



Evaluation Report

Darwinian Morphometrics: Cross-Topology

Registration of Shape Working Group

January 10-12, 2010

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April, 2010

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Executive Summary

Brief Synopsis of Event

This report is an evaluation of a NIMBioS Working Group entitled “Darwinian Morphometrics: Cross-Topology Registration of Shape Working Group” (Darwinian Morphometrics), which held its first meeting at NIMBioS January 10-12, 2010. 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 Darwinian Morphometrics group comprised 16 participants, including organizers Patrick A. Carter (School of Biological Sciences, Washington State University), Richard Gomulkiewicz (Department of Mathematics and School of Biological Sciences, Washington State University), David Houle (Department of Biological Science, Florida State University), and J. Stephen Marron (Department of Statistics and Operations Research, University of North Carolina, Chapel Hill). Participants came from 10 universities in Australia, Canada, and the United States (See Appendix A).

The Darwinian Morphometrics group brought together evolutionary biologists, mathematicians, statisticians, and an agricultural animal researcher to understand the actual biological processes that result in variations of form among species and/or individuals, and to develop easier ways to analyze the functions of complex evolutionary traits that result in these variations. The Darwinian Morphometrics group proposes to meet for four three-day meetings over the next two years to discuss and brainstorm solutions to current problems arising from cross-topology registration.

Evaluation Design

An electronic survey aligned to the following evaluation questions was designed by the NIMBioS Evaluation Coordinator with input from the NIMBioS Director and Deputy Director:

1. Were participants satisfied with the Working Group overall?
2. Did the meeting meet participant expectations?
3. Do participants feel the Working Group made adequate progress toward its stated goals?
4. Do participants feel they gained knowledge about the main issues related to the research problem?
5. Do participants feel they gained a better understanding of the research across disciplines related to the Working Group's research problem?
6. What impact do participants feel the Working Group will have on their future research?
7. Were participants satisfied with the accommodations offered by NIMBioS?
8. What changes in accommodations, group format, and/or content would participants like to see at future meetings?

The final instrument was hosted online via the University of Tennessee's secure online survey host mrlInterview. Links to the survey were sent to the 16 Working Group participants on January 13, 2010. Reminder emails were sent to non-responding participants on January 20 and 25, 2010. By February 1, 2010, 15 participants had given their feedback, for a response rate of 94%.

An electronic demographic survey aligned to the reporting requirements of the National Science Foundation was designed by the NIMBioS Evaluation Coordinator with input from the NIMBioS Director. The final instrument was hosted online via the University of Tennessee's online survey host mrlInterview. Links to the survey were sent to the 16 Working Group participants who had not previously attended a NIMBioS event on December 21, 2009. Reminder emails were sent to non-responding participants on January 4, 2010. By December 8, 16 participants had filled out the survey for a response rate of 100%. Demographic questions regarding gender, race, and ethnicity, and disability status were optional (disability status is not reported in this evaluation report). All demographic information is confidential, and results are reported only in the aggregate. When feasible, the evaluator filled in missing demographic data from other sources (e.g. address, institution, field of study). The evaluator did not assume race, ethnicity, or disability status for any participant who did not report this information.

Highlights of Results

- Overall satisfaction with the Working Group was high among respondents, all of whom agreed that the meeting was very productive, and 92% of whom indicated the Working Group met their expectations.
- Ninety-three percent of respondents thought the presentations were useful, and all thought that the presenters were very knowledgeable about their presentation topics.
- All respondents either agreed or strongly agreed that they would recommend participating in NIMBioS Working Groups to their colleagues.
- Respondents were satisfied overall with the travel, housing, and other amenities offered by NIMBioS, although several participants indicated being dissatisfied with the travel agent used by NIMBioS.
- Respondents reported high levels of learning overall, agreeing that they had a better understanding of the main research issues.
- All respondents indicated they had a better understanding of research happening in the Working Group's subject area in disciplines other than their own.
- All respondents agreed that the Working Group format was effective for achieving its goals, and that the group made adequate progress toward finding a common language across disciplines for analyzing complex evolutionary traits.
- Eighty-seven percent of respondents felt that the Working Group made adequate progress, for its first meeting, toward developing a deeper understanding of the actual biological processes that underlie differences in form.
- Eighty percent of respondents said they left this meeting with a good idea of what their contribution will be at the next meeting.
- All respondents said they planned to take the knowledge they gained during the Working Group and apply it to their own research.
- Ten respondents said that they developed unanticipated plans for collaborative research with other Working Group participants; while two said they had developed collaborations that they had anticipated would occur.

Conclusions and Recommendations

Overall, the Working Group was very successful in making progress toward its goals. Working Group respondents were satisfied with the meeting, indicating that it was a productive experience that met their expectations. Respondents were also satisfied overall with the travel, housing, and other amenities offered by NIMBioS, although several participants indicated being dissatisfied with the travel agent used by NIMBioS.

Respondents overall reported high levels of learning overall, agreeing that they had a better understanding of the main research issues. Additionally, all respondents indicated they had a better understanding of research happening in the Working Group's subject area in disciplines other than their own.

All respondents felt that the group made adequate progress toward finding a common language across disciplines for analyzing complex evolutionary traits. Additionally, the majority of respondents felt that the Working Group made adequate progress, for its first meeting, toward developing a deeper understanding of the actual biological processes that underlie differences in form. The majority of respondents also said they left this meeting with a good idea of what their contribution will be at the next meeting, although several said they were not entirely clear what their individual tasks should be in the interim.

All respondents indicated they planned to take the knowledge they gained during the Working Group and apply it to their own research, and several said they had developed solid plans for collaborative research with other Working Group participants.

Several participants offered suggestions for future meetings, including more time to discuss the next steps for the Working Group, better organization among group leaders regarding group tasks, more generalized presentations covering background material, and focusing discussion more on research and less on grant proposals. Suggestions for NIMBioS included providing cereal for breakfast, providing a more suitable area for meals, fixing the weak/unreliable Wi-Fi connection, and looking into problems with the travel agent.

Based on analysis of participant response data, the recommendations to NIMBioS and/or Working Group organizers are as follows:

- Many respondents indicated some level of uncertainty about what is expected of them between group meetings. Before the conclusion of each meeting, consider designating a specific time slot to synthesize the information discussed, address the next steps that should be taken, and assign specific tasks to individuals or groups with tentative timelines for completion.
- Consider providing participants with more background material, such as models used in evolutionary biology and shape analysis. This could be done through presentations at the next meeting, or by posting relevant papers/presentations/datasets for the group using the Wiggio.
- NIMBioS should look into the problems with the Wi-Fi connections, and investigate the complaints made about the travel agent.

Darwinian Morphometrics: Cross-Topology Registration of Shape Working Group Evaluation Report

Background

Introduction

This report is an evaluation of a NIMBioS Working Group entitled “Darwinian Morphometrics: Cross-Topology Registration of Shape” (Darwinian Morphometrics), which held its first meeting at NIMBioS January 10-12, 2010. The Darwinian Morphometrics group comprised 16 participants, including organizers Patrick A. Carter (School of Biological Sciences, Washington State University), Richard Gomulkiewicz (Department of Mathematics and School of Biological Sciences, Washington State University), David Houle (Department of Biological Science, Florida State University), and J. Stephen Marron (Department of Statistics and Operations Research, University of North Carolina, Chapel Hill). Participants came from 10 universities in Australia, Canada, and the United States (See Appendix A).

The Darwinian Morphometrics group brought together evolutionary biologists, mathematicians, statisticians, and an agricultural animal researcher to understand the actual biological processes that result in variations of form among species and/or individuals, and to develop easier ways to analyze the functions of complex evolutionary traits that result in these variations.

Working Group Background

Many critical biological traits are defined by mathematical functions. The selection, variation, and evolution of these “function-valued traits” has become an increasingly popular field of research. One of the fundamental challenges to understanding the evolution of function-valued traits is properly registering (or aligning) them while accounting for variation among individuals or taxa.

An example of this is measuring the alterations of wing shape between different taxa of flies. For example, *Drosophila* wings develop from a single sheet of cells composed of unlimited self-regenerating patterns of gene expression that draws at least three different types of functions. These functions occur at different intervals during development. To fully understand the evolution of wings, it is necessary to understand what combination of these functions will lead to the variations in wing shape.

The Darwinian Morphometrics Working Group hopes to prove that the problem of registration is not separate from the analysis of the functions themselves, but is an essential part of that analysis. Current methods used by evolutionary biologists are based on convenient geometric properties that allow general approaches to be developed, but do not take in to account the nature of variation among traits. The Darwinian Morphometrics group proposes to meet for four three-day meetings over the next two years to discuss and brainstorm solutions to current problems arising from cross-topology registration.

Participant Demographics

Darwinian Morphometrics Working Group participants, who were college/university faculty (94%) and postdoctoral researchers (6%), came from 10 universities in Australia, Canada, and the United States

(See Appendix A). Primary fields of study for the 16 participants included agricultural sciences/natural resources, biological/biomedical sciences, engineering, and mathematics (Table 1).

Table 1. Participant fields of study and areas of concentration

Field of Study	Concentration	# Participants
Agricultural Sciences/Natural Resources	Agricultural Animal Breeding	1
Biological/Biomedical Sciences	Evolutionary Biology	7
	Ecology	1
Engineering	Bioengineering & Biomedical	1
Mathematics	Applied Mathematics	1
	Math/Statistics, General	1
	Statistics	4

The 2 females and 14 males (three of whom self-identified as being of Hispanic/Latino ethnicity) mostly self-identified racially as white (Figures 1 & 2).

Figure 1. Racial composition of program participants (n =16)

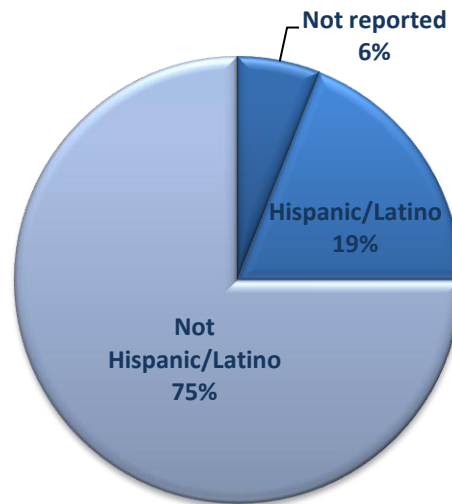
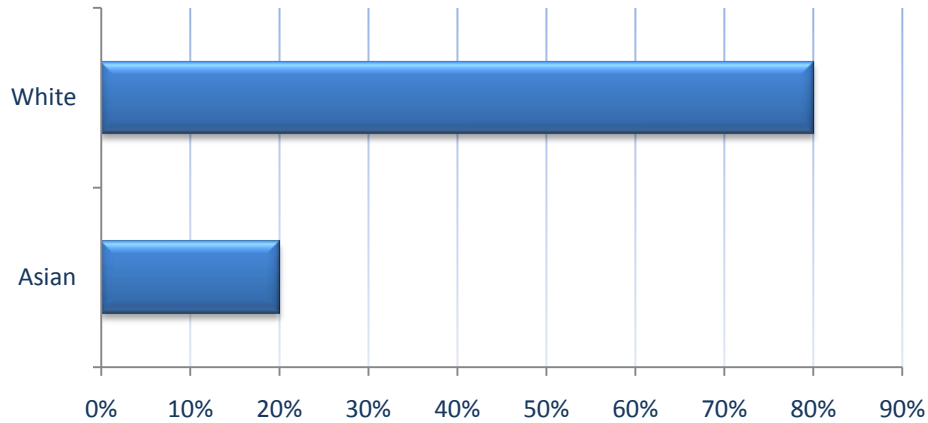


Figure 2. Ethnic composition of program participants (n =16)



Four respondents indicated their work is currently supported by a total of seven National Science foundation grants (Table 2).

Table 2. NSF grants supporting participant research

Name of grant	Institution(s) at which grant is held
Robust Functional Data Analysis	University of Wisconsin, Milwaukee
Novel Computational Methods for the Analysis, Synthesis, and Simulation of Shape of Surfaces	Florida State University
Demographic Heterogeneity within Populations and Its Consequences	Washington State University
A Unified Theoretical Approach to Community Coevolution	Washington State University
Foundation in Mathematical Biology Through Interdisciplinary Research, Training, and Curriculum Development	Washington State University
Consequences of Habitat Heterogeneity and Seed Dormancy for Adaptation at the Margins of a Native Plant Population	Washington State University
The Dictionary of Genetic Effects and the Language of Morphology	Florida State University

Evaluation Design

Evaluation Questions

The evaluation of the Working Group 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 Working Group 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, 1994¹). The evaluation questions were developed according to level one of the model, participants' reactions, in order to gather information about how participants felt about the content and format of the Working Group, as well as the accommodations provided by NIMBioS. Several questions constituted the foundation for the evaluation:

1. Were participants satisfied with the Working Group overall?
2. Did the meeting meet participant expectations?
3. Do participants feel the Working Group made adequate progress toward its stated goals?
4. Do participants feel they gained knowledge about the main issues related to the research problem?
5. Do participants feel they gained a better understanding of the research across disciplines related to the Working Group's research problem?
6. What impact do participants feel the Working Group will have on their future research?
7. Were participants satisfied with the accommodations offered by NIMBioS?
8. What changes in accommodations, group format, and/or content would participants like to see at future meetings?

Evaluation Procedures

The NIMBioS Evaluation Coordinator designed an electronic survey aligned to the evaluation questions with input from the NIMBioS Director and Deputy Director. The final instrument was hosted online via the University of Tennessee's secure online survey host mrInterview. Links to the survey were sent to the 16 Working Group participants on January 13, 2010. Reminder emails were sent to non-responding participants on January 20 and 25, 2010. By February 1, 2010, 15 participants had given their feedback, for a response rate of 94%.

An electronic demographic survey aligned to the reporting requirements of the National Science Foundation was designed by the NIMBioS Evaluation Coordinator with input from the NIMBioS Director. The final instrument was hosted online via the University of Tennessee's online survey host mrInterview. Links to the survey were sent to the 16 Working Group participants who had not previously attended a NIMBioS event on December 21, 2009. Reminder emails were sent to non-responding participants on January 4, 2010. By December 8, 16 participants had filled out the survey for a response rate of 100%. Demographic questions regarding gender, race, and ethnicity, and disability status were optional (disability status is not reported in this evaluation report). All demographic information is confidential,

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

and results are reported only in the aggregate. When feasible, the evaluator filled in missing demographic data from other sources (e.g. address, institution, field of study). The evaluator did not assume race, ethnicity, or disability status for any participant who did not report this information.

Data Analysis

Data from the electronic survey included both forced-response and supply-item questions. All data were downloaded from the online survey host into the statistical software package SPSS for analysis. Quantitative data were analyzed using SPSS, while qualitative data were analyzed in SPSS Text Analysis for Surveys. Qualitative responses were categorized by question and analyzed for trends.

Findings

Participant Satisfaction

Overall Satisfaction

Overall satisfaction with the Working Group was high among respondents, all of whom agreed that the meeting was very productive, and 92% of whom indicated the Working Group met their expectations. Some general participant comments:

“Bravo. A very productive meeting in a positive environment.”

“It was great to work with such a group of smart and highly motivated people.”

“I feel like I learned a lot, met some people I had not known about before, had the chance for others to hear about my related work, and gained some very valuable input as to where my research should go.”

Ninety-three percent of respondents thought the presentations were useful, and all thought that the presenters were very knowledgeable about their presentation topics. Additionally, 100% of respondents either agreed or strongly agreed that they would recommend participating in NIMBioS Working Groups to their colleagues (Table 3).

Table 3. Participant satisfaction with various aspects of the Working Group

	<i>n</i>	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I feel the Working Group was very productive.	15	87%	13%	0%	0%	0%
The Working Group met my expectations	15	71%	21%	7%	0%	0%
The presenters were very knowledgeable about their topics.	15	100%	0%	0%	0%	0%
The presentations were useful.	15	73%	20%	7%	0%	0%
The group discussions were useful.	15	67%	33%	0%	0%	0%
I would recommend participating in NIMBioS Working Groups to my colleagues.	15	87%	13%	0%	0%	0%

* Note: Percentages in tables may not add to 100% due to rounding

Satisfaction with Accommodations

Overall, respondents reported being satisfied with the housing, travel and facilities provided by NIMBioS during the Working Group. NIMBioS arranged housing for all 15 respondents, all of whom said they were satisfied with their accommodations. NIMBioS also arranged travel for 14 respondents, 67% of whom were satisfied with their travel plans. Respondents who reported feeling “neutral” or “very dissatisfied” about travel indicated that the travel agency used by NIMBioS was expensive and provided unnecessarily complicated itineraries:

“Get a new travel agent! They are providing very poor itineraries and drastically inflating the prices (in my case, by 300%!”

“I think the travel agency that NIMBioS must use is very expensive and not very effective. I found much better and cheaper flights than the travel agent, and passed that info on to Jennifer, who was then able to get those flights for me. I know others in the group had similar experiences.”

The majority of participants also reported being satisfied with the comfort and resources of the NIMBioS facility, as well as the quality of meals provided (Table 4).

Table 4. Participant satisfaction with Working Group accommodations

Please indicate your level of satisfaction with the Working Group accommodations:	<i>n</i>	Very satisfied	Satisfied	Neutral	Dissatisfied	Strongly dissatisfied	Not applicable
Facility in which the Working Group took place	15	73%	20%	7%	0%	0%	0%
Travel arranged by NIMBioS	15	33%	33%	13%	0%	13%	7%
Housing arranged by NIMBioS	15	87%	13%	0%	0%	0%	0%

Working Group Format and Content

Most Useful Aspect

Most respondents said the multidisciplinary composition of the Working Group was its most useful aspect, as they were able to learn from those in fields other than their own. Participant comments about the most useful aspect of the meeting:

“The interaction with biologists gave me a much better and focused understanding of the problems they would like to solve and how expertise in shape and data analysis can help the group reach some of the goals.”

“Getting together with researchers from such different disciplines, in a relatively small group where discussion is manageable.”

“Bringing together people with a range of very diverse backgrounds but dealing with similar issues - there were clearly some previously unknown matches between data sets and methods available.”

“Cross-discipline interactions: the biological problems I presented were seen through a different perspective by the math crowd, and vice-versa.”

Other respondents felt the open discussions among group members were the most useful aspect:

“The brainstorming sessions, both as a full group and smaller break out groups, were very fun and productive.”

“The open discussion of biological and mathematical problems in the area of Darwinian morphometrics.”

Participant Learning

Respondents were asked several questions to gauge their gains in understanding regarding several areas related to the research problem, including learning about biological processes that underlie difference in form and methods of registration to produce logical and systematic methods of analysis. Respondents reported high levels of learning overall, agreeing that they had a better understanding of the main research issues (Table 5). Additionally, 100% of respondents indicated they had a better understanding of research happening in disciplines other than their own in the Working Group’s subject area.

Table 5. Participant learning about issues related to the Working Group’s research problem

As a result of participating in this Working Group, I have a better understanding of:	<i>n</i>	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Research happening in disciplines other than my own in the Working Group’s subject area	15	93%	7%	0%	0%	0%
Biological processes that underlie difference in form	15	33%	47%	13%	7%	0%
Methods of registration to produce logical and systematic methods of analysis	15	67%	33%	0%	0%	0%

Progress Toward Goals

All respondents agreed that the Working Group format was effective for achieving its goals, and felt that the group made adequate progress toward finding a common language across disciplines for analyzing complex evolutionary traits. Most agreed that this was a definite challenge for the group; however, the group members recognized the challenge and put much effort into overcoming it:

“Interdisciplinary dialog is always a challenge. But this group seemed well aware of that particular challenge, and was interested in trying to deal with it.”

“The members of the group are from very different backgrounds - biology, math, stat - very different perspectives and languages. As an example - some members of the group do not know the breeders equation. We are understanding each other - really good progress here.”

“Participants worked very hard to ensure a smooth cross-dialog, even though it was clear at the outset that they spoke very different languages--even within biological disciplines. I believe this cross-communication flow was attained early in the meeting and made most discussions run smoothly and stay productive.”

Additionally, 87% of respondents felt that the Working Group made adequate progress, for its first meeting, toward developing a deeper understanding of the actual biological processes that underlie differences in form. Participant comments:

"We had some discussion of basics of evolution (breeders equation, for instance). I knew these basics. So I think some people learned some biology. I didn't learn that much new on the biology side, a little."

"...Some clear lines of investigation, methodology and strategies were identified for the development of such deeper understanding. I would favor slightly longer and more detailed presentations by some of the participants to further enhance this aspect of the Working Group."

Eighty percent of respondents said they had a good idea of what their contribution will be at the next meeting, although most felt more solid tasks for individuals would be developed during the next meeting. Some participant comments:

"I have a specific project to work on in the interim and anticipate some discussion on progress at the next group meeting. It seems that others are in the same situation. So we will re-group to discuss progress, see if we need to re-adjust the various projects."

"They are more or less clear, but I feel the discussed topics gave the participants enough ammunition to move forward toward the next meeting."

"My answer is really yes and no. I have a pretty good idea of where the Working Group is headed but I'm not entirely sure of what my own contribution might be."

Impact on Future Research Plans

All respondents said they felt that the exchange of ideas that took place during the Working Group would initiate and/or influence their future research. Some participant comments:

"...we began new collaborations with people outside my usual area (in particular, statisticians and mathematicians)."

"I see at least 3 new lines of investigation that I intend to explore in the near future in collaboration with other participants and many others for long-term projects."

"It already is influencing my research, and it's hard for me to think any other way I could have acquired the mathematical and thinking tools to do this."

"It was really good to get some expert geometric insights into some of the methods that I have trying to develop."

"We came up with some short term work - a few specific problems to attack via small group collaborations. I anticipate making headway on one before the next meeting. So that is a short-

term influence., For long term influence - yes, there were some big and interesting statistical ideas brought up that would constitute a long term research program.”

“I have not dealt with registration previously; the meeting convinced me that this is a topic I need to look at & I am planning to participate in one of the working projects identified.”

In addition to new ideas for research, 10 respondents said that they developed unanticipated plans for collaborative research with other Working Group participants, while two said they developed plans for collaborations that had been anticipated:

“While I've been collaborating with some group members in the past, it is clear that this meeting will start some of us moving in some much deeper geometric directions than we have previously done.”

“New applications of shape registration and modeling [were] motivated by biological problems presented at the meeting.”

“The possibilities for developing databases and common tools was an unexpected bonus of this meeting.”

Suggestions for Future Working Group Meetings

Respondents were asked several questions soliciting suggestions for future Working Group meetings. Overall, participants were highly satisfied with the content and format of the current meeting. Several participants, however, did offer suggestions for future meetings, including more time to discuss the next steps for the Working Group, better organization regarding group tasks among group leaders, more generalized presentations covering background material, and focusing discussion more on research and less on grant proposals:

“To set the direction for the next meetings, it would have been useful to have had another day for this first meeting - it would have allowed better development of the issues to be pursued next.”

“Us leaders of the meeting need to be more prescriptive about what is to be done - we spent some not very useful time talking about what we should be talking about. As collaborations develop, this should be easier.”

“First, let me say that I think the first meeting of the Working Group was very successful. A few presentations covering background material such as models used in evolutionary biology and shape analysis could enhance cross-disciplinary interaction. Longer and more detailed presentations by (some of) the participants could lead to deeper understanding and discussion of some of the problems.”

“...more focused discussions on research rather than grant proposals.”

Suggestions for NIMBioS included providing cereal for breakfast, providing a more suitable area for meals, fixing the weak/unreliable Wi-Fi connection, and looking into problems with the travel agent.

Conclusions and Recommendations

Overall, the Working Group was very successful in making progress toward its goals. Working Group respondents were satisfied with the meeting, indicating that it was a productive experience that met their expectations. Respondents were also satisfied overall with the travel, housing, and other amenities offered by NIMBioS, although several participants indicated being dissatisfied with the travel agent used by NIMBioS.

Respondents overall reported high levels of learning overall, agreeing that they had a better understanding of the main research issues. Additionally, all respondents indicated they had a better understanding of research happening in disciplines other than their own in the Working Group's subject area.

All respondents felt that the group made adequate progress toward finding a common language across disciplines for analyzing complex evolutionary traits. Additionally, the majority of respondents felt that the Working Group made adequate progress, for its first meeting, toward developing a deeper understanding of the actual biological processes that underlie differences in form. The majority of respondents also said they left this meeting with a good idea of what their contribution will be at the next meeting, although several said they were not entirely clear what their individual tasks should be in the interim.

All respondents indicated they planned to take the knowledge they gained during the Working Group and apply it to their own research, and several said they had developed solid plans for collaborative research with other Working Group participants.

Several participants offered suggestions for future meetings, including more time to discuss the next steps for the Working Group, better organization among group leaders regarding group tasks, more generalized presentations covering background material, and focusing discussion more on research and less on grant proposals. Suggestions for NIMBioS included providing cereal for breakfast, providing a more suitable area for meals, fixing the weak/unreliable Wi-Fi connection, and looking into problems with the travel agent.

Based on analysis of participant response data, the recommendations to NIMBioS and/or Working Group organizers are as follows:

- Many respondents indicated some level of uncertainty about what is expected of them between group meetings. Before the conclusion of each meeting, consider designating a specific time slot to synthesize the information discussed, address the next steps that should be taken, and assign specific tasks to individuals or groups with tentative timelines for completion.

- Consider providing participants with more background material, such as models used in evolutionary biology and shape analysis. This could be done through presentations at the next meeting, or by posting relevant papers/presentations/datasets for the group using the Wiggio.
- NIMBioS should look into the problems with the Wi-Fi connections, and investigate the complaints made about the travel agent.

Appendix A

List of Participants

Participants

Last name	First name	Institution
Beder	Jay	University of Wisconsin Milwaukee
*Carter	Patrick	Washington State University Pullman
Gervini	Daniel	University of Wisconsin Milwaukee
*Gomulkiewicz	Richard	Washington State University Pullman
Hallgrims	Benedikt	University of Calgary
Heckman	Nancy	University of British Columbia
*Houle	David	Florida State University
Joshi	Sarang	University of Utah
Kingsolver	Joel	University of North Carolina Chapel Hill
Kirkpatrick	Mark	University of Texas Austin
Marquez	Eladio	Florida State University
*Marron	James Stephen	University of North Carolina Chapel Hill
Meyer	Karin	University of New England
Mio	Washington	Florida State University
Stinchcombe	John	University of Toronto
Yao	Fang	University of Toronto

*** Organizer of Working Group**

Appendix B

Darwinian Morphometrics: Cross-Topology Registration of Shape

Working Group Survey

Darwinian Morphometrics Working Group Survey

Thank you for taking a moment to complete this survey. Your responses will be used to improve the Working Groups hosted by the National Institute for Mathematical and Biological Synthesis. Information supplied on the survey will be confidential, and results will be reported only in the aggregate.

Please check the appropriate box to indicate your level of agreement with the following statements about this Working Group: (Very satisfied, Satisfied, Neutral, Dissatisfied, Very dissatisfied)

- I feel the Working Group was very productive.
- The Working Group met my expectations.
- The presenters were very knowledgeable about their topics.
- The presentations were useful.
- The group discussions were useful
- I would recommend participating in NIMBioS Working Groups to my colleagues.

Please check the appropriate box to indicate your level of agreement with the following statements.

As a result of participating in this Working Group, I have a better understanding of:

(Strongly agree, Agree, Neutral, Disagree, Strongly disagree)

- Research happening in disciplines other than my own in the Working Group's subject area
- Biological processes that underlie differences in form
- Methods of registration to produce logical and systematic methods of analysis

Do you feel the Working Group made adequate progress, for its first meeting, toward developing a deeper understanding of the actual biological processes that underlie differences in form?

Yes

No

Comments:

Do you feel the Working Group made adequate progress toward finding a common language across disciplines for analyzing complex evolutionary traits?

Yes

No

Comments:

Do you feel the expectations for the next Working Group are clear (in the sense that you are leaving this meeting with a good idea of what your contribution will be at the next meeting)?

Yes

No

Comments:

Do you feel that the exchange of ideas that took place during the Working Group will initiate or influence your future research? Please explain:

Did you develop unanticipated plans for collaborative research with other Working Group participants? Please explain:

What do you feel was the most useful aspect of the Working Group?

What would you have changed about the Working Group?

How do you feel about the format of the Working Group?

This was a very effective format for achieving our goals

This was not a very effective format for achieving our goals ->

The Working Group format would have been more effective if:

Is your work currently supported by an NSF grant?

Yes ->

No

Name of NSF grant:

Institution at which NSF grant is held:

Please indicate your level of satisfaction with the Working Group accommodations:

(Very satisfied, Satisfied, Neutral, Dissatisfied, Very dissatisfied)

Travel arranged by NIMBioS

Housing arranged by NIMBioS

Facility in which the Working Group took place

Please indicate any changes NIMBioS can make to improve the resources and/or accommodations available to Working Group participants:

Please provide any additional comments about your overall experience with the Working Group:

Appendix C

Open-ended Survey Responses

Open-ended responses, by question and response category

Do you feel the working group made adequate progress, for its first meeting, toward developing a deeper understanding of the actual biological processes that underlie differences in form? (n=8)

This was the 1st of 4 meetings; we have identified issue to pursue in the interval to the next meeting.

WE laid the groundwork for several collaborations I know of, and furthered some already in progress.

Yes. Some clear lines of investigation, methodology and strategies were identified for the development of such deeper understanding. I would favor slightly longer and more detailed presentations by some of the participants to further enhance this aspect of the working group.

This was not the main emphasis of the discussion, although these themes obviously were pervasive through the discussions.

We had some discussion of basics of evolution (breeders equation, for instance). I knew these basics. , So I think some people learned some biology. I didn't learn that much new on the biology side, a little.

I feel like I learned a lot, met some people I had not known about before, had the chance for others to hear about my related work, and gained some very valuable input as to where my research should go.

This was an even more productive and stimulating first meeting than I had hoped.

The meeting was incredibly productive and I am excited about our next meeting when we can assemble manuscripts based on the work we did this past week.

Do you feel the Working Group made adequate progress toward finding a common language across disciplines for analyzing complex evolutionary traits? (n=6)

The meeting was very successful in this regard.

This is difficult, but participants were patient at explaining things.

Interdisciplinary dialog is always a challenge. But this group seemed well aware of that particular challenge, and was interested in try9ing to deal with it.

The members of the group are from very different backgrounds - biology, math, stat - very different perspectives and languages. As an example - some members of the group do not know the breeders equation. , We are understanding each other - really good progress here.

Participants worked very hard to ensure a smooth cross-dialog, even though it was clear at the outset that they spoke very different languages--even within biological disciplines. I believe this cross-communication flow was attained early in the meeting and made most discussions run smoothly and

stay productive.

I think we did a good job finding common language between the biologists and the statisticians. Several key "overview" presentations were quite helpful in this regard.

Do you feel that the exchange of ideas that took place during the working group will influence your future research? (n=7)

As proof: we began new collaborations with people outside my usual area (in particular, statisticians and mathematicians).

I see at least 3 new lines of investigation that I intend to explore in the near future in collaboration with other participants and many others for long-term projects.

It already is influencing my research, and it's hard for me to think any other way I could have acquired the mathematical and thinking tools to do this.

It was really good to get some expert geometric insights into some of the methods that I have trying to develop.

We came up with some short term work - a few specific problems to attack via small group collaborations. I anticipate making headway on one before the next meeting. So that is a short-term influence. For long term influence - yes, there were some big and interesting statistical ideas brought up that would constitute a long term research program.

I have not dealt with registration previously; the meeting convinced me that this is a topic I need to look at & I am planning to participate in one of the working projects identified

Yes, the methods that we will develop will be key to both future experimental design and analysis.

Did you develop unanticipated plans for collaborative research with other working group participants? (n=5)

The collaborations that have come out of the recent meeting involve: people I have already collaborated with, and people I haven't met before but anticipated collaborating with after this meeting. (Thanks for bringing us together!)

No, I don't think so--it was more that collaborative interactions that I was hoping would occur did occur.

While I've been collaborating with some group members in the past, it is clear that this meeting will start some of us moving in some much deeper geometric directions than we have previously done.

New applications of shape registration and modeling motivated by biological problems presented at the meeting.

The possibilities for developing databases and common tools was an unexpected bonus of this meeting.

Do you feel the expectations for the next working group are clear (in the sense that you are leaving this meeting with a good idea of what your contribution will be at the next meeting)? (n=7)

Some very interesting seeds have been planted. It will be very interesting to see what grows out of these.

I think it is quite clear what we need and want to accomplish at our next meeting.

not yet - this depends on progress that can be made in the interim

My answer is really yes and no. I have a pretty good idea of where the working group is headed but I'm not entirely sure of what my own contribution might be.

I don't think we can say too much about this until collaborations develop. I hope they will.

They are more or less clear, but I feel the discussed topics gave the participants enough ammunition to move forward toward the next meeting.

I have a specific project to work on in the interim and anticipate some discussion on progress at the next group meeting. It seems that others are in the same situation. So we will re-group to discuss progress, see if we need to re-adjust the various projects.

What do you feel was the most useful aspect of the working group? (n=9)

The brainstorming sessions, both as a full group and smaller break out groups, were very fun and productive.

The open discussion of biological and mathematical problems in the area of Darwinian morphometrics.

Broad-thinking Statisticians interested in similar problems to those I have.

1. New collaborations. 2. Exciting pairing of new statistical ideas on shape with clear biological needs. 3. Potential for new biology - shape statistics grant proposals.

Getting together with researchers from such different disciplines, in a relatively small group where discussion is manageable

The interaction with biologists gave me a much better and focused understanding of the problems they would like to solve and how expertise in shape and data analysis can help the group reach some of the

goals.

Bringing together people with a range of very diverse backgrounds but dealing with similar issues - there were clearly some previously unknown matches between data sets and methods available.

diverse participants

Cross-discipline interactions: the biological problems I presented were seen through a different perspective by the math crowd, and vice-versa.

What would you change about the working group? (n=9)

To set the direction for the next meetings, it would have been useful to have had another day for this first meeting - it would have allowed better development of the issues to be pursued next.

Us leaders of the meeting need to be more prescriptive about what is to be done - we spent some not very useful time talking about what we should be talking about. AS collaborations develop, this should be easier.

First, let me say that I think the first meeting of the working group was very successful. A few presentations covering background material such as models used in evolutionary biology and shape analysis could enhance cross-disciplinary interaction. Longer and more detailed presentations by (some of) the participants could lead to deeper understanding and discussion of some of the problems.

Nothing. I thought the meeting was incredibly productive.

I don't see any productive changes at the moment.

Nothing, really. However, I do come away wishing I had learned about some aspects in more detail. But that is good, right? Three days is short to learn everything. I will be back for more.

It was really very well put organized and executed.

I can't think of nothing that wouldn't be fixed by simply further refining the aims at future meetings.

shorter presentations, more focused discussions on research rather than grant proposals

The working group format would have been more effective if: (n=0)

Please indicate any changes NIMBioS can make to improve the resources and/or accommodations available to working group participants: (n=12)

Cereals for breakfast.

Institutional surroundings are a definite minus. There are no places to sit and eat, so the catered breakfasts and lunches devolve into an awkward stand-or-sit? Rearrange the furniture? Where do I put my drink? Set of questions. I suggest some widely-spaced tables suitable for seating about 6 take the place of the rows of tables and chairs in the main room.

Change travel agency!! Or allow us to do our own flight booking and reimburse.

I had difficulty confirming my travel plans because it turned out that NMBIOS was closed for the holidays..... simple things like updating voice mail greetings to indicate that the office is closed or having "out of the office" auto replies to emails would have been very helpful., \$14 for 6 hours of travel is cheap-- I understand that NMBIOS doesn't want to subsidize extravagant airport meals, beverages, etc. But I connected internationally, and my total travel time was about 6-8 hours in each direction. For most people, this will involve 2 meals in an airport. Finding two meals in an airport that are reasonably healthy for \$14 is a near impossibility.

Get a new travel agent! They are providing very poor itineraries and drastically inflating the prices (in my case, by 300 %!).

I think the travel agency that NIMBioS must use is very expensive and not very effective. I found much better and cheaper flights than the travel agent, and passed that info on to Jennifer, who was then able to get those flights for me. I know others in the group had similar experiences.

the wireless access in the meeting room dropped out frequently; perhaps NIMBIOS needs to impose a little more control over the travel agency used - a number of people found that their itinerary provided was unnecessarily complicated or that the tickets issued were somewhat on the pricey side.

Everything was great. I really appreciate the hard work of NIMBioS people, especially with accommodating our Sunday meeting. Thanks!

Very well organized, with a staff responsive to the inevitable issues that arose.

I was satisfied with what NIMBioS offered

None. I thought our working group meeting went very smoothly.

Nothing major really, maybe it should be easier to get a Wi-Fi hook.

Please provide any additional comments about your overall experience with the working group: (n=4)

Bravo. A very productive meeting, in a positive environment.

The staff (Jennifer, Chris et al) was great and made it easy for us to focus on our work.

it was great to work with such a group of smart and highly motivated people

My overall experience was excellent.

NIMBioS is creating a web page with links to blogs written by our participants about relevant research topics. If you maintain a blog and would like to be included in our list of links please provide your URL, as well as a brief description of the topic of the blog: (n=1)

www.stat.ubc.ca/~nancy

Brief description of your blog: (n=1)

This is just my home page, not a blog. Don't use it if you don't want to use it. It is standard - linking to publications, research interests.