

Setting the Agenda for Giant Screen Research Workshop

October 18, 2013
Hyatt Regency Albuquerque
Albuquerque, New Mexico



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October 18, 2013

Welcome to the *Setting the Agenda for Giant Screen Research* Workshop. You represent a range of stakeholders from the giant screen industry, the immersive community and academic research. Thank you for agreeing to participate in what is just the first step in developing the research to address key issues in giant screen film.

This Workshop grew out of many years of discussions about the potential of the giant screen format to educate, engage and entertain, and responds to the multiple calls for research on giant screen films (Fraser *et. al.*, 2012; Heimlich, Sickler & Yocco, 2010; Lantz, 2011; Schnall, Hedge & Weaver, 2012) (see below). However, for all their beauty and engagement, there has been little to no formal research that has examined what makes these films unique. The goal of this workshop is to redress this lack of research by generating the community infrastructure needed to develop and implement long-term research efforts.

This Workshop follows on the heels of the Center for the Advancement of Informal Science Education (CAISE) efforts and others in promoting a research-to-practice link to promote innovation and advancement in practice. We are indebted to their efforts in modeling how to successfully include a wide range of stakeholders in this process, and hope that we emulate their inclusiveness with this convening of a diverse group of experts with different goals related to giant screen.

The purpose of this workshop is to create a working document that details key questions and proposals for research. After the Workshop this document will be distributed to the wider community for reflection and comment, with the ultimate goal of creating a network of like-minded colleagues to support and participate in giant screen research. Given the diversity represented in this Workshop, we ask that you keep coming back to the root of our concern: the giant screen experience. We believe that the range of knowledge and expertise you bring to the table will only enhance the outcomes of the Workshop.



Bigger. Bolder. Better.

This marks the third time that the NSF has supported the giant screen industry's efforts to promote lifelong learning; without NSF, giant screen films would not have been able to enlighten, engage and entertain millions of people around the world.

Tammy Seldon
Executive Director
GSCA

Mary L. Nucci, Ph.D.
Principal Investigator

Fraser, J., Heimlich, J.E., Jacobsen, J., Yocco, V., Sickler, J., Kisiel, J., Nucci, M., Jones, L., F. Stahl, J. (2012): Giant screen film and science learning in museums. *Museum Management and Curatorship*, 27, 179-195.

Heimlich, J.E., Sickler, J. & Yocco, V. (2010). Influence of immersion on visitor learning; Maya Skies research report. Accessible at <http://www.mayaskies.org/>

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Schnall, S., Hedge, C. & Weaver, R. (2012) The Immersive Virtual Environment of the digital fulldome: Considerations of relevant psychological processes. *Int. J. Human-Computer Studies*. 70,561-575

Acknowledgements

In its conception, preparation, implementation and follow up, this Workshop has depended upon the contributions of numerous colleagues. In particular, thanks go to Jamie Bell, Barbara Flagg, Kerry Handron, John Jacobsen, Valerie Knight-Williams, and Toby Mensforth, all of whom were incredibly generous with their time and expertise over many months.

Thanks also to the GSCA's Lifelong Learning Committee for embracing the need for this workshop, the GSCA Board of Directors for its support for the idea of the Workshop, and the GSCA staff, Tammy Seldon, Kelly Germain and Eileen Pheiffer, for their indispensable assistance and friendship.

The Workshop is indebted to David Corson, Wendy Hancock and Mary Mathias of ASTC for their guidance, expertise and logistics assistance with both the Workshop and the Museum Screens Community of Practice. Carrie MacDougall of NOAA and Michael Daut, Ed Lantz, Dan Neafus, Judith Rubin, and Ryan Wyatt of IMERSA all were gracious with their support and time in discussions about the Workshop.

Ultimately, this Workshop would not happen without the financial support and encouragement of the National Science Foundation (NSF) (DRL-1341016). Special thanks to Sandra Welch, Valentine Kass and Ellen McCallie, and Bob Russell for their long term guidance and encouragement.

Mary L. Nucci, Workshop Organizer. Jeffrey Jacobson, assisting.

GSCA Lifelong Learning Committee

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Barry Crean, Telus Spark

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Daniel Ferguson, Cosmic Picture

Paul Fraser, Blaze Digital Cinema Works

Rick Gordon, RPG Productions

Bob Harman, MacGillivray Freeman Films

Tim Hazlehurst, Marbles Kids Museum

Mark Katz, National Geographic Cinema
Ventures

Don Kempf, Giant Screen Films

Jeffrey Kirsch, Reuben H. Fleet Science
Center

Dennis Laws, British Film Institute

Mike Lutz, IMAX Corporation

Shaun MacGillivray, MacGillivray Freeman
Films

Toby Mensforth, Mensforth and Associates

Berend Reijnhoudt, Omniversum

Glenn Shaver, Ontario Science Centre

Gordon Stalans, Tennessee Aquarium

Lisa Truitt, National Geographic Cinema
Ventures

Participant Biographies

Jamie Bell

Center for Advancement of Informal Science Education

Jamie Bell has been Project Director and Principal Investigator of the Center for Advancement of Informal Science Education (CAISE) since October 2010. Prior to that he spent 1 year as a visiting scholar at the University of Pittsburgh Center for Learning in Out of School Environments (UPCLOSE), 3 years as the founding director of the Center of Learning at Petrosains: The Discovery Center in Kuala Lumpur, Malaysia, 3 years as a consultant to the Harvard Smithsonian Center for Astrophysics Science Media Group and TERC, and 15 years in leadership roles at the Exploratorium.

Steve Bishop

Whitaker Center for Science and the Arts

Steve Bishop is Vice President of Science and IMAX Programs at Whitaker Center for Science and the Arts in Harrisburg, PA, where he is currently working on Expedition Chesapeake, a giant screen film and supporting environmental education materials about the Chesapeake Bay watershed. Steve grew up in suburban Minneapolis and has worked in the science museum and giant screen cinema fields for more than 30 years. He attended his first giant screen cinema conference in 1978. Prior to his appointment at Whitaker Center, Steve worked at the Washington Pavilion of Arts and Science in Sioux Falls, South Dakota, as founding director of the Pavilion's Kirby Science Discovery Center. Before that he worked at the Museum of Science and Industry in Chicago as director of the museum's Omnimax Theater and distributor of the Museum-produced giant screen film *Antarctica*. He also served as director of the Cernan Earth and Space Center, a public planetarium at Triton Community College in suburban Chicago. Steve holds a B.A. degree in astronomy from Northwestern University in Evanston, Illinois, and a M.S. degree in geology from Northeastern Illinois University in Chicago. Steve currently serves on the Board of Directors of the Giant Screen Cinema Association and is a member of GSCA's Lifelong Learning Committee.

Kim Cavendish

Museum of Discovery and Science

Cavendish has led science museums since 1981. Starting her museum career in Fort Lauderdale, she originally served fourteen years as Executive Director of the Museum of Discovery and Science in Fort Lauderdale, Florida, leading it from a small children's museum into a new state-of-the-art science center and IMAX Theater that opened in 1992, serving 550,000 visitors annually. She led the Virginia Air and Space Center from 1995 to 2000, where she increased public support and philanthropy by 40%. She then served as President of the Orlando Science Center for over 2 years before returning to Fort Lauderdale as President/CEO of the Museum in 2002. In recent years she led the planning, development and funding of the new \$25 million museum expansion, the

with Dr. Joyce on several projects in Oaxaca, Mexico. At CU I am building interactive spherical VR learning modules for the Rio Verde Archaeology project, as well as basic e-learning modules for this bi-lingual website National Science Foundation funded project. I have been a volunteer at the Denver Museum of Nature and Science (DMNS) since 2003 and I have been working with experimental fulldome technologies in the Gates Planetarium at DMNS since 2005. In 2011 and 2012, I worked as the fulldome education coordinator for the Immersive Media Education Research, Science and Arts (IMERSA) Summit at DMNS. I am excited to collaborate, constantly learning more about immersive media, expanding opportunities to share this knowledge with others.

Michael Daut

Evans & Sutherland

Michael received a BA in Media Communications with a Film/Video emphasis from Webster University where he also served as an Adjunct Professor. He has spent the past 26 years as a writer/producer/director for fulldome videos, theatrical productions, music videos, live concert videos, commercials, documentaries, corporate videos, and trade show presentations. With his company, Michael Daut Productions, he produced videos for various corporate clients including St. Louis Opera Theater and Apple Computer. After moving to Salt Lake City in 1998, he wrote, produced, and directed corporate videos and trade shows for Evans and Sutherland, for which he won several industry awards. In 1998, he produced the world's first show in the fulldome digital format. This show was the centerpiece of E&S' participation in SIGGRAPH '99. Since late 1999, as the Director or Show Production/Marketing at Evans & Sutherland, Michael has been the producer/director and co-writer of fulldome features for E&S, many of which have also won industry awards. He has created a number of 3D films for giant flat screen display and has done pioneering work incorporating 3D technology in fulldome theaters. He also helped create the world's first digital fulldome transfer of a giant screen film, *Africa the Serengeti* in 2007, and introduced giant screen films to the fulldome market. As a result of this groundbreaking first step, there are now over 25 films that have been converted to fulldome. Michael is a member of the ASIFA-Hollywood International Animated Film Society, a member of the Telly Awards' Silver Council, a member of the Producer's Guild of America, and a board member of IMERSA.org, the Immersive Media Entertainment, Research, Science and Arts organization. Michael resides in Salt Lake City, Utah with his wife and three children.

Rita Deedrick

COSI

Rita Deedrick is responsible for managing research, evaluation, and dissemination of visitor studies work within COSI as well as advancing COSI as a leader and advocate for research and evaluation in informal learning. The Center for Research & Evaluation (CRE) centralizes all social science research and evaluation connected with COSI or COSI audiences. In addition, CRE houses the Lifelong Learning Group (LLG), a

consultant group focused on collaborative study of how people learn across the lifespan, in informal settings, and in the intersection of school and out-of-school learning. Ms. Deedrick oversees teams of in-house experts who design and implement visitor studies projects ranging from small concept and experience tests to large-scale research and evaluation projects. Ms. Deedrick joined COSI in November 1993 and has held various roles related to evaluation and research at COSI since 2001. She recently served on the Executive Committee of the Visitor Studies Association Board of Directors for six consecutive years and is still active on association committees and task forces. Education: Franklin University (Columbus, Ohio), Marketing & Communications, MS 2003 The Ohio State University, Business Education, BS cum laude 1985 Affiliations: Visitor Studies Association Member of the Grants and Contracts Task Force, May 2012 to present Member of the Development Committee, July 2011 to present Member of the Oversight Committee, 2011 Vice-President for Organizational Development, July 2009 to July 2011 Lead, Bylaws Task Force, September 2010 to July 2011 Lead, Task Force for Strategic Alignment, October 2009 - March 2010 Member, Professional Development Committee, 2007 to 2010 Secretary, Board of Directors, August 2005 to July 2009 Co-Chair, April Award & Student Scholarship Committee, 2005 to 2008 Chair, Conference Host Committee for 2003 Visitor Studies Conference Association of Science & Technology Centers ASTC Dimensions editorial board, 2007 – 2010 Columbus Area Visitor & Audience Studies Community of Practice (CAVAS) Founding Member, 2005 - present American Evaluation Association, member since 2001 Ohio Museums Association, member since 2003.

John Falk

Oregon State University

Dr. John H. Falk, Sea Grant Professor of Free-Choice Learning at Oregon State University and Director, OSU Center for Research on Lifelong STEM Learning, is internationally acknowledged as a leading expert on free-choice learning; the learning that occurs while visiting museums or parks, watching educational television or surfing the Internet for information. Major foci of Dr. Falk's research are: Investigations and modeling of the structure and functioning of science education experiences at the community level; Measuring the impact of that individual informal science education institutions have on public science literacy and interest; and Investigations of the nature of self and the ways that personal identity influence free-choice learning. Dr. Falk has authored over one hundred fifty scholarly articles and chapters in the areas of learning, biology and education, more than a dozen books, and helped to create several nationally important out-of-school educational curricula. He serves on numerous national and international boards and commissions and has been Associate Editor of several internationally prominent journals. Before joining the faculty at Oregon State University, he founded and directed the Institute for Learning Innovation where for

twenty years he oversaw more than 200 research and evaluation projects involving a wide range of free-choice learning institutions. He also worked as an early child science educator at the University of Maryland and spent fourteen years at the Smithsonian Institution where he held a number of senior positions including Director, Smithsonian Office of Educational Research. In 2006 Falk was recognized by the American Association of Museums as one of the 100 most influential museum professionals of the past 100 years. In 2010 he was further recognized by the American Association of Museum's Education Committee with its highest award, the John Cotton Dana Award for Leadership. In 2013 the Council of Science Society President's gave Falk their Educational Research Award for his outstanding achievement in research that improved children's learning and understanding. Falk earned a joint doctorate in Ecology and Science Education from the University of California, Berkeley.

John Fraser

NewKnowledge.org

John Fraser Ph.D. AIA, is conservation psychologist, architect, and educator serving as President and CEO of the non-profit think-tank, New Knowledge Organization Ltd. Dr. Fraser holds adjunct faculty positions at Columbia University, Hunter College, Canisius College and Indiana University-Purdue University Indianapolis where he teaches conservation psychology. Dr. Fraser is a Research Scientist with The Earth Institute at Columbia University, holds the California Academy of Sciences appointment as Associate Editor-Operations for Curator: the Museum Journal, is a founding editorial board member of Museums & Social Issues and was a Fellow of the Wildlife Conservation Society from 2010 - 2013. He served as the Vice-President for Professional Development with the Visitor Studies Association from 2001 - 2007 and was actively involved in the restructuring of three of museum studies' major journals, including Visitor Studies now published by Taylor and Francis, Museums & Social Issues now published by Maney Publishing, and Curator: The Museum Journal now published by Wiley-Blackwell. Fraser's current research focuses on how social experience and media influence learning. Current projects include an ongoing study of how science learning can be promoted in public space, national studies of public understanding of climate change and the emotional experience of working in conservation, ongoing research for The Nature Conservancy's national youth programs, and evaluation for the EPA/Cornell University's environmental education program EECapacity. His public health research includes longitudinal studies for the NIH-funded SimLab--a program leveraging patient simulators traditionally used to replace cadavers in medical training for teen programs--and an upcoming project working with the University of Pennsylvania to explore the story of environmental justice for those living in the shadow of one of the country's most notorious brownfield superfund sites. Dr. Fraser led the writing of the paper "Giant screen film and science learning in museums" published in 2012 in *Museum Management and Curatorship* and continues to research the

impact of film on place-based learning as part of the California Environmental Legacy Project being produced for public broadcaster, KQED's program Quest.

Kelly Germain **GSCA**

Kelly is GSCA's director of communications and membership. Her career in the giant screen industry began nearly 13 years ago at the Science Museum of Minnesota when she was hired as editor of *The Big Frame*, the industry's then quarterly publication. As editor, she managed all aspects of the publication, including budgeting, editorial, advertising, design, printing, and distribution, and wrote feature articles and columns that were included regularly in each issue. In 2006, as GSCA's web editor, she supervised the launch of the association's new website. Promoted to director of communications and membership in 2010, Kelly manages all content for the website, association communications, databases, newsfeeds, forms, surveys, etc.; membership; marketing; social media; advertising sales; print materials; and *The Big Frame*, the now yearly publication that includes the GSCA member directory and an annual report of the association's activities and industry milestones. She also assists in GSCA conference and event planning. Prior to GSCA, Kelly was a program manager in the Minneapolis office of Jack Morton Worldwide, a global marketing agency. There she managed multi-million-dollar communications programs that included conferences, employee training programs, videos, print materials, research, etc., for clients such as Target and Wells Fargo. Kelly has a B.A. in English from the University of Wisconsin-Eau Claire, works from her home in St. Paul, Minnesota, and thanks her lucky stars she gets to work in the giant screen industry.

James Hyder **Cinergetics, LLC**

James Hyder is editor of *LF Examiner*, the independent journal of the giant-screen motion picture industry. Mr. Hyder has worked in the GS business since 1984, and has experience in all phases of the industry: production, distribution, and exhibition. In the 1970s, Hyder worked hands-on in audio and video production. In 1984 he started working at the Langley IMAX theater at the Smithsonian's National Air and Space Museum. As manager of the most popular IMAX theater in the world, he learned the concerns of exhibitors. While at NASM he assisted in the development and production of several IMAX films, including *Cosmic Voyage*, although he modestly declines to accept any direct credit for its Oscar nomination. In his last position at the Smithsonian, Hyder researched the GS distribution business and reported on establishing a film distribution office for the Smithsonian. In 1997 Hyder founded *MaxImage!*, the first independent publication dedicated exclusively to the GS industry. He has been its editor and publisher through its renaming to *LF Examiner* in late 2000 to the present day. Hyder holds a Bachelors degree in Liberal Arts from St. John's College in Annapolis, MD.

John Jacobsen**White Oak Institute**

John W. Jacobsen, president of White Oak Associates, Inc. and CEO of the White Oak Institute, was associate director of the Museum of Science in Boston in the '80's, leading the Theaters and Marketing Division, where he was also executive producer of their highly successful, \$24 million Hall Wing and Mugar Omni Theater. During that time, the Museum served 2.2 million visitors during a twelve month period, a record since unsurpassed. Before that management position and since then, Jacobsen and White Oak Associates, Inc. have led strategic planning and marketing initiatives for over a hundred museums and hundreds of commissions. Recent projects include 14 museums representing a billion dollars of actual and anticipated investment in new and expanding museums. Jacobsen is the founder of the Museum Film Network ('85), the Planetarium Show Network ('88), the Ocean Film Network ('92), AAM's Professional Committee on Green Museums (PIC Green '08) and of the Digital Immersive Giant Screen Specifications (DIGSS 1.0 '11). With Ms. Jeanie Stahl, Mr. Jacobsen formed the White Oak Institute in 2007, a non-profit dedicated to research-based museum innovation, with completed awards and contracts with the NSF, the IMLS, the AAM and the ACM.

Jeffrey Jacobson**PublicVR**

Jeffrey Jacobson, Ph.D. is the Director of PublicVR (<http://publicVR.org>), a nonprofit dedicated with free software and research in virtual reality for Education. His current research has been in game-based learning with visually immersive displays, especially the new low-cost all-digital interactive domes. His experiments have produced evidence of superior learning in the dome compared to a standard desktop computer in PublicVR's (virtual) *Living Forest* and *Virtual Egyptian Temple*. He has also worked with the Carnegie Museum of Natural History to extend their physical collections into the virtual space of their digital partial dome, the Earth Theater. His NEH-funded *Egyptian Oracle* performance was another innovative project that combined live performance, digital puppetry, and audience participation. It's most recent performance was at the Boston Museum of Science. Dr. Jacobson has been involved in virtual reality for 20 years, having developed CaveUT, a freeware modification to Unreal Tournament that enables the game to support multiscreen immersive displays. Over the years, CaveUT has garnered over 500 citations in the scientific literature. Dr. Jacobson also developed a VR simulator for the Medical Virtual Reality Center to support their research in visual effects with balance disorders. His later writings are in VR for education, particularly history and cultural heritage. Dr. Jacobson has contributed to organizing workshops, conferences, educational talks, and has mentored 19 students in internships, independents studies, and master's thesis. All of them have jobs, today. For more information, see <http://publicvr.org/JacobsonResume.pdf>

Mina Johnson **Arizona State University**

Dr. Johnson-Glenberg graduated with a degree in cognitive psychology from the University of Colorado at Boulder. She has extensive experience in implementing and assessing the effects of reading and text comprehension programs and in designing videogames to teach STEM (Science Technology Engineering and Math) content. At ASU she directs the Embodied Games for Learning Lab (<http://egl.lsi.asu.edu/>) where the team creates cross-platform content that uses the body as a learning interface. EGL specializes in mixed reality learning (via SMALLab) and in using large projected surfaces like whiteboards to instruct with motion capture as the input (e.g., using the Microsoft Kinect).

Mark Katz **National Geographic Cinema Ventures**

A successful distribution industry veteran for more than 25 years, Mark Katz is president of distribution for National Geographic Cinema Ventures, representing a wide array of highly acclaimed specialty, art and independent films. They include the award-winning 3-D films "U2 3D and Sea Monsters" as well as box-office hits *Forces of Nature*, *Lewis & Clark*, *Mysteries of Egypt*, *Shackleton's Antarctic Adventure* for WGBH and *The Human Body* for Discovery and the BBC, and the highly acclaimed, *Restrepo*. Katz is also a past Chairman of the Board for the Giant Screen Cinema Association (GSCA). Prior to joining National Geographic, Katz was president of distribution for nWave Pictures, from 1998 to 2005. Previously he was vice president of sales for Sony Pictures Classics from 1994 to 1998, where he led the successful distribution of the original 3-D films *Wings of Courage* and *Across the Sea of Time*. He also worked for IMAX Corporation, where he released the groundbreaking film *Rolling Stones at the Max* and the Academy Award-nominated film *Fires of Kuwait*. Before entering the large-format industry, Katz worked for The Movie Network in Canada from 1986-88. He also spent more than two years in the Canadian film production industry. Originally from Montreal and bilingual, Katz has a Bachelor of Arts in film from the University of Western Ontario, Canada, and a Master of Communications from the State University of New York at Buffalo. Katz lives in Greenwich, Conn with his wife and three daughters.

Mike Lutz **IMAX Corporation**

A 25-year + veteran in providing programs to science and natural history museums worldwide including 14 years at MacGillivray Freeman Films Distribution Company and the past 2 years at IMAX. A leader in the Giant Screen Cinema Association (GSCA) co-establishing its Professional Development programs (2007-2010), chairing its Marketing Task Force (2008-2010), serving on the Board of Directors for the maximum 3 terms and co-founding the industry's Distributors Interest Group (2006). Currently

Mike is a member of the GSCA Board of Directors, Chair of the Marketing & Membership Services Committee and Member of the Governance Committee.

Lynn Liben **Penn State**

Lynn S. Liben is Distinguished Professor of Psychology at Penn State where she also holds faculty appointments in Human Development and Family Studies and in the College of Education. One focus of Dr. Liben's research is on children's and adults' developing understanding of spatial representations (e.g., maps, photographs, diagrams) and their relevance to science education. She has collaborated with geographers, geologists, astronomers, and engineers to study links between spatial concepts, abilities, and skills and science learning. She has been involved in developing and implementing interventions aimed at enhancing spatial thinking, and in evaluating whether these interventions result in students' increased success and interest in pursuing science, technology, engineering, and mathematics (STEM) careers. A second major focus of her work is on the development of gender stereotypes, including ways in which these stereotypes may affect children's educational and occupational choices. Her work at the intersection of the domains of space and gender includes studying sex-related differences in spatial skills and the gender gap in performance on the annual National Geographic Bee. She has applied her research to a variety of educational contexts including children's television, museums, art education, play, and classrooms. Dr. Liben received her B.A. in Psychology from Cornell, and her M.A. and Ph.D. in Developmental Psychology from the University of Michigan. Dr. Liben is currently President of the Society for Research in Child Development and former President of Division 7 (Developmental Psychology) of the American Psychological Association (APA) and of the Jean Piaget Society. She is former Editor-in-Chief of *Child Development* and of the *Journal of Experimental Child Psychology*, and currently serves on editorial boards of several leading journals. She is a Fellow of the American Educational Research Association, APA, and the Association for Psychological Science, and her research has been funded through the National Institutes of Health, the National Geographic Society, the National Institute of Education, the Social Science Research Council, and the National Science Foundation.

Robb Lindgren **University of Illinois at Urbana-Champaign**

Robb Lindgren conducts research on how people learn in immersive and interactive digital environments. He is particularly interested in the design of large interactive spaces for STEM learning. Robb currently has a project funded by the National Science Foundation to examine "metaphor-based learning" in mixed reality environments where learners can embed themselves within a simulation to learn about basic physics

principles and planetary astronomy. The simulation involves large projections on both the floor and wall with laser-based motion tracking that allows the displays to be interactive. Children come to learn about how objects move in space by taking the perspective of an asteroid and making predictions about how it will move as it comes to encounter other objects (planets, etc.). Robb received his PhD from Stanford University in 2009 in Learning Sciences and Technology Design. His dissertation was a series of studies on how the perspectives that designers give users in interactive media technologies (digital video, virtual world simulations) affect their ability to learn. He also received an MA in Psychology from Stanford, and his undergraduate degree from Northwestern University is in Cognitive Science and Computer Science. Previously Robb has conducted studies on how people learn from video, doing simple manipulations such as showing participants the exact same event recorded from two different perspectives and measuring the learning outcomes. One of the interesting findings from this work is that people seem to learn more when watching video shot from a first-person perspective, possibly because this allows the opportunity to experience the event as an active participant, or perhaps because it shifts the viewer's identity to more of an expert in the domain.

Marti Louw **University of Pittsburgh**

Marti Louw is Research Faculty at the University of Pittsburgh Center for Learning in Out-of-School Environments (UPCLOSE) and a Research Associate at the Carnegie Museum of Natural History. Her design research practice focuses on how emerging digital media and sensing technologies can be used to create learning experiences that support participation, engagement and shared meaning-making with science.

Shaun MacGillivray **MacGillivray Freeman**

Shaun MacGillivray is the producer and president of MacGillivray Freeman Films. He produced MacGillivray Freeman's *Grand Canyon Adventure* and *To The Arctic*, and is currently producing the company's forthcoming films *Journey to the South Pacific*, *Humpback Whales* and *Return to Everest*. Shaun also leads the business development and partnership team for MFF. Shaun was born in Laguna Beach and grew up working with his dad, Academy Award nominated filmmaker Greg MacGillivray, on film shoots all around the world. Shaun graduated Magna Cum Laude from Emory University with a degree in economics, then went on to receive a graduate MFA degree in Film Production from the University of Southern California where he specialized in editing, directing and producing documentaries. He has an amazing wife, Katie MacGillivray, who he met while at graduate school at USC. They have a 2-year old son, named Charlie and a 3-month old daughter, named Greta and live in Laguna Beach, California. In his free time, Shaun loves being with his family and surfing in Laguna Beach.

Wendy MacKeigan SK Films

Wendy is Executive VP of SK Films and also is a writer and co-executive producer of the award winning *Flight of the Butterflies 3D* and other IMAXR/Giant Screen films. She has also coordinated the Educational Outreach Materials/Programs for several Giant Screen films including *Flight of the Butterflies* which won Best Film for Lifelong Learning, Best Education Program and Best Big Idea with the Maryland Science Center. She is one of Canada's most experienced and respected film executives with both a strong creative and production background. She has had successful senior executive positions in the private sector of the film and television industry working with Canada's top filmmakers and distributors and also in government. She is also the producer of *The Water Brothers*, an award winning, eco-adventure TV series examining the most important water stories of our time which won the BBC Earth Prize at Wildscreen for Best Newcomers for its dynamic hosts and filmmakers. Wendy has been a mentor to many and has made many valuable volunteer contributions to the industry including as Chair of Women in Film and Television for 4 years with many groundbreaking studies and programs to her and team's credit. Wendy has her MA from the University of Toronto in Environmental Studies. She is currently co-writing SK Film's next production called *Amazon Adventure 3D* about the discovery of mimicry by Henry Walter Bates during his perilous 11 year journey throughout the Amazon in 1850.

Wendy is Executive VP of SK Films and also is a writer and co-executive producer of the award winning *Flight of the Butterflies 3D* and other IMAXR/Giant Screen films. She has also coordinated the Educational Outreach Materials/Programs for several Giant Screen films including *Flight of the Butterflies* which won Best Film for Lifelong Learning, Best Education Program and Best Big Idea with the Maryland Science Center. She is one of Canada's most experienced and respected film executives with both a strong creative and production background. She has had successful senior executive positions in the private sector of the film and television industry working with Canada's top filmmakers and distributors and also in government. She is also the producer of *The Water Brothers*, an award winning, eco-adventure TV series examining the most important water stories of our time which won the BBC Earth Prize at Wildscreen for Best Newcomers for its dynamic hosts and filmmakers. Wendy has been a mentor to many and has made many valuable volunteer contributions to the industry including as Chair of Women in Film and Television for 4 years with many groundbreaking studies and programs to her and team's credit. Wendy has her MA from the University of Toronto in Environmental Studies. She is currently co-writing SK Film's next production called *Amazon Adventure 3D* about the discovery of mimicry by Henry Walter Bates during his perilous 11 year journey throughout the Amazon in 1850.

Erica Meehan

Bio in process.

Toby Mensforth**Mensforth and Associates**

Toby Mensforth is an 18-year veteran of the cultural attraction and museum industry where he has applied his skills in effective business development, strong management and sustainable growth strategies. Toby brings international perspective to his work having developed cultural properties in Canada, Europe and Asia in addition to the United States. Toby has helped to plan for, build and train teams in operations, marketing, cultural cinema and simulator attractions for major museums and cultural centers including the Smithsonian Institution, the Canadian Museum of Civilization and the IMAX Corporation. He is known for his creative win-win management-style and for his ability to balance the need for greater revenues with a dedication to the social-benefit mission of "life-long learning". Toby's experience includes having developed award winning theaters, films and business operations for IMAX Corporation. Based in Toronto he ran their chain of 13 owned-and-operated theatres and led their international client services group. At the Smithsonian Institution, Toby was a leader for nearly a decade, in developing and managing business lines in retail concessions, food service and giant screen cinema for the Institution's flagship museums on and off the National Mall. During his Smithsonian tenure, Toby led a range of construction and design initiatives, including revenue-generating projects for the National Air and Space Museum Udvar-Hazy Center and the renovation of the National Museum of American History. Mensforth has worked in every aspect of film development and programming in the Institutional market industry. Including; digital conversions to 15.70, script development, educational sales and marketing, distribution development and film programming for over 20 giant screen, digital and digital dome theaters. Based on his depth of knowledge and his expertise in Giant Screen Theaters, film programming and 3D film development Toby was elected as Chair of the Giant Screen Cinema Association. Toby has been on this member elected board for over 6 years and held the position of Chair from 2008-2011. He currently is on the GSCA Executive. Toby began his museum career at the Canadian Museum of Civilization in Ottawa. Toby is President and CEO of his own consulting firm "Mensforth and Associates" and specializes in helping optimizing revenue generation for cultural attractions and museums.

Dan Neafus**Denver Museum of Nature & Science**

Dan Neafus is the Operations Manager for the Gates Planetarium, Denver Museum of Nature and Science Founding Director of IMERSA.org. He has produced engaging audience experiences for over 35 years, and continues to do so as Operations Manager of one of the finest immersive theaters in the world, the Gates Dome Theater at the Denver Museum of Nature & Science. As Producer, his fulldome films have been distributed to theaters world-wide. Dan is a frequent speaker at international

conferences focusing on "The Language of Fulldome", "Immersive Cinema" and Fulldome standards development. His consulting firm Neafus Network advises on Fulldome film development and technical considerations for new theaters. He has also created numerous public and performance artworks utilizing light and form. With an emphasis on technology, Dan utilizes many tools in his work, from supercomputer graphics, to 3d sound and automated lighting. By collaborating and inspiring fellow visionary pioneers he has charted a course for the future of dome theaters and the immersive experience.

Mary Nucci

Rutgers, the State University of New Jersey

Mary is a Research Assistant Professor in the Department of Human Ecology at Rutgers University. Her research focuses on issues in science communication: public perception of science, science communication in film, media and museums. Mary holds an A.B. in Biological Sciences from Mount Holyoke College; and an M.S. in Zoology and a Ph.D. in Media Studies, both from Rutgers University. She has been an individual member of GSCA since its creation from the merger of LFCA and GSTA.

Deborah Raksany

Giant Screen Films

Deborah Raksany is the vice president of development and partnerships for Giant Screen Films (GSF). She supports the production and distribution of GSF's large-format titles, and leads the company's educational outreach initiatives, which have included collaborations with museums and science centers, corporate partners, government agencies, and conservation and advocacy groups. She was a co-producer of GSF's recent release *Tornado Alley*. Her background also includes work in environmental research, journalism, and non-profit fundraising and communications.

Robert Russell

National Science Foundation

A developmental psychologist by background, I have conducted cross-cultural research on children's learning and adolescent social networks and taught at Georgetown University. I have served as director of the Omaha Children's Museum, Impression 5 Science Center, Nokomis Learning Center, and as PI of a number of NSF, NIH, DOE, Dept of Justice and CDC projects in youth development, informal science and health education, including several media and outreach project designed to engage Latino families in science and health. As a consultant, I worked with many government agencies, museums, and media organizations on the design and evaluation of after school, exhibit, giant screen film, radio, and television projects. Currently (after an earlier stint in the early 1990's), I serve as a Program Director at NSF in several programs including Advancing Informal Science Learning, DRK-12, and ITEST.

Annette Shloss

University of New Hampshire

My main interest is in environmental education. I work with learners both in field studies outdoors and in using technology to enhance learning. I believe that blended learning environments that take advantage of both hands-on experiences and technology have the best potential to engage students in STEM. The digital dome provides a unique immersive experience that is especially valuable for taking audiences to places they cannot go otherwise, such as an ancient Egyptian Temple, to seeing the ice removed from the continent of Antarctica, or experiencing changes in a forest over 200 years. My dome projects include creating *Ice Worlds*, a 20-minute full dome film for the International Polar Year (IPY). *Ice Worlds* explores the dynamic climate on Earth and compares it to icy planets in the solar system. The film has been well received by the educational community and is available to schools through the Discovery Dome network. More recently, I have collaborated on the MyDome project with the Houston Museum of Natural Science and PublicVR in examining group learning experiences through interactive productions. MyDome programs are designed to teach sustainability as the audience explores a Mayan village to discover why it collapsed, a living forest to learn about changes in ecosystem services as the forest ages, or attempts to build a workable lunar colony. Each program engages the audience in a different way and allows audience members to "drive" using an Xbox controller. Unlike the static film, MyDome programs are adaptable to different group sizes, age levels, and background of the learners.

Tammy Seldon

GSCA

Tammy Seldon is the Executive Director of the Giant Screen Cinema Association (GSCA). She has 20 years of experience in association management, business development and international business. Tammy's expertise lies in the strategic management of all functional areas of business, including strategic planning, marketing, finance, association management, and board governance. Her management and business style is one of aggressive marketing, detailed planning, and strict fiscal management. Tammy began her career in the giant screen industry in January 2004 as Conference and Membership Director. She has successfully managed all aspects of 21 GSCA events, including site selection, budgeting, technical and theater relations, registration, scheduling, and volunteer and staff management. She successfully manages the GSCA annual budget of nearly \$1 million. Prior to joining the GSCA, Tammy was the third employee hired by CARFAX, Inc. She served as Director of Human Resources and Office Administration for eleven years and helped grow the company from its infancy to 250 employees. She managed an annual budget over \$2 million and a staff of seven. Tammy has a BA in Psychology and an MBA from George Mason University in Fairfax, Virginia. She is a CMP (Certified Meeting Professional) and is currently working towards her CAE (Certified Association Executive). She

studied in Chiba City, Japan and Valencia, Spain and speaks conversational Spanish and French. She has traveled to over 120 Giant Screen theaters worldwide. She works from her home in Holly Springs, North Carolina, and has two teenage children. She is certain she has the greatest job in the world!

Frieda E. Smith **Saint Louis Science Center**

Frieda Smith has over forty years in nonprofit management. The last 14 of those have been spent at the Saint Louis (MO) Science Center. Her current position is Senior Director of School and Public Programs, Camps, Planetarium and Galleries. Her departments are responsible for school, adult, Scouts and other public programs, day and overnight camps, planetarium and gallery experience/programs/design. Those departments are keenly aware of their charge to deliver many aspects of the mission of the institution. As such they are responsible for exciting, enjoyable, educational and entertaining inquiry-based programming in multiple on- and off-site venues for all ages - infants through mature adults. We also, work across the organization to ensure guests enjoy our Omnimax films and special exhibitions, by providing regular educator open house offerings when movies and exhibits change (during the school year) to help create awareness and demonstrate educational linkages. We also offer programs that relate to movie and exhibit topics, to help engage and interest target audiences.

Ryan Wyatt **California Academy of Sciences**

Ryan Wyatt assumed his role as Director of Morrison Planetarium and Science Visualization at the California Academy of Sciences in April 2007. Since the Academy reopened in September 2008, more than 7.3 million people have visited the institution. Ryan wrote and directed the Academy's three fulldome features, *Fragile Planet* (2008), *Life: A Cosmic Story* (2010), and *Earthquake: Evidence of a Restless Planet* (2012). The completely rebuilt Morrison Planetarium utilizes the latest in digital dome technology, with the goal of helping to redefine the planetarium for the 21st Century. In addition to the planetarium, the Academy features other new media venues, including two smaller dome spaces, a stereoscopic theater, and numerous high-resolution video environments. Prior to arriving in San Francisco, Ryan worked for six years as Science Visualizer at the American Museum of Natural History in New York City, contributing to the fulldome productions *The Search for Life* (2002) and *Cosmic Collisions* (2006). Previously, he opened technologically-advanced planetariums in Phoenix, Arizona, and Albuquerque, New Mexico. Ryan has also worked to develop standards and "best practices" in the planetarium community; along with Dan Neafus and Ed Lantz, he is one of the Founding Directors of IMERSA (Immersive Media Entertainment, Research, Science & Arts), which celebrates and promotes immersive digital experiences for education and entertainment in planetariums, schools, museums, and attractions. On an informal level, Ryan's rarely-updated "Visualizing Science" blog provides a look at his

ideas and opinions related to visual representations of science. His hand-drawn fulldome short, *Dome Sketch*, received the experimentation award at the 2005 DomeFest. Ryan also indulges avid enthusiasms for archeoastronomy as well as the history of science and the intersection between art and science.

Ka Chun Yu

Denver Museum of Nature & Science

Ka Chun Yu received his PhD at the University of Colorado in Boulder in 2000. He joined the Denver Museum of Nature & Science in January 2001 as part of the scientific visualization team tasked to create a real-time 3-D visual simulation of the known universe. He continues to be involved in the planetarium's evolution, including creating software for generating visualizations from astrophysical datasets; developing a virtual reality presentation tool for immersive lectures; helping to create pre-rendered and live planetarium shows and presentations; and working closely with the software developers of the real-time visualization platform Uniview to maximize its effectiveness for both formal and informal learning. He is one of the co-founders of the Worldviews Network, a nation-wide group of researchers, educators, and artists using immersive visualizations for connecting informal audiences to global change issues at a range of spatial and temporal scales. Ka Chun is interested in the different ways in which immersive displays can impact audiences. He is finishing up the ALIVE (Astronomical Learning in Immersive Virtual Environments) project, which evaluates the effectiveness of digital planetariums for teaching astronomical topics more effectively than pedagogy in a traditional classroom. His previous research was in observational star formation, where he studied outflows from protostars. He has been involved in observational programs using the Hubble Space Telescope, as well as ground-based optical, infrared, and radio observatories around the world.

Preparing for the Workshop

Before the Workshop

- Please accept the invitation to join the ASTC Museum Screens Community of Practice website and answer the questions posted:
 - What are the key question(s) for research on giant screen?
 - What outcomes or products should this meeting produce?
- Please read the papers Fraser *et. al.* (2012) and Bell *et. al.* (2009) available on the Museum Screens Community of Practice website.
- Please bring business cards to share with other participants.
- Please bring any other materials you wish to share with the participants.

At the Workshop

- Listen, question, and challenge the information presented.
- Challenge your own way of thinking about research needs.
- Collaborate with your colleagues to frame the key research questions and strategies to implement them.
- Network with others at the Workshop.

After the Workshop

- Complete a post-Workshop online survey within one week to help guide next steps and future industry conferences.
- Consider ways to implement discussions from the Workshop.
- Continue to question and discuss the Workshop outcomes.
- Disseminate information to others in the industry or in your workplace who could not attend.
- Engage in further discussions with Workshop contacts about research on giant screen.
- Participate, and encourage others to participate, in giant screen research.
- Tell others about, participate in or take a leadership role in the ASTC Museum Screens Community of Practice.
- If you are willing, complete a brief follow-up survey a few months after the Workshop to help us learn about any next steps you may have taken as a result of participating.

Workshop Schedule

Thursday, October 17, 2013

5:15 pm, Bus from the Hyatt Regency Albuquerque to the New Mexico Museum of Natural History

5:30 pm, Screening of *Flight of the Butterflies*

6:30 pm, Bus from the New Mexico Museum of Natural History to the Hyatt Regency Albuquerque

7:00 pm, Dinner hosted by GSCA, Board Room, Hyatt Regency Albuquerque

Friday, October 18, 2013¹

7:30 am, Breakfast, Sage Room, Hyatt Regency Albuquerque

8:00 am, Welcome: General introductions, review operations, goals.

8:30 am, Breakout: Research questions: Identify key research questions and what we know now.

10:30 am, Coffee break: Review breakout results

11:00 am, Group report and discussion

12:00 pm, Working lunch

1:00 pm, Breakout: Research approaches

3:00 pm, Coffee break: Review breakout results

3:30 pm, Group report and discussion

4:30 pm, Breakout: Practical: Develop ideal research approaches and dissemination of results.

¹ NOTE: All events will take place in the Sage Room Hyatt Regency Albuquerque. Note that the focus of the breakouts may change based on results of discussions in previous breakouts.

6:00 pm, Working dinner: Review breakout results.

7:00 pm, Group discussion of pragmatics, next steps

7:45 pm, Wrap up

8:00 pm, Adjourn

Monday, October 21

9:45-11:00 am, Museum Screens Community of Practice Meet-Up,
Acoma Room, Albuquerque Convention Center

Attendance optional

Tuesday, October 22

10:00 am- 6:00 pm, Big Screen Day (Hosted by GSCA)

Lockheed Martin DynaTheater, New Mexico Museum of Natural History and Science

Attendance optional

Film Schedule

10:00-11:00 am	<i>Titans of the Ice Age 3D</i>
11:00 am-12:00 pm	<i>Jerusalem 3D</i>
12:00-1:00 pm	<i>Mysteries of the Unseen World</i>
1:00-2:00 pm	<i>Space: Unraveling the Cosmos</i>
2:00-3:00 pm	<i>Hidden Universe</i>
3:00-4:00 pm	<i>Watermelon Magic</i>
4:00-5:00 pm	<i>Penguins 3D</i>
5:00-6:00 pm	<i>Fighter Pilot: Operation Red Flag 3D</i>

Workshop Objectives

The key goal of this workshop is to foster and engage researchers in aligned disciplines to define the key issues in giant screen research and develop an active research community to address these questions through collaboration. This goal will be achieved by the following:

Short term objectives

- Convene experts from across relevant disciplines.
- Define the key research questions and outlining the appropriate research strategies and research needs.
- Establish connections between research and practitioners through multiple venues pre and post-Workshop including industry association meetings and the ASTC Museum Screens Community of Practice.
- Promote the inclusion of research in every giant screen project.
- Create a working document that details key questions and proposals for research.
- After the Workshop, disseminate results to the industry for stakeholder comment and engagement.

Long term objectives

- Create the infrastructure for collaborative research proposals.
- Develop a long-term research program.
- Disseminate results through published proceedings, online reporting and peer-reviewed publications.
- Encourage and mentor researchers in giant screen.
- Implement and expand the research agenda.

Workshop Evaluation

An evaluation of the *Setting the Agenda for Giant Screen Research Workshop* will be conducted by Knight Williams Research Communications , an independent firm specializing in the development and evaluation of informal science media and outreach projects. The firm's Co-Director, Dr. Valerie Knight-Williams, has an extensive background in giant screen film development and evaluation. During the past fifteen years she has: collaborated on the formative evaluations of more than a dozen giant screen film projects, directed the summative evaluations of four giant screen film projects, directed the evaluation of the 2008 GSCA Symposium *Connecting Society with Science: the Greater Potential of Giant Screen Experiences*, and presented at three GSCA and LFCA conferences.

As part of the National Science Foundation (NSF) funding for the *Setting the Agenda for Giant Screen Research Workshop*, the evaluation team will conduct a variety of activities before, during, and after the workshop. The team will, for example: (i) help GSCA document the development and implementation of the workshop, (ii) summarize the level of activity and nature of the discussions that ensue through the Museum Screens Community of Practice prior to and after the workshop, (iii) gather participant feedback on the workshop within one to two weeks, and (iv) follow-up with these participants within a few months to explore the workshop's longer term impacts.

Please feel free to direct any questions about the workshop evaluation to Valerie Knight-Williams at val@knightwilliams.com

Definitions, Links and References

Giant screen

In 2009 the Technical Task Force of the GSCA developed a set of requirements for a theater to be defined as giant screen. Whether flat-screen, panoramic, or dome theater (2D or 3D; film or digital), a giant screen fills a large part of each audience members' field of view. If the screen is flat, it must be 70 feet wide or 3100 sq. feet in area or, if it is a dome, at least 60 feet in diameter. All seating must be within one screen width of the screen plane, so everyone's horizontal viewing angle is at least 53 degrees. Though not included as requirements for designating a theater as giant screen, resolution, brightness and theater architecture are considered essential components of the giant screen experience. Digital delivery specifications (Digital Immersive Giant Screen Specifications; DIGSS) for flat and dome screens were developed by the DISCUSS Colloquium (partly funded by the US National Science Foundation).

Links

<http://giantscreencinema.com>

<http://www.giantscreencinema.com/MemberCenter/DIGSS.aspx>.

<http://www.giantscreencinema.com/MemberCenter/GiantScreenSpecifications.aspx>

Readings

NOTE: The *LF Examiner* is an important source for additional writings on giant screen.

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- (2004). 'The largest picture ever executed by man': panoramas and the emergence of large screen and 360 degree technologies, In J. Fullerton (Ed.). *Screen Culture: History and Textuality*. London: John Libbey Publishing, 199-220.

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- (2005). Reconsidering the technological limitations and potential of large format. *FLOW*, 3(4), <http://flowtv.org/?p=268>.

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Ploeger, J. (2004). Techno-scientific spectacle: the rhetoric of IMAX in the contemporary science museum. *Poroi*, 3, 73-93.

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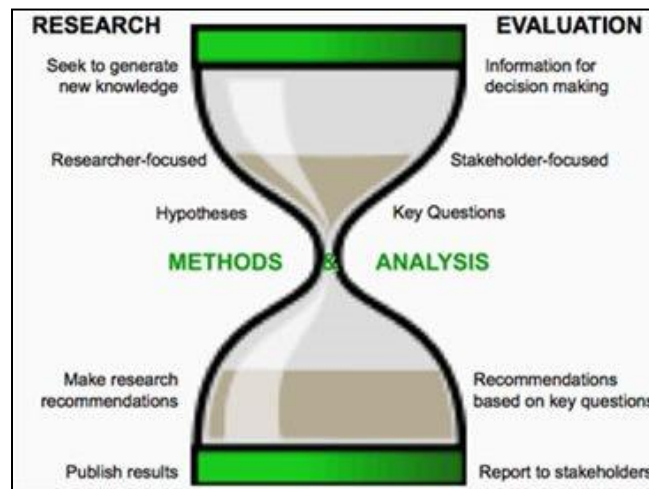
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Research and Evaluation

Research and evaluation are not the same: Research is the systematic study directed toward fuller scientific knowledge or understanding of the subject studied. *Basic* is concerned with the fundamental aspects of phenomena and of observable facts without specific applications towards processes or products in mind. *Applied* research looks to satisfy a specific need. In both cases, the goal is to establish some theory that guides further inquiry or applications. Research employs many of the same tools and methods used in evaluation, and there are valid lines of inquiry that could be classified as either.



From <http://www.uniteforsight.org/evaluation-course/module10>

Evaluation is the systematic measurement of an experience or a curriculum in order to understand its impact and improve its performance. The General Accounting Office defines evaluation as

“A program evaluation is a systematic study using research methods to collect and analyze data to assess how well a program is working and why. Evaluations answer specific questions about program performance and may focus on assessing program operations or results. Evaluation results may be used to assess a program’s effectiveness, identify how to improve performance, or guide resource allocation” (GAO, 2012).

Evaluation is used to measure effects on the audience, the experience itself (e.g. to analyze its structure), or the production process and answers questions such as:

- How well does the program work?
- Does the program do what we intended it to do?
- Does the program work for the reasons we think it does?
- Is the program cost-effective? Are the benefits worth it?
- What are the unintended consequences of the program?

Formative evaluation happens before and during the process of creating the experience or curriculum to guide design decisions in order to improve the final product.

Summative evaluation occurs after the program is put into use, primarily to measure its effectiveness. This stage may use the control groups and comparative analysis usually associated with research. Lessons learned from summative evaluation will inform the most effective use of the product and inform similar projects.

Links

<http://tde.sagepub.com/content/31/2/150.full>

<http://www.hfrp.org/evaluation/the-evaluation-exchange/issue-archive/reflecting-on-the-past-and-future-of-evaluation/michael-scriven-on-the-differences-between-evaluation-and-social-science-research>

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<http://www.uniteforsight.org/evaluation-course/module10>

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Informal Learning

Informal learning happens throughout people's lives in a highly personalized manner based on their particular needs, interests, and past experiences. NSF defines informal as “out-of-school learning that makes learning Lifelong, Life Wide (occurring across multiple venues) and Life Deep (occurring at different levels of complexity)” (NSF, 2013). This type of multi-faceted learning is voluntary, self-directed, and often mediated within a social context. It provides an experiential base and motivation for further activity and subsequent learning. It occurs in a wide variety of settings and through a rich palette of designed environments and products — among them, film and broadcast media, science centers and museums, zoos and aquariums, botanical gardens and nature centers, cyberlearning and games, and youth, community, and out of school time programs. Grounded in a view of the human as naturally curious, social, and actively engaged in learning, informal science education is characteristically pleasurable, open-ended, equitable, and accessible.

Links

<http://informalscience.org/about/informal-science-education>

<http://informalscience.org/nsf-aisl>

<http://informalscience.org/>

Readings

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STEM

NSF defines STEM as “all of science, technology, engineering, and mathematics (STEM). As defined by the National Research Council STEM subjects include,

- Science is the study of the natural world, including the laws of nature associated with physics, chemistry, and biology and the treatment or application of facts, principles, concepts, or conventions associated with these disciplines.
- Technology comprises the entire system of people and organizations, knowledge, processes, and devices that go into creating and operating technological artifacts, as well as the artifacts themselves.
- Engineering is a body of knowledge about the design and creation of products and a process for solving problems. Engineering utilizes concepts in science and mathematics and technological tools.
- Mathematics is the study of patterns and relationships among quantities, numbers, and shapes. Mathematics includes theoretical mathematics and applied mathematics.

STEM education can be an interdisciplinary or trans-disciplinary approach to learning where rigorous academic concepts are coupled with real-world problem-based and performance-based lessons. At this level, STEM education exemplifies the axiom "the whole is more than the sum of the parts." There is a movement to expand STEM to include arts, and change STEM to STEAM.

Links

<http://www.cde.ca.gov/pd/ca/sc/stemintrod.asp>

<http://informal.science.org/nsf-aisl>

<http://stemtosteamm.org/>

Interaction/Interactivity

The level of interaction or interactivity in a giant screen experience is governed by how the visual environment responds to the audience. This can be in direct response to actions by members of the audience or through a tour guide acting as a mediator or surrogate. The more ways in which the environment can change or respond according to real-time input, the more interactive it is said to be. However, these responses must also be plausible--consistent, believable, comfortable, and even pleasurable. The interaction does not have to be realistic, which simulates some aspect of our current reality.

With the notable exception of live interactive planetarium shows, most giant screen presentations have been movies, where all the action is on the screen and in the audience member's head. Today, new all-digital projection equipment creates many more opportunities for interactivity. This creates great opportunity for educational design, because interactive elements of the experience will dominate attention and greatly enhance learning, but only if it is well designed. It can be difficult to provide a meaningful interactive experience to every member of an audience, when they have to share the virtual environment.

Links

http://aer.aas.org/resource/1/aerscz/v8/i1/p010108_s1
<http://www.instituteofplay.org/work/projects/smallab-games/>
<https://ive.scm.tees.ac.uk>

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Immersion

The degree of immersion provided by a display is a function its technical ability to provide the virtual environment to the audience. For a movie, this depends on the quality of the sound and visuals and the degree to which they surround the audience. For example, the broader the audience field of view, the more directions the viewer can look. The higher the resolution of the image, the closer the audience can focus on the image. Also, the more interactive presentation is, the more immersive it will be. However, the interactivity must be well designed, or it will have the opposite effect.

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Presence, Place Illusion and Plausibility Illusion

In the virtual reality research of the 1980's and 90's, and in some later giant screen related papers, *presence* had been defined as the feeling of *being there* or being *in* the virtual world projected or represented. The concept is compelling and useful for description, but it was not sufficiently rigorous to support research. Research studies conducted by the virtual-reality community that attempted to measure presence, its causes, and education effects were often inconclusive.

More recently, researchers have been striving toward concepts that are more specific and more testable. Dr. Mel Slater has redefined presence as *place illusion*, a construct of the mind which gives the feeling of being present in the virtual world. Properly employed, the immersion provided by a giant screen theater can be used to support *place illusion*, but that is not enough, by itself. The narrative of the experience must also explicitly place the audience in the virtual environment.

With virtual reality, most researchers require that the environment be interactive, as defined above, and the more the better. In that case, *plausibility illusion* is also desirable—that is the expectation that the virtual environment will respond in a believable way.

Readings

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Upcoming Calls and Funding Sources

Calls for Papers

Science Communication Call for a Special Issue: Communicating science visually in the digital age

The recent advent of new communication and representation tools and technologies has created a myriad of new potentialities and new realities in the creation and dissemination of science visuals, both within and outside of the scientific disciplines. This trend has also raised questions about the use and impact of these visuals. Science visuals have progressed beyond simple tables and graphs to include digitized schematics and simulations, interactive computer graphics, and even video games, in addition to film, video, and photographic treatments. Computerization gives the creator new power to shape representations and thus invite new interpretations of information. In this call we intend the term visualization to include any kind of representation that relies on “pictures” (broadly defined) rather than solely on language, text, or numbers. Visuals can both provide an entry point to science for people without scientific training but also trivialize or confuse people about science through the range of possible interpretations of imagery. They may also encourage creative thinking within science. This special issue will bring together research that considers the changes in science visualization considered across a variety of disciplines to encourage synergy among divergent approaches and provide a resource for communication, teaching, and future research.

This call is looking for submissions that focus on whether and how visuals and visualization technologies (old and new) and the broader access that they may provide are affecting science communication. Questions to be addressed include how science is represented visually, how visuals influence public perceptions and understandings of science, and what is ultimately the impact of new science visualization technologies both within the disciplines and in the public sphere. Papers can address such topics as:

- the impact of visualization techniques and technologies on public understanding/perceptions
- the ethics of visual science communication
- how scientific results are represented using new visualization technologies, along with the implications of these representations
- visual metaphors, rhetoric, and framing in science visualization
- the changing use of visuals within science disciplines and what this means
- the use of iconic science imagery and its effects on emotion and public perception
- power issues related to the use of visuals and the public accessibility of science

- visuals and their reception in the science museum/center and/or other particular contexts

This is not intended to be an exhaustive list but only a starting point. Theory-based papers with an empirical or analytical focus and using any quantitative or qualitative methodology will be considered. All papers submitted will be subject to a rigorous and competitive peer review process.

Papers are due April 1, 2014 for publication likely in late 2014 or early 2015. *Earlier submissions are very strongly encouraged. Mention the special issue in your cover letter.* Papers should follow the *Science Communication* guidelines for length and format; submit at mc.manuscriptcentral.com/sc. Our ideal manuscript is between 7000 and 9000 words, inclusive of notes, references, and other material. Additional guidelines can be found at scx.sagepub.com. Queries regarding the special issue can be addressed to guest editor Mary Nucci at mnucci@rutgers.edu or to the journal's editor, Susanna Priest, at editorscicom@gmail.com.

Calls for Research

NSF Advancing Informal STEM Learning:

The Advancing Informal STEM Learning (AISL) program seeks to advance new approaches to and evidence-based understanding of the design and development of STEM learning in informal environments for public and professional audiences; provide multiple pathways for broadening access to and engagement in STEM learning experiences; advance innovative research on and assessment of STEM learning in informal environments; and develop understandings of deeper learning by participants.

Full Proposals due January 14, 2014 and November 14, 2014

<http://informalscience.org/images/research/nsf13608.pdf>

NSF Education and Human Resources:

The Research on Education and Learning (REAL) program represents the substantive foci of three previous EHR programs: Research and Evaluation on Education in Science and Engineering (REESE), Research in Disabilities Education (RDE), and Research on Gender in Science and Engineering (GSE). What is distinctive about the new REAL program is the emphasis placed on the accumulation of robust evidence to inform efforts to (a) understand, (b) build theory to explain, and (c) suggest interventions (and innovations) to address persistent challenges in STEM interest, education, learning, and participation. The program supports advances in research on STEM (science, technology, engineering, and mathematics) learning and education by fostering efforts to explore all aspects of education research from foundational knowledge to

improvements in STEM learning and learning contexts, both formal and informal, from childhood through adulthood, for all groups, and from the earliest developmental stages of life through participation in the workforce, resulting in increased public understanding of science and engineering. The REAL program will fund research on, human learning in STEM; learning in STEM learning environments, and broadening participation research.

Full Proposals due January 10, 2014.

Funding Sources

Mellon Foundation

http://www.mellon.org/grant_programs/programs

National Institutes of Health

www.nih.gov

National Science Foundation

www.nsf.gov

National Oceanic and Atmospheric Administration

www.noaa.gov

The Sloan Foundation

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Additional Readings

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Appendix A: Giant Screen and Related Media Evaluation Reports

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Knight-Williams, V. (2008). *Evaluation Report: Connecting Society with Science: The Greater Potential of Giant Screen Experiences*. Available on request from mnucci@rutgers.edu.

Koster, E., Nucci, M. & Knight-Williams, V. (2008). *Final Report to the National Science Foundation Connecting Society with Science: The Greater Potential of Giant Screen Experiences* Grant No. DRL-0803987. Accessible at <http://www.giantscreencinema.com/Portals/0/2008%20Symposium%20final%20report.pdf>

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NOTE: Informalscience.org website is an invaluable resource for research, reports and evaluation of informal learning programs.

Appendix B: Lessons learned from the *Connecting Society with Science: the Greater Potential of Giant Screen Experiences Symposium (2008)*

Introduction²

During each of two 65-minute afternoon sessions, focus groups discussed the questions:

- What is the meaning of lifelong learning?
- What is the importance of lifelong learning?
- What are the optimal development procedures for educational giant screen films?
- What are the primary criteria for recognition of superior outcomes of educational giant screen films?

Results: Lifelong Learning

Nowadays, learning is a continuous opportunity, neither starting nor stopping with our years of formal education at school, college or university. Indeed, a feature of the e20th century was that it became impossible to learn everything we ought to know during the first decades of life. Learning throughout life helps to maintain personal relevance as informed consumers and decision makers in today's knowledge-based, fast changing society. It helps to assure individual well-being and enable democratic participation. Those who continue to learn during their senior years prolong their mental faculties and overall quality of life.

Lifelong learning emphasizes the learner in us, rather than someone else in the role of teacher. The term usefully shifts the onus and opportunity to use as individuals. Fueled by interest, circumstances and passion, it sums up learning about life, integrating knowledge into life, learning how to get the most out of life, and our place in changing communities. It makes us more informed, more useful citizens, in society. The concept of lifelong learning helps the public put a label on, and a context around, disparate aspects of their lives. For some people, lifelong learning becomes personally transformative, leading to great insights and achievements.

These characteristics of lifelong learning from a consumer perspective carry over in situations where we have a responsibility for the learning of those around us. This has implications for ethical values as well as the overall social and environmental responsibility of leadership in society, whether this be political, corporate, or nonprofit.

² Koster, E. (Ed.). (2000). *Giant Screen Films and Lifelong Learning: Compete Symposium Proceedings*. Liberty Science Center, Jersey City, NJ.

From an everyday perspective, though, each of us is exposed continuously to learning situations from a web of leader and follower situations at home, at work, and in play.

Because giant screen films take viewers where they cannot otherwise go, easily or at all—physically, emotionally, intellectually—they have the power to inspire learning at any age. As discussed by several of the authors of advance papers at this Symposium, the giant screen film experience can be an efficient and effective catalyst for generating curiosity and advancing comprehension about the subject matter of the film. Museum-type institutions are in the lifelong learning business and therefore a giant screen theater as part of their menu of educational offerings is a high-profile vehicle for conveying mission. From the standpoint of film makers, the value of lifelong learning provides a direction for the content and approach of their projects.

Results: Educational Giant Screen Films

Giant screen film experiences intended to be educational are optimized by adhering to a systematic series of developmental steps, such as the one that follows:

1. Obtain seed money for conceptual planning and feasibility checks.
2. Develop a conceptual plan for the whole project in terms of learning outcomes, audience targets, preliminary location and storyline planning, and evaluation and marketing methodologies.
3. Assess the project's suitability to the giant screen and the availability of funds for film development and production.
4. Liaise with theaters, especially those with educational missions, to test for interest, gain feedback, and if possible, obtain early 'buy-in.'
5. Present the project as a film-in-development at minimally one GSCA conference.
6. Define learning outcomes for the film in relation to formal education and lifelong learning in the countries where the film is expected to be shown.
7. Develop a detailed outline for the film and any collateral materials making extensive use of content, film, and education experts.
8. Finalize the business plan for the complete project and secure full financing.
9. Decide on a practical filming plan before going on location.
10. Define checkpoints throughout the development process of the film and of any collateral materials to assure ongoing communications with and between all stakeholders. These include reviews of content accuracy by an advisory committee, of educational merits by specialists in school and public education, by audience focus groups, and with project evaluators.
11. Present the project as a film-in-progress at minimally one GSCA conference.
12. Review the script with an industry-wide sample of stakeholders.

13. Develop an alliance with at least one museum-based theater (the same or different as step 4) as a collegial sounding board during finalization in filming, graphics, narration, title testing, etc.
14. Remain flexible at the rough-cut stage for fine-tuning of project details based on industry and audience feedback.
15. Present the project as a new film at the next GSCA conference with documentation on hand about its particular developmental approach as a professional development aid to the industry.

Second, aspiring to superior outcomes with educational giant screen film projects is helped by the following checklist of quality-related questions:

In terms of content, does the film...

- Show the scientific method and scientists at work (or do the same for musicians, artists or others featured in films)?
- Convey useful information, dispel misconceptions and avoid sensationalism?
- Accurately handle educational concepts?
- Encourage reflection and critical thinking?
- Offer new perspectives and pose questions?
- Connect with formal educational curricula?
- Advance the ideals of lifelong learning?
- Provide resources and pathways for further learning?
- Stimulate viewers to discussion about the topic and related issues?

In terms of audience, does the film...

- Appeal to both genders?
- Appeal to a range of ages?
- Have suitability for a family audience?
- Reach out to all ethnic/racial groups?
- Have different language versions?
- Appeal to non-traditional audiences of the medium?

In terms of the overall experience, does the film...

- Present a balance of sensory impacts and intellectual stimulation?
- Deal with subject matter that is effectively handled on the giant screen?
- Create engagement and generate intellectual stimulation?
- Give audiences the “you are there” feeling?
- Help in understanding a broadly important subject matter?