

BRAIN BODY + BREATH

music by

TOD MACHOVER

VOCAGAMMIFIED

*for soprano, strings,
and electronics*

BREATHING TOGETHER

*for flute, ensemble,
and electronics*

BRAIN OPERA 2.0

*for ensemble, electronics,
and "living/singing AI"*

Karol Bennett, soprano
Jessica Shand, flute

BO2.0 Ensemble
Tod Machover, conductor

This concert has been organized in celebration of the opening of the new MIT Museum, at the invitation of museum director John Durant. The program consists of three brand new pieces, presented in public for the very first time. We have created these works to showcase the power music has on our minds and bodies, while interrogating why this might be so.

Mostly, we hope that you will enjoy listening to these pieces as much as we have enjoyed putting them together.

VocaGammified is based on an earlier work, *Gammified* (2019), that was composed for the Kronos Quartet. Growing out of research from the labs of MIT neuroscientists Li-Huei Tsai and Ed Boyden, the music weaves around a Gamma frequency drone—sounding at 40Hz (the lowest E on the piano), with complex and varying frequencies above—that has been shown by Media Lab grad student Alexandra Rieger and others to produce many positive effects in the brain, including reversing some of the pathology of Alzheimer’s disease. The piece is composed so that the “scientific-sounding” frequencies are extended and embellished by the strings, moving from noise to harmony to melody, all the while preserving the hypothesized therapeutic benefits of Gamma. In 2021, during the pandemic, I decided to add a vocal line to the piece, in order to guide the ear—and the emotions—even more clearly along this “Gamma journey,” and the result is *VocaGammified*. The vocalist for tonight’s performance is Karol Bennett, a long-time collaborator of mine, and I am just delighted that she will be the one—along with the marvelous string players—to share this new piece with you.

Breathing Together is a meditation on breath in all its forms: the power of slow, controlled breathing to bring calm, focus, and wellbeing; the dangers of breathing in the time of COVID; the potential for profoundly connecting with others through synchronized breathing. This piece, composed in spring and summer of this year, explores these different perspectives on breathing, with a flute soloist—performed here by MIT Media Lab grad student Jessica Shand—as our guide. Sometimes the breathing is literal, as with the halting flute-breath at the opening of the piece, sometimes it is metaphorical through the shape of musical gestures and phrases, and many times it is somewhere in between. Always it was inspired by research into the effects of musical creation, listening, and performance by Media Lab grad student, Kimaya Lecamwasam, who worked closely on *Breathing Together*. The piece starts with many different simultaneous breathing patterns, as if each player in the ensemble is finding their own way to “catch their breath.” A meditative slow section finds the flute shepherding the other musicians to synchronize breathing with one other, culminating in a calming ensemble breathing pattern in the center of the piece (which audience members are welcome to join). The final movement accelerates with propulsive breathing, like Kundalini Yoga’s “Breath of Fire,” used to increase concentration and to expel wayward thoughts. At the moment of fastest breathing, the whole ensemble does indeed breathe together, leading to a long held breath and then an even longer exhalation which continues—musically—through the end of the piece.

Brain Opera 2.0 is a revival and reinterpretation of the music from my Brain Opera project, first launched at New York’s Lincoln Center in 1996. The project was based on Marvin Minsky’s seminal *Society of Mind*, and invited audiences to immersively explore what happens in our minds when we listen to—or create—music, through a “Mind Forest” of interactive instruments, one of the first Internet-enabled audience participation vehicles, and a performance that pulled contributions from the audience—in close to real time—that made each show distinct and special. The Brain Opera was not only about music, it was immersed in music that I composed for each of the interactive experiences and for the final performance. After opening in Lincoln Center, the Brain Opera toured around the world for three years, and then was installed—after a significant redesign and upgrade—at the House of Music museum in Vienna, where it was open to the public from 2000–2012. Since that time, it has been difficult to share the Brain Opera, since its instruments are mostly disassembled in my basement and the music itself—designed for fully electronic performance with our specially designed hyperinstruments—has not been accessible. So, inspired by the opportunity to share a range of work at this MIT Museum concert, I decided to bring back the core of the Brain Opera music, to score it for the first time for live instruments with electronics, and to update certain elements to be as bleeding edge as the original project was. *Brain Opera 2.0* starts with a meditation on the meaning of music, “narrated” by the voice of Marvin Minsky and surrounded by dream-like fragments of music from many periods and styles, with my version of Bach’s 6-part Ricercare from the *Musical Offering* holding it all together. This segues into Minsky Melodies, that sets to music a series of interviews that I did with Marvin, accompanied by animated text designed by David Small and Yin Yin Wong. In the original Brain Opera, the centerpiece was an Internet app through which anyone anywhere could tap into a live performance and send fragments of sound that we would incorporate. In this new version, we are using for the very first time a new “musical brain” designed by Media Lab PhD student Manaswi Mishra, that contains an enormous wealth of musical and sonic material and responds to our performers in provocative and compelling ways. To me, it feels as if we have simultaneously opened our ears to the universe of sound, while we are also experiencing the birth of a new kind of musical intelligence, something I searched for in our original project. Leading on from this “Music-Mind-Improv,” the rest of the piece crackles with jagged melodies, harmonies and rhythms that try to pull the “whole world of music” into coherent form. Throughout *Brain Opera 2.0*, you will hear all kinds of beautiful voices in the electronic part; many of these—including in the Minsky Melodies section—were sung by Karol Bennett, but you will also hear Anne Azéma, the late Lorraine Hunt, and Christopher Nomura. And as with all my projects, including the original Brain Opera, I hope that *Brain Opera 2.0* opens doors—rather than closing them—to the imagination, while providing ample sonic stimulation and satisfaction along the way.

Notes by Tod Machover

Special thanks go to John Durant and the entire MIT Museum team for requesting and supporting this project; to violinist Marina Kifferstein for assembling the wonderful musicians of the BO2.0 Ensemble and for coordinating numerous complex logistics with the MIT Media Lab team; to flutist Jessica Shand for accepting to play the demanding flute part to Breathing Together before she even started as a grad student at the Media Lab and—even more—before the piece was even written; to Simone Ovsey for coming back to the Media Lab to lend her superb production skills to this project, without which we never could have achieved this result; to Nikhil Singh for putting together all the systems that make this concert run; to SAVI for providing the exceptional audio system for these concerts; to long-time collaborators Karol Bennett, Peter Torpey and Ben Bloomberg for lending their genius and experience to the genesis and presentation of this concert; to my MIT Media Lab colleague Joe Paradiso who was my partner in building the original Brain Opera, and who is convinced that we can bring parts—if not all—of the original system back to life, starting with the Sensor Chair which is hopefully destined for a home in the MIT Museum; and to the entire Opera of the Future group at the MIT Media Lab who contributed to this work and to these pieces and projects in so many ways, always with generosity, creativity, curiosity and kindness.

BRAIN, BODY, + BREATH

Music of Tod Machover

The Exchange, MIT Museum, October 14 and 15, 2022, 7 PM

VOCAGAMMIFIED (2021)

Karol Bennett, soprano

Marina Kifferstein and Leah Asher, violins

Carrie Frey, viola

Meaghan Burke, cello

Emilio Guarino, double bass

Gamma electronics

BREATHING TOGETHER (2022)

Jessica Shand, flutes

* BO2.0 Ensemble

Electronics

Tod Machover, conductor

SCAN HERE TO PARTICIPATE
IN OUR RESEARCH



BRAIN OPERA 2.0 (2022)

Texts by Marvin Minsky, from interviews with Tod Machover

Minsky Melodies text animation by David Small and Yin Yin Wong

* BO2.0 Ensemble

Marina Kifferstein and Leah Asher, violins

Carrie Frey, viola

Meaghan Burke, cello

Emilio Guarino, double bass

Yuma Uesaka, clarinets and tenor saxophone

Sam Jones, trumpet

Jen Baker, tenor trombone

Mike Truesdell, acoustic and electronic percussion

Cory Smythe, keyboard

Electronics and "Living/Singing AI"

Tod Machover, conductor

All three pieces are World Premieres, being performed for the first time at these concerts.

Video by Peter Torpey (*Breathing Together* and *Brain Opera 2.0*)

and Brian Mayton (*VocaGammified*)

Sound Design, Ben Bloomberg

Audio Production, Nikhil Singh

Producers, Simone Ovsey and Brooke Ciardelli

Program designed by Jessica Mindel

Technology by MIT Media Lab

⚠ WARNING: Video displayed during this performance may potentially trigger seizures for people with photosensitive epilepsy. Viewer discretion is advised.

TOD MACHOVER is a composer, researcher and educator, and is a founding faculty member of the MIT Media Lab. He is currently the Lab's Muriel R. Cooper Professor of Music & Media, as well as Academic Head of the Media Arts and Sciences graduate program. Called "a musical visionary" by *The New York Times*, Machover strives to invent technologies that open doors to musical creativity for virtuosos and amateurs, to pull opera into the 21st century and beyond, to develop audio for healing and wellbeing, and to tell sonic stories that matter. His next opera—based on Richard Powers' Pulitzer Prize-winning novel, *The Overstory*—will be previewed in New York and Seoul in March 2023.

CARRIE FREY, VIOLA Carrie Frey is the violist of the Rhythm Method string quartet and a founding member of string trio Chartreuse and string quartet Desdemona. She has performed with many of New York City's notable new music groups, including Wet Ink Large Ensemble, AMOC, Talea Ensemble, and International Contemporary Ensemble. Her compositions, described as "a moldering compost heap" (I Care if You Listen), have been performed by The Rhythm Method, Arco Belo, Adrienne Munden-Dixon, and Kallie Sugatski.

CORY SMYTHE, PIANO Pianist Cory Smythe (he/him) has worked closely with pioneering artists in new, improvisatory, and classical music, including multi-instrumentalist-composer Tyshawn Sorey, violinist Hilary Hahn, and transdisciplinary composers from Anthony Braxton to Zosha Di Castri. He has been commissioned by Present Music, the Banff Centre for the Arts, the Trondheim Jazz Orchestra, and the International Contemporary Ensemble, of which he is a longtime member. Smythe received a Grammy award for his work with Ms. Hahn and a 2022 Herb Alpert Award in music.

EMILIO GUARINO, BASS Emilio Guarino is a bassist, composer, and audio engineer. He has collaborated with The Lucerne Festival and Stavanger Kammermusikk Festival as well as regularly performs with dub reggae group CC Roots and Lateef Dameer's hip-hop project First Life. As a composer, Emilio has remixed for Collapsing Scenery, frequently releases electronic music with Unit7Noise in Australia, and most recently composed and produced a seven movement orchestral suite titled *Il nome scelto da Birgitte* in collaboration with Michael Folmer Hansen.

JESSICA SHAND, FLUTE (BREATHING TOGETHER) Jessica Shand is a performer-composer, researcher, and current Presidential Fellow of the Opera of the Future group at the MIT Media Lab. A Wm. S. Haynes Co. International Young Artist, she is a recent graduate of Harvard University ('22), where she earned a bachelor's degree with highest honors in mathematics and music while also studying flute performance at the New England Conservatory.

JEN BAKER, TROMBONE NYC-based Trombonist/Composer and author Jen Baker collaborates, composes, and improvises with artists everywhere, finding common ground in the joy of tapping into the stream of consciousness for improvisation, compelling extended techniques such as multiphonics, and developing unity in the many chamber groups she has performed in. Baker started this season performing with Bang on a Can at Carnegie Hall, the Annual Le Poussin Rouge performance of Terry Riley's *C*, Vinny Golia's Large Ensemble at Roulette, the John Cage Award recipient Petr Kotik's 6-hour *Many Many Women*, Randy Gibson's *Infinite Structures Visual/Sound Exhibit*, and the Anna Webber/Angela Morris Big Band.

KAROL BENNETT, SOPRANO (VOCAGAMMIFIED) Soprano Karol Bennett has been heard worldwide in recital, oratorio, opera, and new music. Her honors include an Artistic Ambassadorship, a Duo Recitalists Grant from the National Endowment for the Arts, the Pro Musica International Award, a Bunting Institute of Radcliffe College Fellowship and an Alumni Award from UMKC. A champion of living composers, her extensive repertoire includes some of the most vocally challenging works of the past century with many works written especially for her. After Covid's concert shutdowns she is especially grateful to be with live audiences in MIT's brand new space and delighted to sing the World Premiere of Tod Machover's *VocaGammified* at MIT where their first collaborations began.

LEAH ASHER, VIOLIN Violinist/violist, composer, and visual artist Leah Asher is an avid performer of contemporary music and creator of new artistic works. Leah is a member of The Rhythm Method string quartet and co-creator of MEANINGLESS WORK with Nicolee Kuester. She regularly performs with New York-based ensembles such as International Contemporary Ensemble, Talea Ensemble, and S.E.M. Ensemble. Leah joined the faculty of Manhattan School of Music as of 2022.

MARINA KIFFERSTEIN, VIOLIN Marina Kifferstein (she/they) is a violinist and generative artist based in NYC. Equally comfortable in major international halls and intimate DIY venues, she enjoys a diverse career with a focus on contemporary chamber music. Marina is a founding member of TAK ensemble and The Rhythm Method string quartet, and is a principal member and curator with the Lucerne Festival Contemporary Orchestra.

MEAGHAN BURKE, CELLO Meaghan Burke is a Brooklyn-based cellist, vocalist, and composer working in the space between contemporary music, songwriting, and improvisation. She's a co-founder of contemporary feminist string quartet The Rhythm Method, avant-grunge band Forever House, Miho Hazama's Grammy-nominated chamber jazz ensemble *m-unit*, and Viennese songwriter collective Loose Lips Sink Ships. Meaghan can also frequently be found rehearsing with her family band, which features her 10-month-old twins on toy piano and found objects.

MIKE TRUESDELL, PERCUSSION Mike is thrilled to be back in Boston for this exciting premiere! Though this is the first time collaborating with Tod Machover, he has had the privilege of working alongside many of the performing musicians you see here in his past musical lives. Perhaps you've seen him slapping backs in a diner or scratching a shirt on YouTube, or maybe you've heard him in concert: either in NYC (where he did his graduate work) or in Ithaca, NY (where he currently resides). Either way, tonight's performance is going to be a blast!

SAM JONES, TRUMPET Trumpeter Sam Jones is a soloist, improviser, and freelancer in New York City. He is a member of Talea Ensemble and Ensemble Échappé. Upcoming highlights include his debut album release and a performance on November 5th with Bang on a Can at Carnegie Hall.

YUMA UESAKA, CLARINET, BASS CLARINET, AND SAXOPHONE Saxophonist and clarinetist Yuma Uesaka (b.1991) works within the intersection of jazz, creative music, and new music. Active in New York City since 2014, he came to wider attention with Ocelot, a record with his collaborative trio with Cat Toren and Colin Hinton, and Streams, a duo recording with pianist Marilyn Crispell. As a composer, he's received recognition from the ASCAP Foundation, Metropolis, and Either/Or Ensemble. He has performed with Anna Webber, Jessie Cox, Lesley Mok at venues such as The Jazz Gallery, Roulette, and National Sawdust, and has recorded for Pi, New Focus, NotTwo, and Polyfold Records.

PETER TORPEY, VIDEO AND LIGHTING DESIGN Peter A. Torpey combines light, image, music, interactivity, and storytelling. As the founder and principal creative at The nth Art, he collaborates with theater-makers, orchestras, museums, festivals, companies, educational institutions, and other artists to create experiences that connect audiences and participants with stories and each other. Throughout his work, Peter addresses the technological needs of complex performances and exhibitions, as well as the design of visual and experiential languages for each project.

BEN BLOOMBERG, SOUND DESIGN Ben Bloomberg finished his PhD at the MIT Media Lab in 2020, and has been a long time collaborator of Tod Machover, having designed audio technology for many of his operas including *Death* and *The Powers* and *Schoenberg in Hollywood*. He was also recently nominated for the 2021 Album of the Year Grammy Award for his technical and creative contributions to Jacob Collier's *Djesse Vol. 3*, having worked to develop much of Collier's live production and custom technology. In his research and practice, he seeks to build technology to humanize live music performance by letting musicians influence and shape production systems intuitively and with creativity.

NIKHIL SINGH, AUDIO PRODUCTION Nikhil Singh is a researcher and PhD student in the Opera of the Future group at the MIT Media Lab. He works to develop new computational techniques to augment how humans and computers engage with sound and multisensory media, drawing on extensive professional experience as a musician, composer, and audio engineer. He previously studied classical music composition, jazz guitar, and music technology at the Berklee College of Music, graduating in 2017.

BRIAN MAYTON, INTERACTIVE VISUALS (VOCAGAMMIFIED) Brian Mayton completed his Ph.D. in 2020 at the MIT Media Lab, where he explored how wireless sensor network technologies can help document the process of ecological restoration to facilitate learning and artistic expression. He collaborates with Living Observatory, a non-profit organization that connects scientists, artists, and wetland restoration practitioners. He also designs and builds custom audio and performance electronics and systems.

SIMONE OVSEY, PRODUCER Combining her love of music with her studies at MIT's Sloan School of Management, Simone began her journey in performance production while an undergrad researcher with Tod Machover at the MIT Media Lab. After graduation, she worked on large-scale projects with Machover, including his *Death* and *The Powers* opera world premiere and a host of high-profile events and experiences. Simone continues to pursue professional endeavors at the intersection of art, science, and technology.

OPERA OF THE FUTURE GROUP, MIT MEDIA LAB The Opera of the Future group at the MIT Media Lab under the direction of Tod Machover explores concepts and techniques to help advance the future of musical composition, performance, learning, and expression. Through the design of new interfaces for both professional virtuosos and amateur music-lovers, the development of new techniques for interpreting and mapping expressive gesture, and the application of these technologies to innovative compositions and experiences, the group seeks to enhance music as a performance art, and to develop its transformative power as counterpoint to our everyday lives. Current students Alexandra Rieger, Nikhil Singh, Manaswi Mishra, Kimaya Lecamwasom, Max Addae, Jessica Mindel, Jessica Shand, and Manuel Cherep contributed greatly to this performance series.