



SALZBURG  
GLOBAL  
SEMINAR

SESSION REPORT

547

# The Neuroscience of Art: What are the Sources of Creativity and Innovation?



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**Charles Limb and Gary Vikan**

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**Session 547**

Salzburg, February 21 to 26, 2015

# **The Neuroscience of Art:** What are the Sources of Creativity and Innovation?

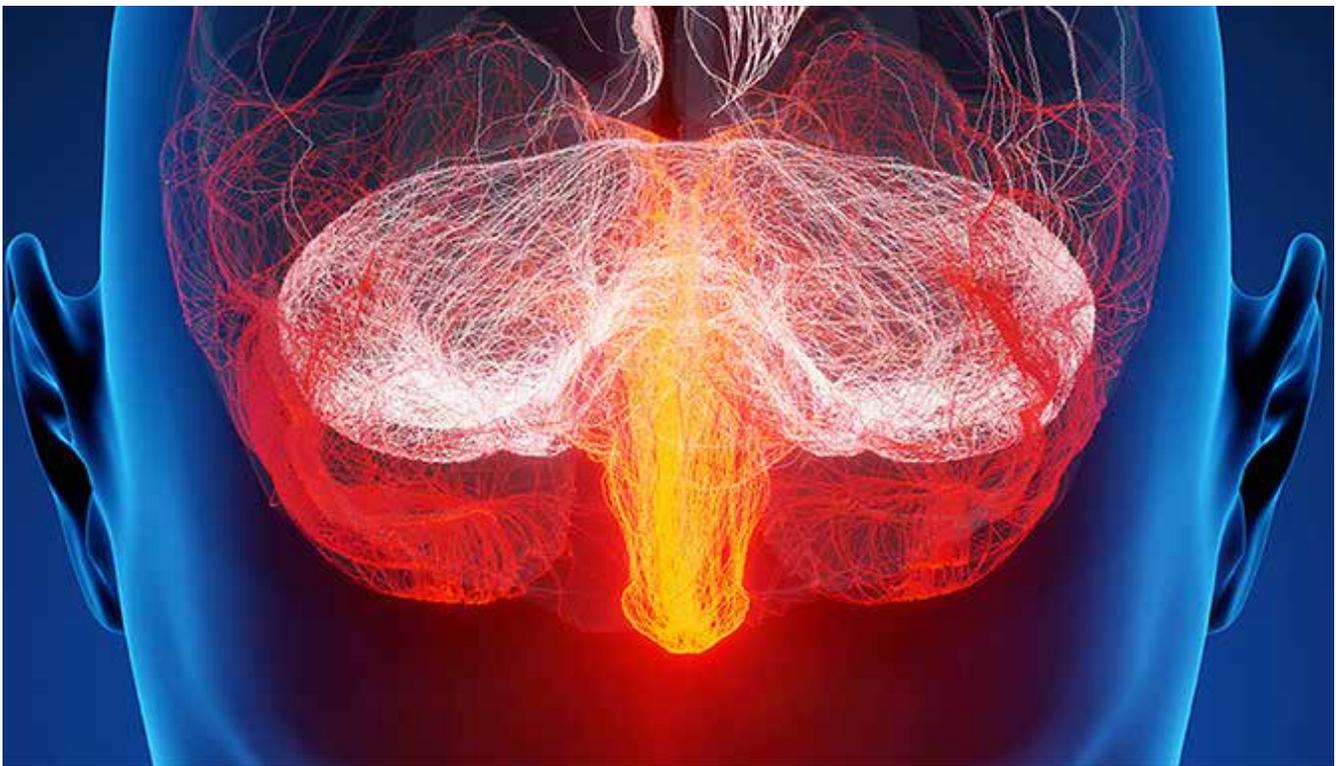
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## Preface

In recent years, there have been an increasing number of scientific investigations into art, exploring what actually happens in the brain during the creative process. Most of these collaborations have been based in neuroscience and psychological approaches to how art is perceived, produced and created, with music the main focus of studies carried out to date. These studies have yielded important new information that relates to a very basic fact of human biology: all behavior, even that as complex as creativity, can be linked to brain function. Building on this fundamental linkage, the neurobiology of art promises to yield exciting new insights as this research field evolves. Creative behavioral patterns are likely to be a critical component for developing the neurological capacity for innovation.

The Salzburg Global program *The Neuroscience of Art: What are the Sources of Creativity and Innovation?* that was convened at Schloss Leopoldskron in February 2015 represented a pioneering step to establish a neutral international forum to discuss state-of-the-art findings from a cross-disciplinary perspective, prioritize future research, and expand creative opportunities for learning, innovation and collaboration. Given that most research in this area is taking place in various national and regional settings, SGS felt that more global dialogue is needed between specialist silos in order to catalyze knowledge exchange around the results, implications and potential practical applications of new cutting-edge research.

*The Neuroscience of Art: What are the Sources of Creativity and Innovation?* program brought together an inspiring and unusual mix of 50 artists, scientists, physicians, psychologists, sociologists, scientific agency representatives, educators, and entrepreneurs from across the globe to explore this rapidly-evolving field of the neurobiology of art and to create a collaborative international platform to identify and address emerging issues at the creative intersection of neuroscience and art.



*“This was a very forward-looking and experimental session for Salzburg Global Seminar. The session was poised at the frontier of the research that is happening at the nexus of neuroscience and the arts.*

*The program brought together visual artists, poets, musicians, a beat-boxer, a caricaturist and filmmakers as well as neuroscientists who are looking at these various artistic disciplines to learn more about the roots, sources, and processes of creativity.”*

Susanna Seidl-Fox,  
Program Director – Culture and the Arts  
Salzburg Global Seminar

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*“The session was intense, creating a very fluid environment in which ideas from science and art found a fertile opportunity to intertwine. This is the first event of this type I attended and I feel I look at the world differently. I am constantly checking my own work for possibilities of including or addressing questions about neuroscience or art. I am even questioning my own life for the quality and quantity of artistic influences that can help the outreach of my science... A few weeks after the immersive intellectual and cultural experience at the Salzburg Global Seminar, I find myself looking at my work differently. It is as if I got an additional pair of eyes that give me a different insight in the world around me.”*

Aline von Davier



## Introduction

### *A Meeting of Two Worlds*

The human brain is often called the most complex object in the known universe. In a single brain, there are about 80 billion neurons, distinctly individual cells, separated from each other by infinitesimal spaces. Despite such separations, these individuals in the brain can communicate, sending and receiving signals, forming perhaps up to a thousand trillion connections, across synapses.

The result is a continuous network of information processing. Having evolved in command of the nervous system, the brain coordinates responses throughout the body, adapting instantaneously. To a human being, all of this seems seamless. We survive in our minds, with each present moment, unconscious of the gaps in our anatomy. Somehow, out of this fundamental discontinuity, there is a coherent wholeness. This is the beauty of the brain. While alive, a mass of soft tissue creates the universe of our experience. Once dead, it can be carried in our two cupped hands.

After the Second World War, Europe was in fragments, pieces of a civilization. The Salzburg Seminar in American Studies was founded as a “Marshall Plan of the Mind,” a center for intellectual exchange, a way to rebuild the infrastructure of its collective brain. The first session, in 1947, hosted nearly one hundred participants at Schloss Leopoldskron, the former home of Austrian theatre impresario Max Reinhart, many of whom the war had alienated. (Reinhardt, whose widow had loaned the use of the Schloss, had himself fled Austria in 1938 following the Nazi Anschluss.) Despite close contact, sharing their opinions (and a dormitory) for six weeks, real connection might have seemed to them impossible. How could enemies communicate? Among the Fellows, there was an Austrian, who had fought for the Nazis in France, and a Romanian Holocaust survivor, who had

watched as her mother was shot dead at Auschwitz. Common ground came from the study of American culture, politics, and economy.

For nearly 70 years, the organization now known as Salzburg Global Seminar has been determined to break down barriers between people and ideas, spanning the globe to challenge countries and institutions across all sectors and stages of development. Last year, as part of a re-envisioning of its mission to challenge present and future leaders to solve issues of global concern, Salzburg Global announced three exciting new interconnected program areas around the themes of Imagination, Sustainability, and Justice. This year, during the last week in February, Salzburg Global Seminar convened session number 547, titled *Neuroscience and Art: What are the Origins of Creativity and Innovation?*, an interaction between two worlds, art and science, with leading figures from each domain discussing the future of research, performance, and practice.

According to session co-chair **Gary Vikan**, this session was inspired by a new field called neuroaesthetics, which studies this question. What happens in the brain when we experience art? During the 2012 session *Public and Private Cultural Exchange-Based Diplomacy: New Models for the 21st Century*, Vikan happened to mention an exhibit called “Beauty and the Brain” (2010), which morphed digital artworks with



Clare Shine,  
Vice President & Chief Program Officer,  
Salzburg Global Seminar

Session co-chair Charles Limb (l) and  
Gary Vikan (r)





“ [The] questions we asked in Salzburg [are] fundamental to advancing our knowledge of the central nervous system and subsequently ‘unlocking its potential’.

*Collaborating with the minds that came together at Schloss Leopoldskron brought me one step closer to answering these questions – and will continue to do so. ”*

Clayton Aldern



Harry Ballan

feedback from neuroscience data. Participants at that session could not stop discussing neuroscience and art, even during the coffee break. The idea eventually morphed into the concept for the February 2015 session in Salzburg, supported in large part by the Edward T. Cone Foundation, a long-running sponsor of the Salzburg Global multi-year series in Culture and the Arts.

Opening the session, Vikan encouraged participants in Salzburg to be individuals, not necessarily representatives of their organizations and institutions, and to share generously with each other. Co-chair **Charles Limb**, a hearing specialist, ocular surgeon, and TED speaker, praised the great talent from around the world. Although his own research has imaged the brains of jazz improvisers, he wonders whether artists need neuroscience. Arts are struggling for funding and support, and educational policy is on the line. With new methods and techniques, science might be able to provide crucial evidence for the value of the arts, but there is considerable distance to cover. Artists’ worldview is not intuitive to most neuroscientists. Limb expressed his hope for some electricity between artists and neuroscientists, perhaps the spark of creativity, or the spike of an axon potential.

Throughout the opening presentations, there were slides showing images of artworks, which participants had cited as sources of their own inspiration. Every few minutes, participants saw a sculpture by the Belgian artist Jan Fabre (b. 1958), submitted by Pieter Broucke, Director of the Arts at Middlebury College. The sculpture, made out of metal, is of a man in work clothes, standing on a modest stepladder. He is holding a yardstick, his arms straight above his head, looking upward. The title is *Man Who Measures Clouds*, and the work is installed on the roof of a museum. The clouds are always moving, and the frame, which is to say the sky, is infinite. As Emily Dickinson wrote, “the brain is wider than the sky.” What do we see when we look at the brain? Can science measure the arts? What defines creativity? Are there valuable products? Are these questions even unanswerable? What will come of us trying?

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# The Creative Process

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**Charles Limb**

*Associate Professor of Otolaryngology-Head and Neck Surgery, Johns Hopkins Medicine; Peabody Conservatory of Music and School of Education, Johns Hopkins University, Baltimore, MD, USA*

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**Kevin “KAL” Kallaugher**

*Editorial Cartoonist for The Economist and The Baltimore Sun Baltimore, MD, USA*

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The opening conversation paired a scientist and an artist in the Great Hall of Schloss Leopoldskron, with its last remaining working fireplace. **Charles Limb** said that his living room is the temporal bone in the human ear, which houses the hearing organ. He believes that we cannot understand music without looking at the body, where tiny structures convert energy from the world into electricity in the brain. With fMRI research, admittedly flawed but useful, Limb has explored the biological basis of creativity, which, he believes, is measurable. His assertion is that artistic creativity is a neurologic product that can be examined using rigorous scientific methods. He defined creativity as “the generation of something new,” and art as “the most homogenous form of total creativity.” Projecting the image of a 35,000-year-old bone flute, Limb suggested that artistic creativity is a hard-wired, deep-seated trait necessary for human survival. We have always needed to innovate; adaptability is at the core of our biology. What



Suzanne Burgoyne

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*“The most important outcome for me at this point are the professional contacts; a better sense of the relationship between creativity and science; a better understanding of neuroscience; and a better understanding of the limitations regarding what we can know.”*

Pieter Broucke

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Charles Limb

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(Above) KAL shows some of his earlier work (as a child) during his talk on explaining his creative process; (below) KAL's caricatures of program speakers



experiments can be designed to address these behaviors? For Limb, music is mathematical, lending itself nicely to statistics. Musicians manipulate certain structures, which scientists are able to control and situate within experiments. In his research on improvisation, he has found a difference in brain activity between memorized versus improvisational tune playing. His early results suggest that deactivation in the prefrontal cortex leads to creative or “flow” states. Improvisation is not random, but rather based on prior information, learned patterns. Limb described innovation as “a conversation, or exchange of ideas.” During informal time at the session, such as meals, coffee breaks, or receptions, participants tended to share more freely with each other, proving the seminar itself to be an exercise in creativity.

For **Kevin “KAL” Kallaugher**, the editorial cartoonist for *The Economist* and *The Baltimore Sun*, formality means temptation. In his career, KAL has drawn over eight thousand cartoons, knocking the powerful down a notch, making us not just laugh, but think. Unfortunately, according to KAL, the number of political cartoonists has shrunk from 200 to 70 in recent years, due to the Digital Revolution. Yet the whole world seems to love cartoons, and every child is a cartoonist. “Drawing is etched in our DNA,” said KAL. For most kids, the greatest exhibition is on the family refrigerator. Amongst the great successes

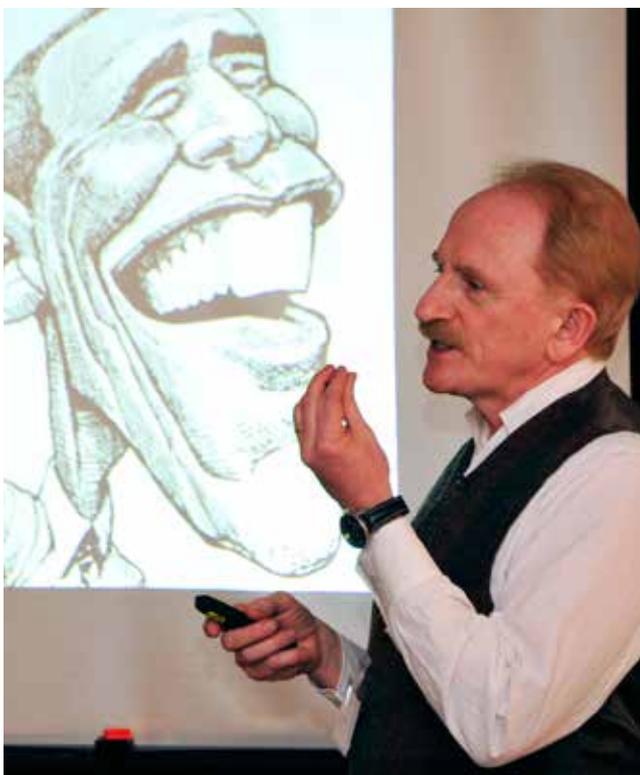
of his career, KAL can now include projecting a drawing, which he made at age six, in the state room of an Austrian palace. KAL spoke about the improvisational nature of caricature, which must change a pattern but still be recognizable. In a good caricature, we always know who it is in the picture. KAL quoted the Renaissance artist Annibale Carracci, who said that “caricature is more real” than any other drawing. When you are in “the zone,” according to KAL, the drawings just appear. (Not the case, perhaps, for the many Salzburg Global Fellows who eagerly joined in his exercise of recreating his standard caricature of current US President Barack Obama, many rediscovering cartoon drawing for the first time since their childhoods.) His content ideas come from knowledge about current events, but his special talent is to conceive of and refine his sketches against a deadline and for an audience of millions. It is important to know your audience, he said, because creativity is a conversation. Later in the session, in that same room, KAL sat at a table for several hours, underneath oval portraits of aristocrats, shading in a drawing about free speech, facing down a midnight deadline, barely looking at his hand as he answered questions from the small crowd of participants that had gathered to watch creativity at work.

*“By talking to [artists], I got a better understanding of what they are thinking when they are engaged in the creative activities, which is extremely helpful for me to explain our neuroimaging findings.”*

Siyuan Liu



Salzburg Global Fellows and Staff attempt to recreate KAL's caricature of US President Obama



“The session was both, a wonderful experience as well as a thought-provoking exchange.

The key component that made it so was the interdisciplinary nature of the session. Bringing together artists and scientists, particularly neuroscientists, allows each to step outside of their own normal intellectual culture and consider questions and perspectives that they otherwise wouldn't.

[Personally, what I took away from this session is] first and foremost, perhaps, the awareness of how creativity manifests itself in other domains. This surely will lead me to consider and think about different brain mechanisms that I did not have on my radar screen thus far.

Another key benefit for me is the collaboration I will start with two other attendees of the Session. This would surely not have happened otherwise.”

Arne Deitrich

## Creativity and Innovation: *What Are They and Where Do They Come From?*

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**Julia Burstein**

Author of “Spark: How Creativity Works” and host of Spark Talks at The Metropolitan Museum of Art, New York, NY, USA

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**Arne Dietrich**

Professor of Psychology, American University of Beirut, Beirut, Lebanon

Artists and scientists do not always speak the same language, and the two presenters during the second plenary discussion seemed to typify this difference in vocabulary. **Julie Burstein**, the Peabody Award-winning radio producer, TED speaker, and best-selling author of *Spark: How Creativity Works*, spoke about “duende”, the elusive element of creativity. Duende is an untranslatable Spanish word, meaning some combination of ghost, evil spirit, inspiration, music, and fire. Duende is the deep passion that inspires and guides us. As the poet Federico García Lorca wrote, “the duende loves the edge, the wound, and draws close to places where forms fuse in a yearning beyond visible expression.” Although the language sounds mystical, Burstein has the most practical method. She simply listens to people,



Arne Dietrich (r) with Julie Burstein

because she believes that listening is the seed of creativity. She opens herself up and invites people to tell their stories to her, and she asks difficult questions. For example, Burstein played a podcast clip of the neuroscientist Brenda Milner, speaking about her experience with the famous amnesiac patient H.M. The duende was not in the experimental results, nor in the radio production. The duende was in the telling of the story, the special transmission of electricity between individuals, as within the brain. During personal conversations, walking around the lake, and as a smaller group facilitator, Burstein showed herself to be practitioner of her own preaching.

For more than a decade, **Arne Dietrich**, a psychology professor at American University of Beirut, has worked to demolish existing ideas about creativity. According to Dietrich, we still have no understanding of how the brain generates new ideas, despite a tidal wave of neuroscientific research. Nevertheless, he loves to study creativity, which might be the most distinctive feature of the human species. Dietrich is calling for a new start in the search for creativity, and he is hunting for mechanisms – as opposed to locations – in the brain. He criticized recent fMRI results, arguing that scientists have confused location for mechanism, which he compared to phrenology. He suspects that creativity is a distributed network, throughout different areas of the brain – a sort of “brain vaudeville” with screens happening at many locations at the same time. Furthermore, there is no real demarcation between creativity and non-creativity, which prevents there from being a true experimental control group. For a neurocognitive framework, Dietrich offered a distinction between two systems in the brain: the explicit and implicit. In his opinion, the implicit system, unconscious, experiential, and “not verbalizable,” is responsible for what is called the “flow state”, colloquially known as “the zone.” He laid out theory of transient hypofrontality, meaning the lessening of activity in the explicit system, which associated with higher cognitive functions.

As Dietrich explained in an interview on SalzburgGlobal.org: “The explicit system is very complex and depends largely, but not exclusively, on frontal cortical activation... It is primarily the source of our cognitive flexibility, abstract thinking and higher cognitive functions. But it has one large drawback, and that is the drawback that all complex machines have – complexity makes a machine slow.



*“The session gave me the opportunity to interact with a large number of artists (and neuroscientists) working in very different domains and stimulated vivid discussions. These interdisciplinary interactions, although getting me sometimes out of my comfort zone, provided me with many novel insights on the process of creativity from an artist’s point of view. These insights are essential to my research aiming for a deeper understanding of creative thought.”*

Mathias Benedek



Lydia Courtney

1. Arne Dietrich speaks from the podium in Parker Hall

2. Julie Burstein

3. Pieter Broucke and Arne Dietrich

“So we have also another system that has a completely different architecture. It is built for speed and efficiency, and the only way you can have speed and efficiency, when you’re very quick with sensory input and motor output, is when you automatize very quick movements. These systems need to be built in a simple, computational form, and that is what the implicit system does.”

To promote creativity, Dietrich suggested running, sleeping, and sex – although presumably not at the same time.



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## The Improvisational Moment

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**Mike Pope**

*Bassist & Composer, Baltimore, MD, USA*

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**Dominic “Shodekeh” Talifero**

*Beatboxer & Vocal Percussionist, Baltimore, MD, United States*

“There is no way that neuroscience can trace everything that is happening during a genius performance,” co-chair Charles Limb admitted, to open the next presentations. In a video, projected behind him, the legendary jazz artist Keith Jarrett improvised an entire concert at the piano, his body electric with rapturous spasms. **Mike Pope**, the world-class bassist, is one of the few people on earth actually capable of such a performance in jazz. He has traveled around the world for many years, playing with some of the top musicians. Pope revealed that there is still thinking while he is improvising, but his thoughts are only on his goals. He listens to what is happening around him but tries not to label anything with words. For Pope, the role of the conscious mind is to lead his movements, nothing more. He spoke admiringly of renowned fiddler and guitarist Arnold Schultz, who describes the conscious mind as the conductor and the motor nervous system as the orchestra in his book *The Riddle of the Pianist’s Finger* (1949). Pope teaches not by telling, but by helping to learn. Performing the task, the student will remember the sensation. There is no need to analyze. More practice leads to better coordination, as motor learning develops in the brain. Years ago, playing standard tunes at a wedding, Pope took a phone call during the set. Seeing this, his band mates tried to screw him up, changing chords on the fly, but he found that he could nonetheless follow along, unconsciously. Although artists do not need scientists, science could provide an explanation for this.

**Dominic “Shodekeh” Talifero**, a professional beatboxer and vocal percussionist, introduced himself through his vocal chords, not only with their speech and sound, but also with intimate images of his larynx, contracting and expanding while he performed. Apparently, even the otolaryngologists who imaged him had never seen anything so amazing. This is the way audiences often feel when listening to him beatbox. Shodekeh can imitate a drum kit with his mouth, often producing more than one rhythmic element at time. A legend in his

*“I am grateful for having been invited to the Salzburg Global Seminar program since it affected me in various kinds of ways. I dealt with issues I did not even know they would exist. And I met wonderful people. Mostly it helped me to discover that it is worth to leave the common path and being not judgmental concerning the unusual and new.”*



Kai Klepzig



Jennifer Crouch

*“Organizing a dinner time Wine Glass Orchestra of all the panelists, scientists & artists at the session led by myself, a crafts artist, a composer, and a neuroscientist: pure magic and pure science.”*

Shodekeh

Mike Pope (l) and Shodekeh (r) improvise together during their panel, with Shodekeh using wine glasses filled with water for additional accompaniment

hometown of Baltimore, he has collaborated with artists, musicians, and orchestras around the world. After all these years, Shodekeh says that he still needs butterflies in order to improvise. During his performance, he never stops moving, his hands stirring invisible records, his body dropping with every downbeat. Shodekeh spoke about diversity of responses to his work, the fact that every audience member will hear sound differently. He stressed the importance of social and historical context in order to understand the “young language” of beatboxing. He will collaborate with anyone anywhere. On the final night of the session, participants heard a classical recital by a Romanian piano prodigy currently studying at the conservatoire in Salzburg, who finished the set with three preludes by George Gershwin, featuring surprise special guest Shodekeh on vocal percussion, followed by a spirited embrace between the two.





Fellows continue discussions during a coffee break

## The Written Word

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### Aryeh Stollman

*Writer & Assistant Clinical Professor Radiology, Mount Sinai Hospital, New York, NY, USA*

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### Pireeni Sundaralingam

*Poet, Cognitive Scientist, and Playwright; Associate Professor, Department of Writing, Consciousness & Creative Inquiry, California Institute of Integral Studies, San Francisco, CA, USA*

Early in his career, neuroradiologist **Aryeh Stollman** figured out that if he took the shifts that no one else at the hospital wanted, on the weekends, when things were especially busy and he was the only one working, then he could spend the rest of the week writing. “Images of the brain can be deceiving,” said Stollman, who enjoys reading brain scans, and whose award-winning fiction readers love. He reminded the audience that, although the brain may represent the outside world, what is encoded is never the thing itself. This internal representation, which we experience, is necessarily different and new. Stollman sees no way to bridge the internal and external worlds, but that this is the reason for creativity. His creative expression comes through language, another means of encoding reality. Words are a special code, ordered into a narrative, alive only in the mind, in consciousness, but imbued with this power of creation. Between the writer and the reader, there is a continuum of awareness, a bridge between worlds, and something of the infinite. The very act



“As a young writer, I cherished being able to watch and learn from other creative people, to whom I would have never otherwise had access. I know that this has been one of the most important times of my life, and I am sure that this will help me with my work. I think that Salzburg Global is a model for intellectual collaboration, and many of us will try to recreate the atmosphere at home.”

Ben Ehrlich

*“The session was an amazing and in many ways an unprecedented gathering of scientists, educators, writers, musicians, media, and artists. This type of meeting, of course, is only a beginning for what I strongly believe will be a fruitful and essential-for-our-times interdisciplinary conversation. What may come from it is to some extent unpredictable at this point, but that has always been true with the pursuit of great science and great art, and certainly will be true when they are combined.”*

Aryeh Stollman

of writing, he believes, can unite the internal and the external, our individual brain with the universal brain. “Imagination is the primary talent of human mind,” Stollman said, as he revealed an interest in what persists, even beyond the letters.

For **Pireeni Sundaralingam**, poetry means resistance to familiar modes, a new way of seeing the world. A poet and cognitive scientist, Sundaralingam quoted Paul Valery, who said, “a poem is really a kind of machine.” Sundaralingam described the mechanics of poetry in scientific terms, namely the aim to produce “a bottom-up response” for a reader, undermining the conventional distinctions of everyday language. Rather than naming and labeling, poetry challenges our attention with words that make the familiar unfamiliar. This disruption of meaning helps us to see the unexpected in the world, introducing ambiguity into our cognitive process. She cited a paper by the cognitive psychologist Tony McCaffrey called “Innovation Relies on the Obscure,” (2012) which demonstrates that noticing obscure features of objects helps people to solve problems. Sundaralingam sees this multiplicity of cognitive solutions as the essence of creativity. In her own work, she will sometimes experiment with formal constraints, such as the sestina, a complex and intricate form of repetition. She read a poem that spoke of her experience in Sri Lanka as a child, where the military detained her family, and she was unsure if her father were alive or dead. Her creativity became an act of resilience, with the poem as a means of communication.



Aryeh Stollman (l) and Pireeni Sundaralingam (r)

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# Approaches to Research on Creativity

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**Patricia Leavy** *Author, Sociologist and Arts-Based Researcher,  
Kennebunk, MA, USA*

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**Sophie Scott** *Deputy Director, Institute of Cognitive Neuroscience, University  
College London, London, UK*

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**James Murray-White** *Filmmaker, Cambridge, UK*

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Artists and scientists both would like their work to reach an audience. Unfortunately, as the sociologist **Patricia Leavy** lamented, almost no one reads academic papers, including her own, and most of them are unintelligible. There were interdisciplinary murmurs throughout the room as Leavy presented the arts as a more effective means of communication, triggering emotional responses and naturally helping us learn. After interviewing women about their lives, for research, Leavy wondered how to best package her findings. She started writing a novel, which became *Low Fat Love* (2012), the first in a series by sociologists. Leavy, the author of sixteen books, sees literature as sociological documentation, and the novels are based on different forms of research. For Leavy, fiction is another methodological tool for the sociologist, demanding conceptual, symbolic, and thematic thinking. Her creative writing is now taught in classrooms. She suggested that neuroscientists ask artists to represent neuroscientific data through their own media.

**Sophie Scott**, cognitive neuroscientist and stand-up comic, engaged her audiences with humor. Scott studies speech in the brain at University College London. According to Scott, the social value of speech can be unconscious. “When we speak together, we breathe together,” she said. She shared the results from her study of professional impressionists, who emphasized the importance of physical gestures and facial features as their creative cues. Normally, there is no proprioceptive activity in the brain of a speaker, no need for a sense of body position. Yet Scott found that in professional impressionists, as suggested by their reports, proprioception areas of the brain showed more activity. In amateur impressionists, the speech production areas of the brain are more activated, because we are trying to mimic sounds, consciously changing voices to match the delivery of different people. For the experts, body movements drove their speech, and they did not need as much activation in their speech



Sophie Scott

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*“As a young researcher getting started in the fields of music cognition and neuroscience, participating in Session 547 was an invaluable experience.*

*I am hoping to continue my current line of research with a more critical eye towards the broader social impacts of my work. I am also hoping to expand my current outreach and education activities, and after attending the session, I have many more ideas and resources to help me accomplish that goal. ”*

Malinda McPherson

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*“Being here is a career-defining moment, and those walking with me, artists, scientists, and educators, all agreed enthusiastically. Being with a group of new friends and colleagues at the Schloss in such a setting has been that exceptional moment – when a group comes together to focus in and shape together a new way forward within an emergent discipline. For me, the time away from my life and work in such a stimulating retreat... has been exceptional and crucial to my health and interaction with the world.”*

James Murray-White

areas. Their brains incorporated more information from a different area of the brain. Both her formal and informal presentations, a neuroscience talk and a stand-up routine, had participants listening, breathing, and laughing together.

**James Murray-White** has made crossing distances his career. As an environmental journalist, he has lived with nomads in Mongolia, the Bedouins in the Negev desert, and the Nunavut in Northern Canada. When his mother was diagnosed with dementia, he started filming their life together, trying to link the present with her past. The resulting documentary, *Keeping Mum* (2012), has made Murray-White a spokesperson for the disease in Britain, and he is now the filmmaker-in-residence within the Alzheimer’s Research Network of Dementia Research. He sees the arts as important for social change, especially in medical science. For his new film project, *MEG and Me*, Murray-White teamed up with Cambridge neuroscientists to help explain how new brain scanning technique, called magnetoencephalography (MEG), can record activity throughout the whole brain. After screening a short introduction, he joked about meeting his neuroscience collaborators at a pub. Although the researchers are clearly speaking a different language, Murray-White says that he loves them very much. Each of the speakers has found creative ways of reaching out to promote their work.



James Murray-White (l) and Patricia Leavy (r)



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## Musings on Music

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**Bruce Adolphe**

*Resident Lecturer & Director of Family Concerts, The Chamber Music Society of Lincoln Center, New York, NY; Composer-in-Residence, The Brain and Creativity Institute, University of Southern California, Los Angeles, CA, USA*

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**Ben Folds**

*Singer-Songwriter, Los Angeles, CA, USA*

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**Ian Cross**

*Professor of Music & Science, Fellow, Wolfson College, Cambridge University, Cambridge, UK*

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**Nigel Osborne**

*Emeritus Professor of Music, University of Edinburgh; Co-Chair of the World Economic Forum on Culture, UK*

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Bruce Adolphe serves as the composer-in-residence at the Brain and Creativity Institute at USC, where neuroscience laboratories and a classical auditorium literally share a wall. Adolphe has written a composition called *Self Comes to Mind*, based on a text by neuroscientist Antonio Damasio, and he has structured another work called *Musics of Memory* to reflect the way memory works in the brain. During his presentation, Adolphe played sections from the upcoming film *Einstein and Light*, featuring his score for piano and violin. The project is a part of the United Nations “International Year of Light,” celebrating the centennial of general relativity. Einstein is a great example of creative interactions between art and science. “Music is the driving force behind my science,” Einstein said. He is known as one of the most intuitive scientists, exploring the universe through his famous gedankenexperiments, or thought experiments. Adolphe, who is also a music scholar, explained how vitally important playing the violin was to Einstein, enhancing his cognition and relieving his exhaustion. If Einstein played music for a rest, but Adolphe is busy working with music for a living, does Adolphe do physics in his sleep?

**Ben Folds** wanted to know if neuroscience could offer him help in writing a song, although everyone knows that he needs none. The multiplatinum recording artist, who still plays solo rock shows on the piano, has a habit of freestyling songs. Musicians ask him where he comes up with his ideas. Folds has found that his second verse is usually more creative than his first. He also believes that those thoughts we are not supposed to have are the ones that inspire good melodies. For Folds, melodies have personalities. Later that



“The like-minded people I met are going to be partners in the future. We have some very definite goals, as well as some open areas for exploration. One of the scientists has agreed to verify the non-musical aspects of my programs. We were an extremely varied group, and yet I think every person was able to express something personal that furthered our mutual understanding and knowledge.”

Joan Koenig

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“This unique venture is one of the finest experiences one can hope to have in the sphere of intellectual, artistic, and social research. I would be back in a heartbeat.”

Bruce Adolphe

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*“As someone who regularly creates a song on stage, and dictates orchestration to symphony orchestras in real time, I am particularly interested in findings on improvisation in music, as so is my audience. I anticipate collaborations with other attendees. Sometimes curiosity and interest lead where you don’t expect and I always intend to follow my heart – this conference helped confirm I’m headed in the right direction. I look forward to seeing where it takes me.”*

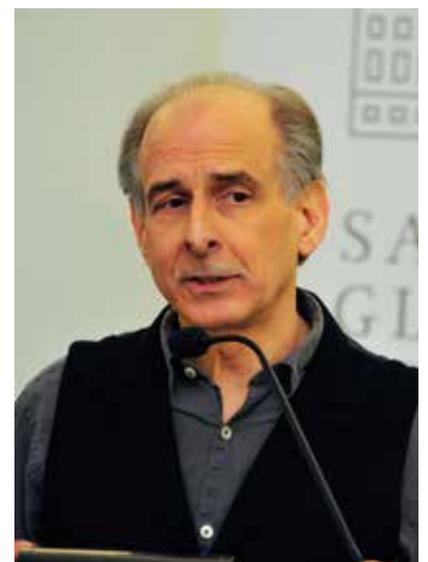
Ben Folds

night, there was an informal performance in the Great Hall, during which some participants sang songs, imagining themselves to be the voices of neurotransmitters. Folds then created a song on the spot, describing his recent late arrival to the seminar and his unfortunate but forced neglect for his own personal hygiene, with a chorus reflecting his surprise at finding himself at that very moment in a palace, all infused with rock ‘n’ roll enthusiasm. There was an abundance of swear words and serotonin in every synapse.

**Ian Cross**, the University of Cambridge musicologist, asked why scientists have gravitated towards music. Perhaps this is because music is a complex phenomenon with universal connections, and perhaps this is because music is fun. Nevertheless, Cross cautioned that no study of music should exist without historical and social context, echoing a refrain from earlier in the session. Most musicologists cannot help but be W.E.I.R.D.; that is to say, White, Educated, Industrialized, Rich, and Democratic. Music is a product of behavior, and behavior depends on factors such as these, some of which are neither scientific nor implicit for the observer. Cross showed a clip of a communal vocal and drumming performance, in which the audience members participate as well. While some musical trends disappear and reemerge, the underlying importance of social function, play, and social consequences seem present throughout music history. This is what is gained from music. There has been much debate in recent years about the adaptive value of the arts – if



Ben Folds



Bruce Adolphes

art is necessary for evolutionary survival or simply an accidental byproduct of other more essential processes. “What does not look survival-oriented,” Cross said, referring to music or art, “is probably the most deeply so.”

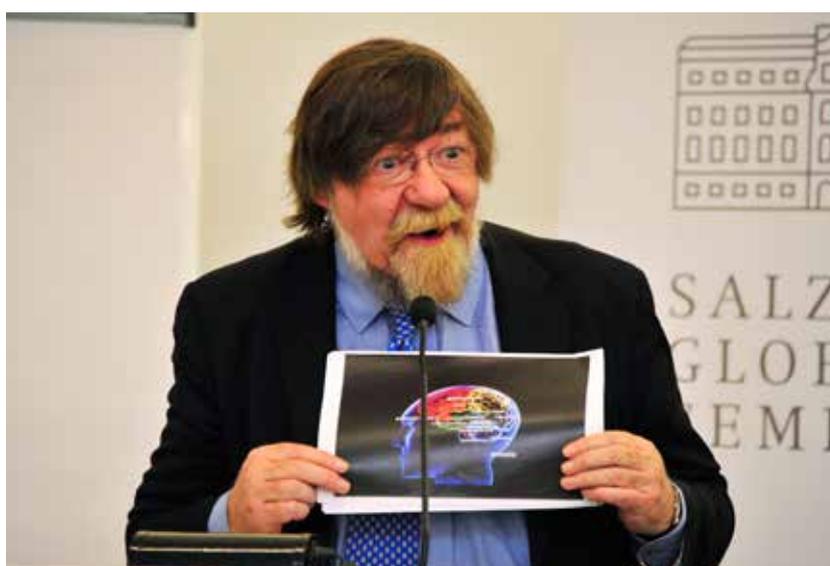
**Nigel Osborne** will tell you that, despite the darkness of the world, optimism is the only choice. His voice would be destined for a performance as King Lear, if Lear had somehow come to his senses, realized his duties as a king, and spent his life traveling throughout the kingdom, trying to heal the suffering of his subjects. An emeritus professor at University of Edinburgh and classically trained composer, Osborne is focused on the humanitarian aspects of music. His work with music therapy has taken him all around the world, to wherever there is grave need, including post-war Bosnia, East Africa, and India. For Osborne, music is a metaphor for the whole of our evolution, which creates new structures from what exists. With his knowledge of neuroscience, Osborne led the audience through the processing of music in the brain, which is surprisingly distributed. For example, there is a lot of meaning with sound even in the brain stem, considered to be the most primitive area of the brain. Within 300 milliseconds, people can unconsciously categorize a song. Maternal sounds are universal, and there is music everywhere in the world. “There are verbal islands of hate, loneliness, and regret,” Osborne said, “but music is the ocean in between.”

*“I learnt a lot, including a number of things I shall be putting into practice in my work in education and with conflict-traumatised children around the world. Just as stimulating as the presentations were the casual conversations. Several potentially important collaborations have been planned for the future based on these conversations.”*

Nigel Osbourne



Ian Cross



Nigel Osbourne



“It was great to convene with writers, musicians, artists, journalists coming from all over the world. I really loved the different perspectives, the different ways to approach questions...

I already proposed this in a book for [second language learners] in 1998. However, at that time, I had no arguments to support my point.

Now, considering the fact that language and music are served by the same neural substrate, this makes sense and this idea gets relevance. ”

Manuela Macedonia



Felicia Lercari

## Implications for Early Childhood Development, Education, Public Understanding, and Research

**Usha Goswami**

*Professor of Cognitive Developmental Neuroscience; Director, Centre for Neuroscience in Education, and Fellow, St. John's College, Cambridge, UK*

**Mariale Hardiman**

*Vice Dean, Academic Affairs; Professor of Education; Director, Neuro-Education Initiative, Johns Hopkins University School of Education, Baltimore, MD, USA*

**Soo-Siang Lim**

*Director, Science of Learning Centers Program, National Science Foundation, Washington, DC, USA*

As the director of the Centre for Neuroscience in Education at Cambridge University, **Usha Goswami** participated in the UK Government Foresight Project on “Mental Capital and Well-Being.” She studies the phenomenon of creativity from early infancy, as a building block for cognitive systems. In her opinion, neuroscience “should not get too hung up on the frontal cortex, because this leaves out all the body can do.” Goswami and others have shown that babies are extraordinarily creative, in ways that we may take for granted. For example, children can match descending tones with “down” rather than “up” arrows, suggesting an implicit understanding of analogy. Metaphor represents a communicable set of relations, but this communication is not always verbal. The structure of syllables and the



Usha Goswami

rhythm of speech also contribute to our processing of the information. As adults, we still have these non-verbal learning systems, which is why Goswami wants to acknowledge earlier expressions of creativity. This may be behind the famous quote by Pablo Picasso, who said that it took him a lifetime to paint like a child. For education, researchers can recommend learning environments with projects that have no right answer, but rather multiple possible solutions.

With many artists in the room, **Mariale Hardiman** bravely admitted that as a middle-school principal she had once cut the arts in one of her schools. The school was failing and losing money, but after the school rebounded, she reinstated the arts. She realized that she could barely recognize education without the arts. Hardiman, co-founder of the Neuro-Education Initiative (NEI) at The John Hopkins University, wants to know how to encourage pedagogy that supports creative and innovative thinking. In other words, she is interested in research that can support practice. For Hardiman, creativity is innovative thinking, collaborative learning, and problem-solving, values at odds with the American education system, which relies on testing metrics. Like Patricia Leavy, she sees the arts as another way to express or demonstrate knowledge. And, the arts help us remember content in the future. In her experience, of more than 30 years in the Baltimore City Public Schools, schools should not only have an arts program, but the arts should also be integrated and embedded throughout the curriculum. Tests taken by middle school students after following either an arts-integrated or an equally active yet non-arts-led life sciences course found that those students who had undertaken the arts-



Mariale Hardiman

*“Having the opportunity to dialogue, interact, and share ideas with some of the world’s most talented scientists and artists was an experience of a lifetime.*

*Interacting with fellow participants was as thrilling as the surroundings. Throughout the five days, I experienced an authentic generosity in the exchange of ideas, an eagerness to learn from others, and a clear respect for the commonalities and differences of the diverse fields represented among participants.*

*I am happy that I found collaborators among the group interested in my work on the effects of arts integration on memory for content and creative problem-solving for school-aged children. A small group of us are planning to further explore collaborations with this research in the fall at Johns Hopkins University in Baltimore, MD. ”*

Mariale Hardiman



*“Listening to the talks of the many artists attending the meeting, I have got new insight into their perspective that might help to set up experiments and grasp important aspects of creativity. Since I attended a workshop that considered the integration of neuroscience and the arts in current educational strategies, I have developed ideas on how this might have implications for my direct environment, e.g. the school my own children attend. I have also envisaged proposing a new framework programme to the German Federal Ministry of Education and Research that would comprise the investigation of how learning through the arts could enhance performance.”*

Nicola Neumann



Soo-Siang Lim

integrated life sciences class scored more highly, particularly in later tests, indicating that arts-integrated education can improve knowledge retention, especially among poorer learners. Hardiman showed pictures of her students making physical movements to illustrate the chemical molecules of water in different material states. Smiling and holding hands, even the toughest boys in the class eventually became liquid.

As a program director at the National Science Foundation (NSF) in Washington, DC, **Soo-Siang Lim** started the Science of Learning Centers, which awards grants to artists and scientists working together. Her presentation, “The Science of Learning Through the Arts,” reviewed programs funded by the US government in the past. For example, there was a project called “Musical training changes sound processing in the brain,” with an interdisciplinary team, which proved that non-musicians detect less speech than musicians. In another project, another interdisciplinary team investigated how rhythm affects learning, eventually correlating attention problems in children with poor timing in music. Although the NSF does not fund the arts, artists and arts-initiative receive attention through a Federal Interagency Task Force on the Arts and Human Development, of which Lim is a member. For Lim, curiosity is an important value, and she herself would be interested to know if art develops social skills, such as what Hardiman’s picture suggested. Clare Shine, Vice President and Chief Program Officer of Salzburg Global, chimed in with the idea that these practical applications of arts-based scientific research might provide a platform for educational development to countries around the world.

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## Visual Arts and Neuroscience Intersections

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<b>Mark Boulos</b>	<i>Artist, Filmmaker, Geneva, Switzerland</i>
<b>Daniel Glaser</b>	<i>Director, Science Gallery, King's College, London, UK</i>
<b>Noah Hutton</b>	<i>Filmmaker, New York, NY, USA</i>
<b>Rebecca Kamen</b>	<i>Artist, Professor Emeritus, Northern Virginia Community College, McLean, VA, USA</i>

**Mark Boulos** is an artist-in-residence at the Agalma Foundation in Geneva, Switzerland, which promotes dialogue between neuroscience and psychoanalysis. His work has appeared at prestigious museums and festivals around the world. During his presentation, he screened *Echo*, a six-minute video installation inspired by the research of the neuroscientist Olaf Blanke, who studies out-of-body experiences. Boulos sought to create a video-induced out-of-body experience, a metaphysical disturbance of identification, perpetual misrepresentation. Boulos has found that artists are always dealing with their own images, and he translated a neuroscientific idea about the self into artwork. However, Boulos is inspired by many sources. He also showed an installation called *All That Is Solid Melts Into Air* (2008), with two large-screen videos on either side of the viewer, each presenting a community at the opposite end of the world of the oil industry: businessmen at the Chicago Mercantile Exchange on the day of the credit crisis and rebel Nigerian fishermen who fight to control a major oil field. Boulos believes that neuroscience and art can become part of a mutual palette, but that neither one should instrumentalize the other.

**Rebecca Kamen** wears a watch with a picture of a neuron on the face, which is to say that she embodies the creative relationship between art and science. Her artwork has come from numerous collaborations with scientists at different institutions, such as the neuroscience program at the National Institute of Health, where she is the artist-in-residence. Following her intuition and curiosity, she seeks to reflect the forms and patterns inherent to the universe,

“It was an exceptional experience - beautifully curated, with a fantastic mix of people in terms of approaches, backgrounds and personalities.

[The time] I was able to be at Session 547 was illuminating, diverse and inspiring – the very best Salzburg Global Seminar experience.

There was so much rich food for thought and such an extraordinary mix of people in terms of approaches, backgrounds and personalities. I know that the ripple effects of this experience will continue for years to come as well as continued connections to make new things happen with many of the people there. ”

Ariane Koek

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Diego Malpede

*“My time at the session was equal parts instructive, invigorating, and inspirational.*

*Instructive because I was surrounded by thought leaders across disciplines who shared their latest and greatest ideas without hesitation, and offered constructive criticism in a safe environment; invigorating because it pushed me to develop my own thinking and take it to the next level in a supportive and receptive atmosphere, where I felt I could take chances; and inspirational because I left Salzburg wanting to pursue new collaborations and grow the seeds that were planted in the Seminar sessions. ”*

Noah Hutton

including the Fibonacci spiral, the periodic table, and black holes. The work of Santiago Ramón y Cajal, the father of neuroanatomy, has been especially influential to her, as has that of the biologist Ernst Haeckel. Both investigators produced a store of incredible images, drawn directly from nature. An emeritus professor at Northern Virginia Community College, Kamen also investigates how the arts and creativity can be used to enhance our understanding of science. She speaks openly about her dyslexia, which she believes prevented her from being a scientist, which was her childhood dream. Instead, she came to see the world in a different way, and she developed techniques for translating her vision into sculpture. Rebecca Kamen is a walking example of how science can inspire art.

Award-winning filmmaker **Noah Hutton** is the founder of *The Beautiful Brain*, an online magazine dedicated to art and neuroscience. He has been active in the field of neuroaesthetics, speaking at a Venice Biennale symposium and curating an exhibition at the Human Brain Mapping Conference. Last year, Hutton won a commission from the Times Square Art Alliance for a creative project involving brain images. For the month of November, every night at midnight, many advertising screens around one of the busiest places in the world showed a video of virtual brain maps, created by four leading international research teams. Hutton sees a mimetic relationship between the brain and the external world, but he has noticed that art is not really represented in neuroaesthetics books, which seem to cite artworks only as the means to an end, explaining brain processing. Hutton called for a bold new theoretical approach, which he called “the Apollo 13 Theory,” after the 1995 American docudrama starring Tom Hanks, Bill Paxton, Kevin Bacon, Gary Sinise, and Ed Harris, directed by Ron Howard. The Apollo 13 Theory encourages intellectual travelers to fuel up on art, gathering aesthetic and visual examples, heading toward the moon of the brain to learn about neuroscience mechanisms, but sling-shotting around the moon, ending up back home in art, only now with the knowledge from the journey. Neuroscience is not necessarily the end domain; artistic creation can be the mission control as well.

**Daniel Glaser** was the first scientist-in-residence at an arts organization, and he now runs the new Science Gallery in London, aimed at ages 15 to 25. Glaser spoke passionately about social injustice, including the fact that people are being alienated from art

and science. He wants to see true interdisciplinarity: people coming from all disciplines and contexts. Glaser has worked with drug users and pushers and other disenfranchised people, and he likes to petition the audience, who he said are his real curators. The role of curators like him is to provide some kind of membrane, but also to encourage permeability. Glaser sees a need for facilitation between artists and scientists, but the truth is that all questions are not equal and open to everybody. Nevertheless, he sees a need for public interrogation, to keep the process honest. Glaser believes that we need to understand culture in order to understand the brain, but that neuroscience can certainly be another lens for art. Glaser happened to lead a focus group at Salzburg, and before the presentations, he approached a participant who was preparing the slides, crouched down to her seated level, and asked if she was happy. Throughout the session, this kind of personal quality proved just as important for successful partnership as seemingly any other resource.



Micheal Oellinger

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1. Rebecaa Kamen

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2. Mark Boulos

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3. Noah Hutton

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4. Daniel Glaser

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*“I wasn’t sure quite what to expect. Certainly, some academic discussion and artists perspectives on what neuroscience might have to contribute to art. However, in practice discussions were far more wide-ranging than I expected and took many different forms including performance, which really helped to illustrate much of what was discussed.*

*The most important outcome for me at this point is a shift in perspectives, a better understanding of what I have to contribute on this issue, a valuable groups of contacts and plenty of opportunities to collaborate on the many issues identified going forward. ”*

Paul Sowden

## Discussion Group Reports

During the first three days of the session, outside of the plenary discussions, participants met in smaller groups, which were led by a facilitator. The format was conversational, sometimes exploratory, heated in moments, with people often sharing their own stories. As a counterweight to formal presentations, these meetings, staged in different rooms throughout the Schloss, allowed for more personal interactions. Later, these discussion groups reported back to the session as a whole, revealing what came of their time together.

The first group, led by **Paul Sowden**, director of ILLUME: The Faculty Creativity Research Centre and leader of the Enhancing Thinking Research Group at the University of Surrey, noticed a trend of convergence between art and science. Citing C.P. Snow’s influential 1949 lecture *The Two Cultures*, the group acknowledged that there are different paths for the two in our society, and that we need to build bridges earlier in the educational process, long before graduate school.

The second group, led by **Anna Abraham**, who researches the neurocognition of imagination as a reader in psychology at Leeds Beckett University, talked about language issues, the lack of common vocabulary for these two cultures. The group also noted that there are good and bad collaborations, not all are necessarily productive. Although the group disagreed about how to study creativity, the participants seemed to agree that a focus on social function and personal wellbeing should drive our efforts.

The third group, led by **Wendy Sternberg**, Founder and Executive Director of the Genesis at the Crossroads school, homed in on how to



Fellows' ideas gather on a notice board in one of the Seminar Rooms of Schloss Leopoldskron

improve communication between neuroscientists and artists, despite some inherent challenges. There is a need for a certain context in order to form interdisciplinary relationships, and the group had the idea for “Collaboratium,” a space that would be part-co-working space and part-laboratory that would encourage this atmosphere.

The final group, led by **Julie Burstein**, stressed our social responsibility as leaders, in whatever field. Not only is there a separation of ideas amongst intellectual disciplines, but there is also a separation between those privileged with knowledge and those who are not. Their group felt that we have a responsibility to our culture, to inform the powers of the world of our work and findings, about the brain, the arts, and education, in order to try to bring about a better world.



Wendy Sternberg



Anna Abraham



*“My participation in the session is having, has already had, and will continue to have major effects on my work, and those with whom I collaborate. I had a meeting this morning [at my university] at which I shared two specific ideas that had arisen at Salzburg. These both concretely support interdisciplinary collaboration. So within less than 24 hours of my return from Salzburg two of the ideas from the Seminar have been adopted (with enthusiasm) on my campus. ”*

Rick Kemp



Jighuan Zhang

## Focus Group Reports

For the final days of the session, participants signed up for four different focus groups, each challenged with a question. After two days of intensive meetings, the groups reported back to the group with concrete recommendations and practical applications.

### *How can scientists and artists learn from each other and provide concrete information?*

The first group provided a values statement, “seeking to advance inspiration through a common mode of inquiry between distinct perspectives.” Their “Methods Manifesto,” outlined some different models for collaboration and called for a central database for relevant funding sources, which interested parties could consult. Because physical locations are important for collaboration, the group proposed the foundation of “Imagination Hubs,” open-ended spaces where artists and scientists could come together. Like Salzburg Global Seminar, these are meant to be incubators, replications of the seminar at home. The group also recommended that universities create initiatives for interdisciplinary ideas, similar to the new task force at the National Science Foundation. Lastly, they suggested a publication for art and science, which would be online and open access. Neuroscience and art collaborations should not just be about pure knowledge, the group reminded, but also social benefit.

### *What is the role of art and neuroscience in education?*

The second group spoke of a “context of relatedness,” and focused on community creation within the context of educational practices and policies. They considered how the arts should play a role in student engagement and learning in several ways, including how arts



Focus group on “Bridging theory and practice” meets in the Max Reinhardt Library

education and the notion of “arts for arts’ sake” are important for a holistic learning environment. Moreover, how does arts integration (the arts as a teaching tool in non-arts subjects) enhance instruction? They explored how educational policies drive how schools approach arts instruction. They posited that student testing should be multi-modal and multi-disciplinary, so that there is a positive outcome for kids. Based on recent research findings from Hardiman’s Johns Hopkins University research team, the group explored how teachers should guide exploration, encouraging creativity and humanity. There are some lingering research questions: Does learning with and through the arts enhance learning? Is arts integration domain-specific or domain-general? Does it only help within the arts, or does it translate more broadly to other areas of cognition and learning? How do arts education and arts integration promote creative thinking and problem solving? This group recommended robust testing at scale for arts integration, so that funders and policy makers will have evidence of its efficacy for cognition and learning. In education, it is important to know not only when to intervene but how. The group sees arts education and arts integration as the way towards sustainable imagination, which combines Salzburg Global’s mission and programmatic areas.



*“My time at the seminar was an extraordinary intellectual intervention for me, revealing a world, in neuroscience, that I had yet to fully grasp the ramifications of, as it relates to my art practice and my understanding of myself as a human animal.*

*These moments of clarity were enabled by the unique hospitality the team, and the environment, provided us as a disparate group of people, soon turned into a team of sorts, certainly working towards one goal. Moreover, the experience allowed me to refine and define my own terms in aesthetics, to sure up arguments I had long been making and develop this understanding in an environment of supportive, but necessarily challenging exchanges. ”*

Steven J. Fowler



Julie Burstein facilitates a discussion group in the Chinese Room

*“The most important outcome is my changed worldview when it comes to creativity, the brain, and art.”*

Phil Yao

*“Spending five days with an incredibly diverse, stimulating group of scholars, artists and thinkers has infused me with great enthusiasm to bridge the huge divide between my work and the human experience of creativity and artistic expression.”*

Sunil Gandhi

## *Creativity and Innovation: How can we bridge theory and practice?*

The third group started their own meetings with breathing exercises and name games as a way to demonstrate that personal relationships are essential for positive interaction. The group suggested bringing artists into the lab, to investigate the nature of their insights and bringing scientists into the studio to gain phenomenological experience of artistic practice. Group members identified potential health benefits from the arts, which science can investigate (for example, whether or not soft music can help prevent nighttime seizures). There could be research bridges concerning both domains, such as biological markers that track human behaviors involved in creativity. The group also expressed the need for the public presentation of science research, and suggested scientist-in-residency positions at art school. One model might be The Hub at Wellcome Trust, which has interdisciplinary team of residents and a non-determinative curatorial model, emphasizing context over content. The poet and artist Steven J. Fowler, who participated in the session, is a part-time resident there.

## How can we foster greater public understanding and engagement?

The fourth group believed that scientific literacy and engagement improves policy and decision-making. However, there should also be honesty about uncertainty and disagreement. The resources for public engagement may actually already exist within grants, if people would budget the money. The group actually created a blog about neuroscience and creativity, pledging three months and beyond of content. The blog might become a place for summarizing and codifying research, with links and central forum for discussing works in progress. The group staged a dating game, to mimic the process of choosing a collaborator out of multiple contestants and invented the KAL Cartoon Prize to be awarded to the most interesting collaboration in the future. The blog is now up and running:

<http://neuroscienceartblog.blogspot.co.at/>

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1. Phil Yao

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2. Sunil Gandhi and Rebecca Kamen

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3. Rick Kemp delivers his group's presentation alongside (l-r) Kai Klepzig, Nigel Osbourne, Steven Fowler, Pireeni Sundaralingam and Maria Fernanda Cardoso

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4. Maira Monteiro Froes

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*“The session was a networking festival. I have now plans to collaborate with several of the participants. Never in my experience a conference had been so productive. The people I met were top in their games, and their brilliance and character was amazing.”*

Maria Fernanda Cardoso

## Conclusion

### *Creating a New Community*

The human brain relies upon the interdependence of neurons. When neurons fire together, their patterns of activity are reinforced, increasing the likelihood of their firing again. In this way, groups of neurons “wire together” to form circuits and systems, sharing information through established channels. Some of these structures are deeply ingrained, passed down like some timeless inheritance, as genetic predisposition. However, the brain has plasticity, which means that its elements can change. Neurons can morph their shapes, healing from trauma, embodying new learning. Sometimes people cannot help but listen and be moved. Connections are dynamic, constantly subject to change. The past can be updated, with the addition of new memories. Resources can be repurposed, and structures can be rebuilt. We hear stories of impossible recovery. The lesson from the brain is that individuals develop relationships, and enough of these overlapping relationships, with reliable means of communication, will lead to a functioning social network or community, regardless of physical separation. There may be traditional ways of thinking and perennial circles of power, but creativity is seeing not just one pathway, but rather multiple possible solutions.

Salzburg Global Seminar, like a brain for the world, contained all of this potential. “Never doubt that a small group of committed citizens can change the world,” the famed anthropologist Margaret Mead said, after the inaugural program session, “In fact, nothing else can.” The collective wish of the participants of this session is to fire together again, communicating and collaborating, with art and with science, challenging existing standards, through education and awareness, as a community of Salzburg Global Fellows, whose activity will someday move the body.



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1. Multi-time Fellows (l-r) Nigel Osbourne, Wendy Sernberg and Harry Ballan discuss the session in the Great Hall

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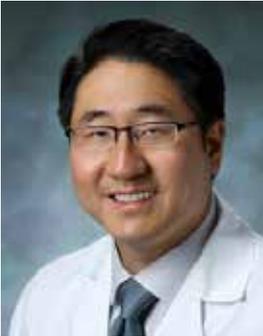
2. Shodekeh (l) explains his beatboxing talents to Richard Kemp, Felicia Lercari and Maria Fernanda Cardoso

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3. Fellows of the session *The Neuroscience of Art: What are the Sources of Creativity and Innovation?* gather on the lakeside terrace of Schloss Leopoldskron for the traditional group photo

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## Session Co-chairs



### Charles Limb, USA

Charles Limb is an associate professor in the Johns Hopkins Department of Otolaryngology-Head and Neck Surgery, where he specializes in neurotology and skull base surgery. He is also a faculty member at the Peabody Conservatory of Music and School of Education of Johns Hopkins University. Throughout his career, he has combined his interests in auditory science, clinical treatment of hearing loss and complex sound perception, especially music. His current areas of clinical care focus on the treatment of hearing loss and auditory disorders. In particular, he specializes in all surgery of the temporal bone, with particular expertise in acoustic neuroma surgery, cochlear implant surgery, implantable hearing aids, stapes surgery, cholesteatoma surgery, and cancers of the ear. His current areas of research focus on the study of the neural basis of creativity (in various musical and other art forms) as well as the study of music perception in deaf individuals with cochlear implants. He is the editor-in-chief of *Trends in Amplification*, the only journal explicitly focused on auditory amplification devices and hearing aids, and an editorial board member of the journals *Otology and Neurotology* and *Music and Medicine*. His work has been featured by National Public Radio, TED, *National Geographic*, *The New York Times*, PBS, CNN, *Scientific American*, the BBC, the Smithsonian Institute, the Library of Congress, Canadian Broadcasting Company, Baltimore Symphony Orchestra and the American Museum of Natural History. Dr. Limb received his undergraduate degree at Harvard University and his medical training at Yale University School of Medicine, followed by surgical residency and fellowship in Otolaryngology-Head and Neck Surgery at Johns Hopkins Hospital. He completed a postdoctoral research fellowship at the Center for Hearing Sciences at Johns Hopkins with Dr. David Ryugo studying the development of the auditory brainstem, and a second postdoctoral fellowship at the National Institutes of Health studying neural mechanisms of musical improvisation, and production and perception of music using functional neuroimaging methods.



**Gary Vikan, USA**

Gary Vikan was director of the Walters Art Museum in Baltimore, and prior to that the museum's assistant director for Curatorial Affairs and curator of Medieval Art. Before coming to Baltimore, he was senior associate at Harvard's Center for Byzantine Studies at Dumbarton Oaks in Washington, DC. An internationally known medieval scholar, he curated a number of critically acclaimed exhibitions at the Walters, most notably, those devoted to the art of medieval Orthodoxy. He has taught at Johns Hopkins University, Carleton College, Goucher College, and was leader-in-residence at the Noyce Leadership Institute. He had a weekly radio program on Baltimore's NPR affiliate called "Postcards from the Walters." Dr. Vikan currently serves on the Advisory Council on Culture and the Arts of Salzburg Global Seminar, on the Board of Advisors of the Masters in the Liberal Arts program at Johns Hopkins University, on the founding board of the Future Symphony Institute in Baltimore, and on the Committee for Cultural Policy in New York City. He is a councilor of the Maryland State Arts Council. He has been an advisor to the Getty Leadership Institute and Princeton University's Department of Art and Archaeology, was appointed by President Clinton to his Cultural Property Advisory Committee, and was knighted by the French Minister of Culture in the Order of Arts and Letters. Dr. Vikan stepped down from the Walters directorship to write, lecture, and teach, to provide consulting services as Vikan Consulting LLC to cultural non-profits, collectors, and dealers, and to pursue projects at the intersection of the arts and sciences. In the fall of 2014, he co-organized an exhibition on "Beauty and the Brain" at the American Association for the Advancement of Science in Washington, DC. He lectures extensively on topics as varied as Byzantine art, Elvis Presley, the Shroud of Turin, looted art and cultural property policy, neuro-aesthetics, and art forgeries. He does readings from his forthcoming memoirs as well. Dr. Vikan holds a B.A. from Carleton College and a Ph.D. from Princeton University. He is a graduate of the Harvard Program for Art Museum Directors and the National Arts Strategies Chief Executive Program. He is a Fellow of Session 482 "*Libraries and Museums in an Era of Participatory Culture*" (2011) and Session 498 "*Salzburg Global Forum for Young Cultural Leaders*" (2012).

## Session Participants

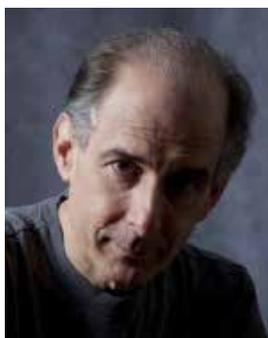
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**Anna Abraham**, *United Kingdom*

Anna Abraham is a Reader in Psychology at the School of Social, Psychological and Communication Sciences at Leeds Beckett University in the UK. She obtained her educational training and professional experience from a wide range of departments and institutions in different parts of the world. She is a psychologist and a cognitive neuroscientist whose research centers on the neurocognitive study of imagination, encompassing domains such as creativity, divergent thinking, mental time travel, mental state reasoning, self-referential thought, and the reality-fiction distinction. Dr. Abraham holds a B.A. in Psychology from the University of Delhi in India, an M.Sc. in Psychology from the University of Essex in the UK, and a Doctorate in Neuroscience from the Ruhr University Bochum in Germany.

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**Bruce Adolphe**, *USA*

Bruce Adolphe is a composer, educator, performer, and author whose music is performed worldwide by renowned artists. His piece *Musics of Memory* celebrated its world premiere in October 2014 at the Brain and Creativity Institute at University of Southern California in LA. The work is structured to reflect the way memory works in the brain. Over the past 25 years, Mr. Adolphe has served as composer-in-residence at many festivals and institutions throughout the USA for which he has also created and led educational concerts and workshops for all ages and levels of musical accomplishment. A key figure at The Chamber Music Society of Lincoln Center, Mr. Adolphe is the founder and director of the Society's *Meet the Music* family concert series as well as the Society's resident lecturer. He has appeared as a commentator on *Live From Lincoln Center* television and regularly lectures at the Metropolitan Museum of Art. The author of three books on music, he has taught at Yale, Juilliard, and New York University. Since 2002, he performs his *Piano Puzzlers* weekly on public radio's *Performance Today*, hosted by Fred Child. Mr. Adolphe co-founded *The Learning Maestros*, a company dedicated to creating new works and related curricula that integrate music with other disciplines, including science, literature, history, and issues of social conscience. His book *The Mind's Ear: Exercises for Improving the Musical Imagination* was published in a second edition in October 2013. Mr. Adolphe was recently appointed composer-in-residence at the Brain and Creativity Institute in Los Angeles, where he works with neuroscientists Antonio and Hanna Damasio and Assal Habibi. He is a Fellow of Session 479 "*Instrumental Value: The Transformative Power of Music*" (2011).



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**Clayton Aldern**, *United Kingdom*

Clayton Aldern is an M.A. candidate in Public Policy at Oxford's Blavatnik School of Government, where he studies as a Rhodes Scholar. He is interested in emerging neurotechnologies, bioethics, artificial intelligence, machine learning, and the relationships between science, policy, and society. Outside the policy sphere, he works as a research assistant and lab technician in a computational neuroscience lab in Oxford's Centre for Neural Circuits and Behaviour, where he studies mathematical models of sensory processing. Previously, he has conducted health policy work for Brown University and One Mind for Research concerning treatment access for different patient populations with post-traumatic stress disorder. He is a freelance science writer and has written for *The Atlantic*, *Scientific American*, and other publications. Mr. Aldern holds a B.Sc. in Neuroscience from Brown University, USA, and an M.Sc. in Neuroscience from the University of Oxford.



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**Harry Ballan**, *USA*

Harry Ballan is a senior partner at the international law firm of Davis Polk & Wardwell LLP and a director of the Institute for Music and Neurologic Function (IMNF), founded by Oliver Sacks. He is engaged in numerous research projects on music and the brain and has used therapeutic music to treat hundreds of patients with psychiatric and neurological disorders. At IMNF, he is the director of the program for Post-Traumatic Stress Disorder and Traumatic Brain Injury in Veterans, in which capacity he has worked with the U.S. Veterans Administration and Congress. Dr. Ballan has taught at Yale University, Columbia University, and NYU. He was a student at the Conservatoire Américain, and is a Fellow of the Tikvah Advanced Institutes. Dr. Ballan holds a B.A., M.A., M.Phil. and a Ph.D. from Yale University, and a J.D. from Columbia University.



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**Mathias Benedek**, *Austria*

Mathias Benedek is a senior scientist at the Department of Psychology, University of Graz, Austria. He is interested in individual differences in creativity, intelligence and personality, and his research focuses on cognitive processes underlying creative thought. Dr. Benedek has published numerous empirical articles in the fields of creativity research and cognitive neuroscience. He is a member of the APA Division 10 (Psychology of Aesthetics, Creativity, and the Arts), and he holds an M.Sc. from the University of Graz and a Ph.D. from the University of Kiel, Germany.



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**Mark Boulos**, *Switzerland/The Netherlands*

Mark Boulos is a filmmaker and artist who lives and works in Amsterdam and Geneva. His recent work “Echo” (2013) is an interactive installation that induces a sense of dislocation and disembodiment, inspired by and made in collaboration with neuroscience researcher Olaf Blanke. Currently, Mr. Boulos is an artist-in-residence with the Agalma Foundation in Geneva, which promotes dialogue between neuroscience and psychoanalysis. His recent solo exhibitions include LAXART, Los Angeles; FACT, Liverpool; MoMA New York; the Stedelijk Museum, Amsterdam, and the Miami Art Museum. His recent group exhibitions include the Geneva Biennale of the Moving Image, the Berlin Biennale, the Sundance Film Festival, and the Sydney Biennale. Mr. Boulos holds a B.A. in Philosophy from Swarthmore College, Pennsylvania, and an M.A. in Film, Television, and Documentary Direction from the National Film & Television School, Beaconsfield, UK. He held a Fulbright Fellowship for Postgraduate Artist’s Residency at Rijksakademie van Beeldende Kunsten, Amsterdam.



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**Pieter Broucke**, *USA*

Pieter Broucke is director of the Arts at Middlebury College. In this capacity he oversees seven academic departments and programs in the arts, the college museum, and performing arts center. He is a professor in the department of History of Art and Architecture, the associate curator of Ancient Art at the college museum, and the acting head of the Architectural Studies program. His scholarship focuses on ancient art and architectural history broadly defined. His most recent book is a co-edited exhibition catalog published in 2012 that contextualizes the Vermont quarry photographs of Edward Burtynsky. His current research project focuses on the early phases of design and construction of the Pantheon in Rome. In 2012, Dr. Broucke co-organized a symposium on creativity and collaboration at Middlebury College. That brought together artists, performers, and scientists for three days of presentations, performances, panels, and discussions. Currently he is preparing a new foundations course on visual culture that will rely, in part, on the neuroscience of visual communication and the mechanics of perception. Dr. Broucke holds a professional degree in architecture from Ghent, Belgium, an M.A. in Archaeology from the University of Minnesota, and a Ph.D. in Art History from Yale University. He is a Fellow of Session 468 “*The Performing Arts in Lean Times: Opportunities for Reinvention*” (2010).



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**Suzanne Burgoyne**, *USA*

Suzanne Burgoyne is the Curators’ Distinguished Teaching Professor of Theatre at the Department of Theatre, University of Missouri. She has also taught directing and dramaturgy at the National Theatre Institute of Belgium. She has been editor of Theatre Topics, vice-president for Professional Development for the Association of Theatre in Higher Education and has published articles on directing and American drama in Theatre Journal, American Drama, Theatre Topics, and Text and Performance Quarterly. She is a co-founder of the MU Interactive Theatre Troupe, and served as a co-investigator on two major MU grants using interactive theatre. Her research is related to the scholarship of teaching and learning in theatre and the impact of interactive theatre on audiences. Dr. Burgoyne holds an M.A. in Theater from Ohio State University and a Ph.D. in Theater from the University of Michigan. She is a Fellow of Session 468 “*The Performing Arts in Lean Times: Opportunities for Reinvention*” (2010).



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**Julie Burstein, USA**

Julie Burstein is a Peabody Award-winning producer, TED speaker, and best-selling author who has spent her working life in conversation with highly creative people – interviewing, probing, guiding, and creating live events, public radio programs about them and their work. In her book *Spark: How Creativity Works*, she maps out some of the coordinates and dimensions of creativity through stories about contemporary writers, artists, film directors, dancers, architects, and musicians. Ms. Burstein is the host and producer of *Spark Talks* at The Metropolitan Museum of Art, and creative consultant for TEDxMet, the first TED at an art museum. She is the creator and founding executive producer of *Studio 360*, public radio’s premiere program about creativity and the arts, and frequently speaks about creativity at universities, corporations, and international forums.



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**María Fernanda Cardoso, Australia**

María Fernanda Cardoso incorporates the rigors of scientific investigation into a body of work that moves freely between sculpture, photography, installation, and performance. Known internationally for her project *The Cardoso Flea Circus*, the artist’s early works incorporated materials with a strong link to Colombian traditions as well as native animal species to create sculptures that, as described by Carolina Ponce de León, sought to “displace, superimpose, and connect different cultural contexts.” Her ongoing project *MoCo (Museum of Copulatory Organs)* investigates the complexity of reproductive organs in both plant and animals. Her artwork has been exhibited in over 30 countries and in prestigious institutions like the Museum of Modern Art in New York, the Museum of Contemporary Art in Sydney, the Centre Georges Pompidou and the Sydney Opera House. Dr. Cardoso holds an M.A. in Sculpture from Yale University and a Ph.D. in Art Science from the University of Sydney.



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**Lydia Courtney, USA**

Lydia Courtney is an educator and a researcher of creative and effective American arts education. Her 16 years teaching choral music, theatre, voice and dance are preceded by seven years as a singer, dancer and actress. She is both an arts and public school advocate and has most recently spoken on the topics of the benefits of science, technology, engineering, math (STEM) and arts integration as well as the emotional component of effective education. Ms. Courtney holds a B.A. in both Vocal and Instrumental Music Education from Bowling Green State University and an M.A. in Music Education from Five Towns College in New York.



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**Ian Cross, United Kingdom**

Ian Cross is professor at the University of Cambridge, Faculty of Music, directing the Center for Music & Science and leading a lively group of graduate students and postdoctoral researchers in exploring music, its materials and its effects from a wide range of scientific perspectives. His current interests in relationships between language and music are reflected in his 2012 co-edited book for OUP, *Language and Music as Cognitive Systems*, and his 2013 paper in *AI & Society* “Does not compute? Music as Real-time Communicative Interaction”. Dr. Cross holds performance and teaching diplomas on guitar from the Royal Academy and Royal College of Music in London, and holds a B.Sc. and Ph.D. in Music from City University, London.



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**Jennifer Crouch**, *United Kingdom*

Jennifer Crouch is an artist specializing in projects that combine art and science. Her work tends to consist of vast, detailed paintings, drawings, ceramic/glass ornaments and participatory works of art. One of the objectives of her work is to explore various modes of representation – from drawings, computer simulations and metaphor to biomedical images and mathematics – and examine how these modes are used in discovery, communication, and knowledge-creation. She is the current and founding artist-in-residence at the University College London’s Centre for Advanced Biomedical Imaging. Ms. Crouch has worked as an artist alongside scientists at the Natural History Museum, the Gordon Museum of Pathology, Queen Mary University, and Imperial College London, and illustrated for the Anatomy Department at St George’s University. She is the co-founder of the art–physics project “Jiggling Atoms”, which explores the role of the visual arts in the communication and understanding of science, and promotes creative thought and practice in everyday life while demonstrating how science percolates into daily life. She has lectured at Central Saint Martins, Camberwell College of Art, The Arts University Bournemouth, and Northampton University. Ms. Crouch’s work has been exhibited prolifically and was used in the recent Paddington Bear film. Ms. Crouch holds a B.Sc. in Physics from The University of Aberdeen, a B.A. in Illustration from Camberwell College, and a post-graduate degree in Medical Illustration from the Medical Artists Educational Trust.



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**Arne Dietrich**, *Lebanon*

Arne Dietrich is a cognitive neuroscientist and professor of Psychology at the American University of Beirut, Lebanon. His research focuses on the neural mechanisms underlying creativity, altered states of consciousness, and the psychological effects of exercise. Prof. Dietrich’s major publications include a new framework for the neural basis of creative thinking, a mechanistic explanation for the flow experience, a comprehensive review article of neuro-scientific studies of creativity, and a new neurocognitive theory of altered states of consciousness, the transient hypofrontality theory. He is also the author of a widely-used textbook on consciousness. He has delivered numerous keynote lectures around the world and his research has been featured prominently in the international press. Prof. Dietrich holds a Ph.D. in Cognitive Neuroscience from the University of Georgia, USA.



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**Benjamin Ehrlich**, *USA*

Benjamin Ehrlich is an independent writer and researcher based in New York, USA. He is a contributing editor to *The Beautiful Brain*, the digital magazine dedicated to neuroscience and art, and a participating member of *NeuWrite*, the collaborative working group for scientists and writers sponsored by Columbia University. He recently contributed writing and editing work to the popular psychology book *Sensation: The New Science of Physical Intelligence*. His translations from *Café Chats* were published in *New England Review*. He is currently developing a book about Ramón y Cajal and the discovery of the neuron. Mr. Ehrlich holds a degree in literary studies from Middlebury College, USA.



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**Ben Folds, USA**

Ben Folds is a multi-platinum selling singer, songwriter and producer. He first found success with the Ben Folds Five. He has gone on to have a successful solo career writing, recording and performing pop hits, as well as a recent new concert for piano and orchestra. He achieved critical acclaim for his insight as a judge on NBC's a cappella competition "The Sing-Off" for the show's first five seasons. Over the past year, he has made cameo appearances in film and TV, including a role on Comedy Central's "Community." He has also written and recorded numerous songs for film and TV and serves as a member of the board of directors of the Nashville Symphony. Mr. Folds is an avid photographer. He recently did a keynote address on his photographic techniques at the prestigious PhotoPius Expo in New York City, and is a member of the distinguished Sony Artisans of Imagery. He is an advocate for music education and music therapy as a member of Artist Committee of the Americans For the Arts. Mr. Folds owns and operates the historic RCA Studio A, once managed by Chet Atkins, and the home to thousands of legendary recording sessions in all genres of music from Elvis Presley to the Monkees, Dolly Parton to Kacey Musgraves, Tony Bennett to the Beach Boys, Brian Setzer to Hunter Hayes.



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**Steven J. Fowler, United Kingdom**

Steven J. Fowler is a poet, artist, martial artist and vanguardist. He works in the modernist and Avant Garde traditions, across poetry, fiction, sonic art, visual art, installation, and performance, often exploring notions of physicality, psychology, and trauma. He has published six collections of poetry and been commissioned by the Tate, Highlight Arts, Mercy, Penned in the Margins and the London Sinfonietta. His work has been translated into 13 languages and performed at venues across the world, from Mexico City to Erbil, Iraq. Mr. Fowler is the poetry editor of *3:AM Magazine* and is the curator of the Enemies project, for which he has won awards from the British Council, Arts Council England, the Austrian Cultural Forum, and Jerwood Charitable Foundation.



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**Sunil Gandhi, USA**

Sunil Gandhi is an assistant professor and fellow of the Center for the Neurobiology of Learning and Behavior at the University of California, Irvine. He is interested in the neural mechanisms that orchestrate critical periods in postnatal development. His recent work focuses on restoring juvenile plasticity to the adult visual system using neuronal transplantation. His published work has appeared in *Nature*, *Science* and the *Proceedings of the National Academy of Sciences*. He is a Searle Scholar and Klingenstein Fellow. Dr. Gandhi holds a B.Sc. from Stanford University and a Ph.D. in neuroscience from University of California, USA.



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**Daniel Glaser**, *United Kingdom*

Daniel Glaser is director of the Science Gallery at King's College. In this role, he works with colleagues across the College to develop projects and partnerships that explore the creative interface between science, health and the arts, pursuing new ways to connect a wider public with the research excellence of King's College. Dr. Glaser has an impressive range of experience across science, culture, engagement, education, and the media, and a long history of working in partnership to deliver bold, imaginative science and art collaborations. His scientific background involves the use of fMRI to examine how experience, prejudice and expectation alter the way we see the world. He was head of special projects at the Wellcome Trust, responsible for commissioning and funding initiatives to engage the public with health research. His work in the media includes a BBC television series on how science really works, numerous appearances on national and local radio, and features in many daily newspapers. He chairs the London Café Scientifique and is one of the Man Booker Prize 2014 judges. Dr. Glaser holds an M.A. in Cognitive Science from Sussex University and an M.A. in neurobiology from the Weizmann Institute in Israel, followed by post-doctoral work in brain imaging at University College London.



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**Usha Goswami**, *United Kingdom*

Usha Goswami is professor of Cognitive Developmental Neuroscience at the University of Cambridge, Fellow of St John's College, and director of the Centre for Neuroscience in Education. She has worked on reasoning by analogy and on reading and developmental dyslexia across languages, most recently studying language encoding by the brain with a focus on prosody. She has developed a range of neuro-educational interventions based on rhyme, poetry and rhythm, plus the software reading game GraphoGame Rime. Prof. Goswami has written many books and articles on child development and is a frequent speaker at national and international forums. She trained as a primary school teacher and holds a Ph.D. in psychology from the University of Oxford, UK.



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**Mariale Hardiman**, *USA*

Mariale M. Hardiman is vice-dean of the Johns Hopkins University School of Education, professor of Education, and co-founder and director of Johns Hopkins' Neuro-Education Initiative (NEI). The NEI has been recognized as an innovative cross-disciplinary program that brings relevant research from the learning sciences through the mind, brain, and teaching masters, as well as doctoral courses and professional development programs. Her research and publications focus on enhancing educational practices through techniques that foster innovation and creative problem solving. Her current research includes a randomized control trial investigating the effects of arts integration on long-term retention of content and student engagement. She is also investigating how knowledge of the learning sciences influences teaching practices and teacher efficacy beliefs. Before joining Johns Hopkins, Dr. Hardiman served in the Baltimore City Public Schools for more than 30 years. With the use of the Brain-Targeted Teaching® Model that she developed, the school was recognized nationally for innovative arts programming. Dr. Hardiman holds a B.A. and M.A. in Education from Loyola University Maryland and a Ph.D. in education from Johns Hopkins University.



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**Noah Hutton, USA**

Noah Hutton is an award-winning filmmaker and founder of The Beautiful Brain. He curated and participated in numerous exhibitions and symposia around the world, most recently serving as curator for the 2014 *Impakt Festival* in Utrecht, Netherlands, and as a featured speaker at the 2013 Venice Biennale symposium on neuro-aesthetics. He created Brain City, a multi-platform project for the Times Square Arts Alliance in New York City, which featured a nightly journey through the brain on all the billboards of Times Square. His first feature-length film, *Crude Independence*, premiered at the 2009 SXSW Film Festival and won Best Documentary Feature at the 2009 Oxford Film Festival. He is working on a 15-year film about the Blue Brain Project, neuroscientist Henry Markram's quest to simulate an entire human brain on supercomputers. Mr. Hutton holds a degree in Art History and Neuroscience from Wesleyan University, USA.



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**Kevin Kallaughter, USA**

Kevin Kallaughter is the editorial cartoonist for *The Economist* and *The Baltimore Sun*. In a distinguished career, which spans 36 years, he has created over 8000 cartoons and 140 magazine covers, mounted a dozen international exhibitions, received honors in seven countries, and published six collections of his work. His most recent anthology of *Economist* cartoons is titled "Daggers Drawn". Mr. Kallaughter has created acclaimed animations and calendars, toured the US with Second City comedy troupe, and addressed audiences around the world. He is currently the artist-in-residence at University of Maryland Baltimore County and is the past president of the Association of American Editorial Cartoonists and Cartoonist Rights Network International. Mr. Kallaughter holds a degree from Harvard University.



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**Rebecca Kamen, USA**

Rebecca Kamen is a sculptor and lecturer on the intersections of art and science seeking "the truth" through observation. Informed by research into cosmology, history, and philosophy, her work connects common threads that flow across various scientific fields to capture and re-imagine what the scientists see. She has researched collaborative projects at the Center for Astrophysics at Harvard University, the Kavli Institute at Massachusetts Institute of Technology, the Cajal Institute in Madrid, and the Neuroscience Program at the National Institutes of Health, where she was artist-in-residence in 2012. Her artwork has been exhibited both nationally and internationally. She is Professor Emeritus at Northern Virginia Community College, where her research and lectures explore how the arts and creativity can enhance innovation and the understanding of science. Ms. Kamen holds a B.Sc. in art education from Pennsylvania State University, an M.A. in art education from University of Illinois, and an M.F.A. in sculpture from Rhode Island School of Design.



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**Rick Kemp, USA**

Rick Kemp is the author of *Embodied Acting: What Neuroscience Tells Us About Performance*, and professor of theatre and head of acting and directing at Indiana University of Pennsylvania. He has over thirty years of experience as an actor and director gained in Europe and the USA, working with theatres and companies such as the Almeida, Complicité, Commotion, Tricycle, Harbourfront, Quantum, the Pittsburgh Playhouse, 404 Strand, Squonk Opera, Circulo de Bellas Artes, Teatr Polski, and the Bouffes du Nord. He holds a B.A. and an M.A. in English Language and Literature from Oxford University, and an M.F.A. in Performance Pedagogy and a Ph.D. in Theatre and Performance Studies from the University of Pittsburgh, USA.



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**Kai Klepzig, Germany**

Kai Klepzig is a Ph.D. student at the Department of Neuroradiology at the University of Greifswald. In his diploma thesis he dealt with strong emotional reactions such as shivers and chills in response to musical stimuli. Currently he is working in a project with stroke patients in order to evaluate lesions of certain anatomical structures with regard to their effects on emotional processing. To this day one of his main interests are the so-called aesthetic emotions, which can be experienced in the context of arts, and their psychophysiological fundamentals. Mr. Klepzig holds a diploma in Psychology from the University of Greifswald.



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**Ariane Koek, Switzerland**

Ariane Koek initiated, created and directed the first international arts program at CERN – the world’s largest particle physics laboratory. Prior to CERN, she produced and directed award-winning work for both, television and radio, at the BBC and received awards for her directorship of the leading UK literature charity, the Arvon Foundation. She is a frequent keynote speaker and writes internationally about leadership, creativity, and innovation through the arts, science, and technology nexus. Her work and lectures have led to policy changes both on individual organizational levels and on the international political levels. She is a consultant on cultural strategy, working with cultural organizations and festivals across the arts, science, and academia to create and develop cultural programs which match as well as enhance organizational needs, profiles, missions, and values. Ms. Koek is an external expert for the European Commission on digital culture, a member of the CERN Cultural Board, as well as serves on advisory boards of both the House of Electronica Arts (HEK) in Basel and Festival. She is also a member of the French national think tank on culture, the Forum D’Avignon. She holds an M.A. in Romanticism and Modernism from Southampton University. Ms. Koek was a keynote speaker on the Imagination with Charles Elachi, Director of the Jet Propulsion Laboratory, NASA in June 2013 at the annual Salzburg Global Seminar Board of Director’s Strategy Weekend.



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**Joan Koenig, France**

Joan Koenig is the founder of *Ecole Koenig*, a private music conservatory in Paris. The school is a laboratory for innovative learning, and cultural entrepreneurship. Over the past 27 years, several thousands of students have benefited from the multi-faceted programs. Many have chosen to pursue careers in the arts. The school launched the first series of public Jazz master-classes in France with Herbie Hancock at the “Bouffes du Nord” theater in 1994. A professional production of “Peter Pan” with children launched a wave of musical comedy productions for and with children throughout France. The *Ecole Koenig* Kindergarten opened its doors in 2008, becoming the first musical and artistic pre-school in France. Ms. Koenig began playing the piano when she was five years old, followed by playing flute. She holds a degree from the Juilliard School and pursued her studies in France with Alain Marion.



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**Patricia Leavy, USA**

Patricia Leavy is an independent scholar and author, who is widely recognized as a leader in arts-based research. She was an associate professor of Sociology and founding director of Gender Studies at Stonehill College, USA. Her seventeen books include “Method Meets Art: Arts-Based Research Practice”, “The Oxford Handbook of Qualitative Research”, “Fiction as Research Practice”, “Essentials of Transdisciplinary Research”, and the novels “Low-Fat Love” and “American Circumstance”. She edits five book series including the *Social Fictions* series, and blogs for *The Huffington Post* and *The Creativity Post*. Dr. Leavy holds a Ph.D. in Sociology from Boston College.



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**Lisha Lercari, USA**

Lisha Lercari is the creator and director of Music and the Brain (MATB), a program started by the 42nd Street Fund, and given to schools on a grant basis. MATB has been used in 200 New York City public schools, 30 around the USA as well as in other countries. MATB students, mostly 5-8 year olds, learn to understand and appreciate the language of music, read music, and play the piano. Ms. Lercari designed the materials, wrote the Piano Books and Teacher’s Manuals, and produced and directed the CD recordings and videos. She holds a B.A. in Music Theory and an M.A. in Music Education from the Manhattan School of Music, and studied three years in Paris with Nadia Boulanger.



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**Soo-Siang Lim, USA**

Soo-Siang Lim is the lead program director and chair of the Coordinating Committee for the Science of Learning Centers (SLC) Program at the US National Science Foundation (NSF). She has led this program since the first SLCs were established to provide intellectual, organizational, and physical infrastructure for addressing large-scale, complex problems about learning in humans, other animals, and machines. Dr. Lim has extensive experience in reviewing, managing, and overseeing interdisciplinary research in her work at the NSF. She serves on the Interagency Task Force for Arts and Human Development, spearheaded by the National Endowment for the Arts, in partnership with the U.S. department of Health and Human Services. Prior to joining NSF, she was an associate professor in the Department of Anatomy and Cell Biology at Indiana University, where she conducted research in cell biology and neuroscience. Dr. Lim holds a Ph.D. in Anatomy from the University of North Dakota, and did post-doctoral training at the University of Wisconsin-Madison, USA.



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**Siyuan Liu, USA**

Siyuan Liu is a neuro-imaging scientist who works at the National Institute of Mental Health. Until recently, he worked as a research fellow with Dr. Allen Braun in the Language Section, National Institute on Deafness, and Other Communication Disorders (NIDCD). His work at the NIDCD focused on understanding how language is initiated in the brain and how this process is disrupted by communication disorders, through the use of functional and anatomical imaging techniques. In this context, he has conducted studies of literary creativity that seek to link the creative process, the quality of the creative product and the impact of expertise to functional interactions between prefrontal and parietal systems. This model has recently been extended to include dynamic measures of entropy that appear to play a central role in these processes. Dr. Liu holds a Ph.D. in bioengineering from the University of Illinois at Chicago.



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**Manuela Macedonia, Austria**

Manuela Macedonia is a research scientist, currently working on the development and testing of intelligent agents, i.e. virtual animated figures teaching language on the base of neuro-scientific findings. Her work focuses on embodiment of language, particularly on how the body and action can be used as a tool enhancing memory in second language education. Her research spans the breadth of applied linguistics, education, cognitive neuroscience, and information engineering. She has published articles and books on diverse language topics and her aim is to unveil the fundamental cognitive basis of L2 learning processes as well as to develop efficient practice tools. Dr. Macedonia is a founder of Neuroscience for You, an institute for the dissemination of neuro-scientific knowledge into education. Dr. Macedonia holds an M.A. in Theoretical Linguistics and a Ph.D. in Applied Linguistics and Cognitive Psychology from the University of Salzburg.



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**Diego Malpede, Argentina**

Diego Malpede is a member of the Foreign Service of Argentina. In the Ministry of Foreign Affairs, he worked extensively on legal, security, and global environmental negotiations. He served at the Permanent Missions of Argentina to the United Nations (UN) and other international organizations in Geneva and New York. He was a member of the cabinet of the 63rd United Nations General Assembly President. He served as research assistant for the Initiative on Science and Technology for Sustainability (ISTS) at the Belfer Center of Science and International Affairs of the Kennedy School, and joined the staff of the Third World Academy of Sciences in Trieste, Italy. He currently resides in Buenos Aires and works in the Directorate for Western Europe at the Ministry of Foreign Affairs. Mr. Malpede holds a law degree from the University of Buenos Aires and an M.A. in Public Administration from the Kennedy School of Government of Harvard University. He is a Fellow of Session 380 “*Biotechnology: Policy Issues and Regulatory Frameworks*” (2000).



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**Malinda J. McPherson, USA**

Malinda McPherson is a current M.Phil. student at the University of Cambridge Centre for Music and Science, under the direction of Dr. Ian Cross. She is a 2014-2015 Churchill Scholar, and a member of Churchill College. Ms. McPherson worked as a research assistant in the lab of Dr. Charles Limb, Hopkins Hospital Department of Otolaryngology-Head and Neck Surgery. Her research interests include the neural processes involved in creative emotional expression (specifically jazz improvisation), as well as the effects of rhythmic entrainment on the perception of emotion in music. Ms. McPherson holds a B.A. in cognitive science and music from Johns Hopkins University.



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**Maira Monteiro Fróes, Brazil**

Maira Monteiro Fróes is associate professor and research director at the Federal University of Rio de Janeiro, Brazil. She leads investigations in basic experimental science, covering biophysics of intercellular communication and neuroscience. More recently, she has done epistemological and experimental investigations at the art and (neuro)science interface. She is the coordinator of the interdisciplinary group Anatomy of Passion, founder and head of the corresponding Laboratory of Experimental Neuro-epistemology, and research director at the Institute Tercio Pacitti of Computational Applications and Research. Dr. Fróes holds an M.A. and a Ph.D. in Biological Sciences (Biophysics) from the Federal University of Rio de Janeiro, complemented at Albert Einstein College of Medicine, Yeshiva University, New York, and was a postdoctoral scholar at the *Collège de France*.



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**James Murray-White**, *United Kingdom*

James Murray-White is a filmmaker, writer, and researcher. He has worked in theatre and education across the United Kingdom and Ireland as well as an environmental journalist in the Middle East. Currently based in Cambridge, UK, he is filmmaker-in-residence within the Alzheimer's Research Network of Dementia Research, and is involved in the University Wellcome funded public engagement project about the MEG (magnetoencephalography) scanner. He writes widely on subjects ranging from the environment, anthropology, politics, and the politics of health and research, and is passionate about finding links between creativity and the sciences, and the processes of both. Mr. Murray-White holds a B.A. in Drama from the University of Hull, Humberside, a diploma in Human Ecology from the Centre for Human Ecology in Edinburgh, and an M.A. in Media from the University of the West England, Bristol.



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**Nicola Neumann**, *Germany*

Nicola Neumann is a research associate at the Institute of Diagnostic Radiology at the University of Greifswald, Germany, where she is interested in the areas of expertise and creativity. She worked with magnetencephalography and investigated the neural bases of special skills in autistic people and investigated the psychological aspects of brain-computer communication in severely paralyzed patients at the University of Tuebingen. Dr. Neumann holds degrees in Psychology and Philosophy and a Ph.D. from the University of Tuebingen, Germany.



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**Michael Öllinger**, *Germany*

Michael Öllinger is a cognitive psychologist and research scientist at the Parmenides Center for the Study of Thinking and a lecturer at the Psychological Department of the Ludwig-Maximilians University in Munich. He is interested in the understanding of human thinking, problem solving, and the development of thinking. He investigates why problem solvers get stuck in impasses and the cognitive mechanisms that help to overcome such impasses. He addresses the interplay of search and representational change as the foundation of problem solving and creativity. Furthermore, Dr. Öllinger is interested in the development of cognitive theories that conceptually incorporate behavioral and neuro-cognitive findings. Methodologically, he conducts behavioral, EEG, and fMRI experiments to get new insights into the fascinating world of human thinking and creativity.



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**Nigel Osborne**, *United Kingdom*

Nigel Osborne is a composer and human rights activist. He is co-chair of the World Economic Forum on Culture and emeritus professor of music at the University of Edinburgh. His works have been featured in most major international festivals and performed by many leading orchestras and ensembles, from the Moscow to the Berlin Symphony Orchestras, and from the Philharmonia of London to the Los Angeles Philharmonic. He has had close relationships with the Scottish Chamber Orchestra, City of London Sinfonia, London Sinfonietta, Hebrides Ensemble and Ensemble Intercontemporain, Paris, and has composed extensively for theatre. Prof. Osborne is winner of the Opera Prize of Radio Suisse Romande and Ville de Geneve, the Netherlands Gaudeamus Prize, the Radcliffe Award and the Koussevitzky Award of the Library of Congress, Washington. Prof. Osborne studied composition with Kenneth Leighton, Egon Wellesz, Arnold Schoenberg, and Witold Rudzinski. He also studied at the Polish Radio Experimental Studio, Warsaw. Prof. Osborne is a Fellow of Session 532 “Conflict Transformation through Culture: Peace-Building and the Arts” (2014).



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**Mike Pope**, *USA*

Michael Pope is a world renowned jazz musician. He has travelled the world with the likes of Chick Corea, David Sanborn, The Manhattan Transfer, and many more. As an articulate educator, he has been sought out to speak in contexts where science and creativity are both discussed, and has been involved in research studies as both a subject and an analyst. Having much experience as an electrical engineer, as well, Mr. Pope brings a unique marriage of the subjective and objective to discussions about improvisation and musical creativity, in general. He has sat on panels at conferences such as The Johns Hopkins Brain Science Institute’s “The Science of the Arts,” alongside guitarist Pat Metheny and Baltimore Symphony music director Marin Alsop where he has made valuable contributions to the dialogue on science and creativity.



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**Sophie Scott**, *United Kingdom*

Sophie Scott is a Wellcome Trust senior fellow, and deputy director of the Institute of Cognitive Neuroscience at the University College London. She researches how the human brain processes sound, and how this relates to communication and the human voice. She is particularly interested in applying models and theories of non-human primary brain organization to the study of how humans engage with sound, and in exploring the varieties of processes that underlie perception and production of sound. She has worked with speech, music and emotional sounds, and has studied actors, impressionists and beatboxers. She has recently been addressing laughter, and has published an opinion paper on the social use of laughter in *Trends in Cognitive Sciences*. She is a fellow of the Academy of Medical Sciences, and has published over 100 peer reviewed scientific papers.



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**Paul Sowden**, *United Kingdom*

Paul Sowden is a reader and the director of ILLUME, the Faculty Creativity Research Centre at the University of Surrey, where he also leads the Enhancing Thinking Research Group. His research has spanned the breadth of experimental psychology and cognitive neuroscience using techniques including cross-cultural investigations, psychophysics, computational modelling, and neuroimaging. He has published numerous articles on diverse topics including visual expertise, learning and training, color perception, and creativity. His current work focuses on understanding the mechanisms of creative thinking processes, how they are influenced by factors such as mood, the physical environment, and artistic activities such as improvisation, and how this knowledge can support the design of interventions to enhance creativity. He is the international representative of the Society for the Psychology of Aesthetics, Creativity and the Arts. Dr. Sowden holds a B.Sc. and a Ph.D. from the University of Surrey.



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**Wendy Sternberg**, *USA*

Wendy Sternberg founded the non-profit organization, Genesis at the Crossroads and has since directed their peace-building work through arts-integrated education and humanitarian initiatives worldwide. She forged national and international partnerships with over 35 institutions on four continents and founded Saffron Caravan, uniting professional musicians from Iran, Afghanistan, Cuba, Morocco, Israel, India and the United States for cross-cultural collaborative performance and educational programs. She masterminds the creative development and management of the future Genesis Academy for Global Leadership, an academically-rigorous boarding high-school, which embeds art throughout a trans-disciplinary curriculum to foster humanism and deepen critical thinking. Towards that end, she has created a body of inquiry-based salon programs on the intersection of human rights and development and the role of the arts to help shape and inform a humanistic society. Under her leadership, Genesis boasts over 100 award-winning programs, internationally-acclaimed by the United Nations, The Kennedy Center, Rotary, The King of Morocco, the US State Department and the British Council. A participant in the Clinton Global Initiative, Dr. Sternberg configured the Genesis Academy for Global Leadership as a scalable global model for peace education. Her medical career informs the healing aspects at the heart of Genesis at the Crossroads.



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**Aryeh Lev Stollman**, *USA*

Aryeh Lev Stollman is a neuro-radiologist and assistant clinical professor of Radiology at the Mount Sinai Hospital in New York City. His first novel, *The Far Euphrates* (Riverhead) is an American Library Association Notable Book, a *Los Angeles Times Book Review* Recommended Book of the Year and National Book Critics Circle Notable Book. *The New York Times Book Review* has called *The Far Euphrates* "radiant . . . remarkable both for Stollman's eloquently understated prose and for the ease with which he constructs his artful plot." *The Far Euphrates* has been translated into German, Dutch, Italian, Portuguese and Hebrew. He is also the author of a second novel *The Illuminated Soul* (Riverhead), translated into German, Dutch and Italian, and a story collection *The Dialogues of Time and Entropy* (Riverhead). His story "Lotte Returns!" was commissioned and broadcast by National Public Radio. He has been a special guest discussing Creativity and the Brain on *Studio 360* hosted by Kurt Andersen.



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**Pireeni Sundaralingam, USA**

Pireeni Sundaralingam is a poet, cognitive scientist, and playwright. She is associate professor in the Department of Writing, Consciousness and Creative Inquiry at the California Institute of Integral Studies in San Francisco, USA. She has held national fellowships in both cognitive science and poetry and most recently, a fellowship in interdisciplinary thinking at Berlin's *Institut Für Raum Experimente*. She has held cognitive science research posts at Massachusetts Institute of Technology and the University of California Los Angeles, while her poetry has been published in over 20 journals, and translated into 5 languages. Literary awards include the N. California Book Award, the PEN Josephine Miles Book Award (for co-editing "Indivisible" the first national anthology of American poets from South Asia), and the 2014 award for Individual Artist from the San Francisco Arts Commission. Her most recent play *War Harvest*, staged by the Asian American Theater Company and the Exit Theater, explores the Sri Lankan genocide. Ms. Sundaralingam is a science advisor to the Irish Government's Department of Art and Heritage. Prof. Sundaralingam was educated at Oxford University.



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**Shodekeh Talifero, USA**

Shodekeh Talifero is a groundbreaking beatboxer and vocal percussionist who pushes the boundaries of the human voice. He currently serves as Faculty, Musical Accompanist and Composer for Towson University's Department of Dance and is the founding director of "Embody, A Music Series of the Vocal Arts", which strives for artistic and cultural unity through the many vocal traditions from the world from opera, throat singing, to beat boxing. Beatboxing is a form of vocal percussion of Hip Hop culture. Imitating and often replacing a drum set, drum machine or drum loop through a series of vocal effects or percussive sounds primarily produced by the larynx, nasal and oral cavities, beatboxing exemplifies the Hip hop philosophy of creating meaningful artistic expressions with limited resources at its most extreme. It replaces the source of the timeless Break Beat – with the human voice. Beatboxing has become a ubiquitous feature of the American city experience and soundscape. In recent years, Mr. Talifero has moved from beatboxing's Hip Hop roots to explore innovative collaborations with a wide range of traditional artists, including Tuvan throat singing, Lithuanian folk music, experimental, funk, jazz, rock, classical, ballet and various forms and techniques of modern dance. He is constantly striving to rhythmically channel the vast spectrum of sounds around him, not just through music, but via the channels of science, culture, history, mathematics and ethnomusicology.



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**Alina A. von Davier, USA**

Alina von Davier is a senior research director at Educational Testing Service (ETS) and an adjunct professor at Fordham University. At ETS, she developed the expertise and psychometric research agenda in support of next generation of assessments. Previously, she led a psychometric center for international tests, where she was responsible for the scores reported to about a million of test takers annually. She edited a volume on test equating, *Statistical Models for Test Equating, Scaling, and Linking*, and wrote several other books on psychometrics. Her novel approach to the assessment of collaborative problem solving skills gained attention recently. She is a frequent speaker at national and international forums on a variety of topics from statistics to educational assessment. Dr. von Davier holds an M.Sc. in Mathematics from the University of Bucharest, Romania, and a Ph.D. in Mathematics from the Otto von Guericke University of Magdeburg, Germany.



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**Phillip Yao, United Kingdom**

Phil Yao is currently a Rhodes Scholar at the University of Oxford studying education and business. His recent dissertation was a qualitative, exploratory study on the emerging phenomenon of teacher training through massive open online courses (MOOCs). He has worked in diverse areas of education, including early education with the Indian NGO Pratham, Common Core education with the U.S. Department of Education, computer science education with the Office of Mayor Michael Bloomberg, art education with the Metropolitan Museum of Art, and college education with the Harvard Educational Policy Committee. Mr. Yao holds an A.B. in Physics and Philosophy from Harvard University.



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**Jinghuan Zhang, People's Republic of China**

Jinghuan Zhang is a professor at the School of Psychology of Shandong Normal University, China. Her research interest have focused on creativity for almost 30 years and she has published several books and numerous papers on that topic. She studies the influential factors, such as family environment, teaching strategies, and classroom climate on the children's creativity development, as well as the creative eminence including creative scientists and teachers. Recently she began to examine the genetic basis of creativity and published two papers. Dr. Zhang holds a B.A. and an M.A. in education from Northeast University and Shandong Normal University respectively, and a Ph. D. from Beijing Normal University.

## Session Staff

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**Susanna Seidl-Fox**, *Program Director*

Susanna Seidl-Fox is the program director for culture and the arts at Salzburg Global Seminar, where she conceptualizes, develops, and manages several seminars and programs each year, including the recently-launched Salzburg Global Forum for Young Cultural Innovators. She has served Salzburg Global in various capacities including academic program coordinator, director of program development, and director of seminars. Before coming to Salzburg, Susanna worked as a simultaneous interpreter for the United States Department of State, interpreting primarily for the State Department's International Visitor Leadership Program. She also worked in publishing at Random House/Pantheon Books and at G.P. Putnam's Sons in New York. Susanna was a Fulbright Fellow, studying German theater and literature at the Universities of Mainz and Berlin, and conducted a comparative study of political cabaret in Germany in the Weimar Period and the 1970s. She holds a B.A. in German literature and in government from Dartmouth College, in New Hampshire, and an M.A. in translation and interpretation from the Monterey Institute of International Studies in California.

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**Clare Shine**, *Vice President and Chief Program Officer*

Clare Shine was appointed vice president and chief program officer of Salzburg Global Seminar in 2012, after a career spanning law, business and the arts. She is a UK-qualified barrister with 20 years' experience as environmental policy analyst for inter-governmental organizations, national governments, the private sector and NGOs. A bilingual French and English speaker and professional facilitator, she is an associate of the Institute for European Environmental Policy and member of the IUCN Commission on Environmental Law. Her work and publications have focused on biodiversity, international trade, governance, transboundary cooperation and conflict prevention, with in-region capacity-building across four continents and the Mediterranean Basin. She has played an influential role in biosecurity policy development, working as legal advisor to the World Bank, European Commission and Council of Europe. She co-authored the European Strategy on Invasive Alien Species endorsed by 43 countries and recently advised the EC on implementing the Nagoya Protocol on access and benefit-sharing for genetic resources. She has been a regular freelance contributor to the Financial Times arts section since 2003. She began her career in industry after studying literature at Oxford University and holds post-graduate degrees from London University and the Sorbonne University, Paris.

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**Julia Stepan**, *Program Associate*

Julia Stepan works as a program associate at Salzburg Global Seminar, where she assists program directors with the development, administration, and logistics of several sessions per year. Prior to joining Salzburg Global in May 2011, she worked first as a nanny, then as a personal assistant in the US. Julia holds an M.A. in American studies, focusing on cultural studies, from the University of Graz, Austria and did a one-year student exchange at the University of Wisconsin - Eau Claire, USA.

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*(at time of program)*

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**Amanda Velez**, *Library*

**Report Author:** Benjamin Ehrlich is an independent writer and researcher based in New York City. He is a contributing editor to *The Beautiful Brain*, the digital magazine dedicated to neuroscience and art, and a participating member of NeuWrite, the collaborative working group for scientists and writers sponsored by Columbia University. He recently contributed writing and editing work to the popular psychology book *Sensation: The New Science of Physical Intelligence* (Atria Books, a division of Simon & Schuster, 2014). His translations from *Café Chats* (Charlas de café, 1921) were published in *New England Review* (33.1). He is currently developing a book about Ramón y Cajal and the discovery of the neuron. Mr. Ehrlich is a graduate of Middlebury College, where he earned highest honors in Literary Studies.

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# Salzburg Global Seminar

Salzburg Global Seminar was founded in 1947 by Austrian and American students from Harvard University. Convinced that former enemies must talk and learn from each other in order to create more stable and secure societies, they set out to create a neutral international forum for those seeking to regenerate Europe and shape a better world. Guided by this vision, we have brought over 31,000 participants together from 160 countries for more than 500 sessions and student academies across cultural and ideological barriers to address common challenges. Our track record is unique – connecting young and established leaders, and supporting regions, institutions and sectors in transition.

Salzburg Global's program strategy is driven by our Mission to challenge present and future leaders to solve issues of global concern. We work with partners to help people, organizations and governments bridge divides and forge paths for peace, empowerment and equitable growth.

Our three Program Clusters – Imagination, Sustainability and Justice – are guided by our commitment to tackle systems challenges critical for next generation leaders and engage new voices to “re-imagine the possible.” We believe that advances in education, science, culture, business, law and policy must be pursued together to reshape the landscape for lasting results. Our strategic convening is designed to address gaps and faultlines in global dialogue and policy making and to translate knowledge into action.

Our programs target new issues ripe for engagement and “wicked” problems where progress has stalled. Building on our deep experience and international reputation, we provide a platform where participants can analyze blockages, identify shared goals, test ideas, and create new strategies. Our recruitment targets key stakeholders, innovators and young leaders on their way to influence and ensures dynamic perspectives on a given topic.

Our exclusive at Schloss Leopoldskron setting enables our participants to detach from their working lives, immerse themselves in the issues at hand and form new networks and connections. Participants come together on equal terms, regardless of age, affiliation, region or sector.

We maintain this energy and engagement through the Salzburg Global Fellowship Network, which connects our Fellows across the world. It provides a vibrant hub to crowd-source new ideas, exchange best practice, and nurture emerging leaders through mentoring and support. The Network leverages our extraordinary human capital to advise on critical trends, future programs and in-region implementation.

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