

CONTENTS

2015 Research Agenda
Technology Horizons Team
Membership Information



TECHNOLOGY HORIZONS PROGRAM

INSTITUTE FOR THE FUTURE

IFTF's Technology Horizons program anticipates future forces in science and technology that will combine to transform how we live, work, and play in the next decade. We monitor early signals and evaluate scientific discoveries to understand the social and organizational change they will drive. We map the technology horizon to anticipate disruptions. We create alternative scenarios and imagine the impacts on people and networks, organizations and institutions, and communities and regions globally.

Each year, we explore the future of science and technology within a framework of three forces that shape technology innovation: creators, new makers, and communities that are driving advances; context, new conditions, and practices shaped by technology that amplify or disrupt people's lives; and computation, tools contained in devices or embedded in the world that are driving new ways of interacting with things and with each other. We tease out the transformations and disruptions at their intersections to tell stories about the future.

› **ANTICIPATE THE FUTURE**

through our signals and forecasts, and avoid being blindsided by disruptive technologies.

› **EXPLORE ALTERNATIVE FUTURES**

and think systematically about the next decade when making decisions about technology and investments in new products.

› **IDENTIFY FUTURE OPPORTUNITIES**

for market growth, new business models, and emerging forms of competitive advantage.

› **EXTEND YOUR INNOVATION REACH**

with our network of visionaries from industry, academia, and regional collaborative networks.

HUMAN-MACHINE FUTURES: ALGORITHMS, IDENTITIES, AND DEVICE ENSEMBLES

We are engaged in a never-ending dance of coevolution with machines. Machines are all around us. We bring them to work, to eat, and even to bed. They provoke our imaginations, expanding what's possible and what it means to be human. As we evolve with our machines, it inspires a new generation of innovations—a cycle that repeats itself over and over again. This cycle is nearly as old as humanity itself.

Over the past century, though, this coevolution has accelerated. We're on the verge of transformation on an entirely new scale. Technologies of automation are set to permanently alter how we get things done. And breakthroughs in computation and biology are set to spill out of research labs and into the hands of the everyday person, changing how we relate to life itself. As machines become more deeply embedded in our bodies and environments, the distinction between human and machine, natural and artificial, will blur. We'll move beyond present-day debates around whether we are competing or cooperating with machines to open new forms of human-machine symbiosis and new varieties of human experience.





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AN AUTOMATED WORLD: TECHNOLOGIES, TRANSFORMATIONS, AND CONFLICTS

Since humans first began creating machines, we've used them to help us do work that we don't want to, or cannot, do ourselves. In the past quarter century, we've witnessed a seemingly impossible advancement in machines' capabilities to get things done without our direct involvement. In the last decade alone, we've seen self-driving cars go from being unable to travel more than ten miles on empty desert roads to navigating over 700,000 miles globally, via highways and city streets.

But this is just the beginning. Similar advances in automation are coming to many other arenas of human activity like food preparation, complex manufacturing, and many white-collar job functions. In workplaces, artificially intelligent systems will help us do some jobs better, take others away, and generate new jobs entirely. In the home, automated systems will know where we are and assist us in everything from calendaring to caregiving. And at the city level, we'll see automation become an embedded function of the systems that manage and control many aspects of our daily lives, creating new conveniences built on the careful orchestration and synchronicity of urban life.

This emerging automated world is made up of a set of component parts—foundational technologies that, in combination, make this future possible. We'll kick off the 2015 research year by examining how these component technologies will be combined and configured to impact all aspects of human life. We will map opportunities and dilemmas at three scales: people and daily life, organizations and work, and cities and systems—creating forecasts of the affordances, conflicts, and transformations made possible by an automated world.

DELIVERABLES

› **Technologies of an Automated World: Card Deck**

A collection of cards containing the foundational technologies of automation that integrate foresight and group process to support combinatorial forecasting and strategic insight.

› **Life in an Automated World: Combinatorial Forecast Map**

A map laying out the technological foundations of emerging forms of automation and forecasts exploring how they could be combined and remixed.

› **Insight Workshop**

A one-and-a-half day client-only session at IFTF on June 16–17.



BODY AREA NETWORKS: OPTIMIZING FOR WORK, PLAY, AND VITALITY

In the next decade, the most transformative technologies will be the emerging suite of devices that travel with us wherever we go: in our pockets, on our wrists, even inside our bodies. Better-than-human prosthetics, brain-machine interfaces, and sensors for tracking everything from sleep to stress to blood sugar are creating a new ecosystem of personal technologies—body area networks. This ecosystem opens the possibility of everything from brain-to-brain communication to virtual environments that overlap and blend with reality. In the next decade, we'll be able to adopt and discard ephemeral identities, build social networks of machines, create crowd and collective identities, and interact with a variety of entities, from natural phenomena like forests to concepts like corporations and cities, as if they were human beings. When technology gets this personal and this powerful, the range of possible uses, experiences, and conflicts it opens up is nearly limitless.

Just as the home was an important arena for technology adoption, Body Area Networks represent a new frontier. But how will we configure these networks for health, work, entertainment, or intimacy? How will we get the most from the data they generate while ensuring privacy? How can we leverage these technologies to enhance relationships, express our feelings, or even change our definitions of self?

DELIVERABLES

› **Configuring Body Area Networks: Forecast Map of Uses and Strategies**

Already, leading-edge users in work, health, entertainment, and sports are experimenting with Body Area Networks, configuring them to address their desires, concerns, and aspirations and, in the process, revealing the unmet needs and underlying demands that will shape the creation and adoption of these technologies in the future. By engaging these pioneers, as well as experts, we'll map the range of ways that people will remix and reconfigure Body Area Networks to remake their lives.

› **New Machines, New Identities: Forecast Perspectives of Emerging Identities**

Machines have always created new identities for humans. The invention of the car was also the invention of the motorist, the mechanic, and the gearhead. However, the effects that technology will have on identity in the next decade will be more profound than anything we've witnessed before. As different uses and configurations of Body Area Networks proliferate, it will be these new identities that will largely shape human experience. This series of perspectives will forecast how these emerging identities will intersect with—and be enabled by—different configurations of Body Area Networks.





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IFTF

HUMANS+MACHINES+OTHER BIOLOGIES

While machines are rapidly transforming the human experience, they're also transforming our relationship with other biologies—plants, animals, and entire ecosystems—and providing us with new insight into the basis of life itself. Technologies of automation and Body Area Networks give us an unprecedented look at ourselves and the world around us—from the scale of microbes all the way up to interplanetary relationships. This data will fuel a plethora of potential advances, unlocking a host of new ways to sculpt people and the planet. In a forecast of 10 combinatorial biological futures, we'll highlight transformations that shift not only the way we think about ourselves and our bodies but open up the ability to create new life forms and enlist them to clean the environment, alter existing life forms to make them more resilient, and create new bio-inspired products and services that transform the material world both around and inside us.

DELIVERABLE

› Forecast Map

We will identify a set of transformative biological futures and their underlying technological foundations—from synthetic biology to the microbiome to biomimicry and bio-inspired manufacturing. This forecast map will highlight innovators making this future now and serve as a strategic tool for present-day choices as you consider a range of combinatorial forecasts at the intersection of these transformative biological futures and your organization.



ANNUAL FORESIGHT RETREAT: OCTOBER 22–23, 2015

Our 2015 research will culminate in an open and collaborative two-day gathering in the San Francisco Bay Area on October 22–23. This event will give attendees a chance to immerse themselves in human-machine futures, identify strategic insights, and get hands-on experience with innovation processes and tools with a network of technology innovators, makers, and disruptive thinkers.



ROD FALCON, PROGRAM DIRECTOR



Rod leads the Technology Horizons program and team. With a deep background in public health policy, he has served in several different capacities at IFTF since 1995, including leading the Global Food Outlook and Health Horizons programs and directing global research projects for the Technology Horizons program.

In the course of his work, Rod speaks to executive audiences and helps them find innovative strategies for participating in the global economy. Rod's research focus areas have included personal health technologies, cities and ecosystems of well-being, social networks and abundant connectivity, and health-aware environments.

Rod likes to think at different scales and across multiple time horizons to tell provocative stories about the future. His current research interests focus on mapping emerging human-machine interfaces and how they'll extend and amplify all of our human senses, creating new experiences in almost every arena of daily life.

Rod is inspired by bringing futures thinking and tools to communities and organizations and looks for creative ways to inspire people to make their own future. Born in Oakland, California, Rod attended nearby UC Berkeley, where he earned a BA in American history and an MA in public policy.

JAKE DUNAGAN, RESEARCH AFFILIATE



As a research affiliate, Jake focuses on examining social invention and the redesign of systems in light of current tools and knowledge. He also designs artifacts, games, immersive experiences of future worlds, and guerilla public engagement projects that inject the future into the mental ecology of the present.

Jake is currently an adjunct professor in the MBA in Design Strategy program at the California College of the Arts, where he teaches strategic foresight, tactical media, and social invention.

He holds a BA in visual anthropology from Auburn University, an MA in visual anthropology from Temple University, and a PhD from the Manoa School of Futures Studies at the University of Hawaii with an emphasis in geopolitics, governance design, alternative futures, and communication of foresight.

DEVIN FIDLER, RESEARCH AFFILIATE



Devin's interests center on applying foresight to organizational strategy, with an emphasis on the impacts of emerging technologies and shifting business models. He sees organizations as systems designed to activate know-how in the right places and at the right times. From this

perspective, he argues that in a post-globalization world, all management is knowledge management. Devin approaches projects from a strongly international perspective, having lived and worked in several countries over the course of his career.

Before joining IFTF in 2010, Devin was involved with a number of projects in the areas of technology assessment and the future of business, including work in the Research and Analysis Center of the U.S. Chamber of Commerce, as director of the International Business Trends Center, as a futurist at the Institute for Alternative Futures, and as an analyst for the Royal Bank of Scotland in Edinburgh. He holds a BA in history from the University of Colorado and an MBA with a focus in emerging markets from Budapest University of Economics and Institut des Hautes Etudes Economiques et Commerciales in Paris. Devin participated in the inaugural class of Singularity University, a program sponsored by NASA and Google.



MIRIAM LUECK AVERY, RESEARCH DIRECTOR



As an anthropologist, Miriam has an overarching interest in how individual and collective choices make the future. Her passion as a forecaster is envisioning futures that inspire people to navigate complex transitions, make resilient communities, and create circumstances in

which we all can thrive. She began interning with IFTF in 2003, joined the research staff full time in 2007, and served as a research director working primarily with the Health Horizons, Global Food Outlook, and Ten-Year Forecast programs.

Miriam identifies and evaluates emerging trends and innovations in health and well-being, health care, food, nutrition, and sustainability. She presents forecasts in strategic roadmaps, conferences, panel discussions, and keynote presentations. She also designs group processes that facilitate anticipating the future and making strategic decisions in the present. Her areas of research interest include well-being futures, food futures, human futures, retail and retail alternatives, and participatory foresight and youth leadership. Miriam holds a BA in anthropology from UC Berkeley.

JAMAIS CASCIO, DISTINGUISHED FELLOW



Selected by *Foreign Policy* magazine as one of their Top 100 Global Thinkers, Jamais writes about the intersection of emerging technologies, environmental dilemmas, and cultural transformation, specializing in the design and creation of plausible scenarios of the future. His work focuses on the

importance of long-term, systemic thinking, emphasizing the power of openness, transparency, and flexibility as catalysts for building a more resilient society.

Cascio's work appears in publications as diverse as *Metropolis*, the *Atlantic Monthly*, *The Wall Street Journal*, and *Foreign Policy*. He has been featured in multiple television programs discussing foresight and environmental issues, including National Geographic Television's *SIX DEGREES*, its 2008 documentary on the effects of global warming, the History Channel's *SCIENCE IMPOSSIBLE*, its 2009 series on emerging technologies, and the 2010 Canadian Broadcasting Company documentary, *SURVIVING THE FUTURE*.

ERI GENTRY, RESEARCH MANAGER



An economist-turned-biotech-entrepreneur and a White House Champion for Change in Citizen Science, Eri is a research manager for the Technology Horizons program. She is also a cofounder of BioCurious and a cohost of the Bay Area Quantified Self.

She was previously VP of open innovation at Scanadu, community manager at Genomera, and CEO and cofounder of Livly. The latter was a nonprofit cancer research company started in a Mountain View, California, garage that soon attracted a community of both amateurs and professional scientists that completely overwhelmed its capacity to support collaborative work. Hence the need for BioCurious, the world's first hackerspace model for biotechnology, now one of the largest DIYbio organizations in the world.

ALEX GOLDMAN, RESEARCH MANAGER



With a background in video game production and design, Alex brings a practiced systems-scale perspective to IFTF by combining an understanding of how multi-user environments are designed, experienced, and tested—and what they're capable of. As a research manager on the

Technology Horizons team, he conducts strategic research on emerging technologies and how they impact the landscape of human interactions—whether with machines or other human beings.

Alex has a special interest in the future of entertainment, particularly the expanding role of gaming and games thinking in society, as well as the shifting definitions of fun. Alex holds a BA in politics from Brandeis University and an MET (masters in entertainment technology) from the school of computer science at Carnegie Mellon University. While at Carnegie Mellon, Alex received multiple recognitions for his work on advancing the use of natural user interfaces in game environments and on developing new design approaches for incorporating learning into games.

BEN HAMAMOTO, RESEARCH MANAGER



As research manager, Ben uses insights from his background in journalism covering issues of race and inequality to explore how well-being is shaped by social and environmental contexts. He has researched the future of food technology, environments that enhance well-being, and the design of

healthy places, and he has an ongoing interest in narrative and health, the meaning of place, and equity and social justice. In addition to his work at IFTF, Ben contributes to the *Nichi Bei Weekly* and edits the National Japanese American Historical Society's official magazine, *Nikkei Heritage*.

Ben believes that short-term thinking is a major cause of today's social inequity and that foresight is critical to successful social change and effective governance. His upbringing in the diverse socioeconomic conditions of the San Francisco Bay Area inspired his interest in issues of race, class, and social justice. He spent half a decade covering these issues as a journalist at *Youth Outlook*, *New American Media*, and the *Nichi Bei Times* before coming to IFTF in 2011. Ben holds a BA in cinema from San Francisco State University.

LYN JEFFERY, RESEARCH DIRECTOR



Lyn is a research director for the Ten-Year Forecast program and frequently contributes to the Technology Horizons, Health Horizons, and Future of Manufacturing programs. Fluent in Mandarin, Lyn also leads IFTF's work in China. Her current research interests

include kids and technology, social manufacturing and new global creative networks, personal identity and data, and the future of communication and collaboration.

Her core interest is exploring how people make sense of the rapidly shifting world around them, whether it's a "left-behind" child in a Sichuan village, an executive in a large multinational organization, or an amateur musician experimenting with new digital tools. She is passionate about understanding how people are using ubiquitous information and digital co-presence to express themselves in new ways and form new kinds of social relationships.

Lyn directed IFTF's Technology Horizons program from 2009 to 2012 and was a lead researcher in IFTF's Global Ethnographic Network. She holds a BA in Chinese studies and a PhD in anthropology from the UC Santa Cruz.

MEAGAN JENSEN, PROGRAM ADMINISTRATOR



Meagan's interests include the study of technological, educational, and environmental trends through the lens of government initiatives and public policy, as well as through personal interviews and narratives. Her experience includes policy analysis and drafting, event and project development, research, and grassroots organization management.

Meagan worked with several non-profit organizations prior to joining IFTF, including the Asbestos Disease Awareness Organization (ADAO), and The Seneca Center. She holds a BA in History from UC Santa Barbara and a JD from UC Davis School of Law, King Hall.



BRADLEY KREIT, RESEARCH DIRECTOR



Since joining IFTF, Brad's research has focused on applying a human-centered lens to make sense of the effects of large-scale change in health, food, and well-being.

From this perspective, he has led research into how shifts within a broad range of subjects, including emerging technologies,

genetics, abundant data, neuroscience, and global water will impact the future of human experience. A frequent speaker and meeting facilitator, Brad particularly enjoys working with groups to use foresight to spark fresh thinking and inspire innovation.

Prior to joining IFTF in 2009, Brad worked in a variety of roles in and around health care, including as a writer for the Advisory Board Company and a freelance health and business reporter. Brad holds a BA in history from Connecticut College and an MA in anthropology from UC San Diego.

MIKE LIEBHOLD, SENIOR RESEARCHER AND DISTINGUISHED FELLOW



Mike is a tech research pioneer and veteran with decades of experience working for iconic companies, including Atari, Apple, Netscape, and Intel. As a senior researcher and distinguished fellow at IFTF, he researches and disseminates information about the technological underpinnings of

tomorrow's world, including the mobile web, immersive media, and context-aware and ubiquitous computing. He has a deep background in information architectures, network services, and technology policy.

Mike is a frequent speaker and commentator on the futures of computing and telecommunications and has authored a number of papers for publications. Along with launching several start-ups, he has been a visiting researcher at Intel Labs, a senior consulting architect at Netscape Communications, vice president and chief technology officer at Times Mirror Publishing, a senior scientist at Apple Computer for ten years, and administrative director of the Systems Research Group at the Atari Sunnyvale Research Laboratory. Mike has also led and helped organize projects with a range of grassroots and hacker groups, meetups and hackathons in mapping, augmented reality, cloud computing, and health tech.

SEAN NESS, BUSINESS DEVELOPMENT DIRECTOR



Sean oversees business development at IFTF, with a focus on the Technology Horizons and Ten-Year Forecast programs. He looks for creative ways to interact with outside organizations and works tirelessly to keep IFTF's client database accurate and up to date. In college, Sean switched from

mechanical engineering to polymer science when he learned that polymer grads often go on to technical sales, an idea that piqued his interest and that he pursued until it landed him in Silicon Valley.

RACHEL MAGUIRE, RESEARCH DIRECTOR



Rachel combines a deep understanding of health finance with an interest in the impact of new media and mobile personal technologies on health practices. She shares her perspective on the future of health, health care, and well-being and the author or co-author of numerous IFTF

reports, as a speaker at health care conferences, and as a meeting facilitator at client workshops and strategic retreats. She serves on the Henry Ford Hospital and Medical Group National Advisory Council.

Rachel's research efforts center on the intersection of health care delivery systems and mobile technologies. She studies how smart, mobile, and increasingly less expensive technologies are transforming self-care and beginning to disrupt clinical care. She has been a contributor to the IFTF's annual forecast perspectives, maps of the decade, and annual retreats since 2006. Rachel holds a BA in politics from Oberlin College and an MPAff (master of public affairs) from the University of Texas at Austin.

SARAH SMITH, RESEARCH + DESIGN



Sarah uses design as a medium to visualize complex systems and provoke people to think about the future in new ways. She draws from her experience in a range of disciplines—international studies, graphic design, creative writing, and the food service industry—to explore how emerging

technologies and social practices will change the way people and communities seek and create well-being. She then works closely with the design team to help conceptualize and create maps, infographics, and artifacts from the future.

Prior to joining IFTF, Sarah led a research-based design project with Chicago's Iraqi refugee population to create a book of Iraqi recipes and stories about hospitality to inspire cultural exchange between newly arriving refugees and American volunteers. She has also designed campaign materials for Amnesty International, where she helped to promote health as a human right.

JASON TESTER, RESEARCH DIRECTOR



Jason focuses on three areas: research into how people use emerging technologies, the application of design to futures research, and facilitating groups to stimulate insights and implications about the future. He strives to look beneath the surface of society and its artifacts for hidden

layers of meaning.

Jason has long been interested in researching and designing the ways people interact with technology, expertise he brought to IFTF's ongoing effort to broaden the ways in which its findings are visualized and presented. To this end, he developed one of IFTF's current methodologies, artifacts from the future.

Jason holds a BS in human-computer interaction design from Stanford University, and an MA from the Interaction Design Institute in Ivrea, Italy. While at Stanford, Jason helped found the Stanford Persuasive Technology Lab, the only research and design group focused on the new field of persuasive technologies—technologies that influence users' thoughts or activities as they use them.

ANDREW TRABULSI, RESEARCH MANAGER



Consultant, author, and entrepreneur, Andrew comes to IFTF with a background in technology forecasting, geopolitics, and economic development policy. His work and research have included technology capacity building with indigenous communities in the Amazon rainforest, economic development

with large-scale commercial banks, innovation consulting with Deloitte LLP, and geopolitical analysis of transnational criminal organizations.

Before joining IFTF, Andrew advised public, private, and social sector clients on issues of strategy, geopolitics, forecasting, and policy development for four years. He advises a machine learning company, Serial Metrics, and a robotics company, Robo. His first book, *Warlords, Inc: Political Instability, Black Markets, and the Rise of Transnational Crime*, comes out in Spring 2015.

NICOLAS WEIDINGER, RESEARCH + DESIGN



Nicolas has a passion for seeking novel technologies and exploring the impact they have on daily life. With a background in industrial design, he has hands-on experience as a toolmaker. During his studies, Nicolas began to see the profound effect that the Internet has on the objects

we make and the tools that we use in our daily lives. His strong desire to study the Internet-driven evolution of our tools led Nicolas to work with IFTF. As a researcher and designer, he explores the intersection between the physical and digital worlds and uses his design skills to visualize IFTF's research.

[+TECH] EVENT SERIES:
**BUILDING A COMMUNITY OF FUTURES THINKERS
AND TECHNOLOGY MAKERS**

Technology is all around us. Rarely, though, do we get a chance to talk to the people who create it—those who shape tomorrow’s technology and the way we interact with it. Our community event series [+TECH] changes all that. At these evening events, expert speakers give short “ignite” talks sharing their visions of how technology will shape industry in the coming decade.

These [+TECH] speakers sit at the edge of technical reality and world-changing possibilities. They are leaders and game changers from the areas of design, robotics, medicine, human-computer interaction, hardware design, materials science, and more. Guests are also technology makers and aficionados, which results in high-level, fascinating Q&A sessions and conversations throughout.

Each event in the series takes a deep dive into the technology of a specific area or industry, and the series as a whole gives a broad view of the technological landscape.

Visit iff.org/plustech for event information.



BECOME A MEMBER TODAY

For more information about the Institute for the Future please visit our web site at www.iftf.org or contact: **Sean Ness at 650-233-9517 or sness@iftf.org**

PROGRAM COST

The Technology Horizons program is an ongoing cost-shared research effort. Each member pays \$65,000 per year. Membership includes attendance at its annual cross-industry conference, print copies of all program deliverables, and electronic access to the Technology Horizons program website.

PROGRAM MEMBERS

(partial list)

Armasuisse

Cross Business Producers

Hallmark Cards Inc.

Huawei Technologies Co. Ltd.

Intel Corporation

Keurig Green Mountain, Inc.

LG Electronics

Microsoft Corporation

North Atlantic

Treaty Organization (NATO)

Siemens

Swisscom

Tekes: Finnish Funding Agency
for Innovation

ABOUT THE INSTITUTE FOR THE FUTURE

The Institute for the Future is an independent, nonprofit strategic research group with more than 40 years of forecasting experience. The core of our work is identifying emerging trends and discontinuities that will transform global society and the global marketplace. We provide our members with insights into business strategy, design process, innovation, and social dilemmas. Our research generates the foresight needed to create insights that lead to action. Our research spans a broad territory of deeply transformative trends, from health and health care to technology, the workplace, and human identity. The Institute for the Future is based in Palo Alto, CA.

