2016 Ars Electronica Festival:

Radical Atoms Exhibition

(Linz, September 7, 2016) Visions of futuristic possibilities of human-machine interaction make up a new exhibition, the subject of which is synonymous with the theme of this year's Ars Electronica Festival. The Radical Atoms exhibition showcases works by the *MIT Media Lab's Tangible Media Group* headed by *Hiroshi Ishii*. His team's mission is to take up ideas of tomorrow and enable us to grasp and experience them today. The works on exhibit include previous installations that have meanwhile advanced to the *status of media art classics*, shape displays that modify their physical form, and a novel fabric for clothing that can monitor the wearer's body temperature, and open up flaps to provide cooling when s/he's too warm. Festivalgoers can also behold Carlo Ratti's digitally controllable seating arrangement and a poetic installation by ART+COM Studios.

Radical Atoms: A Definition of Terms

How do we get the digital world into the physical one? Hiroshi Ishii's Radical Atoms could provide an answer to this question. They stand for a sort of *digital core meltdown in which information and material fuse*—the information is freed from the limitations of the Pixel Universe and the atoms are wrenched out of their rigid state and set in motion. The results are *smart materials* that can be modeled and remodeled, again and again. Scientists and engineers are already at work developing these Radical Atoms into high-tech materials with completely new characteristics and capabilities. The neurosciences and biotechnology, robotics, hardware and software play an important role in this; so do time-honored handicraft traditions. The point of departure of these *trailblazing developments* is *the Media Lab of the Massachusetts Institute of Technology (MIT)*, where Hiroshi Ishii and his Tangible Media Group have been working on new forms of human-machine interaction for over 20 years.

Tangible Bits

Tangible Bits are the forerunners of Radical Atoms. They're the successful effort to surmount the Pixel Empire alluded to above and literally make information tangible. Long before the first touchscreens, smartphones and gesture control, Hiroshi Ishii and his team were already working on doing away with the separation between the intangible depiction of information and the mouse-based remote control of it. Many of the projects that resulted from this endeavor have become classics of media art in the meantime. Their success is attributable to well thought-out functional logic, perfect storytelling and aesthetically pleasing implementation.

With queries, please contact

Christopher Sonnleitner
Tel: +43.732.7272-38
christopher.sonnleitner@aec.at
www.aec.at/press

Several of these classics are on display in the Radical Atoms exhibition:

musicBottles

Tangible Media Group // MIT Media Lab
Exhibition: Penny Webb, Udayan Umapathi, Mitchell D Hwang, Patrick Shin, Tal Achituv, Jasmin Rubinovitz, Hiroshi Ishii
Research: Rich Fletcher, Ali Mazalek, Jay Lee, Seungho Choo, Joanna Berzowska, Craig Wisneski, Charlie Cano, Andres Hernandez, Colin Bulthaupand, Joe Paradiso, Hiroshi Ishi

A table and three bottles sealed with corks were the ingredients of the 1999 original work. One of three sounds—a violin, a cello and a piano—is stored to memory inside each of the bottles by means of electromagnetic tags that made wireless recognition possible in those days. When the cork was removed from one of the bottles on the table, the sound of its respective instrument could be heard. When the cork was reinserted, the sound ceased. The musicBottles enabled installation visitors to intuitively make music or be conductors in their own right. The electromagnetic tags have been replaced by a weight-based system..

SandScape

Tangible Media Group // MIT Media Lab
Exhibition: Daniel John Fitzgerald, Luke Vink, Ken Nakagaki, Nikolaos Vlavianos, and Hiroshi Ishii
Research: Yao Wang, Assaf Biderman, Ben Piper, Carlo Ratti, Hiroshi Ishii

This installation combines computer simulations with a topographical 3-D model composed of sand. A sand landscape set up in a sort of sandbox can be reconfigured and formed into any shape the installation visitor wishes. The mountains can be raised or lowered, cliffs flattened out or made even steeper, rifts deepened or evened out with the surrounding topography. SandScape makes it possible to see how changes to the model would play out on real terrain, and casts projections onto the surface of the sand that indicate how the shadowing would change, where rainwater would accumulate, and where mechanized agriculture would cease to be feasible due to steep inclines.

Topobo

Tangible Media Group // MIT Media Lab
Exhibition: Penny Webb, Hiroshi Ishii
Research: Hayes Raffle, Amanda Parkes, Laura Yip, Hiroshi Ishii

This 3-D construction system consists of static and robotic elements and built-in motors. The individual elements can be combined at will with each other, and the resulting figures are not only moveable; they also possess motion-memory. A few simple manipulations are all it takes to set the constructions into motion—thanks to their faculties of kinetic recollection, they remember their repertoire of movements, which can be retrieved and repeated.

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www.aec.at/press

Radical Atoms: Shape Displays

Radical Atoms animate material on the atomic level and can be realigned into so-called materiables—interfaces that capture data physically and impart a real form to it. Furthermore, this is a real form that can be freely revised just like the data on which it's based. These freely formable, shape-changing displays are information and material all in one, phenomena that reciprocally influence each other.

Projects on the subject of Shape Displays in the Radical Atoms exhibition:

inform

Tangible Media Group // MIT Media Lab
Exhibition: Daniel Leithinger, Sean Follmer, Ken Nakagaki,Hiroshi Ishii
Research: Daniel Leithinger, Sean Follmer, Alex Olwal, Philipp Schoessler, Jared Counts, Ken Nakagaki, David Doan, Basheer Tome, Akimitsu Hogge, Hiroshi Ishii

The concept of remote control can be understood literally in this project, the prototype of an innovative interface by means of which manipulations of a digital model enable the user to move remote objects on a 3-D surface. Plus, inFORM can also be utilized to depict geo-data, urban & architectural plans, x-ray & computed tomography images and many other data sets. For the Radical Atoms exhibition in Linz, the Tangible Media Group has selected an inFORM video conferencing application that enables users to move objects without having to be in their immediate vicinity and without touching the interface.

LineFORM

Tangible Media Group // MIT Media Lab
Exhibition: Ken Nakagaki, Nikolaos Vlavianos, Hiroshi Ishii
Research: Ken Nakagaki, Sean Follmer, Hiroshi Ishii

LineForm explores the potential of a transformable display, one that can be positioned, knotted and folded into all sorts of shapes as if by magic—a touchpad or a telephone, for instance. Plus, LineForm can also store motions, conduct electrical current and change its consistency in a range between hard and flexible.

Lift-Bit

Carlo Ratti Associates

Lift-Bit brings motion into the domestic seating arrangement. This is nothing less than the world's first digitally controlled sofa. It consists of honeycomb-shaped seating modules that can be moved back and forth via hand motion to create new surfaces for sitting and reclining in various positions and degrees. As an alternative, Lift-Bit can be controlled by an app running on a smartphone, which can recall various preconfigured arrangements as well as custom-design and implement new ones. Lift-Bit is a foretaste of interior decoration of the future that makes it convenient to create seating arrangements adapted to individual needs.

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Infinite Cube

ART+COM Studios

Pure aesthetics in motion and a sophisticated interplay with space are the essence of Infinite Cube. Silver balls hanging from the ceiling conform to a computer-calculated dramaturgy executing fluid movements to form abstract patterns. Installation visitors, as reflections on the balls themselves, become part of this kinetic-aesthetic array and thus an additional element in the interplay of real and reflected space. With a composition by Ólafur Arnald providing the musical theme of the installation, the upshot is a poetic interplay of three elements: reflection, sound and motion.

Radical Atoms: Programmable Materials

Radical Atoms make material smart. Material and machine become one. The merger of material and information opens the way to programmable materials. But as breathtaking as the objects developed at MIT might be, for Hiroshi Ishii and his co-workers, they're still only speculative prototypes of human-technical forms of interaction and applications. The focus of their R&D work is on the still-open question of what sorts of human-machine interactions will make sense in the future or which will be absolutely indispensible. The answers to this question will determine how these Radical Atoms will be changing our lives and the environment in which we live in the coming years and decades.

Projects having to do with Programmable Materials in the Radical Atoms exhibition:

PneUI

Tangible Media Group // MIT Media Lab
Exhibition: Jifei Ou, Nikolaos Vlavianos, Hiroshi Ishii
Research: Jifei Ou, Felix Heibeck, Lining Yao, Ryuma Niiyama, Nikolaos Vlavianos, Melina Skouras, Hiroshi Ishii

PneUI makes it possible to move and form materials like paper, fabric and plastic that actually can't be stretched. A part of the reshaping work on materials consisting of multiple layers is performed by air; the rest is carried out by a computer-controlled bending mechanism. Here, individual layers of the materials serve various purposes such as sensors or structural stiffeners. Initial applications of these computer-pneumatically modifiable, novel materials are soft robots, adaptable furniture, intelligent clothing and "breathing art objects."

jamSheets

Tangible Media Group // MIT Media Lab
Exhibition: Jifei Ou, Nikolaos Vlavianos, Hiroshi Ishii
Research: Jifei Ou, Lining Yao, Daniel Tauber, Nikolaos Vlavianos, Hiroshi Ishii

jamSheets add a new element to the interface design repertoire, a multi-strata material that is still very thin. They come in a variety of material compositions. In their soft form, they can

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Christopher Sonnleitner
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www.aec.at/press

be shaped at will and then hardened, or this can be done in reverse, and the materials thus redeployed. Potential areas of application include the field of medicine, the fabrication of clothing, and aircraft construction.

bioLogic

Tangible Media Group // MIT Media Lab
Exhibition: Lining Yao, Jifei Ou, Wen Wang, Hiroshi Ishii
Research: Lining Yao, Wen Wang, Guanyun Wang, Helene Steiner, Chin Yi Cheng, Jifei Ou, Oksana Anilionyte, Hiroshi Ishii

The useful fermentation bacterium with the catchy name bacillus subtilis natto is able to expand and contract, depending on the humidity of the air. bioLogic takes advantage of this knack for adaptability to create smart textiles. Natto cells bred in the lab are subjected to pressure to create a sort of second skin that resembles human skin with respect to its biological capabilities. At areas on the body's surface that display high temperature and perspiration due to athletic activity or other forms of exertion, the fabric opens up and delivers an organic coolant to that area.

Rovables

Responsive Environments Group // MIT Media Lab,Stanford University // Mechanical Engineering
Exhibition: Artem Dementyev, Joe Paradiso
Research: Artem Dementyev, Hsin-Liu (Cindy) Kao, Inrak Choi, Deborah Ajilo, Maggie Xu, Joe Paradiso, Chris Schmandt, Sean Follmer

Rovables are mini-robots that nest in human clothing where, thanks to their magnetic wheels, they can move about securely—even vertically; individually as well as in a swarm— and carry out a variety of assignments. Their repertoire of activities ranges from checking the state of the host's health to forming a watch or some other piece of interactive jewelry or display that the host can wear.

Active Wood Products

Self Assembly Lab // MIT Media Lab, Autodesk Inc.
Erik Demaine, Christophe Guberan
In cooperation with: Institute for Computational Design, University of Stuttgart

In a 3-D pressure process, wood granulate is worked into smart, self-transforming foils that can be used to produce complex constructions. This sort of programmable wood is a project that MIT's Self Assembly Lab launched in collaboration with Swiss product designer Christophe Guberan.

ZeroN

Tangible Media Group // MIT Media Lab
Exhibition: Nikolaos Vlavianos, Daniel John Fitzgerald und Hiroshi Ishii
Research: Jinha Lee, Rehmi Post, Hiroshi Ishii

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What if materials could defy gravity, such that we could leave them suspended anywhere in mid-air? ZeroN is a new physical/digital interaction element that can levitate and move freely, guided by both the human and the computer in three dimensional space.. In doing so, people and computers can physically interact with one another. Once levitated, ZeroN's behavior can be digitally programmed. For example, users can place the sun above physical objects to cast digital shadows, or place a planet that will start revolving based on simulated physical conditions. ZeroN is about liberating materials from the constraints of space and time by blending the physical and digital world.

Perfect Red

Tangible Media Group // MIT Media Lab
Exhibition: Nikolaos Vlavianos, Hiroshi Ishii
Research: Leonardo Bonanni, Hiroshi Ishii, Austin Lee, Paula Aguilera, Jonathan Williams

Perfect Red represents a clay-like material preprogrammed to have many of the features of Computer-Aided Design (CAD) software. Perfect Red is a fictional material that can be sculpted like clay—with hands and hand tools—and responds according to rules inspired by CAD operations, including snapping to primary geometries, Boolean operations, and parametric design. When Perfect Red is rolled into a ball, it snaps into the shape of a perfect sphere (primary solids). When two pieces are joined, Perfect Red adds the shapes to each other (Boolean addition). Perfect Red also has other behaviors inspired by parametric design tools: If you split a piece in two even halves, then the operations performed on one part are mirrored in the other. And much like CAD software, Perfect Red can perform detailed operations using splines projected on the surface of solids. To cut an object in half, for example, all that's needed is to draw a line along the cut and tap it with a knife. Splines and parametric behaviors can also be carried out: If you want to drill 10 holes, you simply draw 10 dots and stick a pin into one of them.

MIT Media Lab: https://www.media.mit.edu/
Tangible Media Group: http://tangible.media.mit.edu/
ART+COM: https://artcom.de/
Carlo Ratti Associates: http://www.carloratti.com/
2016 Ars Electronica Festival: http://www.aec.at/radicalatoms/en/

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