Control system

E-bike

Smart home

Wikicity

From the microchip to the Planet

The projects presented in this article focus on the interaction generated between people and objects, from the household all the way to the urban scale. Integrating and displaying data is transforming everyday objects and environments and the trend will allow us to discover new uses for digital technology.

Carlo Ratti in collaboration with Andrea Cassi, Martine Grange and Jenni Young

"Our objects, our houses and even our cities with the ability to "talk", i.e. to interact with us"

Architect, engineer and *agitprop,* Carlo Ratti owns the Turin-based carlorattiassociati | walter nicolino & carlo ratti studio and leads the MIT SENSEable City Lab in Boston, USA. A graduate of both the Politecnico di Torino and the École Nationale des Ponts et Chaussées, Paris, he also has a PhD from the University of Cambridge, UK. Ratti has contributed to over 200 publications, and his work has been shown at the Venice Biennale, the Disseny Hub in Barcelona, the Science Museum in London, the GAFTA in San Francisco, and the Museum of Modern Art in New York. Fast Company has named him among its "50 Most Influential Designers in America" in 2011.

Talk To Me. This was the faintly Almodóvar-inspired title of the show curated by Paola Antonelli and Kate Carmody at the MoMA in New York that finished last November. The idea was simple: in recent years, the digital revolution has brought many electronic devices into our everyday lives. These devices have endowed our objects, our houses and even our cities with the ability to "talk", i.e. to interact with us. All this is radically changing our way of living and, with it, the role of designers, who now need to be able to operate across a very variable range of disciplines.

Paola Antonelli, who knows something about the *zeitgeist*, seems to have picked up on one of those trends destined to leave a mark. Could *Talk To Me* be the key to the future of architecture and design? It can certainly be considered the key theme of projects that our studio has been focusing on in recent months, from the bike that you can turn into an e-bike (electric & electronic bike) just by changing its rear wheel, to the domestic kitchen with an internet link. Every day, new ways emerge for people to interact with the objects around them. Let's see how, by taking a look at some of our projects.

The Connected Kitchen

What will the kitchen of the future be like? That is a tough question, and the first clue to answering it is this: from next year, many electrical appliances will contain a chip that enables them to connect to the internet and to network with one another (courtesy of Zigbee, a cheap, limited-bandwidth Wi-Fi link). But how exactly will this innovation affect our way of cooking and doing household chores?

▲ *The Connected Kitchen.* In the space of a year, all domestic appliances will have the potential to be connected: they can then be controlled via a remote app that can be installed on personal devices
▶ Simple and intuitive interactive experiences invited people to enjoy the space and get a feel for the proposed concept. Photo: Max Tomasinelli
▶ The interactive induction hob has a new integrated touch-control interface.
Photo: Alberto Sinigaglia
▶ The Sensing Ray shows the status of your domestic appliances and, when touched, it opens out to become a handle. Photo: Alberto Sinigaglia

First of all, if our appliances are online, it will be easier for us to interact with them. There will be no need to rummage through the manual to select one of the washing machine's innumerable programmes or to scratch our heads over how to set the cooking curve for a soufflé (which needs a series of temperature adjustments from 220 down to 160 degrees). We shall simply be able to access all these functions by talking directly to the appliance via one of those interfaces that have now become part of our everyday lives: a smartphone or iPad-like tablet.

So what will become of the refrigerator, dishwasher, oven or stove? Perhaps the answer lies in the incestuous relationship between Apple's iPod and iTunes, where the latter lets us manage all our digital content while the former just gives us a simplified way to access it. Similarly, the electrical appliance would be freed from all its control interfaces and could be given a radical makeover (literally!) to appear in a whole range of different guises. Its interface, on the other hand, would enable us to use only its basic functions: on/off, cooking time, temperature, etc. Continuing along these lines, we have dreamed up a touch-sensitive concealed handle with front lighting from a strip of interactive LEDs that tell you in a stylish, striking way – even from a distance – what is happening inside the appliance (e.g. when a program is ending, or how cooked the food is).

We call it the "sensing ray" to emphasise how it monitors the house. Indeed, it can alert us to a gas leak or tell us about the air quality; it can gather a mass of data and put it on the internet (in the *cloud*) for us to consult from our tab-

lets. How about an oven with a built-in video camera, for example? We could keep an eye on the soufflé while answering our email in the lounge, or we could send pictures showing the chicken roasting away to our friends who are coming round for a meal. (A futuristic way to say "The dinner's on! …")

In similar vein, there is scope for a new take on the idea of an "intelligent fridge" that could recognise the type and number of foods in it and remind us when the milk is about to run out. This old concept dates back over ten years, but it has never become reality for lack of a universal means of automatically identifying objects using RFID. Now, though, it could be implemented simply by collecting data inside the fridge with sensors and video cameras.

Data access will be a key feature of the domestic appliances of the near future. They will enable us to monitor the larder, to do the shopping instantly, to check the nutritional and allergen information about what we eat, and to share recipes with our friends. And, more generally, they will help make our homes smarter, by pursuing an old dream that has not yet become reality but will when the platforms become simple, integrable and economic. Think, for example, of the great success that the Nest thermostat has enjoyed in the USA. It installs itself and is easy to control online by computer or via telephone; it can become a new talking point within the family, as the children play with the temperature settings or vie with one another to reduce energy use.

"Data access will be a key feature of domestic appliances of near future"

The Copenhagen Wheel

There will be changes not only in the home but also in our means of transport. The bicycle is the simplest and most popular means of transport on the market. We thought that it would be useful to make it more intelligent, in order to incentivise sustainable mobility – but how? How could we make the bicycle easier to use without spoiling the simple pleasures of a bike ride? In 2009, we worked on a joint research project with the city of Copenhagen. We set up a team of designers, mechanical engineers, computer scientists, programmers and interactivity specialists; after a few months, they came up with the design known as *The Copenhagen Wheel.* It can electrify any bicycle simply by replacing the traditional rear wheel. Our wheel is completely autonomous, capturing the energy generated by pedalling and braking (as in hybrid cars) and storing it for when you need some extra juice to get up a hill. Free of external batteries, wires or levers, The Copenhagen Wheel is controlled by your feet as you cycle, ready to give you a boost like a virtual companion silently pedalling along behind. The wheel has a Bluetooth interface to send the data captured with its sensors to the cyclist's smartphone in real time. The

▼ *The Copenhagen Wheel,* 2009

information gathered about the route travelled, the distance covered and the speeds reached can help give riders a real, direct sense of the place where they live; thus, *The Copenhagen Wheel* fosters public awareness of and respect for the environment. Moreover, data of general interest – like atmospheric pollution levels, traffic density and the state of the road surface – can be shared in real time to provide a substantial database of detailed information that is useful to the community and for future urban planning.

Eye Stop

Let us turn from individual to collective mobility. Given the millions of journeys made daily by city dwellers, we started thinking about how to make urban transport more practical and, above all, more efficient. Clearly, attuning transport more effectively to residents' needs could considerably improve the quality of their busy and stressful lives. There are many roads that we could take, so to speak. One might be to realise the vision of an "intelligent bus shelter". *Eye Stop*, a project conceived by Senseable City Lab in 2009, is a step in this direction. The aim is to create bus stops that users can interact with – through Wi-Fi connections and touch screens, and with integrated photovoltaic cells for energy generation – to make the entire city transport system more efficient. The shelter will display waiting times, tourist information and service updates, all in real time, of course. Users can plan their trip by specifying a destination on the interactive map: the system will show the route and give details about journey

▼ *Eye Stop*, 2009
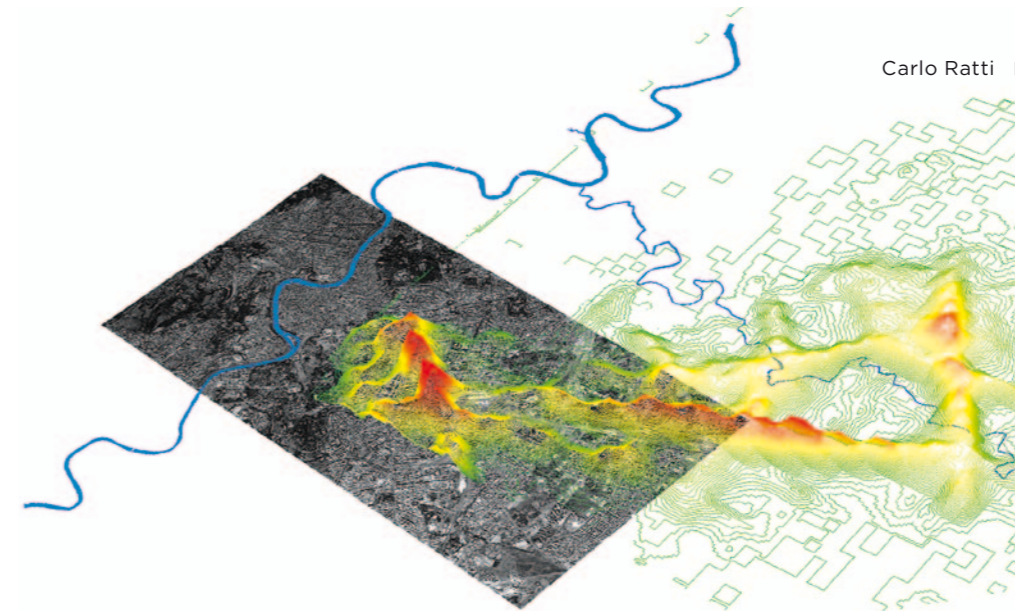
▲ *Real Time Rome*, 2006

times and how long before the next bus arrives. In this way, digital technology will provide a means to gather information about the city while offering a useful service to local people.

Real Time Rome

Urban mobility is also the theme underlying one of Senseable City Lab's first projects: *Real Time Rome*, created in 2006 for the Venice Biennale. The project analysed journeys made by millions of people in the Eternal City. By looking at a particular scenario, like the 2006 football World Cup final, we mapped the city in an innovative and dynamic way, making use of mobile-phone traceability. Using real-time maps, we could follow what happened on that famous night: the army of Italian fans was totally silent during the match, between 8 and 11pm, when they did not use their phones at all, except in great bursts during the breaks; there was total silence during the most crucial moments in the game (like Zidane's infamous headbutt); and finally there was the eruption of joy as the fans telephoned each other and hared all around the city in celebration. The project's basic principle can easily be applied to local government planning mechanisms, with a view to improving quality of life and increasing understanding of the urban ecosystem. Indeed, in *Real Time Rome*, collective mobility was studied by mining the mobile telephone network for traffic information and relating it to the movements of cars, pedestrians and public transport. By overlaying this kind of information with the city's topography, we could illustrate the relationship between physical features and urban flows. These dynamic maps help us to understand how the different areas of the city are used during the day, for example, and how the distribution of buses and taxis relates to population density.

"The project's basic principle can easily be applied to local government planning mechanisms, with a view to improving quality of life and increasing understanding of the urban ecosystem"

WikiCity Rome

This exciting experiment has led to *WikiCity Rome*, a project that allows people to interact directly with the moving city. *WikiCity* takes the data obtained in *Real Time Rome* and presents it to ordinary people in real time, enabling them to add their own comments on the fly. The visual presentation of the urban dynamics therefore becomes not just a reflective analysis but a new tool for exploring the ever-shifting cityscape as it moves. The metaphor underlying the project is that of a real-time control system, in which individuals can be seen as intelligent protagonists interacting with one another and with the built environment, thus helping the overall system to run itself. This tool was put together for the 2007 *Notte Bianca* festival, when Rome was given over to hundreds of after-dark indoor and outdoor events that attracted around two million people. The *WikiCity Rome* map was based on a satellite image that showed the intensity of mobile telephone activity and gave an idea of the Roman people's movements. It also acted as the backdrop for other information, such as the *Notte Bianca* events and their location, where the public transport vehicles were in the city, journalists' comments on the events in real time and much more besides. The spatial and temporal data collected by the system was then presented in a visual display to make it easy to understand. The *WikiCity Rome* map was projected onto a building facade in one of the city's great piazzas. So local people could use the display and see the results of this experiment for themselves. The public screen created a kind of human network across the city, encouraging people to interact by sharing information about their home town. The *WikiCity* interface is a tool for taking collective decisions involving the city's virtual and physical space. It is a first step to developing hybrid physical-digital spaces where the built environment is enriched by ever-growing layers of digital information.

▲ *WikiCity Rome*, 2007

CCD

A concrete example of this ongoing change is *CCD* (standing for *Ciudad Creativa Digital*). This new project is establishing a creative district in Guadalajara, Mexico's second-largest city and the main centre for the creative and multimedia industry, at the heart of the state of Jalisco. A significant level of digital content is envisaged, and there will be considerable engagement with local people, with massive use of high-tech materials. The idea was conceived in late 2011 by the studio *carlorattiassociati srl*, with assistance from MIT, to revamp Morelos park, the green lung of a district that in recent years had almost been swallowed up by the inexorable metropolitan sprawl. The objective is to upgrade a series of buildings around the park in the historic centre and convert them into spaces

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that can be used for professional training and education, which is essential for the creative industries that will drive economic growth in the city and the region. Yet the plan does not look to culture alone. There will also be a broad range of tertiary developments: restaurants, hotels, an open-air theatre for concerts and films, and recreation areas and playgrounds for children amid the green space. All this in 234 hectares that will be home to fifty thousand people. CCD will be a district built in line with the increasingly contemporary concept of the smart city, with a strong interactive dimension. A wide range of digital technologies will be incorporated into the buildings, which will therefore be able to offer different experiences – not just as workplaces but as social and cultural milieus, too. This technology will also help to improve energy management, as eco-friendliness becomes a cornerstone of the local development strategy.

Technology is becoming increasingly used in our cities. The projects that I have described set out not to invade our human spaces but rather to assist us more and more in our everyday lives. For, in effect, the paradox of technology's ever-deeper presence in our lives (ubiquitous computing, or *ubicomp*[1], as it was defined in the 1980s by IT pioneer Mark Weiser) is that it is there, everywhere and always, precisely so that we can forget about it and return our attention afresh to the things that really matter. A simpler life. Building a rich social fabric. All from riding our bikes together or – why not? – even baking a good soufflé.

1   Weiser, M. "The Computer of the 21st Century". *Scientific American*, vol. 265, No. 3 (1991), p. 94-104.

▼ *Ciudad Creativa Digital*, Guadalajara (Mexico), 2011