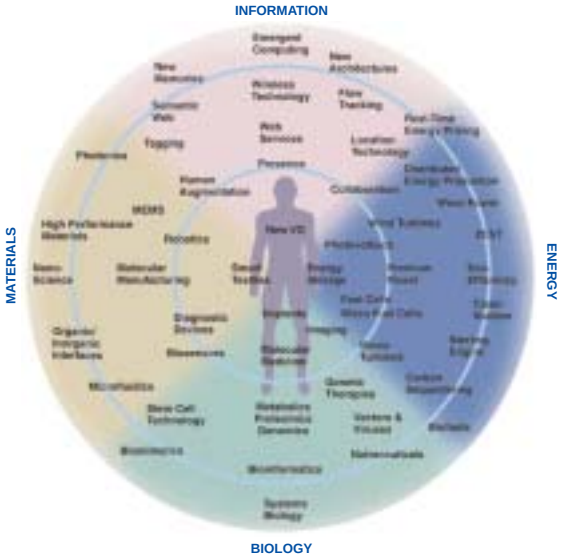
The New Body of the World:

Understanding Place and Space in the Next Decade



Prepared by: Institute for the Future

Authors: Kathi Vian, Frank Baitman, and Alex Soojung-Kim Pang

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About the Institute for the Future

Located at the northern edge of Silicon Valley in Menlo Park, California, the Institute for the Future is an independent, nonprofit research firm that specializes in long-term forecasting. We help businesses identify and evaluate specific opportunities presented by market trends and new technologies. Founded in 1968, the Institute for the Future has become a leader in action-oriented research for business, government, and private foundations. Our members include Fortune 500 companies as well as midsized and emerging companies. We analyze policy, forecast alternative future scenarios, and identify markets for new products and next-generation technologies.

Acknowledgments

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EDITOR(S):	Kathi Vian and Alex Soojung-Kim Pang
ART DIRECTION & DESIGN:	Jean Hagan
GRAPHIC DESIGNER:	Robin Bogott

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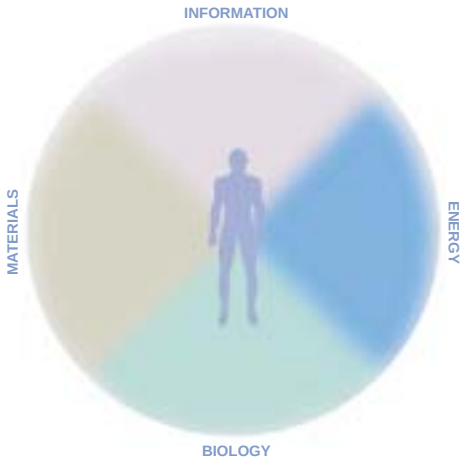

The world is a body as real and whole as our individual bodies. The tools we build change that body. The new body, in turn, changes the mythology of human existence—the deep guiding stories that tell us who we are, where we're going, and what we should be doing.

Issues of body and mythology may seem far off from daily business concerns, and yet these issues form the ecology in which our business concerns arise and are addressed. We may make our choices unconscious of these issues, but not independent of them. Ultimately, business intelligence is the insight that comes from seeing deeper into this changing ecology of matter and myth.

So how, in broad brush strokes, will our ecology change as a result of the tools and technologies that we're developing today?

Perhaps the most important thing to say is that spaces are becoming more like places and vice versa. Space is often how we talk about our online experiences, interactions with people, ideas, and information independent of place. Place, on the other hand, is how we talk about physical experience, about presence, about touching our world intimately. This distinction will fade over the next couple decades as physical objects are embedded with data and as the channels to the virtual world widen and proliferate—and become linked to specific places.

As we begin to occupy this new space/place continuum, three themes will form the deep stories—the mythic issues—that will shape the way we live and work. These themes are:

- The evolution of technology to meet the needs of a globally interconnected species.
- The interconnection of physical objects in webs of meaning.
- The shifting boundary between body and machine.

This memo briefly explores each of these themes, the technologies that will embody them, and the strategic questions they raise for businesses and communities. It draws from a larger project that maps the ten-year technology horizon (see "Additional Reading", on Page 10).

Remote Control:
Technology to Meet the Needs of a Globally Interconnected Species

I see a whole generation
freefalling toward a borderless future
incredible mixtures beyond science fiction:
cholo-punks, pachuco krishnas,
Irish concheros, butoh rappers,
cyber-Aztecs
Gringofarians, Hopi rockers,
y demas...
I see them all
wandering around
a continent without a name...
jumping borders at ease
jumping borders with pleasure
amen, hey man

—Guillermo Gómez-Peña

We humans are genetically wired for close encounters. Our social and economic systems are intimately linked to our biological realities—to bodies designed to see, hear, taste, touch, and smell up close. Our social instincts and intellectual preferences all come down to these five short-range senses.

The last 20 years, however, have dramatically increased the opportunities for distant exchanges—and these far-flung meetings have challenged us as individuals, as companies, and as communities to figure out new ways of being human together, but at a distance.

Over the next 10 years, much of what is new and interesting in the world of technology will be a response to this challenge. We're going to figure out how to be a global species as well as a tribal species, and we're going to ask our technology to help us out in three important ways.

First, we're going to push the limits of distributed systems.

We'll turn existing Internet and wireless standards into experiments in neighborhood-wide wireless LANs. We'll share computing resources and data across organizations worldwide, using peer-to-peer architectures that require no central server or database. Enron notwithstanding, we'll look to distributed energy production—using sun, wind, and hydrogen—to meet growing demand and peak loads. At the limit, we may even find that manufacturing at the molecular level is best done in small, distributed facilities, close to the point of use. We'll do all of these things because we recognize we cannot control our global intelligence, our technology, our energy, and our money from a central authority. It's just too big of a job.

Second, we're going to extend our senses.

If we can reach the bottom of the ocean with a cable, then we'll also pepper it with sensors—mechanical, biological, and chemical. If we can't put ourselves in environmentally extreme conditions—such as battlefields or clean rooms—we'll send robots equipped with cameras and other sensors to do our bidding. If we can't be in the same room with our colleagues, we'll use presence technology—tools designed to facilitate the sense of being together at a distance—to create new physical cues and thus a new body language of remote meetings. We'll learn to collaborate on a very large scale with hundreds, perhaps thousands of people around the world. We'll use remote diagnostic devices for everything from car engines to human hearts.

Third, we're going to track flows.

Utilities, seeking to manage demand for energy or bandwidth, may take the lead here, learning to use information about resource flows to set real-time prices or make real-time sales pitches. Location technology will not only track individuals, but also the flows of people (or cars, or computers, or cell phones) through particular locations—hot spots—providing insights into social phenomena that were previously invisible. We'll learn to use these social phenomena to reinvent our culture, changing everything from the way we target consumers to the way we organize our work, our resources, and our ideas.

As we co-evolve with these technologies, the locus of control will change for organizations. This shift in control will revamp management tools and maybe even the management paradigm itself.

Insights & Opportunities

- **Fragmentation of management channels**—In the consumer sphere, we've seen that the spread of network media has fragmented the channels of communication. As technology continues to push control outward toward the edges of organizations and even across organizations, these same network phenomena are likely to lead to fragmentation of management channels. In the consumer arena, the guiding rule for succeeding in fragmented channels is to "connect the dots"—that is, to use all the channels in concert, but each one appropriately. In the management sphere, the fragmentation of management channels will similarly call on business leaders to recognize the emerging channels and learn to use the channels in concert rather than to try to unify the organization around a single channel.

- **Collaborative households**—The desktop PC moved organizational management from the center of the organization out toward the periphery. From there, it jumped the border between work and home, bringing workplace practices into the home. This is what IFTF researcher Andrea Saveri has been documenting in her work on the "managed household." In the future, as the technology evolves, so will the household culture. The new technologies are distinctly collaborative, so we might expect a new collaborative household to emerge. What are the characteristics of technology-supported collaboration in the household? Across households? What about collaboration between households and organizations? What new opportunities will arise for organizations as collaborative households appear on the horizon?

Semantic Stuff:
Objects in Webs of Meaning

Semantics: the relationship between signs and what they refer to, including theories of denotation, naming, and truth.

Over the next decade, another important boundary will begin to blur. This is the boundary between things—the material stuff of our daily lives—and information about these things. Increasingly, all kinds of information about inanimate objects will be embedded in the objects themselves. And as if this change were not revolution enough, the information will also be coded with metatags that make the objects searchable in time and space.

Here's what it means: we will eventually be able to search the global Web for all objects that, for example, use solar energy, weigh less than 10 pounds, were manufactured in Dublin, and are owned by someone who leases a 2002 Prius hybrid vehicle.

More importantly, machines will be able to construct these searches as part of processes that they are programmed to manage. These same machines will also be able to update the meta-information automatically. The result: the objects will be able to interact with one another.

How do we get there?

Step 1. Data gets liberated from databases.

Data tagging, using Extensible Markup Language (XML), will eventually mean that data can be stored and searched independent of database structures. XML tags provide meta-information about data objects—things like the class, age, and owner of the data. Combine these tags with peer-to-peer systems, and you no longer have server-based databases but rather a web of data that is machine-searchable from any node in the web.

Step 2. Data gets integrated into processes—particularly business processes.

Extensions of XML for specific purposes will link data into processes. For example, Universal Business Language (UBL) is an XML-based markup language for business forms on the Web. With UBL, companies will be able to share data across organizations to streamline ordering, shipping, invoicing, and a host of other business processes. Until now, such cross-organizational data sharing (and the efficiencies it brings) has been limited to very large companies and their few best partners who could afford the investment in electronic data integration (EDI) systems. Now everyone will be able to play.

Step 3. Data gets embedded in objects.

The key technology here is RFID tags—radio frequency identification tags. Embedded with these tags, objects can be found. If they have sensors, they can be queried as to their state: their freshness, their temperature, the environmental conditions surrounding them, their current use of energy, water, air, or other resources. Their tags can also include data which is cataloged using XML metatags—to indicate their source, their purpose, their ownership, and other markers.

Step 4. Objects get integrated into processes.

Once data is embedded in objects with metatags that identify the nature of the data, it will be possible to specify processes for certain objects. For instance, in the sample search we mention previously on page 4, a machine could find all objects that fit the criteria and automatically provide carbon credits to the city of Dublin any time they are used (as a part of an incentive program to manufacture alternative energy products). It could also issue an energy credit to Prius car owners as part of their lease agreement, a service created on the assumption that these car owners are energy-conscious and therefore likely to have goods that meet the search criteria. More mundane processes would allow companies more flexibility in managing products through their manufacturing, warehousing, and distribution—again integrating the information and processes across organizations.

This is the Semantic Web made concrete. Tim Berners-Lee, the father of the World Wide Web, coined the term Semantic Web to explain the potential of a network in which meanings, not just data, are directly accessible. We extend this new layer of meaning to the physical world. It's not just smart stuff—that is, stuff with enough intelligence to react directly to the environment. It's "semantic stuff"—objects that have meaning in a web of processes that may or may not be overseen by humans.

Semantic Stuff: Objects in Webs of Meaning (cont.)

Insights & Opportunities

- **New logistics paradigms**—Managing physical objects in time and space is the heart of logistics, and semantic stuff will increase the choices for solving physical problems in real time, and may eventually even lead to objects making decisions that historically people have made. For example, the decision to change an airplane tire may shift from the mechanic on the tarmac to a network of web services (small, communicating programs) that track weather, sensor information from all the tires on the plane, the flight history and schedule for that particular plane, and manufacturer's data about the tire. Based on all these considerations, the tire itself could communicate the decision to the mechanic. There are obivous opportunities for improved services, quality, and safety—as well as cost-savings—for companies who figure out now which objects to tag, which data to link those objects to, and which decisions to automate.
- **Micro-retailing**—Semantic stuff could change the way brand-name companies open retail channels in emerging markets. Large retailers often have trouble justifying the cost of large new investments in underserved markets, while the small retailer does not have the means to carry inventory or participate in the data flows that large companies require as the basis of partnerships. A combination of XML data tagging, RFID object tagging, and UBL business processes could change all this. Local vendors—even stall and cart vendors—could be outfitted with GPS transmitters and RFID tag readers that would allow their sales to be tracked in real time. Deliveries of products could be automatically scheduled at rendezvous points or even small distribution centers as supplies get low. These transactions would open channels and create new wealth in emerging markets, much the way microlending does. And companies that get there first will have the advantage as these markets expand.
- **Custom neighborhoods**—As information gets embedded in objects and places, neighborhoods could take on much more distinctive characteristics. Aside from differences in product and service preferences in different socio-economic enclaves, neighborhoods may deliberately choose to develop their own "entertainment" style using semantic data. Just as theme parks and historical villages will increasingly program particular experiences for customers based on their own interests, neighborhoods may program unique entertainment experiences for visitors and residents. These will create opportunities for savvy companies to sell into these custom neighborhoods, using real-time technology to tailor products and services automatically to the tastes of a particular neighborhood.

Body Parts:

Shifts in the Boundaries Between Bodies and Machines

I like to think
(it has to be!)
of a cybernetic ecology
where we are free of our labors
and joined back to nature
returned to our mammal
brothers and sisters
and all watched over
by machines of loving grace.

—Richard Brautigan

Our human bodies teem with intelligence, performing acts of biological genius minute by minute. Without our understanding how, they also translate this biological functioning into the most elegant concepts and abstract structures, which in turn re-create the physical body of the human-made world.

So it is perhaps only an illusion that these two universes—our biological bodies and our human-made world—are separate and distinct. Certainly over the next decade, the boundaries between them will blur, creating new human potential and laying the groundwork for extreme social reorganization.

For a simple-minded roadmap to this future, think of us as a species with three basic rules:

Rule 1. Extend our bodily capabilities.

The Olympic athlete in each of us is always trying to break the records—live longer, eat more while getting thinner, read faster, see further, think better, work smarter. Like today's athlete trying to distinguish between food supplements and illegal performance boosters, we have ambiguous attitudes about what is okay in this pursuit and what is not. Some of the technologies that are percieved as okay are:

- Molecularly grown organ replacements (although tissue replacement is probably the best we can hope for in the next decade).
- Cosmetic and remedial implants (for example, to balance hormones).
- Smart fashions (to fend off biological bad guys, generate the energy to power our various mobile devices, or let us look at the world through information-enhanced glasses).
- Genetic vaccines (to inoculate us against our own genetic makeup).
- Food supplements (to enhance our endurance, our moods, and our memory).

Body Parts:
Shifts in the Boundaries Between Bodies and Machines (cont.)

It's easy to see, however, that each of these technologies sits at a boundary or discomfort: the organic/inorganic interface; the threshold between body and machine; and the boundary between personal control and personal destiny. While many of the choices we make at these boundaries will be private choices, we will make them in the context of communities and organizations that will shape our opinions about what capabilities are worth extending and how much it should cost.

Rule 2. Offload our intelligence.

For a species that distinguishes itself from the rest of creation by pointing to its unique intelligence—its language, its ability for abstract thought, and its memory—we humans seem surprisingly eager to offload these very capabilities onto our machines. We have driven the price of digital memory so low and expanded our input capabilities so broadly (using sensors) that we're now on the brink of being able to record our entire life experience ex corpus. We have built self-organizing programs that can solve problems using logic we ourselves can't figure out. While natural language systems remain tough nuts, they are nevertheless finding their way into systems for searching anything that's ever been published in digital format. We are even eager to hand our shopping list over to agents who can think for us about which new products we might want to try.

Aside from the species-wide identity crisis that this behavior is likely to provoke, the impulse to offload our intelligence will exacerbate what is perhaps the single biggest economic problem we face in the coming decade—intellectual property rights. The debate here will range from the comic to the arcane, but the viability of business models and the very shape of markets will depend on how we manage all the intelligence we're about to evict from our physical brains.

Rule 3. Merge.

If corporate mergers were the growth strategy of choice for the 1990s, corporal mergers could become the rage of the 2000s. Combine human augmentation technologies—augmented reality, sensory extensions, wearables, and implants—with peer-to-peer technologies, and you've got the cyborg—the half-human, half-machine who no longer functions independently but rather is a plug-in module in a network species.

Hollywood interpretations aside, we find ourselves exploring the limits of human interconnectivity—and using our machines to do so. In the next decade, we can almost certainly expect an avant garde among the wireless body piercing generation to plug in and start swarming bodily. And even if the literal body-to-body connections don't spread to the general population, the metaphor undoubtedly will. Already

we're using the concept of swarms to suggest strategies for everything from how to offer wireless services to how to organize our R&D.

For better or worse, we humans have decided to direct our own evolution, using tools that we have imbued with our own intelligence. It's somewhat ludicrous to frame this evolution in terms of business opportunities, and yet step-by-step, it will be framed in terms of ROI, market demands, and corporate communication needs. The question is whether we can expand our criteria for success beyond the currently limited tools of corporate accounting. Certainly the next decades will provide the impetus—and some of the tools—for innovations in how we use the marketplace to express changing human values.

Insights & Opportunities

- **The new health marketplace**—As technology moves in close to the body—and even into the body—it will redefine the health marketplace. Traditional healthcare will begin to intersect with an increasingly wide range of consumer industries, including food, cosmetics, fashion, furniture, home and workplace construction, and safety and security products—not to mention information and entertainment. The traditional health care market is projected to be between 16 and 20 trillion dollars by 2010, and these intersections with consumer markets could vastly expand those numbers. Virtually every consumer company will have the opportunity to reframe their business in terms of this new health marketplace, and to participate in the growth economy it represents.
- **Informational ergonomics**—Over the past few decades, ergonomics—the science of human work—has focused on the interface between the human body and the physical environments in which people work. As technology becomes more intimate with the human body and as the body becomes the infrastructure for interacting with information, a new kind of ergonomics is emerging. This new ergonomics will bridge the physical and informational worlds and assess the new environment not only in terms of productivity and quality but also in terms of human safety. In this practice, questions of information design will need to go beyond ease of access to include the health and safety effects of complex information access behaviors, and these effects will lay the groundwork for everything from product design to marketing to health policy.

Additional Reading

In this memo we have explored the emerging technology horizon from the point of view of the changing nature of space and place—and the role of the human body. For additional perspectives, see the Institute for the Future's interactive *New World Map* on CD-ROM (SR-774, July 2002), as well as the two additonal memos in this series, SR-774B (a summary of the ten-year technology horizon) and SR-774C (a look at premium power and the role of security in shaping the energy landscape).

For more information on this Technology Memo Series or on the Institute for the Future's Technology Horizons work please contact, Patty Zablock at 650-854-6322 or pzablock@iftf.org.