construction generates some classic results, like the Debreu Theorem, and suggests some new insights about various continuity notions and extensions in metric spaces. The paper "Canonical Utility Representations and Continuous utility representations" is forthcoming in *Journal of Mathematical Economics*.

Second, I have characterized a model of ambiguity aversion (epsilon-contamination) where subjective probabilities are well-defined, are updated via Bayesian rule, and ambiguity aversion can be compared between any two agents that comply with this model. This comparison generates a new definition of comparative ambiguity aversion that has a potential experimental appeal. The paper titled "Subjective Probability, Confidence and Bayesian Updating" is forthcoming in *Economic Theory*.

Third, I have come up with a representation result for semiorders and search procedures. Roughly, I study a model where the choice is the best alternative among all those that do not require a "substantially deeper" search. "Substantially deeper" is captured by the subjective search semiorder. This is a new area for me; I plan to present this research at IMBS next fall.

Fourth, in collaboration with MBS Ph.D student Junying Zhao, I am studying how to identify several endogenous utility models (states) that are (i) not necessarily linear as in expected utility and (ii) are aggregated to evaluate a menu of alternatives to be chosen from later. At this point, we have a result for two utility states. Note that the Pareto model with two non-linear preferences turns out to be a very difficult model to characterize. It turns out that menus can provide another, more elegant solution.

Natalia Komarova

The fascinating ability of humans to modify the linguistic input and ``create'' a language has been widely discussed. In the work of Elissa Newport and colleagues, it has been demonstrated that both children and adults have some ability to process inconsistent linguistic input and ``improve'' it by making it more consistent. One example is the fascinating study of the performance of a 7-year deaf boy Simon, who mastered the American Sign Language (ASL) by learning it from his parents, both of whom were imperfect speakers of ASL. In a number of papers, Newport and colleagues studied artificial miniature language acquisition from an inconsistent source. It was shown that (i) children are better at language regularization than adults, and that (ii) adults can also regularize, depending on the structure of the input. Together with students Jacquelyn Rische and Timmy Ma we created a number of learning algorithms of the reinforcement-learning type, which exhibits patterns and suggest a way to explain them.

Another set of projects that I worked on with grad student Nicole Fider and in collaboration with Kimberly Jameson and Louis Narens is understanding color categorization in humans. In particular, we used the data collected in the World Color Survey to study the number of basic color terms that evolved in different cultures. We are also studying the role of gender in color categorization.

Over the last year I have also worked on several topics of mathematical biology. This includes stochastic dynamics of stem cells, virus dynamics, and investigating the role of spatial constraints in crossing fitness valleys in evolutionary dynamics.

Michael McBride

Graduate student Garret Ridinger and I conducted a theoretical and experimental study of the relationship between theory of mind ability and cooperativeness. We find that in whether theory of mind ability is correlated with cooperativeness depends on the context rather than being correlated with a fixed trait for cooperativeness. Theory of mind ability operates primarily through beliefs about others' cooperativeness.

Andrew Noymer

I work on demography, with an emphasis on health in general and mortality in particular. The human population is a complex system in constant motion among many dimensions; as such, my work fits very well in the IMBS rubric. My work in the recent past has focused on emerging and re-emerging infectious diseases. I have done some studies on the Ebola outbreak in West Africa as well as on the alarming emergence of *Clostridium difficile* colitis as a cause of death in the United States. I have also worked on nonlinear models of measles epidemiology recently, with a paper in process at this time.

Cailin O'Connor

Last September I won the NSF Standard Research Grant titled 'Dynamics and Diversity in Epistemic Communities'. This project uses game theory and evolutionary game theory to model the emergence of bargaining, collaboration, and communication among academics, and especially across social categories such as race and gender. I am working on a book under contract with Oxford looking at the evolution of conventions of bargaining and social coordination in groups with social categories. Under this grant, my students and I are also using experimental methods to test whether actors use gender to facilitate coordination in games, and to look at how minority groups might be disadvantaged in the emergence of bargaining across social categories.

I have also been using the sim-max game, introduced by Jäger (2007), to model the evolution of natural kinds terms. This game is similar to the signaling game in that two actors transfer information about the world, but states in the sim-max game also bear similarity relationships to one another. As I argue, results from this game put pressure on claims that linguistic terms should be expected to evolve to track objective properties.

In the last year, I have also expanded previous work on the evolution of guilt and guilty apology.

Dale Poirier

I am an econometrician mostly working in the area of Bayesian statistics. Over the past two years I have been writing a monograph entitled *Mostly Harmless Bayesian Econometrics*. One chapter, "Implicit Distributional Assumptions," was presented at the Econometric Society World Congress. Another chapter, "Bayesian Inference in Saturated Models with Bernoulli Outcomes," will be presented in August at the Asian Meeting of the Econometric Society in Kyoto.

Don Saari

Over the last year, my research emphasized unexpected consequences of aggregation methods. The prototype is voting; the goal is to discover how and why all of the paradoxical behaviors can arise. The basic reason has been identified; what remains are many complicated details. ("Paradoxical" means unexpected, with the consequence that the outcome need not represent the intent of the voters.) Surprisingly, these negative aggregation effects exposed by voting extend to explain problem in nonparametric statistics, aspects of game theory (which is being explored with D. Jessie in terms of a decomposition of games into their strategic and cooperative terms), apportionments (which is being explored with B. Grofman, where reasons why Arrow's impossibility theorem hold also affect apportionment methods), and even the physical sciences (showing that techniques to identify dark matter are flawed).

Carole Uhlaner

I have been extending my work on relational goods, a concept which has recently been gaining traction among others. Many other scholars have discussed various specific relational goods as important components of individuals' utility functions – friendship, sociability, respect, identity-enhancement. My contribution has been to recognize that these are analytically similar and collectively different from either public or private goods. I have then also shown how to integrate them into formal models and that their inclusion transforms collective action problems. I have applied these insights to voting turnout, participation in protest (notably the Arab Spring), and participation in general. Other authors have used the concept to examine volunteering and happiness, among other topics.

III. IMBS FACULTY RESEARCH SEMINARS AND LABORATORIES

A. Research Seminars

The research activities of the Institute often result in graduate research seminars. Among those this year:

Bill Batchelder	Mathematical Models of Cognitive Processes	Spring 2016
Carter Butts	Anthro 289 Networks and Organizations	Fall 2015
Carter Butts	Soc 289 Informant Accuracy	Winter 2016
Jean-Paul Carvalho	Econ 243B Theory, History and Development Seminar	Spring 2016
Simon Huttegger	Probability and Randomness	Winter 2016
Marek Kaminski	Game Theory	Fall 2015
Marek Kaminski	Voting Theory	Winter 2016
Robin Keller	HCEMBA 283	Fall 2015
Robin Keller	Mgmt. MBS 283	Spring 2016
Natalia Komarova	Mathematics Graduate seminar series	Spring 2016
Penelope Maddy	The theory of vision (from the ancients to Marr)	F&W 2015-16
Cailin O'Connor	LPS 242: Form & Empr. Approaches to Soc. Epistemology	Spring 2016
Lisa Pearl	Psych201C	Winter 2016
George Sperling	Seminar on Vision	Winter 2016
Louis Narens, Don Saari & Brian Skyrms	Social Dynamics	F&W 2015-16
James Weatherall	LPS 241: The Philosophy of Howard Stein	F&W 2015-16

B. Research Laboratories

Mathematical Reasoning for the Sciences Faculty Organizer: Don Saari
A weekly discussion group (usually on Wednesday afternoons) where the focus is to understand how to use mathematics and/or mathematical reasoning to address problems from the social, behavioral, (and now) medical sciences.

Experimental Social Science Laboratory (ESSL) Faculty Organizer: Mike McBride
The Experimental Social Science Laboratory (ESSL) is a computer laboratory for the experimental study of individual and interactive decision making. Located at SBSG 1240, the laboratory can conduct computer-based experiments of up to 40 subjects, but ESSL also has capabilities to conduct internet-based experiments. ESSL is available for use by researchers of all social scientific disciplines who conduct experiments according to the standards of experimental economics. ESSL personnel are affiliated with many departments in the UCI School of Social Science, including Economics, Anthropology, Cognitive Sciences, Logic and Philosophy of Science, Political Science, and Sociology, and also with departments in the School of Social Ecology and Paul Merage School of Business.

Social Network Research Group (SNRG) Faculty Organizer: Carter Butts
The objective of the UCI Social Network Research Group is to provide an informal setting for discussion of current and ongoing network-related research at UCI (and elsewhere), facilitate the exchange of information regarding new techniques, tools, data sources, and research findings, support graduate student training in the network field, and encourage collaboration among faculty and students on network-related topics. The SNRG meets weekly throughout the academic year, at a time and place that is determined on a quarterly basis. Attendance is open to all interested members of the university community, and "drop-ins" are welcome.
Meets on Wednesdays from 3:30-4:30 p.m. in Calit2 3355.
The SNRG also is an activity of the UCI Center for Networks and Relational Analysis (www.relationalanalysis.org).

Cognition and Color Reading Group Research Organizer: Kimberly Jameson
A weekly discussion group of published research articles, or participants' on-going research interests, on topics of cognition and color perception. Topics covered in recent years include: Color perception correlates of photopigment opsin genes, psychophysical investigations of heterochromatic luminance discrimination, adaptive optics imaging of the human retina, comparative color vision behavior, neural correlates of human color perception, individual variation and color perception, color vision diagnostics and clinical applications, etc. Research topics discussed typically focus on higher-order aspects of color processing, exploring front-end processing issues when they bear on phenomenology. Meeting location: SSPA 2142
Meeting time: Fridays, 11:00 am - 12:30 pm; meeting dates designated at the beginning of each quarter. Schedule posted at: http://www.imbs.uci.edu/~kjameson/ColorCogFALL2015.html

Social Dynamics Faculty Organizer: Brian Skyrms
Social Dynamics is a research seminar, where graduate students and faculty present research projects, and there is vigorous critical discussion.
Instructors: Louis Narens, Don Saari, and Brian Skyrms
Meets fall quarter on Tuesdays, 2:00 - 5:00 p.m. on 7th floor of the Social Science Tower

Computational Models of Language Reading Group (CoLa) Faculty Organizer: Lisa Pearl
Topics of interest for the group include computational models of language learning,

computational learning theory, principles underlying models of language acquisition and language change, and models of information extraction from language by humans. We meet four times a quarter for about an hour, and it's usually a nicely feisty discussion.
Day/time to meet will be updated on the website

IV. GRADUATE TRAINING

A. Ph.D. Students

Louis Narens is the Director of the MBS graduate program. Others on the graduate committee who assist Professor Narens are Professors Marek Kaminski and Michael McBride. Working with the faculty of the Institute are 10 Ph.D. students, of whom 2 graduated this academic year. We are admitting 2 new MBS students fall quarter.

The following is our current roster of students enrolled in the Ph.D. program in Mathematical Behavioral Sciences during the current academic year. They are listed in Appendix F.

Nikhil Addleman
Kalin Agrawal*
Calvin Cochran
Steven Doubleday
Santiago Guisasola
Lisa Guo
William Leibzon
Bahattin (Tolga) Oztan*
Shaun Stipp
Junying Zhao

*Graduated in 2015-2016

In addition to MBS Ph.D, five Masters degrees were awarded Summer 2015 – Spring 2016:

Lisa Guo
Santiago Guisasola
Bennett Holman
Natalie Nakamine
Hannah Rubin

Noted academic and research related achievements by our MBS graduate students include Junying Zhao's Andrew Vincent White and Florence Wales White Scholarship for the 2016-17 academic year. The $20,000 scholarship awarded for her work, "Hippocratic Paradox and Irrational Consensu: A Mathematical Behavioral Analysis of Medical Decision-Making."

IMBS supported participation of two MBS graduate students, Santiago Guisasola and William Leibzon, at the Santa Fe Institute over the summer.

Santiago Guisasola contibuted the following to IMBS:

"This summer I had the incredible privilege of being a participant at the Santa Fe Institute Complex Systems Summer School. I attended many lectures by complexity science legends like

Liz Bradley and Jim Crutchfield. Lecture topics included Nonlinear Dynamics, Computation, Networks, Social Minds, and many others. In addition, I worked with 4 other participants on a project that models dominance hierarchy formation in rhesus macaques. We were an interdisciplinary team composed of a computer scientist, biologist, political scientist, economist, and myself. We are still in communication and plan to have a publication ready by December. I formed friendships with the members of my project, but also with the remaining 76 participants of the program. I am now connected to scientists all over the world. I return to Irvine inspired and more knowledgeable about my fields of interest."

B. Graduate Activities

While the formal part of our graduate program is small, the actual impact on the UCI graduate program is more extensive. This is because several graduate students from other programs participate on a regular basis with our weekly Friday lecture section and our annual graduate conference. This past year the MBS graduate students organized student meetings with weekly colloquia speakers. This gives students an opportunity to interact and network with professors. One of the goals is to gain insight into how students perceive IMBS and how to facilitate more involvement of the social science student body.

C. Friday Research Presentations

This IMBS activity was coordinated by Stergios Skaperdas and Jean-Paul Carvalho and directed by graduate student and participant Michael Sacks. Weekly research meetings give space for graduate students and faculty to gather on Fridays from Noon- 1:00 p.m. in the Luce Conference Room to introduce research they are working on. The presentations are followed by discussion periods afterwards. Below is the list of the presentations for the year:

Date	Presenter	Topic
Oct 9	Junying Zhao, Graduate Student, MBS	"The Possibility of Anonymous Social Orderings Using Curvature of Indifference Hypersurfaces"
Oct 16	Rein Taagepera, Professor, Political Science	"How Male and Female Literacy Interact: A Logical Model"
Nov 13	Lisa Guo, Graduate Student, MBS	"A Dual-Process Exploration of Intertemporal Choice"
Nov 20	Mayuri Chaturvedi, Graduate Student, Economics	"Inequality and Rent Seeking"
Jan 29	Michael Sacks, Graduate Student, Economics	"Club size with private benefits when quality matters"
Feb 12	Michael Guggisberg, Graduate Student, Economics	" Strategic Recusals at the United States Supreme Court"
March 4	Andrew Noymer, Associate Professor, Population Health and Disease Prevention Public Health	"Summertime, and the livin' is easy, or Winter and summer pseudo seasonal life expectancy in the United States"

April 22	Christian Herrera, Graduate Student, Cognitive Sciences	"Psychophysics of Color"
May 13	Igor Kopylov, Associate Professor, Economics	"Imperfect Recall and Empirical Betting Preferences

D. Duncan Luce Graduate Student Conference

IMBS sponsors a yearly graduate student conference where students in the MBS program, as well as other students whose research interests are related to MBS, present their research. The graduate organizers of the 14th Annual conference were Santiago Guisasola, Michael Sacks, and Junying Zhao.

Luce Graduate Student Conference
Friday, May 27, 2016
9:00 a.m. – 5:00 p.m.
SSPA 2112

Session I: Decision Making (9:00 – 10:00)
9:00 – 9:30 Steve Doubleday
Spatial Navigation During Simulated Motion in Rats
9:30 – 10:00 Junying Zhao
Hippocratic Paradox: A Mathematical Analysis of Medical Decision-Making

10:00 – 10:10 BREAK

Session II: Evolution and Learning (10:10 – 12:15)
10:10 – 10:40 Timmy Ma
Regularization of Languages: A New Mathematical Framework of Learning from an Inconsistent Source
10:40 – 11:10 Calvin Cochran
Learning Dynamics in the One-Armed Bandit Problem

11:10 – 11:15 SHORT BREAK

11:15 – 11:45 Aydin Mohseni
Fundamental Disagreements in Evolutionary Dynamics and Infinite Idealizations
11:45 – 12:15 Jennifer Briner
Sexual dimorphism in UV color vision in *Heliconius doris*

12:15-1:15 LUNCH

Session III: Games and Networks (1:15 – 3:20)
1:15 – 1:45 William Leibzon
Altruism as a Network Parameter in a Game Theoretic Framework

1:45 – 2:15 **Nikhil Addleman**
Invasion Dynamics in Coordination Games Played on Networks
2:15 – 2:20 **SHORT BREAK**
2:20 – 2:50 **Michael Schneider**
What it Means for a (Particular) Social Norm to Affect Scientific Inquiry
2:50 – 3:20 **Santiago Guisasola**
A Model of Collaboration

3:20-3:30 BREAK

Session IV: Social Inquiry (3:30 – 4:30)
3:30 – 4:00 **Jessica Kizer**
The Relationship Between Family Background, Skin Color, and the Likelihood of Adult Arrest
4:00 – 4:30 **Pat Testa**
Education, Social Capital, and Social Control

4:30 – 5:00 **RECEPTION**

E. Jean-Claude Falmagne Dissertation Award

Each year, IMBS presents the Jean-Claude Falmagne Dissertation Award to a graduate student for the best dissertation that uses mathematics to develop conceptual advances for issues coming from the social and behavioral sciences. Going beyond the use of mathematics for computational purposes, the intent is to award a dissertation that uses concepts from mathematics to reach new conclusions. The prize is $1,500. Last year IMBS selected two dissertations and co-awards were presented to Tomas McIntee, a 2015 graduate of MBS, for his dissertation, "Geometic Ways of Understanding Voting Problems," and Blake Allison, a 2015 graduate of Economics, for his dissertation, "Essays on Competition and Conflict."

This year the committee selected Michael Sacks, 2016 graduate of Economics for his dissertation, "The Economics of Collaborative Production and Consumption with Applications in Digital Technologies."

Michael Sacks (pictured) completed his undergraduate degree at Towson University, near his hometown in Maryland. He came to UCI to complete his master's degree in mathematical behavioral science (MBS) before earning his Ph.D. in economics. His research interests include game theory, industrial organization, the economics of innovation, and more. He will be joining the Department of Economics and the Center for Free Enterprise at West Virginia University this fall.

V. COMMUNICATION

A. IMBS Conferences

The director's statement expanded on the areas of interest for this year's research conferences. We are providing the following conference agendas to give a more in-depth look at the scope of our presentations.

IMBS CONFERENCE ON SYSTEMATIC DATA COLLECTION & APPROPRIATE MATH MODELING
Celebrating Kim Romney's 90th Year
NOVEMBER 5 & 6, 2015
Social Science Plaza A, Duncan Luce Conference Room

Thursday, November 05, 2015

9:00 am to 9:15 am	Welcome, Don Saari
9:15 am to 10:00 am	Susan Weller, *Free-lists, Sample Size, & Saturation*
	Discussion
10:15 am to 11:00 am	Jean-Claude Falmagne, *Comparing the Psychomotor Development of Black Infants in Johannesburg and White Infants in Brussels*
	Discussion
11:15 am to 11:30 am	Break
11:30 am to 12:15 pm	Tim Satalich, *Modeling Color Appearance*
	Discussion
12:30 pm to 1:30 pm	Lunch
1:30 pm to 2:15 pm	Devon Brewer, *A Systematic Review of Post-Marital Residence Patterns in Prehistoric Hunters-Gatherers*
	Discussion
2:30 pm to 3:15 pm	Jeffrey Johnson, *What Does Social Network Knowledge and Estimation Accuracy Get You?*
	Discussion
3:15 pm to 3:30 pm	Break
3:30 pm to 4:15 pm	Louis Narens, *From Psychophysics to Utilitarianism: Measuring and Combining Subjective Intensities*
	Discussion
4:30 pm	Adjourn for the day

Friday, November 06, 2015

9:00 am to 9:15 am	Morning remarks
9:15 am to 10:00 am	Katie Faust, *Comparing Triadic Structure in Social Networks*
	Discussion
10:15 am to 11:00 am	Bill Batchelder, *Cultural Consensus Theory: Observations about Past, Present, and Future*
	Discussion
11:15 am to 11:30 am	Break
11:30 am to 12:15 pm	Jack Yellott, *Remedial Typography: Correcting Presbyopic Defocus by Spatial Filtering*
	Discussion
12:30 pm to 1:30 pm	Adjournment and Informal Reception

CULTURAL CONSENSUS THEORY, MULTINOMIAL PROCESSING TREES, AND COGNITIVE PSYCHOMETRICS

Celebrating Bill Batchelder's 75th Year

NOVEMBER 16 & 17, 2015

Social Science Plaza A, Duncan Luce Conference Room

Monday, November 16, 2015

9:00 am to 9:15 am	Welcome, Bill Maurer and Don Saari
9:15 am to 10:00 am	Zita Oravecz, *Extensions to the general Condorcet model in the hierarchical Bayesian framework* Discussion
10:15 am to 11:00 am	Stephen France, *Continuous CCT: The FlexCCT Software and Associated Models* Discussion
11:30 am to 1:00 pm	Speakers' Lunch
1:00 pm to 1:45 pm	Jeff Johnson, *Measurement in Cultural Consensus Theory: The Development of Cultural Consensus Statements* Discussion
2:00 pm to 2:45 pm	David Kellen, *Comparing Signal Detection and High-Threshold Models of Recognition Memory* Discussion
3:00 pm to 3:15 pm	Break
3:15 pm to 4:00 pm	Christoph Klauer, *Multinomial Processing Trees and Response Time Distributions?* Discussion
4:15 pm to 5:00 pm	Xiangen Hu, *MPT & SRA: Research, Development, and Selected in Advanced Learning Environments* Discussion
5:15 pm	Adjourn for the day

Tuesday, November 17, 2015

9:00 am to 9:15 am	Morning remarks
9:15 am to 10:00 am	Katie Faust, *Can we Infer any Meaningful Global Network Properties When we Modify Social Network Measurement Scales?* Discussion
10:15 am to 11:00 am	E.J. Wagenmakers, *Subjective Reflections on the Work of William H. Batchelder (and a New Model for Confidence Ratings in Recognition Memory)* Discussion
11:15 am to 11:30 am	Break
11:30 am to 12:15 pm	Joachim Vanderckhove, *Cognitive psychometrics and cognitive latent variable models* Discussion
12:30 pm to 1:30 pm	Adjournment and Information Reception

IMBS Conference on
Crowdsourcing, Big Data, and Social Media in the Behavioral Sciences:
Applications, Methods and Theory
December 3 & 4, 2015
Social Science Plaza A, Duncan Luce Conference Room

Thursday, December 03, 2015

8:45 am to 9:00 am	Welcome
9:00 am to 10:00 am	Ulf-Dietrich Reips, University of Konstanz, *Research in with Social Media*
10:10 am to 11:10 am	Norbert Schwarz, USC & David Hauser, University of Michigan, *Online attention checks: Attentive Turkers and unintended consequences*
11:20 am to 12:20 pm	Patricia Greenfield, UCLA, *Cultural evolution in China and the U.S.: Using the Google Ngram Viewer to study implications of social and political change for cultural values and human development"*
12:30 pm to 1:30 pm	Lunch
1:30 pm to 2:30 pm	Mark Steyvers, UCI, *Combining Human Judgments*
2:40 pm to 3:40 pm	Siddharth Suri, Microsoft, *Crowdwork's Invisible Engine: Valuing the Organic Collaboration that Drives Crowdsourcing Labor Markets*
3:50 pm to 4:50 pm	Niloufar Salehi, Lilly Irani, Michael Bernstein, Ali Alkhatib, Eva Ogbe, Kristy Milland, and Clickhappier, Computer Science and The Human Computer Interaction Group, Stanford University, *We Are Dynamo: Overcoming Stalling and Friction in Collective Action for Crowd Workers*
5:00 pm to 5:30 pm	Discussion
5:30 pm	Adjourn for the day

Friday, December 04, 2015

9:00 am to 10:00 am	Kimberly A. Jameson, Sean Tauber, Prutha S. Deshpande, Stephanie M. Chang, and Sergio Gago, *Crowdsourcing the transcription of archival data*
10:10 am to 11:10 am	Michael D. Lee, UCI, *Making sports predictions by applying cognitive models to crowd-sourced data*
11:30 am to 1:00 pm	On site: Lunch and Student Poster Session
1:00 pm to 2:00 pm	Alexander Ihler, UCI, *Computational Choices for Crowdsourcing*
2:10 pm to 4:10 pm	Ulf-Dietrich Reips, *Tutorial Session: Tools and methods in crowdsourcing and Internet-based experimenting*
4:20 pm to 5:20 pm	Gary H. McClelland, University of Colorado Boulder, *Visualization for Big Data and Internet Research*
5:30 pm to 6:00 pm	Discussion and informal reception
6:00 pm	Adjournment

University of California, Irvine
Experimental Social Sciences Laboratory, Department of Economics,
Institute for Mathematical Behavioral Science and
Paul Merage School of Business Present:
Southwest Experimental & Behavioral Economics Conference
Lyman Porter Colloquium Room (Room 5200, Business School I)
Friday and Saturday, May 20 & 21, 2016

Friday, May 20, 2016

9:00 – 9:10	Welcome
9:10 – 9:40	*Waiting for the Glow: Theory and Experiments on Intertemporal Altruism*, Marta Serra-Garcia, UCSD & CESifo, (with James Andreoni, UCSD & NBER, and Ann-Kathrin Koessler, Queensland University of Technology)
9:40 – 10:10	*Testable Implications of Models of Intertemporal Choice: Exponential Discounting and Its Generalizations*, Taisuke Imai, (with Federico Echenique and Kota Saito), Caltech
10:10 – 10:40	*Dynamic Inconsistency in Food Choice: Experimental Evidence from a Food Desert*, Sally Sadoff, UCSD, (with Anya Samek, USC, and Charles Sprenger, UCSD)
10:40 – 11:00	Break
11:00 – 11:30	*When to Quit: Narrow Bracketing and Reference Dependence in Taxi Drivers,* Vincent Leah-Martin, UCSD
11:30 – 12:00	*Learning from Prices in Models of Models of Higher Order Beliefs*, Radhika Lunawat, UCI
12:00 – 1:30	Lunch, 3rd floor terrace
1:30 – 2:00	*Communication Without the Cooperative Principle: A Signaling Experiment*, Cailin O'Connor, (with Simon Huttegger, Justin Bruner and Hannah Rubin), UCI
2:00 – 2:30	*Information Transmission and the Shadow of the of the Future*, Emanuel Vespa, (with Alistair Wilson), UCSB
2:30 – 3:00	*Experimenting with Measurement Error: Techniques with Applications to the Caltech Cohort Study*, Ben Gillen, (with Erik Snowberg and Leeat Yariv), Caltech
3:00 – 3:30	Break
3:30 – 4:00	*Equilibrium Selection in Stable Matching Mechanisms: Experimental Evidence*, Ahrash Dianat, (with Marco Castillo), Caltech
4:00 – 4:30	*Population Uncertainty in Voluntary Contributions of Public Goods*, Duk Goo Kim, Caltech
5:30 – 8:00	Dinner, Plenary Speaker Shyam Sunder, Yale School of Management, UCI University Club (*by invitation*)

Saturday, May 21, 2016

9:00 – 9:30	*Candidate entry and political polarization: An experimental study*, Jens Grosser, FSU, (with Thomas R. Palfrey, Caltech)
9:30 – 10:00	*Dump, Date, or Marry: Endogenous Group Formation with Varied Contract Length,* Sean D'Evelyn, LMU
10:00 – 10:30	A Theory of Mind Ability and Cooperation in Prisoners Dilemma, Garret Ridinger,

	(with Michael McBride), UCI
10:30 – 10:50	Break
10:50 – 11:20	*Persistence of Power: Dynamic Multilateral Bargaining*, Marina Agranov, (with Christopher Cotton and Chloe Tergiman), Caltech
11: 20 – 11:50	*An Empirical Investigation of Wagering Behavior in a Large Sample of Slot Machine Gamblers*, Florina Salaghe, (with James Sundalie, Mark Nichols, Federico Guerrero), University of Nevada, Reno
11:50 – 12:20	*Tra i Lioni: The Economics of Supersition*, Joshua B. Miller, (with Tommaso Coen, Martin Dufwenberg, Giovanna Invernizzi and Luiz Oliviera), Bocconi University
12:20 – 12:30	Closing remarks
12:30	Adjournment

B. Conferences/Seminars Organized By IMBS Members

Carter Butts

Co-organized the Statnet workshops, "Sunbelt International Social Network Conference." Newport Beach, CA, April 2016.

Workshop for students in the Chemistry and MaterialsPhysics (ChaMP) program. This entailed hands-on training in the use of Ising models,exponential family random gra models (ERGMs), and Markov chain Monte Carlo methods. Exercises included simulating the impact of alternative material structures on the properties of ferromagnets, fitting and simulating ERGMs for social and other networks, and using ERGMs to model hydrogen bond networks in liquid water and RNA folding. UC Irvine, September 2015.

John Duffy

Co-organizer, "Southwest Experimental and Behavioral Economics Conference," UC Irvine, May 2016.

Michelle Garfinkle

Co-organizer,"Workshop on Trade and Conflict," with Stergios Skaperdas, May 2016.

Bernie Grofman

Organizer of Peltason Center for the Study of Democracy "signature" conference around the theme of "Political Persuasion." Participants were leading scholars in political science, psychology, and economics. Laguna Beach, CA, January 2016.

Co-organized an international conference,"New Developments in the Study of Cabinet Coalition Formation," with Professor Patrick Dumont, University of Luxembourg, and held at the Belgian Academy. Rome, Italy, April 2016.

Co-organized an international conference, "The 65th Anniversary of Duverger's Law of Electoral Systems" with Professor Annie Laurent, University of Lille II, and Professor Bernard Dolez (University of Paris I –Sorbonne). Frejus, France, May 2016.

Kimberly Jameson

Organized IMBS conference, "Crowdsourcing, Big Data, and Social Media in the Behavioral Sciences: Applications and Theory." UC Irvine, December 2015.

Robin Keller

Program Committee Member and Special Track Organizer, "12th INTERNATIONAL CONFERENCE on Operations Research (ICOR 2016)," co-sponsored by INFORMS. Organized a set of talks by INFORMS members for the program committee. Havana, Cuba, March 2016.

Michael McBride

Co-organizer, "Southwest Experimental and Behavioral Economics Conference," UC Irvine, May 2016.

Cailin O'Connor

Co-organizer, "Games, Interaction, Rationality, and Learning 2016 Conference," in Lund, Sweden. April 2016.

Michael Lee

Co-organizer of IMBS workshop, "Cultural Consensus Theory, Multinomial Processing Trees, and Cognitive Psychometrics," UC Irvine, November 2016.

George Sperling

Organizer, "Forty-First Annual Interdisciplinary Conference," Breckenridge, CO, January 2016.

James Weatherall

Scientific Organizing Committee, "Fourth International Conference on the Nature and Ontology of Spacetime," Institute for Foundational Studies Hermann Minkowski, Varna, Bulgaria, May 2016.

Workshop co-organizer (with J, Heis, P. Maddy, and P. K. Stanford), “The Scientific Berkeley,” University of California, Irvine, May 2016.

Workshop co-organizer (with N. Boyd, H. Halvorson, J. Norton, G. Valente), “The Field Concept in Physics,” University of Pittsburgh, April 2016.

Conference co-organizer (with N. Boyd, H. Halvorson, J. Norton, G. Valente), “Fourth Annual Irvine-Pittsburgh-Princeton Conference on the Mathematical and Conceptual Foundations of Physics,” University of Pittsburgh, March 2016.

Hongkai Zhao

Organizer for IPAM workshop, “Shape Analysis and Learning by Geometry and Machine,” UCLA, February 2016.

C. Visitors

IMBS hosted Princeton Professor Simon Levin, Moffett Professor of Biology, Princeton University during the academic year. His activities letter can be found in Appendix G.

Next year the Institute will again sponsor the visit of Professor Levin. In addition, researcher Tim Satalich continues work with Professor Kim Romney, and Robert Forbes continues work with Professor Louis Narens.

D. IMBS Colloquia Series

During the academic year the Institute conducts a weekly colloquia series with speakers from both inside as well as outside the Institute. For speakers outside California, we attempt, insofar as possible, to coordinate their visit with other travel to California and to co-sponsor joint talks with other research units. We distribute a relevant paper, when available, prior to each colloquium. Most papers are also downloadable from the IMBS web site at http://www.imbs.uci.edu/newsevents/events/colloquia.php.

The following talks were presented in the IMBS Luce Conference Room during the 2015 – 2016 academic year:

OCTOBER 1
NATALIA KOMAROVA
Professor of Mathematics
UC Irvine
"Networks of control in stem cells"

OCTOBER 15
JOHN DUFFY
Professor of Economics
UC Irvine
"Voting with Endogenous Information Acquisition: Theory and Evidence"

OCTOBER 29
PAUL TUPPER
Joint with Applied and Computational Mathematics
Associate Professor of Mathematics
Simon Fraser University
"Exemplar dynamics and sound merger in language"

NOVEMBER 20
RUSSELL GOLMAN
Assistant Professor, Social & Decision Sciences
Carnegie Mellon University
"Polya's bees: A model of decentralized decision-making"

JANUARY 14
CAILIN O'CONNOR
Assistant Professor
UC Irvine
"Power, Bargaining, and Evolution"

JANUARY 21
PATRICK FORBER
Associate Professor
Tufts University
"The Coevolution of Recognition and Social Behavior"

JANUARY 28
STEVE FRANK
Distinguished Professor
UC Irvine
"The Common Patterns of Nature"

FEBRUARY 18
KEITH DOUGHERTY
Professor
University of Georgia
"**Coalitional Stability: Apportioning the Legislature at the U.S. Constitutional Convention**"

FEBRUARY 25
IGOR KOPYLOV
Associate Professor
UC Irvine
"Approximation Formulas in Continuous Utility Models"

MARCH 10
ASEN KOCHOV
Assistant Professor
University of Rochester, New York
"Stationary Cardinal Utility"

APRIL 7
JAMES LU
Assistant Professor, Economics
UCLA
"Bayesian Theory of State Dependent Utilities"

APRIL 21
MARK SATTERTHWAITE
Professor of Strategy
Northwestern University
"Price Discovery Using a Double Auction"

APRIL 28
JACOB FOSTER
Assistant Professor, Sociology
UCLA
"Made to know: science as the social production of collective intelligence"

MAY 12
DAVID EPPSTEIN
Chancellor's Professor, Information and Computer Sciences
UC Irvine
"Linear-time Algorithms for Proportional Apportionment"

MAY 19
SEAN TAUBER
Assistant Research Scientist, IMBS
UC Irvine
"Bayesian models of cognition revisited: Setting optimality aside and letting data drive psychological theory"

MAY 26
KIMBERLY JAMESON
Research Scientist, IMBS
UC Irvine
"Can we rule out the potential from Potential Human Tetrachromacy?""

JUNE 2
EHUD KALAI
Professor of Managerial Economics & Decision Sciences
Northwestern University
"Learning and Stability in Big Uncertain Games"

VI. BUDGET

A. Appropriations and Expenditures

Appropriations:

2015-16 IMBS Budget allocation	$ 90,000.00
Visitor Allocation	$ 17,430.00
2015-16 Overhead return	$ 15,540.00
Total budget for 2015-16:	*$122,970.00*

Expenditures:

Salaries & Benefits (Dir., Admin., Visitor)	$ 62,823.37
School Administrative Support	$ 7,500.00
Social Sciences Business Office	$ 15,540.00
Conference/Colloquia	$ 21,854.67
Supplies & Expenses	$ 2,001.96
Graduate Student Support	$ 13,250.00
Total Expenditures:	*$122,970.00*

Closed fiscally solvent

B. Extramural Funding Activity

GRANTS AWARDED AND ACTIVE:

IMBS faculty research was supported by research grants totaling $37,764,418. The following is a detailed breakdown of the extramural funding:

William H. Batchelder

Source: John Templeton Foundation
Amount: $54,019
Award Period: 2014-2017
Title: A Formal Modeling Framework for the Dynamics of Subjective Well-being, including Satisfaction, with Interpersonal Relationships
Role: Senior Researcher

Source: NSF
Amount: $299,787
Award Period: 2015-2018
Title: Statistical Extensions and new Application of Cultural Consensus Theory
Role: Co-PI

David Brownstone

Source: UCCONNECT
Amount: $119,554
Award Period: 1/1/2015 – 3/30/2016
Role: Co-PI

Source: UCCONNECT
Amount: $66,982
Award Period: 8/1/2015 – 9/30/2016
Role: Co-PI

Source: UCCONNECT
Amount: $172,314
Award Period: 5/1/2016 – 9/30/2017
Role: Co-PI

Carter Butts

Source: ARO
Amount: $303,284
Award Period: 2014 – 2016
Title: Advancing Statistical Methods for Analysis of Multiple Networks
Role: PI

Source: NSF DMS
Amount: $1,308,441
Award Period: 2014 – 2018
Title: Bayesian Methods for Protein Fibrillization: Model Integration and Network Dynamics
Role: PI and Martin, Rachel W. (Co-PI)

Source: NSF IIS
Amount: $746,783
Award Period: 2013 – 2016
Title: BIGDATA: Small:DA DCM: Measurement and Learning Large-Scale Social Networks
Role: Co-PI and Anandkumar, Anima (PI)

Source: NIH NICHD
Amount: $3,092,315
Award Period: 2011 – 2016
Title: Statistical Methods for Network Epidemiology
Role: Co- Investigator with Morris, Martina (PI); Steven M. Goodreau (Co-Investigator); Hunter, David (Co-Investigator); Bender-deMoll, Skye (Co-Investigator); and Krivitsky, Pavel (Co-Investigator)

Source: NSF OIA
Amount: $2,152,181
Award Period: 2010 – 2016
Title: CDI-Type II: Topology and Function in Computer, Social and Biological Networks
Role: Co-PI with Markopoulou, Athina (PI); Przulj, Natasa (Co-PI)

Source: NSF IIS
Amount: $499,758
Award Period: 2015 – 2018
Title: III: NeTS: Small: Network Sampling and Construction Methods for Inference and Anonymization
Role: Co-PI with Markopoulou, Athina (PI)

Jean-Paul Carvalho

Source: IMBS
Award Amount: $1,500
Award Period: 2015-2016
Title: IMBS Seed Grant
Role: Investigator

John Duffy

Source: NSF
Amount: $79,056
Award Period: 2016-2017
Title: Experimental Evidence on Monetary Policies
Role: Co-PI (with Daniela Puzzello)

Steve Frank

Source: NSF
Award Amount: $275,000
Award Period: 2013 – 2017
Title: ABR: Models of Natural Selection, Development, and Life History
Role: PI

Kimberly Jameson

Source: Private Donations
Award Amount: $65,000
Award Period: 2015
Title: Clinical and Behavioral Investigations of Human hotpigment Opsin Gene Variations and Age-related Macular Degeneration
Role: PI with C.M. Kenney (Co-PI)

Source: NSF
Award Amount: $980,923
Award Period: 2014 – 2017
Title: IBSS: New methods for investigating the formation of individual and shared concepts and their dynamic dispersion across related societies
Role: PI with N. Komarova (Co-PI), D. Wodarz (Co-PI), L. Narens (Co-PI)

Marek Kaminski

Source: Center for the Study of Democracy

Award Amount: $2,500
Award Period: Winter 2016
Title: CSD Seed Grant
Role: Investigator

Natalia Komarova

Source: NSF
Award Amount: $980,923 (calculated with Jameson's award)
Award Period: 2014 - 2017
Title: New methods for investigating the formation of individual and shared concepts and their dynamic dispersion across related societies
Role: Co-PI (with PI K. Jameson)

Source: NIH
Award Amount: $2,249,999
Award Period: 2014 – 2019
Title: Aspirin and Cancer Prevention in Lynch Syndrome: From Cell to Population Data
Role: Co-PI (with PIs D. Wodarz and D. Levy)

Source: IMBS Seed Grant
Award Amount: $1,500
Award Period: 2015-2016
Title:
Role: Investigator

Igor Kopylov

Source: IMBS Seed Grant
Award Amount: $1,700
Award Period: 2015-2016
Title: Subjective Model Uncertainty and Second Model Uncertainty and Second-Order Beliefs
Role: Investigator

Michael McBride

Source: UC Connect Faculty Research Grant
Award Amount: $172,314
Award Period: 2016-2017
Title: Experimental Studies for Traffic Incident Management with Pricing, Private Information, and Diverse Subjects
Role: Co-PI

Source: Army Research Office
Award Amount: $68,439
Award Period: 2016-2017
Title: Instrumentation for the UC Irvine Experimental Social Science Laboratory
Role: PI

Louis Narens

Source: NSF
Award Amount: $980,923.00 (calculated with Jameson's award)
Award Period: 2014-2017
Title: IBSS: New methods for investigating the formation of individual and shared concepts and their dynamic dispersion across related societies
Role: Co-PI with K. Jameson (PI), N. Komarova (Co-PI), D. Wodarz (Co-PI)

Source: AFOSR
Award Amount: $388,187
Award Period: 2012– 2016
Title: Modeling Behavioral and Decision Behavior through Systems of Observers
Role: PI

Cailin O'Connor

Source: National Science Foundation (NSF) Science, Technology, and Society
Award Amount: $305,986
Award Period: 2015 – 2018
Title: Dynamics and Diversity in Epistemic Communities
Role: PI

Lisa Pearl

Source: National Science Foundation (NSF)
Award Amount: $375,000 UCI Amount: $142,000
Award Period: 2014 – 2017
Title: Collaborative Research: An Integrated Theory of Syntactic Acquisition
Role: PI

Hal Stern

Source: National Institute of Standards and Technology (NIST)
Award Amount: $20,000,000
Award Period: June 2015 – May 2020
Title: Center of Excellence in Forensic Statistics

Role: Co-PI and PI of UC Irvine subcontract ($3,700,000); A. Carriquiry, PI

Source: National Institutes of Mental Health – NIMH Conte Center
Award Amount: $10,000
Award Period: 2013 – 2018
Title: Fragmented Early Life Environment and Cognitive and Emotional Vulnerabilities,
Role: Co-PI and Head of Biostatistics Computation and Date Management Core, T. Baram, PI

James Weatherall

Source: NEH
Award Amount: $21,991
Award Period: 2014 – 2017
Title: What is Time? Perspectives from Physics, Philosophy, Fiction, and Film, NEH Big Questions Course Development Grant
Role: PI

Source: NSF
Amount: $221,590
Award Period: 2013 – 2016
Title: A Theoretical Study of the Conceptual, Mathematical, and Explanatory Interconnections at the Foundations of Classical Field Theories
Role: PI

Source: NSF
Amount: $249,928
Award Period: 2013 – 2016
Title: Comprehending and Regulating Financial Crises
Role: Co-PI

Jack Xin

Source: NSF
Award Amount: $451,109
Award Period: 2012 – 2015
Title: Blind and Template Assisted Source Separation Algorithms with Applications to Spectroscopic Data
Role: PI

Source: NSF
Award Amount: $419,691
Award Period: 2012 – 2016
Title: Reaction-Diffusion Front Speeds in Chaotic and Stochastic Flows

Role: PI

Source: NSF
Award Amount: $299,890
Award Period: 2015 – 2018
Title: Theory and Algorithms of Transformed L1 Minimiztion with Applications in Data Science
Role: PI

Hongkai Zhao

Source: NSF
Award Amount: $328,860
Award Period: 2014 – 2017
Title: Shape and data analysis using computational differential geometry
Role: PI

Source: NSF
Award Amount: $249,964
Award Period: 6/1/2016 -05/31/19
Title: BIGDATA: Theory and practice for exploiting deterministic structures of probability models in big data analysis
Role: PI

VII. APPENDICES

A. CURRENT FACULTY MEMBERS

APPENDIX A
IMBS FACULTY, 2015 - 2016

Pierre F. Baldi, (Ph.D. Mathematics, California Institute of Technology). Distinguished Professor of Computer Science; Director, Institute for Genomics & Bioinformatics, University of California, Irvine. Research areas: Bioinformatics, computational biology, probabilistic modeling, machine learning.

Jeffrey Barrett, (Ph.D. Philosophy, Columbia University). Chancellor's Fellow and Professor of Logic and Philosophy of Science, University of California, Irvine. Research areas: Philosophy of science; theory of knowledge; philosophy of physics.

William H. Batchelder, (Ph.D. Psychology, Stanford University). Professor of Cognitive Sciences, University of California, Irvine. Research areas: Mathematical modeling and measurement methodology in the social sciences.

Michael Birnbaum, (Ph.D. Psychology, University of California, Los Angeles). Professor of Psychology, Cal State University, Fullerton. Research areas: Human judgment, decision-making, and utility measurement.

John P. Boyd, (Ph.D. Communication Sciences, University of Michigan). Professor Emeritus of Anthropology, University of California, Irvine. Research areas: Algebraic models of social relations, quantitative methods, and sociobiology.

William A. Branch, (Ph.D. Economics, University of Oregon). Chancellor's Fellow and Professor of Economics, University of California, Irvine. Research areas: Macroeconomic dynamics.

Myron (Mike) Braunstein, (Ph.D. Psychology, University of Michigan). Professor Emeritus of Psychology, University of California, Irvine. Research areas: Visual perception, especially depth and motion perception.

David Brownstone, (Ph.D. Econometrics and Applied Microeconomics, University of California, Berkeley) Professor and Chair of Economics, University of California, Irvine. Research areas: Computer-intensive analysis of statistical estimation strategies and applied econometrics.

Jan K. Brueckner, (Ph.D. Economics, Stanford University). Chancellor's Professor of Economics and Department Chair, University of California, Irvine. Research areas: Urban economics, public economics, industrial organization, housing finance.

Michael Burton, (Ph.D. Anthropology, Stanford University). Professor Emeritus of Anthropology, University of California, Irvine. Research areas: Economic and social anthropology.

Carter Butts, (Ph.D. Sociology, Carnigie Mellon University). Professor of Sociology, University of California, Irvine. Research areas: Social networks, Bayesian methods, informant accuracy and strategic behavior.

Jean-Paul Carvalho, (Ph.D. Economics, University of Oxford). Assistant Professor of Economics, University of California, Irvine. Research areas: Applied game theory; culture, identity and institutions.

Charles Chubb, (Ph.D. Experimental Psychology, New York University). Professor of Cognitive Sciences. University of California, Irvine. Research areas: Vision, perception, and information processing.

Linda Cohen, (Ph.D. Social Sciences, California Institute of Technology). Professor of Economics, University of California, Irvine. Research areas: Political economy, public choice, and government regulation of business.

Art De Vany, (Ph.D. Economics, University of California, Los Angeles). Professor Emeritus of Economics, University of California, Irvine. Research areas: Models of industry organization, health, analysis and policy of extreme events, information processing and market institutions.

Barbara A. Dosher, (Ph.D. Experimental Psychology, University of Oregon). NAS Member, Distinguished Professor of Cognitive Sciences, School of Social Sciences, University of California, Irvine. Research areas: Memory, visual perception, depth from visual motion.

Michael D'Zmura, (Ph.D. Psychology, University of Rochester). Professor of Cognitive Sciences, University of California, Irvine. Research areas: Vision, color, attention, image understanding, virtual reality.

David A. Eppstein, (Ph.D. Computer Sciences, Columbia University). Chancellor's Professor of Computer Science, University of California, Irvine. Research areas: Computational geometry and graph algorithms, including finite element meshing, minimum spanning trees, shortest paths, dynamic graph data structures, graph coloring, graph drawing, geometric optimization, computational robust statistics, and geometric optimization.

Jean-Claude Falmagne, (Ph.D. Psychological Sciences, University of Brussels). Research Professor Emeritus, Cognitive Sciences, University of California, Irvine. Research areas: Assessment of knowledge, measurement theory, psychophysics, mathematical psychology.

Katherine Faust, (Ph.D. Social Science, University of California, Irvine). Professor of Sociology, University of California, Irvine. Research areas: Mathematical, computational, and conceptual models to study complex phenotypes.

Steven A. Frank, (Ph.D. Biology, University of Michigan). Donald Bren Professor of Ecology and Evolutionary Biology, University of California, Irvine. Research areas: Evolution of social behavior; design of reliability.

Linton C. Freeman, (Ph.D. Sociology, Northwestern University). Professor Emeritus of Sociology, University of California, Irvine. Research areas: Cognition of social structure, social networks.

Michelle Garfinkel, (Ph.D. Economics, Brown University). Professor of Economics, University of California, Irvine. Research areas: Strategic aspects of monetary and fiscal policies.

Amihai Glazer, (Ph.D. Economics, Yale University). Professor of Economics, University of California, Irvine. Research Areas: Public choice, especially concerning commitment problems.

Bernard Grofman, (Ph.D. Political Science, University of Chicago). Jack W. Peltason Endowed Chair, Professor of Political Science; Past Director, Center for the Study of Democracy, University of California, Irvine. Research areas: Models of group decision making, models of individual choice, electoral competition.

Donald Hoffman, (Ph.D. Computational Psychology, Massachusetts Institute of Technology). Professor of Cognitive Sciences and Information and Computer Science, University of California, Irvine. Research areas: Formal theories of perception, human and machine vision, recovery of depth from images.

Simon Huttegger, (Ph.D. Universität Salzburg). Chancellor's Fellow and Professor of Logic and Philosophy of Science Science, University of California, Irvine. Research areas: Probability theory; philosophy of probability, induction, decision theory, social philosophy, dynamical Systems.

Geoffrey Iverson, (Ph.D. Theoretical Physics, University of Adelaide, Australia, Ph.D. Experimental Psychology, New York University). Professor Emeritus of Cognitive Sciences, University of California, Irvine. Research areas: Psychophysics, vision, statistical estimation and testing of ordinal models.

Kent Johnson, (Ph.D. Philosophy, Rutgers University). Professor of Philosophy, University of California, Irvine. Research areas: Lexical semantics, metaphysical/epistemological relation between current linguistic theories and broader psychological processes, Methodological issues bearing on linguistic theorizing.

Marek Kaminski, (Ph.D. Government and Politics, University of Maryland). Associate Professor of Political Science, University of California, Irvine. Research areas: Political systems and economics in transition, formal models of voting, political consequences of electoral laws, models of allocation and social choice.

L. Robin Keller, (Ph.D. Management Sciences, University of California, Los Angeles). Professor of Management, Paul Merage School of Business, University of California, Irvine. Research areas: Individual decision making, risk analysis, fairness, probability judgements, decision problem structuring.

Igor Kopylov, (Ph.D. University of Rochester). Associate Professor of Economics, University of California, Irvine. Research areas: Microeconomic theory, decision theory, and game theory.

Natalia Komarova, (Ph.D. Applied Mathematics, University of Arizona). Professor of Mathematics, and Ecology & Evolutionary Biology, University of California, Irvine. Research areas: Mathematical modeling and biology, virus dynamics, cancer modeling.

Michael D. Lee, (Ph.D. Psychology, University of Adelaide). Professor of Cognitive Sciences, University of California, Irvine. Research Areas: Mathematical and computational models of stimulus representation, categorization, memory, decision-making and problem-solving.

Simon Asher Levin, (Ph.D. Mathematics, University of Maryland). NAS Member, Director, Center for BioComplexity, George M. Moffett Professor of Biology, Princeton University. Research Areas: Dynamics of populations and communities; spatial heterogeneity and problems of scale; evolutionary ecology; theoretical and mathematical ecology; biodiversity and ecosystem processes.

Mark Machina, (Ph.D. Economics, Massachusetts Institute of Technology). Professor of Economics, University of California, San Diego. Research areas: Utility, decision making, risk behavior.

Penelope Maddy, (Ph.D. Philosophy, Princeton). Distinguished Professor of Logic and Philosophy of Science, and Mathematics, University of California, Irvine. Research areas: Philosophy of mathematics, especially the philosophy of set theory.

Michael McBride, (Ph.D. Economics, Yale University). Professor of Economics, University of California, Irvine. Research areas: Microeconomics, game theory, and political economy.

Anthony McGann, (Ph.D. Political Science, Duke University). Professor in the School of Government and Public Policy, University of Strathclyde, Glasgow, Scotland. Research Areas: Party systems, democratic theory, formal models of political systems, European government

Louis Narens, (Ph.D. Mathematics, University of California, Los Angeles). Professor of Cognitive Sciences, and Psychiatry and Human Behavior, Graduate Advisor for IMBS, University of California, Irvine. Research areas: Measurement theory, foundations of science, decision theory.

Andrew Noymer, (Ph.D. Sociology, University of California, Berkeley). Associate Professor of Public Health, University of California, Irvine. Research Areas: Medical demography, mathematical sociology, quantitative methodology.

Calin O'Connor, (Ph.D. Philosophy, University of California, Irvine) Assistant Professor of Logic and Philosophy of Science, University of California, Irvine. Research Areas: Philosophy of biology, philosophy of science, and evolutionary game theory.

Richard S. Palais, (Ph.D. Mathematics, Harvard University). Adjunct Professor of Mathematics, University of California, Irvine. Research Areas: Mathematical Visualization and more specifically to continue the development of Macintosh program 3D-Filmstrip (now called 3D-XplorMath).

Lisa Pearl, (Ph.D. Linguistics, University of Maryland at College Park). Associate Professor of Cognitive Sciences, University of California, Irvine. Research areas: Language acquisition, language change, natural language processing.

Dale Poirier, (Ph.D. Economics, University of Wisconsin). Professor of Economics, University of California, Irvine. Research areas: Econometrics, both theoretical and empirical, specializing in Bayesian econometrics

David M. Riefer, (Ph.D. Psychology, University of California, Irvine). Professor of Psychology, California State University at San Bernardino. Research areas: Memory, cognitive science, and mathematical Psychology.

A. Kimball Romney, (Ph.D. Social Anthropology, Harvard University). NAS Member, Emeritus Professor of Anthropology, University of California, Irvine. Research areas: Cognitive anthropology, cultural consensus, informant accuracy, quantitative methods.

Donald G. Saari, (Ph.D. Mathematics, Purdue University). NAS Member, Distinguished Professor of Mathematics and Economics, and Director of the Institute for Mathematical Behavioral Sciences, University of California, Irvine. Research areas: Mathematics and application of dynamical systems to social sciences; decision theory.

Stergios Skaperdas, (Ph.D. Economics, Johns Hopkins University). Clifford S. Heinz Chair and Professor of Economics., University of California, Irvine. Research areas: Economic theory and political economy.

Brian Skyrms, (Ph.D. Philosophy, University of Pittsburgh). NAS Member, Distinguished Professor of Social Sciences, Professor of Logic and Philosophy of Science, and Professor of Economics, and Director of Salzburg Exchange Program, University of California, Irvine. Research areas: Probability, induction, causation, rational choice.

Kenneth A. Small, (Ph.D. Economics, University of California, Berkeley). Professor Emeritus of Economics, University of California, Irvine. Research areas: Urban, energy and transportation economics, econometrics.

Padhraic Smyth, (Ph.D. Computer Engineering, California Institute of Technology). Professor of Computer Science, University of California, Irvine. Research areas: Statistical pattern recognition, probabilistic learning, information theory, artificial intelligence, image and time-series modeling.

George Sperling, (Ph.D. Psychology, Harvard University). NAS Member, Distinguished Professor of Cognitive Sciences, and Department of Neurobiology and Behavior, University of California, Irvine. Research areas: Human information processing, vision and visual perception, computer vision and image processing.

Ramesh Srinivasan, (Ph.D. Biomedical Engineering, Tulane University). Professor of Cognitive Sciences, University of California, Irvine. Research areas: Perception, development and cortical dynamics.

Hal Stern, (Ph.D. Statistics, University of California, Irvine). Ted and Janice Smith Family Foundation Endowed Chair in Information and Computer Science, Professor of Information and Computer Science, University of California, Irvine. Research areas: Bayesian methods, model diagnostics, statistical computing.

Mark Steyvers, (Ph.D. Psychology, Indiana University). Professor of Cognitive Sciences, University of California, Irvine. Research areas: Computational models of memory, reasoning and perceptions.

Rein Taagepera, (Ph.D. Physics, University of Delaware). Professor Emeritus of Political Science, University of California, Irvine. Research areas: Quantitatively predictive models; electoral and party systems; Finno-Ugric area studies.

Carole Uhlaner, (Ph.D. Political Science, Harvard University). Professor of Political Science, University of California, Irvine. Research areas: Rational actor models and statistical analyses of political behavior, especially participation and voting; decision theory; comparative politics.

Joachim Vandekerckhove, (Ph.D. Psychology, University of Leuven, Belgium) Associate Professor of Cognitive Sciences, University of California, Irvine. Research areas: Response time modeling – Psychometrics- Computional methods – Bayesian statistics.

James Weatherall, (Ph.D. Philosophy, University of California, Irvine). Professor of Logic and Philosophy of Science, University of California, Irvine. Research areas: Philosophy of physics. Philosophy of space and time, philosophy of science, atomic, molecular, and optical physics (theory), mathematical physics.

Douglas White, (Ph.D. Anthropology, Social Theory, University of Minnesota). Professor Emeritus of Anthropology, University of California, Irvine. Research areas: social networks, longitudinal social demography, cross cultural, quantitative methods.

Charles E. (Ted) Wright, (Ph.D. Psychology, University of Michigan). Associate Professor of Cognitive Sciences, University of California, Irvine. Research areas: Motor processing and control, visual search, handwriting.

Jack Xin, (Ph.D. Courant Institute, New York University). Professor of Mathematics, University of California, Irvine. Research areas: Partial Differential Equations (PDE), Asymptotic Analysis, Scientific Computation, and their Applications in Fluid Dynamics, Voice Signal Processing, Biology, Nonlinear Optics and Geoscience.

John I. Yellott, (Ph.D. Psychology, Stanford University). Professor Emeritus of Cognitive Sciences, University of California, Irvine. Research areas: Vision, probabilistic choice models.

Hongkai Zhao, (Ph.D. Mathematics, University of California, Los Angeles). Professor of Mathematics, University of California, Irvine. Research areas: Applied and computational mathematics with applications in physics, engineering, imaging science and computer vision.

Robert Forbes, (Ph.D. Mathematical Behavioral Sciences, University of California, Irvine). Project Scientist, University of California, Irvine. Research areas: Applied studies of decision-making under uncertainty. Development of mathematical modeling and methodologies for risk assessment and group decision-making in large corporations.

Kimberly Jameson, (Ph.D. Psychology, University of California, Irvine). Project Scientist, University of California, Irvine. Research areas: categorization behaviors; modeling concept formation for perceptual stimuli (e.g., the cognitive organization of color sensations and its relationship to linguistic classifiers); the development and breakdown of these cognitive functions; and optimum performance in tasks involving color-coding(s).

Vladimir A. Lefebvre, (Ph.D. Psychology, Lomonosov Moscow State University). Researcher for Cognitive Sciences, University of California, Irvine. Research areas: Human reflexion, mathematical modeling of human inner world, military psychology.

Tim Satalich, (Ph.D. Mathematical Psychology, John Hopkins University). Associate Researcher, University of California, Irvine. Research areas: Mathematical modeling of human color vision processing. Development of statistical analysis methods for representing perceptual color space data.

Sean Tauber (Ph.D. Psychology, University of California, Irvine) Assistant Project Scientist, University of California, Irvine. Research areas: Mathematical psychology, computer modeling of psychological phenomena, evolutionary game-theoretic algorithms.

B. SCIENTIFIC PUBLICATIONS

APPENDIX B
SCIENTIFIC PUBLICATIONS OF IMBS MEMBERS, 2015 - 2016

Jeff Barrett

Barrett, J. A., Skyrms, B, & Mohseni, A. (2016). Self-Assembling Networks. Draft.

Barrett, J., Cochran, C.T., Fugijiwara, N. & Hutteger, S. (2016). Hybrid Learning in Signaling Games. Draft.

Barrett, J. A. (2016). Typicality in Pure Wave Mechanics. *Fluctuation and Noise Letters*. Forthcoming.

Barrett, J. A. (2016). Quantum Worlds. *Principia*. Forthcoming.

Barrett, J. A. (2016). Truth and Probability in Evolutionary Games. *Journal of Experimental & Theoretical Artificial Intelligence*. Forthcoming.

Barrett, J. A. (2015). On the Evolution of Truth. Erkenntnis. Forthcoming.

Barrett, J. A. and Skyrms, B. (2015). Self-Assembling Games. *BJPS*. Forthcoming.

Bill Batchelder

Batchelder, W. H., Colonius, H., Dzhafarov, E., & Myung, J. (In Press, To Appear December 2016). *New Handbook of Mathematical Psychology, Vol. 1*. Cambridge U.K.: Cambridge University Press.

Batchelder, W. H. (In Press, To Appear 2016). Discrete state models of cognition. In W. H. Batchelder, H. Colonius, E. Dzhafarov, and J. Myung (Eds.). *New Handbook of Mathematical Psychology, Vol. 1*, Cambridge, U.K.: Cambridge University Press. 65pp. In Press, 2016.

Boyd, J. P. and Batchelder, W. H. (In Press, To Appear 2016). Network Analysis. To Appear in W. H. Batchelder, H. Colonius, E. Dzhafarov, and J. Myung (Eds.). *New Handbook of Mathematical Psychology, Vol. 1*. Cambridge U.K.: Cambridge University Press. 93 pp. In Press, 2016.

Alexander, G. E., Satalich, T. A., Shankle, W. R., and Batchelder, W. H. (2016). A cognitive model for psychodiagnostic assessment of memory related deficits. *Psychological Assessment*, 28, 279-293.

Batchelder, W. H. (2016). Cognitive psychometrics In J, W. Houpt, L. M. Blaha (Eds.) Mathematical models of perception and cognition. Vol. 1. NY: Psychology Press. 245-266.

Batchelder, W. H. , Anders, R., & Oravecz, Z. Cultural Consensus Theory. (To Appear 2017). In E. J. Wagenmakers (Ed.) Methodology Volume oi the Stevens Handbook of Experimental Psychology. N.Y.: Wiley.

John Boyd

Boyd, J. P. and Batchelder, W. H. (In Press, to appear 2016). Network Analysis, Chapter 4 pp. 194 – 273 To Appear in W. H. Batchelder, H. Colonius, E. Dzhafarov, and J. Myung (Eds.). *New Handbook of Mathematical Psychology*, Vol. 1. Cambridge U.K.: Cambridge University Press. 93 pp. In Press.

Bill Branch

Branch, W., & Mcgough, B. (2016). Heterogeneous beliefs and trading inefficiencies. *Journal of Economic Theory, 163*, 786-818. doi:10.1016/j.jet.2016.02.003

Branch, W. A. (2016). Imperfect knowledge, liquidity and bubbles. *Journal of Economic Dynamics and Control, 62*, 17-42. doi:10.1016/j.jedc.2015.11.001

Branch, W. (2016, June). Unstable Inflation Targets. *Journal of Money, Credit and Banking*.

Jan Brueckner

Brueckner, J. Calem, P. & Nakamura, L. (2016). House-Price Expectations, Alternative Mortgage Products, and Default. *Journal of Money, Credit and Banking.* 48, 81-112.

Brueckner, J. & Picard, P. (2015). Where and When to Invest in Infrastructure. *Regional Science and Urban Economics.* 53, 123-134.

Brueckner, J. (2015). Decentralized Road Investment and Pricing in a Congested, Multi-Jurisdictional City: Efficiency with Spillovers. *National Tax Journal.* 68, 839-854.

Brueckner, J. & Lee, K. (2015). Negative Campaigning in a Probabilistic Voting Model. *Public Choice.* 164, 379-399.

Brueckner, J. & Lee, K. Optimal Risk-Sharing in Mortgage Contracts: The Effects of Potential Prepayment and Default" *Real Estate Economics.* In press.

Bruekner, J. & Franco, S. Parking and Urban Form. *Journal of Economic Geography.* Forthcoming.

Brueckner, J. & Lin, M.H. (2015). Convenient Flight Connections vs. Airport Congestion: Modeling the 'Rolling Hub'. *International Journal of Industrial Organization*. Forthcoming.

Carter Butts

Almquist, Zack W.; Spiro, Emma S.; & Butts, Carter T. (2016). Shifting Attention: Modeling Follower Relationship Dynamics Among US Emergency Management-Related Organizations During a Colorado Wildfire. In Social Network Analysis of Disaster Response, Recovery, and Adaptation. Elsevier. Forthcoming.

Butts, Carter T. (2016). On the Equivalence of the Edge/Isolate and Edge/Concurrent Tie ERGM Families, and their Extensions. *Journal of Mathematical Sociology*. Forthcoming.

Butts, Carter T.; Bierma, Jan; & Martin, Rachel W. (2016). Novel Proteases from the Genome of the Carnivorous Plant Drosera Capensis: Structural Prediction and Comparative Analysis. *Proteins: Structure, Function, and Bioinformatics*. Forthcoming.

Butts, Carter T.; Zhang, Xuhong; Kelly, John E.; Roskamp, Kyle W.; Unhelkar, Megha H.; Freites, J. Alfredo; Tahir Seemal; & Martin, Rachel W. (2016). Sequence Comparison, Molecular Modeling, and Network Analysis Predict Structural Diversity in Cysteine Proteases from the Cape Sundew, Drosera Capensis." *Computational and Structural Biotechnology Journal*. Forthcoming.

Fitzhugh, Sean M.; Gibson, C. Ben; Spiro, Emma S.; and Butts, Carter T. (2016). ``Spatio-temporal Filtering Techniques for the Detection of Disaster-related Communication." *Social Science Research*. Forthcoming.

Jose, Rupa; Hipp, John R.; Butts, Carter T.; Wang, Cheng; Lakon, Cynthia M. (2016). Network Structure, Influence, Selection, and Adolescent Delinquent Behavior: Unpacking a Dynamic Process. *Criminal Justice and Behavior.* 43(2), 264--284. DOI: 10.1177/0093854815605524.

Krivitsky, Pavel N. and Butts, Carter T. (2016). Exponential-Family Random Graph Models for Rank-Order Relational Data. *Sociological Methodology*. Forthcoming.

Prytkova, Vera; Heyden, Matthias; Khago, Domarin; Freites, J.; Butts, Carter T.; Martin, Rachel; and Tobias, Douglas. (2016). Multi-Conformation Monte Carlo: A Method for Introducing Flexibility in Efficient Simulations of Many-Protein Systems. *Journal of Physical Chemistry.* B. Forthcoming.

Reed, Philip J.; Spiro, Emma S.; and Butts, Carter T. (2016). Thumbs up for privacy?: Differences in Online Self-disclosure Behavior Across National Cultures. *Social Science Research*. Forthcoming.

Spiro, Emma S.; Almquist, Zack W.; and Butts, Carter T. (2016). The Persistence of Division: Geography, Institutions, and Online Friendship Ties. *Socius.* Forthcoming.

Wang, Cheng; Butts, Carter T.; Hipp, John R.; and Jose, Rupa; and Lakon, Cynthia M. (2016). Multiple Imputation for Missing Edge Data: A Predictive Evaluation Method with Application to Add Health. *Social Networks*, 45, 89--98.

Wang, Cheng; Hipp, John R.; Butts, Carter T.; and Jose, Rupa; and Lakon, Cynthia M. (2016). Co-Evolution of Adolescent Friendship Networks and Smoking and Drinking Behaviors with Consideration of Parental Influence. Forthcoming.

Zhang, Xuhong and Butts, Carter T. (2016). A Novel Multivariate Spectral Regression Model for Learning Relationships Between Communication Activity and Urban Ecology. *IEEE International Conference on Pervasive Computing and Communications (PerCom).* Forthcoming.

Arabshahi, Furough; Huang, Furong; Anandkumar, Anima; Butts, Carter T.; and Fitzhugh, Sean M. (2015). Are you going to the party: Depends, who else is coming? -- Learning Hidden Group Dynamics via Conditional Latent Tree Models. *IEEE International Conference on Data Mining (IEEE ICDM).*

Sutton, Jeannette; Gibson, C. Ben; Phillips, Nolan E.; Spiro, Emma S.; League, Cedar; Johnson, Britta; Fitzhugh, Sean M.; and Butts, Carter T. (2015). A Cross-hazard Analysis of Terse Message Retransmission on Twitter. *Proceedings of the National Academy of Sciences*. DOI: 10.1073/pnas.1508916112.

Sutton, Jeannette; Gibson, C. Ben; Spiro, Emma S.; League, Cedar; Fitzhugh, Sean M.; and Butts, Carter T. (2015). What it Takes to Get Passed On: Message Content, Style, and Structure as Predictors of Retransmission in the Boston Marathon Bombing Response. *PLoS ONE*, 10(8), e0134452, DOI: 10.1371/journal.pone.0134452.

Jean-Paul Carvalho

Carvalho, J.P. Jewish Emancipation and Schism: Economic Development and Religious Change (with Mark Koyama). *Journal of Comparative Economics*, forthcoming.

Carvalho, J.P. Coordination and Culture. *Economic Theory*, forthcoming.

Carvalho, J.P. Education, Social Mobility and Religious Movements: The Islamic Revival in Egypt (with Christine Binzel). *The Economic Journal*, forthcoming. Online Appendix

Carvalho, J.P. Identity-Based Organizations. *American Economic Review: Papers and Proceedings*, 2016, 106(5), 410–414.

Carvalho, J.P. Sacrifice and Sorting in Clubs. *Forum for Social Economics* (special issue on The Economics of Religion), forthcoming.

Carvalho, J.P. A further paper titled "Resisting Education" with Mark Koyama has been revised and resubmitted to the *Journal of Urban Economics*.

Charlie Chubb

Journal articles:

Sun, P., Chubb, C., Sperling, G. (2015). Two mechanisms that determine the Barber-Pole-Illusion. *Vision Research*, 111, 43-54.

Chiao C-C., Chubb C, Hanlon R.T. (2015). A review of visual perception mechanisms that regulate rapid adaptive camouflage in cuttlefish. *Journal of Comparative Physiology A*, 201(9), 933-945.

Sun P., Chubb C., Wright C.E., Sperling G. (2016). The centroid paradigm: Quantifying feature-based attention in terms of attention filters. *Attention, Perception & Psychophysics*. DOI 10.3758/s13414-015-0978-2

Inverso, M., Sun, P., Chubb, C., Wright, C.E., Sperling, G. (2016) Evidence against global attention filters selective for absolute bar-orientation in human vision, *Attention, Perception & Psychophysics*. 78, 293-308, DOI 10.3758/s13414-015-1005-3

Book Chapters:

Chubb, C., Solomon, J.A., Sperling, G. (Forthcoming) The contrast contrast illusion, In *The Oxford Compendium of Visual Illusions*, Eds. Shapiro A, Todorovic D, Oxford University Press.

Chubb, C, Darcy., J, Landy, M.S., Econopouly, J., Nam, J.H,, Bindman, D.R., Sperling, G. (Forthcoming) The Scramble Illusion: Texture Metamers. In *The Oxford Compendium of Visual Illusions*, Eds. Shapiro A, Todorovic D, Oxford University Press.

Steve Frank

Frank, S. A. (2015). D'lembert's direct and inertial forces acting on populations: the Price equation and the fundamental theorem of natural selection. *Entropy,* 17:7087-7100.

Frank, S. A. (2015). Common probability patterns arise from simple invariances. *Entropy,* 18:192.

Bernie Grofman

Brunell, Thomas L., Bernard Grofman, & Samuel Merrill III. (2016). The volatility of median and supermajoritarian pivots in the U.S. Congress and the effects of party polarization. *Public Choice* 166 (Nos 1-2): 183-204.

Grofman, Bernard (2016). Perspectives on the Comparative Study of Electoral Systems. *Annual Review of Political Science.*

Ferris, J. Stephen, Stanley L. Winer, & Bernard Grofman. (Forthcoming). The Duverger-Demsetz Perspective on Electoral Competitveness and Fragmentation: With Application to the Canadian Parliamentary System, 1867-2011. In Maria Gallego and Norman Schofield (Eds.). *The Political Economy of Social Choices*. New York: Springer.

Evenwel v. Abbott, _____ U.S. _____, 136 S. Ct. 1120, 194 L.Ed.2d 291 (2016), see brief of Nathaniel Persily, Bernard Grofman, Stephen Ansolabehere, Charles Stewart III, and Bruce E. Cain as Amici Curiae in Support of Appellees, 2015 WL 5719746.

Simon Huttegger

Simon M. Huttegger (2015). Inductive Learning in Small and Large Worlds. *Philosophy and Phenomenological Research*. In press.

Simon M. Huttegger and Kevin J. S. Zollman (2015). The Robustness of Hybrid Equilibria in Costly Signaling Games. *Dynamic Games and Applications*. In press.

Simon M. Huttegger (2015). Merging of Opinions and Probability Kinematics. *Review of Symbolic Logic*. In press.

Simon M. Huttegger (2015). Bayesian Convergence to the Truth and the Metaphysics of Possible Worlds. *Philosophy of Science*. In press.

Simon M. Huttegger (2015). The Problem of Analogical Inference in Inductive Logic. *Proceedings of the 15th conference on Theoretical Aspects of Rationality and Knowledge*, 3–9. In press.

Justin B. Bruner, Cailin O'Connor, Hannah Rubin, Simon M. Huttegger (2015). David Lewis in the Lab: Experimental Results on the Emergence of Meaning. *Synthese*. In press.

Simon M. Huttegger, Justin B. Bruner, Kevin J. S. Zollman (2015). The Handicap Principle is an Artifact. *Philosophy of Science*. In press.

Kimberly Jameson

Selected Publications:

Published Public-Access Research Platform:

Jameson, K. A., Gago, S., Deshpande, P.S., Benjamin, N.A., Chang, S.M., Tauber, S., Jiao, Y., Harris, I.G., Xiang, Z. Huynh, B.B., Ke, H., Lee, W.J., MacLaury, R.E. (2016). "The Robert E. MacLaury Color Categorization (ColCat) Digital Archive." http://colcat.calit2.uci.edu/. The California Institute for Telecommunications and Information Technology (Calit2). University of California, Irvine.

Peer-Reviewed Research Articles:

Jameson, K. A., Winkler, A. D., & Goldfarb, K. (2016). Art, interpersonal comparisons of color experience, and potential tetrachromacy. © 2016 Society for Imaging Science and Technology DOI: 10.2352/ISSN.2470-1173.2016.16HVEI.

Jameson, K. A., Deshpande, P. S., Tauber, S., Chang, S. M. & Gago, S. (2016). Using individual differences to better determine normative responses from crowdsourced transcription tasks: An application to the R. E. MacLaury Color Categorization Archive. © 2016 Society for Imaging Science and Technology DOI: 10.2352/ISSN.2470-1173.2016.16HVEI.

Jameson, K. A., Nathan A. Benjamin, Stephanie M. Chang, Prutha S. Deshpande, Sergio Gago, Ian G. Harris, Yang Jiao, and Sean Tauber. (2015) "Mesoamerican Color Survey Digital Archive." Ronnier Luo (Ed.). Encyclopedia of Color Science and Technology. Springer Science+ Business Media New York. 10.1007/978-3-642-27851-8_113-10

Deshpande, P. S., Sean Tauber, Stephanie M. Chang, Sergio Gago, and Kimberly A. Jameson (in press). "Digitizing a Large Corpus of Handwritten Documents Using Crowdsourcing and Cultural Consensus Theory." *International Journal of Internet Science.* To appear in 2016.

Paper submitted for publication:

Bochko, V. A., Kimberly A. Jameson, T. Nakaguchi, Y. Miyake, and J. T. Alander. (submitted manuscript). Non-negative matrix factorization using genetic algorithm for spectral colors. *IEICE TRANS. ELECTRON.*,The Institute of Electronics, Information and Communication Engineers.

Peer-Reviewed Research Posters:

Deshpande, P.S., Tauber, S., Chang, S.M., Gago, S., & Jameson, K.A. (2015). A Cultural Consensus Theory Analysis of Crowdsourced Transcription Data. The 48th Annual Meeting of the Society for Mathematical Psychology, Newport Beach, CA, United States.

Marek Kaminski

Kaminski, M.M., Swistak, P., & Lissowski, G. (2014). Formal Theory and Value Judgments. *Polish Sociological Review*.

Kaminski, M.M. (2014). Prisoner's Dilemma. *Oxford Bibliographies*.

Kaminski, M.M. & Nalepa, M. (2015). Suffer a Scratch to Avoid a Blow. Why Do Postcommunists Introduce Self-Hurting Legislation. *Decisions*.

Kaminski, M.M. Empirical Examples of Voting Paradoxes. In Jac C. Heckelman and Nicholas R. Miller (eds). *Social Choice and Voting*, forthcoming, Springer Verlag.

Kaminski, M.M. Voting methods in single-member districts and their properties. *Decisions,* July 23, 2015. (in Polish).

Kaminski, M.M. (2015). Introduction: The seductive power of Mancur Olson. In Kaminski, M. M. (Ed.). *Decisions(24)*, 5-12.

Kaminski, M.M. (2015). "Schelling games, Kuran dominos and electoral coalitions. Non-standard game-theoretic models of collective action." Kaminski, M. M. (Ed.). *Decisions(24)*, 89-103.

Book: (2016). *JOWy i ordynacje większościowe (Single-member Districts and Majoritarian Electoral Laws)*. (pp. 1-200). Warsaw, Poland: Scholar. Book, accepted (in Polish).

Edited volume: Kaminski, M. M. (Ed.). (2015). *Decisions (special issue on 50th anniversary of publication of Mancur Olson's "The Logic of Collective Action")*. (pp. 1-206). Warsaw, Poland: Kozminski Academy.

Robin Keller

Journal articles (peer-reviewed):

Yitong Wang (University Technology Sydney), Liangyan Wang (Shanghai Jiao Tong University), L. Robin Keller, "Discounting over Subjective Time: Subjective Time Perception Helps Explain

Multiple Discounted Utility Anomalies", International Journal of Research in Marketing, 32 (2015), pp. 445–448, http://dx.doi.org/10.1016/j.ijresmar.2015.08.006. Final version published online: 30-NOV-2015. Accepted in August 2015.

Baozhou LU, Tao ZHANG, Liangyan WANG (Merage Ph.D. alumna), L. Robin KELLER, "Trust Antecedents, Trust and Online Microsourcing Adoption: An Empirical Study from the Resource Perspective", Decision Support Systems, 85 (May 2016) pp. 104–114, accepted March 2016.
http://www.sciencedirect.com/science/article/pii/S0167923616300288.

Liangyan Wang (Merage alumna and Associate Professor of Marketing, Antai Management School, Shanghai Jiao Tong University, Shanghai, 200052, WLY@sjtu.edu.cn), Shijian Wang (just graduated student of marketing, kasano@sjtu.edu.cn), L. Robin Keller, Jie Li (Assoc. Prof. of Market., Antai Mgt Sch.), "Thinking Styles Affect Reactions to Brand Crisis Apologies", Forthcoming, European Journal of Marketing, accepted in March 2016.

Jiaru Bai (Merage doctoral student), Cristina del Campo (Universidad Complutense de Madrid and UCI visitor in 2016), L. Robin Keller, "Markov Chain Models in Practice: A Review of Low Cost Software Options", Publication in English; Spanish title: "Modelos de Cadenas de Markov en la Práctica: Una Revisión de Opciones de Software de Bajo Coste", forthcoming in 2017, Investigación Operacional, accepted May 30, 2016. Journal website: http://rev-inv-ope.univ-paris1.fr/, celebrating 50th anniversary of publication in 2016.

Chapters in Books: UPDATED Publication date, listed on last year's report. Candice H. Huynh, Jay Simon, L. Robin Keller. February 2016. "Decision Technologies", Invited chapter 32 in volume II, (pages 903-923). in Wiley-Blackwell Handbook of Judgment and Decision Making- 2 Volume Set, eds. Gideon Keren and George Wu. Malden (MA): Blackwell. Submitted 1/2013, Refereed. (Accepted June 2014; contact authors for a copy of the working paper.) ISBN: 978-1-118-46839-5. http://www.wiley.com/WileyCDA/WileyTitle/productCd-1118468392.html

Working papers:

L. Robin Keller and Yitong Wang, "Information Presentation in Decision and Risk Analysis: Answered and Unanswered Questions", February 2016, peer reviewed; to expand on one area among the "Ten most important accomplishments in risk analysis, 1980-2010," May 2012, *Risk Analysis*, on "recognizing the personal decisions reflect different processes for evaluating and combining anticipated and actual losses, games, delays and surprises," invited by former Editor-in-Chief Michael Greenberg to write this contribution; submitted to Editor-in-Chief Tony Cox (under review).

Xiaona Zheng (former UCI doctoral student, graduated from Duke, Assoc. Prof., Peking University, xzheng@gsm.pku.edu.cn), Luping Sun (Business School at Central University of Finance and Economics, angelsunluping@163.com), Meng Su (Peking University,

sumeng@gsm.pku.edu.cn), L. Robin Keller. “The Role of Brand Origin and Product Knowledge on Intention-Behavior Discrepancy: Evidence from China”, March 2015, revised March 2016. (Revision requested).

James M. Leonhardt (New Mexico State University, Merage doctoral alumnus) and L. Robin Keller, “Do Pictographs of Side-Effect Probabilities Lessen Vaccine Risk Perception?” February 2016.

Liangyan Wang (Merage alumna and Associate Prof. Shanghai Jiaotong), Qin Wang (graduate student, Shanghai Jiaotong), L. Robin Keller, "Counterfeits can Benefit Original Products when People are Caught using Counterfeits", April 2016.

Natalia Komarova

Law, K. M., Komarova, N. L., Yewdall, A. W., Lee, R. K., Herrera, O. L., Wodarz, D., & Chen, B. K. (2016). In Vivo HIV-1 Cell-to-Cell Transmission Promotes Multicopy Micro-compartmentalized Infection. *Cell Reports*.

Sun, Z., Plikus MV, Komarova NL (2016). Near equilibrium calculus of stem cells in application to the airway epithelium lineage. *PLoS Computational Biology*. In Press.

Rodriguez-Brenes, I. A., Wodarz, D., & Komarova, N. L. (2016). Cellular replication limits in the Luria-Delbrck mutation model. *Physica D: Nonlinear Phenomena*, 328, 44-51.

Asatryan, A. D., & Komarova, N. L. (2016). Evolution of genetic instability in heterogeneous tumors. *Journal of Theoretical Biology*, 396, 1-12.

Rische, J. L., & Komarova, N. L. (2016). Regularization of languages by adults and children: A mathematical framework. *Cognitive Psychology*, 84, 1-30.

Komarova, N. L. (2015). The benefits of treating undetectable tumors. *eLife*, 4, e09713.

Yang, J., Plikus, M. V., & Komarova, N. L. (2015). The Role of Symmetric Stem Cell Divisions in Tissue Homeostasis. *PLoS Comput Biol*, 11(12), e1004629.

Rodriguez-Brenes, I. A., Wodarz, D., & Komarova, N. L. (2015). Quantifying replicative senescence as a tumor suppressor pathway and a target for cancer therapy. *Scientific Reports*, 5.

Komarova, N.L. (2015) Cancer: a moving target. *Nature*, 525(7568), 198-199. (News and Views article).

Igor Kopylov

Kopylov, I. (Forthcoming). Canonical Utility Representations and Continuous utility representations. *Journal of Mathematical Economics*.

Kopylov, I. (Forthcoming). Subjective Probability, Confidence and Bayesian Updating. *Economic Theory*.

Michael Lee

Lee, M.D., Abramyan, M., & Shankle. W.R. (2015). New methods, measures, and models for analyzing memory impairment using triadic comparisons. *Behavior Research Methods,* 1-16.

Morey, R.D., Hoekstra, R., Rouder, J.N., Lee, M.D.., & Wagenmakers, E.-J. (in press). The fallacy of placing confidence in confidence intervals. *Psychonomic Bulletin & Review.*

Okada, K., & Lee, M.D. (2016). A Bayesian approach to modeling group and individual differences in multidimensional scaling. *Journal of Mathematical Psychology, 70,* 35-44.

Selker, R., Lee, M.D., & Iyer, R. (in press). Thurstonian cognitive models for aggregating top-n lists. *Decision*.

Wagenmakers, E.-J., Morey, R.D., & Lee, M.D. (i2016). Bayesian benefits for the pragmatic researcher. *Current Directions in Psychological Science, 25,* 169-176.

Mistry, P.K., Lee, M.D., & Newell, B.R. (in press). An empirical evaluation of models for how people learn cue search orders. In J. Trueswell, A. Papafragou, D. Grodner, & D. Mirman (Eds.), Proceedings of the 38th Annual Conference of the Cognitive Science Society. Austin, TX: Cognitive Science Society.

Danileiko, I., & Lee, M.D. (in press). Inferring individual differences between and within exemplar and decision-bound models of categorization. In J. Trueswell, A. Papafragou, D. Grodner, & D. Mirman (Eds.), Proceedings of the 38th Annual Conference of the Cognitive Science Society. Austin, TX: Cognitive Science Society.

Penelope Maddy

Penelope, M. What Do Philosophers Do? *Skepticism and the Practice of Philosophy*. In press.

Penelope, M. Set-theoretic foundations. To appear in a volume in honor of Hugh Woodin's 60th birthday.

Penelope, M. Part I of Believing the axioms' and all of 'Does V = L? Reprinted in Reprinted in *Philosophy of Mathematics*, A. Paseau, ed., (Oxon, UK: Routledge, 2016).

Michael McBride

M. McBride, (2015). Why Churches Need Free-riders: Religious Capital Formation and Religious Group Survival. *Journal of Behavioral and Experimental Economics* 58: 77-87.

G. Ridinger, R. John, M. McBride, N. Scurich. Attacker Deterrence and Perceived Risk in a Stackelberg Security Game," forthcoming, *Risk Analysis* (accepted Oct 2015).

M. McBride, R. Kendall, M. Short, M. D'Orsogna, (2016). Crime, Punishment, and Evolution in an Adversarial Game. *European Journal of Applied Mathematics* 27: 317-337.

G. Ridinger, M. McBride, (2015). Money Affects Theory of Mind Differently by Gender. *PLOS ONE* 10: e0143973.

M. McBride (Forthcoming). A Rational Choice Theory of Religious Authority. *Rationality and Society*. Accepted May 2016.

N. Bandelj, T. Boston, J. Elyachar, J. Kim, M. McBride, Z. Tufail, J. Weatherall (Forthcoming). Morals and Emotions of Money. In N. Bandelj, F. Wherry, V. Zelizer, (eds). *Money Talks*, Princeton University Press.

Louis Narens

Narens, L. (2016). Probabilistic frames for non-Boolean phenomena. *Transactions of the Royal Philosophical Society*. (Philos Trans A Math Phys Eng Sci. 2016 Jan 13; 374(2058): 20150105. doi: 10.1098/rsta.2015.0105)

Narens, L. (2016). Multimode utility theory. *Journal of Mathematical Psychology*. http://dx.doi.org/10.1016/j.jmp.2016.02.003, 1--17.

Narens, L. (2016). An introduction to lattice based probability theories. *Journal of Mathematical Psychology*, 2016 doi: 10.1016/j.jmp.2016.04.013

Narens, L. (2016). Quantum Thinking and Counterfactual Reasoning. In E. Dzhafarov, S. Jordan, R. Zhang and V. Cervantes (eds). Contextuality from Quantum Physics to Psychology. *World Scientific*, 309-324.

Narens, L., \& Saari, D. Modeling decisions involving ambiguous, vague, or rare events. G. Chichilnisky and A. Rezai (eds.), \emph{The Economics of Global Environment,

Studies in Economic Theory 29,} 2016. Switzerland: Springer International Publishing. DOI 10.1007/978-3-319-31943-8_4

Narens, L. Non-Boolean Methods for Modeling Context in Behavioral Science. Submitted to *Frontiers of Physics*.

Fider, N., Narens, L., Jameson, K.A., & Komarova, N. A numerical approach to defining basic color terms. Manuscript. 2016. To be submitted to *PNAS*.

Park, J., Tauber, S., Jameson, K. A., & Narens L. (Manuscript, 2016). The evolution of shared concepts in changing populations. To be submitted to *PLOS ONE*.

Narens, L. & Skyrms, B. (Manuscript, 2016). Learning to compare utilities with others. To be submitted to *Nature*.

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Andrew Noymer

Viytta N. Abdullatif and Andrew Noymer (2016). *Clostridium difficile* infection: An emerging cause of death in the twenty-first century. *Biodemography and Social Biology* 62(2):198–207.

Guest Column: Disease outbreaks & medical sociology. *Medical Sociology Newsletter*, 52(4):4.

(book review) Political demography: How population changes are reshaping international security and national politics, ed. by Jack A. Goldstone, Eric P. Kaufmann and Monica Duffy Toft. *Contemporary Sociology* 45(2):177–179 (2016). With Haruka C. Hatori.

(letter) Did Ebola relatively spare children? Stéphane Helleringer, Andrew Noymer, Samuel J. Clark, and Tyler McCormick. *Lancet* 386(10,002):1442–1443 (2015).

Cailin O'Connor

Rosenstock, Sarita, Cailin O'Connor, and Justin Bruner. "In Epistemic Networks, Is Less Really More?" *Philosophy of Science*. (Forthcoming).

O'Connor, Cailin. "The Evolution of Guilt." *Philosophy of Science*. (Forthcoming).

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Lisa Pearl

Pearl, L. & Phillips, L. (in press). Evaluating language acquisition models: A utility-based look at Bayesian segmentation. *Language, Cognition and Computational Models*, Cambridge University Press.

Pearl, L., Ho, T., & Detrano, Z. (in press). An argument from acquisition: Comparing English metrical stress representations by how learnable they are from child-directed speech. *Language Acquisition.*

Pearl, L. (in press). Evaluation, use, and refinement of knowledge representations through acquisition modeling. *Language Acquisition.*

Bar-Sever, G., & Pearl, L. (in press). Syntactic Categories Derived from Frequent Frames Benefit Early Language Processing in English and ASL. *Proceedings of the 40th annual Boston University Conference on Language Development*, Somerville, MA: Cascadilla Press.

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Dale Poirier

Poirer, D., and Jeliazkov, I. (Eds). (2015). *Advances in Econometrics: Bayesian Model Comparison*, Vol. 34, 2015.

Don Saari

Saari, D. G. (2015). Voting mysteries: A picture is worth a thousand words. *Handbook of Social Choice and Voting,* 284-302.

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Saari, D. G. (2015). Basis for binary comparisons and non-standard probabilities. *Phil. Trans. R. Soc. A Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences,* 374(2058), 20150103.

Stergios Skaperdas

Skaperdas, S. (2015). Myths and Self-Deceptions about the Greek Debt Crisis *Revue d'économie politique***.** 168, 755-785.

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George Sperling

Tseng, C-H, Gobell, J. L., Sperling, G. (2015). Factors that determine depth perception of trapezoids, windsurfers, runways. *Frontiers in Human Neuroscience*. 9(182), 1-14.

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Brian Skyrms

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Hal Stern

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Neumann, C., Stern, H. (2016) "Forensic Examination of Fingerprints: Past, Present and Future," *CHANCE,* 29:1, 9-16.

Carole Uhlaner

Uhlaner, Carole J. "Relational Goods and Overcoming Barriers to Collective Action." Decisions/Decyjze 24 (December 2015): 171-190.

Uhlaner, Carole J. and Danvy Le. "The Role of Coethnic Political Mobilization in Electoral Incorporation: Evidence from Orange County, California." Politics, Groups, and Identities. In press. Published online December, 7, 2015. doi: 10.1080/21565503.2015.1109527

Uhlaner, Carole Jean and Becki Scola*. "Collective Representation as a Mobilizer: Race/Ethnicity, Gender, and Their Intersections at the State Level." State Politics & Policy Quarterly 16(2):227-263. Published online October 7, 2015. doi: 10.1177/1532440015603576

James Weatherall

Void: The Strange Physics of Nothing. Forthcoming from Yale University Press (to be published in November 2016).

"Morals and Emotions of Money,'" with N. Bandelj, J. Elyachar, J. Kim, M. McBride, and Z. Tufail. Forthcoming in *Money Talks*. N. Bandlej, F. Wherry, and V. Zelizer, eds. Princeton: Princeton University Press.

Weatherall, J. Understanding Gauge. Forthcoming in *Philosophy of Science*.

Weatherall, J., Rosenstock, S., & Barrett, T. (2016). On Einstein Algebras and Relativistic Spacetimes. *Studies in History and Philosophy of Modern Physics,* **52B**, 309--316.
Weatherall, J. (2016). Fiber bundles, Yang-Mills theory, and General Relativity. Forthcoming in *Synthese*.

Weatherall, J. (2016). Category Theory and the Foundations of Classical Field Theories. *Categories for the Working Philosopher*. E. Landry ed. Oxford: Oxford University Press.

Book Reviews:

"Black Holes, Black Scholes, and Prairie Voles: An Essay Review of *Simulation and Similarity*, by Michael Weisberg," with C. O'Connor. Forthcoming in *Philosophy of Science*.

Jack Xin

Xin, J. & Zhang, S. (2016). Minimization of Transformed L1 Penalty: Closed Form Representation and Iterative Thresholding Algorithms. *Communications in Mathematical Sciences*. To appear.

Xin, J., Lou, Y., & Yin, P. (2016). Point Source Super-Resolution and Via Non-Convex L1 Based Methods. *Science Computing*. 68(3), pp. 1082-1100.

Xin, J., Ho, M., & Sun, Z. (2015). Weighted Elastic Net Penalized Mean-Variance Portfolio Design and Computation. *SIAM J. Financial Mathematics*, Vol. 6 pp. 1220-1244.

Xin, J., Lou, Y., Zeng, T., & Osher, S. (2015). A Weighted Difference of Anisotropic and Isotropic Total Variation Model for Image Processing. *SIAM J. Imaging Sciences*, 8(3), pp. 1798-1823.

Xin, J., Shi, X., Park, F., Wang, L., & Qi, Y.Y. (2015). Parallelization of a Color-Entropy Preprocessed Chan-Vese Model for Face Contour Detection on Multi-core CPU and GPU. *Parallel Computing*, 49(2015), pp. 28-49.

Xin, J., McMillen, T., Yu, Y., & Zlatos, A. (2016). Ballistic Orbits and Front Speed Enhancement for ABC Flows. SIAM Journal on Applied Dynamical Systems. To appear.

Xin, J., Murphy, N.B., Cherkaev, E., Zhu, J., & Golden, K.M. (2016). Spectral-Analysis and Computation of Effective-Diffusivities in Space-Time Periodic Incompressible Flows. Annals of Mathematical Sciences and Applications. To appear.

Hongkai Zhao

J. Liu, X. Zhang, X. Zhang, H. Zhao, Y. Gao, D. Thomas, D. Low, and H. Gao, (2015). 5D respiratory motion model based image reconstruction algorithm for 4D cone-beam computed tomography, *Inverse Problems* (Highlights of 2015), 31(11).

L. Zepeda-N\'{u}\~{n}nez and H. Zhao, Fast alternating bi-directional preconditioner for the 2D high frequency Lippmann-Schwinger equation, *SIAM Journal on Scientific Computing*. To appear.

C. TECHNICAL REPORT SERIES

APPENDIX C
IMBS TECHNICAL REPORTS, 2015 - 16

MBS 15-06
Decomposing Models of Bounded Rationality
Daniel Jessie and Ryan Kendall

MBS 16-01
Digitizing a large corpus of handwritten documents using crowdsourcing and cultural consensus theory
Prutha S. Deshpande, Sean Tauber, Stephanie M. Chang, Sergio Gago, and Kimberly A. Jameson

D. FACULTY PRESENTATIONS

APPENDIX D
COLLOQUIA AND CONFERENCES OF IMBS MEMBERS, 2015-16

Bill Batchelder

Alexander, G. E., & Batchelder, W. H. (2015, July). *Measuring Cognitive Variables Using a Markov Model*. Paper read at the Annual Society for Mathematical Psychology Annual Meeting. Newport Beach, CA.

Batchelder, W. H., & Gosti, G. (2015, July*). The Linear Operator Model: Learning in the Naming Game*. Paper read at the Annual Society for Mathematical Psychology Annual Meeting. New Port Beach, CA.

Batchelder, W. H. (2015, November). *Cultural Consensus Theory: Observations about past, Present, Future*. IMBS Conference in Honor of A. Kimball Romney. University of California Irvine, CA.

Batchelder, W. H. (2016, May). *Cognitive Psychometrics*. Invited Keynote Address to Association for Psychological Science, Chicago, IL.

Bill Branch

Branch, B. (2015, August). Workshop on Expectations in Dynamic Macroeconomics, University of Oregon.

David Brownstone

Brownstone, D., Wong, T., & Bunch, D. (2015, July). *Aggregation Bias in Discrete Choice Models with an Application to Household Vehicle Choice*. International Association of Travel Behavior Modeler's meeting in Windsor, England.

Brownstone, D. (2015, October). *Measurement errors in travel demand models*. Arizona State University, Department of Civil and Environmental Engineering, Tempe, AZ.

Brownstone, D. (2015, October). *The neglected impact of measurement error on disaggregate transportation demand models*. Northwestern University Transportation Center. Evanstone, IL.

Brownstone, D. (2015, October). *Aggregation Bias in Discrete Choice Models with an Application to Household Vehicle Choice*. University of California, Riverside, Department of Economics. Riverside, CA.

Jan Brueckner

Brueckner, J. (2016, June). ITEA Conference on Transportation Economics, Santiago, Chile, June 2016.

Brueckner, J. (2015, June). Aix-Marseille University.

Brueckner, J. (2016, May). Drexel University.

Brueckner, J. (2016, May). Lincoln Institute of Land Policy Urban Economics and Public Finance Conference.

Brueckner, J. (2016, April). Georgia State University.

Brueckner, J. (2016, April). Federal Reserve Bank of Atlanta.

Brueckner, J. (2016, February). IEB 3rd Urbanization and Poverty Reduction Research Conference, World Bank (keynote address).

Brueckner, J. (2015, November). Urban Economics Association Meetings, Portland, OR.

Michael Burton

Michael L. Burton, James A. Egan, and Karen L. Nero. (2016, June). *Gender and Food Production in Yap and Kosrae*. Presented at the meetings of four food studies societies, University of Toronto, Scarborough, Toronto, ON, Canada.

Carter Butts

Butts, Carter T. (2016, May). *Some Properties of Stochastic Network Models*. Nonlinear Physics Group Seminar, Institute of Physical Sciences (Instituto de Ciencias F\'{i}sicas), National Autonomous University of Mexico. Cuernavaca, Mexico.

Butts, Carter T. (2016, May). *Mechanisms, Context, and Interaction in a Messy World: Statistical Models for Complex Relational Systems. Invited Presentation*. Center for Complexity Sciences, National Autonomous University of Mexico. Mexico City, Mexico.

Butts, Carter T. (2016, February). *Geography, and the Warped Fabric of Social Ties*. Invited Presentation, Informatics Institute, University of Florida. Gainesville, FL.

Butts, Carter T. (2016, January). *Inferring Complex Behavioral Mechanisms in Difficult Pl*aces. Invited Lecture, Data Science Colloquium, University of Washington. Seattle, WA.

Butts, Carter T. (2015, November). *Geography and the Structure of Interpersonal Networks*. Transportation Seminar, Institute for Transportation Studies, University of California, Berkeley. Berkeley, CA.

Butts, Carter T. (2015, October). *Modeling Interaction Dynamics: Mechanisms, Contexts, and Roles*. Invited Lecture, Sociology, Criminology, and Law Department Colloquium, University of Florida. Gainesville, FL.

Butts, Carter T. (2015, August). *A Perfect Sampling Method for Exponential Family Random Graph Models*. ASA Meeting, Chicago, IL.

Fitzhugh, Sean M. and Butts, Carter T. (2015, August). *Patterns of Co-membership: Techniques for Identifying Subgraph Composition*. ASA Meeting, Chicago, IL.

Jean-Paul Carvalho

Carvalho, J.P. (2015, October). *Community Fragmentation and Fragility*. ASREC workshop, Chapman University, Orange, CA.

Carvalho, J.P. (2015, November). *Identity-Based Organizations*. Workshop on The Economics of Cultural Transmission and Evolution, Paris, France.

Carvalho, J.P. (2016, January). *Identity-Based Organizations*. Identity 2016 Panel, ASSA Annual Conference, San Francisco, CA.

Carvalho, J.P. (2016, March). *Community Fragmentation and Fragility*. ASREC Workshop, Chapman University, Orange, CA.

Carvalho, J.P. (2016, April). *Elite Competition, Co-Option and The Iron Law of Oligarchy: Theory and a Tale of 14 Islands*. Political Economy Seminar, UC Irvine, Irvine, CA.

Carvalho, J.P. (2016, May). *Resisting Education*. Theory, History and Development Seminar, UC Irvine, Irvine, CA.

Carvalho, J.P. (2016, June). *Resisting Education*. Summer Colloquium on Identity Economics, London, England.

Charlie Chubb

Yang H, Sun P, Chubb C, & Sperling, G. (2016, May). *Complex Attention Filters for Low Contrast Items*. Poster presented by H Yang at the annual meeting of the Vision Sciences Society, St Petersburg, FL.

Winter AN, Wright CE, Chubb C, & Sperling G. (2016, May). *Conjunctive Targets are Hard in Visual Search but Easy in Centroid Judgments*. Talk presented by AN Winter at the annual meeting of the Vision Sciences Society, St Petersburg, FL.

Groulx, K., Chubb, C., Victor, J., & Conte, M.M. (2016, May). *Using the texture-centroid method to analyze the mechanisms sensitive to higher-order image statistics.* Poster presented by K Groulx at the annual meeting of the Vision Sciences Society, St Petersburg, FL.

Inverso M, Chubb C, Wright CE, Shiffrin R, & Sperling G. (2016, May). *Comparing Efficiencies in Estimating Centroids and Judging Numerosity* . Talk presented by M Inverso at the annual meeting of the Vision Sciences Society, St Petersburg, FL.

Steve Frank

Frank, S. (2015, October). *FSome unsolved evolutionary puzzles: robustness, stochasticity of phenotype, and drug resistance*. CalTech, Pasadena, CA.

Frank, S. (2015, November). *Short-term evolution in virulence and resistance*. Penn State.

Frank, S. (2015, December*). Somatic evolutionary genomics*. UC Berkeley, CA.

Frank, S. (2016, February). *Aggregation and randomness in regulatory control and failure*. Penn State.

Frank, S. (2016, January). *The common patterns of nature*. IMBS, UC Irvine, CA.

Frank, S. (2016, May). *Measurement scale and dissipation of information shape biological pattern*. Ohio State.

Bernie Grofman

Grofman, B. (2015, September). *The volatility of median and supermajoritarian pivots in the U.S. Congress and the effects of party polarization*. Annual Meeting of the American Political Science Association, San Francisco, CA.

Simon Huttegger

Huttegger, S. (2015, June). *Analogical Inference in Inductive Logic*. TARK 2015 at CMU Pittsburgh, PA.

Huttegger, S. (2015, July). *Invariance and Symmetry in Evolutionary Dynamics*. ISHPSSB meeting in Montreal, CN.

Huttegger, S. (2016, January). *Cheaper than Costly Signals*. APA meeting, Washington D.C.

Kimberly Jameson

Jameson, K.A., Tauber, S., Deshpande, P.S., Chang, S.M., Gago, S., & Jameson, K.A. (2015, December). *Crowdsourcing the transcription of archival data.* presented at the IMBS workshop: Crowdsourcing, Big Data, and Social Media in the Behavioral Sciences: Applications, Methods and Theory. Institute for Mathematical Behavioral Sciences, UC Irvine, CA.

Jameson, K.A., Prutha Deshpande, Sean Tauber, Stephanie Chang, Nathanial Benjamin, Yang Jiao, and Sergio Gago. (2016, February). *Using individual differences to better determine normative responses from crowdsourced transcription tasks: An application to the R. E.MacLaury Color Categorization Archive*. UC Irvine, CA.

Jameson, K.A. (2016, February). *HumanVision and Electronic Imaging*. Invited to session: Individual Differences in Perceptual Judgments, San Francisco, CA.

Jameson, K. A. Alissa D. Winkler, and Keith Goldfarb. (2016, February). *Art, interpersonal comparisons of color experience, and potential human tetrachromacy*. (Invited). (Invited to session: Art, Aesthetics, and Perception), HumanVision and Electronic Imaging. San Francisco, CA.

Jameson, K. A. (2016, May). *Can we rule out the potential from Potential Human Tetrachromacy?* IMBS Colloquium. UC Irvine, CA.

Jameson, K.A. (2015, May). *Developing cloud-based educational resources for interdisciplinary research*. Invited presentation at the Multidisciplinary Design Program Lunch Seminar Series. Calit2, UC Irvine, CA.

Robin Keller

Ali Esmaeeli (presenter) and L. Robin Keller, (2016, June). *Real-time Multiple Attribute Taxi Assignment on Weighted Regions*. INFORMS International conference, Kona, Hawaii.

Jiaru Bai (presenter) and L. Robin Keller, based on work with UCI Physician co-authors, (2016, June). *A Markov Decision Tree Model to Evaluate Cost-Effectiveness of Ovarian Cancer.* INFORMS International conference, Kona, Hawaii.

L. Robin Keller, (2016, May). *Nudges.* Invited talk to UC Irvine Merage alumni. Irvine, CA.

L. Robin Keller, Plenary speaker, Program Committee Member, and Special Track Organizer, 12th INTERNATIONAL CONFERENCE on Operations Research (ICOR 2016), Havana, Cuba; http://samm.univ-paris1.fr/12th-ICOR-2016, co-sponsored by INFORMS.

L. Robin Keller (presenter), Jiaru Bai, Cristina del Campo, (2016, March). *A Markov Decision Tree Model to Evaluate Cost-Effectiveness of Cervical Cancer Treatments*. Also organized a set of talks by INFORMS members for the program committee. Havana, Cuba.

L. Robin Keller, invited talk, (2015, November). *Multi-Objective Multi-Stakeholder Decision Analysis*. Systems Analysis 2015 Conference, Session 5: Addressing Diversity in Social Systems, IIASA, Laxenburg, Austria.

Robin Keller, (2015, November). *Ramsey Medal Acceptance Speech*. INFORMS conference, Philadelphia, Penn.

Jay Simon (Presenter), based on work in collaboration with Craig W. Kirkwood and L. Robin Keller, (2015, November). *Decision Analysis with Geographically Varying Outcomes*. Invited talk in session on spatial MCDA, INFORMS conference, Philadelphia, Penn.

Jiaru Bai (presenter), L. Robin Keller, (2015, November). *Markov Cost-Effectiveness Analysis for Cancer Treatment*. Invited talk, INFORMS conference, Philadelphia, Penn.

Jiaru Bai (presenter), L. Robin Keller, (2015, July) *Markov Cost-Effectiveness Analysis for Cancer Treatment*. Invited talk, INFORMS Healthcare conference, Nashville, TN.

Jay Simon, Craig W. Kirkwood, L. Robin Keller (presenter), (2015, July). *Decision Analysis with Geographically Varying Outcomes: Preference Models and Applications*. Invited talk in session on spatial MCDA in the Multiple Criteria Decision Aiding stream at the EURO Conference, Glasgow, Scotland.

Marek Kaminski

Kaminski, M. (2015, July). *25 years after the fall of communism*. Adam Smith Center, Warsaw, PL.

Kaminski, M. (2015, March). *Coalitionwise reversions in transitional democracies*. Public Choice Annual Conference, San Antonio, TX.

Kaminski, M. (2016, March). *Non-standard game-theoretic models of collective action*. Public Choice Annual Conference, Ft. Lauderdale, FL.

Kaminski, M. (2016, July). *Voting methods for single-member districts and their properties*. Adam Smith Center, Warsaw, PL.

Kaminski, M. (2015, June). *Voting methods for single-member districts and their properties*. Adam Smith Center, Warsaw, PL.

Kaminski, M. (2015, June). *Voting methods for single-member districts and their properties*. Institute of Sociology, Warsaw University, PL.

Kaminski, M. (2015, May). *Voting methods for single-member districts and their properties*. Polish Academy of Sciences, Warsaw, PL.

Kaminski, M. (2016, May). *Voting methods for single-member districts and their properties*. Kraków Economic University, Kraków, PL.

Kaminski, M. (2016, May). *Voting methods for single-member districts and their properties*. Koźmiński Academy Business School, Warsaw, PL.

Kaminski, M. (2016, May). *Voting methods for single-member districts and their properties*. Dept. of Economics, Warsaw University, PL.

Kaminski, M. (2016, May). *Voting methods for single-member districts and their properties*. Single-member Districts Movement, Wrocław, PL.

Natalia Komarova

Komarova, N. (2016, July). European Conference on Mathematical and Theoretical Biology (ECMTB/SMB 2016), Nottingham, UK.

Komarova, N. (2016, April). Workshop on Mathematical Oncology, Fields Institute, Toronto, Canada.

Komarova, N. (2016, February). Colloquium, Department of Mathematics, University of Arizona.

Komarova, N. (2015, December). Speaker at the seminar ``Evolution of language'', Max Planck Institute, Ploen, Germany.

Komarova, N. (2015, October). ICMA-V, 5th International conference on Mathematical Modeling and Analysis of Populations in Biological Systems, London, Ontario, Canada.

Igor Kopylov

Kopylov, I. (2016, February). *Approximation Formulas in Continuous Utility Models*, IMBS, UC Irvine.

Kopylov, I. (2016, May). *Imperfect Recall and Empirical Betting Preferences*, IMBS, UC Irvine.

Michael Lee

Lee, M. (2015, June). *Cognitive Models, Bayesian Methods, and the Wisdom of the Crowd.* Invited symposium talk. Society for Applied Research on Memory and Cognition (SARMAC), Victoria, Canada.

Lee, M. (2015, July). *Cognitive Modeling Explorations with Crowd-Sourced Opinions.* Society for Mathematical Psychology. Newport Beach, CA.

Lee, M. (2015, July). *The Roles of Knowledge and Memory in Generating Top-10 Lists.* Cognitive Science Society Conference. Los Angeles, CA.

Lee, M. (2016, February). *Making Sports Predictions by Applying Cognitive Models to Crowd-Sourced Data*. University of New South Wales, Department of Psychology.

Lee, M. (2016, March). *Bayesian methods in cognitive modeling.* Invited colloquium talk, University of California, Riverside.

Lee, M. (2016, June). *Bayesian benefits for the pragmatic researcher.* Invited colloquium talk, National Autonomous University of Mexico (UNAM), Mexico City.

Penelope Maddy

Maddy, P. (2016, May). The Scientific, Berkeley, CA.

Michael McBride

M. McBride, (2015, October). *Identity and the Escalation of Conflict: Theory and Experiment*, Religion, Economics, and Society: An ASREC Mini-Conference, Chapman University.

M. McBride, (2015, March). *Theory of Mind Ability and Cooperation in the Prisoners Dilemma*, Association for the Study of Religion, Economics, and Culture, Chapman University.

Louis Narens

Narens, L. (2016, November). Air Force Office of Research Annual Review, Washington D. C.

Narens, L. (2016, June). Air Force Research Laboratories Workshop on Probability, Uncertainty and Decision, Dayton, OH.

Narens, L. (2016, July). 10th International Quantum Interaction Conference, San Francisco, CA.

Andrew Noymer

Noymer, A., Nguyen, T. & Bruckner, T-A. (2016). *Deviation from expected? Race and life expectancy in the US during the Great Depression.* Population Association of America 2016 Annual Meeting, Session 95, Washington, D.C.

Noymer, A. & Eicswnwie, N. (2016). *You've come a long way, baby': The convergence in age patterns of lung cancer mortality by sex, United States, 1959–2013.* Population Association of America 2016, Washington D.C., Session 159 (and NBER Cohort StudiesMeeting, Los Angeles).

Noymer, A., Deville, M. & Riffe, T. (2016). *Exact Poisson confidence intervals for life expectancy*. Population Association of America, Session 171, Washington D.C.

Noymer, A., Yip, R.C. & Nguyen, A.M. (2016). *Incidence, Severity, and Impact of Influenza*. *Exact Poisson confidence intervals for Serfling-type models: An example of influenza and pneumonia excess mortality in the United States. 2009–13*, Topic 4, Institut Pasteur, Paris.

Noymer, A. (2015). *A preliminary assessment of the impact of Ebola on life expectancy in affected countries.* UAPS Seventh African Population Conference, Session 29, Pretoria, South Africa.

Noymer, A. (2015). *Ebola Virus Disease outbreak, 2013–15, Guinea, Sierra Leone, Liberia: An update*. Day Two, "Plagues and partnerships" (by invitation), UC Irvine.

Colloquia and Seminars:

Noymer, A. (2016, March). *Summertime, and the livin' is easy—respiratory viruses' effect on all-cause mortality: Winter and summer pseudoseasonal life expectancy in the United States*. Ohio State University, Institute for Population Research.

Noymer, A. (2016, April). *Summertime, and the livin' is easy—respiratory viruses' effect on all-cause mortality: Winter and summer pseudoseasonal life expectancy in the United States.* Health Policy Research Institute, UC Irvine.

Noymer, A. (2015, October). *Tuberculosis and influenza selective mortality in the 1918 pandemic.* Hubei (province) Center for Disease Control and Prevention, Wuhan.

Noymer, A. (2015, October). *Cholera in Victorian London: John Snow and the births of epidemiology and germ theory.* Central China Normal University, Wuhan, Hubei Province.

Noymer, A. (2015, November). *Cholera in Victorian London: John Snow and the births of epidemiology and germ theory.* National Taiwan University, School of Public Health, Taipei.

Cailin O'Connor

O'Connor, C. (2016, April). *Power, Bargaining, and Evolution.* Colombia Workshop on Group Agency and Social Epistemology, Colombia University, New York, NY.

O'Connor, C. (2016, July). *Cooperation Without the Cooperative Principle.* Decisions, Games, and Logic. Ann Arbor, MI (presented by co-author).

O'Connor, C. (2016, June). *In Epistemic Communities, Is Less Really More?* Formal Epistemology Workshop. Groningen, Netherlands (presented by co-author).

O'Connor, C. (2016, May). *In Epistemic Communities, Is Less Really More?*' Models and Simulations 7 Conference. Universitat de Barcelona. Barcelona, Spain (presented by co-author).

O'Connor, C. (2016, May). *Communication Without the Cooperative Principle.* Southwest Experimental and Behavioral Economics Conference. University of California, Irvine, Irvine, CA.

O'Connor, C. (2016, March). *In Epistemic Communities, Is Less Really More?* Medical Knowledge in a Social World. University of California, Irvine. Irvine, CA. (presented by co-author).

O'Connor, C. (2016, June). *Power, Bargaining, and Evolution.* Institute for Mathematical Behavioral Studies, University of California, Irvine, CA.

O'Connor, C. (2015, December). *Dynamics and Diversity in Epistemic Communities'*. Minorities and Philosophy, CUNY, New York, NY.

O'Connor, C. (2015, November). *Induction.* Fundamental Concepts in Philosophy of Science Lecture Series, Politecnico di Milano, Milan, Italy.

O'Connor, C. (2015, November*). The Evolution of Guilt.* Department of Philosophy, Carnegie Melon University. Pittsburgh, PA.

O'Connor, C. (2015, November). *Dynamics and Diversity in Epistemic Communities.* Minorities and Philosophy, Carnegie Melon University, Pittsburgh, PA.

O'Connor, C. (2015, September). *Dynamics and Diversity in Epistemic Communities*. The Center for Philosophy of Science, University of Pittsburgh, Pittsburgh, PA.

O'Connor, C. (2015, September). *Communication Without the Cooperative Principle.* Experimental Philosophy Conference. Buffalo, New York.

O'Connor, C. (2015, August). *The Evolution of Guilt: A Modeling Based Approach.* Ninth Principia International Symposium, Florianopolis, Brazil. (Accepted contribution).

O'Connor, C. (2016, June). *Communication Without the Cooperative Principle.*International Society for the History, Philosophy, and Social Studies of Biology Meeting 2015. Montreal, Canada. (July 2015, presented by co-author).

O'Connor, C. (2015, July). *Strategic Thinking in Biology*. International Society for the History, Philosophy, and Social Studies of Biology Meeting 2015. Symposium: *Evolutionary Modeling in Biology and the Behavioral Sciences 2*. Montreal, Canada. (symposium contribution).

Lisa Pearl

Pearl, L. & Bar-Sever, G. (2015, November) *Syntactic categories derived from frequent frames benefit early language processing in English and ASL,* Boston University Conference on Language Development 40, Boston University.

Pearl, L., Paolizzo, F. & Crawford, J. (2016, January). *Interactive music systems: Emotional content & music lyrics*, Integrated Composition, Improvisation, and Technology Colloquium, UC Irvine.

Pearl, L. (2016). February. *The Computation of Language: Syntactic Acquisition Edition*, Linguistics Colloquium, University of California, Los Angeles.

Pearl, L. (2016, February). *Speech and Structure. Language Origins: Evolution, Genetics, and the Brain*, UC Irvine.

Pearl, L. (2016, March). *How to know what's necessary: Using computational modeling to specify Universal Grammar*, Linguistics Colloquium, McGill University, Montreal, Canada.

Pearl, L. (2016, April). *Computational Model Building for Language Acquisition: An Introduction, Great Lakes Expo of Experimental and Formal Undergraduate Linguistics (GLEEFUL)*. Michigan State University.

Dale Poirier

Poirier, D. (2015, August). *Implicit Distributional Assumptions*. Econometric Society World Congress, Montreal, Canada.

Donald Saari

Conferences:
Saari, D. (2015, October). *Dynamical Systems and the Dark Matter Mystery.* Plenary talk presented at Midwest Dynamical Systems, Ohio State.

Saari, D. (2016, May). *Understanding cultural norms via evolutionary game theory; A new approach.* Presented at Workshop III: Culture Analytics, Multiscale Data-driven Models. Institute Pure and Applied Math, UCLA.

Public Lectures:
Saari, D. (2015, October). *From voting paradoxes to the search for dark matter.* Given at Ninth Annual Baylor Public Lecture: Baylor University.

Saari, D. (2015, December). *Mystery of the masses: From voting paradoxes to the search for `Dark Matter'.* Two lectures presented at the Public Lecture: Math Encounters, National Museum of Mathematics, New York.

Saari, D. (2016, March). *We vote, but do we elect whom we really should?* Public lecture at Asprey Lecture in the Mathematical Sciences, Vassar, New York.

Saari, D. (2016, April). *Election year! But will voters elect whom they want?* Public Lecture at the Wing Lecture, University of Rochester, New York.

Colloquia:
Saari, D. (2015, October). *Mathematics of Astronomy.* Mathematics Department, Baylor University.

Saari, D. (2015, November). *Resolving puzzles associated with Nash equilibria.* Economics Department, UCSD.

Saari, D. (2016, March). *Using a torus (or donut) to answer puzzles in psychology and even apportionments.* Mathematics Department, Vassar, NY.

Saari, D. (2016, April). *Mathematics and the dark matter mystery.* Mathematics Department, University of Rochester, NY.

Stergios Skaperdas

Skaperdas, S. (2016, June). *External Interventions and Polarization in Civil WarS.* Conference on Advances in the Economics of Conflict. Stockholm School of Economics, Stockholm, Sweden.

Skaperdas, S. (2016, June). *Policy Determination Under Persuasive Lobbying.* Workshop on Money in Politics, University of Tampere, Finland.

Skaperdas, S. (2016, May). *Persuasion as an instrument of power.* In Persuasion: A Multidisciplinary Symposium, School of Humanities, UC Irvine.

Skaperdas, S. (2016, March). *Conceptualizing the Modern State: Essential Attributes and their Economic Role.* Seminar at the Max Planck Institute for Tax Law and Public Finance, Munich, Germany.

Skaperdas, S. (2016, January). *Contested Persuasion*. Conference on Political Persuasion, Center for the Study of Democracy, UC Irvine.

Skaperdas, S. (2015, December). *Guns, Lawyers, and Markets: Economics Consequences of Costly Conflict.* Keynote Address at the Australasian Meeting of the Public Choice Society, Brisbane, Australia.

Skaperdas, S. (2015, October). *Guns, Lawyers, and Markets: Economics Consequences of Costly Conflict*. Conference on The Political Economy of Social Conflict, Economic Growth Center, Program in Economic History, Yale University.

Brian Skyrms

Skyrms, B. (2015, October). Cognitive Science Colloquium, Indiana University.

Skyrms, B. (2016, May). Interdisciplinary Workshop on Deception, UCLA.

Skyrms, B. (2016, April). *Evolution, Norms and the Social Contract.* Keynote Lecture SEAL (Society for Evolutionary Analysis of Law), Arizona State University.

George Sperling

Sperling, G. (2015, June). *Visual attention as a filtering process that can be efficiently measured quantitatively by centroid methods.* Department of Psychology, Justus-Liebig-Universitaet, Giessen, Germany.

Sperling, G. (2015, July). *Deriving computational models for the brain processes of visual attention.* Colloquiua Traverensia, Leibniz Institute for Psycholgie Information, ZPID, Trier, Germany.

Sperling, G. (2015, July). *Deriving computational models for temporal, spatial, and feature attention.* International Symposium, New Stages in Information Processing Research, Kaiserslautern, Germany.

Sperling, G., Chubb, C., Wright, C.E., Sun, P., Inverso, M., Ton, P., Blair, G., and Winter, N.A. (2015, July). *Paradoxical anomalies in centroid SSRs.* Fourteenth Annual Summer Interdisciplinary Conference, Mammoth Lakes, CA.

Sperling, G., Blair, G., Winter, N. A., Wright, C. E., and Chubb, C. (2015, November). *Color-size conjunction stimuli support feature-based selection for centroid judgments.* Paper presented by C. E. Wright, Psychonomic Society, Chicago, IL.

Sperling, G., Blair, G., Winter, N. A., Wright, C. E., and Chubb, C. (2015, November). *Color-size conjunction stimuli support feature-based selection for centroid judgments.* Paper presented by C. E. Wright, Psychonomic Society, Chicago, IL.

Sperling, G. .Winter, A. N., Wright, C. E., and Chubb, C. (2016, May). *Conjunctive targets are hard in visual search but easy in centroid judgments.* Paper presented by Winter, A.N., Vision Sciences Society, Saint Petersburg, Florida.

Sperling, G., Yang, H. J., Sun, P., and Chubb, C. (2016, May). *Complex attention filters for low contrast items.* Poster presented by H. J. Yang, Vision Sciences Society, Saint Petersburg, Florida.

Sperling, G. (2016, May). *Comparing efficiencies in estimating centroids and judging numerosity.* Inverso, Vision Sciences Society, Saint Petersburg, Florida.

Hal Stern

Stern, H. (2016, February). *Likelihood Ratios in Forensic Statistics: When or When Not to Use Them*. AAAS Meetings, Washington, DC.

Stern, H. (2016, May). Participant, Panel on Similarity-Based Likelihood Ratio Methods, Technical Colloquium: Quantifying the Weight of Technical Evidence, NIST, Gaithersburg, MD.

Stern, H. (2016, May). Participant, Panel on Confidence Intervals for Likelihood Ratios, Technical Colloquium: Quantifying the Weight of Technical Evidence, NIST, Gaithersburg, MD.

Carole Uhlaner

Uhlaner, C. (2015, July). *Relational Goods and Participation in a Revolt: An Approach to Understanding the Arab Spring and the role of Social Media Presented invited talk*, "," Departmental Research Seminar, Department of Political Science, University College London.

Uhlaner, C. (2016, March). *Relational Goods and Overcoming Barriers to Collective Action* Presented conference paper 2016 meetings of the Public Choice Society, Ft. Lauderdale, Florida.

James Weatherall

Weatherall, J. (2015, August). *Understanding Gauge*'. Second International Conference on Logic, Relativity and Beyond. Alfr\'ed R\'enyi Institute of Mathematics, Hungarian Academy of Sciences. Budapest, Hungary.

Weatherall, J. (2015, August). *On Einstein Algebras and General Relativity.* Second International Conference on Logic, Relativity and Beyond. Alfr\'ed R\'enyi Institute of Mathematics, Hungarian Academy of Sciences. Budapest, Hungary. (Delivered by co-author.)

Weatherall, J. (2015, October), *On Stuff*. Center for Philosophy of Science. University of Pittsburgh. Pittsburgh, PA.

Weatherall, J. (2015, November). *On Stuff.* Department of Philosophy. Carnegie Mellon University. Pittsburgh, PA.

Weatherall, J. (2015, December) *On Stuff*. Instituto de Filosofía y Ciencias de la Complejidad. Santiago, Chile.

Weatherall, J. (2016, March). *Theoretical Structure and Theoretical Equivalence*. Perimeter Institute. Waterloo, ON.

Weatherall, J. (2016, April). *On Stuff.* Workshop on the Field Concept in Physics. Center for Philosophy of Science. University of Pittsburgh. Pittsburgh, PA.

Weatherall, J. (2016, April). *Some Philosophical Reflections on Gravitational Waves*. Departments of Physics and Philosophy. Morehead State University. Morehead, KY.

Weatherall, J. (2016, May). *Some Philosophical Prehistory of the Hole Argument.* Fourth International Conference on the Nature and Ontology of Spacetime. Minkowski Institute for Foundational Studies. Varna, Bulgaria.

Weatherall, J., Jhun, J., and Palacios, P. (2016, June). *Giving Econophysics a Chance: On the Plausibility of Modeling Financial Crashes as Critical Phase Transition.* Workshop on Infinite

Idealizations in Science. Munich Center for Mathematical Philosophy. Ludwig-Maximilians Universit\"at. M\"unich, Germany. Delivered by co-author Palacios, P.

Jack Xin

Xin, J. (2015, September). Epstein Institute Seminar, Industrial & System Engineering, USC.

Xin, J. (2015, September). Applied Math Seminar, Univ. of Utah, Salt Lake City.

Xin, J. (2015, October). Math Colloquium, Cal State San Bernardino.

Xin, J. (2016, June). Southern CA Applied Mathematics Symposium, Claremont Graduate University.

Hongkai Zhao

Zhao, H. (2015, August). Frontiers of Applied and Computational Mathematics, in honor of Bjorn Engquist's 70th birthday, Peking University, China.

Zhao, H. (2015, September). Mathematics Department Colloquium, Auburn University.

Zhao, H. (2015, September). School of Mathematics Colloquium, Georgia Tech.

Zhao, H. (2015, October). Applied Mathematics Seminar, UC Santa Barbara.

Zhao, H. (2015, October). Numerical and Multiscale issues for Partial and Integral Differential Equations, in honor of Bjorn Engquist's 70th birthday, UT Austin.

Zhao, H. (2016, January). Workshop on Computational Seismology, Tsinghua Sanya International Mathematics Forum, Sanya, China.

Zhao, H. (2016, January). Workshop on Numerical Methods for Nonlinear Problems, Tsinghua Sanya International Mathematics Forum, Sanya, China.

Zhao, H. (2016, February). Kwan Chao-Chih Distinguished Lecture, 8/24/2015, Institute of Systems Sciences, Chinese Academy of Sciences.

Zhao, H. (2016, February). School of Mathematics Colloquium, Georgia Tech.

Zhao, H. (2016, February). IPAM workshop on Shape Analysis and Learning by Geometry and Machine, UCLA.

Zhao, H. (2016, May). International Conference on Applied Mathematics, Hong Kong.

E. FACULTY AWARDS AND ACHIEVEMENTS

APPENDIX E
IMBS FACULTY AWARDS AND ACHIEVEMENTS, 2015 - 16

Bill Batchelder

An IMBS Conference in my honor titled *Cultural Consensus Theory, Multinomial Processing Tree Models, and Cognitive Psychometrics* took place in November 2015.

Carter Butts

Joined the Board of Reviewing Editors at *Science.*

Jan Brueckner

Named Chancellor's Professor in recognition of scholarly contributions in urban, public and transportation economics.

Jean- Paul Carvalho

The lead article in the June 2016 issue of the Journal of Economic Literature, titled "The New Economics of Religion", cited three of my papers and devoted a paragraph to my paper titled 'Veiling'.

Co-organizer, IMBS Friday lunch seminars. UC Irvine.

Faculty discussant, IRES Graduate Workshop, Chapman University.

Steve Frank

Appointed UCI Distinguished Professor, July 2015.

Appointed Donald Bren Professor of Biological Sciences, June 2016.

I taught a graduate course in evolution with strong emphasis on theoretical concepts.

Following my IMBS seminar in January (see above), I led a session to discuss the topic with a couple of IMBS students and visitors.

Michelle Garfinkel

Golden Key International Honor Society (honorary member), April 2016.

JOURNAL OF CONFLICT RESOLUTION, JOURNAL OF ECONOMICS AND BUSINESS, EUROPEAN JOURNAL OF POLITICAL ECONOMY

Bernie Grofman
I received a $5,000 grant from the Koch Foundation to fund a one week visit to UCI by a Distinguished Public Choice scholar, Professor Roger Congleton to give talks at UC Irvine.

Kimberly A. Jameson

Community Service City of Newport Beach, California :
June 2016. School of Physical Sciences. *Exceptional Faculty Mentor Recognition* for Advising of Mathematics Undergraduate Kirbi Joe.

Winter 2015. Cognitive Sciences. Outstanding Teaching Award for Psych 179 "Color Cognition Research" (co-taught with Narens).

Summer 20-16. Invited Keynote Speaker at the *PICS2016: Progress in Colour Studies Conference* (September 14, 15, 16, 2016. London, UK).

Ad Hoc Reviewing:
PICS2016
Journal of Vision
Color Research & Application
Journal of the Optical Society of America
PNAS

Media:

During 2015-2016 news and media coverage highlighting Jameson's research (sketched as (1), (3) and (5) above) appeared in a variety of public and campus media outlets, including BBC news, KPBS, Discovery channel, Interface Magazine, Vogue Magazine, and several others.

October 2006 -- present. Appointed member of the City of Newport Beach Environmental Quality Affairs Committee. A committee for advising and oversight, focusing on project environmental impact reports and notices of project descriptions for public and private work proposed within the city of Newport Beach.

Marek Kaminski

Reviews of my book Gry Wiezienne (Games Prisoners Play)

- lecture and discussion on single-member districts, for BRJ TV (August 2015), https://www.youtube.com/watch?v=b8bqKq4WhOU&list=PLjrpbjoslcLm7qTZCFura8MUSy1je1ksA
- interview on electoral methods, for TV Republika (December 2015) https://www.youtube.com/watch?v=GbHVu2AhXrg&index=2&list=PLjrpbjoslcLm7qTZCFura8MUSy1je1ksA

Robin Keller

Ramsey Medal for distinguished contributions to decision analysis, highest award of the Decision Analysis Society of INFORMS, November 2015.

Decision Analysis editorial board member.
EURO Journal on Decision Processes editorial board member.

INFORMS (The Institute for Operations Research and the Management Sciences, www.informs.org)

-President, 2015.
-Past-President, 2016.
-Board Liaison to INFORMS History and Traditions Committee, 2016 (as Past President).
-Co-chair of INFORMS Strategic Planning Committee, 2016.
-President's Award Committee, Chair, 2015; Member 2016 and 2017.
-Nominations Committee, Chair for 2017 election- 2016.

Appointment to Committee for a Study of Performance-Based Safety Regulation, Transportation Research.

Board, National Research Council of the National Academies, February 2016.

Elected to Committee on Academic Personnel, September 2016.

Igor Kopylov

Associate Editor: Theoretical Economics.

Simon Levin

National Medal of Science, December 2015.

Louis Narens

During the last academic year I served as Graduate Director for the Mathematical Behavioral Science PhD Program.

Michael McBride

I am one of the organizers for the Experimental Social Science Lunch that meets weekly.

Lisa Pearl

2016 Chancellor's Award for Excellence in Fostering Undergraduate Research, Undergraduate Research Opportunities Program.

2016 Excellence in Undergraduate Teaching, Fall Quarter 2015, School of Social Sciences, University of California, Irvine.

Online media appearances discussing my modeling work:

-The Ling Space. 2016. Simon Snow, Good Omens, and Stylometrics. http:// thelingspace.tumblr.com/post/143126283104/ simon-snow-good-omens-and-stylometrics.

-The Ling Space. 2016. Interview with Lisa Pearl. Announcement: http://thelingspace.tumblr.com/post/141055678819/interview-with-lisa-pearl. Interview: http:// thelingspace.tumblr.com/post/142754971399/were-really-excited-to-have-gotten-to-interview.

2010-current Organizer and faculty leader of the interdisciplinary discussion group "Computational Models of Language": http://www.socsci.uci.edu/~lpearl/colareadinggroup/

Dale Poirier

Invitation to nominate candidates for 2016 The Sveriges Riksbank Prize in Economic Science in Memory of Alfred Nobel.

Kim Romney

Outstanding Emeritus Award, June 2016.

An IMBS Conference in my honor titled *Collection and Appropriate Math Modeling*, November 2015.

Don Saari

Chair: Governing Council, International Institute for Applied Systems Analysis, Vienna, Austria.

NAS Chair: Section 32 (Applied Mathematics).

NAS: Nominating Committee.

NAS: Temporary Nominating Group, Foreign Associates.

NRC: Board on International Scientific Organizations.

NRC: Chair, Board on Mathematical Sciences and their Applications.

NRC: Chair, NMO, IIASA.

Chair: Conference Board of the Mathematical Sciences.

Science Board: Santa Fe Institute.

Stergios Skaperdas

Keynote speaker at the Australasian meeting of the Public Choice Society, Queensland University of Technology, Brisbane, Australia. December 2015.

Hal Stern

2016 DeGroot Prize, International Society for Bayesian Analysis – Bayesian Data Analysis (3rd edition).

- 2015 – present, Chair, American Statistical Association (ASA) Committee on Publications.
- 2015 – present, Member, Board of Directors, National Institute of Statistical Science (NISS).
- 2015, Member, External Review Committee, Department of Statistics, University of Pennsylvania, PA.
- 2014 – present, Member, Scientific Area Committee for Physics/Pattern Forensic. Evidence, Organization of Scientific Area Committees, National Institute of Standards and Technology (NIST).
- 2014 – present, Member, Advisory Committee for AAAS / Arnold Foundation, "Quality and Gap Analysis of the Forensic Science Literature."
- 2013 – 2016, Chair, National Academy of Sciences Panel on Research Methodologies for Understanding Driver Fatigue.

- 2012 – present, Vice-Chair, Ad Hoc Advisory Committee on Forensic Statistics, American Statistical Association.

Rein Taagepera

Karl Deutsch Award presented by the International Political Science Association, June 2016.

Carole Uhlaner

Promoted to Full Professor.

James Weatherall

Visiting Fellowship at the Pittsburgh Center for Philosophy of Science, University of Pittsburgh, 2016.

Elected Visiting Fellow at Clare Hall College, Cambridge University for Summer 2016.

Jack Xin

Appointed to serve the 2nd term of Editor-in-Chief, SIAM Interdisciplinary Journal: Multi-scale Modeling & Simulations, by SIAM Vice President for Productions, May 2016.

F. FACULTY ADVISING

APPENDIX F
GRADUATE STUDENTS AFFILIATED WITH IMBS

(i) Current Student Participants and their IMBS Advisors
(* advanced to Ph.D. candidacy; ** received Ph.D. during year)

	Student	Advisor
	Nikhil Addleman	Narens
**	Kalin Agrawal	Batchelder
*	Gregory Alexander	Batchelder
*	Jerrod Anderson	Carvalho/McBride
	Brian Asquith	Brueckner
	Galia Bar-sever	Pearl
	Michael J. Bannister	Eppstein
	Zach Becker	Eppstein
	Dennis Blew	Kaminski
	Alex Bower	Bachelder
	Steven Brownlee	Poirier
**	Anne Carpenter	McBride/Skaperdas
	Debapriya Chakraborty	Brownstone
	Elliott Chen	Weatherall
	Mayuri Chaturvedi	Skaperdas
	Calvin Cochran	Barrett
	Andrew Colopy	Skaperdas
	John Cuffe	Uhlaner
	Irina Danileiko	Lee
	Archie Delshad	Kaminski
*	Steve Doubleday	Lee
**	Ben Feintzeig	Weatherall
	Nikki Fider	Komarova
**	Ian Finn	McBride
	Katelyn Finley	Kaminski
	Ben Gibson	Butts
	Marian Gilton	Weatherall
	Kier Groulx	Chubb
	Hongyang (Maime) Guan	Lee
	Michael Guggisberg	Brownstone/Poirier
	Santiago Guisasola	Saari
	Lisa Guo	McBride/~~Narens~~
	Christian Herrera	Chubb
**	Michael Ho	Xin
	Kurt Horner	McBride
	Matt Inverso	Chubb
**	Keith Jarrett	Kaminski
	Brian Kaiser	Kaminski

	Student	Advisor *
	Alex Keena	Kaminski
	Si-Yuan Kong	Brownstone
	William Leibzon	Narens
	Francis Lee	Butts
	Timmi Ma	Komarova
	Amine Mahmassani	Brownstone/McBride
**	Daniel Mann	Chubb
	Solena Mednikoff	Chubb
	Percy Mistry	Lee
	Chris Mitsch	Weatherall
	Aydin Mohseni	Barrett/Huttegger/O'Connor
	Fulya Ozcan	Poirier
**	Tolga Oztan	O'Connor/White
	Lawrence Phillips	Pearl
	Nolan Phillips	Butts
	Jason Ralston	McBride
	Jordan Rashid	Chubb
**	Garret Ridinger	McBride
	Gerard Rothfus	Brian Skyrms
	Sarita Rosenstock	O'Connor/Weatherall
	Hannah Rubin	Huttegger/O'Connor
	Michael Sacks	Carvalho/McBride
	K.J. Savinelli	Pearl
	Mike Schneider	Weatherall
	Pele Schramm	Batchelder/Hoffman
	Linley Slipetz	O'Connor
	Emma Smith	Butts
	Shaun Stipp	Narens
	Pat Testa	Carvalho/Skaperdas
*	Brian Vegetabile	Stern
	Jamie Wang	Brueckner
	Cole Williams	Carvalho/McBride/Skaperdas
	Nicole Winter	Chubb
	Karen Wood	Komarova
	Tim Wong	Brownstone
	Fan Yin	Butts
**	Penghang Yin	Xin
	Timothy Young	McBride
	Yue Yu	Butts
	Xuhong Zhang	Butts
	Junying Zhao	Saari
	Irina Zotova	McBride
	Penghe Zu	Xin

G. VISITORS TO IMBS

APPENDIX G
VISITOR'S LETTERS

Donald G. Saari, Director
Institute for Mathematical Behavioral Sciences
University of California
Irvine, CA 926797-5100

Dear Don,

This year, I spent January 3-30 at UCI, primarily based in IMBS, but also with an affiliation with Ecology and Evolutionary Biology. I did make one short trip to the National Science Foundation for a ceremony honoring the recipients of the National Medal of Science. The ceremony at the White House, at which the Medal was to be formally presented, was delayed until May, due to the January blizzard in DC.

While at UCI, I had the pleasure to meet with Provost Lavernia and Don Saari to discuss new initiatives in Convergence at UCI; this is a very exciting direction, and complementary to activities we are developing at Princeton. I look forward to enhanced interactions as the programs develop. At IMBS, I interacted regularly with Don Saari, among others, attended the Thursday colloquia, and worked intensively with Adam Martiny and his group in Earth Systems Science (and EEB). As usual, Don Saari and I discussed a number of research topics, as well as international collaborations at IIASA and the activities of the Board on Mathematical Sciences of the National Academy of Sciences. At Don's invitation, I agreed to join that Board. Also joining Martiny and me in our discussions were my Princeton postdoctoral fellow, George Hagstrom; a sabbatical visitor to Princeton (Ken Andersen, from Copenhagen); and, for one day, Andrew Hein. With Hagstrom, Martiny and I made substantial progress on a manuscript on nutrient patterns in the oceans, as part of our NSF Dimensions of Biodiversity grant; that paper will be submitted for publication this spring. With Andersen, we began a new collaborative project on trait-based modeling of marine systems, and will also explore funding for that. Martiny and I also worked on strategies for future funding to continue our collaboration, which has been highly productive, and met with Jacob Levin to explore funding strategies.

Inspired by discussions we had had previously, I also met with Arthur Lander, joined on Skype by Andrew Lo of MIT, as we explored collaboration on insights drawn from developmental biology for regulation of the financial system. I also met with Qing Nie, with whom I have collaborated recently, and we plan to travel together to Beijing in the fall to meet with our collaborator, Lei Zhang, at the Beijing International Center for Mathematical Research.

I met less formally with Fred Wan, Steve Frank, Francisco Ayala, Susan Bryant, David Gardiner, Kimball Romney and others. Frank and I discussed his latest work, which he presented (with me as host) to the IMBS Colloquium. Throughout the period, I also carried out research on public goods, on ocean modeling, on optimal search strategies, on collective decision-making and on other topics.

Simon Levin
Professor, Ecology and Evolutionary Biology
Princeton