

# Diversity in Visualization

## IEEE VIS 2017 Panel

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### INTRODUCTION

The IEEE VIS 2016 conference in Baltimore, Maryland hosted an interesting and inspiring panel called “On the Death of Scientific Visualization” [1] that discussed the beautiful CiteVis which shows what appears to be an interesting trend, namely, the contraction of the SciVis track of the IEEE VIS (Visual Analytics, Information Visualization, and Scientific Visualization) conference. See Figure 1. During the panel discussion period, immediately at the start, Annie Preston of the University of California Davis stated, “I didn’t hear anyone mention diversity. I think this is a way in which visualization and computer science are not keeping up with other scientific fields. I think in other fields they are talking more about these issues. And I think if we would like to attract people doing inter-disciplinary research that come from a scientific domain we need to keep up in this respect. So what do you think?” [1]

The rest of the panel discussion period centered around the theme of diversity in visualization. It became very clear during the discussion period that the audience is very interested in this topic and would like to discuss it further. A number of audience members and participants mentioned the lack of diversity in visualization, including Annie Preston, Robert Kosara of Tableau, Erica Yang, Kelly Gaither, and Bernice Rogowitz of Visual Perspectives.

This panel discusses what appears to be a weakness of the visualization community, namely, the lack of diversity [2]. This panel addresses some very difficult, core, fundamental questions such as (but not limited to):

- What is diversity? Does it refer to cultural, ethical, age, gender, subject matter, or technology?
- Is diversity healthy? Does diversity bring benefits?
- What could be the cause of this apparent lack of diversity in the VIS community?
- Should we, the VIS Community be concerned about this?
- Do any changes need to be made?
- Are there any lessons we can learn from this?

The panel organizer already had several informal discussions on this topic with some well-known leaders in the field. It is clear

from these discussions that this is an exciting and interesting topic for further discussion.



Figure 1. A snapshot from the IEEE VIS 2016 panel “On the Death of Scientific Visualization” [1]. Available for viewing at: <https://youtu.be/-6TmLPPRjqq>

### WHY THIS PANEL AT IEEE VIS 2017?

This is a logical and natural follow-up to last year’s panel on the death of scientific visualization. It also appears in the list of panel topics that the audience would like to see this year [3]. This is an important and timely theme for the visualization research community that addresses interesting, difficult and challenging questions. To the best of our knowledge, no such panel has ever been presented. This central topic touches on the experience and interest of every researcher in visualization. It is not only of interest to the VIS community if the lessons learned can be transferred to the other tracks in the future. It should be especially interesting for both experienced researchers and newcomers to the field. There is a wide variety of opinion on this topic within the visualization research community. We think a panel addressing the topic of diversity in visualization research will form the basis of lively discussions for the panel and more from the audience.

### PANEL FORMAT AND LOGISTICS

The panelists will present their positions addressing each question posed in the introduction.

- The introductory remarks will be made by Bob Laramée. His introduction will last for 5 minutes.
- He will chair the panel and he himself is not a panelist.
- Each panelist will be given 10 minutes, for a total of 60 minutes of presentations.

- This will provide approximately 35-55 minutes of audience participation in the discussion.
- All panelists will have the opportunity to offer a summary view at the end of the panel (2 minutes each).

The panel chair will solicit audience feedback after the position statements have been delivered. The panel format will also be described in the panel opening.

## POSITION STATEMENTS

### Rita Borgo

Diversity is a hot topic and perhaps one which is usually addressed with quick short-term answers underlining a mediocre way of thinking about problems and perhaps a lack of real intention towards a true commitment.

As a female in science I have found myself more than once subtly coerced into some sort of activity to support *Women in Science*, activities which were, and still are, straying me away from what I love to do, which is exactly Science, instead of helping it.

Take that if I was a Venn diagram, for features that nature gave me beside my reproductive apparatus, I would be one intersecting several sensitive categories which classify me as a sought after *minority* to tick the Diversity check box. I can freely admit that sometimes it has had its perks but more often it has not. It is from this early realization that I have started pondering what really are Diversity and Inclusion and mostly why should I care about them when, from personal experience, they seem to hinder instead of supporting my development as a scientist. I have always considered Science as a meritocratic realm, good ideas should go forward bad ideas no, and I still believe that the principle hold, the problem is criteria that define something as good or bad.

In a recent Artificial Intelligence panel I attended the AI community raised similar issues by underlying how lack of diverse inputs would inevitably entail the procrastination of a homologous way of thinking conforming to social dominant traits rather than the whole. Visualization however is a unique field, by its very definition it requires the *other* to thrive. We naturally connect to a wider diversity of fields and way of thinking with interdisciplinarity at the core of Visualization and almost a requirement to impact on reality. More ideas make a better science and I argue that the majority of us are well aware of that.

Where we do often seem to fail however is in accepting to be challenged by ideas very different from our own and to stray away too much from what we know. Opening to the unknown has its risks but also its rewards, the wider we cast our net, the better the research community will be served.

I do argue however that Diversity for the sake of it is actually a menace, as a colleague from Forbes quite acutely pointed out we might all end up creating something resembling a Pokemon game "*I choose you Little Foreigner Italian Woman!*" instead of capitalizing on the person talents, potentials and most of all interests. The last point I regard of special importance, dreams and aspirations are key: we should inspire not force in the name of Diversity. I argue that as Visualization scientists we should work towards ways to build wider and multi-faceted connections, and provide opportunities for people with a diverse range of backgrounds to flourish, if they wish to do so.

Luckily for us reality is obstinate and things will change despite how limited or narrow our way of approaching it might be, there is a generational change approaching which will shape the community anew, let's make sure this incoming generation is as talented and diverse as we can afford.

### Vetria Byrd

Visualization plays a significant role in the exploration and understanding of data across all disciplines in all levels of scholarship. The process of data visualization encompasses many, if not all, of the skills needed in the 21st century workforce: critical thinking, problem solving, the ability to work both collaboratively as well as independently, and the ability produce innovative and creative solutions to complex data problems. It can be a catalyst for communication, a conduit for collaboration, a pathway to STEM and a mechanism for broadening participation. The need to diversify a field with such far reaching influences is imperative. The ubiquitous nature, volume, variety and velocity of data is driving the demand for persons with data visualization skills.

Exposure to data visualization must occur early and often but how do we embrace diversity in the field and encourage participation and contributions from all persons with an interest in visualization? A review of past IEEE VIS conference websites speaks to the historical lack of diversity in terms of gender, ethnicity of speakers and leadership roles at the conference. If diversity is truly desired, active steps must be taken to engage with demographics traditionally underrepresented, not only but in addition to gender, in the visualization community.

In 2014 the 1<sup>st</sup> Biennial Broadening Participation in Visualization (BPViz) Workshop, sponsored by CRA-W/CDC and NSF, was hosted at Clemson University in Clemson, South Carolina. The workshop was the first of its kind designed to broaden participation of women and members of underrepresented groups and underrepresented disciplines in visualization. Participants consisted of undergraduate and graduate students, faculty, post-docs, research scientists, lecturers, administrators, even K-12 participants interested in data visualization. The workshop was diverse in participants, topics and scheduled events. Speakers for the workshop were representative of the demographic the workshop was intended to reach: diverse in gender, ethnicity, in careers (academia, industry and research) and professional preparation. According to participant feedback, the representation of all demographics at the workshop was significant and crucial to its success. The workshop, small in size compared to IEEE VIS, embraced the differences that each person brings to solving complex problems with data visualization. The key: participants were able to see themselves in the speakers and panelists. The question: "How do we bring this level of diversity to VIS?"

### Aviva Frank

Inequality is built into the structures of our society, be they social, political, academic or legal. These structural inequalities and our personal actions are inextricably linked. Axes of oppression, such as sexism, racism and ableism, function cooperatively, and often invisibly, in our institutions and general consciousness. They uphold one another, to maintain and normalize inequality. The first steps toward a more equitable society is acknowledging and understanding these power structures and the way they permeate our daily lives. The next step is action. We are not divorced from larger power structures; as members of this society we have been socialized to accept and participate in systemic inequality, and as members of society, it is our job to work against that. One way to do so is to make environments more welcoming and available to more people- that is the essence of diversity. I will examine some academic and activist perspectives on diversity in order to illuminate larger systems of inequality and how they function in society and our lives.

## Kelly Gaither

Computational thinking is a 21<sup>st</sup> century skill growing in need and critically important to next generation science and engineering. This is in sharp contrast to a diminishing pool of talent that is both ill prepared for the workforce and is not representative of the population in aggregate. The United States is evolving into a majority minority country and the disparity in producing a diverse workforce is growing ever larger. As our population demographics evolve, the face of science and our grand challenges evolve as well. Dictated by the need to solve larger and more complex problems, there is an increasing need for students and researchers capable of working productively in a multidisciplinary, collaborative environment. It is difficult to imagine working on problems of this magnitude in multidisciplinary teams with multicultural impact without thinking about how to communicate effectively. As visualization researchers, developers, practitioners and educators, we sit at the intersection of data, science, engineering and insight. We are well versed in visual communication, and operate fluidly as bridge builders between disciplines and technology. Our careers have been forged with the knowledge that communication is key, collaboration is vital, interdisciplinary is the future, and problems are getting larger and more complicated. Working in this intersection space provides us with a unique perspective, one that can and should be brought to bear as we broaden and diversify our community moving forward.

We know that diverse teams directly translate to innovative teams and that innovation is key to economic competitiveness. We know that visualizations plays a critical role in understanding and communicating complex phenomena, particularly amongst a diverse group of stakeholders. We know that our inherent ability as interdisciplinary thinkers and bridge builders puts us in a unique intersection space where diversity in thought and approach is celebrated and encouraged. We, as a community, have a responsibility to bring a fresh perspective to fostering diversity and inclusion, but we are at a crossroads. We must make diversity and inclusion part of our fundamental fabric by making it a priority.

Fundamental to what we do as a community is creativity, without which we would not be successful. It seems hard to imagine that we as visualization practitioners and creators have not yet realized that our inherent and acquired diversity has placed us in a unique position to address a looming global workforce crisis. Because we work at the intersection, not in spite of, we bring a much needed perspective to building and maintaining a community that is more in line with our respective national populations. Now is the time to understand what we can and should do, and commit to make diversity and inclusion a priority in our community moving forward.

## Ronald Metoyer

The area of visualization is more important now than at any other time in the history of computing. As data generation and complexity increases at astounding rates our ability to use that data effectively becomes critical and visualization is one popular tool for addressing this issue. A unique aspect of visualization is that it requires the study of not just computing, but of the combination of computing and people and because people are involved, aspects such as culture, socio-economic background, gender, etc., are intimately tied to the solutions we design. For this reason, the visualization community should carefully consider the development of a diverse body of researchers who bring to

bear a wide range of experiences in their problem solving skills. How do we affect *inclusive excellence* in the visualization field?

Research shows that mentoring is a key element in the recruitment and retention of underrepresented groups in STEM fields. If the visualization community is to truly embrace diversity and build an inclusive community, the path must be through the targeted recruitment and retention of underrepresented populations in the community. This form of active inclusion requires that the community seek to invite, include, mentor, and promote underrepresented members in order to more efficiently integrate them into the fabric of the academic community.

In 2010 and 2012, I was a co-organizer of the CHIME workshops offered in conjunction with the SIGCHI conference. These workshops provided a highly technical and supportive environment for underrepresented doctoral students and they were a tremendous success with many of those students currently holding tenure-track positions in HCI. By harnessing the cumulative experience of successful professionals in the HCI field, the CHIME workshops provided a unique forum that not only highlighted the technical achievements of diverse professionals, but that also facilitated mentoring, networking, and honest feedback for underrepresented graduate students. I will discuss how a similar effort can lead to short- and long-term inclusiveness in the visualization community.

## Erica Yang

I would like to look at diversity from a technology perspective and explore how it might have influenced visualization research efforts for different visualization communities, namely SciVis, InfoVis, and VAST. Here, technology diversity refers to the variety, availability, and accessibility of visualization tools, algorithms, methods, data to researchers and software system developers.

In the literature, there is little evidence about the link between technology diversity and the proliferation (or demise) of a research field. This position statement argues that technology diversity is critical to the growth and health of visualization community, deciding the future success of the discipline and underpinning the sustainability of existing research outcomes. Whilst the targeted audience of SciVis, InfoVis, and VAST might be different, it is important to bear in mind that the distinction between these conferences are not always clear-cut to practitioners, i.e. the problem owners who look for solutions for real world problems, be it from science or industry. Many large science facilities are facing hugely challenging big data visualization problems, e.g. in-situ visualization for extreme scale simulation which has become a topical research area. However, there is more to it. I believe there is clearly a gap between developing and adopting advanced infoVis and VAST techniques to complement SciVis. As a community, we can and should encourage leveraging of technology diversity from InfoVis and VAST to help energize the SciVis field. The latter has a higher barrier to entry than InfoVis and VAST, when it comes to the diversity, accessibility and availability of tools, methods, and data infrastructure. As an example, in SciVis, VTK, ITK, VISIT remain the dominant open source tools of choice for the community after many years of development; whilst, for InfoVis and VAST, the rise and proliferation of JavaScript libraries, R, and python based toolkits have led to a revolution of data science and visualization research. The development of the latter is not only astonishing, but also significantly raise the importance of visualization in solving practical problems. This has opened up R&D opportunities in visualization for many research groups who

do not have significant resources or existing track records in InfoVis and VAST, effectively leveling the playfield between established researchers and new comers.

Therefore, if we were able to bridge the gap between SciVis, InfoVis, and VAST, we will be opening up a new spectrum of opportunities to new comers with fruitful research challenges that will be not only fulfilling for the researchers themselves, but also much welcomed by the Community.

## **BIOGRAPHIES**

### **Rita Borgo**

Dr Rita Borgo is a Senior Lecturer at the Informatics Department, King's College London, UK, she is Deputy Director of the Centre For Urban Science and Progress (CUSP) London, an interdisciplinary research center bringing together researchers, businesses, local authorities and government agencies to apply urban science to improving public health and wellbeing. Her main research focus is in Information and Scientific Visualization, Visual Analytics and Human Factors in Visualization. Her work has kept interdisciplinarity at its core with collaborations ranging from Arts and Humanities, Physical and Mathematical Sciences and Social sciences. She has led and collaborated to high profile computational projects with UK's national research councils and worked extensively with research partners across Europe and Overseas. She is an active member of the Women in Computer Science and Women in HPC networks.

### **Vetria Byrd**

Vetria Byrd is an Assistant Professor at Purdue University (Main Campus). She is the Director of the Data Visualization Laboratory in the Department of Computer Graphics Technology in the Polytechnic Institute. She is the founding investigator for the NSF Funded VisREU Site: Research Experience for Undergraduates in Collaborative Data Visualization Applications. She is the founder and organizer of BPViz: Broadening Participation in Visualization Workshop which focuses on broadening participation and inclusion of women and members of underrepresented groups as well as underrepresented majors in data visualization. She is developing curriculum for a new undergraduate major in data visualization in the Department of Computer Graphics Technology at Purdue where she is the faculty representative for the Women in HPC Group at Purdue. She has given numerous invited talks and hands-on data visualization workshops. Her plenary talk at XSEDE14 was featured on HPCWire.com. She is a 3-time invited lecturer for the International High Performance Computing Summer School (IHPCSS, 2015-2017). She was a speaker for two visualization webinars in the 2017 Blue Waters Visualization Webinar Series, and a speaker for openNASA Datanauts webinar events. Byrd holds a PhD in Computer Science, and master's degrees in Biomedical Engineering and Computer Science from The University of Alabama at Birmingham. Prior to joining Purdue University, Byrd was a Research Associate in the Department of Computing and Information Technology at Clemson University where she served as Director of Advanced Visualization for Cyber Infrastructure Technology Integration. She currently serves on the Midwest Big Data Hub Steering Committee, and on the SC Committee as Scientific Visualization Showcase co-chair

### **Aviva Frank**

Aviva Frank is an honors student at SUNY Purchase, where she is double majoring in Sociology and Gender Studies and minoring in Political Science. She is particularly interested in academic and community-based approaches to understanding inequalities and social power structures. For the past year she has been working as a research assistant for an upcoming political science book on women and HIV/AIDS and is active in organizations devoted to civil and social rights. And, as a Millennial, she can offer unique insights into the zeitgeist of the next generation to enter the workforce.

### **Kelly Gaither**

Kelly Gaither is the Director of Visualization and a Senior Research Scientist at the Texas Advanced Computing Center. She recently joined the faculty at the University of Texas at Austin Medical School as an Associate Professor of Visualization and Analytics in the Department of Women's Health. She also serves as a co-PI and the area Director for Community Engagement & Enrichment in the National Science Foundation funded XSEDE project. Gaither received her doctoral degree in Computational Engineering from Mississippi State University in May 2000, and received her masters and bachelors degree in Computer Science from Texas A&M University in 1992 and 1988 respectively. While obtaining her Ph.D., she worked full time at the Simulation and Design Center in the National Science Foundation Engineering Research Center as the leader of the visualization group. Gaither has a number of refereed publications in fields ranging from Computational Mechanics to Supercomputing Applications to Visualization. Over the past eleven years, she has actively participated in the IEEE Visualization conference, and served as the IEEE Visualization conference general chair in 2004. She has also served on the SC committee as Scientific Visualization Showcase chair and on the Diversity and Inclusion Committee.

### **Ronald Metoyer**

Ronald Metoyer is an Associate Professor of Computer Science and Engineering at the University of Notre Dame. He received his bachelors of science degree from the University of California at Los Angeles and doctoral degree from the Georgia Institute of Technology where he worked in the Graphics, Visualization and Usability Center. In 2001, he joined the faculty at Oregon State University and in 2002 he received an NSF CAREER Award. After 14 years at Oregon State University, Dr. Metoyer joined the University of Notre Dame as an Associate Professor and Assistant Dean of Diversity and Special Initiatives in the College of Engineering. His research is focused on human-computer interaction and information visualization. Recent work has explored the design of visual representations of diversity and visual approaches for debugging and explaining Markov Decision Processes. Dr. Metoyer has also worked extensively to broaden the participation of underrepresented groups in the computing field. He has served as program chair for the Richard Tapia Celebration of Diversity in Computing, mentored numerous underrepresented computing students, participated in the Coalition to Diversify Computing (CDC) and is currently collaborating with the Center for Minorities and Students with Disabilities in IT (CMD-IT).

### **Erica Yang**

Dr Erica Yang is Head of Visual Analytics and Imaging System at the Scientific Computing Department, Science and Technology Facilities Council (STFC, one of the seven research councils) in the UK, and also an independent expert appointed by the

European Commission for the H2020 R&D program. She is responsible for delivering the £8M Data and Analytics Facility for National Infrastructure (DAFNI) at Harwell Campus in the UK. Her background is in distributed system engineering, data science, and visualization. She was prompted to the current position in 2016 to bring together two major strands of work: high throughput complex data analysis and visualization. She has delivered high profile computational projects with UK's national science facilities and worked extensively with large laboratories in Europe and the US, in addressing data and compute intensive problems in big science experiments. She also has extensive collaboration links with civil engineering, automotive, and transportation industries.

## REFERENCES

- [1] Mike Kirby, David Laidlaw, Robert S Laramée (Organizer), Klaus Mueller, Han-Wei Shen, and Anders Ynnerman, **On the Death of Scientific Visualization**, *Panel at IEEE VIS 2016*, Baltimore, Maryland, 23-28 October 2016. Archived at: <https://youtu.be/-6TmLPPRjqc> [last access 2017]
- [2] Kelly Gaither, **How Visualization Can Foster Diversity and Inclusion in Next-Generation Science**, IEEE Computer Graphics and Visualization (IEEE CG&A), *forthcoming*
- [3] Alex Endert, Ivan Viola, Michael Sedlmair, **IEEE VIS Panels--Survey Results 2017**  
[https://docs.google.com/spreadsheets/d/1oIrxT9DWO7gRvFeOcwOvXmP\\_0l3cqWqEvzmti5doj7Y/edit#gid=0](https://docs.google.com/spreadsheets/d/1oIrxT9DWO7gRvFeOcwOvXmP_0l3cqWqEvzmti5doj7Y/edit#gid=0) [last access 2017]