intensified DENSITY

Volume 2

Intensified Density

Densification strategies for the peri-urban zone using modular construction prinicples

Petra Petersson, Petra Kickenweitz, Christina Linortner, Bernadette Krejs

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About Boundaries, Thresholds and Porosity

Sophie Wolfrum

Humans draw spatial boundaries to structure their environment, to establish conditions of stability, to differentiate between social affiliations, to define territories, to exercise power. Georg Simmel emphasizes the "incomparable solidity and plasticity that the processes of social delimitation obtain through their spatialization," (Simmel 1908: 552) suggesting that "every boundary is a mental, more exactly, a sociological process; however, by its investment in a line in space the mutuality relationship acquires, from its positive and negative sides, a clarity and security – indeed also often a rigidity – that usually remains denied to it as long as the encountering and partitioning of powers and rights is not yet projected into a sensual form, and thus always persists, so to speak, in the status nascens" (ibid.). The city abounds with such hidden boundaries between social spaces, spheres of dominance and defence, social distinctions and rituals. As they are recognised by the initiated, they unfold their communicative effects. Similarly, Walter Siebel directs our attention to the fact that social conventions have always produced restrictions that understand public spaces as fields of exclusion, and that they continue to do so (Siebel and Wehrheim 2003: 4). All these spaces are superimposed upon one another; their borders are in a state of instability and drift. In many instances they are not articulated in an architectural sense, even though their delicate traces might have materialised, over time, as engravings in the urban fabric.

However, in many other instances territories are clearly demarcated to emphasise their "solidity and plasticity". Legal, economic and social in- as well as exclusion, lead to consolidation of their borders. Property rights are defined through entries in land registers and established by means of survey points; built structures compact territorial boundaries, produce cohesive inner spaces, and exert control over accessibility. Private spheres are walled in and additionally secured. Those are the visible boundaries, markings in space that are constructed to deny or limit access in the service of a regulated exclusivity: walls, fences, hedges, signs, posts, barriers, doors and gates, building setbacks, fore courts and infrastructure corridors. Some boundaries are extensive, so that they establish territories in their own rights, others could be as thin as a line, like a barrier tape or a curb that makes it impossible for wheelchair users to pass. On the other hand, the Berlin Wall surrounded West Berlin as a wide and inaccessible belt for almost thirty years as a radical, deathly space of exclusion. Nicosia continues to have what is referred to as a territorial buffer zone: an extreme kind of hermetically sealed border architecture, devoid of any porosity or permeability.
Drawing from the writings of Gerd Held, Helmuth Berking suggests that "territory as a spatio-structural principle relies on exclusion, the city on inclusion. The former needs the boundary and, in this way, increases interior homogeneity, the latter negates the boundary and increases density and heterogeneity." (Berking 2008: 19). Based on these spatio-structural considerations of Modernity, the city would be conceived as a spatial entity of density and heterogeneity that does not exclude the other. In being open to the alien and the other, as something that, for some, might initially be associated with the exterInal, the external becomes internalised and vice versa. However, even if we were to follow these notions through, the principles of territorial and urban spatial principles would still overlay each other. Boundary conditions, on these premises, are architectural problems, for they need to manage and advance situations of inclusion, exclusion, deferment, in-betweenness, and communication in multiple ways.

Boundaries
August Schmarsow suggests that the marking of a border could be seen as the first step towards the architectural design of space: "Traces of footprints in the sand or a shallow groove drawn with a stick are further stages in continuous representation of boundaries." (Schmarsow 1894: 287) Architecture is always concerned, if we understand the shielding of an inner space from an outer space as one of its basic tasks, with the physical demarcation of territories that we establish around dwellings, buildings, and city quarters. Architecture makes borders tangible, and, in so doing, makes them accessible to practical experience. In contrast to the previous sociological definition, we may understand the architecture of the city as one of boundaries and

boundary spaces. According to Kevin Lynch's research on the "image of the city", boundaries are one of the five features that constitute our mental map and structure the inner image of the city (Lynch 1960: 47; Lynch 1981). The boundary is a membrane, skin, interface, intersection, through which exchange could be encouraged. Understanding the boundary as an active spatial medium, to conceive of architecture as a "membrane" (Teyssot 2008). Yet, the production of physical distance and dedicated buffer zones is still regarded as a viable way to deal with conflicts between urban zones. Separation is still a valid means of fundamental Modernity to avoid conflicts between uses and needs. New boundaries emerge, noise walls and screens divide the city. In colonial cities, an empty space, defined as cordon sanitaire, separated the residential quarter of the colonisers from the colonised local population. Green spaces were derived from them. However, in-between spaces are the urban potential of any city. To abandon all boundaries is not an option.

Enclosure and exclusion, between defining what is internal as opposed to what is external, stand in a mutually ambivalent relation to one another. Nowadays,the need for a complete protection of private areas and boundaries as defensive bulwarks is also to be found within cities. Advanced security systems, the boundary walls of gated communities, or barricaded residential buildings have replaced the former city walls. The act of projecting individual needs for security beyond the confines of the private home into the public realm raises new questions. Where do spheres of private and public influence begin? For changes that are located in the immediate surroundings or the neighbourhood are seen as boundary violations and rejected. In Munich, the "Wall", gained notoriety during the winter of 2017, when residents insisted on a noise cancelling wall between a newly constructed home for refugees and their homes. On the one hand, every boundary is malleable and vulnerable, insofar as it may be overcome by the media, by environmental influences, or by disregard; on the other, there is a countertendency to reinforcement. Even if the dwelling is understood as spatial immune system (Sloterdijk 2004: 501–567), intended to provide complete isolation, it still has to allow for communication with the outside world. Establishing the necessary balance between isolation and integration, between protective measures and targeted transit, between closure and controlled opening is one of the tasks of architecture. Architecture has the capacity to articulate the ambivalent relations between shielding and contact, enclosure and opening, separation and connection.

Thresholds

Based on the example of bridge and door, Georg Simmel explains how fundamental the interlaced relationship between dividing and connecting as concepts of thought and action actually is, suggesting that humans "must first conceive intellectually of the merely indifferent existence of two river banks as something separated in order to connect them by means of a bridge" (Simmel 1909: 174). The bridge illustrates the task of connecting in an immediate way, which is fundamental to our understanding of its aesthetic value. "And a human being is likewise a bordering creature which has no border. The enclosure of their domestic being by the door means, to be sure, that they have separated out a piece from the uninterrupted unity of natural being. But just as the formless limitation takes on a shape, its limitedness finds its significance and dignity only in that which the mobility of the door illustrates: in the possibility at any moment of stepping out of this limitation into freedom" (Ibid.: 7). The door as a spatially efficient tool enables the border to be opened and closed - its threshold being a space that belongs to both sides.

Thresholds make the presence of borders bearable, and, moreover, assign to them a positive connotation through architecturally defining a space that belongs to two spheres simultaneously. The door of the house acts as the threshold to the city – passing through the door means to be, for a brief moment, still inside the house while breathing the air of the city. The street is public, but also "my street", in which we feel at home while engaging with the public city. This typology of ambivalence lends itself easily to other scales in the city. Even though we do not enter the city through defensive gates anymore, train stations and airports continue to fulfil the role of transit spaces. The Mediterranean is seen as one of the gateways to Europe, a threshold space par excellence.

Thresholds delay, control and ritualise the acts of exiting and entering, they can be experienced as situations. The communication between inside and outside is given form, the process of leaving a space is delayed or divided into a sequence of events or the entrance into the space is charged with expectations. The passage between two different urban spaces becomes recognisable by means of its articulation; it is thresholds which anchor our mental maps. Thresholds are spaces of discontinuity, and, at the same time, connecting spaces and spaces of communication; they are "simultaneously symbols and mediators of passage" (Bollnow 1963: 158). This has contributed to the word Schwelle having many different connotations in the German language. It is a meaningful act to pass across a threshold. Sometimes borders are unrecognis-

able unless we cross them.
Thresholds are spaces of passage – we are still here while being already there; we participate in both spheres, albeit to an extent, which changes with each step we take. At the same time, we are within a space in its own right: we are neither still here, nor are we there yet. Situations of this kind have a performative power; sometimes they make us feel uneasy, sometimes they are appreciated and sought-after places. The feelings evoked when crossing a threshold are consequential in that they directly translate into our actions: when we feel intimidated, we may choose not to enter a public building, a restaurant, or a park; or avoid certain urban districts. In some buildings, the deliberate attempts to minimise feelings of uneasiness as much as possible are clearly visible. Solid walls are replaced by glass, everything appears as if it is fully accessible to our gaze; instead of doors there is only hot air. It is hardly possible to differentiate between inside and outside. They abandon the distinction between inside and outside and architecture turns into invisible climatic zoning. In that case, the idea that the threshold could be architecturally articulated is lost, and with it the possibility that it could offer moments of deceleration and in-betweenness that are of a unique quality.
An architecture of thresholds is indispensable for the spatial quality of cities, for thresholds are preferred spaces for city life. Their ambivalence is their strength, beginning with a cushion on a windowsill, a conversation in the doorway, or a farewell at the front entrance. To sit in waiting on a wall, hanging around beneath sheltered canopies, in front gardens or on verandas, resting in street cafés and observing the scenery, sitting on stairs in front of entrances, sunbathing on balconies, lingering in foyers or meetings in entrance halls of stations – it is here that consequential encounters take place, for they occur unexpectedly. This is not no-man's land, but land which belongs to both sides. Urban corridors, broad promenades, plazas and squares, edges and membranes – ambivalent places seem to be necessary at every scale. The architecture of the city can, in fact, be conceived as the art of thresholds.

Porosity
The term porosity, which reflects these thoughts, develops from an element of description and analysis, a metaphor and category of urbanistic concepts. Its source is a report on Naples from 1925 by Walter Benjamin and Asja Lacis:
"The architecture is as porous as this stone. Building and action interpenetrate the courtyards, arcades, and stairways. In everything they preserve the option to become a theatre of new, unforeseen constellations. The definitive, the fully-formed is avoided. No situation appears to be intended forever, no figure asserts its 'thus and not otherwise'. (...) Porosity results (...) from the passion for improvisation which demands that space and opportunity be preserved at any price" (Benjamin and Lacis 1925: 165–166).
Walter Benjamin and Asja Lacis observe the intertwining of urban spaces and the urban texture from cultural and social perspectives. The layering and mélange of spaces, the perforation of borders and the ambiguity of thresholds are perceived as specifically urban qualities. By contrast, the Modernist city was – and continues to be - characterized by homogenous zoning classifications and solidifying borders. "Space and opportunity in any case" is lost. POROSITY becomes a counter model, a critique of this city. POROSITY identifies qualities and architectural attributes that seem indispensable for the complexity and adaptability of urban spaces. As Amin Ash and Nigel Thrift put it as, "porosity is what allows the city to continually fashion and refashion itself." (2002: 10) For them, the focus is on people's everyday action, as it comes to life in the report on Naples. The porous city could enable typical urban ambivalences: distance and proximity, exclusion and integration, heterogeneity and homogeneity, anonymity and community. This requires significant urban spaces as well as a dense interweaving and use of these spaces. Richard Sennett, who understands the porous city as a site of radical mixture, puts his finger on the wound and asks: Why don't we build it? (2015)

This article is based on a chapter in the book POROUS CITY, Birkhäuser Basel 2018 and ARCHITEKTUR DER STADT, Stuttgart 2016.

How to Look at Urban Sprawl

How can we approach the complex topic of peri-urban space? And can we use this consideration to develop methods that are relevant to design and planning processes in these areas? The following contribution sets out to clarify the concepts involved in the topic of broadacre cities and urban sprawl.

Scrambled Eggs

Compact city – Suburbanisation – Fringed edges

As a result of industrialisation, rural exodus, migration and technological and political change, many large cities in Europe changed in form and, above all, grew in size in the late 19th and the 20th Century. Suburbs with their own centres were absorbed by the main body of the city, major industrial and commercial enterprises and municipal infrastructures were set up on the edges of cities, in some cases only to move away again. Brownfield areas remained that were later replaced by new functions and uses in another subsequent phase of urban renewal. The wealthier classes moved to the city centre or more well-situated leafy districts. The middle class increasingly settled in the outskirts, moving to large residential estates in designated urban expansion areas or migrating to more outlying localities that grew into "commuter belts". Meanwhile, these suburban zones have attracted new uses and functions beyond mere housing and continue to grow.
Since the 1990s, mid-size European cities have also seen a growth of large out-of-town industrial areas and business parks. Their electronic and specialist retail stores are aimed at a primarily car-driving section of the population and become knitted together with constantly expanding single-family home areas to form metropolitan urban regions, cannibalising previously rural areas.
The seemingly endless advance of urbanisation has also led to a change in the discourses. "While the binary view of urban and rural space was characterised by Modernist models and ideals, recent discussions on the phenomenon of urban sprawl have also developed views that go beyond the binarity of city and countryside" (Qviström 2013:435). Thus, in connection with the development of the Internet since the end of the 1990s, the term "network" has also established itself within urban development. "Although suburbanity can still be interpreted in terms of centre and periphery, networks, including network cities, are more akin to heterarchies, with lateral links and lateral movement patterns. [...]What is more, the network nature of the sprawling city interacts with the network traits of the main supply systems, particularly the infrastructures of energy transport and telecommunications" (Stichweh 2005:505). From 2007 to 2011, the international, EU-sponsored project "PLUREL – Peri-urban Land Use Relationships – Strategies and Sustainability Assessment Tools for Urban-Rural Linkages" focussed on the possibility of developing innovative planning tools and strategies for developing the changing relationship between urban and rural areas. One of the resultant diagrams defining various different urban zones, was applied to Graz as part of our research project (see Fig.).

Zwischenstadt

In 1997 Thomas Sieverts coined the term Zwischenstadt, or "in-between city".
The Zwischenstadt phenomenon is extremely complex both as a concept and as a reality, being subject to numerous different interpretations. Zwischenstadt describes forms of settlement that have evolved as a result of the dissolution of compact cities and their spread into the open landscape. Zwischenstadt means the urbanisation of the landscape and the landscaping of the city.
"These urbanised, fragmented and hybrid landscapes characterise forms of settlement in which single-family home areas are found adjacent to farming areas, where car showrooms, shopping centres, and equestrian farms are situated next door to little woods, criss-crossed by motorways and railway tracks lined with noise walls, and where you cannot tell where one city or town ends and another begins." (Viczenzotti, 2011:15)
The Zwischenstadt represents a kind of "para-aesthetics". It requires "widening our view and reconsidering to the chaotic wealth of forms of the Zwischenstadt – that is commonly regarded as being ugly.
"One must first study the Zwischenstadt, gain knowledge of its rules, and hone one's eye for its peculiarities before one can take action in terms of successful and respectful design." (Vincenzotti 2014)

Peri-urban space

The term peri-urban space was coined in the European context, in France and in Switzerland. As a common

denominator of different authors, peri-urban space can be defined as the interface between urban and rural space within the “urban shadow” (Qviström 2013:427), that is to say, the zone of influence of a city outside of the suburbs.
Characteristics are mixed (rural and urban) use of land, hybrid uses, the prospect of future development and real estate speculation, continuous change from productive land use towards postproductive land use and attendant conflicts, suboptimal institutional structures, and poorly developed infrastructures.
Alternative interpretations of urban sprawl were called for in the last decades of the 20th century. The chaotic multifunctional landscape required a new perspective (Shoard 2000, Gallent et.al 2007, Meeus and Gulinck 2008). There were also calls for a kind of analysis that breaks away from the bicultural (i.e. rural–urban) perspective (Qviström 2013:435).
In her book A Field Guide to Urban Spawl, Dolores Hayden describes a procedure in that very spirit. Together with photographer Jim Wark, she developed a vocabulary that not only accurately describes contemporary spatial phenomena in the US, but also presents an analysis of political, social and economic circumstances that brought them into being. For Hayden, giving things a name means to make a first step towards handling them appropriately. Just over 50 terms are illustrated exemplarily by means of aerial photos, each explaining constellations ranging from Asphalt Nation and Logo Building to Mall Glut and Zoomburb.
Although many of these phenomena are specific to the US American region, the vocabulary is helpful for analysing the process of sprawl in a European context and offers a chance to identify and name new spatial and urban constellations.

Learning from the Peri-Urban Zone

“For the architect, learning from what is around us, is a form of revolutionary avant-gardism. However, that has nothing to do with the normal kind of avant-gardism. It would be normal, as Le Corbusier proposed in the 1920s, to demolish Paris and rebuild it again; but it would be a more tolerant way if we were to ask ourselves how we actually perceive things around us.” (Izenour/Venturi/Scott Brown 2001: 12)

Early on, Denise Scott Brown, Robert Venturi and Steven Izenour realized that architects and designers should also take emerging tendencies in city development seriously, even if they seemed irritating at first. In a 1968 seminar titled Learning from Las Vegas, they asked architecture students to study the Las Vegas Strip in the same manner as former generations had studied the works of medieval Europe and ancient Rome and Greece (Izenour/Venturi/Scott Brown 2001: 18). One aim of the seminar was to develop an understanding of these new forms through an open and unbiased approach in order to find techniques - at least to some degree - of how to deal with them. This way, a method for analysing new typologies was to be developed.
Special emphasis was put on the need to abandon preconceptions, for “in that way it is possible to learn from everything.” (Izenour/Venturi/Scott Brown 2001: 13). From this emerged Learning from Las Vegas, which has become a classic. Apart from some texts, this book contains lots of analytic methods to approach the famous Strip and its so far unnoticed spatial and symbolic language of form. It was drawn, for instance, according to traditional methods like the Nolli map. In addition, specifically new phenomena such as lighting, car parks, billboards and the functionality of hotel casinos, etc. were analysed in various different ways.
A second seminar investigated a recently completed development of prefab homes in Levittown. Here too, similar to the examples of the Strip, Scott/Frown identified a kind of archetypical typology, i.e. a settlement form conceived by a developer which reflects industrial processes in that it rationalizes the course of time and construction. Innovation did not take place in the actual architecture, which drew from various market-oriented building styles, but rather in the building’s economic production method and “invisible” technological adaptation to 20th century needs (Colomina 2007: 52).
Here, forms of appropriations and different styles and decors of the newly occupied dwellings were analysed, and the findings were presented to a wider audience in an exhibition. Just like before, the focus was on demonstrating how complex interdependencies between the research and design process can be and that they need not remain as two separated units. (Colomina 2007: 56)
In Europe (Austria), Strip-like architectures and urbanistic forms only emerged much later on, towards the end of the 20th century. Although American urban development is not directly transferrable to the European context owing to fundamental structural differences in administration, planning and principal urbanistic attitude, many arterial roads in smaller and larger European cities (Häußermann 2007) are now lined with carparks, shopping malls and billboards. The spatial order has shifted.
In 2017, almost 50 years after Learning from Las Vegas, Sabine Pollak and Lars Moritz have published Learning from Gänserndorf in which they present a case study on a strip that has developed since the end of the 1990s in Central European peri-urban zones. Learning from Gänserndorf reveals the outcome of a research project carried out by the Department of Architecture | Urbanism, University of Art and Design Linz, for Lower Austrian Housing Research. Architectural Forum Upper Austria writes about it as follows:
“Here too, a strip running north from Vienna is lined with emblematic large-scale typologies such as a garbage incineration plant or an organic vegetable shop as well as absurdities like a drive-in cinema, a crude oil information trail and a (former) safari park. The linear string of large volumes, empty space and landscape is open, obeying no aesthetical restraints and therefore, so the theory poses, can be interpreted in a more utopic way than an urban extension near the Vienna city centre.”
Whether the peri-urban zone in Graz and its immediate environs are affected by Strip-like developments or whether other structures will assert themselves and in which way they should be dealt with, is also part, although not a primary focus, of this research project. To that end, the “Learning From” method will be used as an impartial observation method.

How Much Density do we Really Need? Part I
Reflections from a spatial planning perspective

Sanela Pansinger

"Dicht/machen" is a German expression that can convey various different meanings depending on whether dicht and machen are written as one word or as two separate words. These meanings are closely related to the built environment in its design-related, economic, ecological and sociological development. In the English-speaking world, "density" relates more frequently to the physical dimension describing the spatial relationship of elements to each other within a certain system. From an urbanistic perspective, this simple characterisation of the terms Dichte and "density" means a certain attitude is assumed towards the question of "how much density do we really need?" including "design-related sustainability" (Pansinger/Pretenthaler 2016) as one of the most crucial aspects.

Although density may be described as such, there is no denying that density is a major urbanistic tool, especially when it comes to issues of housing, increasing population, the city of short distances and energy efficiency, etc. Rather, what is meant in this context, is its dogmatic use as well as understanding this interdisciplinary construct.

Nowadays, "density" is, as a specialist term, at the centre of all analyses and is presented as a solution for all sorts of problems: as a criterion, goal and, ultimately, as a synonym for the city (Latin: urbs). Furthermore, the word density is often used in conjunction with the adjective "urban" to express urban density. Nevertheless, both terms, "density" and "urban", are equally omnipresent, whether it comes to designer furniture, designer fashion, makeup, styling, food, company names, hotel chains or even urban forms of mobility such as skateboards, bicycles, motorbikes and cars. Mostly, they are equipped with a "retro touch", i.e. a form and appearance that is reminiscent of times when a distinct boundary existed between rural (density) and urban (density). In that sense, then, everything can become "urban" today – even density itself. If city is equal to "urban", and density is characterised as being the basic principle of a city, a new word emerges whose existence would be indeed legitimate: "urban city" = "urban density". Having said that, the question as to "how much density do we really need?" crops up yet again.

We chiefly perceive the "urban city", which today could mean the centre of any western city, as the medieval town with its narrow alleyways. This "urban city" is already "dense" and tailored to all areas of former urban functions: working, living, housing and "leisure time", etc. Despite that, today's city or town centre is in danger of going extinct. It is seen rather as a tourist attraction, increasingly resembling other "urban cities" in their uniformity due to growing numbers of chain stores and eateries established there. Hence, we not only have similar peripheries displaying similar structural characteristics and density, but also comparatively similar city centres. This trend is moving towards the formation of a decoupled system, i.e. the development of new-build quarters. On the outskirts of towns, new housing forms are emerging – chiefly self-contained functioning units – catering not only to families with children, but also to the elderly and single people. For, the main feature of these complexes is their densified architecture and frequently resultant spatial and functional separation from their surroundings.

This small section alone shows that the city is a highly complex fabric consisting of different levels, structures and requirements that are dependent on one another. Although the future of our planet will largely depend on the ecological abilities of megacities and metropolises, current approaches of European cities are more inclined to utilise innovative and sustainable technologies, ecological measures, social integration and new mobility concepts, e.g. digital Smart Cities, multimodal cities, Silver Cities and the Ecopolis etc., thus also contributing to protecting the climate. It follows that the densification of spatial structures is one of the most important measures in this process, but only as long as it generates positive effects within its context, i.e. as long as space, as a resource, remains tangible. For, space, i.e. the type of spatial densification, is a requirement for an efficient and sustainable implementation of new technologies. Space is a vehicle for the synergies of utilisation concepts, available resources and regenerative energy carriers as well as upcoming mobility information systems that will enable interdependencies with other fields of activity, subsequently also avoiding "shutting down" the spatial

system on various scale levels (street, quarter, urban district ...).

Subsequently, one could claim that densification is primarily the design of density. A density that is not designed sustainably will not be able to survive. So the fundamental question here is, do we just fill space instead of creating, accentuating and interconnecting it?

Space in which we live can accomplish more than just being purposeful and efficient. Architecture, urban and spatial planning, i.e. the "densification of space" can generate an unquantifiable amount of additional value for society: spatial organisation happens via the process of "design" and as a scope of possibility between everything that has been and everything to come, i.e. through the densification of built and unbuilt space. Sustainably designed density enables productive communication, it can organise specific groups, link them together (work, leisure time ...), attract new systems and connect them to the environment. It is all about recurrence as well as embedding and connecting architectonic qualities, as well as the renewable quality of building materials, details and surfaces which together with the regional climate and culture reconcile as well as achieve spatial creations and experiences. Hence, it is about the interaction of density and life, i.e. about things that happen in the in-between. Designed density can therefore sustainably adopt and control social expectations of a certain period and perpetuate their existence for the future. In that sense, it is not about evaluative classical-aesthetical ideals such as proportion, contrast and composition, but rather about the presence of density. Essentially, sustainably designed density strives to transform without defining irrevocable conditions, simultaneously creating a multi-scale operational frameowrk for the following spatial situations:

- Dialogue and logic between the existing and the prospective while preserving its own character – the genius loci.
- Flow between content and form beyond functional requirements.
- Conveying and connecting the fundamental topological properties of spaces (affinity, hierarchy, separating and connecting ...) and their succession, and finally, - Shaping and materialising, i.e. designing ideas or physical forms respectively.

Sustainably designed density activates space/urban space over the long term, thus becoming gentle on resources, energy-saving and climate-friendly ... and ultimately, if you will, efficient. Key factors include not only the elements of the system (structure) and its densification but also the type of relations to one another and the intermediate space – including the vertical dimension.

This is exactly where the challenges lie: due to the already high degree of urbanisation in western cities, area expansion will be low in the future. In this setting, the term "density" plays a crucial role. Hence, the following question is paramount: how should "building" continue if it is ultimately all about the in-between? The future lies in a renewal process from the inside out, the successive optimisation of existing structures as well as in the sustainable densification of new areas and territories, i.e. in a permanent "update of the city", without losing essential identity-building characteristics on the way.

For, "hardware density" – infrastructure and building stock – already exists in western cities, thus reflecting the social priorities of their times. Subsequent urban expansion largely continued around these existing infrastructures. Problems arise in places where a certain density surrounding these existing infrastructures causes a rigid spatial organisation and subsequent formation of closed units such as single-family settlements, logistics and shopping centres. Because essentially, cities are organisms, or, in other words, systems. To densify an urban district means to generate a subsystem. Such a system, however, cannot survive if it is isolated from other subsystems and from its surroundings, and it is therefore not sustainable. On the contrary, it represents a spatial barrier.

From a systematic point of view, density is a spatial organisation (object, street, square, quarter ...), i.e. a system of functional and material structures (architectures) which provide the spaces for human existence and meet human needs: utilitarian (purely based on utility), material and immaterial (aesthetical and/or ideological). By satisfying material and practical needs, these spaces are elements of the environment's shape that mirror functional processes. However, they also carry immaterial content, thus also representing a form of social consciousness, a specific kind of art and culture. Thus, the observer perceives density via the intermediate spaces, as a system of built and unbuilt space. Such a system is determined by natural site conditions (topography and natural elements) and cultural parameters (societal systems and aesthetical ideas), i.e. by the genius loci.

One of those in-between or intermediate spaces, when viewed on an urbanistic and regional planning scale, are the areas between infrastructures. As extension areas that have long been incorporated into the city, they have enormous potential for further

urban expansion. They are new urban building blocks. How should one treat intermediate spaces like that in view of their capacity as a key criterion of sustainably designed density? Taking the area surrounding Graz Airport as an example, the “SmartAIRea” project shows different scenarios of how to achieve sustainable densification of space between large infrastructures such as the motorway, railway and airport, while also providing a stimulus for further urbanistic and regional development. Nowadays intermediate spaces like these offer an ideal opportunity for the following topic-related guidelines: to connect the term “density” with and embed it spatially into building and space organisation, energy supply, climate protection and new technologies, integrated mobility, quality of intergenerational life, reduction of noise, economic balance and good governance. The ultimate goal is therefore to carry out urban and regional development in an economically robust and spatially balanced manner that will strengthen urban life. Moreover, interweaving and bundling various infrastructural levels and scale levels such as regions, cities and quarters generate additional value in comparison to individual systems. The main objective of this intermediate space is to create a specific density that will meet the challenges of the spatial context in a positive way, prevent further sprawl and safeguard the landscape, green and open spaces, while representing an appropriate mix of uses in meaningful locations. Furthermore, it should transform now forms of mobility in new social hotspots.

It becomes evident that modern planning tools are not sufficiently adapted to structural transformations and the dependency of those transformations on the interplay between urban and rural areas and infrastructures. Therefore they are also unable to regulate them. As a result, there is a threat of further erroneous developments regarding capacities and resources, energy supply, noise pollution, the allocation and availability of space. This makes it especially hard to take the aspect of sustainability into account. We will not be able to solve this problem by means of urban planning and the density tool alone, but rather by viewing density as a sequence of intermediate spaces, regardless of whether it is a building gap or the area surrounding an airport. In that way, we can contribute to improving the densification of space. For, in-between spaces constitute the sole spatial field in which density can spread, prove its versatility and thus continue to “flow” and remain in motion. By implementing multimodal mobility networks (ranging from macro to micro infrastructures), we can provide space with new stimuli whose main goal would be to form and secure topic-related transitions between scale levels as a prerequisite of liveable spatial organisation.

In that respect, we can maintain that void is density. It happens in the in-between where nothing is built and everything is fluid. This space is the only thing that we can interconnect. Its change and densification does not endanger spatial organisation, but provides potential for quality enhancement. The main actors of versatility and transformability are the public realm and green space. And for that purpose, both need to be mobile. Sustainably designed density is therefore not dense, but fluid.
Ergo: the question should not be “how much density do we really need?” but rather “how much in-between do we really need?”

Reducing the Urban Patchwork

Focusing on the essential

In our Intensified Density research project, the aim is to investigate and test small-scale modular redensification in suburban or Zwischenstadt zones by planning based on the mid-sized Austrian city of Graz. The first step was to define these suburban or peri-urban zones in terms of concepts and to identify them in the urban space of Graz.

Examining various planning documents, including the Regional Planning Model (2004), the Urban Development Concepts 3.0 and 4.0, and taking existing planning target areas into account such as Smart City, Europan, etc., the city was examined in terms of urban development so as to graphically circumscribe the area that form the basis of our research project.

CITY PROFILE

286,686 inhabitants (valid 01/01/2017) of which around 62,000 students 2001 City of Human Rights 2003 European Capital of Culture 2011 UNESCO City of Design

Presently, Graz, the second-largest city in Austria, is regarded as a fast-growing city with an additional 56,600 inhabitants since 2003. The city has fourteen research competence centres and eight universities. The aim of urban development is therefore to densify inner-city areas and areas with good infrastructure. Work is currently under way on a new version of the Flächenwidmungsplan (FLÄWI) [Land Development Plan], and the Räumliches Leitbild (RLB) [Regional Planning Model], with the aim of passing a resolution in 2018. The Urban Development Concept 4.0 (STEK) currently in effect dates back to 2013, and the currently valid Regional Planning Model to 2004.

REDUCING – GREEN BELT

127 km² area with 50% green belt 1997 City Green Sectoral Programme 2006 Graz Streams Sectoral Programme 2007 Graz Green Network Concept 2010 Study on undeveloped areas in Graz

The city of Graz is situated in a sheltered basin site with a mild Mediterranean climate on the south-eastern edge of the Alps. The atmospheric inversion that most frequently occurs in winter prevens air exchange. In addition the high volume of traffic, domestic and industrial emissions cause severe particle pollution. Since the 1990s the city has had a City Green Sectoral Programme that led to the definition of specific green areas in the Urban Development Concept 4.0. The study on undeveloped areas provides a definition of the minimum size of open public space as dependent on the existing building structure: from 3m²/inhabitant in single-family home areas to 10m²/inhabitant in densely developed urban areas. The green belt specified in the development plan comprises open land, forest and existing low-density residential areas (0.3 and 0.4) defined by an absolute limit on building land/development.

REDUCING – HISTORIC CENTRE

The UNESCO world cultural heritage of the historic centre of Graz consists largely of the area of the former renaissance fortification belt and Schloss Eggenberg. In addition to the historic centre, historic suburbs and inner-city centres display largely built-up, space-enclosing and dense development, unified local character with a predominantly high level of design quality, and priority with regard to preservation: Südtiroler Platz (Murplatz), Jakominiplatz (Murvorstadt), Geidorf (Leechkirche), Guntarn-Hof (Leonhardkirche grounds), Griesplatz (Murvorstadt) and Lendplatz (Murvorstadt). The outer ring with historic suburban municipalities of Graz – Liebenau, St. Peter, Waltendorf, Ries, Mariatrost, Andritz, Gösting, Eggenberg, Wetzelsdorf, Straßgang and Puntigam – were transformed into districts of the city and incorporated in 1938.

REDUCING – WORLD CULTURAL HERITAGE AND HISTORIC CENTRE PROTECTION ZONE

1974 Graz Historic Centre Preservation Fund 1980 Historic Centre Preservation Act and Historic Centre Expert Commission 1999 Historic centre of Graz declared UNESCO world cultural heritage 2010 Schloss Eggenberg declared UNESCO world cultural heritage

The scope of the Historic Centre Preservation Act covers the historic centre and those areas of Graz whose landscape and architectural characteristics are formative for the physiog-

nomy of the city and whose appearance, building structure, and building fabric are worthy of preservation. Block perimeter development from the Vorgründerzeit and Gründerzeit periods is a key characteristic of Graz. To protect the world cultural heritage, the Management Plan / Master Plan with buffer zones (Annenstraße and Ring) called for by UNESCO was drawn up by the city of Graz, with an analysis of the core zone and guidelines for action.

REDUCING – SINGLE-FAMILY HOME AND TOWNHOUSE DEVELOPMENT IN THE MUR AREA AND GREEN BELT

The Regional Planning Model (2004) divides the city into fifteen urban morphological areas, including the low-density, open single-family home and townhouse development in the Mur area and green belt with two- and three-storey buildings. A distinction is made between single-family homes and urban townhouses from the Gründerzeit period that are tightly interwoven with perimeter-edge developments and the road grid. The latter areas are no longer purely residential as many dwellings have meanwhile been converted into offices. Recently, these areas have been redensified with new open multi-storey dwellings.

REDUCING – URBAN AREA DENSITY

In the period between the wars and during the war (1914-45) block development continued, generally with a homogeneous appearance. The 1950s to 1990s, by contrast, saw different development structures with variously conceived residential estates with free-standing solitary buildings and developments with a big-city and small-town feel. However, these areas with multi-storey buildings all display a high level of building density and urbanity.

REDUCING – SMART CITY TARGET AREAS 2013–2050

Graz Mitte (Waagner Biro Straße, railway station area, Reininghaus, Don Bosco belt) Mur West (Karlauergürtel, Mur, Gasometerweg, Herrgottwiesgasse) Trade Fair Centre quadrant (area between Jakominigürtel, Münzgrabenstraße, Petersbach, Kasernenstraße)

Smart City is an expansive EU-funded urban development concept (Horizont 2020) that develops new urban districts using the latest energy and digital technologies, usually with the aim of developing energy-self-sufficient districts. The central Smart City areas include former industrial areas near the main railway station of Graz and the area surrounding the Helmut List Hall that was built in 2003. In 2017, the Smart City Projet-Tower, also known as the Science Tower, was opened in this area. This project is the energy flagship project of the city Graz and contains a new centre for research and technology companies. In 2018, the first phase of the building project School Campus Smart City, which consists of a new primary and secondary school for 700 children, should be finished. The aim is to create living space for around 3800 people in addition to office buildings. A total of approx. 330m Euros is being invested by private project partners and the local authorities of Graz. The project is supervised by StadtLABOR Graz on the basis of a participatory district management concept. The current planning area, from Wagner Biro Straße to Reininghaus, was already dealt with in the EU-funded Urban_Link Graz-West project in 2000–2008, with a total of forty sub-projects being carried out.

REDUCING – EUROPAN AREAS

Europan 05 (1997-2000): Mobility and proximity – New landscapes of urban living – Liebenauer Hauptstraße
Europan 06 (2000–01): Europan come back – Graz Wetzelsdorf
Europan 07 (2002–03): Suburban Challenge – Grazer Feld Straßgang
Europan 09 (2007–08): Sustainable city and new public space – Graz Puntigam Brauhaus
Europan 10 (2009–10): European Urbanity Inventing Urbanity – Graz Puntigam
Europan 11 (2011–12): What architecture for sustainable cities? – Graz Liebenau
Europan 12 (2013–14): Adaptable City 1 – Eggenberg, Smart City
Europan 13 (2015–16): Adaptable City 2 – Railway station area
Europan 14 (2017–18): Productive Cities – Kärntner Straße

Europan is the biggest European residential and urban development competition initiative for young architects under forty and has been in progress since 1989 in nineteen European countries. In addition to Vienna and Linz, Graz is also a regular participant in the biannual competition. The aim is to find innovative and experimental approaches for locations proposed by the various cities, to support young architects, and to build the winning projects.

REDUCING – AREAS WITH A DEVELOPMENT STRATEGY

2006 Graz Model 2012 Expert Advisory Committee for Building Culture
For certain larger contiguous areas, the local authorities draw up development plans and development guidelines based on land use plans that define the degree of building development and regional planning. The areas subject to the development plan are defined by the local authori-

ties. To ensure quality and to develop these areas, in most cases architectural competitions are held based on the Graz Model, or the Expert Advisory Committee for Building Culture is consulted if the new building or extension has a larger gross floor area than 2000m², with the exception of commercial areas.

REDUCING – UNAVAILABLE AREAS

Districts and areas that are unavailable in terms of urban planning include monovalent districts such as purely residential and industrial areas, for example Magna Steyr, and non-valent areas, e.g. brownfields, disused railway track areas, etc. This also includes highly symbolic areas such as the railway station, hospitals, cemeteries, barracks, but also the Puntigam brewery or the Citypark shopping centre, for example.

ROUTES THROUGH THE CITY

After reducing the area under review based on the above factors, field research was performed in areas of the Andritz, Gösting, Gries, Jakomini, Lend, Liebenau, Puntigam, St. Leonhard, Strassgang, Waltendorf and Wetzelsdorf districts. Based on a total of seven defined routes, a search was conducted for potential sites.

New Housing in the Building Stock

Interior development and strategic development of residential locations, using Münster as an example

Elke Pahl-Weber

Development of building stock is the challenge facing cities in Europe; this development is primarily made and altered according to the dynamic demands on the cities. This is the case in Germany as well as in Europe. The challenge is also being faced globally, but here we also see the emergence of new cities on a more than marginal scale.

Building stock development affects all functions in the city and, since several years, housing construction has become increasingly important to politicians, administrations, companies, associations and also citizens.

Urban density is characteristic of the sustainable city that is frequently cited in the international literature, municipal concepts, articles and contributions to urban development. For this reason, the concept of densification blazed a trail for planning shortly after the impetus for sustainability was transferred from the environmental planning sector—UN Environment Conference in Rio in 1992—to the city—Habitat II in Istanbul in 1996. The word describes a combination of existing urban structures with Leitbilder of urban compactness and density.

Density and densification - a question of quantity?

Erika Spiegel's ground-breaking description of the keyword 'Density 2000' shows how carefully the concept of density needs to be handled in urban design (Spiegel, 2000). Density is far more than the building density; urbanistic density also covers topics like social density, population density and usage density. In this respect, urbanistic density not only has a quantitative but also qualitative aspect. Without question, population density plays a leading role in determining the function of density for urbanity, but it is precisely this function that can rarely be planned with urban development means. "Thus the correlations between structural and population density, are highly variable. The decisive factor is the density of occupancy in the residences. The reduction in the average size of households from 2.7 to 2.2 persons over the last thirty years and, even more so, the simultaneous increase in the average living space per inhabitant from 24 sq m to more than 38 sq m, have already led to a fall in the population densities in numerous residential areas by half, although the building density has remained the same. If one takes into account that commuter proportions of 30-50% are no exception in many large cities, it becomes clear how the employment density influences social density. At the same time, the area requirements per workplace have also increased, and the employment densities—at least in relation to floor space—have decreased accordingly. Nevertheless, the density of employees remains particularly important, because these are usually adults who are professionally involved in numerous local and regional processes of interaction, have above-average purchasing power and are prepared to use this to access the city's range of goods, services and cultural offers. This does not apply in the same way to the number of visitors. The large number of shopping, conference, or weekend visitors can create the impression of a high "urban" density at certain times and in certain places. However, their contribution to this increase in social density is likely to be small. As a rule, visitors only enter into contexts of urban interaction at short notice and on the fringes" (Spiegel, 2000/42). In the meantime, the figures presented here have changed; the amount of living space per capita has risen (46.5 sq m in 2017; UBA, 2016), the average occupancy rate has remained the same, but has decreased in the major cities, and the number of commuters has continued to rise (59.4 % working commuters in 2016, Statista, 2018). Thus, the trends described here, with their effects on social density, are still observable. In addition, as the amount of living space per capita increases, the density of buildings—as measured in terms of floor space ratios and the site coverage ratios—may increase, but population density may decrease, for example, as the number of single flats increases. In this respect, 'densification' in the sense of additional, physical density related to cubic capacity is not equivalent to an increase in population density, social density, or even urbanity.

Density and quality – an example from the city of Münster

An example of the urban planning work using a qualitative concept of density is the development of the strategic residential development of the city of Münster in Westphalia. Instead of 'densification', "new housing in building stock" is addressed here. The development is continuously com-

municated via a platform created to facilitate exchange among all housing market actors.

Münster was named a model city in the sustainability strategy that was published by the German federal government after Habitat II in 2002. The research field on indicators for sustainable urban development with model cities and a group of reference cities, which was initiated in 1999, continued with this as a framework.
As part of the National Sustainability Strategy, the German federal government is pursuing a coordinated set of measures to reduce land use. In this respect, the economical use of land and soil is a basic principle of the national sustainability strategy (Bundesregierung, 2012), which has been pursued for many years and is also included in § 1 of the German Building Code.

In Münster, this strategy and the work in the research field addressed a current cause. Already in 1997, the forward projection of the land use plan raised the question of which part of the future housing demand for new settlement areas would have to be developed and which requirements could be met with an 'internal development' of building stock (Bartmann, 2000).

The development of the basic information about new housing in building stock was accompanied by the development of a methodology that ascertains the potential for this new form of housing in the overall urban context. The components of this method include determining quantities, surveying the building stock according to the typologies of the settlement structure, assessing the feasibility and conducting design work in pilot studies, whereby the technical exchange takes place in an accompanying workshop with experts, members of the administration and politicians. (Stadt Münster, 2000)

- Types of settlement structures
Those conducting an overall urban study face the challenge of coping with the high levels of complexity inherent in the individual locations and their respective differences. To be able to take the different characteristics of the individual areas into account when determining the quantitative potential for new housing in the building stock, twelve types of settlement structures were identified, which differ depending on the urban development, building and apartment types, open spaces and location, such as settlements with gardens, older city centres and arterial roads. Test designs are used to examine the theoretical potential of these types of settlement structure for new housing in the building stocks. The aim is to fit additional housing units into the settlement structures. Theoretically, there is a high potential that is significantly higher than the number of necessary new housing units based on the projected population.

- Suitable areas
The basic suitability of the individual residential locations was then determined with regard to their competing uses (e.g., by taking into account the capacity of the ecosystem, protection of historical monuments) and support elements (e.g., proximity to public transportation, supply centres and availability of green and open spaces). These elements are quantified as factors and calculated as a deduction of the theoretical potential. In this step the identified theoretical potential is reduced by about 65% during this step. Based on the types of settlement structures identified in Münster, it is clear that the largest share of the potential is found in the settlement structure type 'settlements with gardens', the second largest share, in 'near arterial road', followed by the structured and uncompacted city areas, and the smallest share is found in the settlement structure type 'town houses'.

- Design work in pilot studies
Once the theoretical potential had been determined through design studies on a scale of 1:5000, design studies on a scale of 1:2000 were carried out in pilot studies for the suitability areas. These test designs result in a potential that has already been corrected for numerous influencing factors, and which is higher than the theoretical potential. In the first step, 2.3 LU/HA were found and in the following step, 3.2 LU/ha, but the latter was based on the suitability areas, which only account for a certain share of the total urban area. Without design work, which takes the specific conditions at each site into account, such a determination of the potential is hardly possible.

- Mobilization of theoretical potentials
Mobilizability concerns a wide range of requirements, for which strategies have been developed. Intensive discussions in the accompanying workshop are the means to combine perspectives, values and professional knowledge. The basic strategy for the creation of new housing in the building stock is to assure the quality of the existing buildings and outdoor installations. Urban design competitions would be useful to combine quality assurance with possibilities for new housing in building stock. Another strategy combines infrastructure planning with urban design in an integrated approach, with the aim to utilise existing infrastructures efficiently in all types of settlement structures with decreasing population densities. Mobilization of building land

is necessary to create new housing in the building stock and, for this purpose, a municipal decision of principle on building land policy is sought. A communication concept that consists of a step-wise process of informing, interesting and implementing is regarded as a superordinate strategy, because it will not be possible to reach the potentials without the owners in the building stock.

- Development corridor for new housing in the building stock
Depending on the test results and the mobilizability, very different potentials can be obtained, which are determined as corridor potentials and made available for the residential development of the city.

In the following years, Münster worked intensively on the implementation of a 'strategic residential location development' plan that prioritizes internal development. The strategic development of residential locations endeavors to keep the city attractive as a residential location. A successful business and university location should also be an attractive place to live. The urban economic orientation of the strategic development of residential locations complements the city's current, predominantly supply-oriented and more socio-politically motivated housing policy. The increasing importance of strategic orientation in the urban housing policy is tantamount to a paradigm shift which is associated with the additional development of quality in the building stock.

A decisive step in communicating the strategic development of residential locations was the founding of the "Living in Münster" (Wohnen in Münster) working group. It was initiated by the City of Münster in 2003 and established in 2004. The aim of the working group is to combine the forces of the housing market actors to strengthen Münster as a residential location and avoid negative developments in individual residential districts. It is considered as a political advisory body in terms of its function and position. The development shows great promise, Münster is now one of the most rapidly growing cities. Thus, the city is facing a new challenge. The potential for creating new housing in the building stock is often used, and if new housing is to be offered to the people moving to the city, it will involve balancing out the existing districts through new construction in the future. This process is also being examined in a workshop situation, accompanied by involved actors. The Planungswerkstatt (planning workshop) is currently being held to qualify new areas according to selected criteria, place them in a context with the building stock to create new living space in the existing housing developments and, thus, introduce new grading into the quality development of the residential location. Development of building stock includes the development of areas to create a balance among the existing settlement structures (Zwiebelschalenmodell). (Bartmann 2017)

- (Fig. 1) The model for the additional development of areas for residential location development has been developed the dialogue in which scenarios were discussed and evaluated.
- (Fig. 2) Structural densities determine the areas required. They have been examined in detail in the building stock and agreed upon as a corridor for the new development.
-(Fig. 3) A catalogue of criteria is used to assess which areas are suitable for this additional development of the building stock.
-(Fig. 4) The area examined covered more than 80 areas throughout the entire city. After applying the criteria framework, about 1/3 of the areas remain that will be examined further. A part of these areas will not be investigated further due to implementation restrictions which are mainly property restrictions.

Both studies, which were conducted about 15 years apart, show that the feasibility assessment significantly reduces the theoretical potential for new housing in the building stock. In both studies, a share of about 1/3 appears to be feasible. This is about 10% of the area that was assessed. 600 – 700 acres were assessed, with an expected requirement of 50 – 70 acres.

The development of such a strategy requires communication among the actors in the city and dialogue among politicians, members of the administration and companies. Münster also chose the independent moderation of this dialogue in the planning workshop by members of the scientific community and, thus, found a constellation of actors that provide the innovation, theory and practice needed for sustainable building stock development.

Seven Walks and 120 Plots in Graz
The search for potential plots

The focus of the research project INTENSIFIED DENSITY is on the areas of the "unplanned" suburban regions, also known as periphery, peri-urban zones and/or Zwischenstadt (Sieverts, 1997). These urbanised fragmented and hybrid landscapes are characteristic of forms of residential areas "in which single-family home areas are adjacent to farming areas, and where car showrooms, shopping centres, and equestrian farms are located next to little woods, criss-crossed by motorways and railway tracks lined with noise walls, and where you cannot tell where one city or town ends and another begins". (Vicenzotti, 2011, p. 15)

Heterogeneous zones (Sieverts 2005, Hauser 2006) that are integrated into cities over time and that are currently being combined to form urban regions (ÖROK, 2015) are the subject of controversial discussion in academic and planning circles. Vera Vicenzotti reviewed the history of this discourse in her publication Zwischenstadt-Diskurs: Eine Analyse zwischen Wildnis, Kulturlandschaft und Stadt (2011) [The Zwischenstadt discourse: An analysis between wilderness, cultural landscape and city]. She categorises the countless views of the Zwischenstadt into three ideological patterns of opponents, enthusiasts and qualifiers. Within such a grid, Intensified Density operates at the level of the qualifiers: "The fundamental attitude of the qualifiers is a positive assessment of suburbanisation processes and the reality of the urbanised landscape. Despite this essential recognition, however, it also detects deficits, particularly with regard to possibilities and conditions of urbanity and quality of life [...]". (Vicenzotti, 2011, p. 87)

Selected project areas are investigated and evaluated with quantitative and qualitative methods as part of the Intensified Density research project. The spatial analyses of the potential areas, the sociocultural environment, building stock, and tangible, existing needs to be fulfilled by the specific selected places are performed by surveying qualities, infrastructure, buildings, stocktaking, etc., in some cases on site. Demographic data and empirical research, for example from the survey of quality of life indicators in the city of Graz, are also incorporated in the analysis.
This data is used to derive general criteria for redensification, for utilising free spaces within an existing development and to analyse spatial and social redensification potentials. The aim is to identify potential locations and sites, primarily leftover plots or unused building land in suburbs / Zwischenstädte / peripheries that are of relevance for the questions under examination in the research project.
At times, the peri-urban space in Graz reaches the edges of the 19th century city. Due to the basin topography of Graz, the Zwischenstadt or "peri-urban space" is shifting southwards into the open Graz-Leibnitz Field. To the north, the area is topographically limited to the access roads Weinzöttlstrasse and Wienerstrasse in the Mur valley.
Until the mid-19th century, the suburbs of Graz, the Murvorstädte, as they are known, including Geidorf in the area around the Leechkirche and Guntarn-Hof by the Leonhardkirche, Jakomini around Jakominiplatz, St. Leonhard, Gries around Griesplatz, and Lend around Lendplatz, were characterised by sparse development. The rural building structure is still visible in the cadastral communities of Graz and in the districts of Liebenau, St. Peter, Waltendorf, Ries, Maria Trost, Andritz, Gösting, Eggenberg, Wetzelsdorf and Straßgang that were incorporated after the National Socialists seized power in 1938. In the peri-urban space i.e the Zwischenstadt these structures form the centre of these districts. Nowadays these rural building structures form the districts centres in this Zwischenstadt or peri-urban districts.

The search for sites in urban Graz was performed by subtracting and limiting the potential area under review on a map of the city. A search was then conducted for sites based on seven routes and multiple inspections of different parts of the city, assessing them based on their potentials and classifying them as leftover areas, gap sites, brownfield sites, sealed surfaces, or developed areas available for densification. This makes it possible to generate an overview of existing or utilisable potential areas in the area under examination.

In terms of planning, the selected areas were overlaid with existing infrastructure (centres, doctors/ pharmacies, educational, religious, shopping, social facilities, groceries shops) and analysed. For each route,

around 1–4 plots were selected for in-depth consideration, depending on their available potential based on the given criteria.

The key criterion for choosing sites was a centre or potential centre in the immediate surroundings. All infrastructural facilities required for everyday life, e.g. accessibility to public transport, pharmacy, doctor, groceries shop, educational facility, etc. were required to be within walking/cycling distance. The surrounding area was to be heterogeneous and display mixed use with residential areas – not a purely residential/commercial or industrial area – and thus have different social and economic potential for joint use of industrial/commercial waste heat, for example. Furthermore, the site was to already be developed in terms of infrastructure (electricity, water, sewage system, etc.). Also, the site was to be a brownfield site or leftover area with sealed surfaces (car parking spaces, building stock, etc.) and no larger than max. 3000 m^2. Developed areas with buildings available for additional storeys, e.g. car parks, etc., or gap sites, do have great potential but are not considered for our research project at this initial stage.

This study/field research revealed that the city has a sufficient supply of sealed surfaces such as car parking spaces (not in use 24/7), single-storey or two-storey buildings (including car parks) that could have additional storeys added, etc. As such, there is adequate potential for redensification so that there is no need to seal any existing green space. Graz must act when it comes to protecting green space in large parts of the urban space. Numerous (mill)streams and smaller streamlets crisscross the city that could be a positive factor in terms of quality of life. They are, however, currently unkempt and thus unattractive and in urgent need of revitalisation, also with regard to climate change and constantly rising temperatures in the city. There are also large areas classified as building land. The closer the edge of the city, the larger these areas are and the fewer gap sites are available. Primarily open development exists that appears disordered and unplanned and in need of action in terms of urban development.

Negotiating the City

Matthew Griffin

The urgent question as to what city we want is determined by the land allocation policy. The openness, diversity and social development of a city depends largely on the procedures and targets accompanying the procurement of land. Communities with mindful procurement procedures pave the way towards setting new standards for participative, socially compatible and sustainable urban development. In that way, citizens can partake in the making of the city and assume responsibility for their place of residence.

Mindful procurement procedures are negotiated publicly and transparently as to which plots are used by whom and for what purpose. Such decisions are not based on economic gain, but on the social value of future utilisation, while also taking into account the economic circumstances of citizens. As a rule, urban real estate is not sold, but exclusively leased.

Procurement procedure, Berlin Central Flower Market

For the first time, three plots of land around the former Central Flower Market in Berlin were tendered in a conceptual procedure as part of an exemplary procurement procedure. With their FRIZZ23 project, the architectural practice Deadline was extensively involved in the process. Possibilities and limitations of that process had a major impact on the project, because the quality of interactions between the bidder and vendor greatly affects the outcome. The co-operation within the procedure was crucial for the success of all three participanting projects and subsequent development of the quarter.

Principles of a mindful procurement procedure

Which factors are crucial for sustainable and integrated urban development when considering the procurement procedure? By considering the following five principles, cities and communities can set the course for future urban development.

1. Building land as a future asset

Securing the future of communities requires ensuring that future generations will have access to communal plots of land. Urban building land is a scarce and finite resource that needs to be treated carefully and sustainably. That is why political and administrative bodies involved in urban development should act as trustees of future generations and not as short-term crisis managers.

2. Cultivating diversity

Whether an urban quarter will be diverse in all of its functions and social structure will depend on the procurement procedure. Joint building initiatives, building co-operatives and other self-organised forms of housing represent a differentiated society. In order to cultivate this kind of diversity, it is necessary for communitees to create conditions which will enable this. Although community-centred buildings are trendsetting, they merely complement public sector housing. Communities, however, will remain responsible for providing sufficient and long-term affordable housing.

3. Building lease as a long-term guarantee for scopes of action

Municipalities secure their interests and that of their citizens over generations if plots are principally awarded as a building lease. In that case, communal land is leased to citizens, investors or local initiatives for a period of 99 years, instead of sold. After that, the right of disposal will revert to the city. Building leases counteract speculation in land value and ensure affordable housing, thus stabilising the cost of living. The city of Amsterdam owns 80 percent of its land, which is leased to private contractors in the form of building leases.
If the city owns the land, it secures a permanent and regular income from the lease contract. In the long run, that income will exceed the short-lived profit of a one-off sale.

4. Lowering thresholds for participation

Procurement processes should not cater primarily to the requirements of professional and institutional investors but should seek to include the wider population in urban development processes. If those processes respect the needs of citizens and smaller initiatives, they unleash a wave of urban investments and innovations.
In contrast to an auction, a mindful procurement procedure is based on the steady and controlled transferral of rights and duties. Municipalities and initiatives act as partners ultimately pursuing the same goal, i.e. dynamic

and authentic urban development.

5. Workshops for optimum utilisation

Frequently, a plot's type of use represents a greater value for the community than its sales revenue and communally oriented utilisation strategies can help to mitigate social problems, particularly in difficult parts of town. If workshops replaced auctions, then local needs, visions and values could be incorporated into project development. For, a development that is deeply knit into the fabric of the neighbourhood can be more successful than one resulting from top-down decisions.

Procurement procedure, Central Flower Market

Berlin-Kreuzberg Central Flower Market's procurement procedure has exemplarily implemented almost all of those principles.
As a consequence of the new land policy passed in 2010, Berlin State, for the first time, conducted a conceptual procedure for the Central Flower Market.
Emerging directly from the procurement procedure, the project group Projektgruppe ex-Blumengroßmarkt (PxB) continues to work on building a mixed and small-scale urban environment.

Point of departure in the procedure was a public debate on the redevelopment of the market hall built in 1965, which is centrally located between Friedrichstrasse and the Jewish Museum. Over several years, citizens, artists and architects did a lot of talking, writing and convincing so that a quarter could emerge there that would express Berlin's creativity, diversity and creative power.

In the end, it was not the highest price, but the best concept that was decisive for procuring the plot.

The procurement was a process in and of itself and was refined in each step. Bidders were required to submit their increasingly detailed projects in three steps, initially for the selection committees and finally, for transparent presentation to the public.

Preliminary workshop: In a workshop procedure on the future use of the plot, citizens and neighbours participated as early as 2011. FRIZZ23's concept was based on the uses defined in this process.

Procurement based on redevelopment concept: From over 40 submissions, six projects were short-listed according to the determined criteria. After exhibiting the plans for the public, citizens were then invited to voice their opinion in a public workshop. Three ambitious projects were selected which had to agree to guarantee completion by the beginning of 2018.

Diverse mixed uses: The selected projects were based on three innovative, yet quite different development models, which would directly establish an intensive and locally integrated mix of uses and users for the quarter's development. As a long-term agreement, a 15-year period of innovative mixed uses was included as part of the purchase contract.

Partnership-based development process: Following the procurement decision and prior to purchase implementation, the projects were granted sufficient time for the final harmonisation of funding in order to ensure that construction work would commence without any further delay after signing the contract.

Dialogue-based design procedure: The architectural quality assurance took place via a 'qualifying procedure' that was especially designed for this plot in a dialogue between PxB architects and city administration. Over a period of 18 months, the projects were intensively discussed and developed further together with representatives of district and senate administration, local initiatives and external architects in four workshops.

Networking hub: PxB projects committed themselves to establishing a mutual networking and communication hub in the framework of the purchase contract. The site office, which emerged in co-operation with the district and several neighbours and initiatives, takes care that the building projects are sensitively realised in the neighbourhood.

FRIZZ23, Deadline's contribution to PxB, stands for a transparent and communicative collaboration between citizens, politicians, architects and investors, with the aim of jointly seeking suitable uses for the plots and implementing those uses in the form of buildings in a dialogic process.

FRIZZ23 First comes the dialogue, then the design

Five years have passed between the plot's procurement and start of construction in which this dialogue has continued on a formal and informal level. The built outcome of this exchange is due for completion in 2018.
FRIZZ23, a building co-operative for cultural commerce, implements this model, well-tried in the housing sector, for a commercial new build for the first time. FRIZZ23 is a particular mixture of art, creative industries, education, food services and retail.
It includes ateliers for artists, studios for writers, scenographers, musicians, cartoonists and co-workers, offices

for architects, online service providers and communication agencies, workshops for upcycling bags and bikes, seminar rooms for vocational training, mini-lofts as guest accommodation, a mini-bar, restaurant and project hall. All project participants are users and investors in one.

The architecture by FRIZZ23 expresses those specific uses and their history in built form. A building is by no means an anonymous monetary investment, but reflects a community of many who together build a vision of the city, which is locally rooted. This project would never have been born without a conceptual procedure.
By means of a sensitive procurement procedure, the city enables its citizens to actively participate. Inclusion strengthens a quarter sustainably in several respects. The projects evolving from it can react accurately to local needs. They bundle creative energies from committed citizens in order to design the city according to the ideas they share. The specific architectonic expression of dialogue-based buildings consolidates the identity of a city because they represent the opposite of an ever-proliferating anonymity of investment objects flooding the market.

The way in which a city deals with its land sets the course for long-term urban development. Ultimately, careful treatment of valuable land resources will be of utmost importance for sustainable urban development.

Two Plots in Graz

Analysis, criteria and screening

While prefabricated, modular and standardised structures are usually planned independently from their later environment, the Intensified Density research project intends to focus on the architectural design process itself and compare the tests of it on several concrete plots of land.

In doing so, hands-on research in the field of architecture is initiated which, on the one hand, strives to link the disciplines with the conceptual level more closely, while, on the other hand, also introduce the architectural planning process into research. Architectural projects evolve within an interdisciplinary process consisting of a multitude of different and varied influencing factors. Problems arising in planning processes exist within a broad range of spatial, functional and design-related aspects that need to be brought in line with prevailing societal, political, economic and scientific framework conditions, in order to activate and develop their potential further. Essentially, the objective is to seek realisable approaches within a concrete plan by applying architectural methods of design and analysis in collaboration with an interdisciplinary and international research team along with external experts, as well as incorporating the project in teaching.

"The Intensified Density project aims to identify possibilities to activate derelict land and to inspire visions for contextually incorporated, trendsetting, higher-density and small-scale dwelling forms."

At the beginning of the research project, we looked forn suitable plots of land in the urban areas of Graz, for instance, unused building spaces, small to medium-sized leftover areas and gap sites. Our search also included developed and sealed building land located in an area classified as "unplanned", fragmented and hybrid suburban regions, or as periphery, peri-urban zones and/or the Zwischenstadt. Primarily, that meant analysing an area that possesses no clearly defined boundaries between the city and country due to urban sprawl and urban districts that have grown together in the past. It is mainly characterised by mixed land use found both in rural and urban regions, hybrid uses with heterogeneous housing development ranging from single-family home areas to multi-storey buildings that directly encounter large-scale special purpose developments, commercial and industrial zones and specified shopping areas, without having any urban cultural or central facilities. Those plots of land, which are now awaiting future development and real estate speculation, are subject to continuous change from productive to post-productive land use.

Subsequently, potential plots of land corresponding to the research question were filtered according to predetermined criteria. In that context, the list of criteria and aspects does not claim to be complete and is not to be understood as a self-contained construct. Making this comprehensive list would not be possible within the frame of a one-year's investigative study. These predetermined criteria are partially subject to the beholder's and analyst's individual viewpoint and are always bound by context and time as well as dependent on the concrete situation, thus representing a momentary appraisal. That means that those basic prerequisites that are seen as being ideal in the frame of this one-year research project are likely to change in the near future of our "fast-moving" times, and could therefore create new basic prerequisites. The qualities, the urbanity of a place amongst others, which were elaborated in a criteria analysis, are not solely derivable from an analysis of facts, theoretical considerations and abstract concepts, but also require for their selection a concrete case study and discussion within the research team.

The following criteria were determined, ascertained, analysed and then implemented:

Place and location

In the category of place and location, it is possible to ascertain objectively measurable criteria relating to being within a short walking distance of the city centre and the centre's function. Besides that, data such as the geometry of the plot, its topography (sloping or level, etc.) and soil conditions including problem sites (containing bombs or contaminated earth), geological soil properties, ground water level and other waterbodies, etc., is ascertainable and comparable and has a direct influence on the economic feasibility of the project (planning and construction measures). Moreover, it was attempted to take into account subjective criteria such as the assessment of the place itself in its ability to create identity with a specific genius loci, e.g. via existing old buildings and residents' general attitude. In

accordance with the research targets, this category receives additional input by assessing the said location in a peri-urban zone and the plot's small scale (as compared to large-scale quarters such as Smart City).

Category
Localised plots can be categorised as follows: small-scale and large-scale leftover plots (plots of land become larger the closer they get to the urban periphery), small-scale and large-scale brownfield area, sealed plots of land, developed land with buildings that could be demolished or buildings to which storeys could be added.
Plots that are built up or sealed due to necessary demolition work are objectively measurable and have a direct influence on the economic feasibility of a project (planning and construction measures). Furthermore, the use of the building or buildings on the plot, as a vacancy, temporary use, parking lot, housing, commercial or green space among others was taken into account.

Additional value and potential
The category Additional Value and Potential subsumes the current proportion of the plot's publicly utilisable space in the form of open green spaces and sports areas where people can spend time without having to buy anything, etc. Furthermore, objectively measurable criteria that had a direct influence on the economic feasibility of the project (planning and construction), such as the effect of pollutants or disturbance through neighbouring commercial and industrial plants, the railway, motorways or heavy traffic were also added to the list. As a subjective criterion, the following potentials regarding social sustainability were taken into account in this category: more publicly accessible green spaces and the need for mixed uses in order to achieve an improvement for the quarter and its residents.

Infrastructure
Criteria relating to the plot's infrastructure (sewage system, power, water, telecom, district heating and gas) and its connection to the road network (existing access road), public transport and cycle paths were also taken into account as objectively measurable technical infrastructures that have a direct impact on the economic feasibility of the project (planning and construction). Moreover, the following existing infrastructures that will become increasingly significant in the future also include the co-generation of energy and heat via commercial and industrial buildings in the neighbourhood as well as the idea of sharing existing parking lots 24/7. In addition, an analysis was made of local accessibility to cultural and social institutions, care facilities and other offers such as schools, doctors, pharmacies, theatres, event centres, sports facilities and playgrounds, etc., including public spaces, such as non-commercial green recreation and sports areas as well as of the plot's access routes and thoroughfares.

Legal parameters
Legal parameters, above all, have a significant direct influence on the economic feasibility of the project by way of their objective measurability (planning and construction measures), which might also entail necessary rezoning due to existing specifications laid down in the current zoning plan. Existing development plans and guidelines, including those regarding the preservation of trees, monuments and townscapes as well as regional building standards and regulations (e.g. boundary distances and spaces between buildings, etc.) can lead to specific building restrictions just like ownership structures (private or public) and rights and liabilities such as easements, rights of use and duty of maintenance, etc.
One of the main reasons for the selection of the following two plots was their location in a peri-urban area, as well as their size and economic feasibility, which favoured planning a project due to on-site conditions such as the available infrastructure, and no or little need to demolish buildings, etc. Other important selection criteria included the possibility and implementation of a project that could offer public thoroughfares and green spaces as additional value to the quarter, as well as the need for a mix of uses.
Two completely different plots of land were selected (place, size and geometry, etc.), in order to be able to test the suitability of different scenarios and variants while considering various concepts.

Plot Fabriksgasse

The selected plot as a basis on which to review our research question

The first plot we selected according to our research criteria (available infrastructure, etc.) is one of a number of brownfield plots that were discovered on walks around the fringe areas of Graz. It is located in the District of Gries directly next to the ramp of the centrally located Citypark shopping centre on Lazarettgürtel ring road. It is an oblong plot that is accessed via a driveway through the rear courtyard of a Gründerzeit perimeter block development on Fabriksgasse. At the moment, it is used as a carpark, mainly by the neighbouring bakery. On its western boundary, a fence alongside the access road via Fabriksgasse currently separates the plot from the grounds of Citypark shopping centre.

Sealed surface | land-use classified as core zone KG+WA + general residential area | building density 0.8-2.0 | size of plot 4393 m^2 + 758 m^2 | plot no. 1398/2, 1411 | cadastral community no. 63105 | registry no. 1096, 727 | District of Gries | plot classified as sealed (asphalt, gravel) | protection zone no, urban redevelopment area | plot prices 150-270€/m^2 and residential rents 8.00-10.80 €/m^2

From an urbanistic point of view, the plot is situated at the interface between historically developed village structures (Karlauerplatz), where, in the 19th century, commercial and industrial businesses first settled along the Mühlgang mill stream, a residential area largely consisting of single-family homes and residential blocks (commuter town) as well as modern commercial buildings and a shopping centre chiefly designed for vehicle traffic (car-friendly city). The area has access to public transport (bus) connecting it to the inner city of Graz. In terms of urban planning, the principle of the functional city has been implemented on a small scale through the functional separation of dwelling and working quarters (Athens Charter 1933, German translation 1962).

Low village-like commercial and residential buildings are confronted with an urban density of tower blocks (vertical city) and an over-dimensioned conglomerate of shopping centre buildings.

Based upon the Learning from Las Vegas study (1968) by Venturi/Scott Brown/Izenour, we investigate the question of what can be learned from a seemingly unplanned place in a peri-urban context. Despite the fact that the shopping centre with its multi-storey carpark and the neighbouring petrol station are obviously oriented towards (transregional) vehicle traffic, the whole area was explored on foot. As a first step, therefore, details that did not seem important at first sight were photographed in the course of our field research and freely categorised according to Venturi/Scott Brown/Izenour.

Design parameter Plot Fabriksgasse

Urban design analysis

In accordance with urbanistic practice, information (plans, studies, etc.) was researched, analysed and prepared for the design process in parallel to our field research. On the basis of the analysis and within the framework of the discussion in the research team, initial design parameters and design-specific determinants emerged which were defined in the form of design rules.

Existing buildings should not be demolished. Vacant buildings should be renovated in an affordable way keeping their original use in mind.

The century-old village-like structure around Karlauerplatz is characterized by some very old buildings such as the bakery, which was established in 1733, and the building on Karlauerplatz 46, which, from 1701 onwards, accommodated a leather manufacturer, and from 1891 to 1896, Johann Puch's bicycle factory. In the 19th century, commercial and industrial factories began to settle along the Mühlgang millstream, a process that is reflected in the name of Fabriksgasse. Essentially, those old buildings with their characteristic appearance not only establish identity but are also historical places of remembrance in the urbanistic context and should therefore be preserved. The area of interest around the selected plot on Fabriksgasse contains a multitude of residential and commercial uses, as well as one religious cultural institution. Some of the buildings around Karlauerplatz accommodate commercial facilities in the ground floor zone with apartments on the upper floors. In the same way, we aim to maintain connection between living and working in the sense of "the mixed and productive city" (cf. Europan 14, 2017) on the Fabriksgasse plot and to test it in various ways in our concepts.

There is no further necessity to develop new spaces for carparks – no underground garage.

The area around the selected plot near Citypark is characterised by a high percentage of impervious surfaces due to building stock and sealed surfaces (roads, car parks). Moreover, the shopping centre possesses a high proportion of parking spaces (multi-storey car parks) in the quarter that are not used to 24/7 capacity and whose potential surface area could be optimised by improving their management. Hence, the figure-diagrams show that there is a significant lack of continuous green spaces. Instead, residual spaces such as traffic islands are prevalent, and there are no parks, playgrounds and sport facilities. Traffic clearly dominates the streetscape's design, especially with regard to feeder traffic to Citypark shopping centre, which is exclusively tailored to car traffic, with a lack of designated footpaths and cycle path connections. Here, the urban short-distance principle has been disregarded.
Provide green spaces and public connections for pedestrians and cyclists.
Most noticeably in the planning area is the lack of thoroughfares and networks for pedestrians and cyclists and the inherent privileged position of vehicular traffic, as well as a lack of continuous green spaces with recreational quality. Both of these issues will therefore be taken into consideration in our following concepts.

Do not build too high.

Essentially, the density of a plot is representative of a certain historical period and its prevailing urbanistic ideals. In the heterogeneous area under consideration, visible are, amongst others, remains of Biedermeier village structures, parts of a 19th century perimeter block development, residential blocks from the 1960s and 1970s and commercial buildings, as well as a shopping centre from the end of the 20th century.
Density is limited to 2.5 in Styria according to provincial building density legislation. Specifications regarding density vary somewhat depending on the size of the city, town or province. In practice, a number of different calculation models are used within Austria: e.g. in Salzburg, the floor area ratio is calculated, while in Styria, only a wall of up to 30 cm thick is taken into account for the gross floor area. By contrast, density is not calculated in Vienna at all; instead, the maximum building height is specified. Furthermore, density is always a question of scale. In Graz, with a population of around 280,000, buildings are principally much lower and have less storeys than in Vienna, a city with a population of 2 million.
As regards building height development and density, Citypark shopping centre and a few residential blocks south of the plot dominate the area under consideration. Reconstruction should therefore reconcile those

differing scales.

In order to strengthen the neighbourhood, not more than max. 7-8 units should share a common access.

In a heterogeneous area such as the one in question, it seems particularly important to strengthen the existing fragmented residential quarters. Here, smaller structures connecting dwelling units and shared spaces, etc. could be especially effective. Neighbourhoods and quarters work well when certain territorial structural elements (zonings, clarity and infrastructure) are given, often in comfortable sizes and units, as first described by Jane Jacobs as 'Defensible Space' in 1961 and later elaborated on by Oscar Newmann in 1972.

Heterogeneity wanted.

Since 2006, the City of Graz has compiled a by now fairly comprehensive Geographic Information System, also known as "quality of life indicator model" (LQI-Modell Graz). The system is available online and provides information about urbanistic, demographic and social situations on the basis of regularly gathered objective data and subjective opinion surveys. That way, in smaller areas within the districts of Graz (in this case, Gries 05-3), local people can be asked as to what action should be taken in terms of satisfaction and importance relating to eleven indicator groups.
This model indicates that our planning area requires urgent action as concerns safety, environmental quality and the cost of living, and a moderate course of action as regards the housing and employment situation and co-existence. The housing situation and, connected to that, the question of whether people are happy to live in their particular quarter is the lowest in the Gries district of Graz at 75%.

In comparison, people's satisfaction with living in the neighbouring district of Lend scores 80,5%, which is much higher. As a result, only one-third of the people living in Gries district would like to remain there. The cost of rented accommodation and lack of job offers in the district also meet with criticism. From an urbanistic point of view, it would be desirable to improve connections to the city centre, workplaces, recreation areas, sport and green spaces and to improve infrastructure within the quarter for pedestrians and cyclists as well as public transport. What that means in practice for planning our concept is that topics such as neighbourhood, integration, quality of public space, but also affordable living and creation of possible working spaces require sufficient attention. In general, people criticise the lack of jobs in the area despite the nearby Citypark shopping centre.

Possible uses and jobs that need to be created in our planning area have emerged from the survey of the LQI model as follows: Organisation of a farmers' market (or a farm produce shop), adult education centre, emergency service centre (ambulances, police force and fire brigade), doctor's surgeries, possibilities for cultural events (theatre, cinema, concerts, etc.) and eateries. There is also a lack of barrier-free dwellings and of available accessible local recreational areas and sports facilities.

Plot Exerzierplatzstrasse

The selected plot as a basis on which to review our research question

The second selected plot that complies with our research criteria with respect to existing infrastructures, besides the one on Fabriksgasse (District of Gries, Graz), is in the District of Gösting. It is located on a side street off the Wienerstrasse, one of Graz's major access roads, leading from there to the centre of the historical village Gösting. Due to its proximity to Interspar shopping centre, the plot's location can be described as central. The building site is situated on a narrow strip between Wienerstrasse and the raised railway embankment and along Wienerstrasse, where there is a mixture of commercial and residential buildings. The City of Graz Urban Planning Department deignated this area as a local centre. Currently, the plot of land in question is accessed via the narrow side of the plot on the Wienerstrasse. Due to the fact that the Thalerbach stream flows along the longer side of the plot, it lies somewhat beneath the street level of Exerzierplatzstrasse. There is a bus stop on the corner of Exerzierplatzstrasse and Wienerstrasse.

Developed area | land-use classified as commercial development area | building density 0.5-1.5 | size of plot 1649 m² + 1816 m² | plot no. 1065, 1251, 383/22 | cadastral community no. 63112 | folio no. 413 | District of Gösting | plot classified as developed (warehouse and residential building) | protection zone no | plot prices 100-276 €/m² and residential rents 8.60-15.90 €/m²

From an urbanistic perspective, the plot lies within a development area that, was largely settled since the end of the Second World War. Along the main access road, the Wienerstrasse, there is a predominance of car-friendly commercial buildings due to the high amount of traffic in the area. Individual single-family homes and other residential buildings can also be found along the road. Both to the west and east, residential blocks from the 1960s and 1970s, set back from the street, characterise the streetscape due to their size. Recently, a new village complex consisting of various blocks of flats, shops and other amenities – the Wohnpark Gösting – was built behind the railway embankment. The area has access to public transport (bus) connecting it to the inner city of Graz. In this area again, the principle of the functional city (Athens Charter 1933, German translation 1962) is discernible; it is characterised by the segregation of a mixed fragmented urban structure through the functional separation of living and working quarters.

Here too, similar to the plot on Fabriksgasse, low, village-like buildings alongside commercial and residential buildings are confronted with the urban density of residential blocks (vertical city).

Based on the Learning from Las Vegas research paper (1968) by Venturi/Scott Brown/Izenour, a spatial urbanistic investigation was commenced by conducting field research on a walk through the area. In an area where cars play the main role and all errands are run by car, there is a lack of cycle paths and pedestrian connections, e.g. to the newly erected Billa supermarket at Wohnpark Gösting on the other side of the railway embankment. The impressions gained from the field research where documented with a camera and then analysed.

Design parameter Plot Exerzierplatzstrasse
Urban design analysis

An urbanistic concept analysis for the above-named plot in the district of Gösting was carried out analogous to the first selected plot on Fabriksgasse. In both cases, findings from the analysis were discussed by the entire research team and, as a consequence, a number of design rules were defined.
An analysis of the historical development of the said planning area revealed that the area in question had remained undeveloped until the end of the 19th century, when a few town houses, tenements and a factory were initially built on the stretch of land beside the millstream behind today's Interspar shopping centre. Accordingly, there is no architecture worth preserving that would create identity. The area under consideration surrounding the selected plot on the Exerzierplatzstrasse is located in direct proximity of the city's main northern arterial road, the so-called Wiener Strasse, which is lined chiefly by commercial buildings as well as single-family houses. Since the Exerzierplatzstrasse provides an important connection to the historical centre of Gösting district on the other side of the railway embankment, our location also offers fruitful ground for linking living and working in the sense of the "mixed and productive city" (cf. Europan 14, 2017).

There is no further necessity to develop new spaces for carparks – no underground garage.

The area around the selected plot is enclosed by the Wienerstrasse and railway embankment. Above all, the raised railway embankment represents more than a mere visual barrier. Principally, building density in the quarter is lower and the proportion of green space is higher due to the predominance of single-family homes. The overground proportion of car parking areas is extremely limited – and there are hardly any public car parks. Interspar shopping centre possesses a substantial number of underground and overground parking spaces that are chiefly occupied during working hours and whose spatial potential could be optimised by enhancing overall management. Car traffic plays a dominant role in the streetscape's design. The as-built plans reveal that there are neither continuous public green areas for recreation and sports, nor playgrounds. There is a lack of designated footpath and cycle path networks, especially on the other side of the embankment. Thus, the urbanistic principle of short distances remains largely unfulfilled.

Provide green spaces and public connections for pedestrians and cyclists.
Analogous to the plot on the Fabriksgasse, there is a marked lack of pedestrian and cycle paths and networks in our planning area and car traffic is prevalent. A direct comparison reveals that although there is a higher quantity of green space due to single-family housing, no publicly accessible green areas offering qualitative recreation facilities are available. The green areas alongside parts of the railway embankment lack any kind of pathways. The following concepts will take both problems into account.

Do not build too high.
The heterogeneous area under consideration contains single-family homes, residential blocks from the 1960s and 1970s, more recent multi-storey housing blocks as well as commercial buildings and a shopping centre (Interspar) from the end of the 20th century. With regard to the different heights and building density, the three residential blocks to the east and west of the plot dominate the area. Reconstruction should therefore seek to reconcile those differing scales.

Heterogeneity wandet.

In a heterogeneous area such as this, it seems especially important to create a centre that will connect the existing fragmented dwelling quarters, integrate the quarter beyond the railway embankment and enhance the quality of the footpath and cycle path network as well. This will result in improved accessibility to the car-focused local supplier (Interspar).
The "Quality of life indicator model" (LQU-Modell, 2013), which is a comprehensive, urbanistic, demographic and social survey of the City of Graz consisting of objective information and subjective population opinion surveys, suggests that there is an urgent need for action in the planning area Gösting 13-1 as regards the cost of living, followed by the job situation, co-existence and healthcare services, as well as with respect to recreation and leisure time. The living situation in this particular district and the related question as to whether people are

happy to live there scores 90.3% for the entire Gösting district, i.e. the bottom third in comparison to other districts. Some 40% of people living in the area in question would like to move away. What is needed from an urbanistic perspective is increased accessibility to the city centre, workplaces, recreation areas, sports facilities and green areas as well as a functional network within the quarter for pedestrians, cyclists and public transport, especially to the area beyond the railway embankment. Thus, in terms of planning our concept, we need to pay specific attention to topics such as neighbourhood, integration, quality of public space, affordable dwellings and creation of possible work spaces. Despite the high proportion of commercial businesses along the Wienerstrasse, people criticised the lack of jobs in the area.

Possible uses and new jobs that need to be created in our planning area have emerged from the LQI model's survey as follows: doctors' surgeries, a counselling and care centre, assistance for elderly people and organisation of homecare services and assisted living facilities, a care and retirement home and adult education facilities. Furthermore, space for associations and their activities, organisation of a farmers' market (or a farm produce shop) and emergency services (ambulance, police force, fire brigade) are required. Besides that, there is a notable lack of barrier-free dwellings.

One Room Planning System

One of our research targets was to develop a modular or prefab construction as an approach, amongst others, to provide affordable housing while also taking into account state-of-the-art developments in the construction business. Modular construction has made huge progress recently, especially in the hybrid timber high-rise building sector, partly due to research with 1:1 pilot projects as well as realisation projects such as HoHo in Aspern, Vienna. The key feature of all those past and present examples is that said construction type was developed independently from and without being tied to a specific place, i.e. without taking the concrete location or plot into consideration. Certainly, the context with its local circumstances and possibilities, possess enormous potential, especially in connection with the use of existing infrastructure such as shopping centres and millstreams, as in the case of the two selected plots on Fabriksgasse and Exerzierplatzstrasse. This has had a major impact on the investigation into the modular and prefab construction developed in the course of this research project.

In conventional contemporary design processes, grid measurements, minimum dimensions and certain standard executions are applied early on in order to achieve a structure and the buildability of the project right from the start, especially when it comes to larger construction projects.

By rationalising the design and execution of the building, this research project aimed to find solutions that would be utilisable in a larger context.
In this approach however, it is essential to distinguish between the development of a specific module or element emerging from a technically controlled solution and a design process that – by means of abstraction and reduction of spatial elements - uses designed modules in order to develop a distinct building from them. Both approaches can lead to a similar outcome. However, the design-oriented approach is expected to achieve a better spatial quality through the prioritisation of space.

In modernist architecture, the grid and the repetition of equivalent spaces has already been used as a means of democratising building complexes. In structuralism, systems were developed which, because of their repetition, seemed to enable endless and flexible spatial interrelationships. Later on, several of those projects were criticised sharply and their existence questioned, particularly in connection with residential housing. In the One Room Planning System it is key to combine the positive aspects of a structural design process with an awareness of context and scale in accordance with contemporary architecture.

This design approach requires deconstructing the hierarchies that define current housing development. Decisions on the size and location of spaces within dwellings are based on functional criteria and cultural standards. That, in turn, means that dwellings often lack flexibility and can thus only be utilised according to a certain standard. Dwellings, for instance, built for families with two children, or for couples, older people or students. Although massively altered family and cohabitation structures have been a recurring subject of architectural discussion in recent years, this has so far failed to bring about any substantial change to standards, laws and regulations.

Inspired largely by the research project's location, i.e. a highly changing peri-urban environment, the development of a flexible structure simultaneously supports the project's long-term sustainability.

The basic principle of the proposed system is, that flexible use of spaces can be achieved by creating a constellation of equivalent spaces. That means, as opposed to the majority of modern and contemporary housing based on a strong, spatial and functional hierarchy, this system will enable the utilisation of spaces for different functions.

Interestingly, many dwellings that were built for the upper classes according to the highly hierarchical and socio-political criteria and standards of the time, particularly in European city centres, are now used quite differently than originally planned. Such dwellings, often consisting of a flight of large rooms that were originally intended for various representative functions, now accommodate extended families, flat-sharers, offices and surgeries, etc.

It is a prerequisite for flexible use, to ascertain the right size for the space and to design the ceiling height as generously as possible. To that end, several alternatives were analysed and evaluated during the research project. The chosen system is based on a planning grid of 1.35 metres, which is often used for office buildings. The grid is designed in such a way that it works just as well for single and double offices as it would for underground garages, and it can be applied sensibly as a structural grid.

The planning modules are square in order to maintain combinability in all directions and the ability to respond flexibly to various different plots and building geometries.

In a test, the three-fold planning grid measuring 4.05 x 4.05 was used. The space was therefore somewhat larger than a conventional master bedroom, i.e. big enough for a kitchen and for a living room when combined with a further module. Those dimensions would also correspond to the size of a normal office.

Since the selected ceiling height is slightly higher than currently provided for in conventional residential dwellings, the module can be used for housing and commercial purposes as stipulated in current building regulations. Moreover, high rooms offer additional spatial quality and enhanced room lighting.

As part of this research project, many different system variants were evaluated and later tested on, and adapted to, the chosen plots. The modules were analysed with regard to their structural qualities in collaboration with our project partners.

Definition, module:
- Technically: modular construction and/or prefab construction
- Design-related: architectonic unit (room module)
Why 4.05 x 4.05?
Planning grid
- 1.35m office
- 3 x 1.35m = 4.05m living space
- 2 x 4.05m = 8.10 construction grid

Room module 4.05 x 4.05 x 3m
- Ceiling height 3m
- Neutral use of rooms
- Old city apartments
Advantages:
Structural
- High degree of prefabrication
- Prefab construction = efficient transportation
- Compact basic structure
- Favourable construction grid = no large spans
Architectonic
- Existing basic structure
- Non-hierarchical spaces
- Adaptable spaces
- Wide range of uses and flexibility of use
- Barrier-free
- Mixed use
- Flexible dwelling configuration

Test dwellings
Various dwelling types

- 2 x 2 modules = 2-roomed dwelling
- 3 x 2 modules = 3 – 4-roomed dwelling
-1 x 4 x 3 modules = townhouses with 3 floors

Test mixed use = constellation of various dwelling types and other functions tested in two contexts and five designs.

Reference Project Modular Housing Construction

Modular housing construction and children's day-care facility Kransbindervägan, Hägersten Stockholm, REALARCHITEKTUR

Modular construction and small-scale densification of suburbs is a core issue that REALARCHITEKTUR architectural practice has focussed on for over ten years.

During the course of the "TenstaBo 06" national construction exhibition back in 2006, possibilities to densify and upgrade a Stockholm suburb were investigated. The winning competition entry for a residential complex submitted by Petra Petersson, REALARCHITEKTUR, Head of the Institute of Construction and Design Principles at TU Graz, was presented on site and utilised by the housing association and the City of Stockholm to establish contact with residents and potential users.

That, in turn, led to a co-operation between REALARCHITEKTUR and the housing developer Familjebostäder in the form of a housing construction project that was completed in 2014 in Hägersten, a suburb of Stockholm. The project encompassed a children's day-care facility and 38 dwelling units, 50% of which were let by a municipal housing association and 50% of which were sold by a private estate agency to a homeowners' alliance. The project, which consists of four types of houses with recurrent basic modules, was built constructed of prefab concrete structures. Having been published several times, the project was nominated in 2015 as one of Stockholm's top ten architecture projects.

An additional building at the entrance to the residential complex accommodates the children's day-care facility. The new residential buildings face a heritage-protected residential complex for workers of the Ericsson factory, an early example of modern housing construction in Sweden.
In view of Stockholm's shortage of housing space, it seems that the city's underdeveloped fringe areas, most of which were built between 1930 and 1970, could offer a promising opportunity to design a new type of suburb. Inspiration for the project's design was drawn from the Scandinavian small town typology with its dense perimeter block development consisting of one to two-storey houses without front gardens, directly fronting the street, and thus creating an urban character.

For the new residential development, four types of houses ranging from two-storey four-room dwellings to three-storey five-room dwellings were developed. As a starting point for the planning procedure, modular room concepts were developed according to Swedish standards that would recur in all four types of houses. All types of houses have an axial width of approx. 5.5 metres and differentiate in their length and height development. The plot, which includes a steep slope, is accessed from a road to the South.

House type B was designed as a two-storey four-room dwelling. Its entrance area is an open design with direct access to the kitchen and dining area. While the bedrooms and bathrooms are at the rear, the living room is located on the upper floor with a terrace facing south. House type A is designed as a longer and thus larger variant of type B featuring an underground garage beneath. House type C was developed so as to respond to the sloping parts of the plot and is therefore designed as a three-storey five-room dwelling variant with a ground floor that is lit from one side. House type D works on a split-level basis, i.e. while responding to the terrain it is nevertheless lit from two sides. All houses possess barrier-free ground floors and are accessed either directly from the street or via ramps.

The individual house types were integrated into four elongated structures which reflect the scale and extent of the existing 1920s estate's structures. Together, the existing structures and the new buildings form shared street spaces and green intermediate zones, thus generating additional value for the entire area.
Although construction costs of the residential housing are low thanks to standardisation, modular construction still allows for an individualised approach to each context. Ultimately, the aim is to utilise the townhouse structure to facilitate not just individual small-scale dwellings, but to create homogeneous and large-scale buildings as well.

What makes Housing Affordable?
Six strategies for affordable housing

Petra Kickenweitz

Owing to a projected population growth of up to 30% by 2030 in the conurbations of Graz, Linz and Vienna (Austrian Conference on Spatial Planning / ÖRÖK, Statistics Austria) and the increasing number of single households (Statistics Austria), it is expected that the demand for affordable housing in urban areas will rise, particularly in view of current real estate market developments and increasing prices ("Die Presse", 7th November 2017). Problems will be exacerbated by an ever-rising construction costs index (Statistics Austria), declining real income, i.e. the income gap has widened substantially since 1998 (Income Report 2016, Austrian Court of Audit and Statistics Austria), and by an increasing inequality of global wealth distribution (Molander, 2017). In 2016, some 18% of the Austrian population (Statistics Austria) were at risk of poverty or social exclusion as defined by the EU. Housing is a basic need that unfortunately still remains unaffordable or barely affordable especially for low-income earners, recipients of state benefits, immigrants, single parents, students, young people, pensioners and artists, etc. Moreover, the number of homeless people (registered homelessness) in Austria is on the rise again (Statistics Austria).

Firstly, overall societal problems are well researched and documented within the context of the affordable housing problem: inequality, land consumption, costs of development, costs of public transport and lack of sufficient local supply infrastructures, etc.
However, the causes of cost increase are manifold and vary from region to region: firstly, radical changes occurring in the housing subsidies sector from 2000 on finally led to the annulment of appropriation relating to funds transferred by the state government to the provinces, in accordance with 2008 Fiscal Equalisation Law, which also means that it is no longer necessarily required to allocate those funds to the housing sector. Hence, budgetary autonomy of the provinces was strengthened, which led to the state government's withdrawal from that particular area of responsibility, while also limiting the scope for government funded action and thus encouraging the deployment of funds elsewhere, either to restructure budgets or resort to speculative investments. This is one of the reasons why public spending alone recently has not been able to meet the demand for affordable housing. In 2018, only about 37 million EUR are available in Styria for just 1400 of 2500 required dwelling units developed by housing associations ("Kleine Zeitung", 9th January 2018). Therefore, from 2018 on, the federal provinces will receive tariff autonomy to determine the amount of housing subsidies contributions they wish to levy themselves, thus perpetuating specific inequalities amongst Austrian provinces (Correspondence of the Austrian Parliament, No. 972, 20th September 2017).

Housing subsidies contributions, which are shared equally by employers and employees have so far amounted to 1% of the social insurance assessment basis.
Secondly, the increasing mass of complex regulatory frameworks (standards, guidelines and provincial buildings regulations) has turned out to be the real cost driver in the multi-storey dwelling sector over the past 20 years. Essentially, they include requirements relating to fire safety, barrier-free accessibility, noise and thermal protection (Energy Performance Certificate), etc. In that context though, it has still not been possible to unify all those different standards in provincial building regulations (ongoing legal proceedings regarding OIB Austrian Institute of Construction Engineering guidelines since 2007).

In addition to that, the personal responsibility of all companies involved in construction is complicated further by more complex planning and controlling processes, which fuels anxieties concerning liability in everyone concerned (warnings and follow-up management). High additional costs from building co-operatives and the fact that those co-operatives in Austria operate more on a "profit" than a non-profit basis often lead to increasing overall investment costs. Additionally, prices for land are high, especially in inner city areas.

Meanwhile, supply not only determines demand on the housing market, but prices are under the growing influence of investment properties (high rate of return) as well. Housing costs are rising faster than earnings (cf. Wippel, Statistics Austria).

In the case of new buildings, tenants face a host of start-up costs: besides having to pay a financial contribution to cost recovery (production costs, construction costs and additional costs) included in the rent calculation, they have to pay for running costs of property services and management, the reserve fund for maintenance and renovations as well as a deposit of one to three months' rent as a security deposit, and maybe an estate agent's fee as well. In high deposits in particular, are a stumbling block for many. Additionally, more and more tenancies are limited to three to five-year contracts which allows landlords to increase the rent more easily. Exemplary regional initiatives, such as the City of Graz deposit fund, which was established back in 2010, or that of Graz Communist Party politicians, who have since 1998 voluntarily paid part of their salary into a relief fund, are attempts to provide financial help in emergency situations.

In centrally located zones within greater conurbations, attempts have already been made to respond with increasing densification. However, there is no comprehensive interdisciplinary and transnational perspective on those problems in place that would allow public authorities to develop appropriate parameters, i.e. means to control re-densification. Sticking to various different approaches pursued by individual states to deliver affordable social housing coupled with a lack of political will to reform is not particularly helpful either.

The assessment basis of Styrian housing subsidies, which limits subsidised useful floor area to the area behind the entrance door, can also be seen as problematic for new developments in the housing sector, because it accounts neither for open spaces and circulation areas nor socially integrative infrastructures such as common rooms and leisure zones, including balconies and loggias (cf. Styrian Housing Subsidies Act 1993/WFG, 1993). Usually, construction costs are assessed according to standard calculations in the construction business (ÖNORM B 1801-1) which are normally based on the planned gross floor area or gross volume.
Additional adverse factors include specific regulations and standards, such as stipulated dwelling sizes eligible for subsidisation and a specified number of dwellings to be developed within two years (Kickenweitz, 2010), which impede an adequately rapid response to current socio-political circumstances such as the 2015 refugee crisis.
This has led to a wider gap between actual requirements and currently available offers. Hence, in Graz some 1150 people are still on the waiting list for a council flat (according to information supplied by "Wohnen Graz" on 14th September 2017). It was only in 2017, after 48 years of entrusting housing construction to building co-operatives, that the city of Graz finally succeeded in providing and funding enough social housing to meet its own demand without requiring housing subsidies (Faunastrasse residential development by Leb Idris Architects, 2017-2018).

In view of their complexity, it is very difficult to compare all of those different perspectives and approaches, and the question of how affordability is measured and defined becomes apparent. To that end, there is an urgent need for comparative research into the states' varying subsidisation models as well as their harmonisation, i.e. a federal guideline on subsidies, including new models of thought, concepts and approaches that will take architectonic qualities and quantities into due consideration as well.

The answer to the question of what makes housing affordable frequently evolves from discussions on affordable housing – and is primarily based on seeking alternatives to common approaches and standardisations (small PVC windows, circulation via recessed corridors and thermal insulation systems, etc.) without compromising the architecture. The following six strategies for affordable housing outline possible scopes of action and approaches:

Participation – do-it-yourself
Participation in residential housing is no new approach: especially in the 1970s and 1980s, several significant projects were realised in Austria by Eilfried Huth, Günther Domenig, Szyszkowitz Kowalski and Werkgruppe Graz, amongst others, as part of the state's 'Modell Steiermark' initiative. When in 1991 political events led to a change of government, that experimental approach was discontinued on alleged grounds of cost pressure.
In Austria, so-called building group projects using housing subsidies are currently only realisable via building co-operatives or developers in possession of a housing construction quota, as is the case in Styria. As opposed to Germany or Switzerland, it is practically impossible to establish a private non-profit co-operative in Austria. Hence, the Sargfabrik by BKK-3 in Vienna (1992-1996), built by a non-profit association, only received state funds because it complied with zoning plan requirements as a residential home. While Vienna meanwhile not only subsidises, similar projects built by developers, but also shared flat floor plans of up to 150 m², inertia reigns in all other federal states.
Even though the participation of future residents in a building project has been proven to promote social interaction and community formation. Interaction between neighbours and

urban interaction spark personal responsibility for and builds identification with the location, thus counteracting problematic social developments such as isolation, loneliness and lack of integration on a smaller scale. Creating open and common spaces such as event rooms, workshops, swimming pools and saunas etc. that are built, funded and used jointly, encourages social interaction and in-house activities (child care, house parties). Projects pursuing experimental and alternative solutions are pioneering in their approach to building standards, ecological living modes and new forms of living such as clusters. One such project is Kalkbreite in Zurich by Müller Sigrist Architects (2012-2014) which combines several autonomous smaller dwelling units into a collective with a joint living room, kitchen and guest room where all necessary infrastructures are shared.
Most building groups pay special attention to social and age-related diversity amongst users. In that context, participatory approaches are multifaceted and flexible and can be considered as early as the planning phase of the urban quarter, in order to implement them already when building, or they emerge from DIY activities such as in the Project Grundbau Siedler by BeL Architects IBA Hamburg (2012-13). Further potential in the course of project completion lies in the dwellings' interior design: final surfaces, cloak rack and kitchen furniture, furnishing of common spaces and designing and planting outdoor areas.
Profit and returns play no role in projects involving participation, self-initiative and self-management, so that living and working spaces, and that goes for inner city areas too, can be secured for the future. Gaps, unused land and empty spaces next to new buildings are often reactivated, either to re-densify a quarter or to upgrade fringe areas.

Reducing standards and basic requirements

In view of lifestyle demands communicated in the media, with individualisation and consumer behaviour leading to an increasing consumption of energy and resources (Statistics Austria) and high building standards owing to a restrictive regulatory framework as mentioned before, the question arises as to what is appropriate, necessary and efficient. For, the average housing space per person required in Austria has risen from 41 m² in 2004 to 44.60 m² in 2016 (Statistics Austria), and is therefore significantly higher than in Germany (cf. Elke Pahl-Weber). Moreover, the average dwelling size has reached 99.3 m², although the proportion of single-person households has meanwhile risen to 37% (Statistics Austria). While the Styrian Housing Subsidy Act even specifies appropriate floor space for single-person households at 50 m², Austrian Tenancy Law stipulates 30 m² as minimum floor space in Category A dwellings.
In countries such as Japan, for instance, where only 23 m² space per person (2013, cf. Schittich, p.15) is required, less than half the useful floor area needs heating for less than half a day in roughly the same climate conditions. Thus, innovation in housing is possible from the perspective of reduced standards and a culturally different way of seeing and approaching certain conditions while maintaining equal standards of life and requirements. Moreover, conventional living functions are outsourced to the neighbourhood and suburbs in the form of new models of cohabitation, e.g. convenience stores, small cook-shops and bathhouses.
It follows that a reduction of standards and basic needs does not necessarily mean functional and creative monotony, or less architectonic or socially-related spatial qualities, but rather a reduction of space consumption.
In order to provide simple solutions which would also be of advantage for common rooms, wall-mounted installations (electricity and HVAC), which are common in many European countries, are preferable. Furthermore, ecological aspects and possible compensation could be accounted for by doing without hi-tech technologies (controlled solar protection, air conditioning by means of natural ventilation, etc.), vestibules, porches, separate storage and basement storage facilities, as well as by providing bathrooms with showers instead of bathtubs.
In that way, a shared and rentable wellness and fitness area could be facilitated.

Easy building – low tech

In Austria, housing and housing complex construction prices have risen by 4.2 % in comparison to 2016. Amongst some of the most significant cost drivers as indicated in the construction costs index are construction steel, steel grids and aluminium sheet metal (Statistics Austria). Additional cost factors include logistics (transport, crane and machine hours, man hours, etc.) infrastructural costs (construction site set up, accessibility, etc.) and material properties (thickness of components, span widths, time-consuming detailed solutions, etc.), which have an enormous influence on construction and its cost. Those, in turn, are dependent on the size of the construction volume as well as Austria's east-west divide, and vary strongly, especially between more cost-efficient urban and more expensive rural areas. Also, country-specific manufacturing methods such as prefab concrete elements for housing construction, which is commonplace in Sweden, were not able to establish themselves on the European market despite globalisation. In Austria, the market is dominated by on-site concrete production, which is

far from material-efficient.
Generally speaking, a reduction of construction costs can be achieved by means of an efficient overall planning process involving, for instance, less highly complex building concepts with a tendency to automation and mechanisation (e.g. cooling and ventilation technology), the use of regional and ecological building materials, due consideration of life cycle costs, which would include renovation and demolition of the building plus the recyclability of building materials, as well as doing without basement floors, underground garages and basement storage spaces, etc. If changes in the climate were given due consideration as well, it would pay off to extensively plant green flat roofs and recycle rain water for flushing toilets and irrigating lawns and gardens.
A building wrapping of translucent, differently tempered and openable climatic chambers as presented in the project 23 Dwellings in Trignac, France by Lacaton Vassal (2009-2010) or in the renovation of Tour Bois Le Prêtre in Paris by Druot and Lacaton Vassal (2011) can serve as a protective screen against high temperatures in summer and as a thermal buffer in winter, thus saving heating costs sustainably. New approaches to the energy autonomy of buildings – e.g. the utilisation of waste heat from neighbouring commercial buildings or the self-sufficiency of residential and commercial units should be supported more strongly. This would help to raise awareness amongst residents and users with regard to the ecological treatment of water, such as water consumption, etc. In that sense, the low-tech approach stands for an intelligent planning procedure that takes local conditions into account.

Prefabricated structures
Prefabricated system construction in the form of modules or elements ensures cost and energy-efficient building construction and cuts construction time considerably while reducing the risk of (building physics-related) damage that would result with a lot of heavy machinery on site. Prefabrication enables utilisation of new materials and develops high performance structural systems, as well as facilitating the systematisation of flexible floor plan uses, i.e. flexibility of the dwelling's specified use. Besides the advantage of reducing the overall planning effort, another important aspect is to potentially save costs by handing over the dwellings in the form of a standardised "superior shell construction". This requires users' proactive commitment and allows them to participate creatively in shaping their own homes.
Many examples prove that prefabricated construction and its related standardisation does not entail any kind of restrictions when it comes to utilisation or design; on the contrary, it leads to innovative solutions that, due to the cost savings, also open up considerable leeway and possibilities (cf. Benze and Kaufmann).

Redensification – urban density
Urban density that is based on the relevant scale of a place and represents the urbanistic value of time-period in question enables cost-efficient construction through the compactness of the building or the quarter. Re-densification is therefore a measure for inner urban development providing improved utilization and cost-efficiency of the existing infrastructure. It also prevents the further sealing of agricultural areas, land consumption and urban sprawl.
Of eminent importance for reviving the quarter and the ground floor level is the attractiveness of the place, its diversity and generosity of intermediate spaces as well as the differentiated design of private / semi-public / public spaces and zones in which future residents and users (including the surrounding community) should ideally participate. In that sense, public accessibility of green spaces and plazas is vital.
For, according to Eberle's and Frank's 19 hypotheses on density, the higher the density is, the higher the proportion of publicly accessible spaces should be (30-40% minimum). However, allocation and development of public and private spaces only commences at a density of 1.2 (quarter-related) and 1.5 (plot-related). Filling a quarter with life depends on the density and use of the ground floor. Hence, a high density of 1.5 upwards (quarter-related) is imperative for lively, mixed quarters. Pedestrian accessibility as a principle of supplying oneself with daily necessities and facilities is only achievable with a density of 1.5 upwards. Very high densities tend to be used more for work-related than residential purposes.

Mixed use
The social fabric of a functioning neighbourhood, in the building and the quarter, is naturally not a given, but can be influenced to a certain extent by providing incentives such as freely usable weather-protected places and non-commercial meeting zones, places with central functions and an urban mixed use consisting of facilities for educational purposes, religious and leisure activities and social and community work so as to generate a social space of interaction and action (cf. Pierre Bourdieu and Henri Lefebvre). To that end, one needs to create spaces for self-management, spaces enabling possibilities that are open to appropriation, future developments and further uses as well as spaces with a multitude of potential uses (i.e. productive city).
For, according to Ursula Kremer-Preiß, the future will not just be about

developing new forms of living, but primarily about developing quarters, i.e. new quarter-related concepts. New ideas about cross-generational living are required that can adapt to people's various different needs in their different stages of life, ideas that will foster solidarity and quality of life while simultaneously spawning participative local solutions. In that context, it is necessary to fully exploit the existing potential of a location (Feuerstein, 2015, p.28f.)
Essentially, rather than just realising a social housing project, we not only need to achieve mixed use in one and the same building, but should also ensure social diversity by providing freehold flats, rentable flats, socially subsidised rented accommodation, dwellings for assisted living and allotted accommodation (e.g. for homeless people, flat-sharing younger or elderly people, asylum seekers, etc.) as well as space for commercial and office uses. As a typological ideal, 19th century historical buildings with minimum ceiling heights of 3 metres could provide flexible usability and facilitate effortless transition to other uses, such as from residential to commercial use and vice versa.

Summary
Although Austria performs well in terms of the Gini coefficient, i.e. the measure to represent income or wealth distribution, compared to other European countries (Eurostat database), more effort must be made to secure educational and opportunity equality for future generations. First and foremost therefore, the land and vacancy rate policy in Austria needs to be rethought. Affordable housing in the form of new builds should only be provided if housing is required locally and there are no other alternatives left to activate and revitalise older or vacant buildings. Also, they should only be realised in places with a fully developed infrastructure in order to avoid additional land consumption and development costs. This would also require public authorities to consistently survey and increasingly secure potential spaces in the form of plots and green areas in order to independently realise affordable housing according to given demands.
To meet those requirements, revising and harmonising housing subsidy legislation, abolishing the subsidisation of single-family homes and new builds on "greenfield" land and adapting requirements related to interior design and dimensions to prevailing demands is absolutely essential. To that end, incentives need to be created for the revitalisation of older buildings and vacant land with sufficiently developed infrastructure as well as plots that provide good access to local centres. Ultimately, all of that needs to happen with a view to reducing private transport usage. Once again, political decision makers are called upon to take appropriate action to create an adequate basis for social change in society.

Modular and Serial Building
What is Modular Building?

Modular building is a system for a construction method consisting of multiple elements. The system is an existing entirety that encompasses a certain amount of recurring individual parts. It is defined by the relationship between the individual parts and between the individual parts and structure as a whole.
This definition is also used in the building sector for 'system building' or 'modular building'. Basically, it implies striving for a bigger holistic and systematic picture of planning and construction, which means that terms like industrialised building, modularity and prefabrication are used in conjunction with modular building. Normally, modular building involves harmonising planning, production, assembly and utilisation processes while taking into account ceiling heights and room dimensions, their modular layout and the resulting geometrical design, element dimensions, spatial relationships and jointing technology within a superordinate "entirety" or "production process". (Nerdinger 2010)
Subsequently, the mechanisation and – to some extent – automation of factory production processes are accelerated under the aspect of "industrialised building". In that way, it is possible to increase the productivity and quality of construction elements in a weather-protected manufacturing environment, thus ensuring high process safety, planning predictability and easier cost control. Moreover, it ensures a high workplace safety and helps reduce injuries at work. Weather-related delays are avoided and workplace quality is substantially higher for those working on site. (Knaack/Hasselbach/Chung-Klatte 2012)

Achieving cost reduction in the construction trade by means of mechanical prefabrication in terms of mass production is no new idea. During and especially after World War II, providing quick and affordable housing for many families who had lost their homes had already become an urgent necessity. In those days, the form of modular construction used was devoid of any architectonic ambition. Many buildings required for military purposes and industrial plants had to be built economically and quickly. As such, those purely functional buildings appeared bleak, unattractive and were frequently reminiscent of emergency accommodation, which caused long-term image problems. That in turn prompted manufacturers to concentrate on using higher quality, i.e. more expensive materials. Cost reduction became secondary and higher demands were placed on buildings.
Inspired by space flight and structuralism, architectural research in the 1960s had already conceptualised numerous modular housing systems and room cells, with some of the best known visionary projects coming from Japan, like Arata Isozaki's "Clusters in the Air" (1961) or Kisho Korokawa's "Capsule Building" (1970-72). Those projects, however, remained unique interventions and were not designed as standard solutions for housing tasks. (Klotz/Fischer 1986)

Today, the adaption of large-format shipping containers such as the "40' Standard" type, which is the standard type used in the transport business, has led to the occasional realisation of individual "container home" projects. In the building sector, container modules are currently used for temporary purposes such as on-site facilities, transitional housing units or for re-densification measures. Meanwhile, a few companies such as SÄBU Holzbau GmbH and Kaufmann Zimmerei und Tischlerei offer complete container solutions for residential purposes. These approaches primarily apply to hybrid construction and additionally involve relatively high planning costs. (Knaack/Hasselbach/Chung-Klatte 2012)

Major aspects for the low market share could be a low level of automation, continuing high levels of skilled manual labour in the manufacturing process and unfamiliar room proportions based on given transport dimensions. However the automatisation i.e digitalisation of the production process represents a huge potential. Planning and managing construction projects is coming under increasing pressure to become more efficient. Faster, more sustainable and on a predictable budget – those are the challenges that one faces today. Crucial for the decision to use modular building methods today is the time it saves. By prefabricating parts, time savings of up to 70% can be achieved (on site) (Lawson/Goodier/Ogden 2014). This is a vital factor, especially in city centres and peri-urban areas. A further positive factor is that noise,

vibrations, emissions and dust can be kept to a minimum. The same goes for infrastructural disturbances caused by diversions or closed roads. Most of these disturbances pose a long-term problem for local residents and the environment, which naturally incurs a considerable amount of costs as well. Since the aspects mentioned above much depend on the chosen material, degree of prefabrication, desired standard and building method, no rule of thumb calculations can be made as to whether on-site operations could be enhanced by using modular construction methods as compared to conventional building methods.
To what extent cost reduction can be achieved in the planning and preparation of a construction project based on a modular planning concept also depends on the management of the building site. To recapitulate, the criteria that need to be emphasized, are the short construction time (school buildings, hotels)the advantages that occur even when modules are only repeated a few times and the good working conditions at production venues including the inherent quality.

Criteria for Structural Design in the Peri-Urban Space

Prefabrication of elements

Since it is not possible to prefabricate the building as a whole, the degree of separation into individual elements entails certain requirements and criteria. In a first step, modular construction can be described in two categories, each of which involves different systemic approaches. Modules can be arranged to form a primary load-bearing structure but can also be conceptualised as self-supporting and randomly stackable individual objects. In the case of modules that are arranged within a primary structure, i.e. a kind of shelf system, requirements concerning the load-bearing structure are shifted from the individual module to the superordinate structure. In the case of stackable systems, every single module must firstly support itself, and secondly, be able to transfer loads from the superordinate structure or from surrounding modules. This implies a system that is systematically oversized. Historical references show that modular concepts were always designed as specific individual solutions for a particular construction site or construction task.

In an initial analysis, no urbanistic plan for these container or capsule/modular buildings was found. Why has this construction type not yet been able to assert itself as an inner-city re-densification strategy? One crucial specificity of modular construction is the subordination of individual modules within a superordinate grid system. Similar to a two-dimensional “pixel” on a screen, this system defines a spatial resolution, i.e. the grid on the construction site. In the context of the endeavoured development on sites with extremely challenging conditions, the all-important question arises as to whether that grid produces unusable residual or leftover spaces, or whether it could be rendered adaptable to specific spatial situations. The more small-scale a grid is, the less residual spaces there will be, which means that modular construction will develop in the direction of construction focused on individual elements. One fundamental challenge of planning is to provide infrastructure such as access routes and technical services to any location within the grid system.

Hence, room modules as closed units that can be juxtaposed or stacked on top of each other are only marginally suitable for inner city leftover plots. Besides that, juxtaposing the units doubles the interior walls, or, the ceilings, when stacked, resulting in an increased gross floor area. That in turn can have an effect on the minimum distances between buildings, fire protection-related requirements, or on the spatial quality of the overall situation. At interfaces between existing structures, a minimum height offset must be observed. To compensate for that, steps, ramps or lifts must be included in the plan. The same goes for the façades, where height offsets need to be resolved creatively.

State-of-the-art modular buildings were analysed during research, which revealed that many efficient systems are already in use. Most of them are consistent with industrially optimised production series. This, however, occurs at the expense of flexibility and creative quality of building systems. One good example for that is how projections and balconies are handled. Frequently, they are added to the basic elements or are placed in front of them as independent structures. This, however, neither leads to formally nor technically satisfactory solutions. Certain rules need to be defined with respect to modular building or planning methods. In order to work efficiently and creatively at the same time, we need to strike a balance between constraints and liberties.

In view of the vast range of available load-bearing structures and construction methods, choosing the right one is a complicated matter. After all, the different criteria that are exemplified in this chapter based on the selected tasks need to be assessed and weighted.

Generally speaking, the design of a load-bearing structure is influenced by many factors such as the basic concept of the structure, the supporting system, materiality, utilisation, legal frame conditions and aesthetical ideas. Finally, the location itself and the spatial conditions on site will likewise have a major influence on the choice of construction method. In the peri-urban zone and inner-city areas, however, these factors play the most important role. (Frank 2016)

Owing to the aspects listed above, in this design, preference was given to a modular building method in the form of elements as opposed to room modules. Here, the bracing works exclusively via the façade, thus enabling a flexible floor plan without being bound to reinforced walls. This variant also allows for larger support-free rooms as well, which in turn means more flexibility as regards future utilisation or reconfiguration.

Dynamics
The peri-urban zone is a highly dynamic environment with changes in building and area uses.
Within a single decade, transformations between buildings with a myriad of different functions such as petrol stations, supermarkets, fitness studios, offices and residential buildings could happen abruptly in any place.
In order to ascertain the suitability of construction types for this dynamic space, investigations were conducted as to varying building typologies and their implementation depending on the region's preferential type of construction. In that context, it is necessary to take into account conventional construction types and the building materials connected to them. Which construction systems are preferable for temporary intermediate uses? Are most commercial buildings in the Graz area steel framed, while ferro-concrete frames are prevalent in residential and office buildings? Diagrams are used to attempt to represent the quality of the individual systems with respect to various possibilities of extension, demolition and conversion in connection with their life span.

Site logistics
What strikes us most when it comes to building in urban and peri-urban zones are the limited spatial conditions on site. In view of cramped conditions, on-site facilities as well as working and storage spaces require logistics that are specifically tailored to the requirements of the task at hand as compared to conventional "greenfield" construction sites.
Due to limited storage space for building materials on the site, it is vital to plan the construction process efficiently. Accurate timing and the resultant comparatively high frequency of deliveries and removals of building material and/or elements are needed to ensure smooth operations. However, it will only be possible to implement a predetermined time plan, and thus avoid additional cost and delay, if site logistics planning and management are spot on.
In this case, the advantage of building with elements is obvious. Construction elements are easily loaded and unloaded and require less storage space because they are ready for installation as soon as they are delivered. In that way, time and valuable storage space are saved. Besides that, elements can be stored at the factory and are thus available at relatively short notice.

Assembly times – site duration
Overall duration of construction work on a peri-urban construction site is directly related to prevailing conditions owing to limited space. The shorter the site's duration, the less noise, dust and vibrations it will cause for residents. Also, working hours could be limited depending on where the site is, which would entail an especially efficient management of available time.
Buildings erected using elements or modular construction can contribute significantly to reducing the duration of building work due to their shorter assembly times. (Proporowitz/Unruh 2008)

Degree of prefabrication
Using prefabricated products, elements or modules has a lot of advantages that can help to save time and money on inner city construction sites. However, the degree of prefabrication depends on different criteria. The larger the elements or modules are, the shorter construction time will be owing to the lower number of connections between the elements and crane manoeuvres, thus reducing the danger of building damage and accidents. On the other hand, prefabrication work and traffic, i.e. air pollution, will increase. And the larger the modules are, the more effort it will take to optimise the planning procedure. Compared to conventional building sites, detailed plans need to be rendered very early on in the project in order to be able to commence with the production of prefab parts, elements or modules. In such cases, the design and planning phase accounts for about 40 to 60% of overall construction time, but hazards and delays are largely avoided. (Fechner 2003)
On the other hand, opting for smaller elements facilitates more on-site flexibility and easier handling. Bringing the elements to their destination is less problematic. Depending on the construction task, it is necessary to harmonise the size of the elements and their relevant requirements with regard to space, possible crane loads and delivery logistics.

Quality control and lack of skilled workers
If a particularly top-quality building is required, for example, with exceedingly high demands on exposed concrete quality, factory prefabrication offers a host of advantages. Likewise, serially manufactured construction components are meaningful if the building's design consists of as many recurring elements as possible. This is often the case for serial housing construction and industrial and commercial buildings. (Frank 2016)
As opposed to on site processes, the offsite production of building elements in a protected environment with controlled climatic conditions as regards temperature and humidity, and independent of the weather, ensures a higher and consistent quality. (Rosenthal/Dörrhöfer/Staib 2013)
Another factor that is becoming increasingly acute in today's building business is the serious lack of skilled workers on site. This is the result of changes in demographic. This change has been apparent for a long time and will only increase in the future. Skilled

workers are becoming scarce and the costs for the available personnel are rising as a result. The lack of skilled workers also leads to an increasing risk of quality defects on the building site. Too few and insufficiently trained workers need to accomplish tasks in too short a time frame, and the costs for well-trained workers is on the rise as a result. This must be taken into consideration when planning load-bearing structures and constructions by planning in-depth and as detailed as possible to avoid potential mistakes on site. In that respect, building with elements or modular construction can help to prevent errors as well as avoid delays and quality defects. A trend towards automation, which is increasing in importance can already be observed, An example of this is the digital building information model BIM.

General infomation

Proof of general structural integrity is required for each building and construction component. This defines the ultimate limit state of load-bearing capacity and usability, and also includes proof of permissible deformation. In an equation, the resistance of the load-bearing structure in its materiality and tectonics is compared with stresses caused by various different loads and efforts. Before, however, the actual performance of a system is calculated, the application of empirical formulae and more abstract considerations on the principal level lead to the structural design. For instance, certain construction types and construction methods are related to a certain catalogue of properties. Knowledge of those categorisations and pertaining properties enables to test their basic suitability for the construction task and design. Many criteria described here guide the planner to a more or less ideal structural design. It is crucial for the verification of modular and element buildings to put a specific focus on a neat and detailed execution of the points of connection. They should function reliably and simply, be easily fastened and, ideally, non-destructively disassembled (Fechner 2003). In that respect, it is important to pay attention to recyclability of those elements (Jäger 2013). Loads are exclusively transferred over these defined points of connection.
As a rule, the following structural principles of skeleton design should be observed: the skeleton's basic structure should be as simple as possible, and vertical and horizontal loads should be transferred as directly as possible. In this case, modelling, calculation and dimensioning as well as deformation prediction are less likely to involve uncertainties, possible sources of errors can be reduced to a minimum and predictions are more reliable. When building with modules or elements, a certain redundancy of load transferring components should be taken into account. In the event that a fastener fails to operate correctly or was not built in according to plan, loads can then be transferred via alternative paths.
Hence, the modular construction considered in this project initially reveals certain geometric qualities that are generally advantageous for a standardised and economic production. This means that discussions are probably looking at predetermined modular units with defined dimensions within a grid system that relates them to each other. Individual modules possess defined span widths and points of connection and, when duplicated, coalesce to form an overall system. From a structural perspective, the challenge lies in the detailed execution of the connections between modules.
Following the project principles, the first support structures for ready-made parts were developed for specific architectural examples.
The results show sensible degree of segmentation into modules and elements. However, these examples are not enough for a general assessment of the efficiency and architectural quality of modular construction. More case studies at alternative locations and with varying configurations are necessary.

The Village Test by Docteur Mabille

Mathieu Wellner

In the Test du Village (Village Test), patients have to build a village with building blocks. In 1949, Pierre Mabille developed Arthus' personality test further by redesigning the test to be more scientific as well as standardized and objective, so that comparable results could be obtained. As a result, the method used while carrying out the test has been considerably improved. The test itself was inspired by a popular children's game, the goal of which was to build a village out of wooden blocks. Most important here is the observation of the test person's behaviour and the recognition that conclusions about the psyche can be drawn from this behaviour. The material inventory lists three types of elements: figurative, non-figurative and less-structured elements. This construction game is based on the idea that the way in which a person builds their ideal village is closely related to their perception of society and their individual mental state. It is no secret, that playing games, not to mention the result, often reveals a person's character. In this game, which involves building a village, it revealed through architecture and urban planning.

The only sources that describe this test can be found in the 154-page book La technique du test du village by Pierre Mabille himself, which was published in 1950, and the 25-minute documentary Test du village (1956) filmed by the Belgian artist Jean Raine. An attempt at a summary and translation is provided below:

Elements
Figurative Elements:
18 houses (36 x 20 x 32 mm), each of the same size and with a red gable roof. The façades and lettering describing their respective functions are drawn on the sides.
There is a mill, a grocery store, a butcher's shop, a shoe shop, a fashion boutique, a hairdresser's shop, a pharmacy, a stable, a wheelwright's shop, an office building, a laundry house, a police station, a school, a railway station, a post office, a hotel, a café and a town hall.
Less easily recognizable elements are a clock tower, two animal and four human silhouettes.
Non-figurative, abstract parts that can be combined:
Six large (47 x 20 x 20 x 20 mm), three medium (35 x 20 x 20 x 20 mm) and three small (26 x 20 x 20 x 20 mm) roofless houses; six large, three medium and three smaller single roofs; fifteen white walls (63 x 12 x 4 mm); ten red walls (34 x 12 x 4 mm), eight green walls (57 x 7 x 7 mm); four small fireplaces; two green pyramids (height: 30 mm) and two bridge arches.
If only elements with easily recognizable functions and forms would be made available, the village would be built exclusively through associations. This would provide insights especially into the patient's social behaviour. If figurative elements are completely omitted, then patients—lacking any context or references—will probably feel obliged to invent something completely new. They could feel very inhibited and react accordingly. Presented with the mixture of recognizable and abstract elements, the patients open up, become engaged in the test and express their ideas.

Table
The ideal table shape is the square bridge table (82 x 82 cm).
The part of the table that is further away from the patient is called "above" while the part that is closer is called "below".
The term "above" is used for the upper part of the table because it requires a small effort to place elements there. It is, in a sense, far away and can be interpreted as an outside world, as a zone of mental and orientation. People who are very dreamy and cerebral build their villages here. They are extroverted, seek interactions with others and enjoy social contact. All the elements on the upper part of the table represent an idealization and have a spiritual aspect. It is the place of the Soi: the Self. One could also call this zone the projection surface.
The lower part of the table shows the Moi: the Ego. The elements on the lower part of the table have a direct, highly realistic, materialistic and almost physical relation to the patient. Patients with a focus on the Moi are more fearful, withdrawn, worried, lacking in confidence and prone to inferiority complexes.
Most people are right-handed, so for most patients, building on the right side of the table is a bit more difficult. They protect the left side, however, with their arm, much like boxers who hit with their right fist and shield themselves with their left. The right side is therefore the side of the table where emotions are displayed, where desires for the future are located.

If a railway station is placed in the upper right part, this is a sign for an escape or a break with something, but perhaps also only the vague idea of a future escape.
If a railway station is in the lower right, however, this is a sign for the physical urge to flee or the desire to change physically.
The left side of the table symbolizes the past, the memory and an inner retreat.
If a railway station is at the upper left, it is a sign for the memory of an earlier separation due to a personal changes. In many tests, trees are placed in the upper left corner. These symbolize nostalgia about childhood experiences in nature.
If a railway station is in the lower left part, it is the sign of a memory of a difficult separation in the past, of an abrupt family separation, or a change that occurred due to a serious illness. At the lower left, one often finds signs for deep conflicts and the existential fears of the patients.

Village design
Concentric village design shows the egocentric nature of a patient. What they truly build is not a village, but instead a constructed decoration around the Moi — around themselves. Such an urban design is characteristic for mostly very simple, infantile and egocentric personalities.
A horizontal design with streets or rivers creates a separation between the upper and lower parts of the table, a boundary line or wall between the Moi and the Soi. If this border or wall is close, the patient is dreaming of the freedom, from this perceived prison, that awaits them on the other side. If this wall is further away, then it represents the boundary of a large plot of land, and the patient is not afraid of strangers.
Vertical village designs are signs of communication, they connect the upper and lower parts of the table and symbolize the desire for contact and participation. The patient wants to create a connection between him and his hidden desires, wants to get in touch with the outside world.
Crossings are hybrid forms of horizontal and vertical designs. They are usually implemented by highly organized, tradition-conscious and orderly patients.
Structures with a centre are characterised by a central element: the centre of rotation. Closed structures around a monument are a sign of schizoid behaviour or of painful autism in the patient.
Dead ends are signs of inhibiting, social constraints that are perceived by patients as major obstacles.
In star-shaped structures, the centre of rotation is an empty, closed space — a symbol for a centre of communication. Patients who create such designs are usually extroverted individuals who push themselves into the spotlight and feel a strong desire to dominate, for example politicians or actors.
Enclosed, fenced village designs, the so-called heap-shaped designs, are a sign of the strong desire to own property. Patients who create such designs do not usually have homogeneous personalities but rather a volatile character and often display neurotic twitches and mental disorders.
Village designs with a separated structure are characterised by the fact that the village has been divided into several separate and spatially different quarters. Sorted vertically, the different social classes may be placed in the different quarters. The rich live in “upper” areas, and the poor live in “lower” quarters. This structure symbolizes a patient’s double life and personality. For example, the patient could be a sophisticated lawyer and a left-wing, extremist politician at the same time.
The presence of scattered structures shows a strong rejection of central elements, which allows for an almost anarchistic multiplication of sensory and intellectual experiences. The paerson strives for freedom and wants to express their modernity. It can also be indicative of a non-Cartesian way of thinking, i.e. cultural reasons.

Questionnaire
1. Is the person being tested right-handed?
2. Have you invented a village? Does it remind you of a village that you have seen? Is it an ideal village?
3. Are you satisfied with what you have created? Did you have enough elements?
4.Did you quickly have a plan in mind?
5.Have you thought about the orientation? Where is the sun?
6. Where is the village?
7. Where do you live in this village?
8. Where is the entrance to the village?
9. Individual questions about particular buildings.

Procedure: (15 - 60 Minutes)
After the patient has sat down on a chair in front of the table, the tester empties a box that contains all the elements in front of them in the middle of the table. She then sits off to the side, positioned slightly behind the patient, but not too far away, so that she can observe the patient’s facial expressions and movements during the test and note key words. She must be very careful not to disturb the patient with her presence. During the test, it would actually be best if the patient were allowed to build his village alone, quietly and without any distractions.
The tester gives her only instruction from the adjacent table: “Build a village with these elements. You have as much time as you like and are free to do whatever you want.” It is very important that the patient is allowed to build the entire village freely. If the patients were given the instruction that they needed to use all the elements,

this would have the same effect as a command. Under the pressure of this command, they would feel as though there would be a right or wrong way to build the village. The standard answers that should be given in response to queries are: “You can do whatever you want with the elements.” and “You have as much time as you need”.
In all automatic productions, such as the dessin automatique or the écriture automatique of the surrealists associated with Pierre Mabille’s friend André Breton, the artists struggle to be able to express their subconscious abilities freely. Only this struggle allows them to pull that which is unconscious into consciousness. The more the Test du Village can emphasize playfulness and bring out that which is unconscious, the more informative the designed village structures will be.

Example
Observation XV, on 10th April 1948. (Figure on page 145)
Monsieur B., a 55-year-old politician and writer, who initially did not want to take part in the test, immediately starts building a closed circle of houses and trees in the middle of the table. He places an arch in the middle of the square (1). In order to make the inclusion of two-storey houses possible, he enlarges the circular arrangement of the houses. He creates a larger building (2) from different elements in the upper right half of the table and connects it with the round square via a straight avenue. He opens the circular construction again on the lower left side to connect a second branch road to the plaza. He places a second arch next to the arch in the middle of the square and places both on a pedestal. He leaves the remaining elements scattered all over the table.
When asked whether it is a fictional village, he replies that it is not a village but a small town or only a small section of a small town. He cites a place in Aix-en-Provence as an example. In his opinion, the object in the centre of his square is an obelisk, although he has built something completely different, namely two arches on a pedestal. To him, the monumental building (2) at the end of the avenue represents a school or a public building. He forgot to add a church and a town hall. He had not thought about orientation at all and does not want to comment on this afterwards. He has deliberately chosen not to include a factory, river, prison, or railway station.
Monsieur B., seemingly a very famous politician and Marxist with brilliant analytical skills, was not be able to convince Mabille. His behaviour during the test, especially when unexpected incidents occurred, was fierce and impulsive, which Mabille considers indicative of a schizoid disorder and paranoia.
The round, closed form of the central square and its symmetry reveal the abstract, theoretical esprit of B., who wants to break out of this closed system and is looking for new ways of communication to do so. At the end of one of these communication channels, the avenue, he projects a public building (2). An institution in which he can be heard. Here, Mabille sees B.’s urge to be a prophet. The other road, which stretches back into the past, is blocked by a tree (3) and seems abandoned. Mabille believes that the monument (1) in the centre of the square with its two arches symbolizes a deification of the female for B., especially since his mother had died not long prior to the test.
The fact that he forgot to include a church and town hall during the test shows that his desire for tradition and social order is purely rhetorical. To start building without thinking about what you want to build shows that Monsieur B. is basically a highly impulsive and non-reflective person. The precise layout, like all highly geometric layouts, shows that the patient seems to float above things. He sees his construction purely with a bird’s eye view and would never live there himself.

Example
Observation XVIII, on 20th February 1948. (Figure on page 152)
Monsieur D. V. is a 31-year-old politician from South America. He suspiciously asks if this is a French game and if he is allowed to use the whole table width during the test. He then scatters all the elements across the table and builds without any layout, without any roads or paths and without referring to the descriptions of the houses. He places a round arch (1) in the centre of the upper half of the table, positions smaller monuments (6) at various locations across the entire surface and sets three, free-standing roofs (4) and three smaller stacks of walls (2,3,5) in front of him on the table. When asked, it turns out that D. V. has intentionally chosen not to build roads to make the whole area (not village) car-free. Children and animals should be allowed to move freely there and should have equal rights.
He puts a horse on top of a house roof. There is no church, shop, prison, or cemetery in his “village”, but there is a mausoleum (2) and a monument to glorify the state (3). Because he placed many trees on the site, it looks like a garden city. Three parallel roofs on the border are tents (4) for guests and visitors. Mabille is impressed by the young, sophisticated politician. Without having sorted the elements beforehand and without considering a method, D. V. instinctively designed this spatially balanced village. The entire surface of the table was used for this purpose. This leads Mabille to recognize a strong desire for freedom. To Mabille, an almost religious idealization of women is evident in the central, arched monument (1) located on the upper half of the table. The

three smaller monuments: the mausoleum (2), swing (5) and hall of fame (3) symbolize the father, the love for children and the personal desire for success. Because he kept elements in his left hand until the end of the test, Mabille diagnoses him with a severe fear of loss.

Example
Observation I, on 24th May 1950. (Figure on page 98)
Mademoiselle C. is a 24-year-old waitress. At the beginning of the test, she digs a hole in the middle of the pile (TAS) and places individual houses and elements into the hole so that she can focus on them. Without sorting or classifying the rest of the elements, she picks up the parts of the church (9) (clock tower, house and roof) and places them in the centre of the top half of the table. She repeats the preparatory phase by meticulously studying the descriptions on the figurative elements. She then begins to sort the houses from right to left on the top of the table with both hands. She then positions the laundry (1), the train station (6), the school and trees apart from one another on the table. She asks "Can there also be a river there?" and gets the standard answer "You can do whatever you want with the elements", whereupon she places some trees flat on the table and declares them to be fish in the river. Later on, she also states that the loose roofs can also represent residential buildings (5). She changes the positions of the elements constantly and, by the end of the test, she has created an ensemble in which the curves of the roads and the river dominate.
The upper half of the table appears very dense and lively, while the lower half seems to be chaotic and without structure. Even though C. had begun the test very full of self-confidence and without any inhibitions, she began to doubt herself after a few minutes and, thus, moved the pieces too hastily and without any method. Her initial desire to study every description on the houses and fathom their meaning and purpose leads Mabille to conclude that C. regrets not having finished her studies. Although she had started her layout with the church (9), she moved the building it so many times that the church was finally lost within the village structure. Mabille concludes from this that C. has no profound religious feelings.
Both the road and the river move towards the left side, towards the symbolic area of the past, childhood nostalgia, dream worlds and holidays. The horizontal axis is inhabited by a police station (4) and a butcher (3) and changes its course upwards. Mabille believes that the functions used for this purpose (police (4) and butcher (3)) show a strong tendency toward sadism, but he attests that C. also has a great zest for life at the same time, because she attaches such a great degree of relevance to the river in her village. In fact, C. had begun, but not finished, an apprenticeship as a midwife. Mabille thinks that the constant doubts and changes observed during the test, coupled with her great imagination, are indicative of a very unstable social life.

Example
Observation VIII, on 18th June 1950. (Figure on page 123)
Madame N. R. is a 23-year-old actress. She initially spreads all the elements across the table and carefully reads all the inscriptions on the houses, but then abruptly takes two abstract blocks and two roofs and puts them together to form a house with two roofs. It's her house (8). She places all the trees around the house to form a dense forest. She places a stable (7), mill (9) and bridge (10) at certain distance from the house to complete the rural idyll. She builds a completely different structure in front of her at the lower end of the table. There, she creates a strictly organized layout of rows of houses, walls, with vertical walls as tree replacements, animals, a bridge (11), etc as a small part of a town.
In a conversation with Mabille, she says she tried to rebuild a village from her childhood: her grandmother's village. She is very dissatisfied with the result, as it would have required many more elements. She did not think about the position of the sun during the test, but spontaneously decides that the sun rises in the upper left corner. The test reveals the split personality of N. R., because, on the one hand, there are few people in the immediate vicinity of their house. On the other hand, the village is much denser and livelier in the lower left-hand part of the table, which is the area of immediate reality. N. R.'s family is bourgeois and famous. Her father was an eccentric artist and drunkard who died when she was a child.
She does not get along very well with her mother. The castle (2) and the railway station (1) at the lower left symbolize the tragic past of N. R. and her desire to free herself of it. In the lower crossroads, Mabille sees the feeling of oppression and a retreat into herself. The street leads to two houses: the house of the cartwright (5) (sadistic behaviour towards oneself) and the washhouse (6) (cleansing effect). Both houses and both types of behaviour are related to the conflict with her mother. Although Madame N. R. seems very brave and realistic, she has the feeling that she is suffocating in her family life and tries to escape from it in her (8) detached house in the woods.

Example
Observation XII, on 07th September 1948. (Figure on page 136)
Monsieur R. R. is a 30-year-old technical employee. He moves the pile

away from himself toward the front of the table with both hands and starts to look at each of the figurative houses. He constantly asks questions during the test: whether there is a time limit for the test, what exactly the arches should represent, why no completed church is offered, etc.? His method of working is fast, rational and logical, because he places the grocery store near the butcher's, in order to avoid having to walk long distances when shopping, positions the animals in the area he has defined as a pasture and puts the mill (4) in a place where he could imagine a river. In short, he invests a great deal of energy when creating the layout of village.
He has no particular village in mind but places his fantasy village in Provence on a flat plain. He had not initially thought about the position of the sun, but he could imagine that it was on his side of the table or that north would be in front of him. The well-proportioned streets, the railway tracks and the river flow almost undisturbed from left to right. His house (8) is located along the river, on the lower right side. Mabille considers the overall result to be a transversal village. The small, plaza-like square in the centre of the village and its position on the edge of a quiet river shows R.'s strong need for peace and quiet.
However, the fact that he asks occasionally puzzling questions during the test shows his functional fear, which leads him to plan his village very carefully. It also shows that he tends towards convenience and comfort.
R. R. is an uncomplicated realist who is highly practical and appreciates specificity. He had lived in the French colonies for a long time and now lives again in France, in seclusion in the countryside. Other tests, such as the Rorschach Test, had yielded similar results regarding R. R.'s personality. Monsieur R. R.'s constant need to question is a way of compensating for fear in order to explain a possible failure and, thus, relieve himself of responsibility.
Pierre Mabille (1904 - 1952) was a French doctor. He held professorships at the École d' Anthropologie and at the Faculty of Medicine in Paris and was a sociologist and a friend of André Breton, who was himself a surrealist. He worked as an art critic and acted as a French cultural attaché in Haiti for a year in 1945.

Testing Five Designs

As part of the Intensified Density research project, investigations were carried out as to whether a small-scale densification strategy using modular construction in suburbs and in-between cities, i.e. the Graz peri-urban area, whilst also utilising existing infrastructure on leftover plots, could be a competitive alternative to the growing sprawl of single-family housing and to large projects (Smart City), which promise to provide ecologically sustainable architecture and town planning. Accordingly, research-related topics were selected and elaborated in the course of the specific design process: Two quite different plots in terms of location and size (on Fabriksgasse and Exerzierplatzstrasse), which were chosen based on field research as specific planning locations in the peri-urban area of Graz, were subsequently developed further in view of the concrete task.

Both plots have access to local infrastructure (transport, sewer, water, electricity, telecom, local heating and gas) and offer additional potential due to their proximity to commercial facilities (Citypark and Interspar) with regard to accessibility of parking space and co-generation of energy and heat. Furthermore, both plots are located near millstreams, which, besides providing quality of life, could possibly generate energy as well. Both plots posed different challenges requiring different approaches not only because of their urbanistic scale, but also due to existing buildings on plot 2's – Exerzierplatzstrasse – land as well as the area's definition as an urban node with a local transport hub in the City of Graz's current urban development concept.
Both plots required considering the following topics in the design process: creation of a public thoroughfare network and sightlines with differentiated zoning of private, semi-public and publicly accessible open and green spaces for the generation of additional value within the area or quarter. Also, a mix of uses and possibilities of spatial reutilisation analogous to the qualities of Gründerzeit buildings, consideration of the local context, use of various different typologies with respect to the height development of new buildings, discussion on existing laws (regional building regulations and spatial planning acts, standards and directives) as well as the study on density.
Hence, three designs were developed on plot 1, Fabriksgasse, and two on plot 2, Exerzierplatzstrasse, which all work along similar lines, i.e. with the same flexible planning modules and three different barrier-free dwelling floor plan types developed according to the One Room Planning System, in order to generate comparability of the designs: the three-floor townhouse (terraced house), 2-room dwelling with 4 modules, 3 – 4-room dwelling with 6 modules that can be split into 1 and 2-room dwellings if required. In the process, three different building typologies and a mix thereof were applied: the terraced townhouse type (linear structure, maisonette), the compact multi-floor dwelling and the high-rise (high density) tower as a vertical densification strategy and the low build structure that obeys the principle of horizontal densification of a courtyard house (low rise, extensive structure). Accordingly, designs 1 and 2 on Fabriksgasse plot 1 were based on the City of Graz's maximum permitted building density of 2.5, while the current zoning plan permits a maximum density of 2. With regard to design 3 on the same plot, it was attempted to ascertain the critical value of urban density and to lower it to 1.6 due to the prevailing development structure. Due to low building density in the immediate vicinity and maximum permitted density of 1.5 as specified in the zoning plan, designs 3 and 4 on Exerzierplatzstrasse plot 2 were based on values of 1.0 and 1.4.
Importantly, the developed modules revealed a high degree of flexibility with respect to the housing typology's organisation, which allowed for a design that would fit into the local context despite plot 2's challenging plot topography, size and configuration. On the other hand, the ceiling height of 3m provided flexibility with regard to space utilisation. All five designs are based on a mix of uses consisting of residential dwellings, offices and commercial and handicrafts businesses. With the exception of the fourth design on plot 2, all designs provide shared spaces for users and for the neighbourhood. Generally it was attempted to generate public open/green spaces and public thoroughfares that would not only benefit immediate users and residents of the buildings, but also offer additional value to the neighbourhood and quarter. Only in two cases were private green spaces allocated to the

respective housing units: design 3 plot 1 and design 4 plot 2.
In those five designs, three of the Six Strategies for Affordable Housing, which had become clear during the course of research, can be directly implemented and taken into consideration via the planning process of our Intensified Density research project:

1. Mixed use: creation of spatial structures to enable mixed use (housing, offices and trade) and social diversity in the quarter (productive city).
2. Redensification: to prevent sealing and sprawl, future new buildings and extensions should be limited to plots that already have good access to infrastructures.
3. Prefabricated structures: modular and prefab construction cuts construction costs decisively and ensures that affordable housing is delivered to lower income households.

It will be vital to investigate the fourth point Easy Building and fifth point Reducing Standards and Basic Requirements during the further development of prefab construction in our One Room Planning System. In connection with the proposals emerging from the design process, this phase has already revealed a high amount of potential possibilities that could be explored in a further project. Moreover, the fifth point Reducing Standards and Basic Requirements, just as the sixth point Participation, is closely linked to user behaviour, because it includes a willingness to reduce basic needs in terms of an ecological and economic way of life, while simultaneously fostering social interaction and quarter formation.
In view of demographic change together with increasing homelessness and single households – currently representing a third of all households in the EU – as well as rising accommodation costs, the importance of functioning neighbourhoods is bound to grow. Hence, (according to details provided by City of Graz Housing Department), as of 14 Sept 2017, some 1,150 accommodation seekers were on the council housing list, 40.5% of whom require single-person accommodation up to 50m², 15.5% for two persons, 12% for three persons and about 32% applied for accommodation in excess of 80m² for larger families of 4 persons and more. With the help of the module we developed as part of our One Room Planning System scheme, we attempted to respond flexibly to those current needs and developments and to offer and present appropriately dimensioned accommodation.

The resulting architecture strives to adapt to the respective existing context and to imagine various different possibilities and scenarios as well. Empty lots are thus seen as an experimental platform that provide the opportunity to test various architectural approaches and to compare the different situations that arise form them. The designs that were presented as a consequence by no means claim to represent a final solution for a small-scale redensification strategy, but rather attempt to paint a differentiated picture, emphasising the complexity of the issue and discussing content and relevant aspects. This means that the focus is on the architectonic design process.

Base with 3 Housing Blocks
Design 1 - Plot Fabriksgasse

Adapting the planning grid to the context
With its three solitary-looking stepped structures resting on a base, design 1 can be seen as an attempt to respond to small-scale urban development and large-scale volumes in the vicinity of the planning area, while taking full advantage of the maximum permitted density as specified in the Styrian Spatial Planning Act. In its composition and elemental interrelationship, this ensemble strives to communicate on an urbanistic scale and to integrate itself in the existing context.

Generating public space and diverse uses
In this concept, the ground floor with its public uses is designed as a shared base upon which the three housing blocks stand. The exterior area on the first floor provides an additional platform for in-house and local residents alike, simultaneously serving as an extension of public space which therefore spans several levels. On the first floor, the public space flows through all three compact solitaires, thus creating an interactive network of passageways as well as interesting visual axes within the building complex.

Adhering to minimum distances between buildings
In principle, distances between existing buildings and design-related structures (separating distances) are observed in accordance with Styrian building regulations. In the area to the west, a private road runs alongside the plot's boundary, which serves as an access route to the Citypark shopping centre. Here, the specified minimum space was not adhered to. In this case, the aim is to share the road for the sake of efficient planning (to avoid dual access routes).
A recess in the south-eastern section of the base volume closes the existing perimeter block development and enlarges the courtyard at the same time, thus forming a 'cocooned' and protected semi-private garden area. This is, above all, intended to enhance residential quality both in the housing complex and the quarter.

No basement floor
As the building's main access and circulation area, the base connecting the three housing blocks is functionally diverse and multi-functionally utilisable, housing all facility rooms (storage rooms, garbage, and technical services) for the tower blocks and shared areas for neighbourhood use, while also offering commercially utilisable shop and office spaces. This design therefore can do without a basement or underground floor completely, which helps to cut overall construction costs drastically.

No habitable space on the ground floor
In view of the plot's location between streets with heavy daytime traffic and commercial spaces, as well as the subjective safety aspect for residents due to the lack of publicly used space, this design includes no plans for habitable space on the ground floor.

Many points of access on the ground floor
By creating a lot of access points on the ground floor and an accompanying network of thoroughfares across the plot, the quarter is considerably upgraded, and existing commercial spaces are linked together in an urban context.

Ensuring flexible and barrier-free use
Meanwhile, the three compact solitaires exclusively offer habitable areas with ceiling heights of up to 3m and non-hierarchically organised rooms, reinterpreting the flexible use of dwellings in historical buildings, therefore also providing space for offices and smaller businesses. Moreover, all dwelling units and accesses on the ground floor and upper floors are barrier-free throughout.
While the horizontal circulation concept for the ground floor tends to foster a flow of interactive pathways and the possibility of a mixed use of semi-private and public accessibility, the vertical access points signalise a distinct separation between private and public spaces. Three access cores, placed at the centre of each solitaire, provide sole access to the dwelling units. At the same time, three public staircases accessing the upper base level create a stepped landscape in the rear area, while at the front, they neutralise the pedestrian zone in the building.

Low Rise - High Rise
Design 2 - Plot Fabriksgasse

Adapting the planning grid to the context.
This design is a redensification concept that takes full advantage of the maximum permitted density as specified in the Styrian Spatial Planning Act. It consists of two independent structures seeking a controversial dialogue, thus thematising the interesting context of the surrounding buildings. While the building to the north develops vertically, the southern building spreads out horizontally. Height development here follows the logic of the ambient urban area, relating on the one hand to large-scale structures, such as Citypark shopping centre to the north and high-rise housing to the south, and to small-scale historically grown structures on the other.

Generating public space and diverse uses
The project offers additional free space in and around the ground floor, which is defined as public, semi-public and private space, by means of its compact volume composition and the stacked vertical area. As a consequence, the courtyard area of the perimeter block development can be extended along its long side in a northerly direction. Pedestrian traffic is guided through narrow alleyways leading to large open spaces. The green open space meets the needs of a residential quarter and is also suitable for multiple uses in this urban district.

Adhering to minimum distances between buildings
Surrounded on three sides by access routes to Citypark shopping centre, the stand-alone high-rise has only one bottleneck on its south-eastern corner leading to a neighbouring building which it does not overshadow.
In some places, the three to four-storeyed building has moved nearer to the plot's western boundary along which runs the private access road to Citypark, extending it by adding a currently missing pedestrian and cycle path. In principle however, the design adheres to boundaries and distances between buildings as stipulated in Styrian building regulations.

Ensuring flexible and barrier-free use
The nine-storey tower is a compact structure enabling mixed use on its vertical level. Its inner composition and room organisation offers a flexible change of uses due to having a ceiling height of 3m, ranging from private to public, from businesses and offices to residential purposes and vice versa. Public commercial use is therefore not limited exclusively to the ground floor. While the high-rise, as a compact building structure, possesses a clear and smooth façade structure, the lower three to four-storey building dissipates owing to its projections and recesses, thus boasting a diverse terraced landscape. The lower building draws a distinct borderline between business and residential housing. The two commercial zones are both flanked by and topped with maisonettes. The three-storey maisonettes form a kind of townhouse complex. In this design approach, many different modular and prefab construction constellations, which form the actual basis of the dwellings, were tried out: from small and medium sized dwellings to commercial premises and maisonettes. All units can be used for a variety of purposes and are barrier-free. That means the rooms of the maisonettes on the entrance level could accommodate offices or studios as well.

No basement floor and multiple points of access on the ground floor
The ground floor zone was planned in such a way that individual commercial spaces were placed between the floor area of the townhouses and semi-private entrance of the housing block, with the aim of enlivening the street both by day and in the evenings and thus increasing people's subjective feeling of safety. In the tower, the adjoining rooms of the dwelling units are positioned at the centre of the building whilst the lighted and externally effective areas are used for businesses and shared spaces. This design too, does without a basement or underground floor. Vertical circulation in the tower is provided by way of a centrally placed stairwell. The low build is accessible on its longer edge running alongside the road to the west, while access to commercial spaces would be available along the longer edge to the east. Here, we find a mixture of private and semi-private circulation areas on the ground floor just as we know from historical urban and village complexes. In this design too, special attention was paid to generating public space by providing a multitude of possibilities to access and cross the plot, which will be instrumental in connecting the various different quarters and uses in this district.

Structural Design Proposal
Material, Construction and System

During the Intensified Density project, various building designs were developed on different plots. In order to assess the capacity of those designs from a structural perspective, a load-bearing design was elaborated for structurally relevant geometry and calculated in the form of a structural analysis.

The Low Rise - High Rise design for the Fabriksgasse plot presented in the chapter Testing on Site encompasses one elongated, flattish structure and a high, compact, yet comparatively slender structure. Being slenderer than the others, it provided the basis for the load-bearing design. Elements and components deemed suitable for this geometry are also utilisable for all other designs with regard to their usability and load-bearing capacity. However, a dimensioning based on the least favourable position of load tends to oversize the components in most designs, thus limiting their economic feasibility. It was therefore proposed to grade the individual elements in terms of their load-bearing capacity and to assess them in an overall context.
A number of basic conditions resulting from the architectonic design needed to be considered for the load-bearing design.
- The load-bearing structure will be built of modules or elements. During the development of the design, the decision was made to use small-scale elements in the form of supports, walls, beams and shear walls for the later structural implementation.
- It was specified that the building height will not exceed the high-rise building limit. A maximum of seven storeys with an approximate floor height of 3 m are planned.
- Reinforcement against horizontal loads will be carried out on the façade plane to achieve a maximum amount of flexibility in the interior.
- A floor plan grid measuring 4.05m x 4.05m shall be used.
- At a spatial depth of 4m, the façade requires 12% lighting area. Based on a 4.05m long façade element, this corresponds to approx. 1.75m^2.
A spatial depth of 8m requires 15% lighting area, which corresponds to a maximum of 4.5m^2.

1.1 Materiality
The table “Structure and material analysis” lists the criteria that have to be considered when selecting materials – the assessment of individual criteria is based on the authors’ experience and research.
To summarise, all materials listed here are suitable for the load-bearing design owing to their very short span widths and simple geometries. Aspects of economic feasibility need to be assessed separately for each project because they are dependent on the site location, season, technical progress and day-to-day material prices. From a purely technical perspective, any of the materials listed above could be chosen. Reinforced concrete was selected for this particular load-bearing design.

1.2 Design principles
The load-bearing structure comprises the following elements, which can be combined as needed:
- Support 250/250 mm, height 3.2 m
- reinforced concrete C30/37
- Beam elements b/h = 250/300 mm, length 4.05 m
- Beam elements b/h = 250/700 mm; length 8.10 m
- Reinforced concrete C30/37
- Wall elements 4.05 x 2.90 m, thickness 150 mm
- Ceiling elements 4.05 x 2.025 m, panel thickness 180 mm
- Reinforced concrete C30/37
- Balcony element, 1.50 cantilever
- Reinforced concrete C30/37

A grid of supports and beam elements spaced at 4.05 x 4.05 m forms the basic framework for the element building, which consists of continuing supports and beam elements attached to their sides. (Wichmann 1989) All joints are flexible and the supports transfer normal loads only onto the element below, while the beams transfer vertical loads solely to the supports, which, in turn, are transferred as normal forces. Possible eccentricities emerging from asymmetrical joints such as in edge or corner areas are absorbed by the support head. The supports are designed to cope with those additional loads. A beam with a length of 8.10 m would also be able to span an axis free of additional support.
This basic grid is not yet reinforced, it only defines the space for other building elements. The horizontal reinforcement should preferably occur on the façade plane, which is why façade elements were developed to let sufficient light into the interior while also being stiff enough to transfer horizontal loads into the ground. The U-formed shear walls are decoupled vertically from the elements above so

that no vertical loads are transferred to the shear walls. Horizontal loads are transmitted axially as shear forces to the shear walls via shear dowels, thus only causing in-plane stresses and preventing any out-of-plane deflection. This, in turn, means that very slender shear walls can be used. Centrally applied loads facilitate single layer reinforcement at the centre of the wall.
The individual ceiling panels (4.05 x 4.05 m each) are each made up of two prefab parts. Ceiling elements measuring 4.05 x 2.025 m are connected floor-wise using turnbuckles to form a shear stiff ceiling plate, which also contributes to ensuring horizontal stiffness. Shear dowels ensure shear force transmission between walls and ceilings, which again guarantees the building's global stiffness. Care should be taken when designing details, so that redundancy as regards the transmission of shear force is given.

1.3 Loads
The following load cases are considered in the structural design analysis:

1.3.1 Dead weight
In accordance with ÖNORM (Austrian Standards Institute) B 1991-1-1:
The structure's dead weight is ascertained automatically
Reinforced concrete
γ_c = 25.0 kN/m³

1.3.2 Additional load
The selected floor and roof constructions are standard for residential buildings. They are also on the safe side for commercial and office buildings (Krapfenbauer 2016)

- Flooring system
$g_{k,floor}$ = *1.60 kN/m²*
Assumed system concrete, 10 cm fill, footfall sound insulation, foil, screed, covering

- Roof system
$g_{k,roof}$ = *2.00 kN/m²*
Assumed system warm roof, walkable, use category H, 6 cm insulation, 3 layers of bituminous roofing membrane, 8 cm gravel fill
- Façade load
$g_{k,façade}$ = *2.00 kN/m*
Assumed system glazing of façade elements
- Attic
$g_{k,attica}$ = *2.63 kN/m*
Assumed system height = 70 cm, width = 15 cm, reinforced concrete

1.3.3 Specified loads
A maximum of residential spaces, office spaces and commercial spaces is planned on the floors. Maximum specified load inside the building therefore amounts to 4.0 kN/m². Circulation areas, stairs and balconies in office buildings are generally assigned to category C3.1. Otherwise, the specified load for balconies in residential spaces is specified at q_k = 4.0 kN/m². If the roof construction permits a lateral transfer of loads, it is possible to allow for the specified load of displaceable partition walls by means of the evenly distributed surface load Δqk, which is added to the specified loads. This evenly distributed surface load, which depends on the dead weight of the partition walls, may be calculated as follows:
Dead weight of the partition walls > 1 <= 2.0 kN/m: Δq_k = 0.8 kN/m² (Krapfenbauer 2016)

1.3.4 Wind loads
Wind loads are calculated according to ÖNORM EN 1991-1-4 and ÖNORM B 1991-1-4.
Depending on the exact form of the building, its surface, geometry and height, it is required to ascertain aerodynamic coefficients based on the building's dimensions. (Block/Gengnagel/Peters/Aubert/Pirker 2015)
An exact representation of these values has been omitted here.

1.3.5 Snow loads
Snow loads are calculated according to ÖNORM EN 1991-1-3 and ÖNORM B 1991-1-3. Depending on the exact building form and other additional recesses, it is vital to take additional load situations such as local accumulations, drifts or ice loads into consideration. (Krapfenbauer 2016)
Thus, the calculable characteristic snow load is as follows: s = 1.30 kN/m².

1.3.6 Earthquakes
Earthquake loads are calculated according to ÖNORM EN 1998-1 and ÖNORM B 1998-1.
Depending on the building design, a distinction can be made between simplified and accurate analysis methods (simplified or modal response spectrum method).
Since it is not possible at this point to define any generally valid response spectra or earthquake impacts, the following basic principles of earthquake proof design are defined according to EC 8, chapter 4.2:

- Design simplicity
Care should always be taken that loads are transferred directly to the ground.
- Regularity, symmetry and redundancy
Floor plan regularity is characterised by an even distribution of loadbearing components, thus enabling short and direct transfer of inert forces developing in the distributed masses of the built structure.
- Bidirectional stress resistance and stiffness
Horizontal earthquake movement is a bidirectional phenomenon that requires the loadbearing structure to be able to resist horizontal impacts in every direction.
- Torsional stress resistance and torsion stiffness
Besides resistance and stiffness in a horizontal direction, built struc-

tures should also possess sufficient torsional stress resistance and torsion stiffness to be able to limit the development of twisting movements which cause uneven loads on different loadbearing elements.
- *In-plane impact of ceilings on the floor plane*
As mentioned before, floors, together with the roof, play a very important role in the overall seismic behaviour of the building. They act like horizontal shear walls that gather inert forces which are transferred to the vertical loadbearing and stiffening elements, thus ensuring that these systems collaborate when it comes to absorbing horizontal earthquake loads.
- *Adequate base*
In the event of seismic impacts, the base's design and structure and its connections to the superstructure should ensure that the overall construction is exposed to a uniform earthquake motion.

1.3.7 Load combinations
The above loads are combined according to Eurocode and those combinations serve as a basis for defining standards such as Ultimate Limit State (ULS) and Serviceability Limit State (SLS).

1.4 Summary
The loadbearing structure with dimensions as stated in chapter 3.3 complies with all loadbearing and serviceability standards. The pillars, beams and ceiling elements comply sufficiently with minimum reinforcement as specified by Eurocode 2, and the beams are slightly higher than necessary (Minnert 2015) so that no vertical loads are transferred to the wall elements. The wall elements have a single-layer reinforcement; a slenderer execution than chosen for this loadbearing design is possible.
The beam element with which support-free areas can be achieved requires a more accurate analysis with regard to excess height, since greater deformations are expected in this case, depending on the number of floors above it. Principally, no more than three floors should be absorbed by that beam.

Urban Village
Design 3 – Plot Fabriksgasse

Adapting the planning grid to the context and being careful not to build too high
The third design can be seen as an attempt to implement the urban redensification concept of low-rise quarter formation by means of one single low building comprising three to four storeys, which aims to reinterpret the perimeter block development concept. In that sense, the building relates to the two to three-storey housing development in the surrounding area, steering well clear of large-scale high-rise and high-density building structures. In that way, the project blends well with the existing silhouette and adds to the present urban contour without changing it.

Generating public space and diverse uses
In order to avoid excessive overall depths and thus unlighted habitable spaces, a longitudinal courtyard was cut into the structure, thus providing cross-ventilation and double-sided lighting to all dwelling units. In that way, a kind of small-scale introverted atrium courtyard was created that is consciously secluded from the street scene. Hence, the publicly accessible space runs through the inside and outside of the building. Moreover, an additional filter is created – a semi-public space – which communicates and differentiates between the public realm, the access road to Citypark shopping centre and the courtyard belonging to the existing perimeter block development.

Creating neighbourhood structures
In an attempt to establish the courtyard as a meeting place for residents and as an interactive platform for social exchange, a higher proportion of external stairs was designed for in the atrium. The stairs divide the building structure into smaller neighbourhood structures of two to a maximum of six dwelling units per floor. At the same time, the flights of stairs represent a visible and significant design element of the courtyard's façade.

Adhering to minimum distances between buildings
Owing to its three to four storey structure and its projections and recesses, this design can respond very well to the ambient buildings and building and plot boundaries in accordance with currently applicable Styrian building regulations. Just as in the other two designs, the private road running alongside the plot's western boundary will be widened to accommodate a currently missing pedestrian and cycle path.

Ensuring flexible and barrier-free use
In order to avoid a long, straight, and thus monotonous contour line, and to achieve interesting small-scale spatial configurations while simultaneously creating residential terraces, it was endeavoured to develop an interesting building complex with a courtyard by creating a series of recesses and projections that correspond to the relevant modules. While from an architectonic perspective the structure is designed to appear rather dissipated and playful, its uses are distinctly defined.
In comparison to the other two designs, this design's smaller proportion of commercial spaces in the ground floor zone is oriented west and north towards the street, whereas the dwelling units are oriented towards the inner and rear courtyards. Hence, a clear zoning of public, semi-public and private open spaces is accomplished. From the first floor upwards, the building exclusively features residential housing, however, the module's ceiling height of 3 m could also provide sufficient space for businesses and offices. By way of differentiated, staggered heights, a mixture of all proposed housing typologies (2.5, 3.5, 4-6 module dwellings and maisonettes) was tested successfully. In principle, all dwelling units and accesses are barrier-free and adaptable in accordance with Styrian standards.

No basement floor
This design also includes multiply oriented, commercially utilisable spaces as well as side rooms which are situated on the ground floor so that it is not required to provide a basement or underground floor.

Contextual Town Houses
Design 4 – Plot Exerzierplatzstrasse

Adapting the planning grid to the context
This design investigates the re-densification of present structures while maintaining building stock. The selected space consists of two plots. The plot bordering the railway embankment is currently occupied by a warehouse and workshop that are in use and the other plot contains an inhabited single-family home and a derelict warehouse. For that reason, the latter will be demolished in this proposal. In adopting this attitude, the hope is to confront the existing surroundings affirmatively and to provide new architecture that will unleash momentum in the quarter. Additionally, the plot will be stimulated by providing a public network of thoroughfares. The small-scale and compact new volume is consciously placed right in the middle of the plot in order to establish a harmonic transition between the single-family homes and nearby warehouse.

Generating public space and diverse uses
The topography of the plot lies somewhat below the street level of the Exerzierplatzstrasse. To the north, the plot is bordered by a millstream and to the west by the railway embankment. In order to achieve a fluid connection on the edge facing the street and to create a sightline between the ground floor zone and pedestrian zone, an extruded base is embedded in the natural topography by forming a basement floor. Hence, the terrain remains principally unchanged – and only to the north alongside the millstream is it slightly adjusted to accommodate a public pedestrian and cycle path. To the west, the access route to the basement floor, which houses storage rooms and parking lots, will run across the neighbouring plot. The built structure separates the public space at the front from the private garden at the rear, thus distinctly differentiating between public, semi-public and private zones.

Ensuring flexible and barrier-free use
The building consists of four slim, stacked three-storey townhouses which are oriented towards the north and south. All of the maisonettes are adaptable for barrier-free use (staircase with lift, enlarging the washroom). Each dwelling unit possesses an elevated access in the north, thus establishing a clear differentiation, visual and structural, between the publicly utilisable pedestrian and cycle path and private housing access. In view of the module's neutral configuration, the ground floor could also be used for offices and studios. On the edge facing the garden, the structure's length is reduced to one module, thus forming generously dimensioned terraces.

Adhering to minimum distances between buildings
This design's three-storey building adheres to currently applicable Styrian building regulations with respect to building and plot boundaries. In this case, however, there is less distance between the buildings because the existing single-family house and the planned new build occupy the same plot of land.

Fitting In
Design 5 – Plot Exerzierplatzstrasse

Adapting the planning grid to the context
With the intention to test a whole range of possibilities on the plot the developed modular construction offers, and in view of the fact that the urban planning department in their urban development concept envisions the area as a future urban node owing to a planned local transport hub, the final design aims to use the maximum area of both plots of land and to demolish existing structures. The result is an area which serves as a basis for a new 'experiment' and presents us with a different set of tasks that requires a corresponding approach. To that end, it was decided to use Interspar shopping centre on the other side of the Wienerstrasse and the housing development beyond the railway embankment as points of reference, and to choose a building structure with a mix of uses that would be more in tune with the future node development.

Generating public space and diverse uses
As a first step, the topography of the area to the west, adjacent to the existing access, is raised to street level in order to generate a public forecourt that opens up into a small park between the two new buildings, thus extending the public space well into the plot. Pedestrian and cycle path connections to Wienerstrasse run parallel to the millstream's course On this elevated base, two compact volumes are consciously set at an angle to each other, while the second smaller building follows the street contour in its orientation. In that way, an interior space is generated as a place for further possibilities. Pedestrian and cycle path to the Wienerstrasse is located along the millstream. A public transport connection running along the foot of the embankment is planned to serve the residential area beyond the railway embankment.

Ensuring flexible and barrier-free use
While the higher five-storey building which is closer to the noisy railway line offers a mix of commercial uses on several floors, the protected lower, four-storey building has a purely residential function. All units are designed barrier-free. The ceiling height of 3m ensures that all units can be used flexibly, i.e. as dwellings, offices or commercial spaces. As for the height development, the buildings are staggered by 1.20m. The larger building, which is accessed from the forecourt, features commercial use on the ground floor in order to stimulate the public space. The concept of maximum compactness, interior stairwells and shared terraces, etc. aims to achieve structural and architectonic cost efficiency.
Both buildings possess car parking spaces in the basement and on ground floor that are accessed from the plot's narrow edges to the west along the railway embankment as well as from the existing access on the Wienerstrasse.

Adhering to minimum distances between buildings
This proposal with its two buildings bridges the gap between high-density and high-build structures and low-build development. Both plots of land are viewed together with respect to the minimum distance between the buildings. Clearance to plot boundaries is observed in accordance with currently applicable Styrian building regulations.

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Concept and design assistance
Donika Luzhnica, Gresa Kastrati

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Y'plus – Maria Nievoll

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