The Real-time City

REFLECTION
An ongoing research about tailor-made cities adapting over time.
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A fully adaptable living environment

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I. Introduction

The Real-time City is a city on demand, which is shaped by customization over time. The inhabitants can shape the content of the city and their personal spaces by giving their desires as input. As situations of people are changing, the city has to update itself in real-time; analysing the given input, applying parameters and act upon the changing situations. Real-time City represents a personal perspective and exploration of living in a fully adaptable environment. It is both challenging and provoking current trends and developments in our society. The vision explores different aspects living in fully customization and adaptivity, a new social and economical model, innovative technologies and sustainability in order to create a city that responds to changing individual desires.

Inspiration for the National Spatial Strategy 2050 (NOVI)

The aim of this project Real-time City is to inspire the next National Spatial Strategy (NOVI) of the Netherlands in 2050, which is currently in development by the Dutch government. During my internship at the Ministry of Infrastructure and Environment, I have been working on this vision, joining several meetings and discussions. I discovered that key values for the next spatial strategy include: co creation, connecting citizens and governments, participation, customization, sustainability, circular economy and adaptive (city) planning.

We cannot predict the future, therefore we need a city that can adapt to change instead of one based on fixation and standardization. In times of (rapid) urbanization and mass customization, strategies that look at individual desires are more relevant than ever before. Architecture should no longer be a frozen moment in time but should respond to these fast changing desires.

Tailor-made over time

Previous works include the search for tailor-made environments. In the last years I have mostly been working on projects about mass customization and personalization in high densities, participation and adaptable structures. During my internship at the Ministry of Infrastructure and Environment I have been working on the book 'Tailor-made Cities', which was published as inspiration for the government. The main conclusion after writing this book was that time and adaptation to change are the most important elements to focus on in such a tailor-made environment. The starting point for the Real-time City was to create a tailor-made environment that is able to change over time.
II. Reflection on research and application in design

The research itself explores a number of different components that feed into the notion of the tailor-made city, from the activities of the users, analysis of adaptive environments, ‘living’ materials that may build up this evolving city. The manifesto describes the theory of living in such a fully personalized and adaptable world which include the principles for the design. In this chapter I would like to reflect on the process of the research and the application on the design.

The user
People have different desires over a lifetime; moving in with someone else, expanding the family, moving to a different place or city, the need for extra care. An important conversation with Marcel Bilow reminded me again of the notion and importance of time in Real-time City. Time is not only of importance in the daily patterns of the inhabitants, but there are different cycles and aspects of time. In the first chapter about the user, I have mostly focussed on the daily patterns of the citizen. Changing situations are not just only about changing activities, but are about desires that might be present for a couple of hours, it might be needed for many days, months years or decades. Situations change also in the lifetime cycle: people fall in love, move in together, start a family, the household might extend or shrink over time. Those adaptations should also get a place in Real-time City.

The environment
Constant Nieuwenhuys stated in his New Babylon that the environment should adapt to the activities of life, and not the other way around. People should not get limited by the environment and the boundaries of it. Space should be created by the activities that are taking place at that time and should stimulate these activities. After talking with people from different disciplines and fields, reading several books and papers, I found out that there are four important values of an adapting environment; the personal aspect of adaptive space, the frequency of adaptation, the freedom to move and the level of comfort in adapting spaces. I have always been very interested in the visionaries of the 1960’s as the architects of that time have created many radical concepts against modernism, standardization and mass production. Five visionaries have inspired me in the interest for adaptive architecture and urbanism. After focusing in on these concepts, I found many important aspects
that could create an adaptive environment but none of them was scoring high on all levels of adaptivity. Currently there are better technologies and other methods to create adaptivity.

I choose to focus on a second set of references to take also a closer look at adaptive structures in a more contemporary context: the pop-up movement. Those pop-up spaces are offer solutions to quick desires in contemporary society. In most cases they offer a quite standard solution that require high level of manual effort. Those two sets of references have inspired me to create an environment of maximum adaptivity, inhabiting maximum desires of its inhabitants.

Maximizing values of Real-time
Maximizing the value of personalization results in a society where people can have everything they want, anywhere at anytime. Individual spatial desires can be realized and can be asked for at any time. Maximizing the value of frequency is caring that people have the opportunity to change their space according to (fast)changing desires. Permanent temporality will be part of this society as well as a continuous cycle of using and reusing materials and products. In order to create maximum freedom to move and adapt environments, the inhabitants will live in society and economy based on services. Every product will become a service which is available at anytime. The service based economy will occur a radical change in the behaviour of our society. The inhabitants don't have to buy products anymore, but they can rent anything they want. Automated processes and the use of data will maximize the level of comfort in Real-time City.

Service-based economy
A service based living without ownership sounds as a difficult and large influence on people's life, but the opposite is the case. People will only benefit and enjoy products as long as they want. Instead of making large investments at once, will the Real-time citizen pay for the time that he is actually using the product or space. The inhabitant will not anymore be responsible for the raw materials of a product. The responsibility is in hands of the manufacturer. The same counts for the functionality of products. In this way, manufacturers will create products that are more sustainable and durable for the consumer and the environment. After usage, all materials will go back to the manufacturer which he can use to create a new customized space.

Biodegradable materials: one material can do all?
Customization is a very important value, because the user should live in an environment that adapts to him. As situations might change fast, a new desire might be necessary in short time as well. This is demanding a building system that allows adaptations as well as materials that can be recycled in a short time.

Digital fabrication and additive manufacturing are ideal to create customized spaces with highly precision and can function fully automated. Most spaces and products can be created out of biodegradable materials such as bioplastics and biopolymers. Those materials are ultimately applicable for building processes in additive manufacturing and robotic fabrication. Especially bio-polymers are suitable as they can be recycled many times and nanoparticles can be added in order to achieve different characteristics and properties within the material. In this case a smooth gradient in hardness, transparency or color can be created by using one base material.

There are several studies and application of the usage of biopolymers in different fields of manufacturing and fabrication. Additive manufacturing makes it possible to add different properties and create different assemblies of in fact one material which gradiently flow from soft to hard, opaque to transparent, structural and aesthetic. In the scope of this project I have only focussed on the usage of one hypothetical bio-polymer to which I add different properties to create the desired functionality and aesthetics. In reality not everything might be created out of one material. In every place on earth the process of real-time have to be considered with local biodegradable materials.

Time vs. energy vs. value
Not every building process or material usage is suitable for every changing situation. Changing an entire home with many valuable elements might become unaffordable for the user. The building processes are therefore divided in several categories. An adaptation in each category is in theory made by its own building processes.

Adaptation in daily patterns
Adaptations that are only desired for a short time, will be created with materials and a building method that is fast, doesn't cost a lot of energy and is very affordable. Inflatable structures are an answer to fastest changing desires for example when visitors are coming over for a couple of hours. Phase-changing and shape memory materials can provide temporary solutions for a changing situation. A sensor sends
an electrical signal to the nitinol wires inside the opening of the cell allowing the person to enter the space. The transparent area of the facade includes electrochrome particles to make the area less transparent when too much light is coming inside the living space. An extra chair can change shape or be inflated when guests are joining for dinner.

Adaptation in cycles and phases
Structures that will appear for a couple of days, weeks or months can be created with robotic fabrication and additive manufacturing. These structures can be more valuable and integrated features such as photovoltaics be implemented to regenerate the used energy consumption. Changing situations in this timeframe might be moving in together, the start of a family, the moving out of a family member. More details in for example ornaments can be added as the structure will last longer.

Adaptation in generations
Long term adaptations over years can be created by more refined building process and materials. The infrastructure for example is a more refined structure within the city. Accessibility and transportation is desired by many people and existing infrastructure will also influence the growth on new individual structures and vice versa.

Desire
Desires in Real-time City are about living in tailor-made spaces. As situations and activities are changing over time, the user will desire different spaces and different compositions over time. The user can customize every space according to his personal preferences. But desires might conflict with desires of others. The application is evaluating all desired input of the user. It synchronizes the profile and preferences of the user from all available data about this user. It synchronizes the timeline, location, desired program and activities. This input will be evaluated by the application with the already existing and future context. These evaluators might influence the design and output of spaces. Accessibility, climate, structural optimization, neighboring population, daylight will all influence the output.

Not all desires are affordable by every user; money and energy are important factors that might influence the outcome of the design. A theater for only one person might not be affordable in material costs, equipment and energy consumption. But once the user is sharing his desire with others, it might be affordable for a larger public. Sharing spaces can also create more variety. Everyone is able to create public events; the joy as well as the costs will be shared.

Building technology
The building technology part of the Real-time City is inspired by nature and has a strong analogy with the anatomy of the human body. From the central hearts of the city, veins are nourishing every cell with mechanical ventilation, cooling, heating, water, electricity and networks. Waste will be transported back to the system. As every cell is responsible to produce energy, gallium selenide particles are integrated in the areas with the most direct sunlight. On the basis of data of every individual, as well as from the collective, the city content can be constantly analysed to control the flows of infrastructure, water and energy, to optimize the structure as well as the city’s content.

In the scope of this project I have mainly focussed on detailing elements created by additive manufacturing, using 3D/4D printing with a hypothetical biopolymer. The approach of using additive manufacturing with a hypothetical biopolymer is inspired by the material science of Neri Oxman’s ‘Materialecology’.

Real-time City explores the application of the digital fabrication and additive manufacturing techniques on the scale of the city. The technology is not the drive for the city, it is embedded in the background to create physical interaction and emotional experiences.
III. Impact and consequences on society

Which social developments does Real-time City want to address?
Real-time City is a new city model including some key values of the National Spatial Strategy. It provokes and challenges current trends and development to address certain social issues. Real-time City builds upon these current trends and developments to provide a perspective on the future society.
In first place, Real-time City is providing a completely customized experience for the citizen. It provides a perfect fit to every citizen, anywhere and all the time. Customization becomes a common in future society.
The most impactful development is the movement of our current society based on mass consumption towards a society based on a sustainability and a circular economy. Every material and energy we borrow from our planet earth, we have to give back. Real-time City is not about living with the minimum, but living in a world based on desires with the awareness of materials, energy and space of our environment. Within this development there is a movement from a business model of mass production, disposables, standardization to one that includes a perfect fit to the user and where the consumer is renting for usage of a function instead of the owner of material resources.
Instead of speculation on the future, real-time data will be used to shape the content of the city. The building processes and the city content is much more adaptive and the city is able to faster to changing desires within the content.
At last Real-time City is exploring the application of innovative technologies and building process which will be embedded in the background of our lives in order to create physical interactions and emotional experiences.
Real-time vision as dreamt reality
Reflection on Real-time City

Real-time City is exploring life in a fully adaptable environment. As situations in life are continuously changing, the environment needs to adapt in order to ‘fit’ to the user. Architecture should constantly fit to the user’s activities and desires.

In the contemporary society, the built environment is based on fixation and standardization. In times of mass-customization and rapid changes, we need something else than fixation. Architecture can no longer be a frozen moment in time. A strategy that looks at individual desires is more relevant than ever before.

The vision for Real-time City is a dreamt reality. It incorporates a society based on fast changing desires, mass-customization, personalization, adaptivity and a self-organizing bottom-up mechanism. The city will act as a perfect fit over time where every citizen can create his personal living environment. The focus is on user-based architecture while adding the component time in the equation. The citizens will evolve through their life together in non-fixed and adaptable spaces.

The architecture of Real-time City is organic and will evolve over time. The city grows based on emergence, as a bottom-up, self-organizing mechanism. The architecture of this vision is continuously changing. It is also dependent on the input of the citizens. The architecture will be shaped by the desires and activities of the user. The architectural outcome of Real-time City is a metaphor of what can be designed. New materials and fabrication methods allow the user to create anything he desires. The outcome of the architecture can be more
Living Real-time means living in completely personalized spaces that are able to change over time, according to the desires and activities of the user. In order to create this adaptive environment, we need to move away from fixation and standardization. No space will exist forever. It will last until the user is changing desires.

In Real-time City everything becomes on demand; not only information, goods and services, but also architecture. This service wants to provide the user more freedom to move, to change to extend, in order to create a perfect fit all the time. Living on demand has also the consequence that people don’t have ownership anymore. This is a change in mindset for most people. Materials belong to earth, so in fact everything we create, is borrowed from the planet. Materials will be used and reused in order to create everyone’s desires.

The physical history of the city will not be preserved as long as nobody is demanding it. All history will be stored digitally and can be reordered over and over. This is a very radical statement and has a huge impact on society of course. But isn’t this a very realistic scenario? Isn’t this something which is already going on in our current society? More and more data is getting digitalized and people nowadays replace all their books by one small electronic device, where even more data (more books) can be stored and requested. Not only books, but also other goods, information, services are accessible on demand. More and more we live in a virtual world and more of our lives is getting virtual. Music, photographs, information, video, social life and experiences. Aren’t we moving towards a society where the virtual and physical world is getting intertwined?
The city as self-organizing mechanism

*Reflection on Real-time City*

The organization of Real-time City is based on emergence, a self-organizing mechanism by the input of all individuals. Every citizen will give his desired input and the city will evolve through the changing situations, desires and activities over time. The networks and flows of infrastructure and energy will be optimized, and data and patterns will be analyzed and anticipated upon in order to adapt to the changing desires of its inhabitants and to avoid conflicts.

At the moment there is a lot of public data available that we don’t use in a proper way to shape our cities to a more tailor-made environment. With Real-time City I want to show that we can do more with our data. With GPS tracking we can analyze flows, densities and movement. We could optimize energy production and consumption. We could optimize public facilities and services within the city.

The application is allowing the users to realize their individual dreams. The user can shape his ideal spaces, in principle the personal data will only be used to shape a completely tailor-made environment. The personal data is protected and can only be accessed by the user himself.

In fact, the whole city functions as a bottom-up mechanism that is able to organize itself. The application could provide the tailor-made environment for every individual, as well as it it is optimizing energy production and consumption, daylight access, avoiding neighboring conflicts.

The use of big data can also be a Governmental instances could stimulate sustainability, beware porosity and setting the rules for quality of public space and avoiding conflicting desires.
The city is permanently able to act, change and adapt through time and space

Reflection on Real-time City

Real-time City can inspire the National Spatial Strategy (NOVI) for The Netherlands in 2050 as a vision that is permanently able to act, change and adapt through time and space. Input of citizens can be used to shape and optimize the content of the city. Real-time City as a vision could be perfectly implemented in existing city structures to give a solution for growing population and fast changing desires within the city. In times of rapid urbanization and mass customization, strategies that look at individual desires are more relevant than ever before. Real-time City is an inspiration for a new strategy with key values as cocreation, participation, adaptivity and sustainability.

The Real-time City as a vision can provide architecture in any situation, in any (extreme) condition. It could act upon the changing climate and rising water level and at the same time it creates more sustainable architecture as it makes use of renewable energy sources, active energy production and it is reusing its materials. The vision could provide architecture in extreme situations such as natural disasters. By GPS tracking architecture can be send to any possible location and as new technologies allow us to create architecture with more flexible production methods, it could provide architecture on any extreme location.

The vision of Real-time City is extremely suitable for future scenarios such as life outer space. The spaces can be provided with an extra air lock to preserve the level of oxygen inside the spaces. Electrical energy can be created by the gallium selenide photovoltaics. Potable water can be created by melting ice in the local ground soil. A portion of water is stored while another portion is used to produce oxygen. The structural ribs provide oxygen and water to every space within a closed purifying system.
Make reality of our imagination
Reflection on Real-time City

The next big thing is not parametrics, and it is not new geometry. It is more than that... We are leaving the certainty of geometry, logic and arithmetic. We are moving from the information age towards an age where the symbolic is the new metalevel, where information and technology are supporting new experiences and the spectacle.

Our physical and virtual realities are becoming increasingly intertwined. New technologies such as augmented reality, virtual reality, wearables, big data and the internet of things are pointing to a world where technology will envelop and support every aspect of our lives. It will be the support between every interaction and experience, offering amazing possibilities to create greater personalized environments, while also controlling the way we understand the world. This machine of spectacle is a desire making machine, which is permanently acting, changing and adapting through time and space.

Architecture becomes a stage of experiences, of limitless possibilities. Every ordered space becomes personalized, the user transported to any location in a sea of universal placelessness. Every place becomes a destination and any destination can be anyplace. Architecture of the contemporary city is no longer simply about the physical space of buildings and landscape. More and more it is about the synthetic spaces, created by the digital information that we collect, consume and organise.

Real-time City is exploring these immersive environments where the public can meet, perform, interact, indulge and play, giving space for the spectacle of (public) life. Architecture and the built environment, including clothes and movement are augmented, interactive and will celebrate the virtual. It is about a world where realms blend with other realms. The journey itself is up to the user. Experience is destination. Virtual movement allows the visitor to consume the space as spectacle and animation.
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