Rice Visual Communication Symposium 2019 Visualize Your Research

6

-MM

*. 0.) 0

0

0

0

<B<C

H

VCS at a glance

Friday, March 1st

9:00 am	Registration & Light Breakfast Moody Center for the Arts (MCA) Creative Open Studio
9:30 am	SESSION 1 – FIGURE & DATA VISUALIZATION DESIGN Moody Center for the Arts (MCA) Lois Chiles Studio Theater
12:05 pm	Lunch by Local Foods MCA Creative Open Studio
1:30 pm	SESSION 2 – ILLUSTRATION FOR FIGURES & COVERS MCA Lois Chiles Studio Theater
1:30 pm	SESSION 2 – HANDS-ON DEMONSTRATIONS MCA 2 nd Floor & Duncan Hall

Saturday, March 2nd

9:00 am	Registration & Light Breakfast MCA Creative Open Studio
9:30 am	SESSION 3 – KEYNOTE ADDRESS MCA Lois Chiles Studio Theater
10:50 am	SESSION 4 – MAPPING & MODELING PANEL MCA Lois Chiles Studio Theater
l2:30 pm	Lunch by Local Foods MCA Creative Open Studio
2:00 pm	SESSION 5 – RESEARCH VISUALIZATION AT RICE MCA Lois Chiles Studio Theater
4:30 pm	Reception MCA Central Gallery & Lantern Terrace



Rice Visual Communication Symposium 2019

Visualize Your Research

Welcome

We are **so** pleased that you are here. We see VCS 2019 as a place to talk about the fact that, though we come from different backgrounds, we share the need to visually explore and communicate complex ideas.

We encourage you to use VCS as an opportunity to reach outside of your bubble and get to know people with other perspectives - discuss methods, trade ideas, compare notes.

- VCS Organizing Committee

Anneli John John

Jenmons Wilson Jour the

Thank you

to our generous sponsors –



GRAD starter



Vincent Botta on

Credits

ORGANIZING COMMITTEE



Anneli Joplin



Kyle G. Sweeney



Elizabeth A. Festa



Ginny Whitaker



Jennifer Shade Wilson



Lauren Howe-Kerr



COVER ARTIST

Sriparna Saha



Shar'-Lin Anderson



Elaine Chang

- SPONSORS Program in Writing & Communication at Rice University Rice University Office of Research Rice University Gradstarter
- FEATURED ARTIST Jennifer Delaney
- PROGRAM DESIGN Anneli Joplin
 - CONTRIBUTORS Lina Dib, Adrienne Correa, Tony Day, & Maureen Haver
 - REGISTRATION Jane Zhao SUPPORT Heather Holley
 - REFERENCES
 The Irish Times Quotes from the article, Colouring:

 a rich and rewarding avenue into science (January 4, 2018)

 Starry Night photo by Ryan Hutton on Unsplash

 Bubble photo by Vincent Botta on Unsplash

 Cover background photo by Johny Goerend on Unsplash

 A map of the world c. 1600 from Wellcome Collective

 Mars Rover Images from NASA/JPL-Caltech/MSSS

 Images from Art Forms of Nature by Ernst Haeckel and Adolf Giltsch,

 made available by the Library of Congress

 Images from Cyanotypes of British Algae by Anna Atkins,

 from the New York Public Library Digital Collection



D



Table of contents

VCS at a glance Inside front cover

Welcome 1

Credits 2

Table of contents 3

Program 4

Abstracts 8 In chronological order

Your VCS vis 20

VCS attendees 24 & color

Color of the year 25

Coloring research 28

Notes 31

Maps Inside back cover



9:00 am	Registration & Light Breakfast Moody Center for the Arts (MCA) Creative Open Studio
9:30 am	SESSION 1 – FIGURE & DATA VISUALIZATION DESIGN Moody Center for the Arts (MCA) Lois Chiles Studio Theater
9:30-9:40	Welcome & Introductory Remarks Anneli Joplin Instructor of Visual Communication & Design at Rice University
9:40 - 10:40	Visual Approaches to Exploring and Explaining Data Bang Wong Creative Director of the Broad Institute of MIT and Harvard
10:40 - 11:00	Coffee Break MCA Creative Open Studio
11:00 - 12:00	The Value of Visual Design in Scientific Communication Karen Cheng Professor of Visual Communication Design at the University of Washington
12:00 - 12:05	Overview of Afternoon Sessions
12:05 pm	Lunch by Local Foods MCA Creative Open Studio
1:30 pm	SESSION 2 – ILLUSTRATION FOR FIGURES & COVERS MCA Lois Chiles Studio Theater
1:30 - 2:30	Telling Your Story through Illustration Mary O'Reilly Owner of O'Reilly Science Art

Program Friday, March 1st

1:30 pm SESSION 2 – HANDS-ON DEMONSTRATIONS MCA & Duncan Hall



1:30-4:30

³⁰ Visualisation with ggplot2

Hadley Wickham

Chief Scientist at RStudio, a member of the R Foundation, and Adjunct Professor at Stanford University and the University of Auckland

MCA 2nd Floor Double Studio Classroom / Room 205

INSTRUCTIONS FOR ATTENDEES

In order to cover as much material as possible during this workshop, we ask that you please bring a laptop with RStudio and ggplot2 installed ahead of time. Instructions for downloading this package can be found at **ggplot2.tidyverse.org**



1:30-4:30 Linked Exploratory Data Visualization using Glue

Alyssa Goodman Robert Wheeler Willson Professor of Applied

Astronomy at Harvard University

Duncan Hall SYM II / Room 1020*

*Rice shuttle will depart from in front of the Moody at 1:15 pm

INSTRUCTIONS FOR ATTENDEES

In order to effectively cover as much material as possible during this workshop, we ask that you please bring a laptop with Glue installed ahead of time. Instructions for downloading glue can be found at **glueviz.org**

Program Saturday, March 2nd

9:00 am	Registration & Light Breakfast
	MCA Creative Open Studio

9:30 am SESSION 3 – KEYNOTE ADDRESS MCA Lois Chiles Studio Theater

> Introduction by Patrick M. Hartigan Professor of Physics and Astronomy at Rice University

9:30-10:30 Glue-ing Together the Universe

Alyssa Goodman

Robert Wheeler Willson Professor of Applied Astronomy at Harvard University, co-Director for Science at the Radcliffe Institute for Advanced Study

- 10:30-10:50 Coffee Break MCA Creative Open Studio
- 10:50 am SESSION 4 MAPPING & MODELING PANEL MCA Lois Chiles Studio Theater
- ^{10:50-11:35} Animated Science Graphics for a Digital Audience Brian T. Jacobs Senior graphics editor for *National Geographic*
- 11:35-12:10 Cities Full of Data: Developing Critical Perspectives on Spatial Research Laura Kurgan Associate Professor of Architecture and Director of the Center for Spatial Research at Columbia University
- 12:10-12:30 Q&A facilitated by Elizabeth A. Festa Associate Director of the Program in Writing & Communication at Rice University

Program Saturday, March 2nd

12:30 pm	Lunch by Local Foods MCA Creative Open Studio
2:00 pm	SESSION 5 – VISUALIZING RESEARCH AT RICE MCA Lois Chiles Studio Theater
	Introductions by C. Fred Higgs III Vice Provost for Academic Affairs, John and Ann Doerr Professor of Mechanical Engineering, Director of Rice Center for Engineering Leadership at Rice University
2:00-3:00	Temporal Cartography and the Visualization of Diverse Data Farès el-Dahdah Professor of the Humanities and Director of the Humanities Research Center at Rice University
3:00 - 3:20	Coffee Break MCA Creative Open Studio
3:20-4:20	Exploring Mars through the Eyes of Robots Kirsten L. Siebach Assistant Professor of Earth, Environmental, and Planetary Sciences at Rice University
4:20-4:30	VCS Closing Remarks Jennifer Shade Wilson Director of the Program in Writing & Communication at Rice University
4:30 pm	Reception

MCA Central Gallery & Lantern Terrace





Bang Wong

Visual Approaches to Exploring and Explaining Data 9:40 am, March 1st – MCA Lois Chiles Studio Theater



Researchers today have access to an unprecedented amount of data. The challenge is to benefit from this abundance without being overwhelmed. Data visualization for efficient exploration and effective communication is integral to scientific progress. Each goal entails different approaches to data representation, but sound graphic design principles are important in both. Despite the importance and widespread use of visualizations, we primarily rely on our intuition, common sense and precedent in published material when creating them – a largely unscientific process. This presentation will focus on data visualization techniques informed by human perception and cognitive psychology intended to support data exploration and explanations.



Karen Cheng

The Value of Visual Design in Scientific Communication 11:00 am, March 1st – MCA Lois Chiles Studio Theater



ORIGINAL Too cluttered—also, interior diagram too small to be legible.



REDESIGNED Reformatted using a series of close-up views.

From the moons of Saturn to the double helix of DNA, scientific discoveries from all ages are associated with memorable, iconic images. These images communicate in ways that text cannot, making difficult, complex concepts accessible. Discoveries today occur at an astonishing rate: scientific output doubles every nine years in approximately 24,000 scientific journals. Given this flood of information, first impressions count, and the overview figure is critical in shaping that first impression. At the University of Washington, our team sought to understand how visual design impacts the overview figure. Our team tested ten original and redesign figures with scientific readers. The results show that figures designed in accordance with classic visual principles significantly enhanced readers' first impressions of a paper. Improved figures made the associated papers seem more interesting, more clearly written, and more scientifically rigorous. These results confirm the value of visual design, and establish that aesthetic appeal enhances rather than detracts from the perception of intellectual and scientific competence.



Mary O'Reilly

Telling Your Story through Illustration 1:30 pm, March 1st – MCA Lois Chiles Studio Theater





In order for scientific progress to move forward in a world inundated with information, researchers need to be able to communicate with each other within and across fields, and to the public, effectively and efficiently. A well thought out graphic can capture the attention and ultimately the understanding of an audience before losing their initial curiosity. As an added benefit, the process of creating an illustration often forces one to think about their model deeply, leading to new insights and even new experiments. However, the task may seem daunting when the researcher feels that they are not creative or artistic.

In this talk, I will provide tips, techniques and resources for harnessing your own creativity, but will also discuss when it might be time to enlist a professional illustrator or designer, and what that looks like. I will also talk about creating journal covers, which is more about making an eye-catching piece of art than telling the whole story, but shares many similarities with the creative process of figure design. Left: *Microfluidics for electrophysiology, imaging, and behavioral analysis of Hydra*. Right: *A Processive Protein Chimera Introduces Mutations across Defined DNA Regions In Vivo*.

By Mary O'Reilly

Je the Ch

题

-

-



Hadley Wickham

Visualisation using ggplot2

1:30 pm, March 1st – MCA 2nd Floor Double Studio Classroom



In this hands on tutorial, I'll show you the basics of visualisation your data with ggplot2. You'll learn practical tools to create the most important statistical graphics like scatterplots and histograms. You'll also learn about the rich theory that underlies ggplot2: the grammar of graphics. This will help you to continue to build on what you learn in this class, and over time create graphics specifically tailored for the problem at hand. ggplot2 is part of the tidyverse, a collection of R packages designed to make data science as easy as possible. I'll also touch on some of the other most important tidyverse packages: readr for reading your data from disk, tidyr for reshaping data into a form amenable to analysis, and dplyr for summarising and manipulating your data.



Alyssa Goodman

Linked Exploratory Data Visualization using Glue 1:30 pm, March 1st – Duncan Hall SYM II / Room 1020



Glue is a Python library to explore relationships within and between related datasets. With Glue, users can create scatter plots, histograms and images (2D and 3D) of their data. Glue is focused on the brushing and linking paradigm, where selections in any graph propagate to all others. Glue uses the logical links that exist between different data sets to overlay visualizations of different data, and to propagate selections across data sets. These links are specified by the user, and are arbitrarily flexible glue is written in Python, and built on top of its standard scientific libraries (i.e., Numpy, Matplotlib, Scipy). Users can easily integrate their own python code for data input, cleaning, and analysis. Glue is a multi-disciplinary tool, designed from the ground up to be applicable to a wide variety of data. Today, Glue is being used extensively in astronomy data and in the analysis of medical images.



Alyssa Goodman

Glue-ing Together the Universe 9:30 am, March 2nd – MCA Lois Chiles Studio Theater



Astronomy has long been a field reliant on visualization. First, it was literal visualization—looking at the Sky. Today, though, astronomers are faced with the daunting task of understanding gigantic digital images from across the electromagnetic spectrum and contextualizing them with hugely complex physics simulations, in order to make more sense of our Universe. In this talk, I will explain how new approaches to simultaneously exploring and explaining vast data sets allow astronomers-and other scientists-to make sense of what the data have to say, and to communicate what they learn, to each other and

to the public. I will focus on the multi-dimensional linked-view data visualization environment known as "Glue" (glueviz. org), explaining how it is being used in astronomy, medical imaging, and geographic information sciences. I will discuss its future potential to expand into all fields where diverse but related multi-dimensional data sets can be profitably analyzed together. Toward the aim of bringing the fruits of visualization to a broader audience, I will also introduce the new "10 Questions to Ask When Creating a Visualization" website, 10QViz.org.



Brian T. Jacobs

Animated Science Graphics for a Digital Audience 10:50 am, March 2nd – MCA Lois Chiles Studio Theater



As a digital graphics editor, I create animated maps and graphics to tell visual stories about a wide range of scientific topics, for a general audience. I'll go behind the scenes of the design and development of some of these projects to detail process, and describe the techniques used to make experiences approachable and legible across the varying capabilities of the devices people use online. I'll break down the use of animation, where it can be successful, and where lessons from print inform where animation might not be helpful to understand concepts. Some of these projects were created with 3D graphics, rendered in browsers, in real-time. I'll talk about the role of 3D in visualizing and modeling scientific data, about the successes, challenges, and the approaches others have taken to visualize similar topics in alternate ways.

By Brian T. Jacobs





Laura Kurgan

Cities Full of Data: Developing Critical Perspectives on Spatial Research 11:35 am, March 2nd – MCA Lois Chiles Studio Theater

Commonwealth of Puerto Rico Population 3,411,307



Before the storm

Commonwealth of Puerto Rico Population 3,411,307



120 days after the storm 439,000 households (29.82%) without power

As a hub for interdisciplinary collaboration in spatial research, the Center links the work of the humanities with the fields of digital mapping, spatial data analysis, data visualization and design. Engaging in projects with civic and social orientations, as well as deploying an aesthetic project that treats big and small data as an urban resource, we map and visualize the complex and often invisible forces transforming cities today. Acknowledging the evolving features of this unruly terrain, our definition of spatial research treats cities and data as inextricably bound together. In order to understand cities historically and today, we cannot avoid engaging with data: it needs to be understood, harnessed, confronted, critically examined. Spatial research means getting deep into the data to find out what can be done and undone with it. We insist that

the conditions of its production must be identified and defined, the ways it is collected or generated and distributed understood, and the feedback loop between what is generated as data and controlled by data scrutinized. What are the varying effects that data-based approaches to the city have had on cities themselves? And how can we deploy data-based approaches, and critiques of those approaches, to imagine alternative futures for cities? Images by Diller Scofidio + Renfro, Laura Kurgan, and Robert Gerard Pietrusko with the Center for Spatial Research. The installation is conceived and designed for Dimensions of Citizenship, the US Pavilion at the 16th International Architecture Exhibition of La Biennale di Venezia. commissioned by the School of the Art Institute of Chicago and The University of Chicago.



Farès el-Dahdah

Temporal Cartography & the Visualization of Diverse Data 2:00 pm, March 2nd – MCA Lois Chiles Studio Theater



This presentation will feature searchable digital atlases that illustrate the urban and architectural evolution of cities, as they existed and as they were previously imagined. Street views, aerial images, historical maps, and ground floor plans are located in both time and space while their visual and spatial data are integrated across a number of databases and servers, including a public repository of images, a geographic information system, an open-source relational database, and a content delivery web system. The relationship between the various project elements produces a web environment where vector, spatial, and raster data are simultaneously probed, toggled, viewed, and/or queried in a system that supports multiple expressions of diverse data sources.



Kirsten L. Siebach

Exploring Mars through the Eyes of Robots 3:20 pm, March 2nd – MCA Lois Chiles Studio Theater

Our collective imagination has long been captivated by the surfaces of extraterrestrial worlds. Mars, as one of our closest planetary neighbors, has been the subject of speculation for millennia. As few as 55 years ago, when Mariner 4 successfully flew by Mars and sent back the first pictures of that planet taken from space even NASA was surprised by the presence of impact craters littering the surface. Today, Mars remains at least 34 million miles away, and human travel there is still futuristic, but it feels much closer because of the pictures robotic explorers send back of Martian landscapes that appear eerily familiar. As scientists, these photos of the deserted Martian landscape provide our best opportunity to compare and contrast the geologic processes that happen on Earth with any other world both those happening today and those in the ancient past. As new



technologies allow us to virtually "walk on Mars" through the eyes of rovers, we gain new opportunities to learn what it is that makes our own planet so unique. I will describe how we use new visualization technologies to drive rovers to explore the surface of Mars and learn about its active geologic past.

Introducing your personal VCS vis

What is it?

This personalized badge captures you, as a symposium attendee in a visual. Answer the following questions about your skills and interests to generate your own custom design. Yeah, it's admittedly a little odd and pretty complex to interpret at a glance, but we just want to encourage you to think about creative ways to visualize ideas.

Step 1 – education

How many degrees do you have? Fill in a line to represent each one (you can even use a partial line for degrees in progress).



Step 3 – art & design

Do you frequently complete art / design projects? If so, do you usually complete projects for your own use? in direct collaboration with someone else? for others?



Step 4 – teaching

Do you currently teach? If so, do you teach your own class? co-teach? and/or mostly support the classes of others?



Step 2 – data & research

Do you work with data? If so, do you analyze your own data? work with data in collaboration with someone else? and/ or analyze the data of others?





Step 5 – languages

How many languages do you read, write, or speak? Divide this tile into that number of segments in whatever way you like. For example –

Step 7 – modalities

Color the tile that represents the mode of communication (written, visual, oral) you enjoy most. If you focus on more then one equally, color them all.



Step 6 – data visualization

Color this tile with a pattern that reminds you of your favorite or most frequently used type of data visualization.





Step 8 – colors Finish your design by filling in these 3 tiles with a few colors that you like.



VCS vis (practice version)







Example by Sriparna Saha

As a doctoral candidate in the Department of Earth, Environmental and Planetary Sciences at Rice, I work with both my own data and have been involved in collaborations. My science outreach endeavors have provided me opportunities to develop my science communication skills. I have taught classes and guest lectures on geology at local middle schools and various STEM events. I love learning languages, resonate the most with contour plots, and like shades of red and peach.

Example by Anneli Joplin

As the Instructor of Visual Communication & Design for the Center for Academic & Professional Communication at Rice, I teach workshops and guest lectures. I enjoy visual communication most (unsurprisingly, perhaps) and also like dot plots and the color green.



Created by



Show us what you've made on Twitter **@VCSRice / #VCS2019**

or email your design to us at vcs@rice.edu

What is your favorite color?



These colorized images are selections from *Photographs of British algae: cyanotype impressions* by **Anna Atkins** (1799-1871). According to the New York Public Library description, this work "is a landmark in the histories both of photography and of publishing: the first photographic work by a woman, and the first book produced entirely by photographic means. Instantly recognizable today as the blueprint process, the cyanotypes lend themselves beautifully to illustrate objects found in the sea."

This year combine your favorites + Living Coral



This screen print was produced as part of the class *Art and Environment: Making alongside Coral Reefs* taught by **Dr. Lina Dib, Dr. Adrienne Correa, Tony Day** and **Maureen Haver**. Research in the Correa Lab focuses on the microbial ecology and conservation of coral reef ecosystems. In addition to research, Correa Lab members conduct science outreach; environmental art is one avenue that they have used to connect with the community.

Living Coral Pantone Color of the Year 2019

C 0	R 244
M 65	G 122
Y 63	B 95
Κ Ο	

Living Coral is enthusiastic and vibrant – a perfect hue to try as an accent color in your next project. To help you get started, we've come up with a few potential color schemes that combine Living Coral with other selections from the Rice extended color palette.

Under the Sea													
C 100	R 3	C 100	RO	C 90	R 0								
M 80	G 78	Μ 0	G 170	M 40	G 90								
Υ 0	B 162	Y 38	B 176	Y 65	B 80								
Κ Ο		ΚΟ		K 35									
Late St	unset												
C 50	D 101	C 45	D 104	C OF	D <i>C</i> 4								
C 52	K 131	C 45	R 104	C 85	K 54								
M 49	G 130	M 100	G 19	M 85	M 85 G 47								
Υ Ο	B 190	Y 70	B 47	Y 40	B 82								
ΚΟ		K 40		K 35									
. .													
Day at	the Be	acn											
C 0	R 249	C 0	R 255	C 68	R 77	C 34	R 160						
M 42	G 163	M 20	G 205	M 28	G 154	Μ 0	G 221						
Y 66	B 100	Y 70	B 103	Υ Ο	B 212	Υ 0	B 249						
ΚΟ		ΚΟ		ΚΟ		ΚΟ							

Tidal Pool

C 100	R 14	C 30	R 179	C 58	R 117
M 95	G 17	M 60	G 122	Μ 0	G 197
Y 35	B 62	Y 2	B 176	Y 55	B 148
K 55		ΚΟ		ΚΟ	

Rice Classic

C 100	R 26	C 15	R 146	C 17	R 209	C 34	R 160
M 95	G 32	M 15	G 143	M 17	G 203	M 0	G 221
Y 5	B 102	Y 15	B 143	Y 14	B 205	Υ Ο	B 249
K 36		K 38		ΚΟ		ΚΟ	

Wildflower Bouquet

C 90	R 0	C 58	R 117	C 5	R 208	C 52	R 131
M 8	G 164	Μ 0	G 197	M 80	G 81	M 49	G 130
Y 51	B 149	Y 55	B 148	Y 50	B 94	Υ 0	B 190
ΚΟ		ΚΟ		K 10		ΚΟ	



Have you ever considered coloring your research?

In her coloring book, *Life Under the Lens*, Jennifer Delaney creates imaginative and informative visualizations of objects on the microscale. In an interview with *The Irish Times* she explains, "The book is like an exploration of the microscopic world through coloring, looking at all different forms, bacteria and archaea and plants and animals. It's to get people to appreciate microscopic life in general, maybe they have never seen it before." *Life Under the Lens* can be purchased on Amazon.



Daphnia pulex by Jennifer Delaney







VCS notes

Lines on the front for the \blacksquare 's & other markings on the back for all the $\blacksquare \land \neg \circ$'s out there



+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

1



															é			ļ	Ę				K			
																							ų			
		Ì		į.				÷	÷	Ì			÷	÷	÷			Ì	Ì	÷		÷.	÷.			ĺ
•				•	•														•			•	•			
•	•	•	•	•	•	•	•	•	•	•	•	•				•		•	•		•	•	•	•		
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	÷	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
		÷	÷		÷	÷	÷	÷	÷		÷	÷	÷	÷	÷	÷	÷	÷		÷	÷			÷		
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•		•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•		•	•	•	•	•	•	•	•		•			•		•	•	•	•		•
							÷																			
•	•		•	•	•							•				•			•			•	•	•		
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
34	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•







+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++38 +++

1



															é			ļ	Ę				K			
																									•	
			•																					•		
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	·	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•		•	•		•		•	•	•	•	•					•	•	•			•		•	•	
		÷			÷	÷	÷	÷	÷	÷	÷	÷	÷	÷	÷	÷	÷		÷	÷	÷	÷	÷	÷	÷	Ċ
•	•																									
•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	÷	•	•	•	•	•	•	•	÷	•			•	•	•	•	•	•	•	•	•	•
		÷			÷		÷	÷	÷	÷	÷	÷	÷	÷	÷	÷	÷	÷	÷	÷	÷	÷	÷	÷	÷	Ċ
•	•		•	•					•									•								
•	•	•	•	•		•		•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•					÷			÷								÷				÷		÷				
																								•		
•																										
•	•	•	•	•		•	•		•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
40																										







+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++44 +++

1



															é				Ķ				K			
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
				•		•	•	•	•		•	•					•	•			•			•	•	
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
																			÷		•					
									•		•	•			•		•			•	•		•	•	•	
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•
												•						•						•	•	
		•							•		•						•	•						•	•	
2	16																									





Maps

Rice University



Main symposium location – Moody Center for the Arts (close to entrance 8)

Linked Exploratory Data Visualization using Glue – **Duncan Hall SYM II** / Room 1020 Shuttle leaves from the Moody at 1:15 pm on March 1

Attendees can park in any of the indicated **Visitor Lots** Greenbriar Lot: \$3 per entry, per day. All Other Visitor Parking Facilities: \$1 each 10 minutes, \$12 daily maximum.

Moody Center for the Arts

1ST FLOOR



2ND FLOOR



Presentations – **Lois Chiles Studio Theater** Breaks & lunches – **Creative Open Studio** Reception – **Central Gallery & Lantern Terrace** Visualization using ggplot2 – **2nd Floor Double Studio Classroom** / Room 205

