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A TREE IS A CITY

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Of Trees and Buildings

One of the authors of this text once received a sneering comment from a professor in his student days when he suggested putting a building on one side of a plot of land in the Vallon Quarter in Lausanne to spare a full-grown tree. The professor found the argument ridiculous. That was not urban design. You could just plant a new tree; anyway, trees were for forests, not for cities.

Even back then, over twenty years ago, the scorn was incomprehensible: if a building burns down, we can almost fully replicate it in a few years. But how could I, or anyone, replace a decades-old tree? Not that this has not been done, but it is costly and dangerous for the tree. When the Limmattal light railway was built, the inhabitants of Schlieren protested because they wanted to keep their eighty-year-old copper beech. The ninety-five-ton tree was moved at a cost of 200,000 Swiss francs but died a year later.

Urban designers too often start with the buildings. But Jan Gehl was right: urban life is what is between the buildings, and that is what urban design is about.[1] When we take on a new commission, we go to the site to experience it. How is life between the buildings now? What is the potential? We believe that urban design is about enabling productive relationships: relationship wealth and relationship potential for meaningful experiences.[2] Our world of things is an intermediary for relations between living beings – that is why matter matters. So, we start to think about those experiences first, and what kind of urban spaces would enable them later. Eventually, buildings come last in our design, and quite often, trees come first. While the urban environment emerges in a myriad of different perspectives, a tree is often an excellent place to start to explore existing and potential life on a site.

We are very interested in point cloud technology for this reason: trees become the focus of attention, and so do topographical data. Looking at the works presented in this issue of Pamphlet, one notices

1 Jan Gehl, *Livet mellem husene* (Copenhagen: Arkitektens Forlag, 1971).

2 Simon Kretz and Christian Salewski, "Urbanity of Things: Relationship Potential and Wealth of Relations as Urban Resource," in Tim Rieniets, Nicolas Kretschmann, and Myriam Perret, eds., *The City as Resource: Texts and Projects 2005–2014* (Berlin: Jovis, 2014), 167–80.

Fig.10 Künstlergasse, Zurich 2018. Platanus tree, view from below. By Mattia Furler, Valentin Ribi

that life takes place not only between buildings, but also on benches, along walls, on streets and sidewalks, behind hedges, and last but not least, under and in trees. Inspired by these beautiful visualizations, we will first episodically share some of our experiences with trees in the context of urban design and city planning processes, and then conclude with the potential of point cloud as a potent tool to bring trees (back) into the center of design and planning strategies.

Building Around Trees

When we visited the L-formed plot of the former municipal administration of Birsfelden, we found a veritable arboretum in the car park and at the playground in the back, a notably perfectly grown black oak and a row of large-leaved lindens. We proposed transforming the old industrial building into housing and adding three new apartment buildings. We clustered all but one building as densely as possible around a small lane that would lead from the main road into the inner part of the urban block, where it would end in a small park around the old trees. Toward the other street, we positioned the smallest building behind the large-leaved lindens.

Our competition entry was selected and is about to enter legal status. In the process, we found that it was of paramount importance to watch over the trees throughout the entire process. A municipal department almost dug new foundations right under the black oak for a temporary building. Our engineers came up with a simple organization of the construction site: we would just have to cut down the large-leaved lindens. And the fire brigade wanted direct access through the trees. We were fortunate that our client, the planning department of the municipality, shared our enthusiasm for trees and supported our solutions to build around them, reorganize the construction site, and reroute the fire brigade's access. The most important condition was to keep the underground parking space to a minimum and almost entirely under the building footprints, so that the trees could not only grow but grow old: trees live much longer than the insulation and sealing of underground concrete structures, so if trees are planted on top of an underground garage, they need to be felled after about forty to fifty years.

In the legal planning document we had to consider how to include the trees. The city now demands that if any tree needs tending, a professional expert must be consulted, and the minimum number and quality of trees is fixed. And trees are not only protected; they must also be precisely drawn to scale, which is rare. Point cloud technology would have been useful in this context, as mapping, modeling, and measuring trees and other forms of vegetation are important features of point clouds.

The Functionalist Tree

We have found it quite difficult at times to convince clients and administrations to keep an old tree. We often hear similar arguments against it: just plant a tree somewhere else. Why should I keep a tree that could die tomorrow in a storm? That tree takes too much light from my apartment. Drivers hate leaves and sticky fluids on their cars, and so do janitors. (A pensioner once proudly told us how he personally cut down a dozen fully grown plane trees in his company's car park to avoid cleaning up leaves in fall.) A tree cannot be placed so close to a building. And so on.

These arguments are often tone-deaf to any thought about the poetry of a tree. They cannot see the dew on the young green leaves on an early spring morning, the pleasure of reading on a hot summer afternoon under the shade of rustling branches, or the joy of listening to birds in the treetops at sunset.

Climate change has enabled us to enter the discussion with another kind of thinking. In Switzerland, the very hot summer of 2018, which killed the copper beech in Schlieren, led to a wider awareness of the dangers of our future urban climate. In the same year, the Federal Administration for the Environment published *Heat in our Cities*, a small but timely booklet with research on urban climate and a tool set for urban designers.[3] Large trees are by far the most effective tool to counter urban heat islands. They provide shade in summer when it is most needed and cool through evapotranspiration – trees are in fact the most efficient water pumps on this planet and can lower the temperature in their vicinity by up to 10 degrees Celsius. Furthermore, the growing

3 Bundesamt für Umwelt, *Hitze in Städten: Grundlage für eine klimaangepasste Siedlungsentwicklung*, Umwelt-Wissen no. 1812 (Bern: Bundesamt für Umwelt BAFU, 2018).

awareness of our current and accelerating dramatic loss of biodiversity puts old trees in focus as complex and evolved ecosystems. Quantification helps, too: The city of Marinette, Wisconsin has calculated the monetary value of a full-grown urban tree (about 230,000 USD per year),[4] and the city of Atlanta, Georgia, estimates that it takes at least seven ten-year-old new trees to replace the ecosystem services of one full-grown tree (other counts put the number at up to twenty).[5] In our experience, these rather one-dimensional functionalist and economic arguments have proven helpful in putting trees on the agenda of decision-makers. In this context, point clouds could play an important role: they cannot only track how fast a tree grows but also collect data related to temperature and radiation, for example to display and calculate correlations between tree canopy ratio and urban heat island effect.[6]

How to Plant a Tree

Another project we are currently working on, the transformation of the WIFAG factory in Bern, is about planting trees. The former industrial complex is today one-third car park with enormous plane trees and two-thirds factory buildings of different ages packed together in a conglomerate along Wylerringstrasse. Fortunately, the plane trees are protected, so we placed the new buildings at a safe distance: as a rule of thumb, the root diameter is equal to the diameter of the tree crown. Along Wylerringstrasse, facing southeast, we proposed to plant new trees for a nice neighborhood street. However, the city administration refused to plant these trees. For their standards, they would be too close to the new buildings.

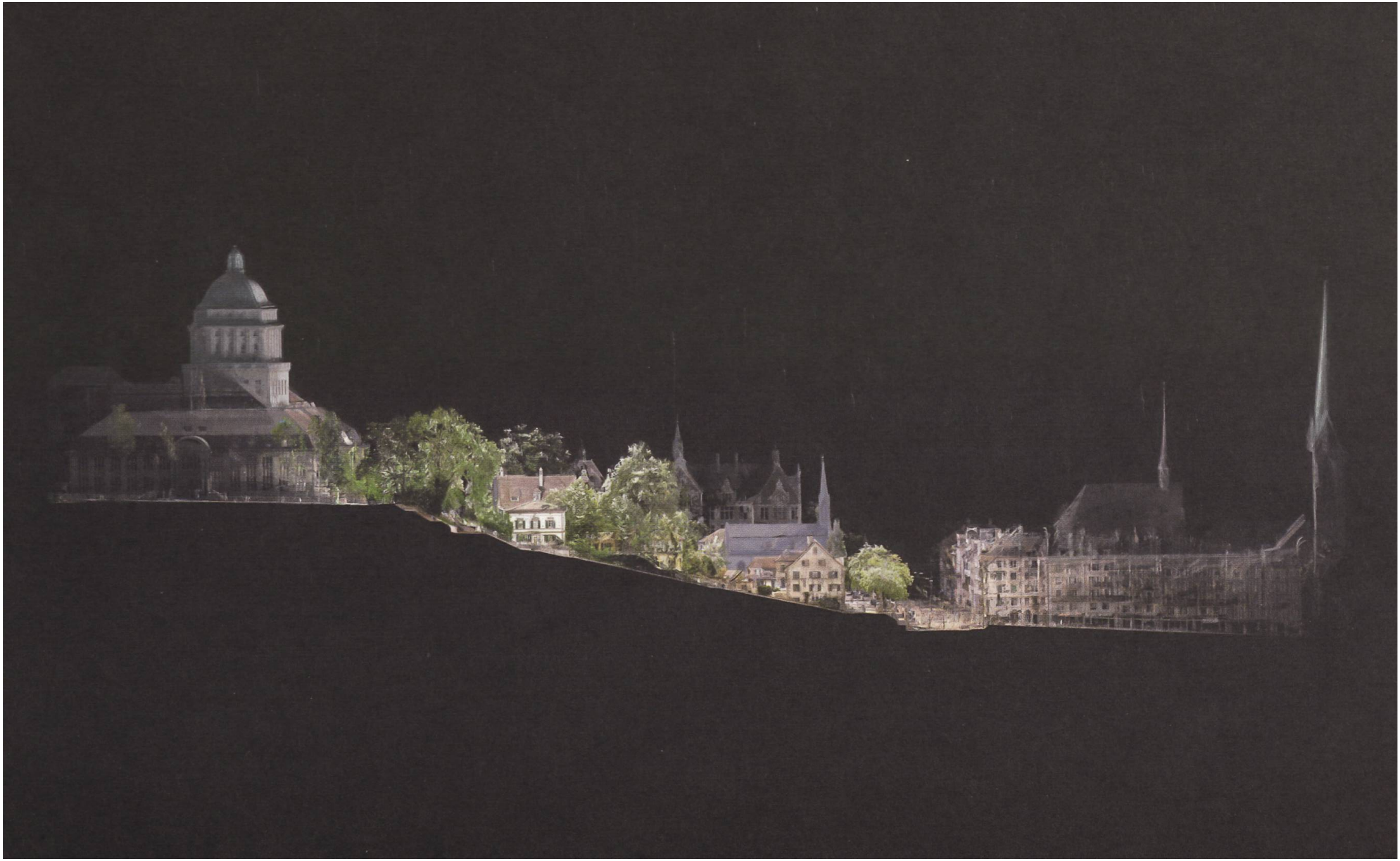
We often hear the question: How close can you plant a tree to a building? As Jeremy Bryan, a landscape architect we like to work with, answers: 0 meters. Growing trees can be extremely adaptive to their environment. A special form are the fruit trees on old farming buildings

4 Bundesamt für Umwelt, *Hitze in Städten*.

5 City of Atlanta, "Atlanta: City of Trees," https://www.atlantaga.gov/Home/ShowDocument?id=12763 (accessed June 6, 2022).

6 Ari Soltani and Ehsan Sharifi, "Daily Variation of Urban Heat Island Effect and its Correlations to Urban Greenery: A Case Study of Adelaide," *Frontiers of Architectural Research* 6 (2017), 529–38.

Fig. 11 Künstlergasse, Zurich 2018. Topographical section from the Künstlergasse to the Hirschengraben. By Brendan Buchanan Dee



that grow on trellises, but non-restricted growth forms can be found in many cities. There is a wealth of examples of large trees that literally seem to grow out of the wall.

If a tree is positioned close to a building, the inhabitants will literally live in the treetops. Trees are a natural seasonal shading system: in summer the tree will provide shade and a little penetrating sunlight, and in winter, with bare leaves, the sun can penetrate deeply into the building. We convinced our client by showing a combination of renderings and existing photos of what the street could look like. They decided to purchase the land from the city to plant the trees on private ground: that way, the administration's norms do not apply and we could plant the trees.

For the inner courtyard, planting trees has proved trickier in the already built part of the project. We will keep and reuse the existing underground story and its foundations. The new apartment buildings on top will be challenging to build for static reasons, but we can save a lot of gray energy and carbon dioxide. To plant large trees, we need to cut through the underground story to give enough room for roots – about four-and-a-half meters wide and a story high. If possible, a perforation of the 85-centimeter strong base plate will allow for retention and seepage of rainwater. The result is basically a giant flowerpot.

The Scale of a Tree

In our urban design practice in Switzerland, we often find ourselves presenting and discussing our projects with dozens of experts and stakeholders around a 1:500 white plaster scale model. These models are a standard requisite for architectural and urban design competitions and show abstract topography and buildings – but no trees or any other vegetation. In fact, the white models show what a city hit by a neutron bomb may look like – with no life whatsoever. This will hopefully change in the future, and municipalities and organizers of competitions will additionally provide designers and planners with a point cloud model including vegetation. For the time being, we have to add trees to the model to show their spatial impact. However, we have found that it is quite difficult to show what a tree actually does to an urban space.

The problem begins with scale. Time and time again we come across

site plans, floor plans, sections, and prospects drawn with minuscule trees. In most cases, trees are drawn less than two stories high: at most, six meters high, and usually not wider. We therefore consult our copy of Cesare Leonardi and Franca Stagi's masterpiece *The Architecture of Trees*, which comes with scale drawings and shadow diagrams for dozens of common urban trees.[7] And we are thankful for being able to work with Teresa Galí-Izard, who taught us to always draw the roots of trees in sections. Yet, more often than not, architects do not draw the trees at all because they would cover the building. And drawing a tree is challenging. A tree is a complex form with many moments of transparency depending on the viewpoint, the season, the sun, and the wind. That is something even Leonardi and Stagi's drawings cannot achieve. This gap can be filled, at least in part, using point cloud representations: as the student work demonstrates, the transparent property of the point cloud is a helpful complement to line drawings. And by recording the point cloud in different seasons, early-season blooms, autumnal color changes, and leafless winter branches can all find their way into the representation of urban space and thus into design concepts.

Our scheme for the Landis+Gyr industrial area adjacent to the Zug railway station proposed keeping a handful of old industrial buildings as testimony to the site's past and as low buildings that could relate the multiple high-rises to the human scale. The majestic plane tree on Landis+Gyr-Strasse, which is about twenty meters high and has a crown diameter of more than twenty meters, has taught us how to mediate between pedestrians and tall houses: its presence in the public space is unmistakable, partly because the street curves around the tree, making it visible even from the railway tracks 200 meters away. As one approaches the plane tree, its iconographic view gives way to its sheltering canopy under which people like to meet for a chat.

It took some years and a very successful case of temporary reuse of an enormous industrial warehouse as the "Freiruum," an urban food court, to convince the owners that these buildings would add value to their scheme. Yet it was much more challenging to convince them of the value of trees. In the end, it was the argument of urban climate

7 Cesare Leonardi and Franca Stagi, *The Architecture of Trees* (New York: Princeton Architectural Press, 2019).

that went furthest. Due to the very high density, large underground car parks will be built between the buildings. Our current proposition is to leave out two parking spaces to provide about 25 square meters of open ground for each large tree. But what was the fate of our teacher, the plane tree? Although the canton's traffic engineers saw cutting it down as the only way to route motorized traffic through a narrow gap between the two buildings next to it, the tree was saved because we were able to argue that the distance between the buildings is too narrow for all road users, cars, and pedestrians, and that no road should enter there at all. Once again, the qualitative goal could only be achieved by means of technocratic argumentation.

Trees and Urban Character

When hard-built density contrasts with the softness of vegetation, urban quarters can make for wonderful living environments. The gardens and courtyards of the Middle Ages or the public parks of industrialization made for great cities. In our current process of infill development and densification of urban textures, this old knowledge sometimes seems to get lost.

When the council of Zollikon commissioned us to do some research into their urban development, they had already been discussing the changing character of their municipality for a few years. They had observed that most new developments resulted in an impoverished urban space, yet could not precisely say what caused it. However, they provided us with many bad and a few good examples of recent new buildings. Zollikon lies on the gentle Eastern slopes on Lake Zurich. It was a village within vineyards before it became a wealthy villa suburb just outside Zurich. Most of the urban growth happened before the implementation of formal planning laws and resulted in a large homogeneous urban texture of villas surrounded by large gardens.

In our research, we soon discovered that the massing of the buildings was not the cause of the problem, nor was the increased density.

Fig.12 Künstlergasse, Zurich 2018.
Sectional view of a tree in its urban environment.
By the teaching team

What was really different in the new developments was the gardens. Instead of gates and stairs, plots now faced the street with garage doors, retaining walls, and high evergreen hedges. Beyond the plot, the lack of large trees changes the entire streetscape. Most of the sites are completely excavated to build underground parking with no space left for roots. Furthermore, trees would block the lake view of the expensive homes.

We analyzed all relevant building laws, norms, and regulations and found that they made planting trees almost impossible. For example, large trees have to keep a distance from neighbors, which is difficult on small plots, or garages need five meters of paving in between the door and the street. Not least, the typological change from a single-family villa to a multi-party apartment block changes the requirements of privacy on the ground floor, and the demand for lake view from all stories. In short, the economic and regulatory conditions lead to a loss of large trees and a fundamental change of character of the quarter. This is not without irony, since in literature, wealthy, well-situated neighborhoods are often called "leafy neighborhoods": it is exactly those leaves that the neighborhood is now losing. For the municipality, this is a challenge, because much of the regulation is beyond their influence. We set up a manual with principles for a good garden to improve the design. However, it is almost impossible to find space for trees. We eventually found it on public ground: changing parking spaces in the streets for trees might make up for some of the losses in private grounds. However, the character will still change from a garden city to a tree-lined streetscape.

Tools for Trees

After these brief narratives, we would like to deliberate on the future potential of point cloud scanning. As we have pointed out, in current practice trees have little agency in the vast majority of architectural tools. White plaster models are only one example. And since it is well known that design decisions are strongly influenced by design tools, the missing representation of trees and other forms of vegetation

in design tools is literally fatal.[8] Until now, we have compensated for this mainly with our memories of the experience of walking through the real places, with on-site tree measurements and photo documentations. The emergence of tools such as digital tree cadastre plans and city-wide point clouds, however, makes us optimistic. Point cloud technology in particular has many advantages, as the student work beautifully demonstrates: it captures vegetation as well as buildings or roads; there is no loss of detail; it is true to scale; it represents different seasons; it shows all vegetation and its size, not just as a diameter, but as the true shape; and it shows the growth and different ages of the trees. By means of these features, the presence of flora in digital design tools has the potential to not only expand our idea of the skin of the city[9] but also to foster aesthetic concepts that address the relationship of matter and living things, and potentially thus to save trees.

In this context, the proverbial blind spot of the point cloud technique should also be pointed out: since point clouds focus on the visible crust, it is convenient for mapping the treetop, but the roots remain a mystery. Point clouds cannot measure geometries in the ground. So, let us spin the thread further for additional, complementary tools: we would like to see future tools that also make visible the rooting of trees in the ground, the sewer system, and the seepage of the soil. The expansion of the three-dimensional into the supposedly invisible underworld would not only prevent us from carelessly moving trees in design schemes, but also from replacing the nourishing soil of our cities with sealed, reinforced concrete parking garages. No trees without roots, no roots without soil.

8 Christian Gänshirt, *Tools for Ideas: Introduction to Architectural Design*, rev. and enl. ed. (Berlin: Birkhäuser, 2020).

9 Manuel de Solà-Morales, *A Matter of Things* (Rotterdam: NAi, 2008).