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Intelligent cities

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Presentation

The state of the University

Imma Tubella

Dear members of the UOC community,

This is the second academic year that I am beginning as rector and I want to undertake the commitment at least once a year of addressing all of you to explain *the state of the University*, in other words, how I value the work done and the projects for the new academic year.

As well as guaranteeing our mission of offering quality virtual university training and of working especially in the deployment of and adaptation to the European Space for Higher Education, over the last eighteen months, we have concentrated our efforts on ensuring the sustainability of the university. We have successfully achieved this and that gives us a sense of tranquillity and security with which to face new projects. Good financial resource management, optimisation of organisation, the solidity of our companies and a working culture based on transparency, trust and flexibility are questions that remain invisible, but which will possibly be the ones that will enable us to put the UOC in a leading technological and especially academic position.

It is now time for us to establish ourselves with this same spirit in the Spanish university system, where we have a significant number of students, but where we have to develop a policy of alliances and collaboration with public and private universities and institutions that will position us as a benchmark university.

Parallel to this and working from collaboration, we need to strengthen our presence in Latin America through alliances with prestigious universities. During the 2007-2008 academic year, we will also be laying down the bases for our offer in English, aimed especially at students from emerging countries, and in French aimed at students from the Maghreb. To promote this, over the coming weeks we will be establishing the International Graduate Institute.

One of the concerns of universities throughout the world is finding the way to adapt their structures and mediaeval roots to the twenty-first century. To give an example, one of the challenges that they face is how to capture and above all maintain and retain what we call the "students of the new millennium", students who were born in the Information Society and whose approach to knowledge is in no way passive, but active. It is the students of the new millennium who demand different styles of learning. You are these students, UOC students who for years have learnt and had contact with each other and with your lecturers and the university administration in a different way.

The interdisciplinary nature, transversality, participation, collaboration and cooperative work are values that you experience and practice every day: students, lecturers, teaching collaborators and administration staff. You have a huge advantage!

We know, however, that we need to make technological progress. The internet of ten years ago is nothing like the internet of today. This year, we aim to culminate the UOC's technological transformation to maintain its position as leader in the use of ICT and to ensure the innovation and diversity of platforms. We will have a new portal within the next few weeks and this year we will be starting pilot trials of the new campus, which will include new teaching, collaboration, multichannel and multimedia functionalities.

Yet innovation should not be limited only to technology. The mission of the new Vice Rector of Innovation is to foster innovation in all spheres of the university as a system and culture of continuous transformation, creating internal meetings to promote teaching and administration innovation projects, spaces for experimentation and an innovation portal. We cannot be left behind! We cannot be sleeping innovators! We need to consider how we move forward in open and collaborative learning models in a world of contents also generated by the user and where tutorisation and exchange between equals is increasingly the norm.

We number 4,500 students, 240 lecturers, 200 teaching collaborators, 450 administration staff, 10,000 graduates. We account for 15.4% of the Catalan University System. We are an example of the University of the future. We have got used to overcoming obstacles, you to combining your studies with family and work life, and we to constructing and continuously adapting the model. We have spent two years strengthening the foundations. It is now time to build. And we will do so from curiosity, independence, openness, collaboration, freedom, and, above all, quality.

We will continue to foster research, following the advice of the International Scientific Commission, and increase the level of academic requirements on degree and postgraduate courses. We want our courses and your degrees to be a guarantee of academic quality at a time when a degree will carry the same prestige as the university that awarded it. To this end, we will advance in building solid strategic alliances with the Open University and the Internet Institute of Oxford University.

We are starting an academic year in which we will continue to work for humanity from the Campus for Peace, which has been an international benchmark since it first began in 2000 in the use of ICT for humanitarian action. We are also committed to being more present in the areas where we have students with a cultural offer that complements our task of dissemination of knowledge. Knowledge that is increasingly less proprietary and more open.

Finally, I would also like to say to you that very soon the UOC will have its own Ombudsman, at the service of the whole community.

My aim, then, is to create a modern university where people enjoy working and studying and of which they are proud to be a part. The Strategic Plan, which will have been the work of us all, will help us achieve this.

Please permit me to offer you my warmest welcome to this 2007-2008 academic year, which, as is customary, we are starting with a prestigious inaugural lecture. This year, our guest is Professor Bill Mitchell, senior professor and academic director of the Media Lab at the MIT, which, to some extent, is a metaphor for all the values that I have quoted thus far. My speech during his investiture as Honorary Doctor of our university bore a title that defined his spirit and ours: ***I connect, therefore I am***. In this speech, I quoted an excerpt from his book: *Me++ The Cyborg Self and the Networked City*, with which I would like to introduce his lecture: "I construct, and I am constructed, in a mutually recursive process that continually engages my fluid, permeable boundaries and my endlessly ramifying networks". This way, we have to work hard to construct the UOC and its actions.

Imma Tubella
Rector of UOC

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article

Inaugural lecture of the UOC 2007-2008 Academic Year

Intelligent cities

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Abstract

Following a historical journey through the different physical structures of cities, we arrive in the twenty-first century, where cities have all the sub-systems that are needed by living organisms: structural skeletons, various layers of protective skins and artificial nervous systems. In this context, to create new intelligence in the cities, we need to combine software and digital telecommunications networks, ubiquitously embedded intelligence, and sensors and identifiers

The City Car is an example of the comfortable, cheap and sustainable contributions that a smart city can make to citizens' personal mobility. This prototype is a clean, compact and efficient city car, which can fold and stack like a shopping trolley, and charge up on electricity in the meantime.

If intelligent embedded technology starts to be used ubiquitously, vehicles and the different mechanical and electrical systems in buildings can become specialised robots able to respond intelligently to the surrounding environments in which they are integrated. Likewise, resources can be managed in more sophisticated ways, with unimaginable effects on space use models and building systems.

Keywords

intelligent city, city car, urban planning, transport, sustainability

Resum

A partir d'un recorregut històric per les diferents estructures físiques de les ciutats, arribem al segle XXI, en què les ciutats posseeixen tots els subsistemes crucials dels organismes vius: esquelets estructurals, diverses capes de pell protectora i sistemes nerviosos artificials. En aquest context, per crear la nova intel·ligència de les ciutats, cal combinar el programari amb les xarxes de telecomunicacions digitals, la intel·ligència integrada de manera ubiqua i els sensors i identificadors.

El cotxe urbà és un exemple de les aportacions que pot fer una ciutat intel·ligent a la mobilitat personal, d'una forma còmoda, barata i sostenible per als ciutadans. Aquest prototip és un cotxe urbà net, compacte i eficient, que es plega i s'encaixa com els carretons de la compra i que mentrestant es carrega elèctricament.

Si s'imposa la tecnologia de la intel·ligència integrada de manera ubiqua, els vehicles i els diferents sistemes mecànics i elèctrics dels edificis esdevindran robots especialitzats, que podran respondre de manera intel·ligent als entorns més grans als quals estan integrats. A més a més, els recursos es gestionaran de maneres més sofisticades i els efectes en els models d'ús d'espai i en els sistemes d'edificis seran inimaginables.

Paraules clau

ciutat intel·ligent, cotxe urbà, urbanisme, transport, sostenibilitat

It's impossible to predict the futures of cities, and certainly unwise to try. For one thing, there are too many uncertainties and random contingencies. For another, there's an indeterminacy effect; interventions concerning the futures of cities —predictions, prophecies, warnings, jeremiads, utopian proposals, science fictions in the style of *Minority Report*, and the like— themselves have the potential to change thinking and therefore the very futures they address. But designers and planners can usefully suggest *possible* futures, and demonstrate ways to achieve them. This engages the imagination, provides a concrete basis for debate about what might be desirable and achievable, and establishes some starting points for constructive action. In this lecture, then, I will sketch one possible, particularly interesting urban future —that of *intelligent cities*.

Evolution of urban intelligence

To put the idea of intelligent cities in perspective, it is useful to go back to the beginning of a long evolutionary process. The physical fabric of the earliest cities, long before the industrial revolution, consisted essentially of skeleton and skin —columns, beams, walls, floors, and roofs. Its functions were to provide shelter and protection, and to intensify land use. The inhabitants, sometimes assisted by animals, provided their own mobility, performed social and economic transactions face-to-face, and supplied the coordinating intelligence needed to make the city function as a system.

This began to establish a cyborg condition; spatially extended layers of artificial skin augmented the protection offered by living human skin. Then, with industrialization, cities started to acquire, as well, increasingly extensive artificial physiologies. Now there were water supply and liquid waste removal networks, energy supply networks, transportation networks, and heating and air-conditioning networks in buildings. Food processing and supply networks extended human alimentary canals at one end, while sewers extended them at the other. Inhabiting a city meant being continually plugged into these networks, and dependent upon them for your survival. Cities extended the capabilities of human bodies in more comprehensive and sophisticated ways, and took over more of the functions traditionally performed by the unaided human body, so the cyborg condition intensified.

Finally, in the latter half of the nineteenth century, cities began to add artificial nervous systems to their fabrics of skeleton, skin, and supply, processing, and removal networks. This process began with the construction of telegraph, telephone, and radio communication systems, picked up momentum through the first half of the twentieth century, and then accelerated in extraordinary fashion after the introduction of digital telecommunications in the late 1960s —eventually producing today's pervasive connectivity through the internet and mobile wireless networks. The pioneering media theorist Marshall McLuhan presciently hailed these new networks as extensions of human nervous systems.

At the dawn of the twenty-first century, then, cities possessed all of the crucial subsystems of living organisms: structural skeletons; input, processing, and waste removal networks for air, water, energy, and other essentials; and multiple layers of protective skin. Even more importantly, the existence of artificial nervous systems was enabling cities to sense changes in their internal and external environments and respond, like organisms, in intelligently coordinated fashion. In my 2003 book *Me++: The Cyborg Self and the Networked City*, I discussed this development in detail.

Elements of digital urban intelligence

The elements of artificial urban intelligence did not appear all at once. Instead, there has been a complex and messy process of technological emergence and integration into larger systems —much as, in biological evolution, existing structures and unexpected mutations are appropriated for new purposes within emerging functional organizations. (This sort of process is sometimes called technological convergence, but this terminology suggests something far less messy and *ad-hoc* than what actually goes on.) First came development of the theory of digital information by Claude Shannon, followed, in the 1960s by the invention of packet switching, the Arpanet, Ethernet, the Internet, and the World Wide Web. Combined with ongoing rapid expansion of wired and wireless communication channels —including very fast fiber optic cable connections— this put in place the necessary nerve pathways at building, city, national, and ultimately global scales.

Next, during the 1970s and 1980s, came the increasingly profound effects of the semiconductor revolution. Computers, which had hitherto been large, delicate, expensive, and confined to a few specialized and privileged sites became much smaller, much less expensive, and much more robust. By the mid-1980s, this development had made desktop personal computers part of everyday life, and these were soon linked into the growing digital networks. With further miniaturization and improvements in performance of semiconductor devices came laptop computers, mobile phones, Blackberries and iPods. Less visibly, but maybe even more importantly in the long run, tiny, embedded microprocessors became crucial components of devices and systems ranging from automobiles to digital cameras. Digital intelligence was no longer tightly concentrated, but was now ubiquitously present throughout urban environments.

During the dotcom bubble of the late 1990s, it seemed to many that the digital era was all about internet connectivity, personal computers, and websites. There was much excited discussion (partially, but not entirely grounded in reality) of the alleged death of distance, the dematerialization of just about everything, and the emergence on new business opportunities. Meanwhile, though, a third wave of technological innovation —that of digital sensors and tags— was making its presence felt. Minuscule, digital cameras and microphones gave the internet eyes and ears everywhere. GPS and other location technologies made devices, such as automobiles and mobile phones, continuously aware of where they were. RFID tags embedded in products and packaging began to revolutionize logistics and retailing. All this had the effect of weaving a very tight web of connections between the now-global artificial nervous system and the physical world. The artificial nervous system developed the capacity to perceive and quickly respond to conditions and events in the physical world, while digital processes had increasingly immediate and significant consequences in the physical world. Old metaphors of a distinct "cyberspace" and transcendent "virtual worlds" —though still favored in the popular press, and by some cultural theorists— began to seem quaintly outmoded.

Finally, we have now seen the development of large-scale software that ties all these pieces together to function as intelligently coordinated, geographically distributed systems. The most vivid example of this, of course, is the immense and highly sophisticated software apparatus of Google, which now structures daily intellectual life throughout the world. But there are many more. Today's global financial markets would be impossible without an immense and very sophisticated software infrastructure. Businesses, from financial product manufacturers to airlines, depend upon their enterprise software. Retailers like Amazon.com could not operate at all without the software that manages transactions, keeps track of consumer preferences, and handles back-office functions. MySpace and YouTube enable and sustain social and cultural connections through the operation of software. And, of course, the Campus of the UOC, which provides you with access to this text and the means to discuss it, is mostly a software construction.

We are also seeing the emergence, in the software world, of cognitive hierarchies similar to those exhibited in the operations of human minds. At the lowest level is software, usually operating on local processors, that provides straightforward, reflex-like capabilities. For example, a sensor-equipped microprocessor in a machine might detect overheating and switch it off. This outage might be noted by central plant management software, which then adjusts the flow of a process accordingly. And this higher-level response, in turn, might be noted and responded to by the still more centralized software for global enterprise management.

Such large-scale software systems are now crucial and inescapable in daily urban life. Their economic, social and cultural effects are undeniable, and are increasingly the focus of important social science research. Mostly, I'd be prepared to argue, they have enhanced human life. But they do deserve much closer critical scrutiny —and sometimes resistance— than they have customarily received. They have become very significant expressions of ideology, mediators of consciousness and instruments of power.

The new intelligence of cities, then, resides in the increasingly effective combination of digital telecommunication networks (the nerves), ubiquitously embedded intelligence (the brains), sensors and tags (the sensory organs), and software (the knowledge and cognitive competence). This does not exist in isolation from other urban systems, or connected to them only through human intermediaries. There is a growing web of direct connections to the mechanical and electrical systems of buildings, household appliances, production machinery, process plants, transportation systems, electrical grids and other energy supply networks, water supply and waste removal networks, systems that provide life safety and security, and management systems for just about every imaginable human activity. Furthermore, the cross-connections among these systems —both horizontal and vertical— are growing. And we are just at the beginning.

An example: intelligent personal transportation

To illustrate some of the possibilities of intelligent cities, let us now consider how they might handle the task of providing convenient, inexpensive, sustainable personal mobility to their citizens.

The problem, of course, is a familiar and pressing one. And standard approaches to developing solutions no longer seem adequate. For too long, too much of the discussion about urban mobility and its relationship to sustainability has been locked into an increasing sterile debate between proponents of public transit and advocates of the automobile. Both sides ignore some inconvenient truths.

Transit enthusiasts point out the inherent efficiencies of high-capacity public transportation networks, but often neglect to mention that, under most practical circumstances, they offer no solution to the "last mile" problem. They can get you to approximately where you want to be, approximately when you want to get there, but rarely exactly. You still have to get from the nearest transit stop to your actual destination by walking, bicycling, taking a taxi, or driving. It is nice to imagine that this problem could be handled by clustering high-density development within convenient walking distance of transit nodes, and sometimes it can —at least partially, but this is far from a general solution. Often, circumstances conspire against it: the distances are too great: it's impractical for the aged, small children and the physically impaired; it can expose you to a variety of dangers; it's unattractive in rainy, snowy, very cold, or very hot weather; and it just doesn't work if you have a lot of stuff to carry.

Defenders of the private automobile emphasize that it provides mobility on demand; there are no timetables for its use, and it gets you right to your destination. As a result, people really *like* their cars —not only for the convenience they offer and for their elimination of the "last mile," but also because they function as powerful symbols of personal freedom. (Automobile advertising, of course, plays heavily to this— showing cars in a wide variety of attractive, and otherwise inaccessible locations). Furthermore, the economic, social and cultural vibrancy of cities depends upon dense, convenient, unrestricted interconnectivity, and automobiles have become universal agents of this.

The problem with cars, which has become increasingly evident as their popularity has grown, is that the scale effects and externalities come back to bite you. When there is an extensive road network with few vehicles on it —as, for example, on the Los Angeles freeway system late at night, it's indeed astonishingly quick and easy to get around, but when the network becomes choked with traffic, congestion and delays begin to negate the automobile's advantages. Automobiles account for huge percentages of the energy consumptions of cities, producing economic and geopolitical problems in the short term and a significant threat to sustainability in the long term. Tailpipe emissions turn out not only to produce local pollution, but also to contribute to global warming.

In my Smart Cities group at the MIT Media Laboratory, we have been developing a third option —a clean, compact, energy-efficient City Car that promises very high levels of personal mobility at low cost, and effectively complements transit systems by, among other things, efficiently solving the "last mile" problem. This project illustrates the growing potential of ubiquitously embedded intelligence and networking to revolutionize the ways we design and operate buildings and cities.

Figure 1. City Car prototype

The crucial enabling technology of the City Car is an omnidirectional robot wheel that we have developed. This wheel contains an electric drive motor, suspension, steering, and braking. It is fully drive-by-wire, with just an electric cable and a data cable going in, and there is a simple, snap-on mechanical connection to the chassis.

This highly modularized vehicle architecture, together with elimination of the traditional engine and drive train, offers great flexibility in design of the body and interior. We have taken advantage of this to create small, lightweight passenger vehicles that fold and stack like shopping carts at the supermarket or luggage carts at the airport. The independent, omnidirectional wheels provide extraordinary maneuverability; cars can spin on their own wheelbases instead of making u-turns, and can parallel park by slipping in sideways. Depending upon context, we can park six to eight folded and stacked City Cars in one traditional parking space.

Although City Cars can work quite nicely as privately owned vehicles, they provide the greatest sustainability benefits when they are integrated into citywide, intelligently coordinated, shared-use mobility systems. The idea is to locate stacks of city cars at major origin and destination points, such as transit stops, airports, hotels, apartment buildings, supermarkets, convenience stores, universities, hospitals, and so on. You just swipe a credit card, drive a vehicle away from the front of the stack, and return it to the rear of another stack at your final destination. From the user's perspective, it's like having valet parking everywhere.

From the operator's perspective, it's a mobility service business. Success depends upon having enough stacks and vehicles to satisfy mobility demand, while minimizing unnecessary capacity, and implementing an effective strategy for tracking vehicles through GPS and redeploying them, as necessary, from points of low present demand to points of high present demand. This system enables a very high vehicle utilization rate, doesn't leave vehicles sitting uselessly around for most of the time —as with private automobiles, and minimizes the number of vehicles needed to provide a high level of personal mobility within an urban area.

This isn't entirely new. The feasibility of shared-use personal mobility systems based upon vehicle stacks throughout urban areas has recently been demonstrated by the Velo shared-use bicycle system in Lyon, France. Currently, this system is being extended to Paris —with approximately 2,000 stacks and 20,000 bicycles. And Barcelona has recently introduced a similar bicycle-sharing scheme.

Just as your electric toothbrush automatically recharges when you replace it in its holder, so City Cars automatically recharge when they are parked in stacks. Since they only need to travel from stack to stack, they don't need long ranges or the associated bulky, heavy, and expensive battery packs that are, unfortunately, characteristic of today's electric and hybrid cars.

Figure 2. City Car prototype

When City Cars are stacked, they insert storage capacity into the electric grid. They function as intelligent agents with the capacity to buy electricity from the grid when they need it and prices are low, and also to sell electricity back when they don't need it right away and prices are high. In effect, they become active, alert traders in a dynamic electricity market. This helps the power grid to even out peaks, and allows it to make more effective use of renewable but intermittent power sources such as solar and wind. A project developed by Google and Pacific Gas and Electric, using plug-in hybrid cars, has already demonstrated (on a very small scale) the idea of vehicle-to-grid power.

Figure 3. City motorbike prototype

Large-scale implementation of this concept would be a significant step towards transforming cities into distributed virtual power plants —an internet-like arrangement that promises many sustainability and security advantages. Buildings would not only consume electricity, but also produce it through various combinations of solar, wind, and hydrogen fuel cell technologies. Vehicles, and perhaps some buildings, would provide battery storage capacity. The system would be coordinated through ubiquitously embedded intelligence and networking. Vehicles, appliances and the mechanical and electrical systems of buildings would become intelligent economic agents, trading in energy markets with excellent knowledge of demand and price patterns and the capacity to compute optimal buying and selling strategies.

The concept of intelligent agents operating cleverly in markets with dynamically varying prices can be extended, as well, to road space and parking space. Consider, for example, a citywide system that monitors traffic volumes in real time on a block-by-block basis, adjusts congestion road prices accordingly, and conveys this information to the GPS navigation systems of wirelessly networked City Cars. Drivers could then ask their navigation systems to find the quickest paths to destinations subject to cost constraints, or the cheapest paths subject to time constraints. This produces a feedback loop controlling the allocation of road space; vehicles adjust their routes in response to current price patterns, and price patterns adjust in response to vehicle densities.

Figure 4. City motorbike prototype

We propose a similar approach to parking space. Through simple sensing combined with wireless networking, the availability of parking stalls and stack space near vehicle destinations can be monitored and made known to navigation systems. Based on instructions from drivers about the urgency of finding parking and the acceptability of some displacement from destinations, City Cars might automatically bid in eBay-style auctions for available spaces and then guide drivers to them.

With our sponsor General Motors, we have prototyped and demonstrated the feasibility of the crucial elements of City Car systems, and we are currently exploring possibilities for initial implementations in realistic contexts. A major exhibit on the City Car will open at the MIT Museum on September 28.

Some concluding words

The concept of the City Car illustrates, in some detail, how a crucial component of a twenty-first-century intelligent city might operate. It demonstrates a general principle that, I suspect, will become increasingly important in architecture and urban design as the technology of ubiquitously embedded intelligence takes hold and as designers recognize and respond imaginatively to its possibilities. Vehicles, appliances (both fixed and mobile), and the various mechanical and electrical systems of buildings will all evolve into specialized, networked robots that can make decisions and respond intelligently to the varying conditions of the larger environments within which they are embedded. Resources —particularly energy and space— will be managed and allocated in far more sophisticated ways than they are today. The effects upon patterns of space use, building systems and their functionality, and the prospects for long-term urban sustainability, will be profound —often in ways that are, as yet, unimagined.

Remember, though, that this is a vision of one possible future, not a prediction. It isn't the inevitable outcome of technological development, but something that might be achievable if we collectively want it and work for it. This prompts many questions. Does it make sense? Is it, in fact, desirable? What would be its advantages and disadvantages to citizens in their daily lives? What barriers to implementation exist? How might these be overcome? If a city wanted to move in this direction, how might it begin? The community of the UOC, which is held together electronically and already functions in intelligent city style, seems an ideal place to explore and debate these questions. I hope that I have stimulated such a discussion, and I look forward to seeing it unfold.

Recommended Reference:

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His publications include:

- *Placing Words: Symbols, Space, and the City* (MIT Press, 2005)
- *Me++: The Cyborg Self and the Networked City* (MIT Press, 2003)
- *e-topia: Urban Life, Jim-But Not As We Know It* (MIT Press, 1999)
- *High Technology and Low-Income Communities*, with Donald A. Schön and Bish Sanyal (MIT Press, 1998)
- *City of Bits: Space, Place, and the Infobahn* (MIT Press, 1995)
- *The Reconfigured Eye: Visual Truth in the Post-Photographic Era* (MIT Press, 1992)
- *The Logic of Architecture: Design, Computation, and Cognition* (MIT Press, 1990)

Before coming to MIT, he was the G. Ware and Edythe M. Travelstead Professor of Architecture and Director of the Master in Design Studies Programme at the Harvard Graduate School of Design. He previously served as Head of the Architecture/Urban Design Programme at UCLA's Graduate School of Architecture and Urban Planning, and he has also taught at Yale, Carnegie-Mellon, and Cambridge Universities. In spring 1999 he was at the University of Virginia as Thomas Jefferson Professor.

He holds a BArch from the University of Melbourne, an MED from Yale University, and an MA from Cambridge. He is a Fellow of the Royal Australian Institute of Architects and the American Academy of Arts and Sciences, and a recipient of honorary doctorates from the University of Melbourne and the New Jersey Institute of Technology. In 1997 he was awarded the annual Appreciation Prize of the Architectural Institute of Japan for his "achievements in the development of architectural design theory in the information age as well as worldwide promotion of CAD education."

Mitchell is currently chair of The National Academies Committee on Information Technology and Creativity.

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Counterpoint

Intelligent cities and innovative cities

Jordi Borja

The intelligent city is the one that maximises the possible connections. In other words, it multiplies the positive dimensions of size, density and diversity. Wirth's old definition still stands today to interpret the potentialities of the city. Yet we also know that, beyond a certain size and if no adequate responses are provided, economies of agglomeration become diseconomies. An obvious case is the loss of functionality that is generated in the big cities due to the infrastructure not being able to support the growing economy and the ensuing perverse effects: social and economic cost (time invested), pollution, congestion, degradation of the public space, etc. In his article, Professor Mitchell sets out the dysfunctionality of committing to "all public transport" or all "private car". Once the dialectical reasoning has been established on the economies and diseconomies of agglomeration, and applied the progresses derived from digital intelligence, he proposes an example aimed at solving the mobility dilemma –the City Car– as a means of combining social efficiency with individual freedom. A suggestive example, even though it would have to be integrated as part of a proposal that took multi-modality and inter-modality into account and was therefore applicable to very different cities. It is also an interesting case of applied research conducted in the university sphere, and that alone justifies its serving to instigate a debate on the UOC campus.

The comment that we are interested in making does not refer to the case of mobility. The usual discourse on city management is functionalist, as is the case of the text mentioned, and it is certainly a perspective as necessary in the analysis as it is useful in the management. But if we remember the initial definition –size, density and diversity– we can propose the application of intelligence to city management from another perspective. Guaranteeing the good functioning of the big and dense city is important, as too is multiplying the possibility of interaction among the populations and the diverse individuals. It is often considered to be a residual aspect of the configuration of the city and we even find ourselves faced with dynamics and policies (private and public) that tend to reduce the non-functional relationships or that go beyond those that occur within the same social or professional group.

I will sum up my reasoning very briefly. The economy of the city is the knowledge economy incorporated into productive activities. The progress of knowledge depends on research and innovation. In other words, on highly socialised processes which find a favourable environment in the heterogeneity of urban life. But the functionalism applied mechanically to big cities tends towards zoning, to creating specialised areas, such as campuses or technology parks, a dynamic that the social segregation of housing still multiplies. The possibilities of having relationships with "others", with very different people, are reduced and are consequently unexpected, unprogrammed contacts. In other words, everything that could be the product of chance. And if chance does not intervene, innovation is less probable. Breton said that he was only interested in cities where something that was worth it, unexpected or surprising could happen. And if a more "scientific" reference is needed, studies show that chance, the unexpected, played a part in approximately a fifth of the scientific discoveries of the twentieth century and we found something that we were not looking for. For example, Viagra is the result of research aimed at controlling high blood pressure.

The intelligent city is therefore the one that combines chance and necessity. We are fully aware of everything that we consider necessary for the city to function. In short: to optimise the relationship between places of residence, production and consumption. In other words, mobility, basic urban services, facilities. But we do not always consider how serendipity can occur, the possibility of discovery thanks to chance. Obviously, serendipity needs to be linked to the richness of the public space, to the existence of many places and meeting places between different people, to the ability of urban development to reduce the dynamics that tend to generate specialist places and to segregate the population socially.

We find an example of how recent technological progresses can contribute to the intensity of urban life in the revaluation of small businesses, thanks to just in time distribution. Stock computerisation enables us to have just one unit of each product and once it is sold, the central office automatically receives the information and immediately replaces the product.

Returning to the de W. J. Mitchell text, we should honour the dual merit of the author. On the one hand, he has opened up innovative ways of analysing the dialectical relationships that occur between the scientific and technological progresses that characterise the information society and the organisation and functioning of the city. See his books: *City of Bits* (1995), *e-topia* (2001), and the book quoted in his text, *The Cyborg Self and the Networked City.* And on the other, he has looked for answers backed by these progresses to the problems generated by the contradictions of the development of our cities. With our comment, we have simply sought to introduce a less usual dimension, that of chance as an indispensable complement of need, and therefore the claim made for public space and for the intensity of urban life. Some years ago, the city planning director of the City of London told me that the best economic feature of the city were the pubs, as these were where different people exchanged all manner of information.

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