

# Dynamic Decision Making Laboratory

Carnegie Mellon University

## A note from Coty

2011-2012 has been a very exciting academic year in the DDMLab!

New post-doctoral fellows started in 2011: Noam Ben-Asher (Ben-Gurion University, Israel), Muniba Saleem (Iowa State University), and Sara Levens (New York University) were all post-docs in this academic year. Varun Dutt graduated from Engineering and Public Policy (Carnegie Mellon University) and also started as a post-doc in August 2011. They all contributed in many ways with new ideas, analyses, papers and presentations to the laboratory. Thanks to all! Except for Noam, who continues to be a post doc in the lab, all the other post-docs have started faculty positions in several universities. In 2012, we are lucky to welcome new post-doctoral fellows: Katja Mehlhorn (University of Groningen, Netherlands), Jason Harman (Ohio State University), and Shikhar Kumar (University of Arizona, Tucson). We look forward to their contributions!

Several research grants got renewed, including our grant from the Army Research Office on Cyber-Situation Awareness, our grant from the Defense Threat Reduction Agency on understanding conflict with a socio-cognitive computational approach. We also obtained new grants during this academic year including one from the National Science Foundation to study Decisions from Experience phenomena with Instance-Based Learning models; a grant from the Qatar National Research Fund, in collaboration with Professor Iliano Cervesato (CMU-Qatar) to study inferential processing and decisions; and a grant from the Army Research Laboratories, the Network Science-Collaborative Technologies Alliance (NS-CTA) to study trust and scalable recommendation and in-

formation sources. We also worked on a large-scale funding effort, the Minerva initiative, that unfortunately did not get funded but that was a lot of fun to write, given interesting collaborations from the IDC in Herzeliya, Israel.

The productivity in terms of publications was amazing during 2011-2012!! For example, during this academic year, our IBL modeling paper that integrates decisions from experience in the sampling and repeated choice paradigms, got published in *Psychological Review*. As a result of that work several interesting theoretical developments emerged. Including a second theoretical note in *Psychological Review*, currently in press. We made progress in several fronts including our understanding of decisions from experience in important domains such as Cyber-Security and Global Warming. Please go over our list of new publications 2011-2012 and you will find a wide diversity of interesting papers in highly ranked journals!

We also presented and showcased our work in many national and international conferences. Notably, we participated in a special workshop regarding Game-Theoretic approaches to study Cyber-Situation Awareness, and in an international conference on Decision Making at University of Allahabad, India, where we presented the results of decisions from experience across sampling and repeated choice paradigms and the corresponding Instance-Based Learning modeling work.

We look forward to continuing our efforts in understanding how humans make decisions in dynamic environments!

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Group photo from staff luncheon at the Church Brew Works restaurant, May 2012

## Our Members

Four of our members left the lab this past summer. We'd like to thank them for their contribution and to wish them the best in their future endeavors.

Congratulations to **Varun Dutt**, who is now an Assistant Professor at the [Indian Institute of Technology, Mandi](#) in India. He has a joint appointment in the School of Computing and Electrical Engineering and the School of Humanities and Social Science.

Congratulations to **Sara Levens**, who has taken an Assistant

Professor position in the Psychology Department at the [University of North Carolina at Charlotte, NC](#).

Congratulations to **Muniba Saleem**, who is now an Assistant Professor in the Department of Behavioral Sciences at the [University of Michigan](#).

**Jani Bergström**, our visiting Fullbright Scholar, returned to Finland to continue his Ph.D. work at the [University of Eastern Finland](#) (Kuopio Campus).

## New Faces

This semester, we are going to be joined by:

**Katja Mehlhorn** (*Post-Doctoral Fellow*) transitioned to a full-time position in August. She did her Ph.D. at the [University of Groningen](#), The Netherlands and at the [Chemnitz University of Technology](#), Germany. She is interested in how memory processes affect the way we think and make decisions. Through combining behavioral experiments and cognitive modeling, she hopes to get a better understanding of complex cognition.

**Jason Harman** (*Post-Doctoral Fellow*) did his Ph.D. in Experimental Psychology at [Ohio University](#). His research interests include judgment and decision making, dynamic cognitive models, goals and goal pursuit, models of choice, learning and social perception.

**Shikhar Kumar** (*Post-Doctoral Fellow*) did his Ph.D. in Psychology and Cognitive Science at the [University of Arizona](#),

[Tucson](#). His research interests include computational cognitive neuroscience of decision making and memory systems. He is also broadly interested in computational social science and complexity theory, where he uses mathematical modeling to understand various dynamical features of societies and cultures.

**Neeraj Saini** (*Research Assistant*) is currently pursuing his Masters in Information Technology at Carnegie Mellon University. He has previous work experience as an Information Security Administrator and Engineer. We are fortunate to have him as part of our cybersecurity research team.

**Tomek Loboda** (*Visiting Research Programmer*) is currently pursuing his Ph.D. from the [School of Information Sciences](#) at the [University of Pittsburgh](#). His research interests include eye-movements during reading, eye-tracking as an input device, Bayesian networks, and computational and user modeling.

## New Research

We obtained a new grant from the Army Research Laboratories (ARL) program on the Network Science-Collaborative Technologies Alliance (NS-CTA). This is an exciting project that involves collaborations with the University of California at Santa Barbara and the University of Illinois at Urbana Champaign. In general the project involves the study of trust among people and people and systems. Particularly we will study the development of trust through experiential interactions with people and systems.

Our research involving laboratory experimentation, analyses of large data sets, and computational cognitive modeling will have an impact on how recommender systems, which aim at providing a more intelligent and proactive information service according to the learning preferences of users of the web. The main contribution to these systems involves the development of trust through interaction with these systems or users. We will use large data sets from twitter, Facebook, and other sources.

Below is a summary of research highlights during 2011-2012:

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**From Mike Yu**

We are currently focusing on further developing our work around trust. Based on some earlier work done in the lab, we recently submitted a revised manuscript on time delay and reciprocity to the Journal of Economic Psychology and are pushing forward on new work investigating the influence of first impressions and experience in a repeated trust game.

Meanwhile, we have been wrapping up some of our outstanding work from the NIOSH grant, with a manuscript on order effects in dynamic (emergency) environments with a conditional acceptance in Human Factors and a methodo-

logical paper on developing scenario-based risk scales accepted in the Journal of Risk Analysis (see Recent Publications).

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**From Noam Ben-Asher**

We continue to investigate how information security analysts establish cyber situation awareness and detect threats. Focusing on the ability to distinguish between different types of cyber threats.

We explore ways to train a decision maker to moderate risk taking in a dynamic environment where productivity increases in parallel with risk taking. We find that the spacing between adverse experiences, whether they are clustered or distributed, can lead to different levels of risk-taking.

The combination of behavioral game theory and cognitive modeling yields exciting results through which we learn about the way information plays a role in decision making. We also use this paradigm to study the emergent of trust and coordination in an iterative games.

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**From Katja Mehlhorn**

How do people search for information before making a decision? And how can decisions be predicted from this initial stage of information search? Despite the importance of these questions, little is known about their answers. Our results indicate, for example, that people have a preference for searching information about options with variable outcomes. We also find that peoples' decisions can be predicted well from their experiences during information search.

## Recent Publications

It has been an extremely productive year for the lab in terms of journal publications. In the past year, twelve articles and three book chapters authored by members of the DDMLab and our collaborators were published, including pieces in journals like *Climatic Change*, *Cognition*, and *Psychological Review*. An additional nine journal articles and three book chapters are currently in press.

For a full list of publications, please see the publications page on the laboratory's website at <http://www.hss.cmu.edu/departments/sds/ddmlab/papers.html>.

## Conference Proceedings

Lab members also applied to and were accepted into several summer workshops. **Katja** attended the [Summer 2012 Institute on Bounded Rationality in Psychology and Economics](#) in Berlin, Germany. **Noam** participated in the [19th ACT-R Summer School](#). Here are some papers that appeared in conference proceedings recently:

Juvina, I., Lebiere, C., Gonzalez, C., & Saleem, M. (2012). Generalization of learning in games of strategic interaction. In *Proceedings of the 34th Annual Meeting of the Cognitive Science Society (CogSci 2012)*. August 1-4, Sapporo, Japan.

Gonzalez, C., Dutt, V., Martin, J., & Ben-Asher, N. (2012). Decisions from experience in conflict situations: Cognitive model of the effects of interdependence information. In *Proceedings of the Behavioral Decision Research in Management Conference (BDRM 2012)*. June 27-29, 2012. Leeds School of Business, Boulder, CO.

Juvina, I., Lebiere, C., Gonzalez, C., & Saleem, M. (2012). Intergroup prisoner's dilemma with intragroup power dynamics and individual power drive. In S. J. Yang, A. M. Greenberg, & M. Endsley (Eds.), *Lecture Notes in Computer Science. SBP 2012* (Vol. 7227, pp. 290-297). DOI: 10.1007/978-3-642-29047-3\_35.

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## Presentations & Invited Talks

Coty was/is invited to give the following talks during 2011-2012:

**September 6, 2012**      *Making decisions from experience: explaining sampling and repeated risky decisions with Instance-Based Learning cognitive models*. Center for Behavioral and Decision Research Seminar Series. Carnegie Mellon University; Pittsburgh, PA.

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**April 15, 2012**      *Human performance modeling*. International Conference on Cognitive Modeling (ICCM 2012). Berlin, Germany.

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**March 28, 2012**      *Decisions from Experience in Advanced Technological Systems*. **Keynote speech** for the annual meeting of the Mexican Society of Computer Science. Salamanca, Mexico.

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**February 1, 2012**      *Instance-Based Learning: Integrating decisions from experience in sampling and repeated choice paradigms*. Cognitive Science Colloquium: Psychological and Brain Sciences. Indiana University, Bloomington.

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**December 10, 2011**      *Instance-Based Learning: Integrating Decisions from Experience in Sampling and Repeated Choice Paradigms*. International Conference on Decision Making. University of Allahabad, India.

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**November 20, 2011**      *The Description-Experience Gap in Decisions under Uncertainty*. Commemorative Colloquium for Horacio Arlo-Costa. Center for Formal Epistemology, Department of Philosophy at Carnegie Mellon University.

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**October 14, 2011**      *A Game-Theoretic Approach to Study Cyber Situation Awareness*. Second ARO Workshop on Moving Target Defense. University of Maryland. Fairfax, VA.