Land **2014**, *3*, 105-130; doi:10.3390/land3010105

OPEN ACCESS

land

ISSN 2073-445X

www.mdpi.com/journal/land/

Review

Urbanity and Urbanization: An Interdisciplinary Review Combining Cultural and Physical Approaches

Christoph Schneider [1,*], Bianca Achilles [2] and Hendrik Merbitz [1]

[1] Department of Geography, RWTH Aachen University, Templergraben 55, D-52056 Aachen, Germany; E-Mail: hendrik.merbitz@geo.rwth-aachen.de

[2] Human Technology Center, RWTH Aachen University, Theaterplatz 14, D-52062 Aachen, Germany; E-Mail: achilles@humtec.rwth-aachen.de

* Author to whom correspondence should be addressed;
E-Mail: christoph.schneider@geo.rwth-aachen.de;
Tel.: +49-241-80-96048; Fax: +49-241-80-92157.

Received: 20 October 2013; in revised form: 27 November 2013 / Accepted: 13 January 2014 / Published: 23 January 2014

Abstract: This review paper focuses on research schemes regarding urbanity and urbanization, and brings together both cultural and physical approaches. First, we review the cultural and social construction of urbanity (as related to urbanization) in Germany. In the early 20th century, urbanity was mainly the result of identity derived from a historical perspective in cities. This has changed profoundly in recent decades as urbanity stems more and more from various urban lifestyles and the staging of societal experiences, as summarized in the German term, "Erlebnisgesellschaft" (thrill-seeking society). The discussion is extended by an assessment of the recent state of the art regarding physical urban research. The focus lies on different fields of research; we address topics such as biodiversity, urban climate, air pollution, and resilience, as well as their impact on urban planning and governance. In conclusion, in order to tackle recent developments and future challenges regarding social and environmental issues, an integrative approach urges novel cross- and inter-disciplinary research efforts in urban studies, including urban-rural linkages. A newly constituted assessment of urbanization and city quarter development is proposed; the assessment focuses on the conjoint analysis of mobility, "Energiewende" (energy transition), cultural drivers, demographic development, and environmental issues.

Keywords: urbanity; urbanization; urban diversity; urban climate; climate change; urban air pollution; resilience; ecosystem services; Central Europe; Germany

1. Introduction

A continuing trend of urbanization can be observed worldwide. While in the year 2008 half of the world's population already lived in cities, global urbanization is not letting up; three million people are added to cities in the developing world each week. An urbanization level of 70% is anticipated for the year 2050 [1]. Ongoing urbanization will take place in conjunction with climatic change, energy transition, and other developments that affect urban life, and which pose challenges to cities worldwide. The question arises: What should future cities look like? The Charter of Athens (1933/2003) [2,3] incentivizes urban development, while the Leipzig Charter on Sustainable European Cities (2007) [4] picks up current trends in Europe, such as demographic change, so as to achieve sustainable urban development. However, such declarations and visions require a sound scientific basis. Scientific symposiums and research programs with promising titles—which often begin with an "s"—like "smart city" (in the Federal Ministry for Transport, Innovation and Technology, Austria) [5], "sustainable city", "slow city", ("citta slow" initiative, in Italy and internationally) [6], "shrinking city" or the "SENSEable city" (SENSEable city lab, MIT) [7] consider, how cities need to be transformed for the future. Notably, these programs bring together researchers from different fields. Meanwhile, it has been widely accepted that past experiences demonstrate that simple and unilateral statements concerning multi-dimensional cities are inadequate to solve problems. A city is a lively and steadily changing complex, and is dependent on various drivers. Consequently, the research on urbanity or urbanization cannot be restricted to single specific fields of research.

In this paper, we address both the cultural–historic perspective and the state of the art regarding various fields of physical and environmental urban research. For the first topic, the German speaking areas are taken as an example; these areas highlight how the perception of the term "urbanity" has changed during the 20th century, and analysis elucidates why this term is often so important for the justification of urban interventions in contemporary Germany (Section 2.1). For the second topic, current results from the international scientific community that are related to urban research are considered (Section 2.2). Finally, Section 3 combines the two perspectives by presenting a new holistic concept of urban research, and highlights different currently ongoing or recently completed scientific projects.

2. Results

2.1. Historical Periods of Cultural Urbanity Concepts

Urbanization and urbanity influence cities as much as society. They demonstrate changes in our building activities and social structures. In the following passages, the historic-cultural relevance of urbanization and urbanity in Germany will be examined and demonstrated.

In the last decades, researchers from different disciplines—philosophers, architects, sociologists, *etc*.—contributed a large quantity of papers about urbanity, particularly in German-speaking areas [8–13]. In general, these researchers asked what urbanity is, how it has changed, and how important urbanity is for the contemporary perception of space. However, a compelling explanation of urbanity is hard to find. There are different opinions and derivations. That is why urbanity—in German, *Urbanität*—is difficult to conceive. It is a mystified [11] and highlighted term, more so in German than in English. For that reason, in this paper, we will only discuss urbanity from the German point of view.

To put it briefly, *Urbanität* in German is a sense of life. In his paper, "Von der Urbanität zur «Urbanistik»" ("From Urbanity to 'Urbanism'") [8], economist Edgar Salin depicts the conceptual history of *Urbanität*. It has its origin in ancient Greece and stems from the Latin, "*urbs*" (the city), and "obviously also denotes a lifestyle, which only can be found in a city" [8]. Furthermore, he calls attention to the English phrases, "urban, urbanity, and urbanization", all of which lack the divisive connotations of the German *Urbanität* [8]. Salin states that *Urbanität* requires educated middle-class and democratic cities to develop. Most likely, he adds that this may be the reason why only the inhabitants of Berlin celebrated the Roaring Twenties in the Weimar Republic [8]. As a consequence of the "cultural, economic, political and sociological changes of the last century there are no possibilities today for a revival of urban life in the historic sense of the word" [8]. In contrast to the English concept of urbanity, *Urbanität* did not keep up with the times. Salin's conclusion is: "*Urbanität* is dead!" [8].

In the last few decades, the term *Urbanität* has been used increasingly in the context of cities in German-speaking areas. It seems that *Urbanität* is the keyword for a successful city with happy citizens, and is therefore a "must-have" quality that urban planners have to create. But how suitable is this German phrase today, when most cities are designed in CAD and the liveliness of *Urbanität* is lost? Moreover, how contemporary is this German term compared to English and other cultural backgrounds? In the next sections, these questions and the use of *Urbanität* will be discussed.

2.1.1. Changing Perceptions of Cities in the Early 20th Century

With the beginning of the industrial revolution, invisible structures changed with the visible changes observed on the landscape. The basis for this process lies in the Early Modern Age. The early modern city is not famous for its growth (Table 1), but for social differentiation. Pre-modern systems of estates and different guilds affected daily life. These estate-based groups particularly influenced the cultural, economic, and constitutional primacy of cities, and were the basis for subsequent technical innovations.

In the 18th century, industrialization started "as a result of advantage in manufacturing techniques powerful enough to raise the productivity of a whole industry" [14]. Steam machines made it possible to run professional mining, especially in Great Britain. However, in regions with scarce resources, such as Southern Germany, the Netherlands or Switzerland, "smart" inventions also started a development in these areas' respective industries and changed their landscapes. The rapidly growing cities, with their smokestacks, new worker districts, and infrastructures, were symbols for this turn toward a new era. Within only a few decades, the populations of mainly residential, port, and early

industrial cities increased dramatically (see Table 1) [15]. First craftsmen, and then the peasants of the hinterland, moved to the cities with their industry and technologies to find work. Living space became scarce in the cities and "the housing question consequently became a major topic of urban discourses" [16]. A social revolution started: communal and family lives changed with the rapid urbanization.

Table 1. Numbers of population of the 10 biggest European cities, in the years 1700, 1800, 1850 and 1900 [15].

1700		1800		1850		1900	
City	**Population (1,000)**	**City**	**Population (1,000)**	**City (with Suburbs)**	**Population (1,000)**	**Urban Agglomeration**	**Population (1,000)**
Constantinople	700	London	861	London	2,320	London	6,480
London	550	Constantinople	570	Paris	1,314	Paris	3,330
Paris	530	Paris	547	Constantinople	785	Berlin	2,424
Naples	207	Naples	430	St. Petersburg	502	Vienna	1,662
Lisbon	188	Moscow	238	Berlin	446	St. Petersburg	1,439
Amsterdam	172	Lisbon	237	Vienna	426	Manchester	1,255
Rome	149	Vienna	231	Liverpool	422	Birmingham	1,248
Venice	144	St. Petersburg	220	Naples	416	Moscow	1,120
Moscow	130	Amsterdam	201	Manchester	404	Glasgow	1,072
Milan	124	Adrianople	200	Moscow	373	Liverpool	940

With the beginning of the 20th century, sociologists became interested in these invisible structures of a city or, more precisely, how people dealt with the new circumstances. The sociologist Georg Simmel studied Berlin and described the changing behavior of the new inhabitants in his paper "Die Großstadt und das Geistesleben" ("Metropolis and Mental Life") from 1903 [17]. He reported that the people reacted with a "Blasiertheit" (blasé attitude, in the broadest sense) on closeness, noise, anonymity, and a flood of information. Simmel showed how people found their way to cope with the city—with blasé and the tendency to narcissism [17]. More than twenty years later, Robert E. Park, cofounder of the "Chicago School", regarded the city as a "laboratory for the investigation of collective behavior" [18]. With his statement, "The city is, finally, the natural habitat of civilized man" [18], he recognized the modern city as what it was: an ordinary living space with all its pitfalls. The metropolis and its structures were now mundane. In the paper, "Urbanism as a way of life" (1938) Louis Wirth described how urbanism "has wrought profound changes in virtually every phase of social life" [19]. The experience of *Urbanität* and urbanization were significant parts of irrevocable social changes. Simmel, Parker and Wirth witnessed the circulation of urbanization and *Urbanität*, which kept each other alive.

Heinz Reif in 2006 assumed that each metropolis has only one period of innovation, e.g., Paris with the early world exhibitions or New York with its pop culture and Andy Warhol, or Berlin with the Roaring Twenties [20]. Particularly, these unique characteristics marked a zenith of *Urbanität* and urbanization. Up to that point of time, *Urbanität* was a daily occurrence, present but invisible. It was a free development and the result of circulation of "economic, social and political processes" [13]. It can

be suggested, then, that this zenith was at the same time the end of *Urbanität*. This period of free innovation was often followed by the structuring of cities. *Urbanität* got lost.

2.1.2. In between: The 1930s–1980s as the Years of Structural Change in West Germany

To be specific, the liveliness of *Urbanität* stopped with the Nazi takeover in 1933. They stopped the free development of *Urbanität* and exchanged it for the "Eternal City Model".

After World War II, with its high devastation of German cities, the housing shortage was a major problem (as it was at the beginning of the century). In the first years following the war, German citizens were busy with reconstruction. Afterwards, the "gegliederte und aufgelockerte Stadt" (structured and scattered city), a spatial construct of the 1920s, was the general principle of the spatial planning in post-war West Germany. This concept was based on the "garden cities" and the Charter of Athens from 1933, which aimed to structure the city into working, leisure, and living districts [21]. In the 1950s, old city structures were rebuilt and city planners also had the chance to construct new city quarters. It was the decade of structural urbanization, but not of *Urbanität*. "The keyword *Urbanität* no longer exists in the *Grosser Brockhaus* [encyclopedia] from 1957. It was obvious that *Urbanität* itself perished in the Millennial Reich" [8]. At that time, the term *Urbanität* was hardly used—just like urbanity in English-speaking areas.

An economic miracle then came to define West Germany in the 1960s. It was the decade of mass purchasing power and mass production, as well as of the increase of traffic density and cars. Suburbanization profoundly changed the cities through the rise of industrial quarters, and later through the construction of living quarters with multi-story buildings and single-family houses. On the other hand, city centers more and more were turned into economic and cultural centers [21]. Prefabricated multi-story buildings were new symbols of the urbanization of the post-war era, just as smokestacks were symbols of urbanization during the industrial revolution. Multi-story buildings in the outskirts were built to evoke an "Urbanität durch Dichte" (urbanity through density). A lot of people lived in one building, but because of missing infrastructure and leisure places, these houses only formed dormitory towns. Through the separation of the districts and the uniformity of the buildings and flats, *Urbanität* was rather interfered with than supported. Still, infrastructure facilities and meeting places were situated in the city centers, and represented the history and identity of a city. The multi-story buildings could not develop an *Urbanität* through density. The experiment had failed.

The 1970s marked a decade of mobility, especially with the rise of the "autogerechte Stadt" (car-friendly city), which had new and multi-lane streets and highways, parking spaces, and garages. Suburbanization and industry sprawled along these roads. Simultaneously, a radical refurbishment of the city centers took place, where more and more service provider industries settled down [21]. In particular, a structural change in the economy, involving rationalization and automation, changed whole regions in the 1980s. Mining was no longer profitable. Coal districts in Germany, Belgium or France experienced a far-reaching structural change. Globalization was in progress. The social structures also changed in the last decades. The baby boomer generation of the 1960s grew up. This new adult generation mainly lived alone or in two-person households [21]. If these adults raised a family, they often moved to a house in the green suburbs. However, leisure places, workplaces in the service sector and infrastructure, like schools or health care, were often situated close to the city center.

This new and individual lifestyle required mobility for commuting and the solution often was a car. All in all, the 1980s meant a continuation of the car-friendly city.

However, the 1980s also denoted the start of a new concept of sustainable cities in West Germany. Building preservation was preferred to building demolition. This happened not only because of the green movement, but also because demolition became so expensive. Furthermore, citizens started to fight for the preservation of their old city quarters. Likewise, new parties were founded, which lobbied for environmental issues.

All throughout West Germany, cities were changed by the Charter of Athens. The segmentation of public space into leisure, working, and living quarters suppressed the circulation of "economic, social and political processes" [13]. With this step—in Salin's words—*Urbanität* was dead.

2.1.3. The Aestheticization of Cities since the 1990s

The advancing age of the Internet and the development of new communication technologies changed daily life and space. The city became a medium with a message [22], and the message had to convey beautiful pictures and positive statements. The marketing and presentation of a city became more important for its development. The city had to be livable and good-looking, because it is now a stage for people, companies, and tourism. When tourists go on a holiday trip, they want to make presentable pictures; companies want a nice and hip environment for their headquarters. Both spaces—physical and medial—illustrate aesthetic positions through impressive statements like buildings, pictures, advertisements, *etc*.

The German philosopher Wolfgang Welsch describes the public space of a city as being hyper-aesthetic, because it no longer has anything to do with art [23]. Hyper-aestheticism refers only to the staging of cities: the centers get a facelift; companies need impressive buildings or desire to enhance their publicity by sponsoring the cultural sector [23]. It seems that art is not necessary and publicity has assumed its role. Aestheticization promotes the city; the center in particular only shows a beautiful picture of itself. It is the "renaissance of the city centers" [24]. Ugly edges are to disappear. With the beginning of the 21st century, Roost describes this process as "the Disneyfication of Cities" [25] in respect to Bryman's "the Disneyization of Society" [26]. The ideals of the Walt Disney Company and its amusement parks sprawl into the public space. Spaces have to be an amusement; they have to look nice and have to entertain. The values of Disney and the "displacement of immoral tendencies" [25] have priority. As examples, Roost specifies the change of Times Square in New York or the reinvention of the American town [25]. Diversity is unsolicited here, too.

Michel Foucault discussed the need of diversity of places—heterotopias—for the development of space in his early speech "Andere Räume" ("Of Other Spaces", 1967) [27], and thus initiated the debate on spatial turn and the discussion of urban questions in the humanities [28]. Heterotopias construct space through their diversity [27]. In this context, the meaning implies that particular places perform different tasks and change their relation to adjoining places in history. At the same time, the whole space is changing. Places and spaces can be regarded as alterable, and thus keep alive history and safe identity. The question remains: what happens when this diversity is extinguished by aestheticization and heterotopias disappear? New space cannot develop and *Urbanität* gets lost.

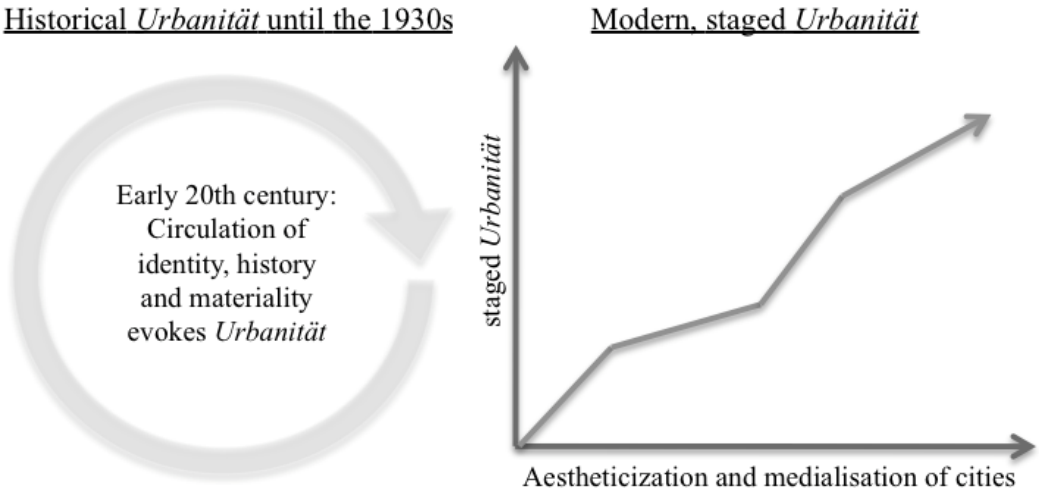
Today, space is often staged for a general public. It is shaped by aestheticization and the presentation of company values. Urban sociologist Hartmut Häußermann determines that people are often regarded as consumers only. From this point of view, they have to visit the established shops and have to use the infrastructure, which is designed by urban planners [29]. *Urbanität* often serves as a justification for these urban interventions [29]. *Urbanität* has become a lifestyle phenomenon: we all want it, but we do not really know how to create it.

The aestheticization of space is a mirror of social change. Sociologist Gerhard Schulze sums up this change in the German term, *Erlebnisgesellschaft* (thrill-seeking society) [30]. This *Erlebnisgesellschaft* looks for positively related events, which increase their intensity within a sequence of events [30]. As a result, space has to provide a variety of event places for the "customers", each of which is better and more beautiful than the other. There is no more free circulation between space and society. Such circulation has been replaced by a continuous increase of aestheticization (Figure 1). This is the reason why Disneyfication has become so famous. It is a new kind of *Urbanität*, which has nothing to do with the *Urbanität* of the Roaring Twenties in Germany. It is a mere reproduction of *Urbanität*, which lost its unique aura [31].

Identity and history are no longer the pillars of *Urbanität*. Aestheticization and medialization have taken their place (Figure 1). Cities are planned as future scenarios with CAD and their development is no longer determined by either knowledge of the past or the city's and its inhabitants' rhythms. The diversity of cities stops through this process. Likewise, modern cities have a lot of "non places" [32], such as fungible shops, chain stores, hotels or similarly arranged train stations. "These places do not create individual identities, they have not a collective past or they do not build social relationships: 'The space of "non-places" causes solitude and conformity'" [32].

The use of the term *Urbanität* is wrong in reference to these aestheticized and globalized cities, because diversity and individual identity have been abandoned. It can be suggested that English-speaking scholars realized and accepted that earlier. Therefore, they do not use urbanity/*Urbanität* as a justification for urban interventions (as is done in Germany).

Figure 1. Change of *Urbanität* in Germany from the 19th century until today.



2.2. The New Charter of Athens and the Current State of Urban Research

"The New Charter of Athens" symbolized a vision of a connected city in Europe [3]. Spatial planners and architects from Europe developed this vision in 2003 in response to economic, technological, environmental, and urban changes. The citizens of connected cities form a macrocosm—an entity. They are strongly involved in the political, social, economic, and environmental issues of their cities. Furthermore, the connected city will possess multi-cultural richness and build up a social identity, because "the personal identity of citizens is strongly related to the identity of their cities" [3]. Mobility plays an important role in different ways for European society. "In the connected city and its regional hinterland, new technologies will be applied creatively to provide a variety of systems of transportation of persons and materials, and of information flows" [3]. Recently, the strong development of renewable and decentralized regional energy supplies further enable regional integration in metropolitan areas. Economically, ECTP states that "local and regional economies will be increasingly connected to the economies of other cities and regions, both nationally and internationally" [3]. Consequently, networks between cities, like networks between cities and their hinterlands, will be also be boosted. In conclusion, the connections between society and the environment, like landscape and nature, are important for "successful urban living" [3].

The New Charter directs urban planning in a new century of sustainability and smart cities. It can also pioneer urban development (as the Charter of Athens has since 1933). Another field, which mainly changed through upcoming urban ideas, is the policy of each country, and especially of the European Union. Since the 1950s, regulation of urban planning and urban law developed. For example, the German government launched the "Bundesbaugesetz" (Federal Town Planning Law) in 1960, from which the "Bundesbaugesetzbuch" (Statute book of Federal Town Planning Law) 1987 was developed. Equally, European Union policy has changed. Cross-border metropolitan areas like the Meuse-Rhine region developed as a connected region with manifold connected cities.

The connected city requires "smart" citizens as well as "smart" researchers; both will direct this new urban movement in the right direction. Parallel to the formation of the new Charter of Athens in the beginning of the 21st century, the physical sciences are discussing more and more topics and questions concerning urban and environmental issues.

Since the year 2000, urban research has largely focused on current trends in cities, such as re-urbanization, social and demographic change, land use changes, environmental issues (air pollution, noise, thermal load) and the question of resilience of cities in the context of anticipated changes and challenges. Furthermore, metropolises and megacities are gaining more and more attention in the course of an ongoing urbanization. Reif (2006) stresses a new and increasing significance of metropolises since the early 1990s, both in the developed and in the developing world, as economic, cultural, and political intersections within new transnational European and global spatial contexts [20]. It is anticipated that the rapidly advancing removal of market boundaries weakens national states, while benefiting metropolises and metropolitan regions. Global cities are considered to be control places in the worldwide network of international flows of people, goods, and capital; these cities keep the capitalist world economy together [20].

A bibliographic study by Kirby [33] revealed that current research on cities covers many different scientific fields and disciplines from virtually all branches of the academy; such fields range from

geology and meteorology to political philosophy. Also, the importance of integrative fields, such as urban ecology or regional science, is accentuated, so as to understand physical processes and urban and regional economics, respectively [33]. In recent years, one topic that is becoming more and more widespread in the urban–regional context is resilience. However, different aspects and dimensions of resilience must be taken into consideration. Climate change adaptation is probably the most regarded issue, but resilience may also include disaster management, energy security [34] or social resilience in the context of natural hazards [35]. The changes of land use and land cover is a widely discussed topic in terms of urban and regional research. For the time period from now until 2030, on the basis of scenarios incorporating demographic, economic, and policy changes, a profound land use change is expected in Europe [36]. The main trajectories of this land use change can be identified as agricultural abandonment (in the least productive areas in Europe), agricultural expansion in other regions, and urban growth [36,37]. Since the beginning of the 21st century, considerable fields of research, concerning the physical aspects of urban environments, are urban climatology, research on air pollution, ecosystems services, resources, energy, as well as economic issues, urban infrastructure and mobility, urban planning, communication, and the aforementioned topic of resilience, with its different dimensions. The topic of urban planning and health in particular has been gaining more attention recently, and has been addressed by various academic fields [38]. The following sections will focus on five groups of research fields, highlighting major trends of current urban scientific progress. The five groups (1. Urban climate, climate change, and air pollution; 2. Biodiversity and ecosystem services; 3. Resources and energy transition; 4. Economy, infrastructure, and mobility; and 5. Urban planning and resilience) have been selected because they represent scientific approaches toward major current and near-future challenges that are associated with the field of "global change".

2.2.1. Urban Climate, Climate Change and Air Pollution

The urban climate is modified in many ways in comparison to non-urbanized areas. Due to high building densities and a high degree of surface sealing, cities exhibit higher temperatures than rural areas; this phenomenon is known as the "urban heat island" effect [39]. In the course of anthropogenic climate change, temperatures in cities are expected to further rise. This projection accentuates the need for adaptation strategies [40]. Consequently, current research on urban climate focuses to a large extent on the topic of thermal comfort and heat stress in cities. Studies of outdoor thermal comfort [41,42] investigate the influence of meteorological parameters, such as air temperature, radiation, and wind speed, on the well-being and health of humans [43]. In order to represent human thermal comfort as a function of the energy balance of the human body, several versatile indices have been developed. These indices, e.g., the physiologically equivalent temperature (PET), the predicted mean vote (PMV), the standard effective temperature (SET), or the Universal Thermal Climate Index (UTCI) take into account the combined effects of air temperature, radiation, humidity, and wind speed on human thermal sensation [44–48]. In order to assess outdoor thermal perception, these indices, which are based on meteorological measurements, are often accompanied by questionnaires that account for non-physical factors, such as psychological parameters [45,48]. In many cases, field studies are complemented by numerical simulations conducted with micro-meteorological models, such as the ENVI-MET model [49]. These modeling approaches allow for an assessment of the current state of

urban climatic conditions as well as the evaluation of possible benefits caused by modifications of the building structure or greening, which may lead to desired cooling effects [50,51].

The impact of climate change on cities is investigated especially for large metropolises, e.g., Ho Chi Minh City, Vietnam [52] or Paris, France [53]. Such investigations focus on flood risks and heat stress. For the city of Paris, an interdisciplinary study has been carried out in order to develop strategies for city planners, who are putting forward general guidelines for the Parisian urban area's evolution by 2030. The most notable suggestion involves the extension of urban green areas and nearby forests, so as to decrease the urban heat island effect and foster carbon sequestration [53]. Numerical model results show that the nocturnal urban heat island may be decreased by 2–3 °C if landscape changes are implemented (e.g., forested areas are expanded and water is added) in conjunction with the introduction of reflective surface coverings (e.g., white painted buildings). The suggested landscape changes are not constricted to the urban area, but also would involve rural environments in the urban fringe [53]. The impacts of anthropogenic climate change have also been assessed for medium-sized cities (in addition to megacities). For Frankfurt, Germany, an urban climate model has been applied, which simulates future urban heat load changes on the basis of regional climate projections [54]. For the assessment of urban climate and for urban planning strategies, urban climate maps have been produced for many cities worldwide in order to visualize certain conditions, such as thermal load and air quality [55,56].

Besides thermal characteristics, urban climates are characterized by enhanced air pollutant concentrations, which lead to negative health impacts for the urban population. Gaseous pollutants, such as NO_x, SO_2, O_3, VOC, and particulate matter (PM10, PM2.5) are considered especially dangerous to human health [57–60]. Most studies on urban air quality investigate the concentrations and chemical properties of air pollutants at fixed monitoring sites [61]. However, in order to assess the distribution of spatially variable pollutants like NO_x and PM over a heterogeneous urban area (such an assessment is prerequisite to a broader assessment of population exposure), a small number of fixed monitoring sites is generally insufficient [62]. In order to determine the concentration distribution of air pollutants, modeling approaches, such as dispersion modeling [63] or geo-statistical regression techniques, which are based on measurements at a large number of sites [64,65], are required. Geo-statistical methods have also been applied to identify urban areas with a high potential of both enhanced heat and poor air quality [66].

The interdisciplinary, cross-boundary project "MEGAPOLI" conducted air quality-related research on megacities worldwide, including European cities, such as London, Paris, Moscow, St. Petersburg, Istanbul, and the regional agglomerations of the Rhine–Ruhr area and the Po Valley. The aim of the project, which was completed between 2008 and 2011, was to investigate both the problem of local air pollution within these large agglomerations and also the impact of megacity emissions on regional and worldwide climatic changes [67]. For instance, one of the results, achieved through a combination of measurements and modeling approaches on different scales, was that the contribution to arctic soot deposition by northern and western European megacities was 1 to 2 orders of magnitude higher than that of East Asian cities [67].

2.2.2. Biodiversity and Ecosystem Services

Ecosystem services are generally defined as benefits that can be obtained from ecosystem functions, such as food, water, regulating services (e.g., those that regulate floods, drought, land degradation, and disease), support services (e.g., those that concern soil formation and nutrient cycling) or cultural services (e.g., those that provide recreation and other nonmaterial benefits) [68]. Urban ecosystem services may be divided into biophysical, economic, and socio-cultural dimensions. Ecosystem services with positive effects on urban life quality may be noise reduction, urban cooling, air purification, runoff mitigation, recreation, and contributions to mental and physical health. It can be assumed that the benefits of ecosystem services in cities provide high social and economic value, while the loss of urban ecosystems may involve long-term economic costs and severe impacts on social and cultural values [69]. Ecosystem services include aspects of "urban green" and "urban blue" policies [69].

The value of urban ecosystem services can be estimated on different scales. Scales can range from single buildings, to streets and neighborhoods, to the scale of a region. It has been reported that there is a non-linear distance decay of willingness to pay for ecosystem services, such as tree cover; such willingness also depends on residents' perception of their neighborhood, which can be estimated in terms of residential property prizes [69].

Studies show that air quality in urban areas may be strongly improved by plants. Particulate matter and heavy metals may be captured by leaves and needles [70–73], while gaseous pollutants, such as NOx are effectively removed from the atmosphere by absorption through the stomata [72,74]. In addition to air quality benefits, vegetation in cities may also be useful for noise reduction [72]. Even green walls in street canyons and green roofs (in addition to trees) have shown the ability to significantly reduce gaseous and particulate air pollutant concentrations [72,73]. Also, green roofs reduce heat flux through the roof by evapotranspiration and shading, thus increasing insulation and thermal mass. The consequence is a reduction of the energy demand for building cooling [75]. Green facades lead to cooling effects by reducing building surface temperatures and mitigating the urban heat island effect [76]. In the context of mitigating anthropogenic climate change (*i.e.*, greenhouse gas effects), urban forests play an important role within the carbon cycle by sequestering atmospheric CO_2, which is stored as carbon [77,78]. In addition to these physical effects, urban green spaces have been reported to influence social relations in urban neighborhoods. Parks may facilitate social ties by allowing for interactions between members of a community [79]. Furthermore, a significantly negative relationship between the amount of green space and the stress level of people living in a certain neighborhood has been detected; this relation is particularly relevant for deprived communities [80]. Positive psychological effects have been verified not only for urban green, but also for urban blue areas, e.g., river promenades, which are associated with positive perceptive experiences in urban environments [81].

In the context of urban sprawl diffusion, it is important to carefully consider the role of non-urbanized areas that provide ecosystem services, so as to preserve and enhance these functions [82]. A study conducted for the city of Rome reported a natural expansion of forests in the suburban countryside during recent decades, which took place at the expense of agricultural areas (which withdrew). In contrast, the expansion of built-up areas accelerated [83].

A study in the Greater Manchester area, UK [84], investigated the value of ecosystem services along a rural-urban gradient, thus creating a non-economic valuation tool. Ecosystem services were divided in different categories and evaluated over urban, suburban, peri-urban, and rural categories of urbanization. Not surprisingly, a steady decline of the mean values of ecosystems, such as aesthetics, spirituality, and noise buffering, was observed comparing rural, peri-urban, suburban and urban areas (which are listed in declining order of value). However, the highest pollination potential was observed for suburban areas, while carbon sequestration, biodiversity potential, and water flow regulation achieved highest scores in the peri-urban category. The high pollination potential and biodiversity in suburban and peri-urban areas were explained by the great abundance of flowering plants within these realms, in contrast to rural and urban areas. Also, the value for carbon sequestration was highest at peri-urban sites, followed by suburban sites, while urban and rural areas exhibited the lowest potentials. The insignificant differences in carbon sequestration potential between urban and rural areas were explained by the fact that a large fraction of rural areas are covered by farmland, while only a marginal fraction was attributed to woodland [84]. Eventually, access to ecosystem services is a social question, which is discussed in the context of environmental justice [85]. Finally, ecosystem services are also an important topic in the field of the young discipline of urban ecology [86].

2.2.3. Resources and Energy Transition

The term "energy transition", which is derived from the German expression "Energiewende", refers to the transition process that describes the transition from cheap fossil energy use to renewable energy sources, such as wind power, solar energy or hydro-electric power. The necessity of this process is commonly explained by a scarcity of fossil fuels, such as coal, oil, and gas in combination with the challenges of climate change (which are driven by anthropogenic CO_2 emissions). In light of the emphasis on energy transition, the topics of renewable energy and energy efficiency are becoming more important. In Geneva, Switzerland, the potential for geothermal power sources within the urban area has been explored for the purpose of satisfying the thermal demand in the Geneva territory [87]. The investigation of both energy supply potentials (from hydropower, solar thermal, photovoltaic, geothermal, and wood biomass sources), and of energy demand for single buildings has also been carried out for the municipality of Trentino, Italy, so as to design a low-carbon settlement [88]. In addition to energy, the topic of waste management optimization and recycling towards a "zero waste city" has recently gained attention [89].

2.2.4. Economy, Infrastructure and Mobility

In the year 2002, the World Bank released a strategy review called "Cities on the Move", which analyzed urban transport problems in developing and transitional economies [90]. Recently, Gwilliam summarized the developments in the 10 years following this report in 2013 [91]. He points out that in the course of continuing urbanization and economic growth in many developing countries, car ownership is increasing and accelerating. This leads to a deterioration of urban streets and increasing levels of air pollution and traffic accidents. Public transport systems, on the other hand, are still often inadequately developed [91]. Specific scientific work has been dedicated in the last years to particular questions within the field of urban transport and its infrastructure. Cheng *et al*. explored the concept of

urban transport networks with regard to their accessibility (e.g., in terms of accessibility to jobs from a residential location, as measured by travel time). In this case, urban networks are regarded from a functional (as opposed to a morphological) perspective [92]. Sheikh Mohammad Zadeh and Rajabi investigate the impact of the street network configuration on the efficiency of the traffic flow; they account for both the demand-side and the supply-side [93]. By doing so, the importance of each street in an urban network is individually quantified. As a result of the study, a network with a high density of nodes, which connected street segments and provided shortcuts (so as to reduce traffic) was identified as the most efficient configuration, whereas the regular grid (e.g., in Manhattan, NY, USA) was found to be the least efficient arrangement [93]. Also, the introduction of public traffic systems, such as park and ride, was investigated in order to assess their impact on total vehicular traffic [94].

Urban sprawl, the uncontrolled expansion of suburban settlements scattered around the countryside, is recognized as a worldwide phenomenon [95]. Urban sprawl causes enhanced traffic volumes between the suburban settlements and the city center, and thus increases air pollution [96]. In order to cope with increasing traffic densities, an upgrading of the public transport system and other planning measures are required. One possibility for sustainable urban planning is transit-oriented development, which is based on locating new construction and redevelopment around traffic nodes, e.g., around railway, bus or light-rail stations [95]. La Greca *et al*. propose a bus rapid transport system, which uses existing motorways, along which transit stations are installed. The accessibility of these transit stations shall be increased by a dense network of cycling and pedestrian paths connecting residential areas with other neighboring land uses [95].

2.2.5. Urban Planning and Resilience

Lately, much attention has been drawn to the topic of resilience [97,98]. The ecological resilience of urban ecosystems has been defined as the degree to which they are able to tolerate alteration before reorganization around a new set of structures and processes [99]. In order to drive the transition to a resilient urban society, so as to allow for the participation of many different stakeholders, modern collaborative and holistic tools are required. Geospatial information and communication technologies provide such tools. In the European Union, the standardized provision of, integration of, and shared access to geospatial databases are facilitated by the 2007/2/EC directive, which called for the establishing of "an Infrastructure for Spatial Information in the European Community" (INSPIRE) [100,101]. Geographic Information Systems (GIS) offer a wide range of tools for the processing of various geospatial data. Also, these tools allow for a visualization of complex planning issues and solutions by presenting spatial characteristics and by showing the consequences of environmental and urban changes [100]. The dissemination of web-based GIS enhances the visualization of planning issues and solutions for the general public. Citizens may be involved in the planning processes and decision-making; this participation fosters resilience-building in urban communities [100]. The topic of climate change adaptation in urban areas is coupled quite strongly with the concept of resilience (e.g., disaster risk management and the protection of ecosystems under projected climatic impacts involve considerations of both climate change and resilience) [98].

Adaptation to future challenges, such as climatic change, requires infrastructural adjustments as well as land use strategies. To utilize the economic potential of all European regions, the "European

Spatial Development Perspective" [102] promotes a polycentric and balanced spatial development scheme that calls for the advancement of medium-sized cities and cooperation between urban areas, so as to achieve physically and functionally connected regions [100]. Furthermore, the strategy involves strengthening urban–rural partnerships on regional, supra-regional, intra-regional, and transnational scales [102]. The promotion of a European, polycentric urban structure for the purpose of establishing a balanced territorial organization is a goal of the Leipzig Charter on Sustainable European Cities, as declared by the European Union member states in 2007 [4]. In this declaration, high quality urban designs, architectures, and environments have been stressed, so as to address the especially important issues of demographic change and social problems, as well as the importance of cultural diversity. In order to achieve these aims, an integrated urban development policy approach is requested, in which the spatial, sectoral, and temporal aspects of key areas of urban policy are coordinated, and where economic actors, stakeholders, and the general public are involved in decision making [4]. Furthermore, coordination at the local and city-regional levels should be strengthened, and a partnership between cities and rural areas, as well as between small-, medium-sized, and larger towns and cities within city-regions and metropolitan regions shall be established. Instead of focusing on development and decisions at the city level, city-regional development and territorial cohesion are requested. Additional aspects of the Leipzig Charter concern the creation of high quality public spaces, the modernization of infrastructure, the improvement of educational systems, knowledge transfer, and measures for the upgrading of deprived neighborhoods [4]. However, it is as yet unknown to what extent the ideas of the Leipzig Charter have already successfully been implemented.

3. Discussion

In this section, we aim to integrate cultural and historical perspectives with the state of the art concerning current physical and environmental research and urban planning. In the last sections, we exposed the relation between urbanity and urbanization. We revealed how urbanization spread in Germany, why urbanity is and was a justification for urban interventions, and finally how the perception of urbanity changed in Germany. After urbanization and suburbanization via the "gegliederte und aufgelockerte Stadt" (structured and scattered city), Germany is now experiencing a time of re-urbanization. Brownfields and vacancy rates in city centers are supposed to decrease. The use of this free space should stop the scattering of urban areas and should point cities in the direction of being connective cities. Current research often focuses on these questions: how cities are ordered and structured and which processes are responsible for urban growth and development. The urban planner and geographer Michael Batty outlined the image of a city as a "machine"; this conception has been replaced by that of an "organism", during the last half century. Since then, urban growth has been determined from the bottom up by the decisions of individuals. This leads to the formation of networks connecting the city with the hinterland [103]. Also, the idea of scaling laws is discussed, which postulates that urban structures, e.g., the transportation system, have the same proportions and scale according to city size [103].

A city has to be in balance to master the urban turn, for which the participation of citizens is important. A connective city with smart citizens (who want to participate in influencing the urban turn) provides a chance for the free development of urbanity. Participation supports the development of an

identity, which is created through the citizens and the built city, which illustrate, respectively, a history and a connective entity. In terms of satisfying urban residents, in addition to the physical conditions of a city (e.g., air quality, noise exposure, thermal comfort), factors such as social, economic, and cultural drivers must be accounted for as well. Zenker *et al*. (2013) developed a multi-scale Citizen Satisfaction Index in order to combine 21 items, which are considered to be responsible for the level of satisfaction, such as environmental pollution, the availability of green areas, cultural diversity, tranquility, job opportunities, and housing costs [104].

Metropolises in newly industrializing countries have not already reached their zenith. As Table 2 shows, in Asian megacities, a continuing and strong growth is taking place. It is expected that a tipping point will be reached in 2026, when most people in Asia live in cities [105]. In Asia, urbanization is in progress and society and circumstances also change rapidly. Urbanization and urbanity rank here on the same level; they influence and push each other. However, research and modern techniques from industrialized countries will affect these Asian cities as well. Urbanization and urbanity in these cities can hardly be compared to Europe's at the beginning of the 20th century. As globalization spreads, there is not only the influence of neighboring countries and other cities to consider: the whole world now provides a driving force for change because globalization integrates metropolises into networks, thereby shaping their future pace and direction of development. The fast growth of metropolises, especially in developing countries (see Table 2), is accompanied by a blurring of city boundaries, which leads more and more to metropolitan areas or urban agglomerations where the city and the regional hinterland, as defined by the Charter of Athens in 2003 [3], are merging together. The question can then be asked: What would a charter, similar to the European Charter of Athens (1933/2003) have to look like in the developing world and to what extent might it be able to influence or regulate the uncontrolled urban sprawl in developing countries?

Table 2. The populations of the eight biggest urban agglomerations of the world (for the years 1950, 1975, 2000 and 2015) [106].

1950		1975		2000		2015	
Urban Agglomeration	**Population (1,000)**	**Urban Agglomeration**	**Population (1,000)**	**Urban Agglomeration**	**Population (1,000)**	**Urban Agglomeration**	**Population (1,000)**
New York	12,339	Tokyo	19,771	Tokyo	26,444	Tokyo	27,190
London	8,733	New York	15,880	Mexico City	18,066	Dhaka	22,766
Tokyo	6,920	Shanghai	11,443	São Paulo	17,962	Mumbai (Bombay)	22,577
Paris	5,441	Mexico-City	10,691	New York	16,732	São Paulo	21,229
Moscow	5,356	São Paulo	10,333	Mumbai (Bombay)	16,086	Delhi	20,884
Shanghai	5,333	Osaka	9,844	Los Angeles	13,213	Mexico City	20,434
Rhein-Ruhr North	5,296	Buenos Aires	9,144	Calcutta	13,058	New York	17,944
Buenos Aires	5,042	Los Angeles	8,926	Shanghai	12,887	Jakarta	17,268

Another question is how the loss of identity and urbanity can be avoided in the course of structuring cities (as has happened in Germany after World War II).

Finding, creating, and preserving identity are difficult, but important. Only cities with an outstanding identity can find their own distinctive course in a time of globalization. New York, the "City that never sleeps", or Paris, the "City of Love", or Cambridge, the "College Town", are prominent examples of successful distinguishing identities. However, the identity must not only be created through campaigns or new buildings. History should not be conserved solely for tourists. History and identity need to come alive through citizens. All in all, urbanity and urbanization are strongly coupled. Both processes are different in each country and city, and are thus difficult to compare. A variety of aspects influence these processes. Factors include the national governmental system, the education level of citizens, infrastructures, the age and history of a city, cultural circumstances, and climatic conditions.

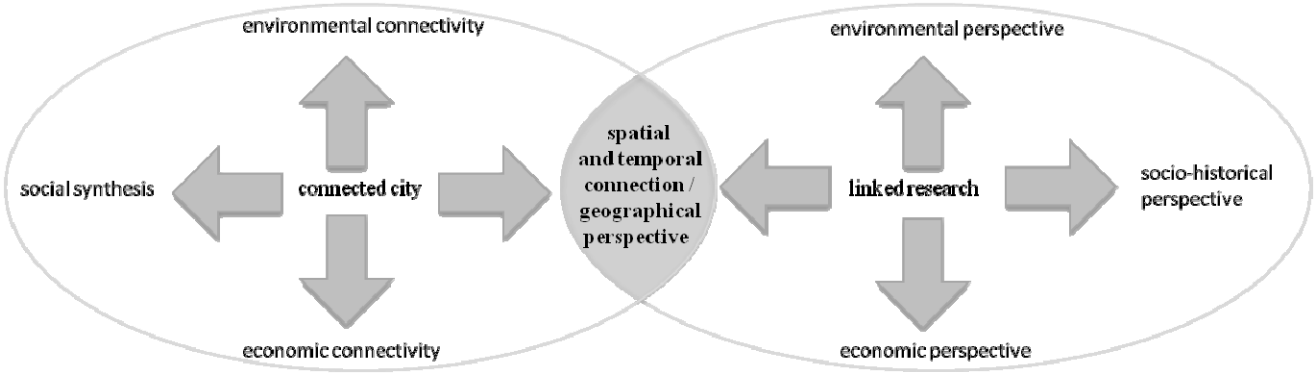
It can be concluded from Section 2.2 that today's physical urban research is to a large extent driven by the major topics and key aspects affecting urban life (e.g., climate change and air pollution, energy transition, mobility, resilience, and the availability of ecosystem services). These aspects are strongly coupled with the often-used term "sustainability". The development of sustainable cities can also be reflected in diverse urban planning declarations. The Charter of Athens of 1933, which mainly reflects the views of urban planners and architects, is supplemented by the new and more differentiated 2003 declaration of the European Council of Town Planners (ECTP), which envisioned a connected city [107]. This "New Charter of Athens" envisions retaining cities' "cultural richness and diversity", which result "from their long history", by "linking the past through the present to the future". The charter also envisions connecting "man-made and ... natural elements of the environment", so as to generate a holistic concept of a city [3]. This concept of a sustainable city respects both space and history as valuable resources. Recently, the term "renaissance of cities" has been observed and related to the term "reurbanization" [24]. Reurbanization is an urban trend and to be successful it requires the beautification of cities through architecture, design, and self-staging. Furthermore, the reurbanization of cities needs a communal life comprising of different cultures; this life will form the basis for a new civil society [24].

The Charter of Athens of 2003 also reflects a shift in attitude that emphasizes more environmental protection. The Charter requests that planners "protect cities from pollution and degradation" [3]; this has resulted in certain legislative processes regulating the technical aspects of environmental protection. Resilience and sustainability are topics that appear in many different contexts (e.g., climate change, energy transition, and urban infrastructure). However, a shift has been observed during the last decade, where the term "resilience" has come to the fore, following "sustainability" [97]. This paradigm shift may be explained by the fact that sustainability concerns rather linear or circular processes, while resilience is a more dynamic, non-linear, and cross-linked concept that includes the handling of uncertainty. However, a challenge for the concept of resilience might be the need for intensified collaboration between different disciplines, as well as between science and practice [97]. The coordination of different fields of action within the framework of urban planning has already been requested within the New Charter of Athens of 2003 [3].

Figure 2 shows a sketch for a holistic research approach for cities. It combines the demands, formulated by the New Athens Charter 2003 (especially the request for cooperation between different fields of action within a connected city) (left), with a multidisciplinary approach covering economic, environmental, and socio-historical perspectives (right). Different scientific fields overlap together

with the concept of a connected city through spatial and temporal dimensions. In the concept illustrated by Figure 2, geography as a discipline is explicitly mentioned. The reason is that the different approaches of physical and human geography offer temporal and spatial perspectives that integrate a wider range of various research areas, as well as urban planning-related research. However, in addition to the city itself, urban–rural interactions should also be incorporated within this holistic concept.

Figure 2. Concept of a holistic urban research approach.



A short review of integrative and multidisciplinary urban research in Germany illustrates the most recent trends regarding disciplinary and cross-disciplinary urban research approaches. The project, the "Fraunhofer Morgenstadt", is a central future project within the framework of the German Federal Government's high-tech strategy for 2020. The aim is to create a leading market for sustainable urban systems of the future. Cooperation between science and economics shall foster innovation in the fields of urban processes, energy, construction, production and logistics, mobility, communication, and security [108]. The topic of new traffic concepts, including e-mobility, is covered by several research projects, e.g., ones by the Institute for Urban Planning at University Duisburg–Essen [109] or by the University of Aachen [110]. The problems of megacities, within the framework of continental and global change, are addressed at the University Cologne [111]. Three interdisciplinary, but more humanity-orientated research projects are discussed as follows. First, there is the "Intrinsic Logic of Cities" of the University of Darmstadt and the Darmstadt University of Applied Sciences. The program wants to "gain an understanding of the basic structures of cities" and wants "to render transparent relations and similarities that cities share" [112]. The second project is the "Low-Budget-Urbanity" of the HafenCity University Hamburg. It is concerned with the "transformation of the urban in times of austerity" [113]. Another interesting and international graduate program is the "Berlin-New York-Toronto" project, of the Center of Metropolitan Studies of the Technical University of Berlin (which involves associated universities in Berlin, New York, and Toronto). The program delves into the different characteristics of a metropolis [114]. Many projects are focused either on social or cultural perspectives, or on physical issues, such as climate change adaptation and ecological topics. However, this review indicates that combining both social and physical sciences will yield the most promising approaches toward investigating current and future urban development (with the goal of meeting the needs of the urban population). Current integrative studies can be seen as forward-looking examples that tackle present and future challenges in cities. For example, a multidisciplinary study on urban ecology at Humboldt University Berlin has covered a

wide range of topics, ranging from natural science to social and economic sciences [115]. These studies show that interdisciplinary research is the appropriate way of providing the scientific basis necessary for the development of solutions to urban problems. The interdisciplinary project City2020+ (2009–2012) assessed the risks and opportunities for residents in urban-built environments under projected demographic and climatic changes for the year 2020 and beyond, using the city of Aachen as a case study. Within the project CITY 2020+ strategies, options and tools for planning and developing sustainable future city structures were developed; these developments combined expertise from the fields of climatology, cultural geography, environmental medicine, sociology, history, urban development, and civil engineering ([116], see Figure 3). More recent projects at RWTH Aachen University (Urban Turn (U-Turn) and Urban Future Outline (UFO)) aim at the integration of environmental and social issues in a broader sense; they concern newly developing issues of restructuring the energy and transport sectors [117]. All of these research strategies include the interdisciplinary assessment of multidimensional perspectives via a holistic approach that brings together scholars from various faculties into the *per se* interdisciplinary environment of a jointly operated project house.

Figure 3. Structure of the CITY2020+ project (modified after [116]).

4. Conclusion

Future project propositions will supposedly extend this interdisciplinary approach towards strategies on coping with climate change, demographic change, energy transition, and limited geo-resources in medium-sized cities in Central Europe. We propose to combine both physical and cultural perspectives, so as to assess the complex transitions cities have to face during the first half of the 21st century. These transitions are affected by the manifold changes, risks, and opportunities that are taking place simultaneously. The main research questions within the frame of this project proposition are: How are medium-sized cities affected by the expected trends of the 21st century? Which interactions take place and how do the expected trends (e.g., the scarcity of geo-resources, climatic change, social

changes, and energy transition) affect each other? What strategies can be applied to cities in order to cope with these challenges and to achieve urban resilience? How can urban and suburban development be influenced by regulatory guidelines, such as the mentioned charters or by scientific expertise?

Acknowledgments

This work has been funded by the Excellence Initiative of the German federal and state governments through the project house, HumTec, at RWTH Aachen University and a grant from the Geoverbund ABC/J, the Alliance of Geoscience Research Units at the Universities of Aachen, Bonn, and Cologne and the Forschungszentrum Jülich. The authors wish to thank all colleagues within research projects City2020+ and U-Turn for their sustained support within these projects.

Author Contributions

First author Christoph Schneider initiated this study. He setup the structure and approach of the manuscript. He contributed to all the sections, in especially to Section 3 and 4. Co-author Bianca Achilles was responsible for literature research, the preparation and writing of Section 2.1. Co-author Hendrik Merbitz contributed with literature research, preparation and writing of Section 2.2. Both co-authors also largely contributed to the writing of Section 1 to 4.

Conflicts of Interest

The authors declare no conflict of interest.

References

1. United Nations Human Settlements Programme (UN-HABITAT). State of World Cities Report 2008/9. Available online: http://www.unhabitat.org/content.asp?cid=6040&catid=7&typeid=5 (accessed on 15 August 2013).
2. Corbusier, L. *The Athens Charter*; Grossman: New York, NY, USA, 1973.
3. European Council of Spatial Planners (ECTP). The New Charter of Athens 2003. Available online: http://www.ceu-ectp.eu/index.php?option=com_content&view=article&id=85&Itemid=118 (accessed on 5 August 2013).
4. European Union. The Leipzig Charter on Sustainable European Cities. Available online: http://ec.europa.eu/regional_policy/archive/themes/urban/leipzig_charter.pdf (accessed on 12 July 2013).
5. Federal Ministry for Transport, Innovation and Technology, Austria. Smart City Program. Available online: http://www.smartcities.at/home-en-GB (accessed on 18 August 2013).
6. Citta Slow. Available online: http://www.cittaslow.org (accessed on 18 August 2013).
7. Massachusetts Institute of Technology. SENSEable City. Available online: http://senseable.mit.edu/ (accessed on 18 August 2013).
8. Salin, E. Von der urbanität zur «Urbanistik». *Kyklos* **1970**, *23*, 869–881.
9. Häußermann, H. *Neue Urbanität*; Suhrkamp: Frankfurt am Main, Germany, 1987.

10. Siebel, W. *Was macht eine Stadt urban? Zur Stadtkultur und Stadtentwicklung*; Bibliotheks- und Informationssytem der Universität: Oldenburg, Germany, 1994.
11. Wüst, T. *Urbanität. Ein Mythos und sein Potential*; Verlag für Sozialwissenschaften: Wiesbaden, Germany, 2004.
12. Paetzold, H. Urbanismus. In *Ästhetische Grundbegriffe. Historisches Wörterbuch in sieben Bänden*; Barck, K., Fontius, M., Schlenstedt, D., Eds.; Metzler: Stuttgart/Weimar, Germany, 2005; Volume 6, pp. 281–311.
13. Selle, K. Urbanität eine fortsetzungsgeschichte. Teil 1. *PND Online* **2011**, *1*, 1–16. Available online: http://www.planung-neu-denken.de/images/stories/pnd/dokumente/1_2011/selle.pdf (accessed on 26 August 2013).
14. Jones, E.L. *Growth Recurring: Economic Change in World History*; Clarendon Press: Oxford, UK, 1993.
15. Chandler, T; Fox, J. *3000 Years of Urban Growth*; Academic Press: New York, NY, USA, 1974.
16. Lees, A. Berlin and modern urbanity in German discourse, 1845–1945. *J. Urban Hist.* **1991**, *17*, 153–180.
17. Simmel, G. Die Großstadt und das Geistesleben. In *Aufsätze und Abhandlungen 1901–1908*; Kramme, R., Rammstedt, A., Rammstedt, O., Eds.; Suhrkamp: Frankfurt am Main, Germany, 1995; pp. 116–131.
18. Park, R. The City. Suggestions for the Investigation of Human Behavior in the Urban Environment. In *The City*; Park, R., Burgess, E., McKenzie, R., Eds.; The University of Chicago Press: Chicago, IL, USA, 1967; pp. 1–46.
19. Wirth, L. Urbanism as a way of life. *Am. J. Sociol.* **1938**, *44*, 1–24.
20. Reif, H. Metropolen—Geschichte, Begriffe, Methoden. In *CMS Working Paper Series*, 001-2006; 2006. Available online: http://www.metropolitanstudies.de (accessed on 15 July 2013).
21. Bundesamt für Bauwesen und Raumordnung (BBR). Stadtentwicklung und Städtebau im Wandel. In *Stadtentwicklung und Städtebau in Deutschland. Ein Überblick*; BBR: Bonn, Germany, 2000; pp. 45–53.
22. Kittler, F.A. Die Stadt ist ein Medium. In *Mythos Metropole*; Fuchs, G., Moltmann, B., Prigge, W., Eds.; Suhrkamp: Frankfurt am Main, Germany, 1995; pp. 228–244.
23. Welsch, W. *Grenzgänge der Ästhetik*; Reclam: Stuttgart, Germany, 1996.
24. Dangschat, J.S. Reurbanisierung—Eine Renaissance der (Innen-)Städte? In *Urbanität neu Planen. Stadtplanung, Stadtumbau, Stadtentwicklung*, 2nd ed.; Frech, S., Reschl, R., Eds.; Wochenschau Verlag: Schwalbach, Germany, 2011; pp. 190–210.
25. Roost, F. *Die Disneyfizierung der Städte. Großprojekte der Entertainmentindustrie am Beispiel des New Yorker Times Square und der Siedlung Celebration in Florida*; Leske + Budrich: Opladen, Germany, 2000.
26. Bryman, A. *The Disneyization of Society*; Sage: London, UK, 2004.
27. Foucault, M. Andere Räume. In *Wahrnehmung heute oder Perspektiven einer anderen Ästhetik*, 6th ed.; Barck, K., Gente, P., Paris, H., Eds.; Reclam: Leipzig, Germany, 1990; pp. 34–46.
28. Christians, H. Landschaftlicher Raum: Natur und Heterotopie. In *Raum. Ein interdisziplinäres Handbuch*; Günzel, S., Ed.; Metzler: Stuttgart, Germany, 2010; pp. 90–99.

29. Häußermann, H. Lebendige Stadt, belebte Stadt oder inszenierte Urbanität? In *Angriff auf die City. Kritische Texte zur Konzeption, Planung und Wirkung von integrierten Shopping-Centern in Zentralen Lagen*; Brune, W., Junker, R., Pump-Uhlmann, H., Eds.; Droste: Düsseldorf, Germany, 2006; pp. 31–35.
30. Schulze, G. *Die Erlebnisgesellschaft. Kultursoziologie der Gegenwart*, 7th ed.; Campus: Frankfurt am Main, Germany, 1997.
31. Benjamin, W. *Das Kunstwerk im Zeitalter seiner technischen Reproduzierbarkeit*; Suhrkamp: Frankfurt am Main, Germany, 2010.
32. Augé, M. *Nicht-Orte*; Beck: Munich, Germany, 2010.
33. Kirby, A. Current research on cities and its contribution to urban studies. *Cities* **2012**, *29*, S3–S8.
34. Coaffee, J. Risk, resilience, and environmentally sustainable cities. *Energy Policy* **2008**, *36*, 4633–4638.
35. Hutter, G.; Kuhlicke, C.; Glade, T.; Felgentreff, C. Natural hazards and resilience: Exploring institutional and organizational dimensions of social resilience. *Nat. Hazard.* **2013**, *67*, 1–6.
36. Verburg, P.H.; Berkel, D.B.; Doorn, A.M.; Eupen, M., Heiligenberg, H.A.R.M. Trajectories of land use change in Europe: A model-based exploration of rural futures. *Landsc. Ecol.* **2010**, *25*, 217–232.
37. Verburg, P.H.; Schulp, C.; Witte, N.; Veldkamp, A. Downscaling of land use change scenarios to assess the dynamics of European landscapes. *Agric. Ecosyst. Environ.* **2006**, *114*, 39–56.
38. *Handbuch Stadtplanung und Gesundheit*, 1st ed.; Böhme, C., Kliemke, C., Reimann, B., Süß, W., Eds.; Huber: Bern, Switzerland, 2012.
39. Oke, T.R. *Boundary Layer Climates*, 2nd ed.; Methuen (Reprinted by Routledge): London, UK, 1987.
40. Hunt, A.; Watkiss, P. Climate change impacts and adaptation in cities: A review of the literature. *Clim. Chang.* **2011**, *104*, 13–49.
41. Katzschner, L. Behaviour of People in Open Spaces in Dependence of Thermal Comfort Conditions. In Proceedings of the 23rd Conference on Passive and Low Energy Architecture (PLEA2006), Geneva, Switzerland, 6–8 September 2006.
42. Matzarakis, A.; Rocco, M.; Najjar, G. Thermal bioclimate in Strasbourg—The 2003 heat wave. *Theor. Appl. Climatol.* **2009**, *98*, 209–220.
43. Chen, L.; Ng, E. Outdoor thermal comfort and outdoor activities: A review of research in the past decade. *Cities* **2012**, *29*, 118–125.
44. Lin, T.-P. Thermal perception, adaptation and attendance in a public square in hot and humid regions. *Build. Environ.* **2009**, *44*, 2017–2026.
45. Makaremi, N.; Salleh, E.; Jaafar, M.Z.; GhaffarianHoseini, A. Thermal comfort conditions of shaded outdoor spaces in hot and humid climate of Malaysia. *Build. Environ.* **2012**, *48*, 7–14.
46. Jendritzky, G.; Dear, R.; Havenith, G. UTCI—Why another thermal index? *Int. J. Biometeorol.* **2012**, *56*, 421–428.
47. Shashua-Bar, L.; Tsiros, I.X.; Hoffman, M. Passive cooling design options to ameliorate thermal comfort in urban streets of a Mediterranean climate (Athens) under hot summer conditions. *Build. Environ.* **2012**, *57*, 110–119.

48. Pantavou, K.; Theoharatos, G.; Santamouris, M.; Asimakopoulos, D. Outdoor thermal sensation of pedestrians in a Mediterranean climate and a comparison with UTCI. *Build. Environ.* **2013**, *66*, 82–95.
49. Krüger, E.; Minella, F.; Rasia, F. Impact of urban geometry on outdoor thermal comfort and air quality from field measurements in Curitiba, Brazil. *Build. Environ.* **2011**, *46*, 621–634.
50. Ng, E.; Chen, L.; Wang, Y.; Yuan, C. A study on the cooling effects of greening in a high-density city: An experience from Hong Kong. *Build. Environ.* **2012**, *47*, 256–271.
51. Srivanit, M.; Hokao, K. Evaluating the cooling effects of greening for improving the outdoor thermal environment at an institutional campus in the summer. *Build. Environ.* **2013**, *66*, 158–172.
52. Storch, H.; Downes, N.K. A scenario-based approach to assess Ho Chi Minh City's urban development strategies against the impact of climate change. *Cities* **2011**, *28*, 517–526.
53. Masson, V.; Lion, Y.; Peter, A.; Pigeon, G.; Buyck, J.; Brun, E. "Grand Paris": Regional landscape change to adapt city to climate warming. *Clim. Chang.* **2013**, *117*, 769–782.
54. Früh, B.; Becker, P.; Deutschländer, T.; Hessel, J.-D.; Kossmann, M.; Mieskes, I.; Namyslo, J.; Roos, M.; Sievers, U.; Steigerwald, T.; *et al*. Estimation of climate-change impacts on the urban heat load using an urban climate model and regional climate projections. *J. Appl. Meteorol. Climatol.* **2011**, *50*, 167–184.
55. Havlik, D.; Ketzler, G. *Gesamtstädtisches Klimagutachten Aachen. Kurzfassung und Bürgerinformation*; City of Aachen: Aachen, Germany, 2001.
56. Ren, C.; Ng, E.Y.-Y.; Katzschner, L. Urban climatic map studies: A review. *Int. J. Climatol.* **2011**, *31*, 2213–2233.
57. Curtis, L.; Rea, W.; Smith-Willis, P.; Fenyves, E.; Pan, Y. Adverse health effects of outdoor air pollutants. *Environ. Int.* **2006**, *32*, 815–830.
58. Peled, R. Air pollution exposure: Who is at high risk? *Atmos. Environ.* **2011**, *45*, 1781–1785.
59. Anderson, J.O.; Thundiyil, J.G.; Stolbach, A. Clearing the air: A review of the effects of particulate matter air pollution on human health. *J. Med. Toxicol.* **2012***, 8*, 166–175.
60. *Health Aspects of Air Pollution with Particulate Matter, Ozone and Nitrogen Dioxide. Report on a WHO Working Group. Bonn, Germany 13–15 January 2003*; World Health Organization-Europe, Ed.; World Health Organization, Regional Office for Europe: Copenhagen, Denmark, 2003.
61. Keuken, M.; Moerman, M.; Voogt, M.; Blom, M.; Weijers, E.; Röckmann, T.; Dusek, U. Source contributions to PM2.5 and PM10 at an urban background and a street location. *Atmos. Environ.* **2013**, *71*, 26–35.
62. Johnson, M.; Isakov, V.; Touma, J.S.; Mukerjee, S.; Ozkaynak, H. Evaluation of land-use regression models used to predict air quality concentrations in an urban area. *Atmos. Environ.* **2010**, *44*, 3660–3668.
63. Merbitz, H.; Detalle, F.; Ketzler, G.; Schneider, C.; Lenartz, F. Small scale particulate matter measurements and dispersion modelling in the inner city of Liège, Belgium. *Int. J. Environ. Pollut.* **2012**, *50*, 234–249.
64. Merbitz, H.; Fritz, S.; Schneider, C. Mobile measurements and regression modeling of the spatial particulate matter variability in an urban area. *Sci. Total Environ.* **2012**, *438*, 389–403.

65. Hoek, G.; Beelen, R.; de Hoogh, K.; Vienneau, D.; Gulliver, J.; Fischer, P.; Briggs D. A review of land-use regression models to assess spatial variation of outdoor air pollution. *Atmos. Environ.* **2008**, *42*, 7561–7578.
66. Merbitz, H.; Buttstädt, M.; Michael, S.; Dott, W.; Schneider, C. GIS-based identification of spatial variables enhancing heat and poor air quality in urban areas. *Appl. Geogr.* **2012**, *33*, 94–106.
67. Baklanov, A. Megapoli Project Final Report. Megacities: Emissions, Urban, Regional and Global Atmospheric Pollution and Climate Effects, and Integrated Tools for Assessment and Mitigation. Available online: http://www.megapoli.info (accessed on 9 July 2013).
68. *Ecosystems and Human Well-Being. Current State and Trends*; Hassan, R., Scholes, R., Ash, N., Eds.; Island Press: Washington, DC, USA, 2005; Volume 1.
69. Gómez-Baggethun, E.; Barton, D.N. Classifying and valuing ecosystem services for urban planning. *Ecol. Econ.* **2013**, *86*, 235–245.
70. Terzaghi, E.; Wild, E.; Zacchello, G.; Cerabolini, B.E.; Jones, K.C.; Di Guardo, A. Forest Filter Effect: Role of leaves in capturing/releasing air particulate matter and its associated PAHs. *Atmos. Environ.* **2013**, *74*, 378–384.
71. Litschke, T.; Kuttler, W. On the reduction of urban particle concentration by vegetation—A review. *Meteorol. Z.* **2008**, *17*, 229–240.
72. Rowe, D.B. Green roofs as a means of pollution abatement. *Environ. Pollut.* **2011**, *159*, 2100–2110.
73. Pugh, T.A.M.; Mackenzie, R.; Whyatt, J.D.; Hewitt, C.N. The effectiveness of green infrastructure for improvement of air quality in urban street canyons. *Environ. Sci. Technol.* **2012**, *46*, 7692–7699.
74. Vos, P.E.; Maiheu, B.; Vankerkom, J.; Janssen, S. Improving local air quality in cities: To tree or not to tree? *Environ. Pollut.* **2013**, *183*, 113–122.
75. Blank, L.; Vasl, A.; Levy, S.; Grant, G.; Kadas, G.; Dafni, A.; Blaustein, L. Directions in green roof research: A bibliometric study. *Build. Environ.* **2013**, *66*, 23–28.
76. Koyama, T.; Yoshinaga, M.; Hayashi, H.; Maeda, K.; Yamauchi, A. Identification of key plant traits contributing to the cooling effects of green facades using freestanding walls. *Build. Environ.* **2013**, *66*, 96–103.
77. Zheng, D.; Ducey, M.J.; Heath, L.S. Assessing net carbon sequestration on urban and community forests of northern New England, USA. *Urban For. Urban Green.* **2013**, *12*, 61–68.
78. Velázquez-Martí, B.; Sajdak, M.; López-Cortés, I. Available residual biomass obtained from pruning *Morus alba* L. trees cultivated in urban forest. *Renew. Energy* **2013**, *60*, 27–33.
79. Kaźmierczak, A. The contribution of local parks to neighbourhood social ties. *Landsc. Urban Plan.* **2013**, *109*, 31–44.
80. Ward Thompson, C.; Roe, J.; Aspinall, P.; Mitchell, R.; Clow, A.; Miller, D. More green space is linked to less stress in deprived communities: Evidence from salivary cortisol patterns. *Landsc. Urban Plan.* **2012**, *105*, 221–229.
81. Völker, S.; Kistemann, T. Reprint of: "I'm always entirely happy when I'm here!" Urban blue enhancing human health and well-being in Cologne and Düsseldorf, Germany. *Soc. Sci. Med.* **2013**, *91*, 141–152.

82. La Rosa, D.; Privitera, R. Characterization of non-urbanized areas for land-use planning of agricultural and green infrastructure in urban contexts. *Landsc. Urban Plan.* **2013**, *109*, 94–106.
83. Barbati, A.; Corona, P.; Salvati, L.; Gasparella, L. Natural forest expansion into suburban countryside: Gained ground for a green infrastructure? *Urban For. Urban Green.* **2013**, *12*, 36–43.
84. Radford, K.G.; James, P. Changes in the value of ecosystem services along a rural–urban gradient: A case study of Greater Manchester, UK. *Landsc. Urban Plan.* **2013**, *109*, 117–127.
85. Ernstson, H. The social production of ecosystem services: A framework for studying environmental justice and ecological complexity in urbanized landscapes. *Landsc. Urban Plan.* **2013**, *109*, 7–17.
86. *Perspectives in Urban Ecology. Studies of Ecosystems and Interactions between Humans and Nature in the Metropolis of Berlin*; Endlicher, W., Ed.; Springer: New York, NY, USA, 2011.
87. Piguet, P.; Blunier, P.; Loïc Lepage, M.; Alexis Mayer, M.; Ouzilou, O. A new energy and natural resources investigation method: Geneva case studies. *Cities* **2011**, *28*, 567–575.
88. Vettorato, D.; Geneletti, D.; Zambelli, P. Spatial comparison of renewable energy supply and energy demand for low-carbon settlements. *Cities* **2011**, *28*, 557–566.
89. Zaman, A.U.; Lehmann, S. Urban growth and waste management optimization towards "zero waste city". *City Cult. Soc.* **2011**, *2*, 177–187.
90. Gwilliam, K.M. *Cities on the Move. A World Bank Urban Transport Strategy Review*; World Bank: Washington, DC, USA, 2002.
91. Gwilliam, K. Cities on the move—Ten years after. *Res. Transp. Econ.* **2013**, *40*, 3–18.
92. Cheng, J.; Bertolini, L.; Le Clercq, F.; Kapoen, L. Understanding urban networks: Comparing a node-, a density- and an accessibility-based view. *Cities* **2013**, *31*, 165–176.
93. Sheikh Mohammad Zadeh, A.; Rajabi, M.A. Analyzing the effect of the street network configuration on the efficiency of an urban transportation system. *Cities* **2013**, *31*, 285–297.
94. Karamychev, V.; van Reeven, P. Park-and-ride: Good for the city, good for the region? *Reg. Sci. Urban Econ.* **2011**, *41*, 455–464.
95. La Greca, P.; Barbarossa, L.; Ignaccolo, M.; Inturri, G.; Martinico, F. The density dilemma. A proposal for introducing smart growth principles in a sprawling settlement within Catania Metropolitan Area. *Cities* **2011**, *28*, 527–535.
96. De Ridder, K.; Lefebre, F.; Adriaensen, S.; Arnold, U.; Beckroege, W.; Bronner, C.; Damsgaard, O.; Dostal, I.; Dufek, J.; Hirsch, J. Simulating the impact of urban sprawl on air quality and population exposure in the German Ruhr area. Part II Development and evaluation of an urban growth scenario. *Atmos. Environ.* **2008**, *42*, 7070–7077.
97. Stumpp, E.-M. New in town? On resilience and "Resilient Cities". *Cities* **2012**, *32*, 164–166.
98. Tyler, S.; Moench, M. A framework for urban climate resilience. *Clim. Dev.* **2012**, *4*, 311–326.
99. Alberti, M.; Marzluff, J.M. Ecological resilience in urban ecosystems: Linking urban patterns to human and ecological functions. *Urban Ecosyst.* **2004**, *7*, 241–265.
100. Collier, M.J.; Nedović-Budić, Z.; Aerts, J.; Connop, S.; Foley, D.; Foley, K.; Newport, D.; McQuaid, S.; Slaev, A.; Verburg, P. Transitioning to resilience and sustainability in urban communities. *Cities* **2013**, *32*, S21–S28.

101. European Commission (EC). Directive 2007/2/EC of the European parliament and of the council of 14 March 2007—Establishing an Infrastructure for Spatial Information in the European Community (INSPIRE). *Off. J. Eur. Union L* **2007**, *108*, 1–14.
102. European Commission (EC). *ESDP, European Spatial Development Perspective. Towards Balanced and Sustainable Development of the Territory of the European Union*; Office for Official Publications of the European Communities: Luxembourg City, Luxembourg, 1999.
103. Batty, M. Building a science of cities. *Cities* **2012**, *29*, 9–16.
104. Zenker, S.; Petersen, S.; Aholt, A. The Citizen Satisfaction Index (CSI): Evidence for a four basic factor model in a German sample. *Cities* **2013**, *31*, 156–164.
105. Dahiya, B. Cities in Asia, 2012: Demographics, economics, poverty, environment and governance. *Cities* **2012**, *29*, S44–S61.
106. The United Nations Population Devision. World Urbanization Prospects: The 2001 Revision; 2002. Available online: http://www.un.org/esa/population/publications/wup2001/WUP2001_CH6.pdf (accessed on 6 August 2013).
107. Göpel, E. Internationale Leitlinien und Konzepte für Gesundheit und Stadtentwicklung. In *Handbuch. Stadtplanung und Gesundheit*; Böhme, C., Kliemke, C., Reimann, B., Eds.; Huber: Bern, Switzerland, 2012; pp. 49–58.
108. Fraunhofer-Institut für Arbeitswirtschaft und Organisation. Morgenstadt. Available online: http://www.morgenstadt.de/de/morgenstadt-initiative.html (accessed on 15 August 2013).
109. Universität Duisburg-Essen, Zentrum für Logistik und Verkehr. Project Cologne Mobil. Available online: http://www.uni-due.de/zlv/cologne-mobil.php (accessed on 15 August 2013).
110. Rheinisch-Westfälische Technische Hochschule (RWTH) Aachen University. Geschäftsstelle Elektromobilität. Available online: http://www.gse.rwth-aachen.de/start (accessed on 15 August 2013).
111. University of Cologne. Megacity Task Force. Available online: http://www.megacities.uni-koeln.de/index.htm (accessed on 15 August 2013).
112. TU Darmstadt. Intrinsic Logic of Cities. Available online: www.stadtforschung.tu-darmstadt.de/eigenlogik_der_staedte/index.en.jsp (accessed on 18 August 2013).
113. HafenCity University Hamburg. Low-Budget-Urbanity. Available online: low-budget-urbanity.de/ (accessed on 18 August 2013).
114. TU Berlin. Center for Metropolitan Studies. Available online: www.metropolitanstudies.de (accessed on 18 August 2013).
115. Endlicher, W. Introduction: From Urban Nature Studies to Ecosystem Services. In *Perspectives in Urban Ecology. Studies of Ecosystems and Interactions between Humans and Nature in the Metropolis of Berlin*; Endlicher, W., Ed.; Springer: New York, NY, USA, 2011; pp. 1–13.
116. Schneider, C.; Balzer, C.; Buttstädt, M.; Eßer, K.; Ginski, S.; Hahmann, J.; Ketzler, G.; Klemme, M.; Kröpelin, A.; Merbitz, H.; *et al*. "CITY 2020+": Assessing climate change impacts for the city of Aachen related to demographic change and health—A progress report. *Adv. Sci. Res.* **2011**, *6*, 261–270.

117. Rheinisch-Westfälische Technische Hochschule (RWTH) Aachen University, Human Technology Center. U-Turn—Research Project on Life Quality in City Quarters in the Context of Mobility, City Structure and Energy Turnaround. Available online: http://www.humtec.rwth-aachen.de/index.php?article_id=881&clang=1 (accessed on 13 August 2013).