Evaluation Data Report

Function and Evolution Working Group
Meeting Three: September 13-17, 2010

Pamela Bishop
Program Evaluation Coordinator
National Institute for Mathematical and Biological Synthesis
November, 2010

This work was conducted at the National Institute for Mathematical and Biological Synthesis, sponsored by the National Science Foundation, the U.S. Department of Homeland Security, and the U.S. Department of Agriculture through NSF Award #EF-0832858, with additional support from The University of Tennessee, Knoxville.

Table of Contents

List of tables

List of figures

Function and Evolution Working Group Evaluation Data Report

Background

NIMBioS Working Groups are chosen to focus on major scientific questions at the interface between biology and mathematics. NIMBioS is particularly interested in questions that integrate diverse fields, require synthesis at multiple scales, and/or make use of or require development of new mathematical/computational approaches. NIMBioS Working Groups are relatively small (10-12 participants, with a maximum of 15), focus on a well-defined topic, and have well-defined goals and metrics of success. Working Groups will typically meet 2-3 times over a two-year period, with each meeting lasting 3-5 days; however, the number of participants, number of meetings, and duration of each meeting is flexible, depending on the needs and goals of the group.

The Function and Evolution group is working to model the dynamics of biological systems at the functional and evolutionary levels, and integrate these two in a unified framework. From cells to human societies, biological organization emerges from the interaction of individual parts. The dynamics of these interactions are governed by the interaction mechanisms. Even though these mechanisms themselves are ultimately products of evolution, the functional dynamics they produce are not identical to the evolutionary dynamics and operate at different scales. In order to explain the emergence of biological organization, researchers need to integrate both functional and evolutionary dynamics.

The group is working to develop the theoretical framework for this task. Particular focal topics that will be addressed are: the evolution of pay-offs and trade-offs in biological interactions, the evolution of interaction mechanisms, and the modeling of the interplay between different types of functional dynamics. The working group will integrate the results from these focal investigations in a multi-scale theoretical framework and identify new avenues for theoretical and empirical research opened by this synthesis.

During the first meeting, the working group determined the conceptual issues and problems underscoring the group's research interests and approaches. One broad conceptual issue focuses on the constraints that occur with different functional dynamic and how these functional dynamics interact with evolutionary dynamics. The group identified several research questions that would benefit from an approach that integrates functional and evolutionary dynamics, such as the evolution of emotions and a dynamical and biological classification of different solution concepts for evolutionary game theory. The group developed an outline of a review paper that will survey the uses of evolutionary game theory and multi-tier approaches across broad scales of biological organization, from individual behavior to macroecology.

The second meeting began with presentations by group members of work initiated in the past meeting, discussing the progress and future plans for the work. Also discussed were a series of recent papers by members of the group on reproductive social behavior and sexual selection, focusing on what type of models would be needed to differentiate between different theories of

reproductive behavior. During the second and third days, break-out groups continued the ongoing projects and started a few new ones, including one on contrasting models of evolution of sex-specific ornaments and a paper on the use of evolutionary game theory in quantitative biology education.

The third meeting, which included several new members with game theoretic expertise from political science, began with discussions of recent papers, including one exploring the connections between political science theory and biology. Progress reports about the group's ongoing projects, which focus on the idea of levels and hierarchies in ecological and biological theory, were also given. Several research projects and the sub-groups to carry them out were identified, including models of parent-offspring communication in the behavioral time-scale and models of sexually dimorphic ornaments. Break-out groups worked on relevant models. A special focus was on how the theory of mechanism design from economics can be applied and adapted to models of communication, especially between parents and offspring. Because this was our last meeting, we also made detailed plans about how to finish and write up the work we have done. The group estimates a total of 10 manuscripts that span topics ranging from the idea of levels in biology to models of prey-predators and parent-offspring interactions. The target time frame for most of the papers to be ready for submission is by early 2011.

Evaluation Design

Evaluation Questions

The evaluation of the meeting was both formative and summative in nature, in that the data collected from participants was intended to both gain feedback from participants about the quality of the current meeting and also to inform future meetings. The evaluation framework was guided by Kirkpatrick's Four Levels of Evaluation model for training and learning programs (Kirkpatrick, 1994[1]). Several questions constituted the foundation for the evaluation:

1. Were participants satisfied with the Working Group overall?
2. How do participants feel about the format of the meetings?
3. How do participants feel about the content of the meetings?
4. Do participants feel they have a good understanding about the work being done by other subgroups within the group?
5. Do participants feel they gained a better understanding of t how the work of the various subgroups will tie together to reach the Working Group's goals?
6. How do the research collaborations happening in this working group differ from participants' other research collaborations?
7. How do participants communicate between meetings?
8. Do participants feel they have a good idea of what their continuing contribution will be within the group?

[1] From Kirkpatrick, D.L. (1994). *Evaluating Training Programs: The Four Levels.* San Francisco, CA: Berrett-Koehler.

Evaluation Procedures

The final instrument was hosted online via the University of Tennessee's online survey host mrInterview. Links to the survey were sent to six Working Group participants on September 17, 2010. Reminder emails were sent to non-responding participants on September 27 and October 1, 2010. By October 8, 2010, five participants had given their feedback, for a response rate of 83%.

Evaluation Data

Respondent Satisfaction

Table 1. Respondent satisfaction with content and format of the working group

	Very satisfied	Satisfied	Neutral	Dissatisfied	Strongly dissatisfied
The amount of effort spent on working group activities	25%	75%	-	-	-
The adherence of meetings to schedules	50%	50%	-	-	-
Utilization of time during meetings	25%	25%	50%	-	-
Organization of the meetings	25%	50%	25%	-	-
The diversity of disciplinary expertise of the participants	100%	-	-	-	-
The level of task productivity of participants	100%	-	-	-	-
The quality of participant ideas and discussions	50%	50%	-	-	-
Overall satisfaction level with the working group	50%	50%	-	-	-

Figure 1. Respondent views of group progress

Respondent comments about progress toward goals:

"I look forward to completing the paper(s) that I am not a part of. I have also formed relationships with a few other scholars working in areas with some overlap with my own."

Understanding of Group Function

Table 2. Respondent understanding of group function

As a result of participating in this meeting, I have a better understanding of:	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The work being accomplished by the other subgroups within the Working Group	100%	-	-	-	-
How the work of the various subgroups will tie together for the working group's publication(s) and/or product(s)	50%	50%	-	-	-

Figure 2. Respondent understanding of what is expected of them before the next meeting

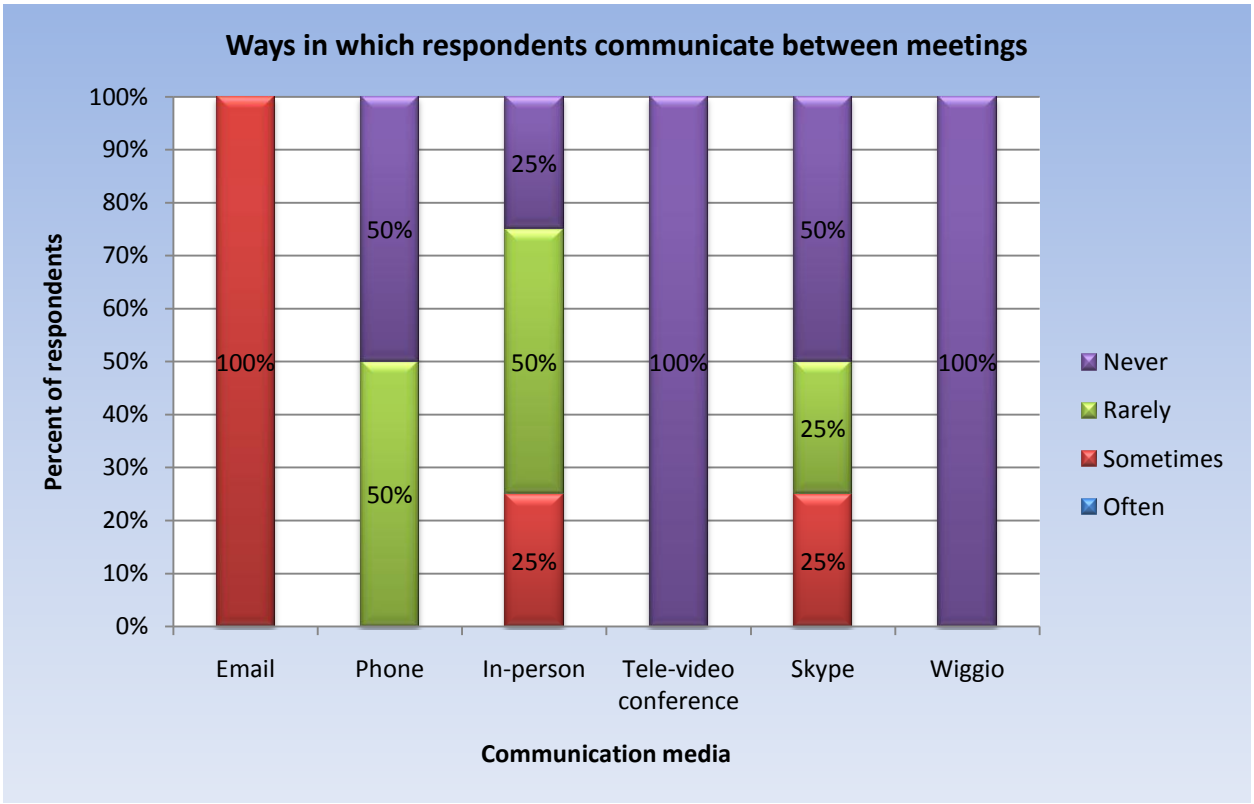
Uniqueness of Working Group Collaborations

Table 3. Ways in which working group research collaborations differ from participants' other collaborations

	Very different	Slightly different	Not different
Disciplinary topics involved	75%	25%	-
Research methods used	-	75%	25%
Scientific questions addressed	75%	25%	-
Academic conferences at which research is presented	50%	25%	25%
Competitive grants applied for	33%	33%	33%
Journals targeted for publication	50%	50%	-

Respondent Communication

Figure 3. Ways respondents communicate



Additional Comments about Working Group

"I think the experience was very rewarding and I hope our research pans out. Thank you."

"I wish I felt freer to take on new collaborative projects - this is the main barrier to me getting more out of these meetings. They have been great and I hope everyone's project succeeds wildly!"

"This was my first experience with NIMBioS and only my second exposure to research in the natural sciences, but I was very impressed with the working group. In 10 years as a Professor I can name only one other working group or conference that was as productive."

Appendix

List of Participants

Participants

Last name	First name	Institution
*Akcay	Erol	University of Tennessee Knoxville
Brown	Joel	University of Illinios Chicago
Fearon	James	Stanford University
Gross	Louis	University of Tennessee Knoxville
Iyer	Priya	Stanford University
Meirowitz	Adam	Princeton University
Potochnik	Angela	University of Cincinnati
*Roughgarden	Joan	Stanford University
Worden	Lee	University of California Berkeley

*** Organizer**