

THE DIGITAL CITY

URBAN LIFE IS ABOUT TO BE TRANSFORMED. REAL-TIME DATA IS TEACHING OUR TOWNS
HOW TO THINK – AND THAT'S REINVENTING EVERYTHING FROM TRAFFIC TO FRIENDSHIPS

Illustrations: **pandayoghurt**
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WORDS ON THE STREET

INFORMATION WILL BE EXCHANGED BETWEEN THE CITY AND ITS CITIZENS BY ADAM GREENFIELD



When rumours of the project later revealed to the world as the Segway personal transporter first surfaced, back in 2001 – in the days when the curious had little more to go on than inventor Dean Kamen's reputation, and the cryptic codename "Ginger" – one of the tantalising titbits of information that emerged was Steve Jobs's reported reaction: "If enough people see the machine, you won't have to convince them to architect cities around it. It will just happen."

"Architect cities around it": now that fired the imagination. What innovation could possibly be so fundamental that it would compel us to rethink something so deeply entrenched in culture, and so hard to alter, as the way we make cities? Speculation regarding the machine and its nature went on for months. Had Kamen come up with an ultra-efficient power source? Some breakthrough in materials science? No one knew. Lying just underneath, though, were more important questions, especially to anyone who'd grown up on *Blade Runner*, *Judge Dredd* and Angus McKie book jackets. If people really *did* come to devise cities around Kamen's machine, what would those cities be like?

Whatever heights the imagination may have scaled in these months, we know how the story ended. Already suffering from impossibly inflated expectations, the Segway launched into a world still reeling from September 11, and in no mood for over-scaled flourishes of dotcom-era technotriumphalism; to say it has not been widely adopted in the years since would be generous. It's had no appreciable effect on the cities of humanity at all, beyond the occasional column of tourists doing their best to sightsee while tilted forward at a 10° angle. But the potent set of expectations that surrounded the Jobs pronouncement – that technological innovation would reshape the way we collectively make and understand cities, that we would see it happen in our lifetimes, and maybe even play a role in its outcomes – *this* possibility lingered.

Over the last decade a great number of people on Earth have embraced the digital mediation of everyday life. Without considering the matter with any particular care, as individuals or societies, we have installed devices in our clothing, our buildings, our vehicles and our tools which register, collect and transmit extraordinary volumes of data, and which share this data with the global network in real time.

Under such circumstances, it is only natural that a great many of these systems will be used in the planning and management of cities. In the interest of managing traffic

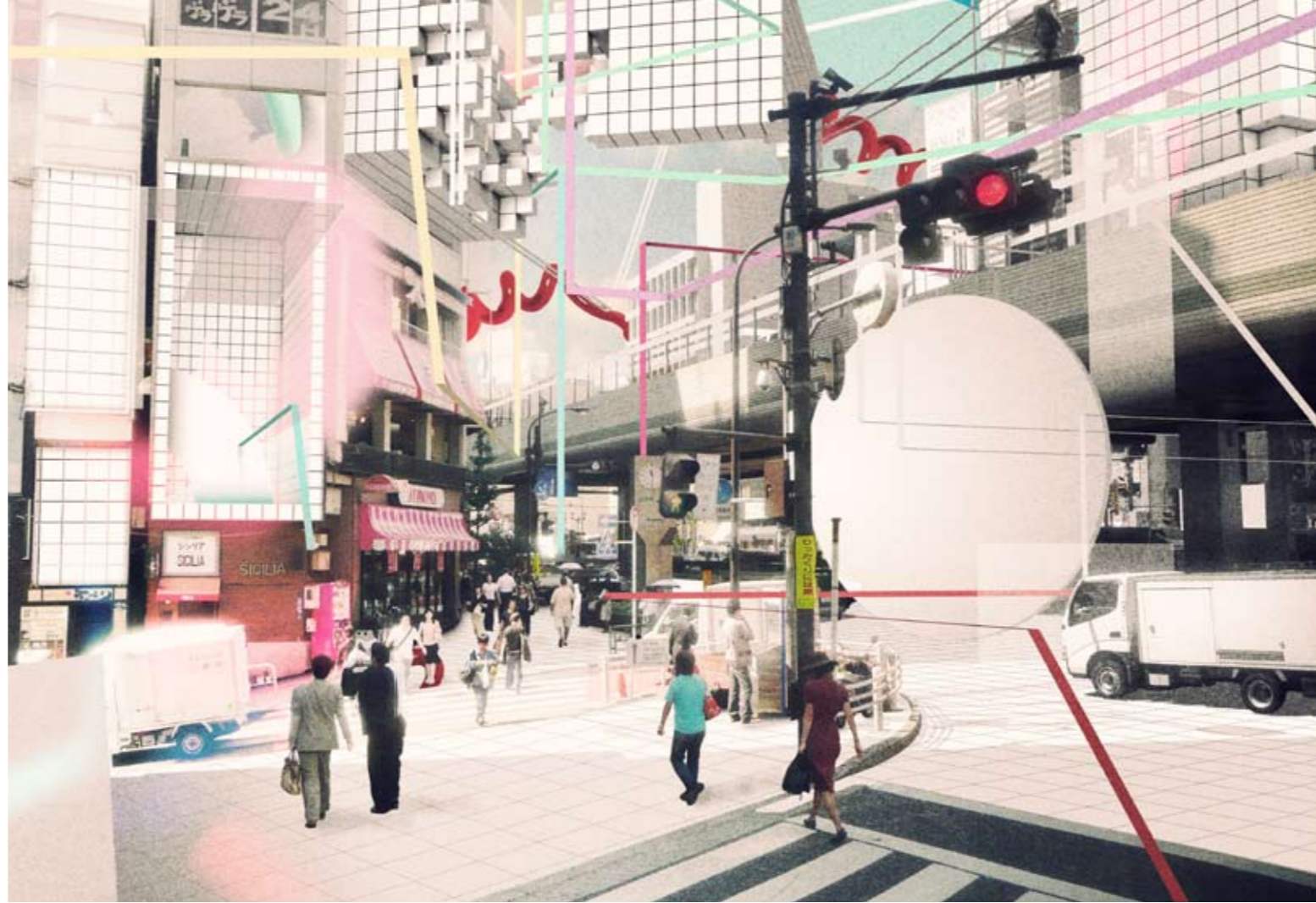
and, ostensibly, enhancing public safety, our streets are ringed with networked cameras, salted with embedded sensor grids. We traverse urban space in networked vehicles that are GPS-tracked and leased to us as hourly services like Vélib' and Bicing and City CarShare, or tap our way on to mass transit with RFID-enabled payment cards like London's Oyster.

The data sheeting off these systems can show us where muggings and assaults happen, when and where the worst traffic arises... or simply if there are any nearby Vietnamese restaurants open. These things are a *fait accompli*, well on their way to being unremarkable. Never mind that this kind of god's-eye perspective on the city was impossible just a few years ago: cheap,

THE TECHNOLOGIES ON WHICH THE NETWORKED CITY RELIES REMAIN OBLIQUE TO MOST OF US



21.4 MILLION
IPHONE
SALES TO
SPRING
2009



ubiquitous, networked information processing has reshaped urban potential as dramatically as the car did the cities of the last century. And all of it in the absence of top-down guidance or orchestration: you won't have to convince them to "architect cities around it". It will just happen.

But as is so often the case, there's a catch: the technologies that the networked city relies upon remain opaque, even to those exposed to them daily. In fact, it's hard to be critical and make sound choices in a world where we don't understand the objects around us. Understanding networked urbanism on its own terms requires an investment of time and effort beyond the reach of most. ("I learned to drive in order to read Los Angeles in the original," said the great 20th-century architectural critic Reyner Banham, and the systems we're talking about are orders of magnitude more complex than mere cars and roads.)

In the networked city, therefore, the pressing need is for translators: people capable of opening up these occult systems, explaining their implications to the people

whose neighbourhoods, choices and lives are increasingly conditioned by them. This will be a primary occupation for urbanists. If we're reaching the point where it makes sense to consider the city as a fabric of addressable, queryable, even scriptable objects and surfaces – to reimagine its pavements, building façades and parking meters as network resources – this raises an order of questions never before confronted, ethical as much as practical: who has the right of access to these resources, or the ability to set their permissions?

All of this will be messy and contentious. It will make for a less satisfying narrative than the heroic genius singlehandedly reshaping cities with his wondercart. But it's the work we have cut out for us, it is profoundly worth doing and the rewards will pay out in increments of better quality of life and a deeper engagement with the places and people that surround us.

Adam Greenfield is head of design direction at Nokia and author of Everywhere: The Dawning Age of Ubiquitous Computing (Peachpit)

STREET HISTORY

URBAN PLANNING, FROM GRIDS TO TRAMLINES



NEW YORK

The grid evolved in the 18th century, laid out by military engineers. In the 19th the grid enlarged when estate agents sold land using just street co-ordinates.



PARIS

In the mid-19th century, the authorities saw the streets as a cause of war and epidemic. Baron Haussmann remade the city with wide boulevards.



BRASILIA

In the 20th century, the car and commuter became the pre-eminent concerns in city planning. Above: a piston-shaped gyratory, injecting traffic into Brasilia.



BILBAO

Zaha Hadid's plan for Zorrozaurre, a peninsula in Bilbao, adapts the city's grid. The area's form derived from a tramline, with spurs of housing off it. TA

DATA ON THE MOVE

THE PETROL CAR WILL TAKE A BACK SEAT IN TOMORROW'S CITY CENTRES BY JOE SIMPSON

digital technology will change not only the vehicles we drive, but in turn the city's very appearance. Indeed, the main impact on city planning will be mediated through transport infrastructures, freeing up road space as it does so.

Dan Sturges, president of Intrago Mobility, and other leaders, such as MIT's William J Mitchell, still believe there's a role for the car, but propose linking it into a system with small urban electric vehicles and other forms of public transport. The "glue" that holds such systems together is digital technology – allowing users to find where vehicles and services are, reserve them, locate stations to return them to, and authorise their own identity. Programmes such as IBM's Smart Cities – which collect data from sensors in infrastructure to understand where demand will arise, and then combine this data with auto-

mated vehicles that can move themselves around cities to meet this demand – are tying together vehicles, buildings, spaces and power-supply in a scheme less inflexible than in the era of the automobile. Walking in cities will become easier as segregations in streets are no longer needed to prevent humans and vehicles coming together. Far from removing control from the average citizen, vehicles and journeys will become more varied, quicker and cheaper.

The car will cease to dominate, or be the sole form of powered private transport in the city. New types of buildings, new services and citizens themselves will fill the resulting space – which over time will completely redraw the hierarchical order and look of a city's streets. In Birmingham the National Trust will become custodians of Spaghetti Junction.

Joe Simpson is a researcher at The Movement Design Bureau

Birmingham's Intrago Mobility "city port" is an interchange built on waste ground below the M6. When you drive into the port, your long-range Zipcar is directed to a parking space. You get out, stretch your legs a little, and then start the next phase of your journey by getting into a 32kph Toyota iReal (a three-wheeled, one-seat, personal-mobility concept vehicle) and driving it up onto the elevated Velo-city, which leads out of the port. This dedicated new network of cycle tubes criss-crosses the city – connecting city ports with commuter towns and city-centre attractions. Its low-friction surface allows cyclists and light electric vehicles to travel at surprising speed, while its enclosed nature protects them from the elements.

The city looks very different from the days of the car. At street level, gone are today's railings segregating pedestrians and vehicles – the highway is level and open, without kerbs or street clutter. It functions like a river, with the fastest traffic (trams, delivery vehicles) in the centre, and the slowest (pedestrian shoppers) closest to the buildings. Where parked cars used to line the roads, today restaurants and cafés have spilled out, unconstrained by kerbs.

Coffee shops have bikes and small vehicles parked in front of them, while some shops no longer seem to have defined thresholds – their frontages are open, allowing people to ride small vehicles right inside.

Surprisingly, pedestrians and small vehicles seem to be sharing the same space without crashing into one another. At the end of the Velo-city ramp you realise why. The iReal's onboard Wi-Fi receives a message that it is entering a public-priority zone, limiting its maximum speed to 15kph. Turning off the ramp, you see the City Port logo above a newsstand, but turning towards it you come to a sudden stop. A pedestrian has stepped directly into your path. The iReal's proximity sensors reacted before you noticed, bringing the vehicle to a halt and thus avoiding a collision.

Instead of struggling to find parking, arriving underneath the City Port's sign you find a docking station and move the iReal into a free bay. Five of these have been built at this station, along with 15 docking points for bikes similar to those of Paris's Vélib'. Once docked, the iReal's front glows red to show the battery is being charged, and when you step out your iPhone beeps to signify your rental has finished.

This scenario is not far-fetched. It's actually a combination of existing concepts: Intrago Mobility LLC's on-demand transport system, Chris Hardwicke's Velo-city and Toyota's iReal. Their interaction shows how

VEHICLES AND JOURNEYS WILL BECOME MORE VARIED AS WELL AS QUICKER AND CHEAPER

FOUR CITIES WHERE THE FUTURE OF TRANSPORT HAS ALREADY ARRIVED

ULM: CAR2GO

Forget the old-fashioned concept of "car-sharing" with all its inconveniences. Car2go, launched by Daimler in Ulm, Germany, uses digital technology to enable cars to be ordered in advance or located spontaneously and left at the driver's destination (rather than a docking zone). Text messages alert members to the location of the nearest vehicle, and the driving cost is €0.19 per minute.

PARIS: VÉLIB'

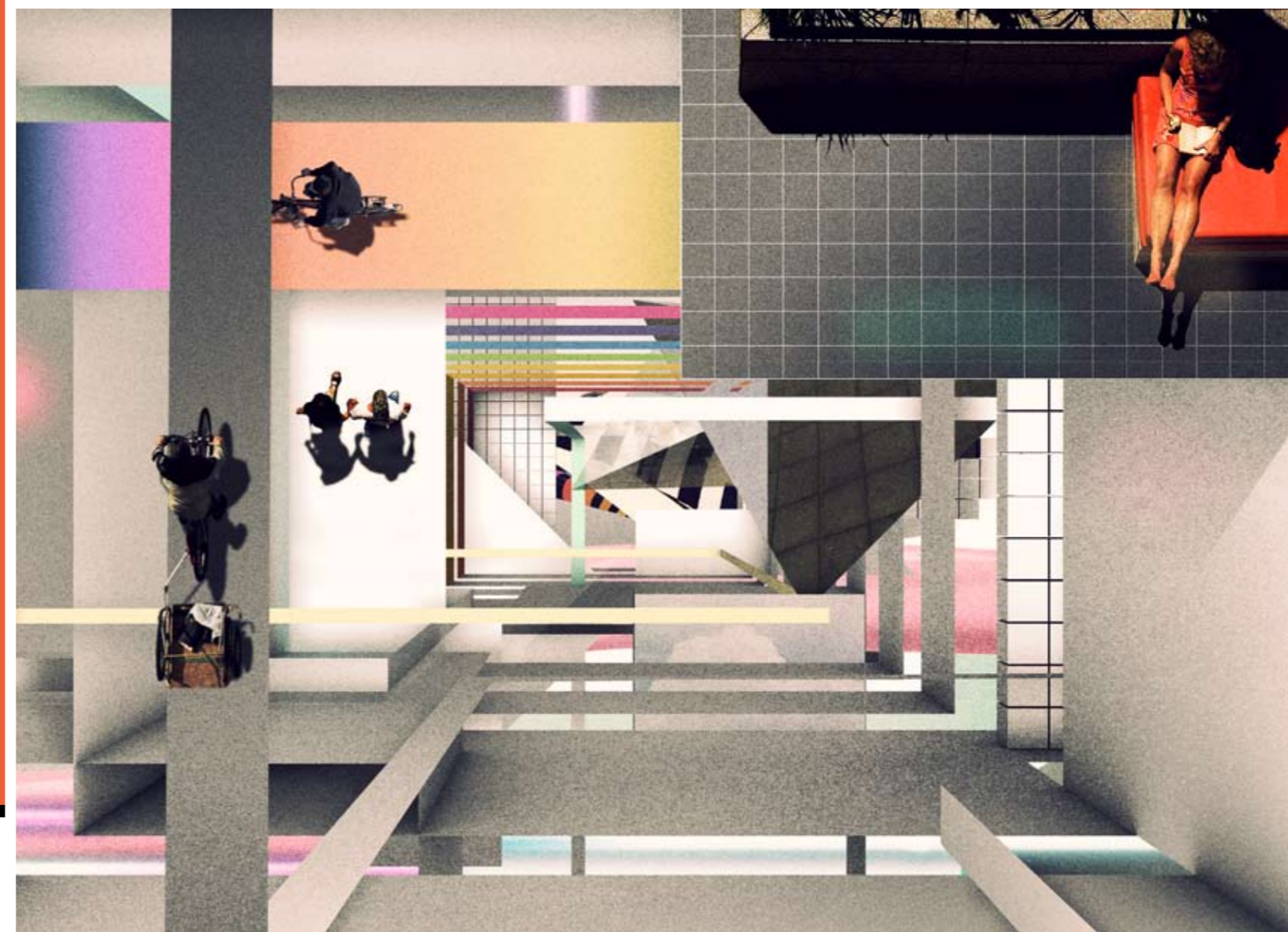
The world's biggest bike-sharing scheme is now two years old. Vélib' ("vélo libre" or "free cycle") now has 1,451 stations – each with around 20 cycle stands – at 300-metre intervals across Paris. Each includes a light to indicate if a bike is available, a lock and a card reader, and the main terminal allows members to access maps or recharge their smart cards. By July of this year, there had been 53 million rides.

STOCKHOLM: SMART CONGESTION CHARGING

After a trial phase in 2006, the Stockholm congestion charge was permanently adopted in August 2007. As Europe's second such system after London's, the Stockholm charge, developed with IBM Sweden, introduced variable charging, with each day divided into differently priced time slots and no fee payable outside working hours.

LONDON: RAPID TRANSPORT PODS

Heathrow's Personal Rapid Transit pods (right), currently being trialled, are the product of a 14-year collaboration between Bristol company Advanced Transport Systems and Bristol University. Smartcard-holding passengers will be able to enter a pod at a bus-stop-type stand, input their destination, and be taken there by the most direct route without stopping.



UNLEASHED

THE INFORMATION NETWORK WILL FREE THE TRANSPORT NETWORK BY CARLO RATTI



CARLO RATTI AND THE SENSEABLE CITY LAB

The SENSEable City Lab collects communications data from cities around the world. It maps them in striking visual forms (above) to illustrate the relationships between urban geography, population density and interpersonal communications. It has demonstrated a fascinating law of modern urban life: that communication increases exponentially with a city's population; more citizens mean less physical infrastructure per head, but far more communication. Ratti is also an architect (his practice, *carlo ratti associati*, is in Turin) and in January he spoke at the World Economic Forum in Davos.

Scholars back in 1995 speculated about the impact of the ongoing digital revolution on the viability of cities. Only 14 years ago, the mainstream view was that, as digital media and the internet had killed distance, they would also kill cities. Technology writer George Gilder proclaimed that “cities are leftover baggage from the industrial era” and concluded that “we are headed for the death of cities”, due to the continued growth of personal computing, telecommunications and distributed production. At the same time, MIT Media Lab’s Nicholas Negroponte wrote in *Being Digital* that “the post-information age will remove the limitations of geography. Digital living will include less and less dependence upon being in a specific place at a specific time, and the transmission of place itself will start to become possible.”

In fact, cities have never prospered as much as they have over the past couple of decades. China is currently building more urban fabric than has ever been built by humanity. And a particularly noteworthy moment occurred last year: for the first time in history more than half the world’s population – 3.3 billion people – lived in urban areas.

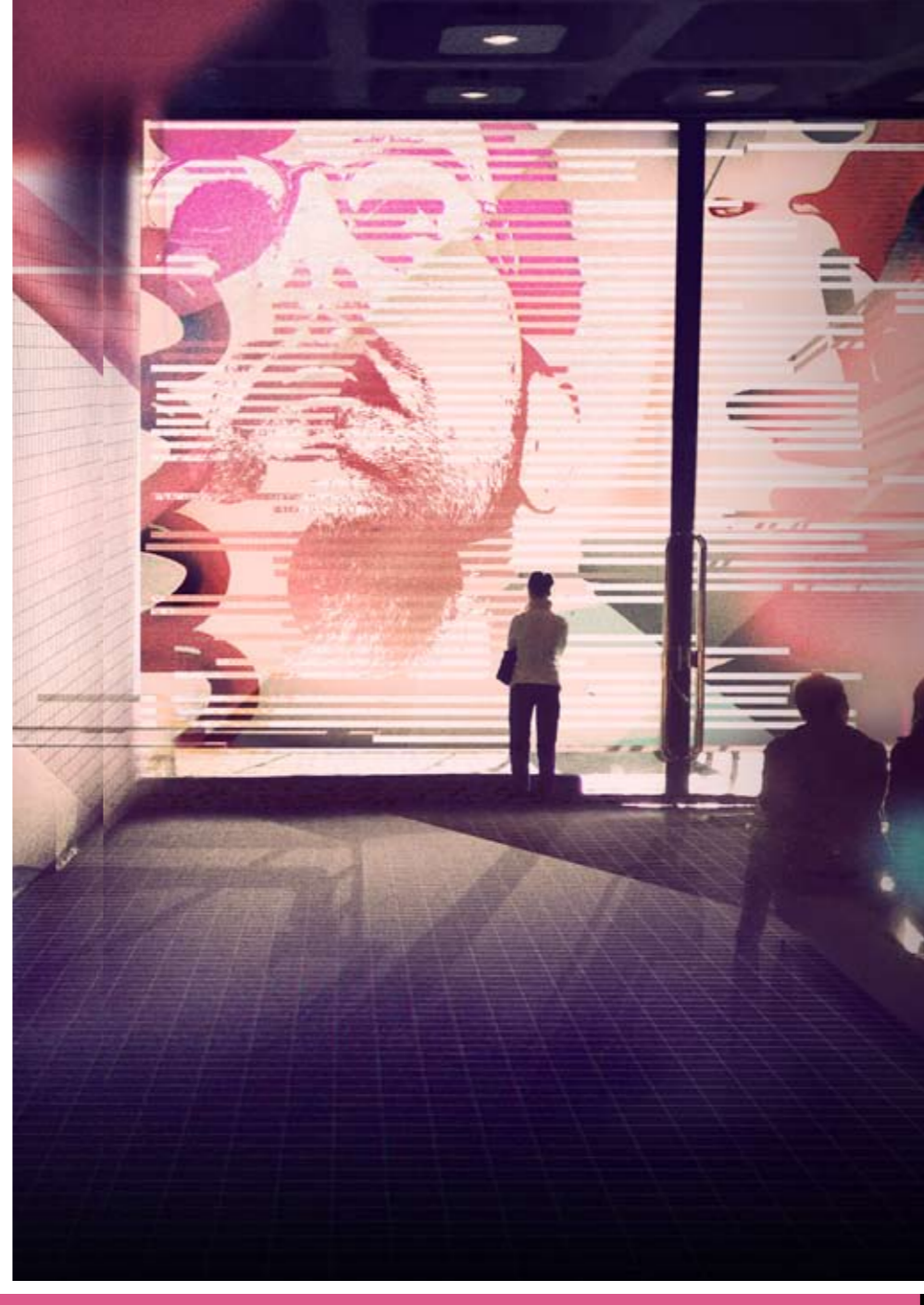
The digital revolution did not end up killing our cities, but neither did it leave them unaffected. A layer of networked digital elements has blanketed our environment, blend-

ing bits and atoms together in a seamless way. Sensors, cameras and microcontrollers are used ever more extensively to manage city infrastructure, optimise transportation, monitor the environment and run security applications. Advances in microelectronics now make it possible to spread “smart dust” networks of tiny, wireless, microelectromechanical system (MEMS) sensors, robots or devices.

Most noticeable is the explosion in mobile-phone use around the globe. More than four billion mobile phones were in use worldwide by early 2009. Across socioeconomic classes and five continents, mobile phones are ubiquitous: they allow us not only to communicate with each other in unprecedented ways, but to create a pervasive sensing network that covers the whole globe.

One consequence of this process is particularly important: cities can start to work as real-time control systems, regulated by a number of feedback loops. In past decades, real-time control systems have been developed in a variety of engineering applications. In so doing, they have dramatically increased the efficiency of systems through energy savings, regulation of dynamics, increased robustness and disturbance tolerance. Now: can you have a city that

UNLIKE OTHER REAL-TIME CONTROL SYSTEMS CITIES HAVE A SPECIAL FEATURE: CITIZENS

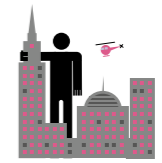


performs as a real-time control system?

The city already contains actuators such as traffic lights, remotely updated street signage, etc. More profound actuation is relatively problematic: for instance, we cannot double the size of a street in real time if we detect traffic congestion. However, unlike other real-time control systems, cities have a special feature: citizens. By receiving real-time information, appropriately visualised and disseminated, citizens themselves can become distributed intelligent actuators, who pursue their individual interests in co-operation and competition with others, and thus become prime actors on the urban scene. Processing urban information

captured in real time and making it publicly accessible can enable people to make better decisions about the use of urban resources, mobility and social interaction.

This feedback loop of digital sensing and processing can begin to influence various complex and dynamic aspects of the city, improving the economic, social and environmental sustainability of the places we inhabit. For example, an automated trip planner that relies on real-time information about bus, train and taxi location, as well as congestion and pollution levels, can help people find not only the fastest travel route, but the one that also has the least impact on air quality. A simple real-



26 THE NUMBER OF MEGACITIES (OVER 10 MILLION RESIDENTS) IN THE WORLD

time feedback mechanism between citizens and emergency-rescue units could avoid the repeat of tragic mistakes like those that affected New Orleans before and after Hurricane Katrina in 2005. Feedback loops could grow inside each other: buildings could become probes and ambient displays, but also evolve into real-time, responsive devices in their own right.

The implications for architectural aesthetics are interesting. For several years now architecture has attempted to mimic in formal terms the rapid flow of digital information. We can think of any number of fluid buildings. Unfortunately, once built, shapes that are designed to look fluid tend to end up frozen in concrete or steel. Antoine Picon, professor of the history of architecture and technology at the Harvard Graduate School of Design, has predicted that with the city incorporating digital technology into its very body, architecture itself will conversely become more restrained.

Picon’s view is heretical. He compares work by architects such as Zaha Hadid to the Baroque architects of the 17th and 18th centuries who were “obsessed by questions like the trajectory of light inside churches and its spiritual meaning”. Like our contemporaries, says Picon, Baroque architects preferred to imitate movement in their work rather than create buildings that made movement easier. Picon predicts a return to the Neo-Classical approach. We’ll see more “compositions that remain voluntarily rigid in order to be functionally more efficient” and a “digital/minimal attitude in which unwanted agitation is suspended”.

In 1963, the British architect Cedric Price created the idea of a Fun Palace. “Every town should have a space... where the latest discoveries of engineering and science can provide an environment for pleasure and discovery,” he said. We need Fun Palaces for the post-digital era.

Carlo Ratti is an architect and director of the SENSEable City Lab at MIT

FIVE TECHNOLOGIES CHANGING THE FACE OF ARCHITECTURE

BY AUSTIN WILLIAMS

LASER SINTERING

Sintering (left) involves heating materials to just below their melting points so they fuse together. By firing a CO₂ laser into a container of various powder particles – from nylon to clay to metals – the particles can be made, layer by striated layer, to fuse together to form a solid object.

BUILDING INFORMATION MODELLING

Information modelling can help to build accurate computer-generated representations by translating otherwise incompatible information into a common format. It embeds metadata relating to its construction, procurement and maintenance.

STEREO-LITHOGRAPHY

Rapid prototyping takes data from a 3D computer drawing and turns it into a physical model. In a process known as stereolithography, a UV laser follows the lines of a drawing and traces the shape into a tank of resin. This solidifies so that a replica solid object forms. Large-scale usage would transform building.

STEREOPHOTOGRAMMETRY

Typically, at least two camera locations are needed to develop a 3D computer construction of a structure. With new stereophotogrammetry techniques, 3D coordinates can be predicted from an ordinary photograph, and a rapid-prototyping device can be used to make a replica structure.

NANO-TECHNOLOGY

Nano-architecture is about construction at the atomic level. We have the possibility of programming self-replicating machines, whether a house or a city, that build themselves, molecule-by-molecule, to create any structure determined by its DNA blueprint; a process of intelligent self-assembly.



SOCIAL NETWORKING HAS MADE CITIES MANAGEABLE

BY ANDREW BLUM



efore a Sunday-afternoon stroll through Brooklyn, I pass the moments spent waiting for my wife in the obvious way, scrolling the Facebook feed on my iPhone. It's business as usual: inside jokes and meticulously described brunches. Kenny thanked everyone for "the birthday wishes!!!". Eva had "pulled out the violin" (a real violin or a euphemism?). Miriam "went to the Flea" (the flea market, I presumed). Out on the street a few minutes later, Eva herself appeared, violin case slung over her shoulder. It wasn't until we bumped into Miriam a few blocks later, bags full of second-hand trinkets, that it hit me: my Brooklyn neighbourhood had become Facebook Live.

Conventional wisdom says that technology is bad for real-world communities, that we are often alone at home in front of blue screens. This is no doubt true. But we are also out on the street stealing glances at smaller screens, and interacting in more meaningful ways because of it. When it comes to technology and cities, today's thrilling development

– "thrilling", that is, if you like real cities and corporeal people – is that social networking is enhancing urban places. I may have been only affirming face-to-face the interactions I just had in cyberspace, but that act was significant for the future of our cities.

The bandwidth of urban experience has increased. The ancient ways are still there: the way a place looks, the neighbours we wave at and the hands we shake. But now, there is an electronic conversation overlaid on top of all that: tweets and status updates, neighbourhood online message boards, detailed mobile electronic maps, and nascent applications that broadcast your location to your friends. This is far more interesting than what we were promised a decade ago: the proverbial coupon blinking on your mobile as you walk past Starbucks. (I have yet to experience this.)

Anthony Townsend, an urban planner and forecaster at Silicon Valley's Institute for the Future, calls this phenomenon "blended urban reality". It is neither cyberspace nor an urban landscape blanketed with blinking television screens, but the regular old city, albeit socially fused with real-time electronic interactions. And it goes way beyond maps provided by sat-navs. The new iPhone, for example, with its GPS and compass, tells you not only where you are but which way you're facing, thereby taking us a step closer to a real-time overlay of information.

But here's the fascinating thing: Townsend sees it as no accident that this is happening concurrently with the rise of megacities. "It makes them manageable," he says. "Cities may be much bigger, but the social graph is the same

85 PER CENT: NEW YORK'S MOBILE-PHONE PENETRATION RATE. IN HONG KONG IT'S **163 PER CENT**



knows your business."

Property developers are beginning to seize on the idea. On 600 hectares of land-fill near Seoul's Incheon Airport, New York-based Gale International is building Songdo, a new city for 65,000 people. The first buildings opened in August, with a sales pitch of a sustainable metropolis modelled on the best bits of the world's cities. The developer's collaboration with Microsoft on a purpose-built social-networking system for residents, U-Life, is nowhere evident in its appearance; indeed, its most striking feature is the increase in density. Will we accept less room to live in if we can organise our communities to our greater satisfaction? It would appear so.

Yet tech is not a panacea. The arrival of all this new bandwidth doesn't cede the task of designing cities to technologists and web developers. Density increases the need for thoughtful public space. For the cities of the future to work, the physical and the virtual have to stick together.

On that Sunday afternoon in Brooklyn, our destination was a gourmet ice-cream truck that announces its location via Twitter. When I was handed a sugar cone of strawberry, I put my phone away.

Andrew Blum is a contributing editor to US WIRED. He wrote about Oslo's opera house in our 05.09 issue

'BLENDED URBAN REALITY' IS THE OLD CITY, FUSED WITH REAL-TIME INTERACTIONS



WHAT THE DOCTORS ORDERED

THE CAPITAL BECOMES A GIANT PHARMACEUTICAL.
A DYSTOPIAN SHORT STORY BY GEOFF MANAUGH



fter the Dutch flu outbreak of 2047 decimated greater London, the politics of the city began to change: everything turned medical. Being a teacher, a policeman, a writer – that didn't matter any more. Lawyers, community leaders, businessmen? No, it was doctors, surgeons and even chemists who were being elected MPs. All the other problems the city faced – from education, inequality and crime to pollution and waste management – became secondary. The ultimate concern was infectious disease. Within five short years, political power had passed into the hands of the medical establishment. It was the doctors who began to reshape the city. Never again would an airborne outbreak trouble the British people; the flu, not to mention the common cold, would become spatially impossible. Pneumonia would be cured by street width.

Designing London was no longer about history, economics or aesthetics. It wasn't about maximising retail frontage, planting trees or pedestrianising the riverfront. Streets were reordered – not for new forms of transport, but to keep people and their germs as far apart as possible. To stop the spread of any infection in its tracks. Moveable

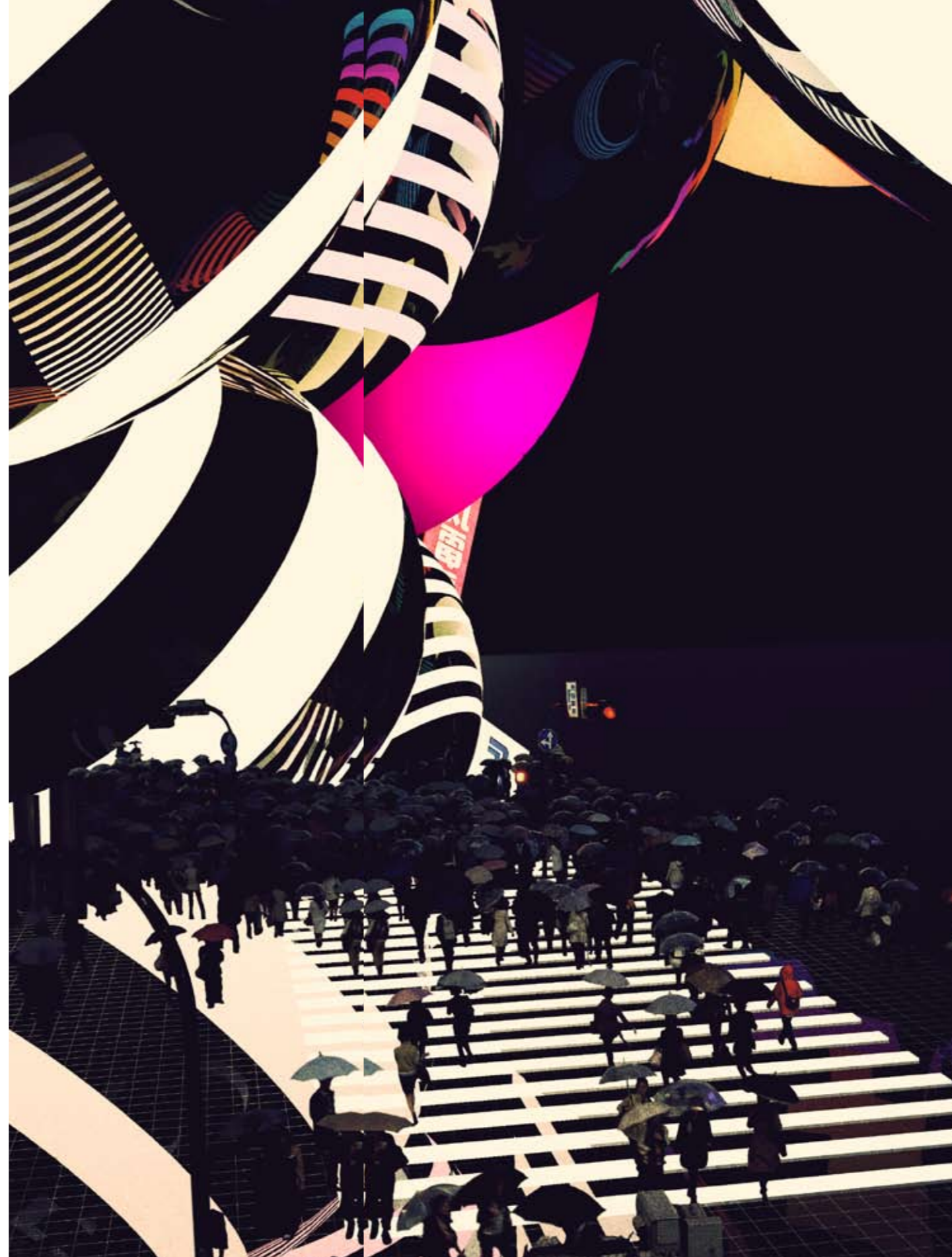
walls, like something out of the occupation of Baghdad, began to appear, only these were made from microbe-resistant plastic and had built-in air filters and blood-testing checkpoints. Watchtowers and body-scanning holograms appeared on Oxford Street.

Public squares were rebuilt using data taken from air-circulation studies and the physics of the human cough. The distance a sneeze could travel took on architectural form. The congestion charge was applied to pedestrians, keeping transmissibility to a minimum; you could cross from borough to borough only with the written consent of a GP. Movement was controlled; public gatherings of people with incompatible immunities were made illegal; even the floorplans of flats and houses were carefully reshaped in accordance with medical regulations. Being at home felt like quarantine (and often, it was: if your daily skin tests didn't look so good, you'd find your front door temporarily sealed). It was cold; some said dystopian. Until the prescription districts started to appear.

They rebuilt Bayswater to cure us: the buildings already had high ceilings, they just repainted them in warm tones and installed simulated suns, UV lamps four metres high in every street. Twenty min-



60 PER CENT
OF THE WORLD
WILL LIVE IN
CITIES BY 2030,
SAYS THE UN



utes a day, you were told: just head over to Bayswater and relax. Space itself was the prescription. Insomniacs gathered in Soho for its "Lotus Clubs", where designer sedatives were available 24 hours a day. A district for erectile dysfunction was proposed as a joke. And then actually built: old men queued for hours with forged prescriptions held tightly in sweating hands.

The Victorian parks of London became gardens of genetically engineered flowers bred to produce pharmaceuticals, not pollen. In every allotment a thousand medicines bloomed, all simply there for the taking. New Londoners felt like Adam and Eve all over again: plucking previously forbidden mixtures and eating crystallised petals from blight-resistant vines.

If you had a condition, there was a dis-

**IN EVERY ALLOTMENT
A THOUSAND MEDICINES
BLOOMED, ALL SIMPLY
THERE FOR THE TAKING**

trict for you. You simply flashed your papers and there you'd be: walking through a tailor-made Utopia of your own private medical necessities. Near-psychedelic levels of self-augmentation ensued, with exact matches made between your nervous system and the walls around you. Allergies disappeared; anxieties clarified; if you had a phobia, a room somewhere would fix it. You'd want to be in hospital, the recovery ward exquisitely camouflaged as a walk-in paradise of well-flavoured antibiotics. In a mist of aerosolised anti-ageing elixirs, like some Egyptian vision or a Blakeian king, you'd sit inside your home cabinet of curatives, drinking immuno-boosting beer.

London – a biopleasure dome washed by antibacterial waters from the Thames. It wasn't long before the architecture itself was edible, Willy Wonka wed with Boots. Buildings crumbled into sweets: painkillers and vitamins littering the streets like conkers. This year we've elected a new mayor – for the first time, a psychiatrist. New districts are planned for freshly dredged marshes out to the east: pillared pavilions astride the fog, based on research into dreams. There are vast excavations beneath Westminster, people say, and there is strange music aboard the Tube. 📺

Geoff Manaugh blogs at BLDGBLOG (bldgblog.blogspot.com) and is the author of The BLDGBLOG Book (Chronicle Books)