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The Why Factory

Poro City

Opening up Solidity

Our current cities are comprised of enclosed, distant and introverted architecture equally isolated from urban life and ecological context.

How might we open these spaces? How might we introduce pockets of space capable of triggering social encounters, multiplying circulation and facilitating the introduction of flora and fauna?

This book gathers the research conducted by The Why Factory into what we term 'urban porosity'. Using both analogue and digital approaches, our researchers and students explored modes to open up our cities.
What might be imagined to open our towers and city blocks? Stepped floors? Public stairways? Grottos in which city dwellers might meet? Could we manipulate building envelopes in order to increase façade area? Might we perforate built volumes and thus create pocket parks?

Each of our hypotheses led to a series of step-by-step interventions that materialized in the form of a vast collection of towers built by our students using LEGO blocks. When gathered together, the resulting army of LEGO towers shows how far we can—and cannot—go. How much can a tower bend before it collapses? At what point does a porous tower become financially impossible to build or maintain?

PoroCity shows the way to the construction of a more open city and society. Why wait to build it? Welcome to the open city! Welcome to PoroCity!

PoroCity is the eleventh book in The Why Factory's Future Cities series, and follows *The Why Factor(y)*, *Visionary Cities*, *Green Dream*, *Vertical Village*, *Hong Kong Fantasies*, *City Shocks*, *We Want World Wonders*, *Barba*, *Absolute Leisure* and *CopyPaste*.

PoroCity is an invitation to open up the built environment. *PoroCity* begins with a series of reflections and articles inviting planners, developers and architects to design and build urban porosity. *PoroCity* provides the tools to prove that urban porosity is socially, environmentally and economically valuable and, through a series of spatial experiments, *PoroCity* proposes a method to reach it. By looking at how to measure urban porosity, this book aims to promote the capacity of the three-dimensional pixel (the so-called 'voxel') for both measuring and evaluating the relative porosity of any built form as well as for negotiating design. *PoroCity* is an invitation to bring more qualities to the development of our built environment and to look critically at the ongoing processes leading to the densification of our cities.

PoroCity by The Why Factory:
Winy Maas and Adrien Ravon
with Tihamér Salij, Alexander Sverdlov,
Ania Molenda and Arend van Waart
Edited by Javier Arpa
Guest contributions by:
Arup, Richard Sennett and Paola Viganò

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Welcome to PoroCity

Winy Maas

Welcome to a porous society!

Welcome to cities that want to be open and porous!

Our current cities consist of environments, terrains, buildings, towers and blocks that are enclosed, distant and introverted.

Together with the artificial climatization they require, such urban spaces beget fundamentally unhealthy situations.

Our enclosed and introverted cities do not allow for urban life, for social possibility or for ecological potential. They do not allow for urban cooling. They somehow block innovation, social cohesion, and ecological and climatic needs. They are simply not open.

How might we open them? How might we blur their boundaries and introduce pockets that facilitate social equilibrium, leave room for the unknown and create streams of circulation and communication?

How might we work to introduce zones for greenery and animals, for tunnels of cooling and refreshment, and for channels of water and sanitation? We think the solution has something to do with what we describe as 'porosity'.

How can we achieve urban porosity? What does such a state even mean? In the series of studies that follow, the beginnings of a porous city are imagined and proposed through the manipulation of tower models.

By opening our towers, we attack contemporary urban introversion.
We imagine logics for towers and buildings

that might allow for openness: for example, using stepped floors to make stairs throughout the towers; creating grottos that group and collect people; splitting towers that multiply the surface of the façade; twisting blocks that thus create pocket parks; and so on.

Each of our hypotheses leads to a series of interventions and evaluations. Step by step. How far can we go before a proposed tower collapses or before it becomes unaffordable? As we work, a series of beautiful towers emerge. Towers with terraces everywhere. Towers with crazy balconies. Towers with stairs. Together, this series forms an 'army' of towers that suggests a more porous and more open city. I wish such marvellous places truly existed.

As we moved in our work from analogue to digital and parametric models and

came to script our operations, we achieved results of ever-greater precision.
We learned which components dictated the different series. We looked at the stepped tower and wondered about sizing and about how the steps might be used for access and egress. We wondered how much program should be added and how to render the tower structurally stable. We were led to envision a tower more beautiful than the spaces that appear in Escher's drawings.

What is the reality of these dreams? What are the costs of such operations? What are the most vulnerable parts of these visions? And can the benefits achieved counterbalance the resulting structural and financial costs?

How can we apply these things to urban typologies?

This conversation between urbanist Paola Viganò and The Why Factory's Research and Education Coordinator Javier Arpa focused on the fabrication of the 'porous city', a concept developed by Bernardo Secchi and Paola Viganò in their urban proposals.

We believe that 'porous is more', and indeed that the concept of porosity encompasses more than the volume between void and mass. For us, porosity is instead a spatial framework, a means to challenge solidity, mainly on the scale of the building and the city block. We have confronted our hypotheses with fundamental questions: Can porosity be measured? Why is a particular built form, a building or a city, more porous than another? What defines porosity? These are the questions that framed our conversation with Paola Viganò.

The Porous City

A conversation between Javier Arpa and Paola Viganò

Javier Arpa: We would like to explore the notion of porosity on the urban scale with you. In other words, the notion of a city understood as a fluid body, a place where flow through filtering bodies is possible. Today, the paradigm of fluidity is frequently used to describe our contemporary postmodern, post-metaphysical and post-historical outlook. In this context, a fluid —or porous—metropolis would be one capable of adapting to change without resisting the multitude of flows that cross it. A metropolis without centre or periphery—at least conceptually—ready to allow for full functional hybridization, constant reprogramming and, very importantly, the introduction of the public realm into the private sphere. What do you make of this definition of urban porosity?

Paola Viganò: Yes—first, let's be clear and say that when we speak about fluids we mean the term in relation to the passage of flows into bodies. Another thing we should clarify is that porosity is not equivalent to total transparency, because in a state of total transparency all fluids and flows would be allowed passage. Porosity also—and fundamentally—involves resisting certain flows. Speaking about porosity means understanding limitations, being aware of the existence of different bodies and flows, and acknowledging that the world is not infinitely transparent. Porosity is instead the possibility to reflect on degrees of transparency, without ever reaching it fully. Rocks, for instance, which are totally solid and not at all transparent, are, however, porous and therefore can metaphorically explain the difficult and often conflictual relation between flows within the city.

JA: Your proposal for the Grand Paris develops around the idea of urban porosity. It seems to propose five strategies to make Paris more porous by 1) managing identity, 2) managing risk, 3) introducing socio- and biodiversity, 4) triggering functional intensification and 5) diversifying accessibility. Is this breakdown a good reading of the proposal? What is missing in this summary? Might you build on it a bit?

PV: I would explain the last two items in a slightly different way —and for the first three I suggest reading *La ville poreuse*.

For us, the fourth strategy was a reflection on the material porosity, considered as built fabric, and the porosity of fracture. The rocks in this moment are the buildings, fractures can be technological or economic, and so on, and we recognize that there are different capacities for adaptability in the different types of urban tissues and architecture, some of them really easy to interpret and manipulate, others way more difficult. The rigidity of the typical modernist neighbourhood, for example, was a first question: How can we make such a place more porous? The fundamental position, and our scenario's aim, was to recycle 100 per cent of what

already exists—to valorise the embodied energy that is already there and to couple this strategy with the reduction of consumption. This is the only way to give a concrete meaning to the energetic transition while considering it an occasion for the adaptation of the built environment to our contemporary lifestyle.

The problem is that we haven't devised a theory radical enough to work on the complete recycling of what is there. We don't know how to deal with a pervasive hypothesis of repurposing, recycling and reconditioning. We need to elaborate on and refine these processes. In this case the concept of porosity—meaning fabrics, tissues and infrastructures—is useful because if we speak about the material consistency of each we can say both how buildings are and how they might be transformed. I feel that close reading is the starting point for any 'recycling strategy' able to open up a building to new uses and the basis for any structure's renewed interpretation.

The fifth strategy is more than simply 'diversifying accessibility'. It's also about the networks and their capacity to structure urban space, which Bernardo Secchi spoke about many years ago using another metaphor, the metaphor of the sponge. Looking at minor networks like secondary roads, small waterlines and ecological continuities, valorising the capacity of lower networks and
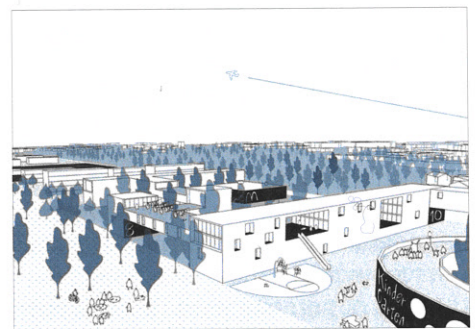

Figure 31: The project of a porous city: a project of stratification, energy, and mixed-use structures

micro-infrastructures and thinking of these things as sponges, we can say that they can develop the same capacity as a big river for the water, or of a highway for other types of flows. However, if we have to solve any issue related to flows—and here I mean not just car flows but also water and energy flows—very hierarchical structures with big pipes are necessary. This is the way in which, still, we conceptualize the design of the city. I am still today working, as we worked in the past, against the common idea that strict hierarchy is the only solution to any problem related to order. There are in fact other forms of order, other structures that do not imply the presence of a main system or a main centre. For example the Horizontal Metropolis project we will discuss later is an ongoing investigation into the space of metropolises without centres and periphery.

Paris seemed to us to represent the opposite of porosity, the opposite of an a-centred system. It was, we felt, instead exactly the non-porous city: rigid in its separations, hierarchical

and non-inclusive. We then imagined, in our fourth strategy, a different type of public transport structure, a mesh that would result from redesigning and diversifying the network of public transport and of mobility more generally. This was a fundamental point because it was the moment in which we connected the idea of porosity with the concept of isotropy, which means having the same condition of accessibility and quality of life in all directions. As we know, Paris was built and structured around a very different idea, the idea of having everything look towards the centre. Nowadays it's a bit different and the radiocentric structure has proved not particularly useful anymore—tensions have more horizontal dimensions and arise between *banlieue* and *banlieue*, rather than just between centre and periphery. So ours was an attempt to reflect on the idea that the old Paris has to be reconceptualized. Greater Paris was asking for a different and new type of structure: meaningful places merged with a new continuity of urbanity, public space, and social and ecological
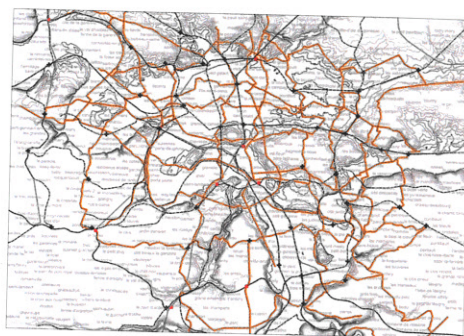

Figure 32: The project of a porous city: space for water and biotic relations. Studio Bernardo Secchi & Paola Viganó

infrastructure (the traversées) seemed to be fundamental to reorganizing the new metropolis.

JA: To what extent was 'porosity' finally implemented in the definitive plans for the Paris metropolis?

PV: The Atelier du Grand Paris, as you know, doesn't exist anymore, but at the same time Greater Paris has been institutionalized. It now has a perimeter and La Societé du Grand Paris is working to realize a large double metro loop. New projects are solidifying this mobility structure with new densification areas. At the same time what is not along those lines risks being forgotten and of course gentrification will modify the social geography of Greater Paris. The problem of not addressing the true questions is that the result will be very exclusive and unequal. However, I think that whatever we imagine and do, Greater Paris is forming independently from Paris and it will become more porous and more horizontal because of the strength of the metropolis, the accumulated energy of people and intentions it contains. But it is doing it without a collective and shared vision and the process will be much slower and more controversial than it might have been.

We had a seminar few weeks ago [21] in Milan and Francois Leclercq said that the new problem they have now in Paris is that there is not enough housing for wealthy people. This, of course, is not the real problem of Paris. Or, if this is the new problem,

it means that there is a strong force ejecting other populations and that the new projects on the northern part of Paris are structuring new conditions of exclusion in which the poorest parts of the population are pushed even farther away. The recent government programme proposed to address the *banlieue* problem has enormous costs and the risk is that, like similar programmes in the past, it will not solve anything. So this is the price you pay as a society, as a nation, for not addressing fundamental spatial and social, that is urban, questions.

JA: In addition to your proposal for Paris, you have also developed visions for Brussels (The Horizontal Metropolis) and Antwerp (Renovatio Urbis). How would you describe these proposals from the point of view of urban porosity?

PV: In Antwerp, the Renovatio Urbis was supported by a vision related to a series of 'images' of Antwerp and strategic spaces of urban transformation.[22] One of the images we proposed was 'Antwerp as a porous city'. This was how its spaces seemed to us: porous, empty, in search of new definition, open to interpretation, ready to be appropriated. Porosity was not a concept devised from scratch, but was instead something that arose from the territory itself. It was recognized as a concept that could be helpful in the construction of an interpretation in specific places and territories. It was the case of diffused and dispersed areas in Italy; it was

also the case of empty and abandoned plots in Antwerp. Working on porosity means working on big demographic changes and changes in types and conditions of work (for example the departure from the urban block of small industry, the porosity of fracture I mentioned a few lines ago), on public space, on habitability, on mixed-use facilities, on real, concrete fabric transformations.

Before we started to work on the strategic plan, Antwerp had already tried to revise itself but had failed to embed the new projects in a more shared vision for the city. The first urban projects realized during the 1990s were not easy experiences, the city was in decline, there was a lot of vandalism, and the spaces were not really working. We thought then that the structural plan needed to address a relation between small/scattered porosity (vacant plots where a new houses could be realized, where pocket parks could enrich the neighbourhood) and a bigger porous structure (the areas left by the harbour moving to the north) that
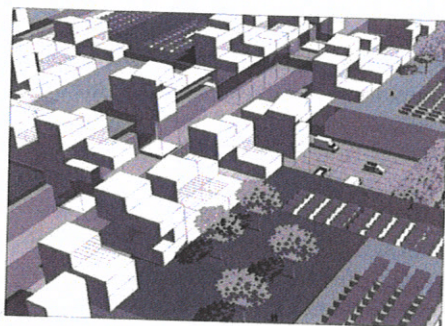

Figure 33: The project of a porous city: a project of stratification, energy, and mixed-use structures. Studio Bernardo Secchi & Paola Viganó

had to be transformed. The two could help each other: the scattered and individual initiatives are very interesting but sometimes don't have the strength to reformulate the city, and the big urban projects alone are not enough either—they risk being isolated and disconnected from the city tissue and urban practice. It was only when the neighbourhood around Spoor Noord was taking part in small strategies of redevelopment and the big Spoor Noord park was realized that the two strategies together demonstrated change in the city. The interesting thing is that today the prices of the homes around the park are slightly higher than in the past, but without dramatic effects. This is what we call soft gentrification: bringing in new populations and promoting diversity without any expulsion.

I would like to introduce another point about porosity. Porosity is not only a fascinating metaphor that suddenly transforms abandoned areas into potential and public space infused with social choreography. Porosity is also a problem inside a form that does not eject chaos, as in the Baroque structures and patterns of life that Ernst Bloch recognized in his article 'Italy. Porosity', which responds to Walter Benjamin and Asja Lacis's magnificent 1925 text, 'Neapel'.

Porosity and connectivity (to have pores that might be in communication) are neither good nor bad, but rather problematic because they concern flows. They concern the contact between bodies that generate flows in space, the relationship between bodies and spaces and between opening and connection. They can be a source of conflict and tension.

Things are sometimes interesting because they remain a problem. Whatever we do, the question of the contact between different objects, different dynamics, behaviours and interests is problematic. This combination of conflict, fluidity and impermanence is for me the most fundamental quality of porosity.

In the case of the Brussels project, porosity was not really an issue because relative to Paris, the city is much more porous and appropriable. This is true in relation to built versus empty space, but also from a social point of view. Because although in Brussels we can see geography defined by different populations, it remains much less segregated than Paris is. What we learned from Brussels, and this is why we speak about the vision for a horizontal metropolis, is that maybe in the Brussels metropolitan area it was possible to address another question. And that is: Can we imagine the metropolis as a horizontal space? The metropolis as it has always been investigated, defined and considered—especially when we go back to the nineteenth and twentieth centuries—as a central city with a vast, surrounding periphery. Today's metropolis, first of all from a spatial point of view, is very different from that of the past. Today the metropolis

is much more dispersed, fragmented, scattered and it is a mix of everything—of agriculture, infrastructure, production, etcetera. The space is simply heterogeneous without a clearly defined interior/exterior. The city is very porous exactly because of its heterogeneity and fracture and the resulting condition of constant overlap. Bernardo Secchi wrote that the metropolis of the twenty-first century could look very much like this type of space.

On the other hand, the idea of horizontality in a socio-political sense means this: the structure of Belgium is made up of many small-to-medium-size cities that each play a specific role and are organized around specific, often complementary, activities. Together these smaller places compose an extremely powerful metropolitan space. It has this potentiality because if we start from mobility there is an abundance of infrastructure. And this is why we proposed the scenario of a country without cars. At the time of the industrial revolution in Belgium, the country had the most railway track per inhabitant in the world. The no car scenario was interesting because it was a reinterpretation of this legacy: at the beginning it was intended as a radical provocation but after six or seven years it has become an idea that has returned and become part of the public debate.

It is clear to me that the problems of the metropolis have to be shared by its different parts. The horizontal

Figure 34: New public space: Spoor Noord, Antwerp. Studio Bernardo Secchi & Paola Viganò

metropolis is the one that diffuses the benefits of the metropolitan condition to larger territories, not only to the space that produces negative externalities. For example, I am researching the Alpine territory (where the landscape is too often seen as a mere resource) and trying to imagine a correlation between the Alps and the metropolitan areas that are proximate to them. This is already happening because metropolitan areas are now considered to be the places where wealth is produced, and as they develop and become more attractive, they also more and more exclude people because living within the metropolis is increasingly expensive. So the question is: How can we imagine the metropolitan space differently, so as to provide good conditions of inhabitability, for example in a minor alpine valley, while being related to but not dependent on the big metropolitan area? What types of exchange can we develop and strengthen between those territories?

JA: One of the key components of the city that needs revision in order to make it more porous is infrastructure in general and mobility infrastructure in particular. Yet, despite its fundamental role, the basic physical form and subsequent settlement organized by infrastructure has remained ostensibly unchanged for the better part of a century.

Given the enormous physical weight and economic cost of urban infrastructure, do you think it would be possible to make infrastructure light, reversible, or even temporary so as to accommodate the changing flows of the porous city?

PV: Yes, I think it is possible to make infrastructure lighter.

I remember when Winy Maas spoke about 'light urbanism' many years ago: the term was a nice way to express the concept. But in reaction to your question specifically, I think we need to think about a structure for the twenty-first-century urban space as we enter a demographic, ecological and economic transition. In respect to the big modern infrastructural project, we need other types of infrastructures, more adaptive and maybe even weak infrastructures. We move towards active mobility, public transport and less use of the car. This is asking for diffuse infrastructures; all types of water management and water infrastructure also produce landscapes, biodiversity and public space. These are other types of

infrastructure to strengthen. On the other hand, we should definitely also reconsider immaterial infrastructures, the digital infrastructure, for example, which contains within itself a kind of utopia—the utopia of horizontality.

I work with different kinds of infrastructures, then: some soft, some hard and some weak. This so that the three of them can, in combination, create something more interesting, for the city of the twenty-first century, also from a 'porous' point of view.

JA: The European paradigm of the dense and compact city clashes with the reality of contemporary urbanization. We constantly read that by 2050 most of the world's population will live in cities. However, in my opinion, most of the world will not live in cities but in suburbs. I think the beginning of the Anthropocene will be characterized by 'sub-urbanization' rather than by 'urbanization'. Do you agree with this?

PV: I think it depends very much on the context we are discussing. In the case of the North American and European contexts, I think that suburbanization is done, complete, already the case, and what is now happening involves the restructuring of that form of urbanization. Of course the term is not precise: in many cases what we tend to interpret as a recent phenomenon of suburbanization is, in fact, the continuation of long-term settlement dynamics.

If we think that the ideal is the compact city, the opposite of the porous city, it means that there will be lots of projects that will tend to eradicate porosity in order to make the city more compact. What we want to demonstrate is that porosity is important in this new type of urban and metropolitan space. It is important because those porosities play a fundamental role ecologically and socially, and in terms of quality of life.

Today the debate between the compact and the porous city is still unresolved, but compared to 20 years ago the difference is that things are already empirically proving the interest of working with porosity and at one point there will be a new awareness of the need for these porous spaces.

JA: If human settlement follows the pattern of the diffuse city, how can design professions introduce porosity into conditions of segregated low-density and low-intensity urbanism? How can design elevate sprawl from its present state?

PV: Speaking about porosity does not mean advocating for the creation of a more diffuse city. This is why the strategies of the porous city discussed above work on the recycling and reconditioning of the contemporary diffuse and fragmented city. Here, design can have an important role in improving the current situation, where ageing low-density areas risk being

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abandoned and less accessible regions further marginalized. It is now the occasion to use 'sprawl', as a foundation upon which to construct a renewable city. This is possible in many European situations, but this might also be possible for the Latin American favelas.

Design can make a difference but we don't always have the conditions in which to ideally operate. If we take the case of the parts of China surrounding the Shanghai megalopolis, for example, we see that the destruction of villages and the arrival of a new poorly conceived periphery are producing a bad city. Water management systems have been completely destroyed and all the fertile land has been destroyed too. It is the example of a banal and incorrect way in which the city can grow.

I have to admit that I feel fully uncomfortable in considering the gated community model that increasingly exists on the scale of a city rather than as just of one of its parts. I do not know how to deal with it, if not by denying it. In this case design alone cannot make the difference.

On governance

JA: What are the social values that need to be expressed by the porous city?

PV: The value of accepting different types of bodies coming into contact with one another. So, social diversity and social values that imply a different relation to the living world and an awareness that accepting porosity means going beyond an anthropocentric point of view. And then, like Bernardo Secchi, we are very convinced that both social and special mobility are a citizen's right.

JA: Is a porous city without physical fragmentation or social discontinuity that allows for balance between diverse communities really possible? What political mechanisms need to be put in place to make it happen?

PV: Europe was and is one of the biggest supporters of the compact city ideology, but as a professor and urbanist my role is to bring arguments in favour of more open and up-to-date understandings of the urban situation today. These arguments try to be reasonable and have to be debated: this is the only political mechanism with which architects and urbanists can be associated.

We can also be activists for porosity, especially when it concerns the social dimension of space, but I remain convinced that we should take care not to lose the position of the intellectual. Intellectuals have to maintain a certain distance in order to properly play a critical role and guarantee their independence.

JA: The notion of the top-down master plan, even though still the modus operandi in many regions of the world (from China and the Middle East to the whole African continent), is, for many, an outdated mode of building the city. Where do you position yourself in the debate between the top-down and bottom-up approaches to urbanism?

PV: We need many bottom-up initiatives but we also need some top-down decisions, financing, projects, etcetera. We can't have just one or the other. The master plan is simply a tool that can be interpreted and designed in many different ways. We should not demonize the master plan, generally, but rather criticize bad ones.

The position of the intellectual requires independence. Of course I can say that because I am not an architect only working as a professional—I am very conscious of the privilege and of the freedom given to me by the fact that I also work as a professor. I believe that universities in this moment can play a role that maybe 20 or 30 years ago they didn't have and this is also related to the weaker position of professionals inside a market system that swallows them up and absorbs and minimizes their contribution. This position, within the academy, allows for exploration through design and for the use of the project as
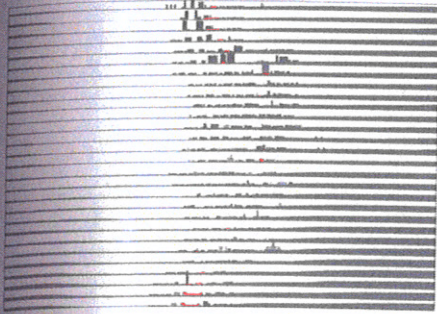
Figure 35: Carpet - Sections. Studio Bernardo Secchi & Paola Viganó

a research tool,[23] highlighting its capacity to bring new knowledge and imagination to the fore. At least, these are the things that I am trying to do.

On visions

JA: The Why Factory has worked for a decade on the agenda of the future of our cities. It explores possibilities for their development using models and visualizations for cities of the future. From science to fiction and back again, The Why Factory proposes, constructs and envisions hypothetical societies and cities.
What is the state of 'imagination' in contemporary design culture? Is it an appropriate place for imagination to be, after all?

PV: Imagination is a great word. We have to say that in respect to the contemporary moment there is not enough imagination. We have to be educated to imagine. Imagination is a very logical exercise; it is a conjectural work and not fantasy. We also need occasions to imagine. I very much like working through scenarios, or in open workshops with students, reflecting on situations and contexts, because I think that these are special conditions in which imagination can work.

Imagination can be also achieved through exercises in which you are obliged to imagine what is possible. We should imagine more, test more and discuss more. Design and imagination are our great assets.

The Why Factory's researchers Javier Arpa and Adrien Ravon spoke to Arup's engineers, Rory McGowan, Edith Blennerhassett, Alan Duggan and Claire Lambe, about the feasibility of porous structures. We wanted to know what porosity means from an engineer's point of view. From climate to structural engineering, how can porosity become a driver to design buildings that effectively challenge traditional typologies?

Engineering Porosity

A conversation between Javier Arpa and Adrien Ravon of The Why Factory
and Arup team members Edith Blennerhassett, Alan Duggan, Claire Lambe and Rory McGowan

The Why Factory: We are interviewing representatives of different disciplines to get a sense of how porosity is conceived in each. We have asked, for example, what porosity is from the social point of view, or from the urban point of view. And now we would like to know about your engineer's perspective. One of the first questions that we want to ask is how you feel about these images from our project. Do they seem like science fiction to you? Or merely like fiction, like this is all totally feasible and simply unrealized. From the point of view of the engineer, what are the first ideas that come to mind when you see the research that we are undertaking with our students?

Arup: We think it is very exciting. From an engineering perspective there are many immediate benefits. The work is also exciting sculpturally and from the point of view of light, which is hugely important issue in terms of making people's lives in cities better. We can see benefits related to both daylight and ventilation, even generally related to heating and cooling, where you can have self-shading or you have gardens that are adding to the mass of the building and assisting with moderating the temperature. So there are huge benefits to having more surfaces and more variety in those surfaces. If you have a building that is varied in that way you can also design for a variety of uses.

We wouldn't call it science fiction at all—one sees many buildings going up now that look almost structurally impossible. For example, garden buildings with vegetation overflowing from balconies, this kind of idea is definitely growing in popularity, especially in cities, to improve air quality and also make them more breathable, even from street level. You might create better airflow in the streets, not just within the buildings.

TWF: Let's discuss this opposition between solid and open buildings, how an open building might perform better in terms of natural ventilation and natural lighting.

Arup: Natural ventilation and natural lighting are both essential. Many cities are very dense and buildings are built very close to each other. When you were showing these patterns with multiple buildings, they seemed to have a nice level of spacing between them so that you could maximize the benefit of daylight and easy natural ventilation. So there are huge benefits. And even the views—views out, views in— all of these aspects add to the experience of being in the building.

TWF: On that note, sometimes, at design schools, students propose large façade areas and there is sometimes an initial reaction to it that's something like, 'well, that's a lot of façade, so you'll need to insulate'. How would you respond to that?

Arup: Insulation is very cheap as a material. In a way, if you make the

building so that it is very well sealed in the winter, when you have as much fresh air as you need for health and respiratory well-being and somewhere you have control over the whole thing, then that insulation is not such a big issue anymore. We know how to build buildings that are airtight and well insulated. Making more surface area at this point in time is not a huge issue.

And it is different per type of building, too—what a residential building might need in terms of thermal insulation and so on is different from what an office might need. It is quite interesting because technology has moved on: initially our offices where all overheated throughout the year because we were insulating our buildings to such an extent that they could not be opened. We were almost making the buildings overheat and then needed them to be artificially cooled. Obviously, reduced heat gains —through reducing computer and lighting loads—are now making this less of an issue again. But it is important to think about different uses and how they drive different façade treatments.

TWF: Coming from this, would you say that there are certain programmes that are more suitable than others for the kind of porosity that we are proposing?

Arup: What you're proposing could be applied towards sustainable and wellness-oriented working environments: it creates views

and natural ventilation, and people obviously perform better and work better in places that are healthy for them. And from a residential point of view, people want things that are aesthetically pleasing. We think the work could be applied to many spaces and to needs across a variety of disciplines. But it's interesting to think about how it works in different contexts. The interesting thing about your cube module of 3 by 3 by 3 is that you can very easily see how it applies residentially. But when you have these bigger volumes and bigger pores—commercial or office spaces, for example—there is a question about what happens in the pores. Do they act as the social, communal space where people meet and interact and then go back to their own spaces? As spaces for interdisciplinary working or inter-group working? Are they completely open or are they only partly open? In an office footprint the goal is obviously for people to be working and not looking at boxes.

TWF: There is also the difference between having one big hole, for

Figure 36: Amorepacific Headquarters, Seoul. Chipperfield Architects. Arup Group Ltd

Figure 37: Bosco Verticale, Milan. Stefano Boeri Architetti. Arup Group Limited

example in the middle of a building, and having lots of small pockets. How would those two models perform differently?

Arup: Yes! And then the small holes—are they public space or are they more private space? The public could come through a building, for example, but maybe some are more private, gardens for example, and others are big holes that connect to the residences of buildings that might have a public context as well.

TWF: Just to explain, the 3 by 3 by 3 module is a level of abstraction that we used with LEGO blocks. It is a kind of structural assumption that allows us to measure terraces, different views, façades, the amount of daylight and so on. There is this idea that there are advantages and disadvantages to opening up a space, creating more façade for example. But we were also wondering how to challenge the core if all of the infrastructure is inside the building.

So what about insulation, circulation, etcetera? Does this become very

complicated from the point of view of an engineer? Structurally? In relation to the multiplicity of installations that are necessary? Is it possible to make this sort of thing easily?

Arup: We are going to start with the circulation. The first thing is drawing the core. And routes. What can bend and what can't bend. The next generation of elevators will be able to bend. They will be able to shift sideways; they won't be going diagonally because they don't have to. The whole idea is that the elevators will share cores.

TWF: As you know, the main focus of our research is the skyscraper. We have criticized the current state of skyscraper architecture because it is opaque, it is enclosed and it's solid—we want to challenge that. We would like to know what you think the future of the skyscraper is. Are we going to see more and more skyscrapers? Is it a valid typology for the future? Or are there other typologies that have been developed that can be alternatives to the skyscraper? We wonder about this
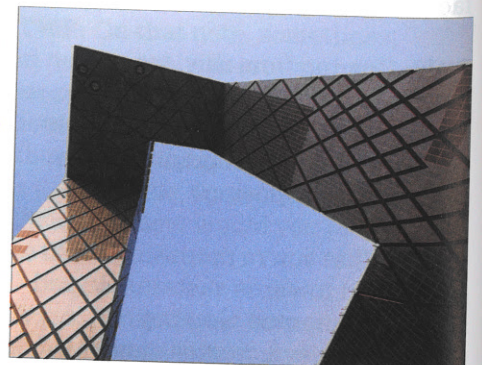

Figure 38: CMG Headquarters, Beijing. OMA. Arup Group Ltd

particularly in terms of efficiency and sustainability.

Arup: We recently read that 70 per cent of the population will eventually live in cities by the end of the twenty-first century. It is then only a question of how vertical these cities will be.

Your question was also related to the future of the skyscraper. Probably the only limit on tall buildings is what we consider acceptable to live in. You can argue that for height but it seems to have more to do with density. The limit is the environment, the society—the limitation on the future of the skyscraper is human.

TWF: You've mentioned density and that's really a key question. Of course we need to live in compact cities instead of in sprawl, because otherwise we will occupy a lot of territory and it's probably very unsustainable. But is there a limitation when it comes to the sustainability of the skyscraper? What we mean is that we can build compact cities, but when the skyscraper starts getting very high it requires resources and material that need to be extracted. By contrast, lower buildings that are compact and dense, for example, don't consume as many resources. I wonder if there is a moment when the skyscraper also becomes unsustainable because of the resources that need to be mobilized to build it.

Arup: We think the current logic related to building materials is a bit confused, which is why we are sort of

pushing along with the idea of human limitation. Yes, there are physical limits to how high you can build, but we also believe that in the future new materials will be developed.

TWF: This is kind of like the way we work at The Why Factory. We believe that in the future there will be materials that will allow different things. We don't know what the future will bring so we want to imagine and envision it.

Arup: We are speaking quite futuristically—we don't know how the structure will be developed. Are we going to see new geometries? Maybe new materials will define new geometries in the way they behave. Who knows how the materials of the future will respond to buildings, to wind, to people inside and so on.

Technology responds to allow changes. We will change, we will adapt. Technologies develop to satisfy human comfort, but human expectations of comfort can change. Technologies are now being used to alter the dynamic performance of the building. The dynamic characteristics of the building can be altered permanently. The wind loading is affected by the dynamic response on the building. So instead of trying to stop the wind we have technologies that try to work with the wind.

TWF: We understand that perforations can help when wind hits a particularly tall building.

Arup: Yes, buildings of 50 or more floors will have perforations. That is to modify the wind environment, to make the wind flows more predictable, to generate some offset airflow—in a way to try to domesticate and modify wind. These things also make it easier for the buildings to get accepted by authorities, providing that the buildings are safe. So things are moving relatively quickly. We have spoken with wind experts several times and they say there isn't really a future for turbines on tall buildings. That said, what is interesting is if we imagine the reverse: that somehow buildings themselves could get energy from the wind without needing turbines. And that is not too far from happening.

Moreover, one thing that porosity can do at the macro scale is to generate air movement. If you get 1 m per second of air movement you can turn an uncomfortable and humid place into a comfortable one, effecting a 4 to 5 degree change in temperature that for places like Hong Kong or Singapore is really important.

Figure 39: Marina Bay Sands, Singapore. Safdi Architects. Arup Group Ltd

So, with careful manipulation, design and understanding of wind, you are able to generate air movement and, thereby, comfort.

TWF: We'd also like to discuss the question of the computational approach, where having a model means being able to make some assumptions about daylight, views, terraces and so on. But of course working this way we miss a lot of analysis. We would be curious to know your point of view on this. Indeed, we want to measure and compare the performances of the LEGO towers we made. How do you think we could improve the evaluation of these performances?

Arup: So you are asking how you could better analyse some factors of the proposed geometries.

TWF: Yes. Of porosity.

Arup: It seems your greatest problem will be defining what is a benefit and what is not a benefit. But the important thing is what are you going to analyse.

One thing you might consider is looking at the WELL certification —that is the certification for buildings used to measure the wellness of its users.

TWF: Certifications like that are very interesting. And one of the questions we had for you concerned something related, which is your take on sustainability, what it implicates and what you make of all these kinds of

certifications that tend to vary from country to country.

Arup: If you want to know what defines a success ultimately you also have to know how to measure that.

TWF: Yes, but I think there are 'soft performances' that are very difficult to measure: you can measure light, you can measure air, but you cannot measure the well-being of people, for example. That escapes our capacity.

Arup: We have our own database here at Arup related to the sense of ownership that alters people's behaviour and sense of well-being. You are in the Netherlands—you have plenty of examples of diverse forms of building occupancy . . .

TWF: Yes—one of the main problems of the buildings you were describing is exactly that. Often users don't identify with the place where they live. You may want to create communal spaces that are used by the public, but the residents don't identify with them and so they become no-man's lands. But actually we are not considering this. We are trying to escape this when we speak about these communal spaces and are more interested in the potential of such areas than in their failures. I think it has a lot to do with maintenance, development and ownership.

Our last question was about certification. Let's come back to that. Sustainability certificates vary depending on the context, country, etcetera—what is your take on them?

Arup: It depends on what your starting point is. If you start from below zero, then having these standards as a design agenda is good. But yes, absolutely, they are branding and are used for marketing by developers. One good thing about them is that they are simple and easy to understand and maybe make up for what's missing in sophisticated software and professional guidelines. Another interesting thing is how quickly these standards are changing, how they are able to merge ecology with new realities.

A Porous Planet

Winy Maas

To begin with, an expanded investigation would need to include the integration of more parameters. Porosity is about the distribution of void inside a solid body. But how can we analyse the topological distribution of these pores?
How can we be even more precise in our understanding of the different forms and degrees of porosity from a social, economic and environmental point of view? For example, how do interconnected pores perform in this regard? And would such a performance differ from that of isolated ones?

How big should open spaces be to allow for sufficient collectiveness and accessibility? How should they be designed to make inviting spaces for everyone? How can we address safety in such a porous city? How should porous spaces be designed and connected to manage climate? Can porous towers be terraced perfectly in relation to the winter sun so as to reduce heat needs? Can they be developed to create ventilation and cooling in the summer? How much cooling can they then provide? How big should they be to make sufficient water cleaning and buffering? How should they be designed to allow for sustainable greenery? How can they provide habitats and corridors for animal life? Can they thus make or contribute to a healthier city? And, finally, what are the larger implications of porous buildings for city life and urban experience?

By way of conclusion,
we can also consider the
application of porosity on
an even bigger scale.
Can we, by expanding the
porous qualities of the built
environment, aim for a new
porous 'crust' around the
planet and thereby establish
a three-dimensional,
topographical cooling
environment?

Can we open up solid
parts of the planet by
mining the needed
elements and allowing
for new connections and
settlements, thus making
it possible for cities to
expand towards the
inside of the earth? How
would a truly porous
planet come alive?

The Why Factory is a global thinktank and research institute, run by MVRDV and Delft University of Technology and led by professor Winy Maas. The Why Factory's Future Cities research programme explores possibilities for the development of our cities by focusing on the production of models and visualizations for cities of the future. The results of this research programme are being presented in a series of books—the Future Cities series—published in association with nai010 Publishers in Rotterdam, and designed by Bastiaan de Wolff of Thonik / BENG in Amsterdam. *PoroCity* is the eleventh publication in this series, following *The Why Factor(y)*, *Visionary Cities*, *Green Dream*, *Vertical Village*, *Hong Kong Fantasies*, *City Shocks*, *We Want World Wonders*, *Barba*, *Absolute Leisure* and *Copy Paste*.

For more information see:
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Prof.Ir. Ing FRIBA HAIA, architect and urban planner, is one the founding principals of MVRDV, an interdisciplinary studio that works at the intersection of architecture and urbanism. The award-winning Dutch practice was set up over two decades ago and has established an international identity with a wide variety of building typologies and scales that are self-generated, innovative, experimental and theoretical.

Winy advocates denser, greener, more attractive and liveable cities, with an approach to design, regardless of typology or scale that reflects a user-defined, innovative and sustainable consideration for the built environment.

In 2008, Winy founded The Why Factory at the TU Delft, a research institute on future cities which he leads as director. He has been a Visiting Professor at GSAPP Columbia and IIT Chicago and has also held teaching positions at the ETH Zurich, the University of Louvain, the University of Hong Kong, the Berlage Institute, the Architectural Association (AA) in London, the Massachusetts Institute of Technology (MIT), Yale University (Eero Saarinen Chair), Ohio State University and the Rotterdam Building Academy. Winy sits on numerous international boards and juries. He was recently named Supervisor of Almere Floriade 2022 and Eindhoven City, and has been Supervisor of Barcode Urban Development in Oslo. Previously, he sat on the boards of the Economic Development Board of Rotterdam, the Spatial Quality Boards of both Rotterdam and Barcelona, the Netherlands National Planning Office and the Netherlands National Design Group.

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Postscripted Towers
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Opening up Cities

Measuring Porosity

The Voxel Tool

The Benefits of Porosity

The Costs of Porosity

Score, Compare and Choose

A Porous Planet

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