



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.



2014 TECHNOLOGY HORIZONS RESEARCH AGENDA

Join us in 2014 as we continue to map the technology horizon. We will take a broad look ahead at the amazing technological innovations and disruptions emerging from the intersection of future possibilities. We will explore the next decade of human-machine interactions by investigating what it means to be human as we gain the ability to technologically amplify and even network our human senses to create new work, learning, and play experiences. We will journey across the new geography of science and technology innovation in maker cities around the world. And through a series of open forecasting events, community meetings, and tools, we will immerse you in future possibilities, provoking your best thinking and strategic insight to make the future.

THE TECHNOLOGY HORIZON: TWENTY COMBINATORIAL FORECASTS

In 2014, we continue the process of creating forecasts and maps that anticipate the technology horizon over the next decade—pointing out technological shifts and transformations of the human experience that might occur.

Today's pace of change, dynamic social reconfigurations, and rapid organizational innovation demand we revisit the processes we use to build foresight. Linear extrapolation of technological trends is insufficient. We think technological change will be driven by the combination and recombination of foundational elements. Combinatorial forecasting, then, involves the systematic mixing and remixing of distinct technology trends with the goal of perceiving alternative outcomes.

This year's Technology Horizon map presents twenty combinatorial forecasts you can use to navigate the future as it unfolds. Each combinatorial forecast is built on a range of enabling technologies and newly opening possibilities. Concrete examples from the world today—including new technologies, research, businesses, or other endeavors—demonstrate the direction of each forecast.

DELIVERABLES

- › **Forecast Report:** A set of combinatorial forecasts that explore amazing intersections of possibility for the next decade, built from IFTF's ongoing research into foundational technologies.
- › **Interactive Digital Map:** An interactive digital version of the forecast map with updated blog posts and new signals from the Technology Horizons team.
- › **Presentation Toolkit:** A ready-to-use PowerPoint with annotations to support both your presentations and the strategic group processes your organization uses internally.





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sensoree.com

HUMANS AND THEIR MACHINES: NEW INTERFACES, NEW INTERACTIONS

In 2014, IFTF's Technology Horizons team will once again focus on the human story in our interactions with technology. We will look beyond handheld devices and wearable technology to map the new language of human-machine interaction, with a focus on cutting-edge sensory interfaces.

We are familiar with high-definition video and high-fidelity audio experiences. Over the next decade, human-machine interfaces will extend and amplify all of our human senses—not just sight and hearing but also taste, smell, and touch. These advanced interfaces will feel more intuitive and even become invisible to users. Our machines will be highly responsive, even anticipatory, as they predict our needs by learning our behavioral patterns and the subtle signals and cues we provide. Communicating with machines may become similar to the way humans communicate with each other, with highly attuned cultural and emotional choreographies.

But this story is not just about how we interact with our machines—it is also a story of human relationships and identity. As we hack and program our senses to enhance our abilities and amplify our reach, we will connect with others (and ourselves) in new and unexpected ways. Over the next decade, a networked sensorium of humans and their machines will redefine human capabilities; generate new ways of working, learning, playing, and sharing; and create opportunities for unprecedented experiences in almost every arena of daily life.

DELIVERABLES

- › **Forecast Map:** A foundational forecast, mapping technologies to our human senses within a framework of new capabilities, new practices, and new experiences.
- › **Artifacts from the Future:** A series of provocative scenarios about humans and their machines, with insights into new interactions and experiences in: work, learning, health, and entertainment.
- › **Presentation Toolkit:** A ready-to-use PowerPoint with annotations to support both your presentations and the strategic group processes your organization uses internally.

MAKER CITIES: FROM MAKING STUFF TO REMAKING SYSTEMS

In 2014, IFTF continues to explore maker cities. How are makers shaping the development of emerging technology? How are they reinventing critical systems, shared infrastructures, and ideas of participation? And what will the growth of maker cities mean for living, working, and doing business ten years from now?

Cities have always captured our imaginations; they are the nexus where people, ideas, and future possibilities come together. Whether they are imagined as high-tech metropolises, models of ecological sustainability, or platforms for the sharing economy, cities are where the future happens. We see a maker movement rising in cities across the planet, whether these makers are tinkering at the fringes of society or are embraced as part of an economic strategy.

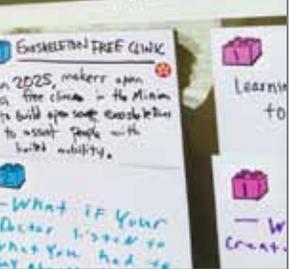
Every city has makers. They're putting in extra time and effort to create or design something personally meaningful online. They're sharing or borrowing cars, spare rooms, tools, skills, and time to save money and make stronger communities. They're participating in social media around a favorite show or carefully editing a video before posting for feedback. Today's maker cities—from San Francisco to Shenzhen, Detroit to Sao Paolo—are defining new forms of collaboration and knowledge creation, providing new platforms to mix and remix the tools of biology and life sciences, or pioneering new ways to live in the age of networked matter.

But what will happen when makers spill out of makerspaces and onto the streets of cities? Makers inscribe the stuff they make with important values (such as openness, sharing, participation, and collaboration). In the same way, they will turn their maker mindsets to other arenas of their lives and remake the systems around them, whether it's work, learning, transportation, energy, food, health, or governance. Over the next decade, project by project, makers will create vibrant new communities as they reinvent the urban experience.





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DELIVERABLES:

- > **Maker City Game:** Players on Makercities.net—a collaborative, ongoing forecasting game for makers in cities across the world, designed as both a research platform and a forum for public imagination—will respond to a range of sponsored challenges and generate scenarios of future possibilities as the maker movement spreads from city to city.
- > **Maker City Immersions:** In spring 2014 we will make immersive learning journeys to places such as Shenzhen (China), Mexico City (Mexico) and New York City (U.S.A.), where field excursions led by notable makers in the community will help us understand the present and future of the region’s capacity for making and innovation.
- > **Maker City Atlas:** The atlas will include a series of reports mapping the new geography of science and technology innovation emerging from maker cities around the world, as well as a set of forecasts and tools for deeper immersion and strategic action.
- > **Conference:** An open and collaborative two-day gathering in the San Francisco Bay Area in October 2014 will give attendees a chance to immerse themselves in the future, identify strategic insights, and get hands-on experience with innovation processes and tools with a network of technology innovators, makers, and disruptive thinkers.

2014 RESEARCH AGENDA

[+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 new 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 makes 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: iftf.org/plustech for event information.





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2014 RESEARCH TEAM

Rod Falcon, Program Director



Rod leads IFTF's 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 about the future at different scales and across multiple time horizons to tell provocative stories about the future. His current research interests are focused 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.

Brinda Dalal, Research Director



Brinda Dalal is a research director for the Technology Horizons program, where she identifies emerging social practices and technology hotspots around the world, and helps organizations understand and design for change. At IFTF, Brinda has led and worked on projects ranging from the future of mobility, consumers, and poverty alleviation, to forecasts about well-being,

planetary monitoring, and access to clean drinking water. Her current research explores how people might integrate ensembles of networked objects and devices into their lives, and how technology can be used to share people's subjective experiences with each other.

Brinda also serves as president of Dhoopa Ventures LLC, providing consulting on innovation and research strategy. She has worked across the high-tech industry for many years, cofounded the Clean Technology Initiative at Xerox PARC, and helped to build a strong ethnographic competency at Xerox Global Services.

Brinda holds a BA from St. Xavier's College in Bombay, India, and obtained a PhD in social anthropology from the University of Cambridge.

Jake Dunagan, Research Director



As a research director for the Technology Horizons program, Jake focuses his research on examining social invention and the redesign of systems in light of current tools and knowledge. He leads the Governance Futures Lab, whose mission is to reimagine and experiment with the basic architectures and processes of governance. 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 Director



Devin's interests as a research director for the Technology Horizons program 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, focused on harnessing emerging technologies to meet humanity's grand challenges.

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 at IFTF. 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 Videogame Production/Design, Alex Goldman 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. He joined IFTF in July 2013 as a Research Manager on the Technology Horizons team. In this role, 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 on 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 in developing new design approaches for incorporating learning into games.

Mike Liebhold, 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 for 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.

Scott Minneman, Research Affiliate



Scott Minneman is an innovative technologist who invents, designs, engineers, fabricates, and exhibits novel physical interactive devices for public spaces. After earning architecture and engineering degrees from MIT (MS and BS) and Stanford (PhD), he was on the research staff at the think-tank Xerox PARC for 15 years, and then cofounded Onomy Labs, Inc.—a make-tank for

interactives. Scott is faculty in Graduate Design at California College of the Arts, where he coordinates the Interaction Design focus, teaches studios on ubiquitous physical computing and hands-on interactives, and shepherds MFA theses.

He has been commissioned to create interactive projects all over the world, including Mexico City, Singapore, Tijuana, Denver, San Francisco, Nashville, Jersey City, Irving, Texas, and more. His public interactive art commissions include pieces in St. Petersburg, Cleveland, Bishkek (Kyrgyzstan), San Francisco, Los Angeles, Hollywood, San Jose, and Goleta, California, among others. The Cinema Snowglobe, his most recent invention (with partner JD Beltran), imbues the traditional tourist tchotchke with cutting-edge video technology for a delightful handheld experience. Blending art with technology, he creates innovative forms of immersive, interactive storytelling.

Sean Ness, Director of Business Development



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. He also hosts monthly potlucks so that the IFTF crew can get to know each other better. 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. Sean often tweets on Twitter and posts to Facebook on behalf of IFTF.

2014 RESEARCH TEAM

David Pescovitz, Research Director



IFTF research director David Pescovitz is coeditor of the tech/culture website BoingBoing.net, a pioneering blog with more than 5 million monthly readers. He is also editor-at-large for *MAKE.*, the DIY technology magazine. For more than two decades, David has been at the forefront of science and technology—as a journalist and technology futurist. He co-wrote the book *Reality Check* (HardWired, 1996), based on his long-running futurist column in *Wired* magazine where he remains a correspondent. From 2000 to 2007 he was the first ever writer-in-residence at UC Berkeley's College of Engineering and the Berkeley Sciences.

He has also written for *Scientific American*, *Popular Science*, *New York Times*, *Washington Post*, *IEEE Spectrum*, *Salon*, and *New Scientist*, among many other publications. In 2002, he won the Foresight Prize in Communication, recognizing excellence in educating the public and research community about nanotechnology and other emerging technologies. Pescovitz holds a Bachelor of Fine Arts in Electronic Media from the University of Cincinnati and an MA in Journalism from UC Berkeley.

Jason Tester, Director of Human-Future Interaction



At IFTF, 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. Jason 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 called "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. When he was 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.

Nicole Tindall, Research Manager



Nicole is an idealist at heart, and she approaches visioning the future with an innovative spirit and deeply empathetic perspective. She is particularly interested in ecosystems thinking and synergies between humans, technology, and all systems and species thriving on Spaceship Earth. Her favorite part of working with IFTF is challenging practitioners and engaging decision makers to imagine and create a better world through futures thinking and insight. In addition to being a member of the Technology team, she works to bring IFTF research and futures thinking to inspire the public through interactions and experiences.

Nicole holds degrees in International Business, Studio Art (spatial), and Energy Management and Climate Policy. Prior to joining IFTF, Nicole worked in the public sector at the City and County of San Francisco, and in the built environment field designing cutting-edge Net Zero Energy Buildings with a focus on energy, sustainability and community. She has special interests in cultivating and supporting local art, exploring imaginary cartography, volunteering at a community farm, and immersing herself in design revelations and maker culture.

Anthony Townsend, Research Director



As research director for IFTF's Technology Horizons Program, a post he has held since joining IFTF in 2005, Anthony focuses on the impact of new technology on cities and public institutions, and the role of technology in economic development. His writing on these themes has appeared in *Scientific American*, *CQ Researcher*, and a number of edited collections. His first book, *Smart Cities: Big Data, Civic Hackers and the Quest for a New Utopia* (Norton, October 2013), explores the rise of smart cities and the players shaping them, placing the current hype about the future of technology-enhanced cities in a broad historical context.

Named one of Postscapes' Top 100 Thinkers tracking the Internet of Things and by Planetizen as a leading thinker in urban planning and technology, Anthony works in New York City. He holds a BA in urban studies with a minor in physics from Rutgers University, an MA in urban planning from New York University, and a PhD in urban and regional planning from the Massachusetts Institute of Technology.

Nicolas Weidinger, Research Assistant



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 research assistant for the Technology Horizons program, he explores the intersection between the physical and digital worlds and uses his design skills to visualize this research.

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 member-only website.

PROGRAM MEMBERS

(partial list)

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Organization (NATO)

Office of the Director
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Intelligence (ODNI)

Procter & Gamble
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Siemens

Swisscom

Tekes

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.

Cover images: IFTF

