SMART CITY CHENGDU
an installation for the 2011 Chengdu Bienalle, Holistic Realm: International Architecture Exhibition, by, Raoul Bunschoten with CHORA and a+p|chora
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Map of The Peoples Republic of China, highlighting the Sichuan province and Chengdu.
In March 2011, The Peoples Republic of China issued its 12th 5 year plan. In this, Climate Change played a key role and it defined serious targets to which its provinces adhere to. The plan outlines the goal to source 11.4% of primary energy consumption from non-fossil fuel sources by 2015. Combined with a 17% reduction in CO2 emissions per unit of GDP (carbon intensity) by 2015, the country seems well on its way to reaching the 40-45% drop in carbon intensity set out in Copenhagen in 2009. These kinds of environmental objectives, combined with the forecast growth rates (over 9%), generate the requirement of low carbon projects at an urban scale. Preceding this is an infrastructure that can accommodate and nourish such projects, allowing them to grow from a business plan to a physical object with an impact on the urban environment. This is a Low Carbon Incubator, where critically vital climate change planning is tested and nurtured.
Chengdu

The city of Chengdu, capital of the Sichuan province, is one of the several official development zones outlined in the latest 5 year plan. Currently it is a favourite for investment from major international enterprises with Intel, Cisco, Sony, Siemens, Foxconn (makes of Apple products) and Toyota holding assembly, manufacturing and corporate bases there, as well as Motorola, Ericsson, and Microsoft having R&D centres in Chengdu. Dell plans to open its second major China operations centre in 2011 in Chengdu, whilst AMD (Intel's rival in chip manufacturing) aims to set up an R&D centre in the city. There is also national investment into the bio-pharmaceutical sector there as well as high tech industrial parks for software, hardware, space and aviation technology.

Chengdu is already a powerhouse of innovation and production (known for its fabrication of 1.2million iPads every month). The Bureau of Commerce aims for the city to grow in the tertiary sector by 13.5% in 2011 as well as maintaining an 18% increase in consumer sales and 44% increase in exports. It has recently achieved such accolades as The Worlds Fastest Growing City in the Next Decade by Forbes, China’s Happiest City, by Oriental Outlook, and by October 2011 Chengdu will produce 100 million computers, accounting for 20% of global output.

Historically Chengdu’s expansion has been achieved through concentric growth, in which, the city expands in ever-increasing rings. Currently there are four; however a fifth is under way. The first two encase the main urbanised districts of the city, as well as the location of the original city wall built in 311BC. It houses approximately 960,000 people, and in the densest manner of all the rings. Beyond that is the third city ring, currently used as an urban mobility tool, and the fourth ring, which acts as a green belt. As the population within the city limits recently reached 14,000,000, demand for a high-speed fifth ring motorway has sparked the debate of the future of Chengdu’s planning. Traffic throughout the inner rings has reach a point where cars now alternate days of access (based on odd or even number plates), as an attempt to alleviate circulatory traffic.
Map of Chengdu, showing the rings of the city and the green belt
The 5th RIng as a holistic Low Carbon Incubator

The development of this fifth ring is an opportunity. It may allow Chengdu to shift towards a low carbon trajectory and away from static, heavy and inflexible infrastructures. The construction of a motorway of this scale today must consider the targets set out by the state in regards to climate change. In 50 years we will be deep into the transition to electric personal transportation, with the potential for intelligent guiding systems. This implies a smart infrastructure that will easily adapt over time without becoming redundant. An adaptive, additive and expansive infrastructure will allow the stakeholders involved in the progression of the city to scale up - as larger agents approach, the infrastructure can be modified to acomodate them.

A truly smart strategy will address carbon production targets not only through technology, adaptability and policy but also through the integration of this with the newly emerging lifestyle in China today. This change is the result of the growth and development of Chengdu and China that was previously mentioned. Such growth creates a New Chinese Society, that allows it’s citizens to enjoy a new lifestyle, which in turn, has the potential to become a smart lifestyle. A smart city allows this by integrating all systems, cultures, socieities, and is achieved by a smart infrastructure. This is a holistic strategy where the fifth ring can lead to such integration (nature and city, urban and rural, high and low tech, inside and outside etc) as it evolves. Nature can be seen as a resource, both psychologically (recovery and leisure) and technically (biomass, water purification etc).

These factors imply an ideal, or utopian, socieity. By examining and referencing popular western utopian concepts, this new type of lifestyle can relate to a new architecture. The architecture has to lead the way by creating cultural, social and economic identity, which people can relate to. Design is at the heart of this, not just planning.

Raoul Bunschoten, director of CHORA, meeting the Chief of Planning in Chengdu and the co-curator of the Biennale.
Developments along the 5th Ring, as viewed from motorway traffic
Chengdu Powerhouse

Chengdu’s infrastructural boom has run parallel to its demographic boom. The population of Chengdu now stands at 14 million, an increase from 10.2 in 2001. This has fueled public and private investment into road (the 5th ring), rail (a new subway network spanning the entire city), space (Chengdu has 1 of China’s 4 space centres) and Air (Chengdu Airport has been transformed to fly internationally). Chengdu’s popularity for foreign investment has risen proportionally to its size; 133 of the World’s top 500 largest corporations had a presence there by the end of 2009; including Intel, Sony, Toyota, Motorola, IBM, Nokia, Siemens, Canon and Microsoft, all of which operate assembly lines and / or research and development centers in Chengdu.

Graph showing Chengdu’s population rise
Chengdu houses 10 of China’s largest companies

Chengdu’s top 3:

1. The New Hope Group: China’s largest agribusiness with over 380 subsidiaries and 60,000 employees is Chengdu’s largest company.

2. Sichuan Kelun Pharmaceutical Co., Ltd. is principally engaged in the research, development, manufacture and distribution of pharmaceutical products, with a major focus on injection related products. 2010 revenues were RMB 4 billion.

3. Billion Tongwei Co., Ltd. is principally engaged in the production and distribution of feedstuffs, chemical products and new energy products. In 2010 it had revenues of RMB 9.6 billion.
Didactic exercise with students at FHD University, Dusseldorf, developing the utopian plans that attach to the fifth ring of Chengdu
INFRASTRUCTURAL UTOPIA

Previous twentieth century thinkers have devised utopian visions that attempt to deal with the issue of mutating infrastructure, urbanism, lifestyles and perceptions. Working with students at the FHD University in Dusseldorf, these visions were interpreted, adjusted and then related to the fifth ring of Chengdu as a series of attached sectors. Three examples are presented here, some of which were used as examples of utopian sector planning.

1. Andrea Branzi – Weak Urbanism

Andrea Branzi coined the term ‘weak urbanism’ to combat what he saw as strong, definitive planning acts characteristic of classic modernity. Branzi echoed the idea of a mutating infrastructure and felt that the idea of conceiving permanent solutions to problems which we are unable to predict was unnatural and that it more sensible to create flexible impermanent processes which could evolve, reverse and ultimately decay.

The idea of shifting, rotational components which could operate on a variety of scales followed through into his 2010 Venice Biennale Installation, ‘Ten modest suggestions for a New Athens Charter’, which includes:

1. The city as a high-tech favela.
2. The city as a personal computer every 20sqm.
3. The city as a place for a cosmic hospitality.
4. The city as an air-conditioned full space.
5. The city as a genetic laboratory.
6. The city as a living plankton.
7. Research models of weak urbanism.
8. Realise faded and crossable borders.
10. Realise great transformations through micro-projects.

Branzi is one of the primary exponents of smart infrastructure. Although through low-tech means, he encouraged architects, designers, and planners etc to consider the evolution of urban planning.
2. Constant’s New Babylon

Constant Nieuwenhuys worked for over twenty years on the development of his utopian vision, New Babylon, for the Netherlands. New Babylon is based on two assumptions; the socialisation of the ground plane and the complete automation of production. Constant envisaged a new world order that defined freedom of movement in society.

In New Babylon man does not have to work. In this new society the inhabitants lead a nomadic, acontextual existence and one can be a fully creative being; he becomes ‘Homo Ludens’.

Constant presents New Babylon as a network or series of units that form a “camp for nomads”. These basic units, the so-called “sectors”, are independent from a construction point of view, and will lie on top of the existing city. The ground surface mainly consists of uncultivated space which can be utilised for fast transport links - in this way, stratification occurs which constitutes the spatial layout.

The free man must respond to the need for playing, adventure and mobility. Starting from this freedom in time and space, we arrive at a new kind of urbanisation. The human being has no links with anything or anyone, and moves independently through the landscape, using the sectors as and when he requires.

Complete automation of non-creative practices is essential to permit the free development of creativity. Therefore urban development is accomplished by machines and robots. These structures are anything but permanent; the development is in continuous transformation, in which the time factor plays an important part. Units are fabricated like flat-pack furniture, standardised and produced ready to disassembled at a moments noticed and moved on.

Just like the infrastructure of the future, Constant’s vision of Homo Ludens assumed total mobility and flexibility of structure. Where his examples may maintain a regular programming, the utopian infrastructure may switch between mobility, shelter, energy creation, water treatment etc, as society and the environment demands.
3. Cedric Price – Potteries Thinkbelt

Radically rethinking the basic concept of a university, Price envisioned a mobile learning resource for 20,000 students utilising the infrastructure of a declining industrial zone. Largely in response to the rash of university campuses being built during the 1960s, Price’s proposal transformed the derelict Staffordshire (UK) potteries into a realm of higher education, mainly on railway tracks, creating a widespread community of learning while also promoting economic growth. His proposal took advantage of local unemployment, a stagnant local housing programme, a redundant rail network, vast areas of unused, unstable land, consisting mainly of old coal-working and clay pits, and a national need for scientists and engineers. It offered a solution to the need for educational facilities whilst also offering to do something about the economic and social collapse of the Potteries.

Potteries Thinkbelt occupied a large area of once vital Staffordshire Potteries. It was designed to be an infinitely extendable network as apposed to a centralized campus. The framework for the network was a 100 year old railway system no longer in use that would transport people between housing and learning areas. Cars would become mobile teaching units. Carriages were designed to have a finite life and were to be continuously implanted and, eventually, supplanted. The rail and road network transports people across the site and allows teaching units to be combined and transferred to various sites as needed. The Potteries Thinkbelt also promotes economic growth in the declining industrial area.

All of these concepts pave the way towards the ‘smart city’ as a holistic project, and even a low carbon plan by implying an adaptive and multi-purpose structure - something that may prove crucial to the transformation of Chengdu’s fifth ring.
Sector forms as designed by FHD University students
The basis of a proposal such as this is the territory (or liminal body). This is composed of two or more neighbourhoods meeting at a site of tension, prosperity, sharing etc. Above this territory is the metaspace, the complexity that connects the communities on either side through a toolkit called which we call the Urban Gallery.

Incubators are where ideas are born and start-ups are tested and proved. Ones that succeed are stimulated, ones that fail are discarded. The key thing is that they share space and resources, within which there can be cross-pollination, mutual influence and development. A competitive nature exists whilst allowing for the accidental discovery of connections and interrelationships - these interrelationships are key to incubators of any type.

This is a requirement of a low-carbon plan, which needs a territory and complexity in order to thrive. In this case, the territory is the boundary of the fifth ring that separates urban and ‘rural’ lifestyles and the complexity is the programming and action of the infrastructure. [See Figure 5 – Sketch of Territory]

Other urban design incubator projects include the Energy Incubator, Tempelhof, Berlin and the low carbon smart city incubator, the Taiwan Strait.

1. Tempelhof, Berlin, Germany

The Site of the former Tempelhof Airport has, because of its spatial dimensions and its historic significance, unique opportunities to show how the future of our cities is going to look like: Low energy structures, energy producing systems and smart networks.

Chora proposed a new type of landscape around the central park (designed by Gross Max): A space where technologies and nature merge; a space where energy is produced by a series of different technologies and a space for learning and experiments. [See Figure 6 – Tempelhof Vision]

Clustered around this ring was the development of several new city quarters within the context of an international building exhibition [See Figure 7 – Tempelhof Plan]. At the core of our proposal is the creation of an innovative...
management instrument which allows for participation of various stakeholders and inhabitants. This instrument also dynamically adjusts the process of the development towards the ambitious goal of Tempelhof in becoming an energy producer: Tempelhof becomes a communal space which connects people, supplies energy for the adjacent districts and implements the goal of the German government to lower CO2 emissions, radically.

Tempelhof airport can become a bridge towards showing how a future, of lower energy use and lower carbon emissions, can look like while providing a high quality of life for local residents and creating a symbol of hope and renewal for the city. Our proposal combined local and incremental steps that can each be negotiated by local communities and other interested parties to set up a process based development that is not imposed on anybody but asks everybody to be engaged. Such a process based development works as a participatory tool and has the potential to become a radical proposal by the engaging energy that supplies houses and the rest of the city and other green technology related industry. It demonstrates how an integrated plan for the whole area could lead to transforming the economical, social, cultural and political context into an alternative power plant: This scheme won the first prize in the Tempelhof Urban Ideas Competition, Berlin 2009.

Tempelhof becomes an energy generator through a range of measures that add quality of life to local residents as well as contributes to the overall city and German target of lowering CO2 emissions in cities [See Figure 8 – Tempelhof Visualization].

2. Taiwan Strait, PRC

Taiwan Strait Climate Change Incubator is focusing on the cross strait relationship between the two cities of Taichung and Xiamen, and their collaborative effort into creating an incubator for renewable energy and energy efficiency pilot projects. The first step in realizing part of this Incubator project has been taken by the Taichung City Government with a strategic energy plan for Taichung, jointly commissioning Chora and Tung Hai University. This plan aims at establishing new policies and regulations for planning and construction.
Both Taichung and Xiamen can turn the policy into mandatory regulation. Parallel to this, Chora were commissioned to establish an energy masterplan for Xiamen, China, which was concluded with an interactive digital model of the city. This model visibly demonstrated the changing nature of the city, in terms of active climate change prototypes, in response to external (public) intervention and indication.

This alternative incubator for low carbon cities is a specific pilot proposal for a low carbon plan [See Figure 10 – Low Carbon Incubator]. It is to be published early 2012 in the form of the book ‘Taiwan Strait Atlas – Towards a low carbon incubator’ as well as various pilot projects within both cities [See Figure 9 – Book Cover].

The reality of this pilot project is the liminal body. In this case it is the strait between Fujian Province and Taiwan. Over this natural boundary spans human interaction, with trade between mainland China and Taiwan on the rise (cross strait trade increased by 36.9% in 2010) [See Figure 11 – Vision towards a low carbon incubator region].
Taiwan Strait Atlas, vision towards a low carbon incubator region
Raoul Bunschoten speaking at the opening ceremony of the Chengdu Biennale.
Low Carbon Incubator

Today, the equivalent of an urban utopic design, like those described earlier, has shifted towards low carbon planning. This is an exciting idea to aspire to however there are many unknowns and variables preventing the immediate success of such a development. To lower carbon emissions as dramatically as China is proposing to is a difficult achievement to perform in one take. It begins by starting with a specific project – a large scale pilot – through which we can demonstrate the possibility to create a smart city. It acts as a startup and initiates the learning curve.

In order for the fifth ring to succeed as a smart city it must satisfy four main objectives. They are, sufficient branding, occupancy of a clearly marked space, possession a set of flows (traffic, energy etc) and must be well managed. Chora proposes to use the fifth ring as this international prototype which can both become the site of a large range of renewable, efficient and highly technological measures, and, become core, adaptable infrastructure which can eventually serve the heart of the city and its high-speed traffic, whilst expanding outwards.

The fifth ring of Chengdu is inevitably a boundary between lifestyles. It is a liminal body between natural and urban development, thus solidifying itself as an opportunity to become a Smart City Incubator. Chora has developed an operating system to encourage and aid this called the Urban Gallery. It is a planning support system aimed at curating information and choreographing action, it has four levels...

1. Pressure
The pressure is the driving forces at play. Currently the pressures are the expansion and growth of Chengdu, the need for a new motorway network, government climate change targets as well as the drive to become a global pilot project.

2. Toolbox
The toolbox is the ingredients for a Smart City; it’s what a city has to do to become low carbon. The Smart City is a pilot project that activates these ingredients in the right quantities in order to improve its status as a low carbon plan [See Figure 12 – Taxonomy of Prototypes].
3. Spin
The spin is the story behind the plan, how it is told and who to. It represents the relevant stakeholders such as city government, provincial government, local communities, new inhabitants, local investors and project developers and foreign investors and experts. Vital to the project’s success are the corporate developers who stake a claim in the plan and encourage it to adapt.

4. Onto the Stage
This is where the incubator takes place. In this case it is the fifth ring of Chengdu. It may be divided into sectors, in which famous visions by well known architects of utopias are curated and planned, which become receptacles for the toolbox. This allows us to begin addressing the targets and relieving the pressure, thus satisfying the stakeholders.

If cultivated correctly, the Chengdu fifth ring can become an international pilot incubator pioneering the Urban Gallery as it’s operating system.
Xiamen Energy Masterplan, timeplan showing the Urban Gallery over time
Chora

Chora’s CDB11 installation attempts to visualise and simulate the Chengdu Smart City Incubator and it’s affect on energy use and carbon emissions.

The fifth ring of Chengdu is represented by a tabular surface embellished with utopian visions at it’s sectors. These visions are exemplary sectors or districts attached to the ring. They act as a metaphor for the planning and development of the fifth ring of Chengdu. It illustrates the 5th ring as a potential incubator for smart developments and demonstrates the need for a widespread and versatile application of a low carbon planning and construction toolbox.

The toolbox of prototypes is presented in a playful manner as a vast quantity of custom dice, which carry a selection of icons relating to a complete, low carbon, urban toolbox. Like the start of a MahJong game, dice are thrown across the board to represent the provision of various prototypes throughout the fifth ring. Their location is not meaningful; it is about reaching targets through proliferation and critical mass of operational prototypes and effective policies.

This method of demonstration (interactivity, critical mass etc) allows for the two key aspects of a low carbon plan to be achieved, and more importantly, demonstrated.

Complexity
The variation of the dice faces and the random nature of throwing them, playing with them etc, ensures a wide mix of prototypes.

Scale
The number of dice will be vast (>1000) ensuring the critical mass for the prototype is achieved, allowing it to become a sustainable and viable operation. One example is the use of 10sqm of solar panels to generate renewable energy versus 10,000.

The impact and result of these prototypes (strategies, technologies, policies etc) is important - we need to know what is the result of such strategies in reference to climate change indicators...
The Animations

This cause & effect principle is illustrated by graphic animations projected onto the walls. On one wall is an animation showing the rise and fall of prototypes in frequency, density, type and organisation throughout the city. It shows a range of constantly changing scenarios mapped in plan. Synchronised to this is an animated graph showing the changes caused by these scenarios on various climate change criteria as a result. This graph is essentially a section through a 3D variable net of statistical data that sits over the entire city, illustrating the changes in these criteria across space as well as time. It attempts to visualise the normally abstract concepts of carbon emissions and energy consumption in a city and highlights the direct influence of a smart city incubator on these.

Chengdu Biennale, Climate Change Graph Animation
measurements. For example, how would a dramatic increase in the installation of solar water heaters within the first ring affect climate change indicators? The 3 indicators nominally represented are energy efficiency and renewable energy production, energy consumption and greenhouse gas emissions.

The overall installation is a space whereby visitors can distribute prototypes throughout the smart city using the dice whilst observing potential changes in climate change indicators as a projection of theoretical scenarios.

The Smart City Chengdu Incubator acts as a manual for stakeholders of various scales to encourage their capital growth with the aid of low carbon technologies, allowing the city to achieve its goals of carbon intensity reduction.
The Sidebar

In order to catalog and register the scenarios that are acted out in the animation, a data sidebar is placed on the ends of both animations. This bar contains a running list of every active prototype, a bilingual scenario summary as well as an index of prototype icons and of course, a timer. This tool helps synchronise the animations and cements the relationship between cause (prototype proliferation change on the map) and effect (impact on climate change indicators throughout the city, on the graph).
The Table

The table top is a timber, dry joined jigsaw of plates and are bolted onto a welded, disassembleable, metal frame. A high quality, gloss finish print of the fifth ring utopian plan is laminated onto the timber and bevelled glass plates sit on top of this. Legs (with welded fixing plates) are bolted through the pre-drilled holes on the sides of the metal frame.

The structure beneath the table’s surface is metaphorical, imitating a network of interconnected sites of varying scales, mapped by the legs. This is amplified by the use of different sized steel sections for primary and secondary supports. The primary support is a ring (divided into 4 segments for ease of transportation and dismantling), this mimics the actual form of the fifth ring, printed inches above. Stemming from this is the secondary (infra)structure, which supplies adjacent regions, both inside and outside the ring, with structural capability. The legs enhance this through the use of large diameter steel poles at primary intersections and smaller diameter poles at secondary intersections.
Photos of the Exhibition
The conference included three parts. The participants talked about the future of cities, provided their perspectives on the current challenges and opportunities, and discussed how to respond to the rapid urbanization trend in different parts of the world. The conference emphasized the importance of sustainable urban development, addressing issues such as environmental protection, efficient resource utilization, and the improvement of living standards in urban areas. The conference showcased successful examples from different cities around the world, highlighting the importance of collaboration and innovation in urban planning and management. The attendees were encouraged to share their ideas and strategies to promote sustainable urban development globally.