LIGHT- AND SOUNDSCAPES OF THE URBAN NIGHT

BERLIN - FLORENCE

Light- and Soundscapes of the urban night - Berlin/ Florence

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Abstract

Light- and soundscapes are integral parts of city life, but they are not properly considered in urban planning - much less the interplay of both phenomena. The negative impacts of noise and light pollution on the environment, public health, fauna, flora, scientific work and the culture of a society put pressure on cities to develop strategies how to deal with these complex issues.

The master´s project "Light- and soundscapes of the urban night: Berlin - Florence" discusses the question which role light and sound play in policies, urban planning and the urban life in Berlin and Florence – two cities, which have relatively far developed concepts for both topics, though they follow different strategic approaches and different dynamics are at work.

Thus, one key issue is the analysis of policies and governance dynamics on different scales (European Union, Germany/Italy, Berlin/Florence). The project analyzes which actors are central for the governance of urban light- and soundscapes, how the (power) relations between them are structured and how citizens participate in the process. Furthermore, it investigates how the political decision-making processes work, which the underlying understandings of light, sound and noise are and which the main narratives within the discourse are. Finally, it explains the impact of these public policies on the fabric of the cities of Berlin and Florence.

The second key issue is the perception of light and sound by the people in two study areas: the Kottbusser Tor neighborhood in Berlin and the Santa Croce neighborhood in the historic center of Florence. The focus lies on the questions what feelings different sounds and lights trigger, how they influence human behavior and what kind of information they generate.

The project is based on a combined quantitative and qualitative approach, comparing at the same time two study areas and the two topics of light- and soundscapes. This requires the use of diverse methods like the analysis of literature and policy documents, expert interviews, surveys, light- and soundwalks, measurements, observations, sound recordings, photo and video documentation.

Light and sound have in common that certain characteristics of them are quantifiable (such as sound pressure, color temperature or light intensity). At the same time people perceive light and sound in a highly subjective way depending on various factors like acoustic/visual socialization, (dis-)abilities, age, cultural background etc. as the empirical work in Berlin and Florence proves. While conducting mapping or action planning, it is very important to keep both the quantitative and qualitative side of light and sound in mind. Though both phenomena follow this logic and have several similarities, they have a different "standing" in the public discourse: most policies focus on noise and its negative impact and neglect the relevance of soundscapes for information about the (urban) environment, the stimulation of emotion and identification with a place. In contrast, light is mostly perceived as something positive that brings security and progress, while negative aspects like light pollution are less in the focus. Bringing these perspectives together allows a more holistic understanding of the phenomena.

In the common practice, light and sound/noise are dealt with separately, while this projects develops the innovative approach to bring the two fields together which creates synergies, makes it possible to learn from each other and think outside the box. The report calls for an integrated approach to consider light- and soundscapes as essential parts of urban planning, which are related to diverse fields like architecture, mobility, security, planning of urban green spaces, public health etc. It promotes the idea that relatively quiet and/or dark urban areas are commons that are important for the quality of life in a city. Comprehensive forms of citizen empowerment and citizen science that go beyond mere consultation are central aspects of any successful light- and soundscape design process. A first step would be to (re-)politicize these issues and to create mindfulness for the visual and acoustic qualities of our cities.

Content

List of abbreviations

ADAC   "Allgemeiner Deutscher Automobil-Club" (General German Automobile Club)

AIA   "Associazione Italiana di Acustica" (Acoustical Society of Italy)

AIDI   "Associazione Italiana di Illuminazione" (Italian Illumination Association)

ALD   "Arbeitsring Lärm" (Noise Control Association)

ARPAT   "Agenzia regionale per la protezione ambientale della Toscana" (Environmental Protection Agency of Tuscany Region)

BA   "Bezirksamt" (district office)

BImSchg   "Bundes-Immissionsschutzgesetz" (Federal Immission Control Act)

BGB   "Bürgerliches Gesetzbuch" (German Civil Code)

BMBF   "Bundesministerium für Bildung und Forschung" (German Federal Ministry of Education and Research)

BMUB   "Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit" (German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety)

BMWI   "Bundesministerium für Wirtschaft und Energie" (German Ministry for Economic Affairs and Energy)

BSI   British Standards Institution

BUND   "Bund für Umwelt und Naturschutz Deutschland" (German Federation for Environment and Nature Conservation)

BVG   "Berliner Verkehrsgesellschaft" (Berlin Public Transport Company)

cd   Candela

CEI   "Comitato Elettrotecnico Italiano" (Italian Electrotechnical Committee)

CEN   European Committee for Standardization

CENELEC   European Committee for Electro-Technical Standardization

CIE   International Commission of Illumination

CRT   „Consiglio regionale della Toscana" (Tuscany Regional Council)

dB	decibel
dB(A)	A-weighted decibel
DEGA	"Deutsche Gesellschaft für Akustik" (German Acoustical Society)
dena	"Deutsche Energie-Agentur" (German Energy Agency)
DIfU	"Deutsches Institut für Urbanistik" (German Institute for Urban Affairs)
DIN	"Deutsches Institut für Normung" (German Institute for Standardization)
DPCM	"Decreto del Presidente del Consiglio dei Ministri" (Decree of the President of the Council of Ministers)
DSP	Dark Sky Places
DST	"Deutscher Städtetag" (Association of German Cities)
EAA	European Acoustics Association
EBA	"Eisenbahn-Bundesamt" (German Federal Railway Authority)
ECSA	European Citizen Science Association
EC	European Commission
EEA	European Environment Agency
EIONET	European Environment Information and Observation Network
EPoN	Expert Panel on Noise
ERDF	Environmental Noise Directive
EU	European Union
ExWoSt	"Experimenteller Wohnungs- und Städtebau" (Experimental Housing Construction and Urban Development)
HARMONICA	Harmonised Information for Citizens and Authorities
HUSH	Harmonization of Urban Noise Reduction Strategies for Homogeneous Action Plans
ICA	International Commission for Acoustics

IDA	International Dark Sky Association
IEC	International Electro-Technical Commission
IHK	"Industrie- und Handelskammer" (German Chamber of Industry and Commerce)
I-INCE	International Institute of Noise Control Engineering
IMAGINE	Improved Methods for the Assessment of the Generic Impact of Noise in the Environment
IP	"Parlamento Italiano, Camera dei Deputati e Senato della Repubblica" (Italian Parliament. Bicameral: Chamber of Deputies, Senate of the Republic)
ISO	International Organization for Standardization
ISPRA	"Istituto Superiore per la Protezione e la Ricerca Ambientale" (Italian National Institute for Environmental Protection and Research)
K	Kelvin
LAI	"Bund/Länder-Arbeitsgemeinschaft Immissionsschutz" (German Bund/Länder working group on immission protection)
Lden	day-evening-night noise indicator
LED	light-emitting diode
LImSchG Bln	"Landes-Immissionsschutzgesetz Berlin" (Berlin Pollution Control Act)
lm	night-time noise indicator
Lnight	night-time noise indicator
LoNNe	Loss of the Night Network
lx	Lux
MiBACT	"Ministero dei Beni e delle Attività Culturali e del Turismo" (Italian Ministry of Cultural Heritage, Activities and Tourism)
MIT	"Ministero delle Infrastrutture e dei Trasporti" (Italian Ministry of Infrastructure and Transport)
NABU	"Naturschutzbund Deutschland" (Nature And Biodiversity Conservation Union)

NGO	non-governmental organization
NKZ	"Neues Kreuzberger Zentrum" (new center of Kreuzberg)
nm	Nanometer
NOISE	Noise Observation and Information Service for Europe
PCIP	"Piano Comunale di Illuminazione Pubblica" (Urban Light Plan)
PGT	"Piano Generale dei Trasporti e della Logistica" (General Plan for Transport and Logistics)
PGTU	"Piano Generale del Traffico Urbano" (Urban Traffic General Plan)
PUT	"Piano Urbano del Traffico" (Urban Traffic Plan)
OWIG	"Ordnungswidrigkeitengesetz" (German Administrative Offences Act)
QM ZKO	"Quartiersmanagement Zentrum Kreuzberg/Oranienstraße" (neighborhood management central Kreuzberg/Oranienstraße)
QUADMAP	Quiet Areas Definition and Management in Action Plan
SenStadtUm (Env. Sen. Dep.)	"Senatsverwaltung für Stadtentwicklung und Umwelt (Berlin Senate Department for Urban Development and the Environment)
SenSW	„Senatsverwaltung für Stadtentwicklung und Wohnen" (Berlin Senate Department for Urban Development and Housing)
S.IL.FI.	"Società Illuminazione Firenze spa" (Florence Lighting Company)
SIRA	"Sistema Informativo Regionale dell´Ambiente della Toscana" (Tuscan Regional Information System)
TA Lärm	"Technische Anleitung zum Schutz gegen Lärm" (Technical Instructions on Noise Protection)
TUB	Technical University of Berlin
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNI	"Ente Italiano di Normazione" (Italian Organization for Standardization)
UniFl	"Universitá degli Studi di Firenze" (University of Florence)
VBB	"Verkehrsbund Berlin-Brandenburg" (Transport Federation Berlin-Brandenburg)

VCD	"Verkehrsclub Deutschland" (German Transport Club)
VDE e.V.	"Verein zur Förderung von demokratischen Entwicklungsprozessen" (Association to promote democratic development processes)
VDGN	"Verband Deutscher Grundstücksnutzer" (Association of German Property Users)
W	Watt
WFAE	World Forum For Acoustic Ecology
WHO	World Health Organization
YAN	Young Acousticians Network
ZVEI	„Zentralverband Elektrotechnik- und Elektronikindustrie e. V." (Central Association of the Electrical Engineering and Electronics Industry)

What we wanted to say in advance…

Today, sound and light as well as noise and light pollution issues are on the way to get more attention in planning as well as in the media.

Although with different intensity and scope both topics are partly present in formal and informal urban planning, but different departments, different actors oversee the respective fields based on different formal frameworks. Since sound and light have a lot in common, since Berlin and Florence are as local authorities well advanced in their respective countries, and since the project organizers have quite some experience in the respective fields (Antonella Radicchi in soundscape and noise, Dietrich Henckel in light and light pollution) it seemed logical to explore the chances and limitations of an integration of both topics.

A planning studio, which play a major role in the curriculum of the Institute for Urban and Regional Planning at TU Berlin, seemed an ideal format to make a first step. The results which are provided in this report do not only justify the endeavor, but warrant more research on the combined topics.

Stepping on such a little developed ground needs the support of a lot of persons, experts in their respective fields both in Berlin and Florence. Since the Institute is based in Berlin, the access was more at hand: the case study area was in public transport distance, the interviews with the experts could be arranged over on longer span of time, some experts provided lessons in class. On the other hand, to get hold of an access to first hand empirics and to experts' knowledge we made a week-long field trip to Florence, where a lot of experts opened their doors, sharing their insights with us, showing us around the city, providing materials.

Without the generosity to spend their time and share their expertise, this project would not have been possible. There we convey our great thanks to:

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Moreover, we must thank the anonymous citizens in the streets of Berlin and Florence case study areas, who took part in the surveys conducted during the night. Without their willingness to participate, many important empirical results – as heuristic and experimental as they may be – would not have been possible.

We hope that the findings and ideas presented here will trigger further insights.

For the project group February 2017

Dietrich Henckel & Antonella Radicchi

1. Introduction

1.1 Context

Imagine a city life without light and sound. Ima Imagine a city life without light and sound. Imagine you walk along a street and the cars don't have those glary spotlights. And they don't use honks and the ambulance doesn't awake you in the middle of the night. Not even you can hear the engines of the cars. Neither the subway nor the air-conditions at the buildings. The blinking advertising board of the casino on the other side of the street does not disturb you anymore. Neither the dog of the woman living in the first floor who is barking every morning. Neither rain nor wind. You can pass and even live next to a bar and music or yelling people do not impede you sleeping. But perhaps you like to feel attracted by the music and the warm glow of the lamps in the bar? Perhaps you also like the voices of the people who talk, laugh and enjoy life. To listen to familiar voices? Even to familiar sounds like the bell of the church in your street? Or the lights that indicate that the shop in the corner is open? Or that the historical buildings are lit? Or the trip hazard in the pavement of the sidewalk or the exit of the subway station?

Light and sounds are integral parts of city life. They influence our all day life enormously – sometimes they enrich, sometimes it is the opposite. Both extremes – absolutely darkness and silence, but also intensive light and noise – are uncomfortable for human beings, and are even used as torture methods. Talking about the overload means the pollution of the environment by sound and light. In the case of sound, sound pollution is by far more known and is more communicated via noise or noise pollution. The negative impacts on health are well investigated and also within the society, there is a large awareness for risks that the exposure to continuous noises produces. Due to a study from the World Health Organization (WHO), noise represents the second biggest risk on health in Europe. According to this study, cardiovascular diseases can result from too high and frequent noise exposure. Furthermore, in Europe, every fifth person is expected to suffer from sleep disturbances (WHO, 2011, pp. 99-100). Light pollution on the other hand is less known

and the negative effects of health are by far less investigated. Therefore, the awareness of the risky impacts for human beings, but also for the environment, are little known in society as well. The rhythm of day and night, light and darkness, is deeply embedded in our organism because we need the nighttime as recovery period. The exposure to light, especially to blue artificial light like LED (light-emitting diode) lights, inhibits the production of melatonin, a sleep hormone that is expected to let us sleep in a recreative and healthy way. The disruption of our rhythm leads to insomnia, depression, cancer and also cardiovascular diseases (Chepesiuk, 2009, p. 24). Besides this extreme impacts, blue light can also decrease visual acuity and influence safety. Dangerous situations can appear in particular if drivers and pedestrians are blinded by car's spotlights or public lighting with a harsh blue light (American Medical Association, 2016). In addition, there are cultural losses because of the enormously lit cities. Two third of the inhabitants of European cities cannot see Milky Way anymore (Posch, 2013, p. 33). The knowledge of stellar constellations or phases of the moon gets lost. For fauna, the increasing lighting also has consequences like the misleading guide for migrating birds. In the case of light, positive aspects are quite common like the positive influence of atmosphere or the basic need to see what happens in the surrounding. But for sounds on the other hand, positive aspects only become to get in the center of interest and is communicated inter alia via soundscape.

The European cities tend to become brighter due to new technologies like LED. The cost factor is becoming less significant, because light becomes increasingly cheap and there is no need to economize anymore (Posch, 2013, p. 29). At the same time the shift is environmentally friendly considering the lower energy consumption. Italy for example is in a leading position in Europe shifting to LED lights. Already today, it is the brightest country in Europe (Falchi et al., 2016, p. 5). But the fatal error is, that in consequence of lower costs for LED lighting, more light is installed. This contributes again to a bigger urban glow that has increasing environmental impacts. And in addition, the blue light LED has harmful impacts on ecosystems and human beings as well. As already described, the impacts of noise are well investigated, so city

administrations, but also guidelines on European Union (EU) level, try to counteract the noise pollution due to different noise directives and noise action plans. In the case for light pollution, official guidelines are only about to be developed. In the official discourse, still minimum standards for public light are in focus. This is justified because of the direct association between light and security – although some studies identified no direct relation between decreasing lighting and increasing criminality (Posch, 2013, p. 39).

Regarding increasing noise and light pollution, local authorities face great challenges. On the one hand, to limit the pollution, they need restrictions that need large support within the society. On the other hand, responsibilities are quite dispersed in many fields and between many actors that need to be coordinated and balanced due to different interests. These challenges become even more complicated, because the two aspects light and sound have to be treated together somehow as there are connections which have not been elaborated yet. Since the intensities are both measurable, but the perception of what is good or bad is highly subjective and influences a lot the well-being of city's residents, the correlation between those two issues are very worthwhile to investigate. To cover both aspects, quantitative and qualitative approaches need to be considered.

Two pioneer cities regarding light and sound issues are Berlin and Florence. Therefore, they have advanced strategies that are worthwhile to investigate. For both topics, action plans and concepts exist. Light concepts cover maximum standards, but they only contain advices and are far from being mandatory. In the case of sound, inter alia an experimental artistic, bottom-up approach exists that could be used as a source of inspiration for the study group for alternative considerations.

Since the research subject is extremely wide, the study group needed to restrict the frame of the investigation field. Therefore, two representative and significant cities are chosen: Berlin and Florence. For a first approximation, the alternative approach of a light- and soundwalk permit a first comprehension for the topic. The awareness gets heightened and the differences within the areas

become more significant. Out of this method, the spots for the empirical investigations are selected: Kottbusser Tor and Piazza Santa Croce/Piazza Sant'Ambrogio. They are especially known for their nightlife and therefore for great challenges due to light and sound (pollutions). Due to the delimited areas, the study group could develop the research frame and questions.

1.2 Research questions

The necessity of an integrated approach of light and sound/light and noise pollution represents one focus of the study group. Therefore the group split up in a first step into two subgroups: one for further investigations on light issues, one on sound and noise issues. During this process, an ambivalence of qualitative and quantitative aspects has been identified while investigating the current literature, methods of municipalities and policies. A combined qualitative and quantitative approach is adequate to be able to compare administration's directives with people's perception. As a consequence, the organization of the subgroups changes into a more experimental one. One group dedicates its further analysis to a political level and investigates different policies that affect the light- and soundscape/light and noise pollution of the urban night. The other group produces own empirics for the case study areas, which are identified in Berlin and Florence due to measurements, observations and surveys, in the urban night as well. The comparison between those two investigation fields should create more information about the coherence of the policies and the subjective perception of the inhabitants and measured data – even though the results are not representative because the possibility to collect measurements, observation and conduct surveys are limited in amount and time due to the frame of the project. Nevertheless, the results give an idea about the current situation and people's perception. The results of those two subgroups should lead to the answer of the overall research question of the project that is formulated as follows: **Which role do light and sound play in policies, in urban planning and in urban life?**

Due to investigations on the actual state-of-the-art of policies from the European Union, the states of Germany and Italy and the municipalities of Berlin and Florence (in Florence in addition the UNESCO World Heritage because of the historical center), the study group wants to figure out the current point of view, insufficient-set focuses and prospective changes according to light and sound issues. Within these investigations, the following research questions provide a framework for the work:

- Which actors are central for the governance of urban light- and soundscapes and how are the (power) relations between them structured?
- How do citizens participate in the process? How does the decision-making process work? Which are the underlying understandings of light, sound and noise?
- Which are the main narratives within the discourse? Which different discourses do different actors bring up? What are the voids of those discourses?
- What impact do those public policies have on the fabric of the cities of Berlin and Florence?

In addition to the policy aspects of sound and light in Berlin and Florence, it is necessary to investigate the perception of the city's residents to identify the role of these factors for the urban life at night times. For this reason, three fields of interest are outlined: Behavior, identification, and information. Furthermore, the comparison between the perceptions of the interviewees, the measurements by the study group and the official data should create deeper insights in terms of correlations or even contradictions. The research questions are formulated as followed:

- Does light and sound influence behavior? And if yes, how?
- Does light and sound create identification with a place? And if yes, how?
- What kind of information do sound and light generate?
- What is the correlation (contradiction) between official data, "measurements" taken by the study group and citizen's perception?

Due to sound and light walks, appointments and interviews with experts in different fields in Berlin and Florence the study group could collects information from professional insights as well as personal impressions in both cities.

1.3 Structure of the report

The focus on empirics and policy analysis structure not only the organization of the investigations and the fieldwork, but also the report. In this sense, one of the main objectives of this research work is to figure out the relationship between light policies, sound (noise) policies and to combine those results with empirical information. Therefore, a structure is developed that considers this relation, but also the interrelation between the three axes: study areas in Berlin and Florence, policy analysis and empirics information, light and sound.

First, it is necessary to develop previously a series of theoretical foundations and concepts that serve as a basis to be able to face this work. For this reason, the paper presents at first the theoretical basis that supports it. It is necessary to understand the functioning and dynamics of sound and light, important related definitions and understandings, the methods by which light and sound/light and noise pollution are analyzed and communicated (chapter 2). Then, the different methodological resources implemented throughout the investigations are clarified (chapter 3). Since the research is based on the use of quantitative (measurements, observations, etc.) and qualitative techniques (surveys, interviews, recordings, etc.), these approaches are discussed in more detail in this chapter.

After the methodology, for both cities, the study areas and the four selected spots are described characterized (chapter 4). Similarities and differences between Kottbusser Tor and Piazza Santa Croce/Piazza Sant'Ambrogio are presented. Furthermore, the selection of the four spots is deduced from those explanations. At the spots, which are considered as relevant, the soundwalk, the surveys, observations and measurements are carried out.

The fifth chapter is dedicated to the research on policies of urban lights and sounds. This chapter analyses the influence of the different organisms on different scales as well as the different actors that are involved. Although at international or national level, Berlin and Florence are framed under certain guidelines, at regional and local level, the circumstances are different and in that sense, a comparative analysis is developed.

In the following chapter (6), the situation of urban sound and lights in the selected spots is analyzed due to empirical information obtained from surveys, observations and measurements. The final chapter (7) concludes all the results of the analysis on different levels and the collected empirics. This includes on the one hand, the findings that can be identified throughout this work and, on the other hand, recommendations that aim to a closer consideration of the problems related to light and sound/light and noise pollution in urban planning.

2. Basics and definitions

2.1 Sound/Noise

Comparable to light, sound persists of waves that are measurable but at the same time interpreted by humans in different ways (depending not only on the acoustic environment, but also on the attentiveness, current activities and expectations of the listener, individual prior experiences, the public discourse concerning these sounds etc.). This leads to the quantitative and qualitative character of sound. It should also be kept in mind that as "the attention is largely multi-sensory and multisensory stimuli can partly be bound into a single percept even prior to attention, the visual context and visibility of the source play a significant role." (Kang et al., 2016, p. 286) But let´s provide some basics definitions and explanations of central concepts:

Sound
Sound can be generally defined as a mechanical wave that is created by vibrating objects and propagated through a medium (i.e. the material through which the disturbance is moving) from one location to another. In contrast to light, which is an electromagnetic wave (see chapter 2.2), sound cannot travel through a vacuum. Sound can be also understood as pressure wave, because it is characterized by a repeating pattern of high-pressure and low-pressure regions moving through a medium. (The Physics Classroom, n. d.)

Sounds can be described in different ways. Relevant are their physical properties (such as time, frequency of occurrence, intensity and duration), the sound origin (nature, music, indoor, transport, mechanical, humans etc.) and their meaning and information (e.g. sounds as values, memories, emotions, immaterial cultural heritage or expression of power) (Radicchi, 2016). Furthermore, Schafer distinguishes three main features of soundscapes:

- **Keynote sounds** are ubiquitously, they are the "anchor or fundamental tone" in reference to which everything else takes on its special meaning. It is not necessary to listen consciously to them. Typical keynote sounds in a landscape are for example water, plains,

birds, insects etc. (Schafer, 1977, p. 9f).
- **Signals** are, in contrast to keynotes, foreground sounds to which we listen consciously. In the city they often serve as acoustical warnings like the sounds of horns and sirens (ibid., p. 10).
- **Soundmarks** make the acoustic life of the community unique and should be protected as Schafer argues (ibid.).

dB/dB(A)
Decibel (dB) is known as the unit for measuring the relative intensities of sound, though "[s]trictly speaking, the decibel is not a unit but the logarithmic ratio of the sound pressure, in a unit such as pascals, to a standard reference pressure in the same units." (EEA, 2010, p. 6) Usually, the levels are corrected for the sensitivity of the human ear, which is called the A-weighting. This explains the often used abbreviation dB(A).

The following table (see Fig. 1) gives an impression of the decibel levels of exemplary sounds. The logarithmic scale makes it difficult to total different values. For example, two times 50 db(A) add up to 53 dB(A) but are perceived by the human ear as a doubling. Two sounds of 50 dB(A) and 60 dB(A) would add up to 60,4 dB. (Senatsverwaltung für Stadtentwicklung und Umwelt, 2013a, p. 3)

0 dB	threshold of hearing, the least perceptible sound
10 dB	breathing (10 times the intensity of 0 dB)
20 dB	whisper, rustling leaves (20 times the intensity of 0 dB)
30 dB	quiet rural area
40 dB	library, bird calls
50 dB	quiet suburb, conversation at home
60 dB	conversation in restaurant, coffee, background music
70 dB	vacuum cleaner, living room music
80 dB	dishwasher
100 dB	electric saw
110 dB	auto horn at one meter, live rock music
120 dB	thunderclap, chain saw
150 dB	jet take off (at 25 meters)

Fig.1: Decibel level of selected sounds.

Soundscape

The term soundscape was first framed by the Canadian composer, writer, music educator and environmentalist Raymond Murray Schafer. Originally, the concept refers to the way the environment is understood by those living within it and is seen as something human-made or "composed": "Soundscape is the acoustic manifestation of `place´, in the sense that the sounds give the inhabitants a `sense of place´ and the place´s acoustic quality is shaped by the inhabitants´ activities and behavior." (Westerkamp et al., 2006).

Schafer distinguishes between hi-fi and lo-fi soundscapes:

- "The hi-fi soundscape is one in which discrete sounds can be heard clearly because of the low ambient noise level. The country is generally more hi-fi than the city; night more than day; ancient times more than modern. In the hi-fi soundscape, sounds overlap less frequently; there is perspective - foreground and background" (Schafer, 1977, p. 43).
- "In a lo-fi soundscape individual acoustic signals are obscured in an overdense population of sounds. The pellucid sound - a footstep in the snow, a church bell across the valley or an animal scurrying in the brush - is masked by broadband noise. Perspective is lost." (Ibid.)

More recently, the International Organization for Standardization (ISO) aimed at enabling "a broad international consensus on the definition of `soundscape´, to provide a foundation for communication across disciplines and professions with an interest in soundscape." (ISO, 2014) A soundscape is defined as an "acoustic environment as perceived or experienced and/or understood by a person or people, in context." (Ibid.)

Noise

As Schafer points out noise can have a variety of (qualitative and quantitative) meanings such as unwanted sound, unmusical sound, any loud sound, disturbance in any signaling system (1977, p. 183). In the course of this report the definition of the European Environment Agency (EEA) will be used - that means noise is understood as any audible sound that causes disturbance, impairment or health damage (as illustrated in Figure 2). Noise does not only affect the health and well being of exposed humans, but has also harmful effects on wildlife both in the terrestrial and aquatic environment (EEA, 2016).
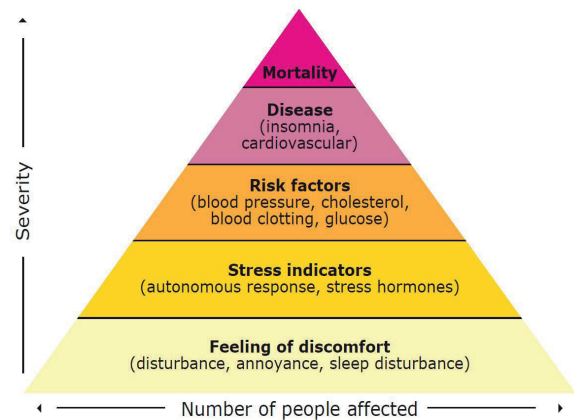
Fig. 2: Pyramid of noise effects.

Environmental noise

As defined by the Environmental Noise Directive (END, article 3) environmental noise refers to "unwanted or harmful outdoor sound created by human activities, including noise emitted by means of transport, road traffic, rail traffic, air traffic, and from sites of industrial activity".

Noise annoyance

Noise annoyance describes all negative feelings that are provoked by noise, such as disturbance, dissatisfaction, displeasure, irritation and nuisance. (EEA, 2010, p. 5)

Noise indicators

According to the END two main indicators shall be applied in the assessment and the management of environmental noise. For the exact formula see annex I of the END. There it is defined that the "incident sound is considered, which means that no account is taken to the sound that is reflected at the facade of the dwelling under consideration (as a general rule, this implies a 3 dB correction in case of measurement)." In annex II of the END it is explained that the noise indicators can be determined either by computation (which is the case in Berlin and Florence) or by measurement at the assessment position.

- **L**den (day-evening-night noise indicator) describes the average sound pressure level over all days, evenings and nights in a year and indicates overall annoyance. (The eve-

ning value gets a penalty of 5 dB and the night value of 10 dB.) The END defines a Lden threshold of 55 dB.

- **L**night (night-time noise indicator) describes the average sound pressure level over one night (11 pm - 7 am), which can be chosen so that it is representative of a longer period. In the context of the END a yearly average nighttime level is intended. Lnight is used to indicate sleep disturbance. It applies a threshold of 50 dB, although the WHO suggests in the Night Noise Guidelines (2009) that from a health point of view the calculations of nighttime burden should start at 40 dB.

Acoustical planning

The END defines acoustical planning as "controlling future noise by planned measures, such as land-use planning, system engineering for traffic, traffic planning, abatement by sound-insulation measures and noise control of sources." (END, Art. 3(u))

Noise mapping

Within the END (article 3) noise mapping is defined as "the presentation of data on an existing or predicted noise situation in terms of a noise indicator, indicating breaches of any relevant limit value in force, the number of people affected in a certain area, or the number of dwelling exposed to certain values of a noise indicator in a certain area".

Strategic noise mapping

A strategic noise map is "designed for the global assessment of noise exposure in a given area due to different sources or for overall predictions for such an area" (END, article 3). EU member states are required to provide these maps every five years for all agglomerations with more than 250,000 inhabitants and for all major roads which have more than six million vehicles passages a year, major railways which have more than 60,000 train passages per year and major airports within their territories (END, article 7). Annex IV of the END defines minimum requirements for strategic noise mapping.

Action plans

Action plans are designed to "manage noise is-sues and effects, including noise reduction if necessary" (END, article 3). EU member states are required to provide these maps at least every five years for places near major roads (> six million vehicle passages/year), major railways (> 60,000 train passages/year) and major airports as well as for agglomeration with more than 250,000 inhabitants. The END requires that action plans shall also aim to protect quiet areas against an increase in noise. (END, article 8) For the minimum requirements for action plans see annex V of the END.

Quiet area

The END (article 3) distinguishes between two types of so-called quiet areas that are both delimited by the competent authority:

- A "**quiet area in an agglomeration**" is not exposed to a value of Lden or another appropriate noise indicator greater than a certain value set by the member state.
- A "**quiet area in open country**" is undisturbed by noise from traffic, industry or recreational activities.

The European Environment Agency argues that no single set of criteria can be set for all quiet areas and that issues such as accessibility and the benefit to biodiversity need to be considered (EEA, 2016b, p. 4). In the "Good practice guide on quiet areas" the EEA suggests the Quietness Suitability Index as methodology assessing potential quiet areas outside urban areas.

Soundscape research

Based on the soundscape concept beginning in the late 1960s there was developed a multidisciplinary approach to bring together fields like acoustics, psychoacoustics, sound recording engineering, architecture, environmental health, psychology, sociology, urban studies and more. In contrast to the above-explained approach of acoustical planning it understands environmental sounds as "resource" rather than as "waste". As Schafer puts it, soundscape studies deal with questions of the "relationship between man and the sounds of his environment, and what happens when those sounds change" (Schafer, 1977, p. 3f). According to him, environmental acoustics should also include the question of which

sounds are worth to preserve/encourage/multiply (ibid., p.4). Schafer is mostly known for his World Soundscape Project, which was a research and educational endeavor founded in 1969 at the Sonic Research Studio at the Simon Fraser University. It contributed significantly to the establishment of the field of soundscape studies. The project aimed at finding solutions for an "ecologically balanced soundscape where the relationship between the human community and its sonic environment is in harmony" (Westerkamp et al., 2006).

Since about 15 years the soundscape approach receives more attention mainly in the field of community noise and environmental acoustics by researchers, and partly also by policy makers and practitioners. Kang and colleagues state that the "importance of soundscape research has been recognized by governmental organizations and national funding bodies in Europe, and a number of national research projects relating to this field carried out in Europe" (2016, p. 285).

Sound walk
The sound walk method is coined principally by the German-Canadian audio artist, composer and teacher Hildegard Westerkamp. She defines it as "any excursion whose main purpose is listening to the environment." The principal objective of it is to rediscover and reactivate our sense of hearing. Westerkamp argues that humans are often exposed to "too many, too loud or too meaningless sound", which leads to the danger "that some of the more delicate and quiet sounds may pass unnoticed by numbed ears and among the many mechanized voices of modern soundscapes and may eventually disappear entirely" (Westerkamp, 1974).

Sound walks might look differently, depending on the circumstances. They can be conducted in any indoor or outdoor, public or private environment, alone or in a group, at any time, once or several times, over a short or a longer period. Participants focus on their acoustical environment and ask themselves questions such as: Which is the quietest sound of my body? What do I hear? Can I detect interesting rhythms? What are the sources of the different sounds? (Ibid.)

According to Antonella Radicchi (2016) sound walks serve both as educational tool and qualitative method. Within the course of the project the students experimented with the method of a combined light and soundwalk as described in chapter 3.

Sound map
Sound maps are used as operational tool to provide a qualitative description of a soundscape environment (Radicchi/Signorelli, 2015, p. 133). According to Radicchi they "can be considered a form of *locative media* [...], conveying information about the visual, spatial, acoustic and temporal aspects of a specific place, aimed at representing the soundscape using an interactive interface." (Ibid., p. 135)

2.2 Light

In physical terms light can be described as measurable electromagnetic radiation in a waveband, which is visible for the human eye. But as one knows, it is much more than this: in the earlier centuries light (or the absence of light) represented the supernatural and was a fixed component of myths or religious rituals. Until today humans relate light to security, wealth and progress. Especially the use of artificial light revolutionized the everyday life of humans and caused many innovations, which have positive advantages but also negative side effects. In the following some general definitions, which are important to understand central concepts and current developments, will get provided:

Light
Light can be generally defined as electromagnetic radiation in a waveband, which is visible for the human eye. The humans possess receptors that are able to sense energy with wavelengths between 380 and 780 nm and turn them into images. The different wavelengths in this spectrum correspond to different colors. For example light with a wavelength of around 420 nm is perceived as blue. (PTB, n.d.; Omega Engineering n.d.)

Light pollution
During the last decades the distribution of arti-

ficial light around the globe has increased constantly. This progress contains decidedly advantages but causes also negative impacts on the environment, the climate and human health. (IGB Leibniz-Institut für Gewässerökologie und Binnenfischerei, n.d.). Against this backdrop the term of light pollution describes "the inappropriate or excessive use of artificial light" (IDA International Dark-Sky Association n.d.) and its multifaceted negative effects. Direct components of light pollution are: "Glare – [the] excessive brightness that causes visual discomfort; Skyglow – brightening of the night sky over inhabited areas; Light trespass – light falling where it is not intended or needed; Clutter – bright, confusing and excessive groupings of light sources" (IDA International Dark-Sky Association n.d.). Over the last years this new approach got established by many different scientists, non-governmental organizations (NGO's) and associations.

Lightscape

The term 'scape' is used nowadays frequently and appears in many different fields. Lightscape has no official or coherent definition. The text at hand uses this term related to the term of soundscape (see chapter 2.1), with the aim to open up the perspective on light related topics and to combine or implement them into one thematic framework.

Light measurements

Light can be measured in different units, which is also known as photometry.

- The **color temperature** of a light source is measured in the unit **Kelvin (K)**. In General the shining color of light can range between reddish-yellow (less than 3,300 Kelvin), which is perceived as warm, and bluish (more than 5,000 Kelvin), which is perceived as cold. (WSH GmbH n.d.)
- The **„Lichtstrom" (luminous flux)** describes the radiation or total energy, which a light source emits in form of visible light. It is measured in the unit **Lumen (lm)**. For example a normal light bulb with 40 Watt radiates around 400 Lumen into every direction.
- The **„Lichtstärke" (light intensity)** is measured in the unit **Candela (cd)**. A light source doesn't emit light to all sides evenly. The unit

Candela describes the luminous flux, which one light source sends out in one specific direction.

- The **„Beleuchtungsstärke" (illuminance)** is measured in the unit **Lux (lx)** by means of a Luxmeter. This unit describes, how much light of a light source reaches a certain surface. It considers the distance between the light source and the surface, as well as the angle. For evaluating different lighting techniques or sources and their effects on the urban space, the unit Lx is most helpful. (WSH GmbH n.d.; PTB n.d.)

Techniques of lighting

The unit **Lumen per Watt (lm/W)** describes the **"Lichtausbeute" (light yield)** of a certain kind of light source. The higher the value, the more efficient is the lamp. For example a normal light bulb has 10 lm/W while a certain LED lamp has 90 lm/W, so the LED is more efficient than the light bulb.

- **„Natriumdampflampen" (Sodium Pressure Lights)** are the most common type for the lighting of streets and infrastructure. The main characteristics are their high light output (up to 180 lm/W) and the well-known yellow light, which doesn't reproduce colors in an authentic way. This light color fits the most sensitive point in the visible spectrum and is considered as less harmful for insects.
- **„Quecksilberdampflampen" (Mercury Vapor Lamps)** are more specialized types and got used as well for street lighting as for indoor use. The light output has a wide spectrum from 35 up to 105 lm/W. Today most mercury vapor lamps in street lighting were outlawed but a huge stock is still in use. The color reproduction is considered as medium.
- **Gas Lanterns** have a very low light output and were mostly used for street lighting in the 19th century or even in earlier years. Nowadays, most of them got replaced due to their inefficiency in comparison to other lighting types.
- **LEDs (light emitting diodes)** are able to cover a wide range of light output (20-125 lumen per watt) and can reproduce colors close to daylight colors. They are used in indoor as well as in street lighting. Since the last years

many cities have replaced their old lamps with LED. One special feature of LEDs is, that colors and intensities can be dimmed and adjusted easily and immediately to reach a consistent illumination. Well it has to be emphasized, that the adjustment has an effect on the efficiency (dena n.d.)

Dark Sky Places (DSP)

Due to light pollution, natural darkness at night is nowadays hard to find. "Less than 100 years ago, everyone could look up and see a spectacular starry night sky. Now, millions of children across the globe will never experience Milky Way where they live." (IDA, n.d.) In this context Dark Sky Places (Dunkelschutzgebiet/Sternenpark) are areas, which are seen, as worth being protected goods because of their slight light pollution/smog. Several non governmental organizations and associations are dealing with this new approach and try to push forward specific protection legislations for the preservation of natural darkness. For example the International Dark-Sky Association (IDA) is by one's own account "the recognized authority on light pollution and is the leading organization combating light pollution worldwide." (IDA, n.d.a) and has started a "Dark Sky Places Program" in 2001. The aim of the project is to "encourage communities around the world to preserve and protect dark sites through responsible lighting policies and public education." (IDA, n.d.b) Until now the World Heritage Committee does not officially recognize Dark Sky Places, because no criteria exist for considering them under the World Heritage Convention yet. (UNESCO World Heritage Committee, n.d.)

Light concepts and Light master plans

Comparable to other fields, a coherent worldwide definition of the term Light concept is not existent. The Senate Department of Berlin defines Light concepts as the main structural bases for prospective planning's of public illuminations, which focus predominantly on the public sector (illumination of streets, places and important buildings). The concept contains general aims and requirements, which can be seen as a framework for prospective plannings and their implementation. In addition to the general Light concept, small-scaled light master plans could contain more detailed information and statements on

specific local places in the city. (Senatsverwaltung für Stadtentwicklung, 2011, p. 9)

3. Methodology

In order to give first answers to the research questions mentioned, the project group chose a **comparative research methodology** with three different dimensions: the field of sound and light, the cities Berlin and Florence, and further four spots in each of the selected neighborhoods of the cities. Because of the absence of an integrated approach of the aspects of light and sound in urban planning, aim of the project was to collect a wide range of data in the public space, and to compile diverse perspectives by researchers, public authorities, enterprises and other contributors functioning as actors in the field of policy-making. Since the project group declared aims to study the perception of people, but also the influence of the regulatory framework on the fabric of the city **qualitative and quantitative methods** had to be applied. Another request was to use the collected data for a comparison with the official data and regulations. Based on the demand of a wide range data collection, the group chose a **cross-national comparison** of Italy and Germany to discover cases of a broader difference of both light and sound and to determine how differently the aspects are treated by urban planning and perceived by people in an urban surrounding.

3.1 Choice of comparative methods

Besides the investigation in two main topics of sound and light in the urban night, the research compares those topics in two different cities. The project group chose one city each, which is already a pioneer in the topics of sound and light: **Florence and Berlin**. Both of them have lighting concepts and noise concepts. Furthermore, Florence on the one hand, is very advanced in terms of light technology by providing LED lighting already extensively in the whole city and on the other hand is also very progressive in terms of noise handling and implementation of soundscape approaches. Berlin as comparative city is also a pioneer in terms of LED lighting, even though in a different research direction than Florence, and provides complex regulations for noise management in the city.

Even though both cities are pioneers in those topics, they are very different to each other in terms of city size, structure, morphology, policies and culture. For comparative reasons, it was necessary to choose similar case study areas in both cities. Due to the fact that this is an investigation in urban sound and light at nighttime, the project group set criteria to pick one area in each city which is especially known for its nightlife. In Berlin, the area around the **Kottbusser Tor** in the district of Kreuzberg was selected. The area is known for its urban life, the multicultural mix and an intense nightlife. Analogous a Florentine pendant was chosen in the area between the **Piazza Santa Croce** and the **Piazza Sant'Ambrogio** in the historic city center. Also here, the area is well known for its "movida" (nightlife), which causes many troubles and problems with its residents.

In order to get to know the areas and to get a feeling for local conditions, existing illumination and sound situations, the project group used the method of **sound and light walking**, which is explained in detail in chapter 3.2.2. With the subjective results of its participants, the group set further criteria to define **four spots of interest** in each area, where the implementation of own qualitative and quantitative investigation methods should take place. The four spots were selected after following criteria: one loud spot, one quiet spot, one bright spot and one dark spot.

Finally, there are 4 dimensions of comparative research. The first and main dimension contains the comparison between the topics of light and sound. The second dimension compares Berlin and Florence to each other and the third dimension compares the four different spots in each city to each other. Furthermore, there is a fourth dimension which compares the perception of people and the perception of the study group in comparison to our own heuristic dataset which is compared to official data.

3.2 Qualitative methods

3.2.1 Literature Analysis

The project group used the method of **literature analysis** of European, national and local policy documents as well as German, English and Italian

secondary sources to understand the main narratives and general legal structure. For the purpose of an actor's compendium, further online search of platforms, institutions and other internet resources have been carried out.

3.2.2 Sound- and Lightwalks

Soundwalks as a method to listen to and explore the environment is already an established method, whereas Lightwalks are not yet well-developed. The Integration of both, to explore the sonic environment and illumination in a single walk is not yet documented by others. As an approach to compare the fields of light and sound, the study group took first steps to carry out combined **sound- and lightwalks** guided by Antonella Radicchi. In both research areas, the group undertook walks in a row and at a slow pace in silence with a duration of 45 minutes. During the walk the participants aim was to concentrate on sources of sound and light, to get a subjective impression of the site. Later on, these impressions were used to discuss aspects of individual perception and as site screenings to decide on the selection of spots for the surveys (see 3.2.3 Surveys and Appendix).

3.2.3 Surveys

In order to get first insights of empirical-based references, a **survey** as a sample of individual interviews has been used in the specific research areas (see Figure 3 as example). In total, 160 oral interviews (80 in each city) using a questionnaire asking both open and closed questions have been conducted in 8 spots in both cities (4 spots in the

area of Kottbusser tor, 4 spots in the area of Piazza Santa Croce). In each spot 10 surveys on the field of sound and another 10 on the field of light have been conducted. The interviewed persons have been picked randomly without regard of gender or age (see Annex C).

3.2.4 Observations

In order to get information about attractiveness and quality of the urban space during nighttime the study group needed a method to make those rather subjective factors measurable. Assuming that people are always trying to choose a surrounding they find attractive and comfortable to stay in public spaces, they decided to observe people standing and sitting at our defined spots in Berlin and Florence. Mapping where people wait, stay, sit and rest is a method that Jan Gehl introduces in his book 'How to study public life' (Gehl, 2013). It is important to keep in mind, that the mapped situation is always a picture of conditions in a specific moment at a defined place. To use that method as a quantitative tool it would have been necessary to map repeatedly the same spot many times to make the results comparable. For the short time of research project, it was not possible to do as many observations. Nevertheless, the mapped situations are taken as one exemplary picture in each spot at a specific time to indicate the quality of public space and can be used as a qualitative indicator. With the mapped information, the idea is to create references to the specific illumination and sound issues in the different spots. In how far is illumination a factor for comfortability in small scale? And what effect has the intensity of sound in a positive or negative way? It could be an indicator for positive intense sound instead of noise that creates a qualitative sound atmosphere. But it has to be kept in mind, that the study was done during wintertime and that this fact may change the outcome of the observations a lot compared to summertime.

The implementation of the method observation was performed in all of the four spots in Berlin and Florence by defined criteria: The observation had to be done for 10 minutes in the time between 8:00 pm and 10:00 pm. Mapped were all people standing and sitting for the time of at

A SURVEY [LIGHT] NR.

city: Berlin

date:

time:

place:

record: Yes ☐ / No ☐

study areas Kottbusser Tor

gender   **age**
m ☐ / f ☐ / o ☐   < 15 ☐   15-30 ☐   31-45 ☐   46-60 ☐   >60 ☐

1   What do you do in this place right now?

Fig. 3: section of the light survey in Berlin

least one minute except people waiting at traffic lights or waiting to cross the street (see Fig. 4). The exception was made because waiting at traffic lights or for crossing the street doesn't tell anything about the quality and atmosphere of the surrounding. It is simply necessary for the act of pedestrian moving, to get from one place to another. For each mapped person, the location was marked and the observed reason for the stop noted.
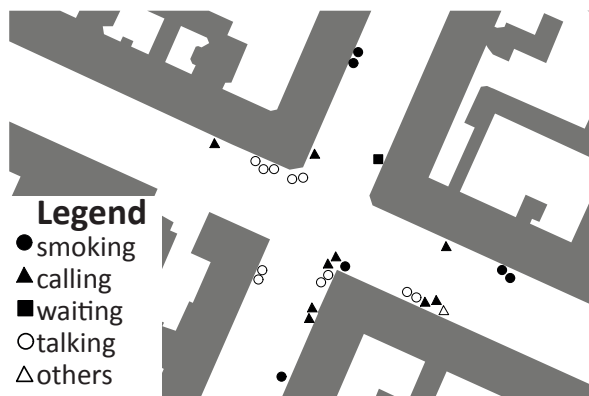

Legend
● smoking
▲ calling
■ waiting
○ talking
△ others

Fig. 4: observation map of Berlin Spot 3.

3.2.5 Interviews and Lectures

To deepen the understanding of e.g. relevant actors, policy making, narratives, citizen participation and more, further **expert interviews** have been conducted. During the study trip in Florence, but also in Berlin various experts of authorities, universities and privates contributed lectures to the study group.

In total, four experts were interviewed: **Claudia Reich-Schilcher** is working in the Senate Department for Urban Development and Housing. She was part of the committee to compile the Berlin Light Concept, which was published in 2011. Besides, Reich-Schilcher was project supervisor for a city-wide advertising concept to provide principles for the advertisement in the public space. **Dipl.-Ing. Aicha Diakite** is research assistant at the Faculty of Electrical Engineering and Computer Science at the Technische Universität Berlin. Within the Institute of Energy and Automation Technology she is working within research projects in the field of lighting technology, such as Light Master plans, Urban Planning and Daylight. **Dipl.-Ing. Michael Jäcker-Cüppers** gives lectures on noise protection at the Technische Universi-

tät Berlin and is deputy chairperson of the "Arbeitsring Lärm" (working group on noise) at the German Society for Acoustics. Furthermore, he is member of DIN committees that develop German Industry Norm standards on noise vibrations and noise measurement methods for vehicles. Besides that, Michael Jäcker-Cüppers is scientific advisor e.g. for the German Environment Agency and the German Federal Ministry for the Environment. **Prof. Dr. Brigitte Schulte-Fortkamp** is professor of psychoacoustics and noise effects at the Technische Universität Berlin and is worldwide involved in soundscape research. She is responsible for the second part of the ISO norm on soundscapes which is right now under development. Formerly, she was vice president of the Acoustical Society of America and is still vice president of the European Acoustics Association as well as associate editor of the International Association of Sound and Audiovisual Archives. Furthermore, Brigitte Schulte-Fortkamp is responsible for the Anti-Noise Day in Germany and Europe and co-edited in 2015 the book "Soundscape and the Built Environment".

The following experts gave further lectures to the study group:

- Evelyn Hoffschröer (Senate Department of Urban Development and Housing)- Introduction to Light Planning in Berlin
- Peter Cusack - The Sonic Environment in our Everyday Life
- Dr. Arnaldo Melloni (Municipality of Florence), Arch. Rossella Natale and Dr. Sergio Luzzi (Vie.en.rose) - Noise Planning in Florence
- Dr. Vannuccini and Dr. Geri (Municipality of Florence) - Open Data in Florence
- Prof. Camilla Perrone (University of Firenze) - Urban Planning in Florence
- Arch. Vallario (SI.L.FI. Municipality of Florence) - Light Planning in Florence
- Dr. Falomi (Municipality of Firenze) and Dr. Stefani - Aspects of Movida and Tourism in Florence
- Dr. Carlo Francini (Municipality of Florence - UNESCO OFFICE) - The Role of the UNESCO in the Historic Centre of Florence

3.2.6 Further Methods

For better understanding, explanation and visualization of the collected data **recordings, videos and pictures** were taken.

3.3 Quantitative methods

For the investigation of sound and light in the two case study areas, the study group used a mix of methods. By using quantitative method, the study group aims to gain heuristic information about existing light and noise levels and uses official provided data about noise and lighting regulations in the areas in order to compare them with results of the qualitative research.

3.3.1 Own measured impressions

To understand the perception of light and sound it is necessary to use quantitative data to contrast the perceived qualitative data to the actual measured light and sound situation. Therefore, the study group used heuristic methods to collect quantitative data. The methods are very experi-

mental and do not fit to any protocol. The results of those "measured impressions" are not representative and can only be seen as indicative results in the limited range of this research project, because the measured results are comparable to each other. For the heuristic measurements of sound volume, a smartphone was used with a db-meter app and for light level measurements a lux meter was used as a tool.

To create a comparable dataset, light and sound conditions in all eight spots in Berlin and Florence were measured. To make the measured data in all spots and both cities comparable to each other, the study group defined criteria for implementation: The measurements were taken in all spots within an approximately 50m radius, exclusively in the timeframe between 8:00 pm and 10:00 pm. All the measurements were taken in November and December which influences the following results due to the fact that the temperatures were low.

For light measurements, a grid of 10 x 10 meters was created to define the specific measurement points to measure light intensity with a luxmeter, type Testo 540 (see Fig. 5). In reality it was not

Fig. 5: exemplary grid for measurements in a 10m-grid.

always possible to stick to that defined grid, due to traffic or individual street sections. For security reasons the group decided to take always three measurements in a street section: right side, middle and left side of the street. This measurement is always repeated in a distance from 10 meters from the last one. The grid should help to create a foundation of the structure of street lighting in exactly this section. In the following chapter 6 these measurements are referred to as light impressions.

For sound pressure measurements, the study group used the same locations but took just one measurement per section. The single measurements show the average sound volume of the specific section for a time of approximately 20 seconds. To measure sound pressure, the group used a db-Meter App called SLA Lite on an Iphone 6. Regular sound recordings were always parallel taken during the same period of time as the measurements with an Ipad Air 2. Those recordings last about 30 seconds and make it possible to rehear the sources of the sounds in the particular period of the measurement. In the following chapter 6 these measurements are referred to as sound impressions.

All detailed results can be seen in maps and diagrams in chapter 6, further information and data in Annex C in tables.

3.3.2 Official applied data

In order to compare the heuristic collected data with official data provided by the cities of Berlin and Florence, the study group uses following official data of Florence and Berlin. In case of comparable noise data, the traffic noise plan from Berlin and the road noise map in Florence were compared to the heuristic results. Interesting is here the fact, that the data in the noise plans/maps are calculated and not measured (Berlin Senate Department for Urban Development and Housing, 2013).

In terms of light data, it was intended to compare the official data of the Piano Comunale di Illuminazione Pubblica (PCIP) (urban light plan) of Florence and the "Lichtkonzept" (light con-

cept) of Berlin. However, it was not possible to succeed within the timeframe of this project in comparison of our heuristic lighting data with the light plan and light concept data. Reason for that is that already the data between the two cities are not really comparable due to the fact that the case study area in Florence is located in the historic city center where there is the special exceptional situation of the UNESCO heritage which dominates over other official regulations.

4. The case studies

4.1 Berlin

Berlin has a population of about 3.6 million people and is both the capital of Germany and of one of its 16 federal states. With forests, parks, gardens, rivers and lakes, which make up around one-third of the city´s area, Berlin counts as a very green city. It is of big relevance for culture, politics, media and science and is characterized mainly by high-tech firms and the service sector. Today, it forms a continental hub for air and rail traffic and is known for its complex public transportation network. Berlin is made of twelve districts which are subject to Berlin´s city and state government, but also have their own local governments (see Fig. 6).

Fig. 6: Districts of Berlin.

4.1.1 Kottbusser Tor

Kottbusser Tor represents one of the interesting places to study in Berlin (see Fig. 7). Located in the Kreuzberg district, this area is famous for its nightlife, which leads to a high density of users and to a high amount of traffic. This situation influences significantly the light- and the soundscape at Kottbusser Tor. The characteristics of this study area will be described more detailed below.

4.1.1.1 Morphology & mobility

The Kottbusser Tor area is in the North-Eastern part of Kreuzberg (which is historically known as SO36). Two principal influences characterize the diverse building structure and living environment: On the one hand, there are large building complexes with more than ten full floors which remind us of radical demolition processes in the 1970s and 1980s (see Fig. 9). On the other hand, there exist old buildings that are well maintained due to the activities of "cautious urban renewal" in the same time period (e. g. at Oranienstraße, Reichenberger Straße and Dresdener Straße; typically, with five to six full floors, see Fig. 10).

Today, Kottbusser Tor is one of the main transport hubs in Kreuzberg with good public transport connections. However, the traffic area under the elevated railway U1 and the traffic circle at Skalitzer Straße form a physical barrier for pedestrians and thus divides the neighborhood in a Southern and a Northern part. (VDE e.v., 2015, p. 3.) Since there are many retail shops and services, the inhabitants have to walk just short distances. Oranienstraße and Adalbertstraße are streets with a lot of gastronomy that attracts visitors (especially at nighttime), while the shops and services at the NKZ (Neues Kreuzberger Zentrum) are mostly used by locals (especially by those with a Turkish background).

4.1.1.2 Environmental situation

Since there is a lot of road traffic particularly at Skalitzer Straße, Kottbusser Straße, Adalbert- and Oranienstraße, there exists the perception that traffic noise strongly affects the neighborhood. However, in the environmental atlas of Berlin the external noise costs of the overall traffic are only characterized as medium in this area. The air pollution is medium to high, the bioclimatic burden
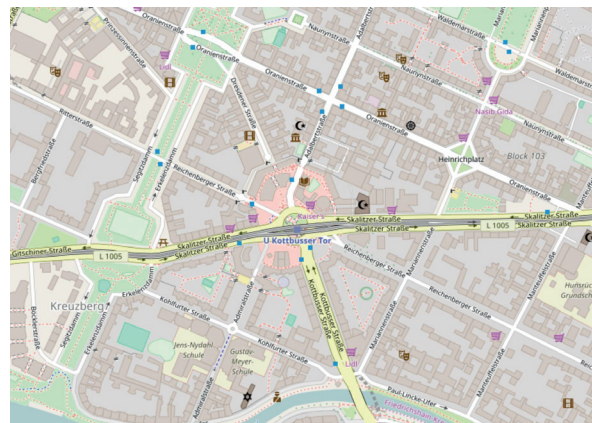

Fig. 7: Kottbusser Tor neighborhood.

high (see Fig. 8). Overall the area is affected by multiple environmental and social burdens (Berlin Senate Department for Urban Development and Housing, 2015).

4.1.1.3 Socio-economic structure and housing conflicts

Because the Kottbusser Tor area is a neighborhood with "special development needs" and significant social issues, the then Senate Department for Urban Development and the Environment established a so called "Quartiersmanagement" (neighborhood management) in the area. It aims at empowerment, participation and strengthening neighborhood structures. Furthermore, it funds projects to support structural development and the work of education institutions. (QM ZKO, n. d.)

In the neighborhood management area, which includes 32 ha, there live around 8,800 residents, of whom more than 38% have a migrant background (which is also reflected in an ethnically very diverse local trade structure). 22% receive social welfare. Compared to Berlin, the population here is significantly younger with 19% under 18 years old and almost 34% between 18 and 35 years old. (VDE e.V., 2015, p. 3.) A changing ownership structure (in favor of private investors) characterizes the Kottbusser Tor area. Especially in the social housing sector renters struggle with rising rents and operating costs. (VDE e.V., 2015, p. 7.) Neighbors organize themselves increasingly across borders of their (ethnic) community. In 2012, the tenants´ community Kotti & Co occupied a part of the public space at Kottbusser Tor and constructed a "gecekondu"[1] (a simple wood-pavilion) which became a neighborhood center. Since then, they organize protest activities against rising rents, displacement and racism and fight for affordable social housing. To their activities belong discussion events, concerts, parties, social counseling, frequent noise marches, an expert conference on social housing and several publications. (Maruschke, 2014, p. 81) This form of organization became essential for the neighborhood[2]: "This protest is not just about the ostensibly special interest topic of `public housing´ and it is not just about a few tenants of Kotti's new privately owned public housing buildings. Instead, this protest addresses a fundamental topic that pertains to the entire city, and other cities in fact." (Bojadzijev et al., 012.)
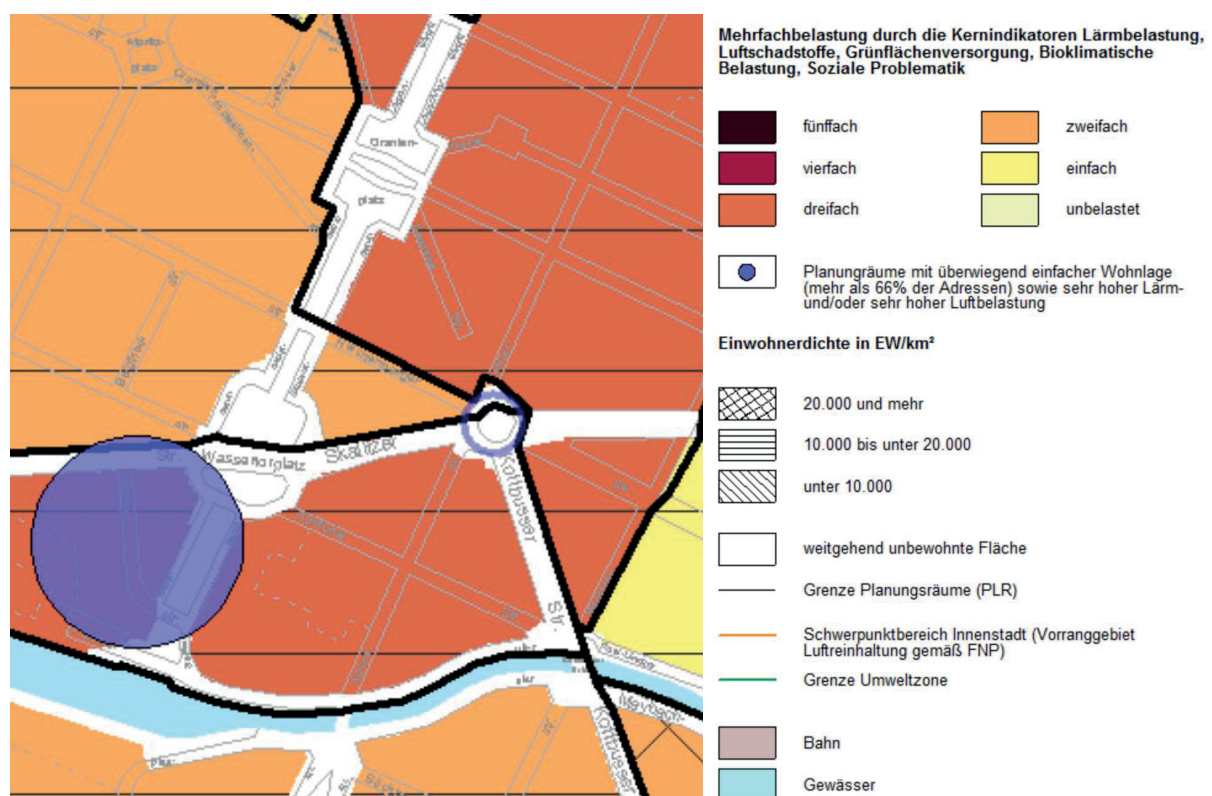

Fig. 8: Integrated multiple burden map - environmental justice map.

Fig. 9: Neues Kreuzberger Zentrum.

4.1.1.4 Public space

The public space plays an important role for the life in this area. There are only few recreational spaces and many green areas and playgrounds are poorly maintained, overused and thus not in a good shape. At many spots the residents complain about waste issues. Nevertheless, the recreational spaces are highly frequented as communicative meeting points (e.g. Oranien-platz, the inner courtyards and the block tips at Kottbusser Tor). Very popular (at daytime with neighbors, at nighttime with party people) is the open space outside of Café Südblock which or-ganizes many neighborhoods activities, counsel-ling services and information events. During the year, the streets host various temporary events like MyFest, Fete de la Musique, Carnival of Cul-tures, Long Book Night, Christopher Street Day, children´s carnival etc. (VDE e.V., 2015, p. 6f.)

4.1.1.5 Public perception

According to the neighborhood management, many people feel insecure in the (semi) public space at Kottbusser Tor, which is partly related to the use and sale of alcohol and other (illegal) drugs (VDE e.V., 2015, p. 7). Also in the public per-ception, the character of Kottbusser Tor seems to be in a process of change since at least 2015. As a journalist puts it: "Residents, drug dealers and junkies used to live for decades in a peaceful coexistence. But now the climate is about to tip over" (Schwarzbeck & Hollah, 2016, own trans-lation). Some time ago the Kottbusser Tor area had still its image as a place of cultural diversity,

alternative lifestyles, squatters, punks and artists. It became a trendy neighborhood that attracts tourists and young people from other districts of Berlin. Nowadays, media articles demonize the Kottbusser Tor as a dangerous, violent, law-less "no-go area" (Welt), "place of the doomed" (Spiegel online), a "place to be afraid of" (Berli-ner Zeitung), where horror movies could be shot (ibid.). Media coverage focuses on the neglection of the place, violent attacks, drugs, shopliftings, police raids.

Fig. 10: Oranienstraße.

However, Ercan Yasaroglu (social worker and ow However, Ercan Yasaroglu (social worker and ow-ner of Café Kotti) sees Kottbusser Tor in general as a good example for integration: "Politicians put this reputation at risk, if they just focus on our otherness and crime, if they hide how good we live together here." (Keseling, 2016, own translation.) A 37 years old woman interviewed in March 2016 at the U-Bahn station said:

"Oh, the Kotti - I have the feeling this is a con-tinuous loop. I live here now for 15 years and every couple of years there are headlines about the Kotti as dangerous site - sometimes it´s about the junkies, sometimes about people from Eas-tern Europe, about alcoholics, and now it is about people from Northern Africa. And every time someone gives him- or herself airs as expert, this person thinks, he or she can say quite a lot about the topic - it is a fact, however, that the Kotti is fucking peaceful for very diverse people with their different mentalities that live here and encounter each other daily. I love the Kotti, es-pecially because of those frictions and its crack-ling. Nevertheless, somehow always it keeps its balance. In my opinion, the Kotti is somehow a

symbol of Berlin as metropolis, with everything that belongs to it." (Merle, as cited in QM ZKO, 2016, own translation.)

4.1.2 Points of Interest - Kottbusser Tor

4.1.2.1 The loud spot

The first "point of Interest" in the Kottbusser Tor area is an open square (see Fig. 11). It is spatially bounded by Kottbusser Straße in the west, Reichenberger Straße in the east, the roundabout of Skalitzer Straße with the train station "Kottbusser Tor" in the north and a building with up to ten floors on its Southside.

Due to this position between two major streets with lots of cars passing by (Kottbusser Straße, Skalitzer Straße) and a minor road with cobblestone (Reichenberger Straße), as well as the elevated line of the U1 train right next to it and a high building that reflects the sounds ahead onto the square on the other side, it was chosen as the loud spot in Berlin. Besides the noise of the traffic in this spot, there are also many people passing

by, who produce sounds for example by talking to each other.

Furthermore, the spot is interesting in terms of light as the square itself is rather dark at night time, but there are lots of lights from street lamps, shops, apartments and the running traffic around it.

4.1.2.2 The bright spot

The second "point of Interest" is located at the crossroads of Adalbertstraße and Oranienstraße (see Fig. 11). Those two lively streets both both have one lane for cars in each direction and a perimeter block development with usually four floors. On the street level are lots of little shops and gastronomy.

This use of the buildings with many different lights from bars, restaurants and stores, the street lighting and the light of passing cars at night, made this crossroads the choice for the bright spot in Berlin.
As it is very busy in the evening, it is self-evident

Fig. 11 Points of interest at Kottbusser Tor.

that there is also a high sound-level, mostly produced by people and cars passing by, but also because of music and other sounds from the bars and shops around.

4.1.2.3 The quiet spot

The third "point of Interest" is in the middle of Dresdener Straße. This is a minor street with a dead end, which has no transit car traffic. The building density is not consistent. It is a perimeter block development on both sides of the street with a varying number of floors. Most of the buildings have four or five floors, while the building that bounds the street at the dead end has ten floors. However, there are a cinema and some bars in this street, it is a rather quiet place compared to the rest of the area. That is why it was chosen as the quiet spot in Berlin.

The intensity of light seems to mirror the sound pressure level. In contrast to most of the other streets around Kottbusser Tor, this street is not very bright, even though there are some shops and bars around. The brightly lit cinema is the only exception.

4.1.2.4 The dark spot

The fourth "point of Interest" in the Kottbusser Tor area is a bit special. It is on a pedestrian refuge island under the high line of the U1 at the crossroads of Skalitzer Straße and Mariannenstraße. The surrounding has no unique character. Besides a car dealership and a gas station, there is a small park and a residential area around. The spot is not very busy, but people who want to cross the Skalitzer Straße at this point, have to pass by as the traffic light for pedestrians is right there. The darkness at the spot, also in contrast to extreme lit up buildings characterized by a rather cold lighting (car dealership, gas station) around there, made it the choice for the dark spot in Berlin. Moreover, it is also a very loud spot as it is in between the four lanes of a major street and under a high line where trains run every few minutes.

4.2. Florence

Fig. 12: Province of Florence (metropolitan area).

Florence is the capital city of both Tuscany and the Metropolitan City of Florence. It has around 1.5 million people in the metropolitan area - with Prato and Pistoia - (see Fig. 12) and around 385,000 inhabitants in the city of Florence (see Fig. 13). Cradle of art in the world, Florence was inscribed on the United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage list in 1982. Since then it has been working permanently to preserve and pass on to future generations the historical value of this city, not only for the monuments, but also for the cultural and literary works artists, poets and writers left behind as a legacy of humanity.

The importance of the city is due to the large number of museums (42), monuments and piazzas (35), gardens (11), libraries (9), institutes and universities (9) and cultural institutions and associations (52), but also to the historical legacy that this city represents. In addition, it has a beautiful urban structure, which is the result of more than six centuries of continuous work. It is important to note that this city does not have a sophistica-

Fig. 13: Districts of Florence.

ted transport network, but only operates the public bus service that connects the whole city and the train that connects with other cities in Italy. Bicycles represent another important vehicle of transport for the Florentine people. Is important to mention that Florence has a pedestrianization plan which covers twelve hectares, according to the Comune di Firenze.

4.2.1 Santa Croce/Sant'Ambrogio district

Piazza Santa Croce and Piazza Sant'Ambrogio are in the eastern part of the historical center of Florence -also known as district 1- and are part of the most crowded places of this city. Tourism represents one of the strongest reasons why many people from all over the world come to this city, specifically to Piazza Santa Croce where different activities are carried out throughout the year and Sant'Ambrogio which is one of the points of the city of Florence with intense nightlife. Below it will be described some characteristics of this neighborhood.

4.2.1.1 Morphology and mobility

Piazza Santa Croce has a larger structure than the second one, being one of the main squares of the city, while Piazza Sant'Ambrogio has a smaller size, but nonetheless remains important (see Fig. 14).

The area between both squares has an old urban structure and architecture with a characteristic

Fig. 14: Piazza Santa Crove/D`Ambrogio neighborhood.

width of the streets: These are of a smaller size (two lanes), although some of them are even smaller (with only one lane). In the streets with two lanes, one of them is used as parking lot for vehicles, while the other is for the flow of these. Because the sidewalks are often very narrow, in some streets both cars and pedestrians use the

Fig. 15: D`Ambrogio.

lanes. In these cases, the passage of the pedestrian is preferential (see Fig. 15).

Although the municipality implemented certain measures to promote public transport, the mobility in the historic center remains challenging which lowers the quality of life for the residents. The historic center (that means the part located within the 19th century ring-roads) is declared as a restricted traffic zone which allows to apply special rules for the access to this zone, the transit through it and parking in it. In general, bicycles, electric vehicles, motorcycles and scooters are permitted. (Comune di Firenze, n.d.)

4.2.1.2 Environmental situation

According to the report "Città Sostenibili di Firenze", Florence is one of the cities with the highest carbon dioxide emissions in Italy and suffers from a high environmental pollution due to traffic. (The province of Florence counts the highest number of private cars per inhabitant in Italy. (Colini et al., 2009, p. 54.)) This is because the city does not have a by-pass and drivers try to

Area "Emissioni CO₂" • Variazione standardizzata del Comune di Firenze rispetto al totale Italia
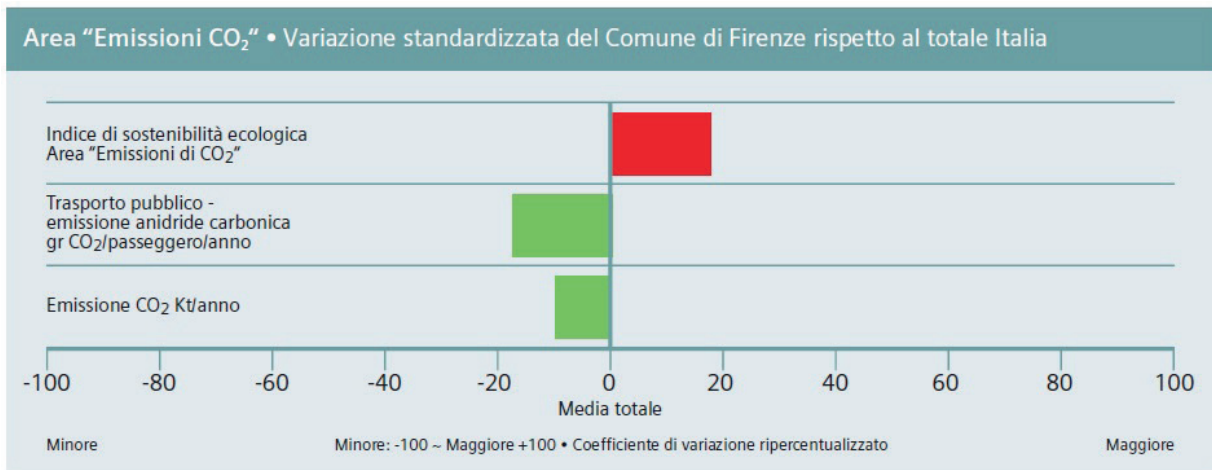
Fig. 16: CO_2-emission of the Municipality of Florence in relation to the Italian average .

drive by alternate routes. This produces not only vehicular congestion, but also large amounts of emissions (see Fig. 16). Nevertheless, Santa Croce/Sant'Ambrogio is less impacted by vehicular traffic. In the study area, the streets are narrow and with little traffic, but there is also the street Via Ghibellina that connects with the Viale della Giovine Italia which has a greater flow of cars but does not represent a main street.

4.2.1.3 Socio-economic structure and housing conflicts

According to the latest UNESCO study in January 2016, in district 1 (historic center) live 67,551 inhabitants, of which 14,738 are foreigners. That is, the number of foreigners represents almost 22% of the population in the historic center, not counting tourists. One of the characteristics of this population is that they are young people without children. The historic center of Florence proves to be inaccessible and unattractive for the elderly and/or parents with children for the old architecture, in addition to the large number of tourists during the day and night. Recently, the character of the Florentine city center changed significantly to an exclusive leisure district. As Colini and colleagues summarize: "The redesign of the city centre expels residential life as well as traditional functions, displaced by market-driven pressures such as the increase of real estate values in central locations, accessible only for profitable activities or temporary users" (2009, p. 51). The historical buildings have relatively high maintenance costs which makes them less suita-

ble for affordable housing. Also concerning the infrastructure it can be seen that, it is increasingly oriented towards the tourism economy at the expense of long-term residents. Those reasons lead to the development that residents of the historic center don't have many alternatives than moving to the outskirts. The new residents of this neighborhood are mostly foreign students who stay only temporary in the city and are able and willing to pay higher rents. (Ibid.)

The Florentines don't observe this development passively and started to organize themselves in grassroots groups against environmental problems, social injustice, discrimination and the commodification of urban life. Thus, they formed an umbrella organization of around 40 citizen committees. (Ibid., p. 52.)

4.2.1.4 Public spaces

With regard to the use of public space, Piazza Santa Croce represents an important meeting point and place to be. It constitutes the largest public space in the historic center and is seen as the "core" of the Santa Croce neighborhood and "one of the traditional social hearts of Florence" (Colini et al., 2009, p. 57). Its wide space allows not only people to cross the square, but also as a meeting point and enjoyment of it. In addition, it is used for different fairs, markets and sports activities (such as Calcio Storico). Piazza Sant'Ambrogio is a square where in the surroundings you can find different bars. It is a meeting point mainly for nightlife. In both squares circula-

te many people, although the number is greater at Piazza Santa Croce. However, there are some streets that have little use of public space for being residential, such as Via Borgo Allegri, Via S. Cristofano, among others.

4.2.1.5 Public perception

Florence (and thus also Santa Croce) evokes for many people an image of romanticism and arts. So "any possible future scenario for the city has to deal with its strong global identity of an iconic historic location due to its unique and precious cultural heritage." (Colini et al., 2009, p. 50.) At the same time, public policies that promote tourism at the cost of the diversity of the city lead to a process of alienation of the historical center from the whole city. Furthermore, "anxiety-including media campaigns" encourage a diffuse perception of urban degradation in this area. (Ibid., p. 51.)

The perception of the study area by the people is very varied. There are people who feel calm and enjoy listening to people talking, while there are also people who perceive some sounds and spots as unpleasant. In general terms, the study area has narrow streets and mixed use, both residential and commercial, where some spots have more people because there are more night activities like bars and restaurants.

4.2.2 Points of Interest - Piazza Santa Croce/Sant'Ambrogio

4.2.2.1 The loud spot

The first "point of interest" in the study area in Florence is Via Ghibellina (see Fig. 17). It is in the first parallel street of the Basilica of Santa Croce, in direction of Piazza Sant'Ambrogio. It is a two-lane street where cars can only park at one side. Although the street is relatively small, vehicles are constantly driving in the direction of the SS67.

There is a mixed use in this street, both residential and commercial (small shops and restaurants). The different sound sources of the street, shops and the vehicles circulating make this street one of the loudest in the study area.
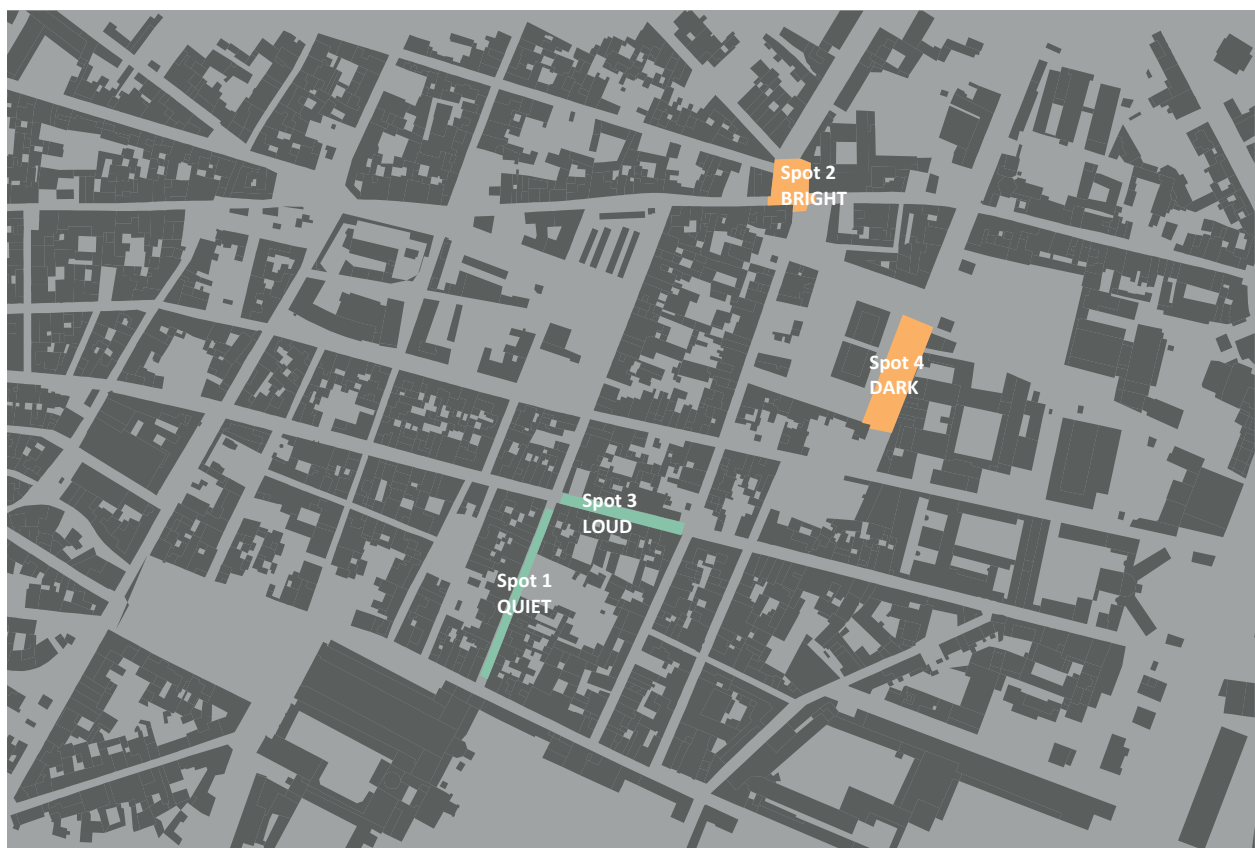

Fig. 17: Points of interest at Santa Croce/Sant´Ambrogio.

4.2.2.2 The bright spot

The second "point of interest" is the Piazza Sant'Ambrogio. It is located between the streets via Pilastri, via di Mezzo, via Pietrapiana, via de Macci, Borgo la Croce and via Carducci. Although the place is smaller than Piazza Santa Croce, it is very crowded, especially in the evenings. There are different bars in the area and in the prolongation of Bordo la Croce is via Pietra Piana where there are several shops of food and clothing (see Fig. 17).

Many people use the Piazza Sant'Ambrogio as a meeting point to enjoy the nightlife. The different sources of light are mainly the bars, shops, public and Christmas lights. People use the the stairs at the entrance of the Parrochia di Sant'Ambrogio to talk and hang around.

4.2.2.3 The quiet spot

The third "point of interest" is Via Borgo Allegri. This street is three blocks away from Piazza Santa Croce. It is a minor residential street, apart from one restaurant. In front of this street is the Basilica di Santa Croce. In addition, there are some restaurants a few meters away at Piazza Santa Croce, Dante Alighieri Monument and the Biblioteca Nazionale Centrale di Firenze (see Fig. 17).

Via Borgo Allegri is a very quiet street where very few people and vehicles pass and without much public or private lighting.

4.2.2.4 The dark spot

The fourth „point of interest" in the area of study in Florence is Via della Mattonaia. It is just a few steps from Piazza Lorenzo Ghiberti, between Piazza Santa Croce and Piazza D'Ambrogio. In this area there are several shops, mostly gastronomic, in addition to Mercato di Sant'Ambrogio.

In spite of several commercial places, this zone lacks a good street illumination. Both, street light and the light of the residences in the area, are either very low or nonexistent. In addition, there is a poorly lighted parking area for vehicles, which increases the darkness in this street (see Fig. 17). It is interesting to compare the darkness in this block, in which the Mercato is located, with the following blocks that are well illuminated. In this block walk very few people, because they prefer to walk through the better illuminated streets.

4.3 Similarities and differences between Kottbusser Tor and Santa Croce/Sant'Ambrogio

The study shows certain similarities and differences between both study areas in Kottbusser Tor (Berlin) and Piazza Santa Croce/Sant'Ambrogio (Florence). Among the main similarities is that both areas of study are very crowded by tourists because there is a lot of nightlife in these two places (bars, discos and restaurants etc.). Another similarity is that both neighborhoods have a significant influence of gentrification.

It is also interesting to mention that public space pays an important role in both study areas. Both in Kottbusser Tor and in Piazza Santa Croce/ Sant'Ambrogio many people congregate. That means, people do not only cross these places but also they use them as meeting points and to stay extended times.

Furthermore, both areas have a mixed use as there are many residences around. In the case of Berlin there are large buildings in the neighborhood and Florence has smaller houses and departments.

However, there are also some notable differences between the study areas. This is mainly the morphological structure of the city. While the Kottbusser Tor area has bigger and more spatious streets, the area of Piazza Santa Croce/Sant'Ambrogio has narrow streets and sidewalks. In this sense, in the case of Florence, people not only walk on the sidewalks, but also use the tracks to circulate, sharing this space with vehicles.

Another very important difference is the traffic. In the case of Berlin, there is a lot of road traffic in the area, making it very noisy and unsafe at certain points, as it is the case at Skalitzer Straße. This street is not only a relevant source of noise

due to all kinds of traffic that pass on, but also the infrastructure for vehicular traffic creates barriers in the public space. The opposite happens in Florence, where the morphological structure of the city does not have the type of traffic as in the case of Berlin, but is noisy for the reflection of sounds in those tiny streets. In this case, motor vehicles, bicycles and pedestrians share the street.

Endnotes

[1] "Gecekondu means `built overnight´ and is a reference to houses built by migrants moving from rural areas to the outskirts of small and large cities in Turkey. If built between dusk and dawn, the government is not allowed to tear down these houses without engaging in legal proceedings in court." (Bojadzijev et al., 2012.)

[2] For a deeper insight in the struggles of Kotti & Co watch the Arte documentary "Miete essen Seele auf" ("Rent eats the soul"): https://www.youtube.com/watch?v=1Ee5sOgmjl 0&feature=youtu.be

5. Policies and governance dynamics

The following - predominantly analytical - chapter focuses on urban policies in Berlin and Florence that are related to the topics of urban soundscapes, noise abatement and light (pollution). Based mostly on expert interviews and desktop research (see bibliography and appendix) the following research questions will be discussed:

- Which actors are central for the governance of urban light- and soundscapes and how are the (power) relations between them structured? How do citizens participate in the process?
- How does the decision-making process work?
- Which are the underlying understandings of light, sound and noise?
- Which are the main narratives within the discourse? Which different discourses are brought up by different actors? What are the voids of those discourses?
- What impact do those public policies have on the fabric of the cities of Berlin and Florence?

In order to make clear what this chapter is about it is useful to recall how to distinguish the terms "polity", "policies" and "politics" (according to Leimgruber, n.d.):

- **Polity** describes constitutional political structures of a society (systems of government, parliaments, political parties, international organizations, interest groups etc.) and its legal system (constitution, laws etc.). Polity is also about normative ideas (i.e. values and intentions of certain provisions).
- **Policies** deal with the content of political disputes (i.e. their subjects, tasks and goals), problem solving and shaping social circumstances. They reflect conflicts of objectives and interests.
- Meanwhile, the term **politics** describes political procedures (like elections, lobbyism etc.) and processes of decision-making (e.g. political debates).

The project deals somehow with all three aspects. Polity is for example relevant for the chapters 5.1.1 and 5.2.1 (on instruments, laws, regulations etc.), and 5.1.2 and 5.2.2 (on the institutions that are involved in political decisions). The relevance of policies for this chapter is clear, because political problems and proposed solutions are discussed in-depth. But also, politics are touched on, e.g. in the chapters 5.1.3 and 5.2.3 on citizen participation.

The sub-chapters 5.1 on policies on noise and sound and 5.2 on light will follow a parallel structure to make the findings more comparable. Each subchapter will end with some topic-specific interim conclusions. For an integration of the results see chapters 7. So far, the topics of light and noise/sound are very rarely discussed together which makes the approach of this project innovative and justifies the necessity of this basic analysis.

5.1 Policies on noise abatement and soundscapes in Berlin and Florence

5.1.1 Legal framework

The following chapter aims at giving an overview over the most relevant instruments and regulations regarding urban noise management that apply to Florence and/or Berlin[1] (see also Fig. 18). On paper, both cities follow the "polluter pays principle" and the "principle of precaution", but these ideas do not always lead to a consequent realization.

Regulations relevant for Florence	Regulations relevant for Berlin
International and European level	
International standards developed by ISO: • e.g. ISO 12913-1:2014: Definition and conceptual framework of soundscape[2]	
WHO reports/guidelines: • Night noise guidelines for Europe • Burden of disease from environmental noise. Quantification of healthy life years lost in Europe • Guidelines for community noise	
EU papers, regulations etc.: • Green Paper on Future Noise Policy (European Commission, 1996) • 7th Environment Action Programme • EU Environmental Noise Directive (Directive 2002/49/EC)[3]	
EEA reports: • Good practice guide on quiet areas • Good practice guide on noise exposure and potential health effects • Noise in Europe 2014 • Quiet areas in Europe	
National level	
"Legge quadro sull'inquinamento acustico n. 447/1995" (National Framework Law on noise pollution) • Requires to City Councils local action plans derived by acoustical classification of territory	**"Bundes-Immissionsschutzgesetz" (Federal Immission Control Act)** • Key role in noise control • Sets the rules for implementing the END under German law (§§47a-f) • Defines the municipalities as responsible for the implementation • Provisions on the construction and operation of installations • Provisions on the nature and operation of vehicles, construction and alteration of roads and rail tracks • Close link between pollution control rights and land use planning
"Decreto del Presidente del Consiglio dei Ministri (DPCM) 14-11-1997: Determinazione dei valori limite delle sorgenti sonore" (Decree of the President of the Council of Ministers: Determination of thresholds for noise sources)	**"Technische Anleitung zum Schutz gegen Lärm" (Technical Instructions on Noise Protection) and other ordinances** • Further specifications
"DPCM 5-12-1997: Determinazione requisiti acustici passivi degli edifici" (Determination on noise protection requirements for buildings)	**"Lärmschutzgesetz" (Noise Control Act)**
D.N. 29-11-2000 • Requires to transportation and infrastructure companies their noise reduction plans	**Germany's General Railway Act** • Regards the analysis of railroad noise • Definition of noise protection in case of the construction or major alteration of railway operating facilities

| Regulations relevant for Florence	Regulations relevant for Berlin
"Decreto Legislativo 262/2002: Attuazione della direttiva 2000/14/CE concernente l'emissione acustica ambientale delle macchine ed attrezzature afunzionare all'aperto" (Decree concerning noise emissions by equipment used outdoors.)	**"Gesetz zum Schutz gegen Fluglärm" (Air Traffic Noise Act)** • Legal basis for uniform aircraft noise protection measures on the national level
Decreto Legislativo 194/2005 • Puts in legislation all the requirements of the END	**"Nationales Verkehrslärmschutzpaket II" (National Traffic Noise Protection Package II)**
Road Traffic Regulation • Prohibits unnecessary noise when using a vehicle	**Road Traffic Regulation** • Requires and allows for the prohibition of unnecessary noise when using a vehicle, the limitation of the use of acoustic signals as well as traffic restrictions, which can be ordered by the road traffic authorities for the protection of the resident population from noise and exhaust gases.
	"Straßenverkehrsgesetz" (Road Traffic Act) • Regulations on the nature and operation of vehicles and craft
	"Bundesfernstraßengesetz" (Federal Highway Act) • Definition of noise protection in case of the construction of major alteration or federal highways of public easement
Law 1150 • Legal basis of the Italian planning system • Was drawn up and has been into effect by central and local government	**"Raumordnungsgesetz" (Spatial Planning Law)**

Regulations relevant for Florence	Regulations relevant for Berlin
	"Baugesetzbuch" (Federal Building Code) • Legally Binding Land-Use Plan gives important noise protection planning measures by listing possible designations on urban-planning grounds • Environmental impact assessments (including noise protection)
	"Baunutzungsverordnung" (Federal Land Utilization Ordinance) • Pollution control ranking corresponding to the purpose of the specific area by classifying the types of building zones • Area-related sound power level for noise immissions can be defined
	"Gesetz über die Umweltverträglichkeitsprüfung" (Environmental Impact Assessment Act) • Obligation to carry out an environmental impact assessment for certain projects
"Codice Civile" (Italian Civil Code) • Relevant in the context of disputes between neighbors	"Bürgerliches Gesetzbuch" (German Civil Code) • relevant in the context of disputes between neighbors
"Codice Penale" (Criminal Code) • Relevant in the context of noise as a consequence of individual behavior	"Strafgesetzbuch" (German Criminal Code) • Relevant in the context of offences against the environment
	"Gesetz über Ordnungswidrigkeiten" (Administrative Offences Act) • Relevant in the context of noise as a consequence of individual behavior
Regional level	
Regional Law 89 (1-12-1998) • implements the National Framework Law of 1995 in Tuscany	
DGRT 490 (16/6/2014) • relevant in the context of industrial establishments, sound-absorbing asphalt, transport infrastructure, temporary noise sources	
City level	
Declaration of the historical center of Florence as cultural heritage	"Landes-Immissionsschutzgesetz" (Berlin Pollution Control Act)
	"Landesbauordnung" (Federal State Building Code of Berlin)

Fig. 18: Regulations concerning noise in Berlin and Florence.

One of the most important above mentioned legal instruments is the Environmental Noise Directive which regulates the monitoring of land-based noise emissions and the development of actions. It obliges the EU member states to use common criteria for noise mapping, to develop and implement action plans to reduce exposure in large cities and places close to major transport infrastructure and to select and preserve areas of good acoustic environmental quality ("quiet areas") (see chapter 2.1). By 2016 the European Commission was expected to undertake a review of the implementation of the END. In summer 2018 an amendment can be expected that will also deal with soundscapes (B. Schulte-Fortkamp, interview, January 17, 2017). As the European Environment Agency states, there is "a clear need to improve implementation of the Environmental Noise Directive in Member States, in particular with respect to the completeness, comparability and timeliness of reporting" (2016). For example, Italy did not provide any data for the comparative EEA report "Noise in Europe 2014". The report shows that compared to other European countries a relatively small part of the population in urban areas in Germany is exposed to road traffic noise (see Fig. 19), which is also true for Berlin compared to other European cities with 100,000 or more inhabitants.

The German Advisory Council on the Environment stated already in 2004 that the reduction of noise pollution can only be successful if the interplay of different noise sources is considered (Sachverständigenrat für Umweltfragen, 2004, p. 490). Nevertheless, Berlin does not provide any data on the total noise level and just analyzes the different noise sources separately. Furthermore, it is not taken into account that different noise sources are related to different degrees of annoyance. In contrast, Florence does calculate the overall noise level including aircraft noise, industrial noise, rail traffic noise and road traffic noise: In 2012, more than 65% of the Florentine population were exposed to night time noise levels of more than 50 dB (L_{night}), which is defined by the EU as critical threshold. The WHO recommends from a health point of view even a threshold of 40 dB at night. This is far away from reality in the urban context, for example in Florence more than 93% of the population are exposed to more than 40 dB at night time. (ARPAT, 2016)

To draw a comparison between Berlin and Florence it is only possible to refer to particular noise sources. Since road traffic noise is the most influential noise type, the comparison will be based on exposure to road traffic at night: In Florence, more than 63% of the population are exposed
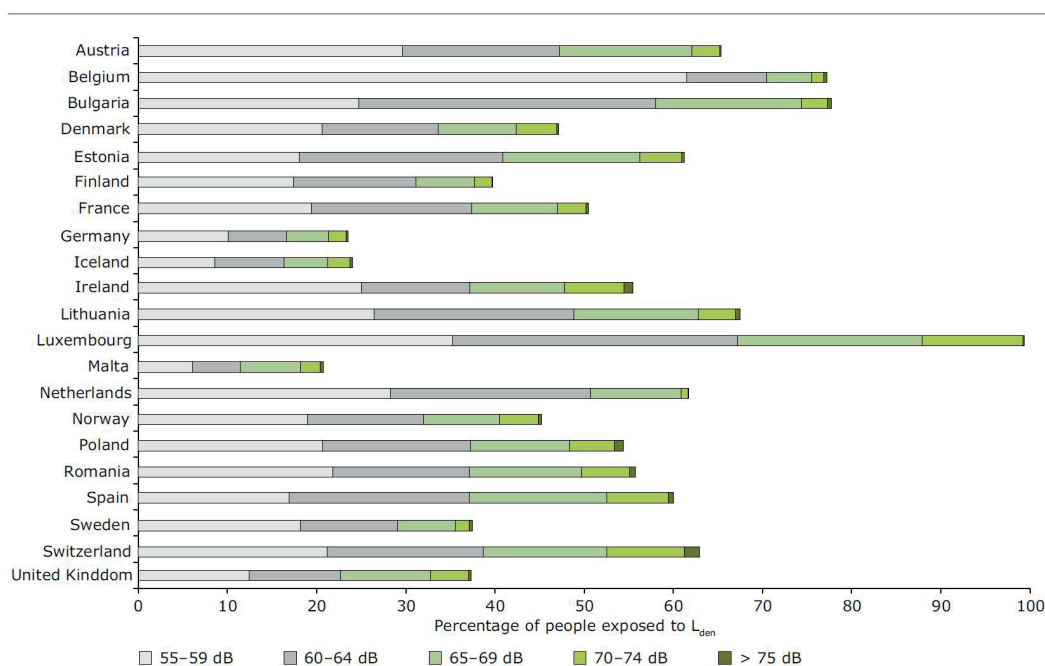
Note: France: Only reported agglomerations from 100 000 to 250 000 inhabitants in 2012.

Liechtenstein: Data not applicable (there is no agglomeration above 100 000 inhabitants in the country).

Cyprus, Czech Republic, Greece, Hungary, Italy, Latvia, Portugal, Slovenia, Slovakia: Data not provided.

Fig. 19: **Percentage of population exposed to road noise L$_{den}$, in 194 urban areas, EEA member states.**

to road traffic noise of more than 50 dB at night (ibid.). Berlin does only provide absolute data and no percentage. But in relation to the total population a bit more than 13% of the inhabitants are exposed to this noise level at major roads (according to estimations of the Senate Department for Urban Development and Housing). This looks way less than in Florence which reflects partially the reality that Berlin is really a less noisy city (also depending on the city structure, green spaces etc.). But on the other hand, a comparison like this one might be misleading, because in Berlin only the major roads were taken into account. This means that the noise exposure was only calculated at 1,416 km of the roughly 5,400 km long road network of Berlin. Citizens´ protest like at the Friesenstraße in Kreuzberg show clearly that also at secondary streets which are not considered for the strategic noise maps, noise levels can reach a very disturbing level. Additionally, the numbers of the cities give the impression that one should expect that there are some more aspects in the cities calculations of noise exposure which distort the results. One open question is for example, whether the nighttime dB(A) levels are calculated for the outside or the inside of affected residential buildings, although the group was not able to identify the exact influence of such possibly relevant factors.

Despite these methodical difficulties and the at least in Florence high numbers of noise exposure, both Berlin and Florence are seen as examples of cities that have relatively far developed approa-

ches and that are experimenting with new techniques and tools. Melloni and colleagues summarize:
"Florence had been one of the first cities to comply with the requirements of Italian national legislation about noise, providing in early 2000 the acoustic zoning and the Noise Reduction Plan. Moreover, it was one of the first agglomerations to fulfil the European Directive on Environmental Noise (END), performing the strategic noise mapping and, as first in Italy, the consequent Action Plan" (2016, p. 1).

Experts like Brigitte Schulte-Fortkamp evaluate Berlin´s activities as relatively innovative compared to other German cities: "Berlin is tremendously open-minded regarding this question. This can be also seen in the action plans that were implemented in Berlin. Based on the citizen consultation Berlin really developed initiatives further. [...] We learned how open the Berlin Senate is for such innovations." (B. Schulte-Fortkamp, interview, January 17, 2017, own translation.)

The following chart (see Fig. 20) gives a rather prosaic overview over the most important plans relevant for the two cities. Of course, it would always be possible to add more plans that are somehow related to the field of noise mitigation and urban soundscapes, but this would make the table even longer and less clear. More explanations on the context and connections will follow in chapter 5.1.2.

Plans/activities (Florence)	Plans/activities (Berlin)
Strategic Noise Map • Analysis of the exposure to environmental noise	**Strategic Noise Map** • Analysis of the exposure to environmental noise
Noise Biennial Report • Mandatory for every municipality with more than 50,000 inhabitants • Analysis of the state of environmental nois • Verification of the state of the noise abatement measures	**Environmental Justice Map** • Integration of the core indicators: noise load, air pollution, availability of green spaces, bioclimate/thermal load, social problems/status-index

Municipality Acoustical Classification Plan • Mandatory for all municipalities • Noise-zoning-act: subdivision of the territory in 6 areas that are acoustically homogeneous; definition of noise limits for day and night • Other instruments like the "piano regolatore generale", the "piano urbano del traffico" and the "piano strutturale" must adapt to it.	
Triennial Regional Plan for Environmental Noise Remediation • Must be performed by regions • Definition of regional priorities, based on national financial resources	
Urban Action Plan • Follows the END requirements about Strategic Action Plans of cities • Acoustic characterization of hotspots and other critical situations • Description of strategic/large-scale actions to acoustic mitigation and protection measures for quiet areas • Commits public administrations to a wide planning and organized noise mitigation activity • 6 areas of intervention	**Noise Action Plan** • Short-, medium and long-term measures for the reduction of contamination
Urban Noise Reduction Plan • Description of detailed actions to acoustic mitigation	
Noise Containing and Abatement Plan • Related to transport infrastructure	
Company Noise Abatement Plan • Considers the abatement of environmental noise caused by manufactures	
Authorization for temporary (concerts, public performances, events…) **and permanent activities** (restaurants, pubs, bar…)	
Citizen & stakeholder participation (see chapter 5.1.3)	

Fig. 20: Noise-related plans in Berlin and Florence.

5.1.2 Dynamics of policy-making

To illustrate the context in which the in chapter 5.1.1 mentioned instruments are relevant, hereinafter the actors that are central for the governance of urban noises and typical policy-making dynamics are analyzed. Exemplary, it will be shown how the (power) relations between them are structured, though in some cases this is for obvious reasons not completely possible (e.g. concerning lobbyism dynamics). For further and condensed information on the actors that appear in this text see appendix D. The practice of sound/noise policies is highly fragmented in terms of responsibilities and actors which are of all kind and located on all scales of policymaking. A complex set of administrative departments (both representing different spatial entities and different policy fields) fosters the development of narrow perspectives, that lose the necessary connections to other policy fields. In a broader sense this can be observed for other urban policy fields that are sound/noise relevant but do not deal consistently with those aspects (see below).

On the other hand, the politics – reaching from sound/noise policy discourses to the implementation of policies – shows that even the sub-issues of sound/noise policy themselves are rarely relating much to each other in a structured way.

Often this lack of coordination is related to different responsibilities and powers, like in the case of policies on traffic noise and commercial and household noise in Berlin which are regulated by different authorities based on different legislation. Whereas, the practical regulation of commercial and household related noises is a responsibility of district authorities based on national and federal state level laws on immission control (BImSchG, LImSchG Bln) and regulations on personal behavior (BGB, OWIG) (Ministry for Economy, Labour and Housing Baden Württemberg, 2013), but there are also land use zoning and building regulation-related limits on noise levels deriving from "Baugesetzbuch" (Federal Building Code) (see chapter 5.1.1) and its specifications "Baunutzungsverordnung" (Federal Land Utilization Ordinance) and "TA-Lärm" (Technical Instructions on Noise Protection) which is mainly a complex of legislation deriving from national

legislation partially specified on federal state level. Those exemplary complexes of legislations do comply with - or at least do not obscure - each other´s main requirements in regulating noise emissions, even though in detail they create a level of complexity hard to grasp for people who are not in touch with this topic on an everyday basis.

But this frequently occurring fact of parallel structures sometimes obscures the objectives of other noise-related policies in general. This becomes obvious when considering that traffic noise is excluded from the regulatory practices mentioned above, although traffic is the main source of measurable noise levels in cities with levels that exceed those fixed in commercial and household noise regulation by far. For example, the "TA-Lärm" sets strict daytime limits of 55 dB(A) (nighttime 40 dB(A)) for general residential zoning areas (there are even stricter limits for some other zoning types), whereas the Berlin noise action planning mentions comparable daytime limits as vague "long term goals" only. For the nighttime requirement of 40 dB(A) it is even only mentioned that other recommendations like the WHO Night-Noise-Guidelines include this value. But it is not adopted as a long-term goal for Berlin. All the measures to be taken in the next years focus on the less ambitious goal of 65 dB(A) at daytime and 55 dB(A) at nighttime (Senate Department for Urban Planning and the Environment, 2014, p. 2) which is a huge difference keeping in mind that dB(A) is a measure of logarithmic kind. Similar difficulties of incoherent and contradictory policies can be observed in Florence, too.

Another kind of difficulty in effective noise policies becomes visible when looking at the internal dynamics of certain key actors. Although, the term "actors" is used for institutions and groups of different kinds, it shall not be implied that those actor-groups are internally homogenous and have clear-cut and consistent objectives. Most institutional actors have internal dynamics which lead sometimes to contradictions. The European level of policy-making is an example of a complex network of actors (the EU legislative body with its huge internal diversity of objectives and processes and other administrative, civic, academic and economic actors trying to push forward their

agendas). Although, an in-depth research on the processes behind different noise relevant policies on the EU-level has not been conducted, it becomes clear that the exemplary case of specific regulations on emissions by car traffic are not coherent at all, even if they deal with the same topic and have been implemented by the same legislative bodies. The European Noise Directive of 2002 aims at reducing traffic noise levels in cities while harmonizing/framing member states´ approaches on this topic. The EU regulations regarding noise emissions by vehicles which oblige manufacturers to comply with limits is a competence in the domain of the EU level, too. But the two policies don't complement each other because of the ineffectiveness of the control of emissions for vehicles themselves (the sources of the noise the END deals with it in a more abstract form). The criticism by several initiatives and media outlets can be summarized in a simplified way like: "beyond 80 km/hour there are no noise limits at all. Below 80 km/hour the tests are rigged" (Raue, 2017)[4]. Concluding on these difficulties of noise policy Mr. Jäcker-Cüppers says: "In policies on noise we can see a relatively complex structure, in which responsibilities and competences are structured in ways that in part actually produces incompetence" (M. Jäcker-Cüppers, interview, January 5, 2017, own translation).

After having shown the fragmentation of noise policies, their respective actors and the problems related to this structure, now it will be explained more in depth how policies and policy innovations are made and implemented. Noise policies are a contested and dynamic field. To structure these dynamics there can be conceptualized four different types of noise policy making and politics. They should be understood as being of a fluid character due to many actors´ possibilities to combine and change between those types. In fact, in both case study cities and on the larger scales of noise policy making all four types are relevant. Nonetheless, certain places and actors will be used to illustrate the dynamics with significant examples, not saying that there would not be other good examples, too. The policy-making/politics types are:

- "Shaping of understandings" (illustrated with WHO)

- "Frameworks for action" (illustrated with END)
- "General operationalization" (illustrated with noise action planning in Berlin)
- "Planning with projects" (illustrated with Florentine quiet areas projects)

In noise policy-making many actors of different kinds are involved, yet most of them do not hold direct competences in shaping the policies and politics of noise. They exert influence in more subtle ways by the **shaping of understandings** via providing knowledge, guidelines and attention for certain issues. The goals of such an approach can be found in practices of agenda setting including the promotion of a certain understanding of sound/noise as an issue requiring a certain kind of action, followed by the creation of consensus and coalitions for the issues. One of the most important ways to do so is the use and the creation of powerful narratives. The WHO is one significant example of global relevance for this approach. The organization published reports on nighttime noise exposure in relation to various negative health effects (the effectiveness of this narrative, its importance in the discourse and its implications are discussed in more detail in chapter 5.1.5). This policy-making style is open to actors from all backgrounds/logics and is therefore the typical mode in which civic, academic and sometimes economic actors try to influence policies. But of course, many actors from an administrative logic can and do easily switch, too.

Another type of policy-making is the establishment of **frameworks for action** whose main goals is the institutionalization of certain policies and creation of new conditions for the politics of a specific subtopic of noise at more basic scales. Different from the more informal ways of policy-making, which often operate at global, European and national scales too, this type exerts its influence via general, yet mandatory means of systematization, comparable instruments and the establishment of minimum/maximum standards. It aims at influencing a broad range of practices in the more action-related styles of politics. The most prominent case of such a policy initiative in recent years has been the END. It focuses on traffic noise and derives from the EU-level of policy making while being implemented on national

state and city levels. Furthermore, the END went along with other European initiatives on traffic noise over the course of the last years, like the funding of research and innovative design projects (e.g. HUSH, QUADMAP) related to noise paralleled by new regulations on vehicles noise levels of contradictory character. Due to the extent of the policy-specific decision-making processes and the lack of transparency of the goals followed by actors involved, it can only be guessed if and to what extent those single policies have been coordinated (or have been intended to be). So, the effectiveness of creating new frameworks for noise politics is on the one hand influenced by the internal dynamics of the large scale administrative actors enacting them.

On the other hand, this kind of policy-making involves a subsidiary approach of implementing a basically mandatory top-down policy. This opens a lot of opportunities for local adaptation and in-

terpretation - a fact that can lead to local innovations in some cases and little effectiveness of the policy's original intentions in other cases. Both Berlin and Florence are often described as relatively advanced in implementing at least parts of the END regulations although there are shortcomings in both cities too and their noise politics have different specifications.

Berlin, compared to other European and German cities, has been quite consistent in implementing and operationalizing at least some of the END instruments. This is true especially for the quantitative ones related to noise action planning, notwithstanding the goals in reducing the quantitative traffic noise levels still do not comply at all with those fixed for other regulations on urban noise levels as it has been shown above. This illustrates the noise politics type focused on operationalization (see Fig. 21 for relations of actors in the case of Berlin noise action planning). Normally, the ge-
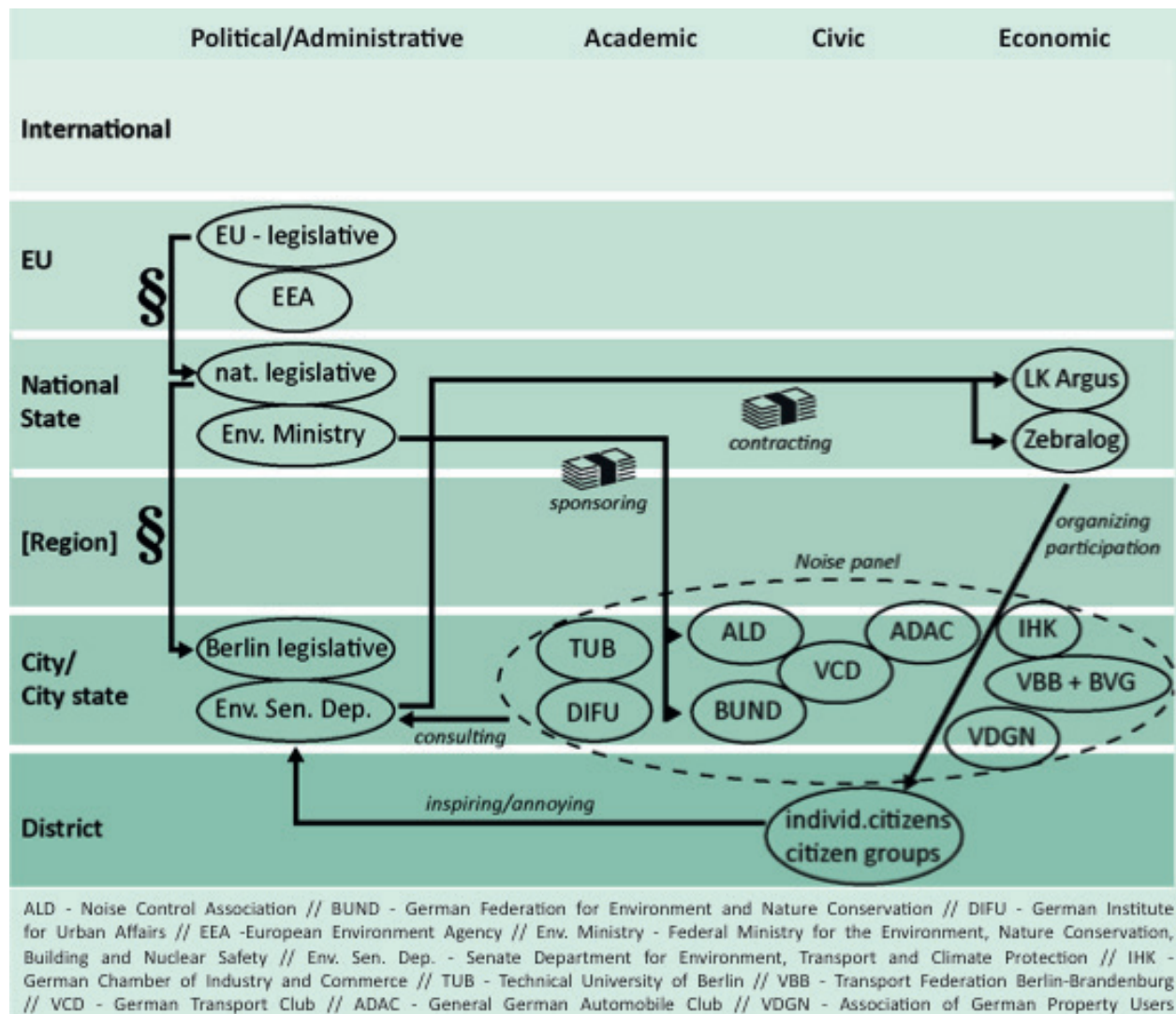

ALD - Noise Control Association // BUND - German Federation for Environment and Nature Conservation // DIFU - German Institute for Urban Affairs // EEA -European Environment Agency // Env. Ministry - Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety // Env. Sen. Dep. - Senate Department for Environment, Transport and Climate Protection // IHK - German Chamber of Industry and Commerce // TUB - Technical University of Berlin // VBB - Transport Federation Berlin-Brandenburg // VCD - German Transport Club // ADAC - General German Automobile Club // VDGN - Association of German Property Users

Fig. 21: Dynamics of noise action planning in Berlin.

neral operationalization of noise policies is highly focused on the internal administrative processes necessary to regulate this specific subtopic of policy effectively. So operationalization is a precondition for pushing policy issues to a broad spatial relevance. But there is also a downside in specified operationalization tending to exclude other actors and hampering connections to other issues and innovations. Another problem is the potential narrowing in the use of measures that can occur over time. Usually certain ways of action prove to be effective while causing little conflicts in the short term. This can lead the responsible actors to prefer them over other measures that could have a big additional potential for improvements and enrichment of the planner's toolbox, but would have commitment and new procedures as their preconditions (B. Schulte-Fortkamp, interview, January 17, 2017).

Although there are a number of fields in sound/noise politics where these fragmenting and hampering dynamics are a big problem, one can summarize on the effects of this policy-making type that the operationalization has been done in a relatively integrated way in Berlin, even if there is still a lot what could be done. At least some of the END-related instruments have been integrated in general and especially traffic-related planning processes. The reduction of noise levels at specific hotspots has become another element promoting the redesign of major streets, albeit it has not developed much traction as a single issue without connection to other objectives.

An obstacle in implementing this kind of operationalization of the framing END instruments has been the existence of established approaches for reducing noise exposures. The sometimes contradictory character of European and national legislation in noise reduction policies affects the processes in many member states. Italy had a kind of pioneering role in finding solutions for these problems. This is especially true for Florence as
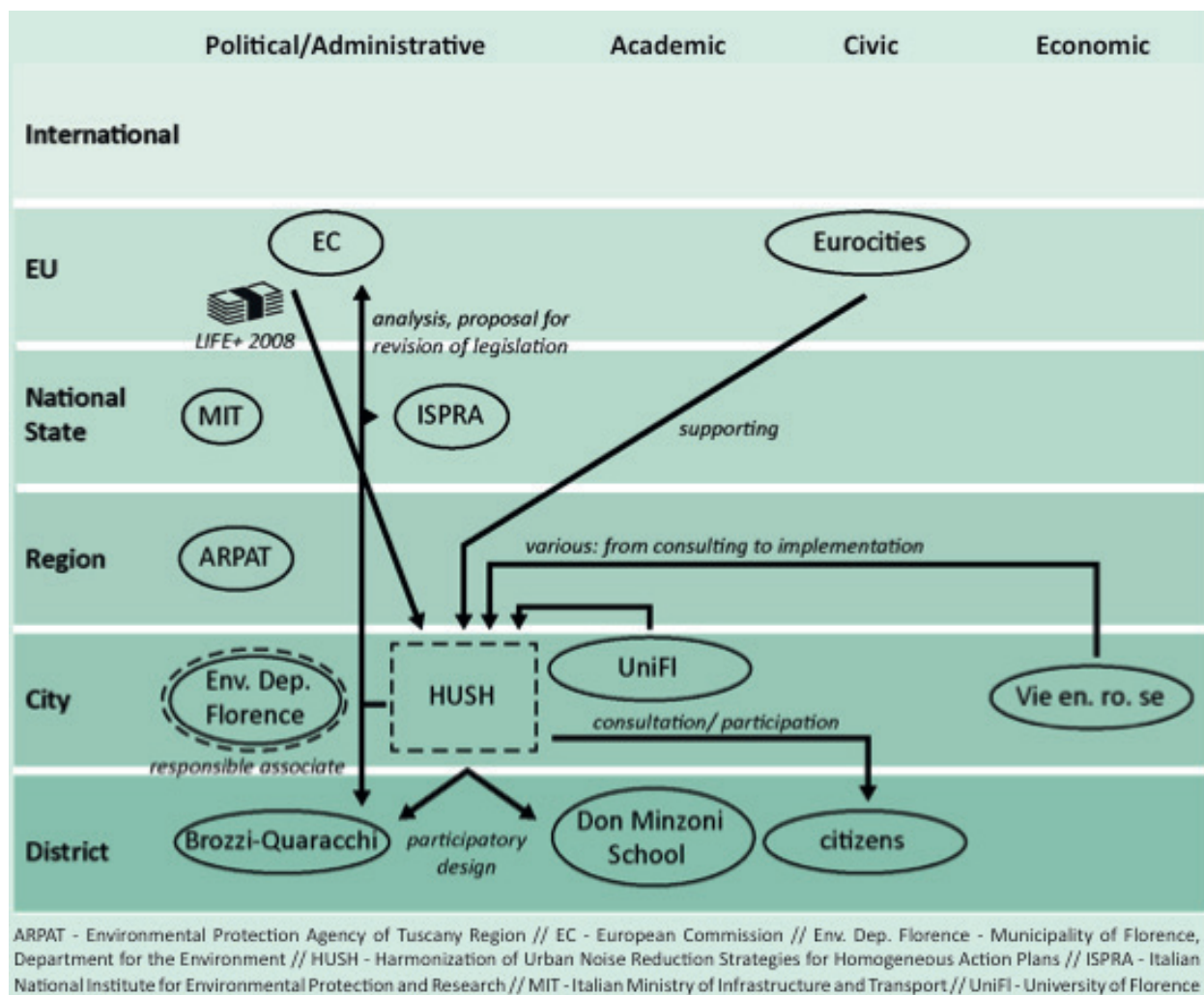

ARPAT - Environmental Protection Agency of Tuscany Region // EC - European Commission // Env. Dep. Florence - Municipality of Florence, Department for the Environment // HUSH - Harmonization of Urban Noise Reduction Strategies for Homogeneous Action Plans // ISPRA - Italian National Institute for Environmental Protection and Research // MIT - Italian Ministry of Infrastructure and Transport // UniFI - University of Florence

Fig. 22: Dynamics of the HUSH project in Florence

the place where the actual project (HUSH) has been conducted (see Fig. 22 for the network of involved actors in the HUSH project). When the END was passed in the early 2000s, in Italy there has been a complex system of politics on noise in place that developed since the 1990s. These parallel structures interfered with effective action by creating insecurity about the procedures to adopt, although this does not mean, that there is no relevant action in this field in Florence[5]. To summarize on the effects of the END on national politics on noise it can be said that those member states not having sophisticated policies on this topic made progresses by adopting the END while others showed mixed results at first (Borchi et al., 2016).

But in the Florentine case there have been additionally rather different ways of implementing goals that got a central role in sound/noise politics. Special design projects on Quiet Areas (as defined in chapter 2) that have been integrated into various research projects gaining attention on a European scale play a much bigger role for innovations in sound politics and policies in Florence. Many official actors involved with regulations on noise focused more on specific projects at selected sites where the obligations of the END (in this case the tool of quiet areas which is more open to thematically broader understandings of sound policy) have been connected to other objectives, creating a more holistic, yet in terms of space and general urban relevance more limited approach than the operationalized practices illustrated for Berlin´s noise action planning.

The example of Florence can be identified as another type of policy-making that uses local projects to achieve results and further innovations. It can be called **"Planning with projects"** (see Fig. 22 for actor networks in the Florentine exemplary case "HUSH") - a style of politics that of course can be identified in Berlin and many other cities, too. (An interesting example from Berlin is the project Nauener Platz.) This pathway usually involves place-specific sets of very different actors that follow their own objectives while designing selected spaces in cities where there are opportunities for action. On the one hand, there are institutions of normally large scales, like the EU level, that provide funding to local projects. On the other hand, there are local coalitions mostly composed of officials, academic and organized civic actors that generate ideas. In effect, this type of policy gives a relatively strong role of framing via defining criteria for funding to major scale actors. But at the same time, it opens opportunities to local coalitions for introducing otherwise underrepresented sound issues and connections between sound subtopics themselves but also to more general sound-related issues. A questionable fact on planning via projects is the narrow spatial focus of action that concentrates funds and attention both from directly involved actors as well as from the public on specific sites while making little to no difference on a city-wide scale and in places where there the preconditions for action are less favorable.

To the non-state actors that influence policies of course also belong journalists and scientists, although they are less in the focus of this report. Regarding the influence from noise and soundscape research on political strategies and actions Brigitte Schulte-Fortkamp states: "Since more than 20 years efforts are made to translate findings from medicine and other research fields into good urban and traffic planning and thus redesign urban life." But "this tends to be quite long-winded, it takes a long way until it can be described as successful." (B. Schulte-Fortkamp, interview, January 17, 2017, own translation.) Media coverage might serve as a mediator between the academic and the political sphere, although it has a relatively indirect influence. Sometimes policies use certain ideas (e.g. from the soundscape research) without naming them explicitly so or quoting the original concepts.

5.1.3 Citizen participation

Closely linked to the policy-making dynamics and the involved stakeholders that were discussed in the last chapter is the question of citizen participation. The involvement of citizens in sound or noise related policies is characterized by manifold dynamics - grassroots initiatives, formal processes organized by state institutions, voluntary approaches, obligations that must be fulfilled... There can be identified at least **four different types**:

1) At least on paper public participation represents a fundamental principle of noise action planning under the terms of the END (Murphy & King, 2010, p. 292): The European Union obliges the competent authorities of the member states to "ensure that the public is consulted about proposals for action plans" and that there exist "early and effective opportunities to participate in the preparation and review of the action plans". The authorities are required to ensure that "the results of participation are taken into account and that the public is informed on the decisions taken" (END, p. 16). Since the requirements are not very specific, the member states deal with them in different ways, depending on their respective planning culture and governance strategies. This type of citizen participation is linked to the "operationalization" dynamic mentioned in chapter 5.1.2. Both Berlin and Florence developed instruments to fulfill the requirements, although in this context citizen participation does not always lead to strong results that really influence noise action planning (and seems to be sometimes confused with mere public relations work). Sherry Arnstein emphasizes: "There is a critical difference between going through the empty ritual of participation and having the real power needed to affect the outcome of the process." (Arnstein, 1969.) In this sense, experts recommend the EU to establish clear procedural guidelines to "ensure that public consultation forms a more central role in

noise action planning and associated decision-making. This would move away from the token public consultation occurring in many states currently" (Murphy & King, 2010, p. 297).

Examples of interesting participation projects in Florence will be presented in the second paragraph. In Berlin, the most relevant campaign was the online platform "Berlin is getting more quiet: active against traffic noise" (January to February 2013) that accompanied the preparation of the last noise action planning. The citizens were asked "Where is it loud? How can we make it more quiet?" to use specific local knowledge for the implementation of noise abatement tools. The then Berlin Senate Department for Urban Development and the Environment reacted with public statements to the most relevant aspects and invited selected participants to a direct dialogue (SenStadtUm, 2013.) Asked for the effectiveness of this practice Jäcker-Cüppers states: "There are some classic examples of local citizens´ initiatives [like the Friesenstraße/Bergmannkiez in Kreuzberg, see below; author´s note] who ensured that an issue, of which the Senate Department was almost not aware of, got a very high priority." (M. Jäcker-Cüppers, interview, January 5, 2017, own translation.) Coming back to Sherry Arnstein and her often quoted ladder of citizen participation (ranging from manipulation to real citizen control, see Fig. 23, these campaigns can be classified as somewhere between consultation (rung 4 out of 8) and placation (rung 5 out of 8), which are rated by Arnstein as mere tokenism.
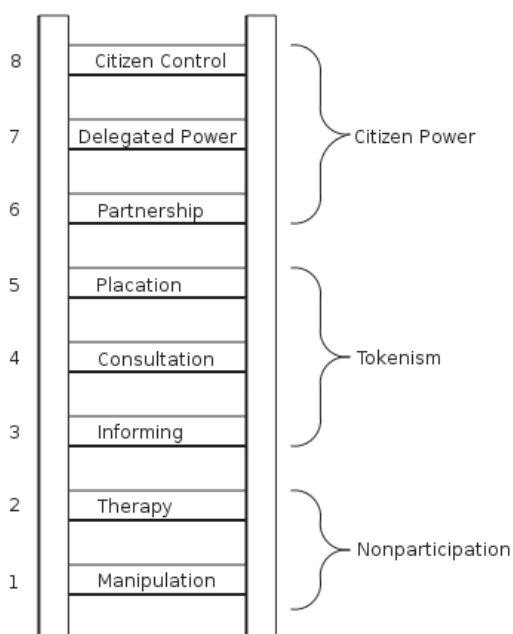
2) As second type of practiced citizen participation could be described state-led top down participation that goes beyond the EU requirements. This can be projects regarding the design of specific sites (like the Don Manzoni School in Florence or the Nauener Platz in Berlin) - this type of small-scale participation concerning specific issues reflects the above explained dynamic of "planning through projects" and triggers often more action, but is usually quite limited in scope[6]. Brigitte Schulte-Fortkamp emphasizes the need to see local people as experts and "learn from them how they feel about and understand an area. And for planning we have to pick up their ideas and expertise to develop new spaces/places." (B. Schulte Fortkamp, interview with berlin sonic places, 2012.)

Fig.23: Eight rungs on the ladder of citizen participation.

To the same category can be put participation that deals with issues of urban development in general and touches on sound/noise-related topics. One example is the maratona dell'ascolto ("listening marathon") in 2015 in Santa Croce, which was a series of public meetings arranged by the City of Florence to "prompt dialogue with residents on some of the key issues concerning Florence´s administration, with the goal of finding mutually agreeable solutions." Noise-related topics that were discussed were for example the sustainable management of increasing tourism in neighborhoods outside the city as well as traffic and transit issues. (Meyer, 2015.) Furthermore, awareness raising campaigns are becoming more en vogue, such as educational activities (both in Florence and Berlin) during the International Noise Awareness Day (April 26).

3) While the participatory strategies mentioned in the last paragraphs are top-down processes, especially in the field of noise there are many grassroots citizens´ initiatives that protest against certain noise issues by which they are directly affected. This means these groups are quite fragmented, since they organize themselves per noise sources. Prevailing, they follow a reactive logic and try to influence policies in a field. Well known are the manifold protests against the expected aircraft noise at the future Berlin Brandenburg Airport BER. In 2011, several local initiatives founded the active alliance "Für ein lebenswertes Berlin-Brandenburg ohne Fluglärmbelastungen." ("For a Berlin-Brandenburg worth living and without aircraft noise.") The aircraft noise opponents use diverse political tools like formal complaints to the competent bodies, a petition to the German parliament, public events, marches, an international tenants´ conference etc. (Bürgerinitiative Stahnsdorf gegen Fluglärm, n. d.) Another current example in Berlin is the initiative "leiser-bergmannkiez.de" that mobilizes since 2012 against traffic noise in the neighborhood Bergmannkiez (in Kreuzberg, close to the Kottbusser Tor area). They organize public events, were involved in the citizen participation for the noise action plan Berlin 2013-2018 as well as for the plans on a shared space at Bergmannstraße. One of the main demands is the closure of Zossener-/Friesenstraße for through traffic. (Hubert, n.d.)

Michael Jäcker-Cüppers points out that those initiatives often are very focused on the local scale of noise issues (even down to the street level) and develop less understanding of city-wide solutions, overriding strategies and the global context of problems (such as global production and transportation chains). "We need higher level initiatives that also take global aspects of noise abatement policies into consideration." (M. Jäcker-Cüppers, interview, January 5, 2017, own translation.) While in Germany there does not exist a higher level initiative regarding road traffic (besides the Noise Control Association of the German Acoustical Society), there are initiatives dealing with rail traffic and air traffic at federal level. The latter indeed came up with powerful impulses for national and European policies. (Ibid.)

4) Especially within soundscape (but also noise) research there is a trend towards "citizen science"[7]. This means usually that citizens are asked to record and upload sounds, comment on their connection/relationship to this soundscape and/or measure noise, localize it and tag it. Often researchers design mobile applications for smartphones, tablets or other gadgets that the "citizen scientists" use in the fieldwork to collect data. This material contributes to interactive online maps (compare chapter 5.1.4). Projects[8] such as the Center for Global Soundscapes[9], the Sound Around You project[10] or NoiseTube[11] use this practice (similar apps can be found regarding light, e.g. Loss of the Night[12] which measures sky brightness). These activities might have a range of positive effects (like raising awareness, a feeling of the citizens to be part of a research project, collected local knowledge), but at the end of the day the participation opportunity is very limited. Neither do the involved citizens define the research questions nor have they influence on the framework conditions of the investigation.

Summarizing it can be said that citizen participation can play a crucial role for the development of livable cities with quiet areas and inspiring hi-fi soundscapes. Different actors in Berlin as well as in Florence experimented with a big range of participation tools like sound walks, online platforms, surveys, collective maps, workshops, etc. Though the responsible government bodies express the will to develop comprehensive strategies to im-

prove participation processes, in practice it often feels like there are still many rungs to be climbed on Arnstein´s ladder of citizen participation: "[P]articipation without redistribution of power is an empty and frustrating process for the powerless. It allows the powerholders to claim that all sides were considered, but makes it possible for only some of those sides to benefit. It maintains the status quo." (Arnstein, 1969.)

5.1.4 Understanding of sound and noise

As mentioned in chapter 2.1 there exist different approaches to deal with the phenomena of soundscapes and noises in the city that are not mutually exclusive, but based on different assumptions/ways of thinking. The European regulatory framework and the strategic noise mapping practices in the EU member states derived from those guidelines are based mainly on physical measurements respectively calculations and the reduction of noise levels. Thus, it is a quantitative approach which promotes technical solutions for problems that are defined by scientific studies (e.g. on the health effects of the exposure to certain decibel levels). Those maps and limits have for sure their value since they come to clear statements and make - at best - different geographical areas comparable to each other regarding their average noise pollution and the number of people exposed to the adverse effects of noise. Their focus lies on selected sound sources (like road and rail vehicles, aircraft and industrial facilities), which excludes other types of sounds. Sometimes there are clearly gaps between the "objective" mapping and how inhabitants and visitors experience a city. For example, since the indicators express an average sound pressure level, they don't distinguish impulsive sounds with a short duration, but high sound pressure levels (Raddicchi & Signorelli, 2015, p.133).

Nevertheless, there are some instruments that are required by the Environmental Noise Directive of the EU that provide the opportunity to create links between the qualitative and the quantitative perspective. The most significant examples are "quiet areas" that should be areas where people can find some refuge from urban environmental stress. Since the idea behind this concept is to preserve and enhance the acoustic quality of these areas, it is not expedient to just look for quantitative measures though this is the general approach of the END. Thus, the requirements are somehow ambiguous. This can be seen less as a deficit, but an opportunity for experiments and for the creation of links between different strategies. "An in-depth analysis has to consider the human activities situated in these places and the temporality and the rhythms of the connected sound events." (Radicchi & Signorelli, 2015, p. 133.) Though the predominant part of noise mitigation policies follows the traditional, quantitative approach, the soundscape approach (as explained in chapter 2.1) is getting at least in the academic discourse an increasing relevance (M. Jäcker-Cüppers, interview, January 5, 2017, own translation). It stresses that the "physical characteristics of sounds do not allow us to assess whether a sound event is perceived as pleasant or annoying or which information and messages are contained and carried by it, and they do not provide knowledge about the values given to them by a community." (Radicchi & Signorelli, 2015, p. 133.)

In terms of integrating this soundscape theory to policies, Florence is way more progressive than Berlin[13]. Vie en.ro.se. Ingegneria, the main acoustic consultant of the Florence City Council, bases its work on the soundscape approach and understands both material and non-materials as part of the urban landscape (including sounds, colors, smells etc.). (R. Natale, talk, November 28, 2016). Their goal is to provide an evaluation both on the quantitative and the qualitative level and use insights of various disciplines like acoustics, physiology, psychology, sociology and statistics. (S. Luzzi, talk, November 28, 2016). Though Florence implemented also the noise mapping, monitoring, regulations and controls required by the END, Sergio Luzzi emphasizes in his view it is not just about noise, but about the urban environment (ibid.) Thus, since humans´ perception works in a multi-sensory way planning should take into account a complex set of aspects like the used materials, visual aspects of the landscape, safety issues, soundscapes and green areas amongst others. (R. Natale, talk, November 28, 2016).

To experiment with those ideas Florence participated in the past years in several EU funded projects like HUSH (Harmonization of Urban Noise Reduction Strategies for Homogeneous Action Plans; 2010-2012), HARMONICA (HARMOnised Information for Citizens and Authorities; 2011-2014) and QUADMAP (QUiet Areas Definition & Management in Action Plans; 2011-2015). Partly those projects strengthen transnational collaboration as it is the case in the QUADMAP project which is based on research in Florence, Bilbao and Rotterdam. A result of the HUSH project and the Florence Action Plan are micro- and medium scale interventions in the city of Florence that test participatory design procedures and develop pleasant soundscapes for example at school grounds. Since there are less examples of soundscape design in Berlin, the redevelopment of the Nauener Platz in Berlin-Mitte gets special attention.

Within the field of researchers and practitioners at least in Germany there exists a deep gap between those who follow a traditional noise mitigation approach and the "sound scapers" who are especially interested in the sound design of cities. A third group are the psychoacoustics whose work might help to build bridges between the different approaches (e.g. noise legislation for vehicles could consider psychoacoustic parameters like different human reaction to the same dB(A) level depending on the source, as Michael Jäcker-Cüppers suggests.

In general, there seem to be very few communication, mutual understanding and appreciation of the work the colleagues are doing. (M. Jäcker-Cüppers, interview, January 5, 2017.) At some points, there exist attempts to strengthen the dialogue, but they show a mixed picture. While meetings within the ALD (the Noise Control Association of the German Acoustical Society DEGA) were described by participants as not very successful[14], it can be seen that since about ten years soundscape research became a relevant part of congresses on acoustics (B. Schulte-Fortkamp, interview, January 17, 2017).

The connection between the two perspectives depends often on the commitment of single persons, which makes the process quite difficult

since few professionals deal with this topic. (M. Jäcker-Cüppers, interview, January 5, 2017.) From the few insights the study group got in the internal debate between the "noise people" and the "soundscape people", they got the impression that there exist certain barriers that make mutual understanding more difficult. For example, the professionals that focus on noise abatement use very strong arguments (in the sense of "Noise kills human beings.") This way to frame it has a quite exclusive effect and might make it difficult to shift the perspective. On the other hand, it seems sometimes that "sound scapers" tend to overemphasize the outcome of their design projects. While the academic soundscape debate is developed quite far, it is sometimes difficult to translate the advanced theory to practices that meet those requirements. In the end, on both sides there might be identified kind of an "unproductive arrogance" (generally speaking, not referring to particular individuals).

Maybe projects like "SONORUS - The Urban Sound Planner" (2007-2013) can help to overcome the void? It aimed at training "a new generation of researchers" and introducing "a new profession, the Sound Urban Planner, with technical expertise in the methods of calculation and control of noise, in soundscaping, urban planning and traffic planning and able to develop and interact with these issues [i.e. noise pollution in urban areas; author's note] in a holistic vision and multidisciplinary approach." (ISPRA, n. d.)[15]

5.1.5 Main narratives within the discourse(s)

In order to understand the sound respectively noise policies in Berlin and Florence it is helpful to analyze the underlying narratives that are dominant within the public, academic, political and administrative discourses. This cannot be by any means a comprehensive discourse analysis as it is used in historical science, social sciences and linguistics. Rather, some relevant aspects will be highlighted to give some insights in the logic of how the topics of sound and noise are negotiated in different cities. Of course, there is a huge range of varying narratives that are brought up by different institutions/interest groups. They are

overlapping, not always explicit and sometimes seem to be contradictory. Since narratives and discourses are always dynamic phenomena this interpretation is just a snapshot of a very complex field and is not free of personal biases.

Within the mainstream political and administrative discourse the focus lies clearly on **sounds of discomfort** and the various **risks** noise can provoke. (It is noticeable that the discourse is very fragmented based on the different sources of noise: car traffic, rail traffic, air traffic, behavior-related noise etc.) There can be identified a strong discursive connection between (especially traffic) noise and **public health** and human well-being as it is highlighted for example by the World Health Organization, different institutions of the European Union and the former Berlin Senate Department for Urban Development and the Environment (see for example WHO/Europe, 2009; Directive 2002/49/EC of the European Parliament and of the Council; SenStadtUm, 2014). At some points, there is a gap between the way inhabitants and users of public space perceive a certain soundscape and how scientists evaluate it from a health point of view. A high decibel level might damage for example the hearing ability while the sounds might be perceived as pleasant (e.g. music, fountain etc.). In this case occurs a gap between an exclusive, academic discourse and the public perception (while politics are often in between). In some contexts, the public health narrative is supported by an **economic argument** that emphasizes the economic burden on a society through environmental noise (e.g. through illness-related costs). Related to the health perspective is also the integrated approach of **environmental justice** that analyzes the type, extent and consequences of the unequal distribution of environmental loads and its reasons. While this perspective does not seem to play a central role for noise-related policies in Florence (or at least they are not "labelled" that way), Berlin is one of several cities where the environmental justice approach is relatively far developed. In a cross-departmental space-oriented pilot project the State of Berlin analyzed in 2008 the core indicators noise load, air pollution, green spaces, thermal load and social issues in order to develop an integrated multi-layered map of the environment and social structure of the city (Senate Department

for Urban Development and Housing, 2015). Nevertheless, socio-economic injustices still seem to play a minor role in the general debate. Since the traditional noise protection approach focuses on noise hotspots (which are usually main roads where due to the lower housing prices typically people with lower incomes live), the European Environmental Noise Directive has a positive effect on environmental justice without using that term explicitly (M. Jäcker-Cüppers, interview, January 5, 2017, own translation).

The narratives mentioned in the last paragraph are mainly relevant for the mainstream European/national/city level discourse and don't seem to be very contested, although yet not necessarily very effective or based on a consensus. On a local/district/neighborhood level the focus shifts. Especially for the Kottbusser Tor area there can be identified a discursive c**onnection between noise, dirt, (legal and illegal) drug use and crime** which leads to the hypothesis that the subjective security of a site is connected to its soundscape[16]. As described in chapter 6 this is also the case in the Kottbusser Tor neighborhood and the Santa Croce/Sant'Ambrogio neighborhood where passers-by describe noisy areas as provoking feelings of insecurity, annoyance etc. (For light this connection is more obvious and also much more discussed, see chapter 6.2.5.) There is still not much research about this relationship available, but it is worth to conduct more studies on this topic, especially comparing the influence of the soundscape to the effects of the lighting situation on the subjective feeling of **(in)security**. This thought is related to the idea of Max Neuhaus that sometimes "it is not sound which annoys us, but the message it carries. We easily recognize the things we hear just as we do those we see, but usually less consciously. Sound is constantly giving us messages, some of which we do not wish to hear; but let's not blame the messenger for the message." (Neuhaus, 1994)

Linked to the narrative of (in)security is the insight that sound design is also a **question of power**[17] (just as light design, architecture, design of green areas etc.). One example would be the **exclusion of marginalized social groups from the public space** through the design of the sonic landscape at a site. This can be made either by

the playback of certain sounds[18] (e.g. music that makes it uncomfortable to sleep, which drives homeless people away) or by certain rules about the use of a place (e.g. criminalization of buskers and street musicians). While the playback of certain sounds/music is as far as we know neither applied in the Santa Croce/Sant'Ambrogio neighborhood, nor in the Kottbusser Tor area, there are clear regulations for street musicians.

Anyway, street music in Florence is on the rise. "Over the past few years, there has been a silent revolution amidst Florence´s street artists, a battle against the bureaucracy regarding permission to occupy public land. In 2014, the City of Florence released a rejigged public tender to assign the 29 posts for street artists, 12 of which are in the center [including Piazza Santa Croce; author´s note]. Thanks to this change in law, the city resounds with a regular turnover of styles, faces, groups and ages - before each spot was assigned to one artist only." (Davis, 2016.) In the case of Florence, street music is (at least if it follows the rules set up in a top-down manner) seen as something that adds its "magic to Florence´s emotionally charged urban landscape" (ibid.). In Berlin street musicians must apply for a special permit, too. Otherwise, they will be charged with high fines. Nevertheless, many musicians ignore those rules and keep performing on public places and many times at the S- and U-Bahn where it is officially prohibited. This is also the case at Kottbusser Tor where improvised music sometimes provokes spontaneous interactions like dancing together at the U-Bahn station[19]. Thus, music may work as a tool of **(re-)appropriation of the public space**.

A similar dynamic is at play in situation where noise production is used as a **tool to gain attention for certain political demands.** The most striking example are the noise marches of the tenants´ initiatives Kotti & Co (compare chapter 4.1.1). On their demonstrations, they use common household objects like pans and pots to make as much noise as possible to be more "audible" and gain attention for their struggle for affordable social housing. Similar dynamics can be seen in "guerilla lighting" techniques as described in chapter 5.2.3. But sound/noise can not only be a tool in political/social struggles. In parallel to

processes of gentrification one can observe local conflicts around tourists and inhabitants of adjacent districts who visit the areas especially at night time, drink alcohol in the public space and make **party noise** that disturbs the neighbors. In the past, this led partly to conflicts between them and shop owners who sell alcohol (BA Friedrichshain-Kreuzberg, 2016). In the Florentine neighborhood of Sant´Ambrogio neighbors even formed an association that protests the noise level at nighttime, hanging sheets out of the windows with slogans like "Here we don't sleep anymore!" (C. Francini, talk, November 30, 2016.) So both in Kreuzberg and the Historic Centre of Florence the public discourse on sound/noises is linked to the topics of **movida/nightlife and touristification**. In these cases, sound and noise become more an issue where a broader process with consequences for uses and the social structure of the areas condenses and becomes accessible.

It can be summarized that there is a broad discourse on noise as pollution (framing it mainly as threat/risk for the society, individuals and the environment), but not much public discussion on the qualities of diverse urban soundscapes. As exception can be seen the recently implemented Florentine approach to understand the soundscapes of the city as part of the **immaterial cultural heritage**. In 2013 the Municipality of Florence created a dataset called "Immaterial cultural goods" (according to the definition of Immaterial Cultural Heritage released by the UNESCO in 2003) which is based on data of the Firenze Sound Map[20] and forms a part of the Open Data system of the Municipality. Nevertheless, the idea of soundscapes as heritage seems to be still a quite marginal phenomenon that did not lead to a broad public debate nor to a clear understanding what theoretical and practical implication this concept has.[21]

Some aspects are less strongly represented in the political discourses, for example the huge variety of sounds of a city, the discussion about desirable urban soundscapes, the relationship between soundscape, light and the lifestyle of a city, how neighborhoods could create a "sonic identity" and how the morphology influences sonic experiences at a site. Max Neuhaus states a general lack of awareness in the architectural community

about sound: "architects think much more about the way a building looks than how sound works in it" (1994). Furthermore, there are so far very few links between the discussion about lights and sounds of a city and about those two phenomena affect the perception of a city´s form.

Parallel to the political, administrative and scientific debates there occur experiments within the art scene, which are usually not very connected to politics, but focus for example on question like how humans interact with the sounds of everyday life and on "emotional geography". One example is Peter Cusack´s project "Favourite Sounds"[22] which explores since 1998 "the connections between sounds in the environment and their geography". It aims to "discover, and celebrate, what people value about the soundscapes of the cities, towns and neighborhoods where they live and work." (Cusack, 2012.) Examples of "favorite sounds" in Berlin would be the sound of the S-Bahn, a midnight nightingale or the "Symphony of Groans, Spreepark Ferris Wheel in Abandoned Fun Fair". Interestingly, similar techniques were during the German Science Year 2015 under the motto "City of the Future". One part of the science year was the campaign Stadtklang ("urban sounds/sounds of a city"), an initiative of the Federal Ministry of Education and Research. In this case the personal experiences of citizens, research and art merged into each other.[23] The result is a platform that provides low-threshold information and is kind of entertaining/interactive. Interventions at the intersection between sound art and science are mostly made by single persons that create certain links through their contributions.

Not all above mentioned narratives have the same influence on the public discourse. The reasons for this phenomenon are manifold and not easy to identify. One of the most "effective" narratives is the one about the health risks related to traffic noise. It can be assumed that one reason for the "popularity" of this narrative is that it is easy to quantify/operationalize effects like heart attacks, sleep disturbances, blood pressure changes, rise of stress hormones etc. In any conversation, these arguments have a threatening effect and imply a call for action (on the level of politics, but also for individuals). That makes it difficult to

question the relevance of the issues. Nevertheless, this perspective expresses a shift from the political sphere to the administrative/technical sphere. In contrast, other narratives like the one about urban sounds as heritage have way less influence. One important factor is that in this case it is much more difficult to translate the abstract concept to a coherent political strategy and concrete actions. This makes it more difficult to make theoretical ideas understandable.

5.1.6 Interim conclusion

As Atkinson describes, sound "provides an often-ignored element of our conceptualization of the urban fabric." (2007, p. 1905.) It is obvious that public policies have a huge impact on the acoustic side of the urban fabric (even if they are not explicitly called noise policies, much less sound policies which rarely exist). "[V]arious changes to city economies, leisure habits and technologies have affected the distribution and aural character of segments of the city, affecting our exposure to noise as well as to particular types and qualities of sound at work, home and in spaces of consumption and relaxation." (Ibid., p. 1909.)

The analysis of the different approaches in Berlin and Florence to deal with noise pollution and soundscapes in the city confirms the hypothesis that it is of great value to integrate those topics into urban policies and planning. This includes a variety of relevant aspects like costs, aesthetics, security, orientation, environmental aspects and more. If the idea of integration is taken seriously, this implies the horizontal as well as vertical harmonization of strategies, plans, actions and data bases. At the moment, it seems to be a challenge even for experts to understand completely the very complex setting of actors, strategies and regulations - much more for citizens or professionals from other fields. Summarizing, it can be said that different fields of the urban life that are - or at least could be - closely linked to the question of noise and soundscapes are negotiated in a highly-fragmented way - mobility, green space, technology, acoustics, security, use and design of public space, health, social and environmental justice, cultural heritage, environment, arts, education, psychology, subjective multisensorial perception of urban spaces...

A first step could be to identify all the relevant aspects and find a communication format to discuss them together. Not only interpersonal relationships play here an important role, but also interinstitutional relationships are relevant as the example of Berlin illustrates: In this case, there is a significant (not only physical) proximity between the Berlin Senate (especially the environment department) and the Federal Environment Agency which is an advantage in relation to other German cities. A similar close relationship exists between Vie en.ro.se (namely Sergio Luzzi) and the Municipality of Florence. Cooperation has a remarkable relevance for the development of innovative approaches (including cooperations between science and urban planning). The experience shows that cooperation not only depends on "attitudes" and "mentalities" but also on single persons who push the dialogue forward. (B. Schulte-Fortkamp, interview, January 17, 2017.) It is recommendable to strengthen networks and formal and informal exchanges between different cities in Europe (and beyond) to share experiences with the governance of urban soundscapes and work on joint projects. Essential for this effort are sufficient financial resources and a platform.

Another relevant aspect is the "sustainability" of campaigns and projects. In some cases they, are based on temporary actions which don't lead to a longer lasting change or which have results that are not integrated very consequently into further projects (see the "Stadtklang" campaign in Berlin). (Ibid.)

Furthermore, it is advisable to simplify the existing legal and organizational framework. If the cities reach a point where the relevant institutions overcome the apparent dichotomy between the traditional approach of acoustical planning and the soundscape approach, they could benefit from synergetic effects. Understanding quietness and soundscapes that respect a "human voice scale" (Radicchi, 2016/ibid., 2017) as commons offers the chance to improve significantly the well-being of communities. But - "[l]ike a form of sonic false consciousness, we perhaps remain peculiarly detached or desensitised to the auditory life and possibilities of the cities." (Atkinson, 2007, p. 1915.) There is still a long way to go...

It is obvious that there is also still a lot of research to be done. Some interesting starting points could be:

- Impact studies on soundscape/sound design projects. Measurement of the tangible effects of urban soundscapes (e.g. on inclusion/exclusion).
- The relationship between light, soundscape and the lifestyle of a city.
- The relationship between light, soundscape and the morphology of a city.
- Conflicts around light and sound/noise in the city and their negotiation.
- Consideration of the needs of vulnerable groups (e.g. sick or disabled persons).
- How cultural differences between societies are revealed in their noise regulations.

5.2 Policies on light

5.2.1 Legal framework

When studying the different instruments involved in the decision-making process, it is also important to understand them in relationship to the different scales and responsibilities implied. The instruments here provided represent an overview of the matter. For a more detailed understanding the Florentine - Berlin Actor Profile should be consulted (see Annex D). The chart doesn't provide a comparative analysis of regulations between cities, therefore the existing regulations and instruments are only listed one below the other with no systematic order (see Fig. 24).

Regulations relevant for Florence	Regulations relevant for Berlin
International - European level	
EN 13201 **("European Norm 13201")** • Minimum standard for the illumination of public streets, applies for all member states of the EU	
European Energy Efficiency Directive EED • General aims for energy saving (production and consumption) which apply for all member states of the EU	
EU-Ecodesign Order EuP 2009/125/EC • New standards and principles for lighting types, applies for all member states of the EU	
UNESCO • "World Heritage List" • "Basic Texts of the 1972 World Heritage Convention" • "Code of the Cultural and Landscape Heritage" • Protection and preservation of Cultural Heritage	
National Level	
"Parlamento Italiano" (Italian Parliament): Law no.10 – 9 January 1991. • Legislative decree for the implementation of the National Energy Plan on the rational use of energy saving and development of renewable sources of energy. Legislative Decree n. 285 – 30 April 1992. New Public Street Code. DPR 495/925. "New Public Street Code" • Update. Legislative Decree 360/93. • Corrective and supplementary disposition from the Public Street Code.	**"DIN (Deutsche Industrienorm) EN 13201"** • Implementation of the EN 13201 in Germany • Applies for all federal states

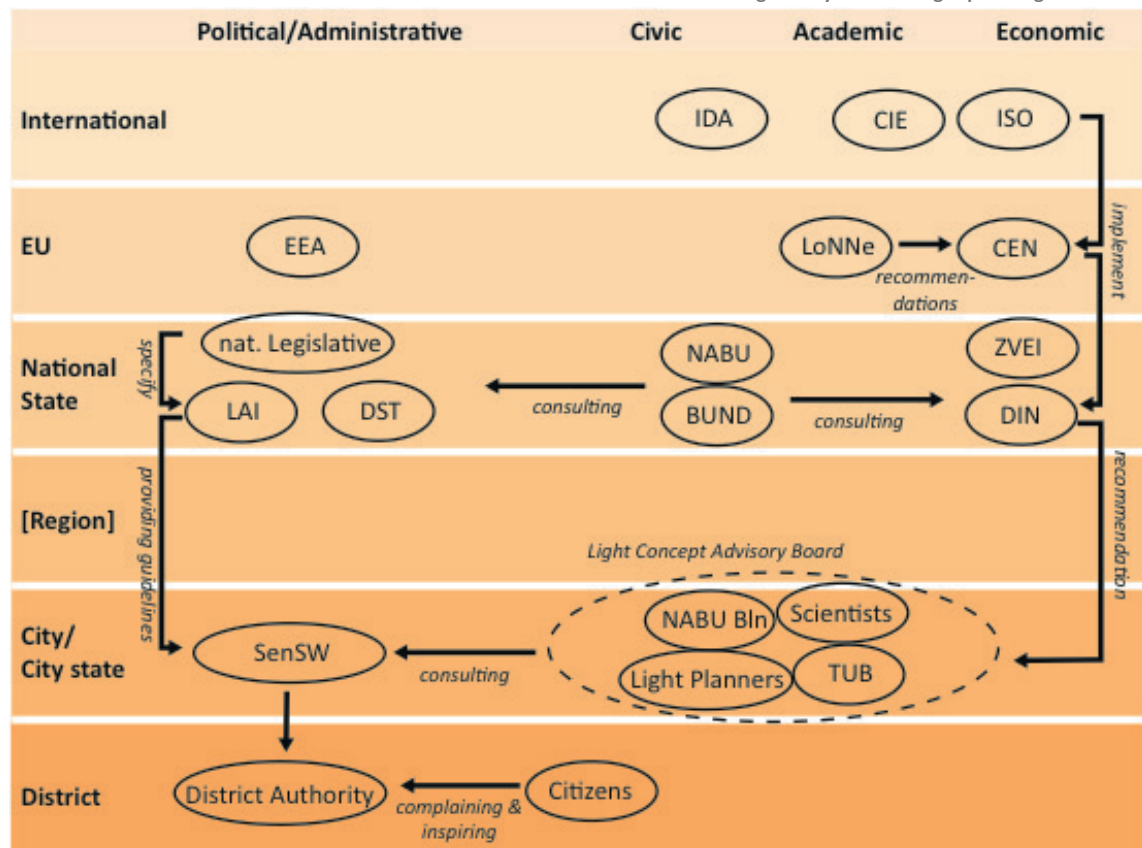| Regulations relevant for Florence	Regulations relevant for Berlin
"Ministero delle Infrastrutture e dei Trasporti" **(Ministry of Infrastructure and Transport) - MIT:** • "Piano Generale del Traffico Urbano" (Urban Traffic General Plan) - PGTU • "Piano Urbano del Traffico" (Urban Traffic Plan) - PUT • "Piano Generale dei Trasporti e della Logistica" (General Plan for Transport and Logistics) - PGT	**"Bundes-Immissionsschutzgesetz"** **(Federal Immission Control Act)** • § 3 BImSchG defines light both emission and immission • Defines the municipalities as responsible for the implementation • No specific statements on traffic or street lighting
"Comitato Elettrotecnico Italiano" **(Italian Electrotechnical Committee) - CEI:** • Norma CEI 11-27; Norma CEI 11-4; Norma CEI 11-17; Norma CEI 64-7; Norma CEI 64-8.	**"Lichtrichtlinie"** **(Light Directive)** • Reifies § 3 BImSchG • Guide value for public street lighting which applies for all federal states
"Ministero dei Beni e delle Attività Culturali e del Turismo" **(Ministry of Cultural Heritage – Activities and Tourism) - MiBACT:** • Law 77 of 20 February 2006. • Special measures for the protection and the fruition of Italian cultural, landscape and natural sites, inscribed on the 'World Heritage List'.	
"Ente Italiano di Normazione" **(Italian Organization for Standardization) - UNI:** UNI 10819. • Requirements for limiting upward dispersion of the light flux. UNI 11248. • Selection of lighting categories. The European Norm EN 13201 was normalized by the UNI standards (UNI EN 13201-2, -3, -4). UNI EN 13201-2. • Street lighting requirements. UNI EN 13201-3. • Street lighting calculation. UNI EN 13201-4. • Street lighting: photometric performance methods.	
Regional Level	
"Consiglio regionale della Toscana" **(Tuscany Regional Council) - CRT:** **Legge Regionale Toscana n.39/2005.** • Energy saving, prevention and reduction of light pollution. • Landscape protection. P.I.E.R. Toscana del 08/07/2008. • Design, installation and operation of outdoor lighting systems and adaptation of existing public facilities with the requirements for the Prevention of Light Pollution.	

Regulations relevant for Florence	Regulations relevant for Berlin
D.G.R.T. n.1000 del 27-12-2007. • Astronomical stations. Mapping of security zones.	
City Level	
"Società Illuminazione Firenze spa" **(Florence Lighting Company spa) - S.IL.FI.:** "Il Piano Comunale di Illuminazione Pubblica" (Urban Light Plan) - PCIP • It is the main document capable of providing the elements to streamline the planning and interventions regarding the lighting systems of Florence. • The general document is divided into two parts. The following are explained below:	**"Berliner Straßenbaugesetz BerlStrG"** **(Berlin Street Law)** • Law, which provides standards in according to traffic safety • Public streets in the have to be illuminated (Berlin Street Law, Article 7)
"Il Piano Comunale di Illuminazione Pubblica" (The Urban Light Plan for public lighting) • Contributes to the maintenance of the luminance and illuminance levels prescribed by relevant regulations related to vehicular mobility, walking and cycling. "Il Piano Comunale di Illuminazione Artistica" (The Urban Light Plan for artistic lighting) • In relation to the quality and perception of the artistic heritage at night.	**"Lichtkonzept"** **(Light concept)** • Informal plan which sets general standards for public illumination • Requirements and guidelines • Applies for all actors, who are involved in public illumination of Berlin
UNESCO Ad Hoc Office: **"Management Plan"** • Used as an instrument to ensure, conserve the Outstanding Universal Value of the City of Florence, and to promote the development of culture.	**"Berliner Bauordnung Bln BauO"** **(Berlin Building Regulation)** • Few general regulations on commercial lighting in the city
	"Werbekonzept Berlin" **(Advertising concept)** • Not binding requirements on the design and comparability of illuminated advertising in accordance to the city scape of Berlin
	"Lichtmasterpläne" **(Light master plans)** • Small scale master plans, which give requirements and set standards for specific important areas related to artistic lighting, illumination of important buildings etc.

Fig. 24: Regulations concerning light in Florence and Berlin.

Fig. 25: Dynamics of light planning in Florence.
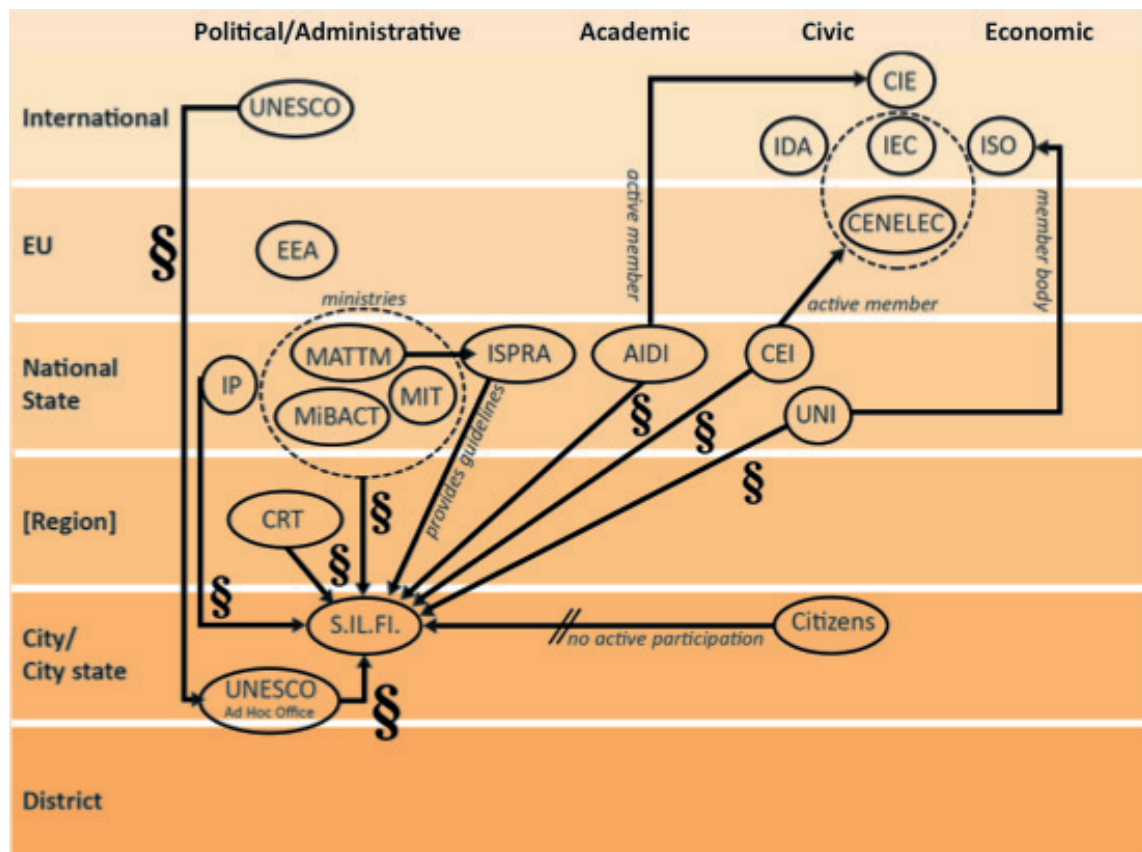
AIDI - Italian Illumination Association // CEI - Italian Electrotechnical Committee // CENELEC - European Committee for Electro-Technical Standardization // CIE - International Commission of Illumination // IEC - International Electro-Technical Commission // CRT - Tuscany Regional Council // EEA - European Environment Agency // IDA - International Dark Sky Association // IP - Italian Parliament // ISO - International Organization for Standardization //ISPRA - Italian // National Institute for Environmental Protection and Research // S.IL.FI. - Florence Lighting Company // UNI - Italian Organization for Standardization

Fig. 26: Dynamics of light planning in Berlin.

BUND - German Federation for Environment and Nature Conservation // CEN - European Committee for Standardization // DIN - German Institute for Standardization // DST - Association of German Cities // IDA - International Dark Sky Association // EEA - European Environment Agency // ISO - International Organization for Standardization // LAI - German Bund/Länder working group on immission protection // LoNNe - Loss of the Night Network // NABU - Nature And Biodiversity Conservation Union // NABU Bln - Nature And Biodiversity Conservation Union Berlin // SenSW - Senate Department for Urban Development and Housing // TUB - Technical University of Berlin // CIE - International Commission of Illumination // ZVEI - German Electrical and Electronic Manufactures' Association

5.2.2 Dynamics of policy-making

In the field of light many **actors** of administrative, civic, academic and economic background on all scales are involved (see Fig. 25+26). Institutions for Standardization, such as the International Organization for Standardization (ISO), the International Commission on Illumination (CIE), the European Committee for Standardization (CEN), the German Institute for Standardization (DIN), the Italian Electrotechnical Committee (CEI) and the Italian Organization for Standardization (UNI) play an important role by providing industry norms. Within these Institutions already private companies, light planners, researchers and others contribute to the decision-making process to provide norms. (A. Diakite, interview, January 9, 2017)

To build awareness of negative effects including impacts on the human well-being, the natural environment and light pollution actors like the International Dark Sky Association (IDA), the Nature and Biodiversity Conservation Union (NABU), the German Federation for the Environment and Nature Conservation (BUND), the Italian National Institute for Environmental Protection and Research (ISPRA) or the Italian Association of Illumination (Associazione Italiana di Illuminazione - AIDI) are engaged.

On the **European scale** there do exist various requirements, which touch the domain of light policy and planning. In 2009 a new order (EU-Ecodesign Order EuP 2009/125/EC) became applicable, which contains different standards and principles for the energy efficiency of lighting products. This law had also significant effects on public street lighting, because certain by then used lighting types weren't permitted anymore. Due to this mercury vapor lamps got prohibited because of their inefficiency. (dstgb, 2010, para. 1) Furthermore, in 2012 the European Union adopted the 'European Energy Efficiency Directive EED' with the aim to save 20% energy (primary energy consumption) until 2020. (BMWi, n.d., para. 1) All member states are obliged to produce and use energy more efficiently. Therefore, the directive includes also vague aims or rather recommendations for energy saving in street lighting, but it's up to the member states in which way they want to contribute

to fulfill the 20% target. (European Union, n.d., para.1f) The main requirement related to public street lighting is the uniform lighting standard 'EN 13201', which applies in all 28 member states of the European Union. (TRILUX GmbH, 2005, p. 2-3) This directive gives recommendations for an 'ideal street lighting' (in connection to traffic safety) and imposes coherent minimum requirements for the illumination of public streets, lanes and spaces in Europe. (NABU, 2010, p. 2) The EN 13201 is not binding and can act as guidance for the organization of street lighting, and, according to Buschmann and Diakite it reflects to some extent the state of the art, but also a compromise between research and industry.

In the European Union, in Germany and Italy, as well as in other member states, the standards from the EN haven't been implemented completely. The European Standard does only provide statutory minimum standards on the national levels, so the organization of street lighting is up to the municipality. (Dena, 2015, p.4) Therefore, a variety of regulations can be found on the national level but also on the level of the regions (or federal states) and municipalities, especially in Italy.

On the **International scale, particularly for the city of Florence**, the UNESCO requisites regarding the maintenance of the declared Cultural Heritage shall be obeyed. The most relevant instruments generated by the entity, that regulate and coordinate the conservation of the "Outstanding Universal Value" of the City of Florence are: the "Basic Texts of the 1972 World Heritage Convention" (UNESCO, 2016a) and the "Code of the Cultural and Landscape Heritage". (UNESCO, 2004) In compliance with the later, on the city level, the "Management Plan" (UNESCO, 2016b) created by the UNESCO Ad hoc Office, is also used an instrument to guarantee the preservation and enhancement of the Cultural Heritage. It is important to highlight that inside the Historical Centre of Florence, the UNESCO regulations are above any other legislative decrees, entitled rules, technical - operational standards and action guidelines given by the European level, the Italian Republic, the Region of Tuscany or even the City of Florence itself. Therefore, if a regulation is not in accordance with the UNESCO requisites, the later shall prevail.

On the **National scale**, there are many regulations given by the **Italian Republic** that are also mandatory. Those include legislative decrees, entitled rules, technical - operational standards and action guidelines given by the Italian Parliament (which includes: the Chamber of Deputies and the Senate of the Republic), the Italian Electrotechnical Committee (C.E.I.), the Italian Organization for Standardization (U.N.I.), the Ministry of Infrastructure and Transport (M.I.T.), Institute for Protection and Environmental Research and the Ministry of Cultural Heritage – Activities and Tourism (MiBACT). The regulations, which are given by these entities, cover different topics. (Com. di Firenze, n.d. a; c) The most relevant are:

- Entitled rules for the implementation of the National Energy Plan on the rational use of energy saving and development of renewable sources of energy. The New Public Street Code (It. Parliament).
- Street lighting performance requirements, calculations (U.N.I.).
- Street lighting photometric performance methods (U.N.I.).
- Requirements for the limitation of the upward dispersion of the light flux (U.N.I.).
- Street lighting selection of lighting categories.
- The "Urban Traffic General Plan", the "General Plan for Transport and Logistics" and the "Urban Traffic Plan" (M.I.T.).
- Code of the Cultural and Landscape Heritage - protection and preservation of cultural heritage.
- The Law 77 of 20 February 2006 enhances the protection of the sites inscribed by the UNESCO on the 'World Heritage List' (MiBACT).

There is a set of policies provided by the Region of Tuscany that shall be applied. (Com. di Firenze, n.d.a;c) The provision of outdoor lighting systems, concerning the design, installation and operation, must be compatible with those laws and regulations. The following enumeration provides a clear insight of the major topics addressed by the current national regulations: Rational use of energy; Prevention and reduction of light pollution; Urban street quality; Control of light dispersion. In addition to this, the Region has also

approved a number of laws and regulations in accordance with the "state of the art". The most relevant topics considered are mentioned below: The design, implementation and adaptation of external lighting systems; The reduction of light pollution; The increase of a system's efficiency and the saving on light consumption; The design, installation and operation of outdoor lighting systems; Description of terms and conditions for the adaptation of public facilities to the new requirements and standards for the prevention and reduction of light pollution; The maintenance and preservation of the night sky; A lists of approval and mapping security zones for astronomical stations.

Regarding **Germany**, although the DIN EN 13201 is setting a standard for the illumination of public streets, the "Deutscher Städtetag", which represents the interests of German municipalities, doesn't perceive it as a legal norm. Therefore the European Standard is not fully abided in Germany. Paragraph 3 of the "Bundesimmissionsschutzgesetz" (Federal Immission Control Act) defines light as both an emission and an immission, but only emissions of facilities, which doesn't include street and traffic lighting. So far, no mandatory regulations for light immissions (equivalent to the regulations giving specific guidance for pollution control of air and noise, such as "Technische Anleitung Lärm", "Technische Anleitung Luft") are implemented. (Hofmeister, 2013, p.133-134) For this reason the LAI- Bund/Länder Arbeitsgemeinschaft für Immissionsschutz (Federal Working Committee for Immission Control) reifies § 3 BlmSchG in term of the "Hinweise zur Messung, Beurteilung und Minderung von Lichtimmissionen" (directions on the measurement, evaluation and reduction of light immissions). Here a "Lichtrichtlinie" (light directive) can be found. (LAI, 2012, p.2) As all federal states have agreed on the directive, their guide values are to be applied in the whole federal territory. (NABU, 2010, p.4) In this context the LAI has developed specific limit values, which are connected to certain area types (as we can find them in the BauNVO). The more vulnerable the area is, the smaller is the lx value. (Rehmann, 2013, p.26) When there are significant excesses measured, the environmental authority is able to ask the polluter, that he/she should switch off the light between 22pm and

6am. Another possibility is, that he/she reduces the light emission. If the polluter doesn't react, the environmental authority can issue a chargeable order. (Rehmann, 2013, pp.17-43) In Germany, the federal states and federal city states (Berlin, Bremen, Hamburg) adopted individual street laws. In addition to these regulations, the city-states of Berlin and Hamburg have published light concepts, which serve as informal plans.

On the **Florentine city level** S.IL.FI. (Società illuminazione firenze spa) has developed the Urban Light Plan, which is the main document capable of providing the elements to streamline the planning and interventions regarding the lighting system of Florence. The fundamental role of P.C.I.P. is to shape and control, in a harmonized way, the historical, architectural, environmental and urban light, by providing set of rules that aim to establish an urban logic for light planning. The Spatial Planning current instruments are divided in two, those are:

- The Urban Light Plan related to functional lighting contributes to the maintenance of the luminance and illuminance levels prescribed by relevant regulations related to vehicular mobility, walking and cycling. This section of the plan is therefore, in accordance with all the legislative decrees, entitled rules, technical - operational standards and action guidelines before mentioned, and aims the rationalization of the public lighting system in terms of energy saving, and the prevention and reduction of the light pollution phenomena. The instrument intends to ensure the visibility and safety conditions needed for vehicular and pedestrian traffic, while tending to standardize the types of installation in relation to the classification of roads and areas (avoiding then, sporadic interventions). It should be remarked, that the sources of private lighting (e.g. billboards, residential houses) that affect public spaces have no regulation whatsoever. (Com. di Firenze, n.d.a-f)
- The Urban Light Plan for Artistic Lighting contributes to maintain and enhance the quality and perception of the artistic heritage during nighttime. "The Public Enlightenment Plan (...) aims to handle the artistic lighting plan-

ning as a matter of particular environmental value, worth of wider consideration than those related to functional aspects of public lighting." (Com. di Firenze, n.d. g., p.3) The statements here described may not always follow the suggestions or mandates given by different laws and regulations. However, as stated before, inside the Historical Centre of Florence, the regulations that shall prevail are the ones given by the UNESCO. The historical lighting system's cultural value is then protected. Therefore, the Urban Light Plan for Artistic Lighting shall only reinforce the laws and regulations on the design and installation of the monumental complex's supporting systems.

It is of primary importance to mention the posture taken by the Urban Light Plan on the effective limitation of light pollution. The objective is to obtain the required uniform levels of light while providing the possibility of decreasing the illuminance levels during specific hours (before dawn and after sunset), when the use and the characteristics of the urban space allow it. This measure was materialized by splitting the network of public illumination (a part of the grid remains off, when there is a low level of natural light). However, the double network also reinforces the idea of Italy as one of the most light polluted countries in the world. (Com. di Firenze, n.d.b;g-h)

The different methods employed (Com. di Firenze, n.d.a) while designing the functional lighting are complex and extensive, however a brief overview for a better understanding of the situation is provided on the following section. First, different macro-regions inside the city of Florence are identified, from which it is possible to specify homogeneous peculiarities about the aspects of light (the macro-regions can present smaller areas with their own singularities). These geographical and sub-geographical extents are, by all means, defined in accordance with the principle of integration between functional and artistic lighting.

In the second place, inside each area, lighting categories for each road or sub-area shall be identified, in accordance with the main entitled rules (UNI 11248 and UNI EN 13201) and the "Urban

Traffic General Plan" from the MIT (defines the hierarchy of the Florentine roads). As a consequence, the lighting standards (which include lighting categories, technical performance, calculation and measurements methods) are closely linked to the geometrical, dimensional characteristics of the road and its traffic. The identification of the lighting category and project parameters has been translated into a graph and a table that specifies particularities and characteristics of each road. The specialist in charge of the lighting design shall then consult the elaborate graph and the associated table where the theoretical lighting categories have been determined (the established type of illumination and the uniformity values provided shall be respected). (Com. di Firenze, n.d.e) Moreover, in parallel with the later, a "risk assessment" analysis is held, where the levels of traffic flow (vehicles/hs), the index of car accidents (number of incidents listed by date and time of event) and the demarcation of the existing conflict zones are identified (all parameters belong to the database created by MIT). The proper evaluation based on specific characteristics of each section of the road allows establishing the correct reference lighting values. The analysis of the diverse influence parameters that belong to the environment can lead to identify a different (and more accurate) lighting category.

Thirdly, the specific power (W / m²), in relationship with the rationalization of energy resources is determined. A table that identifies a number of energy optimization bands parameters - in relation to the average lighting shall be consulted. The objective is to calculate the influence ratio of the lamp and the illuminated surfaces (including sidewalks). After the analytical level, during the planning phase the expert in charge shall determine: the intensity (through luminance- and illuminance-meter) and the light color of the new lighting system, the intervention procedure for the adaptation of the existing lighting systems, the electrical requirements, the design of a plan with technical specifications for the installation of the lighting system, as well as the general indications of use, operation and maintenance. Summarizing, the goal is to identify a lighting category that ensures the safety of road users, while optimizing the energy consumption, the installation, the operational costs and the environmental im-

pacts. A similar approach can be found in Berlin.

The design of the artistic lighting is led by another set of methods, the most relevant aspects are provided on the following section. (Com. di Firenze, n.d.h, p. 36) The Urban Light Plan for Artistic Lighting consists of an analytical phase that provides a guide for the evaluation and design of the monumental complex's supporting systems. The structure of the document is based on the assertion of a general lighting criteria, which does not provide a definitive design or resolution, but defines the basic technical aspects needed in order to achieve a lighting quality that enhances each historical monument and the city as a whole. With respect to new lighting systems, the laws emanated by the Tuscany Region are reinforced by a quality design that tends to reduce the light trespass by limiting the illuminance inside the target, working quantitatively on the aspects of luminance associated with the perception of the observers, providing a measurable and correct amount of light intake. It is of a major importance, that the perception of each individual can be guided and conducted throughout the historical city by a series of "Perceptual Pathways". Quoting the Urban Light Plan for Artistic Lighting, the aim is to "create sequences of spaces differently illuminated in order to invite the viewer to take a path towards the light." (Com. di Firenze, n.d. g, p. 4)

In the first place, in the Historical Centre geographical areas and monumental complexes (palaces, towers, squares, doors, religious architecture, bridges, courses of water) are identified. In accordance with the analysis of the urban structure, the items that may be of particular relevance to the perceptual aspects are sorted out and clustered according to: the density of the urban fabric, the proportional relations between urban space and monuments, the urban morphology and the hierarchy of the constructed elements. The study of the relationships between the main elements of the urban structure allows to identify different axes that regulate the ancient city through a system of continuous reports, providing a regular alternation between built and open space areas, monuments and the urban fabric. The routes and areas identified are arbitrary and therefore, open to changes.
On the image provided (see Fig. 27), the light plan

identifies for Santa Croce area different perceptual pathways and scenic spots, where the luminance balance of the monuments in night vision should be measured and designed. The image was provided as an example of the content belonging to the Artistic Urban Light Plan. (S.IL.FI., n.d.) As previously stated, the study of the monumental complex's supporting systems cannot disregard the existing relationship with the functional lighting of the streets and squares where the same monuments overlooks. That is to say, that the lighting situation of the monuments depends not only on direct lighting, but also on the indirect lighting that comes from its surroundings. For this reason, it is necessary to make reference to the Urban Plan for Public Lighting. For the study, the parameter that provides a balance for a correct perception of light is the "luminance contrast". This parameter depends on the values (measured) of the object luminance (lighting target) and its background. The relationship between those factors defines the contrast value. (Com. di Firenze, n.d.h, p. 36) The Urban Plan illustrates the measurements procedures with some selected monuments (the measurements were taken with a luminance-meter).
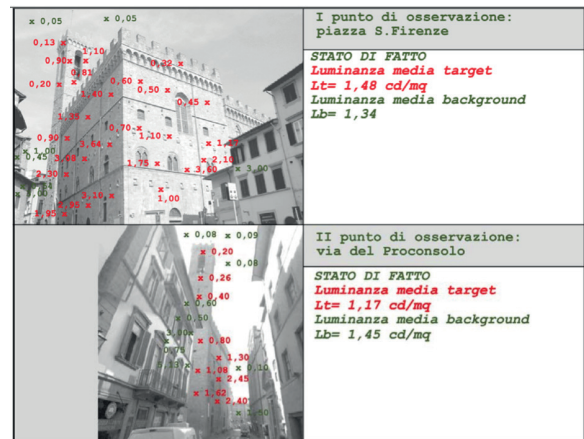
Fig. 28:"luminance contrast" measurement procedures.

An image of the procedure is here provided (see Fig. 28; Com. di Firenze, n.d.h, p. 37).

In both cities local public authorities (Senate Department in Berlin; S.IL.FI. in Florence) have a strong influence, as they provide light planning guidelines. (Berlin Light Concept; Florence Urban Light Plan) In Berlin, a private actor (Stromnetz Berlin /Vattenfall) is in charge of the maintenance, which is in contrast to Florence, where a state corporation (S.IL.FI) manages the entire public illumination grid of the city, which includes: maintenance, planning and retraining of the implants.
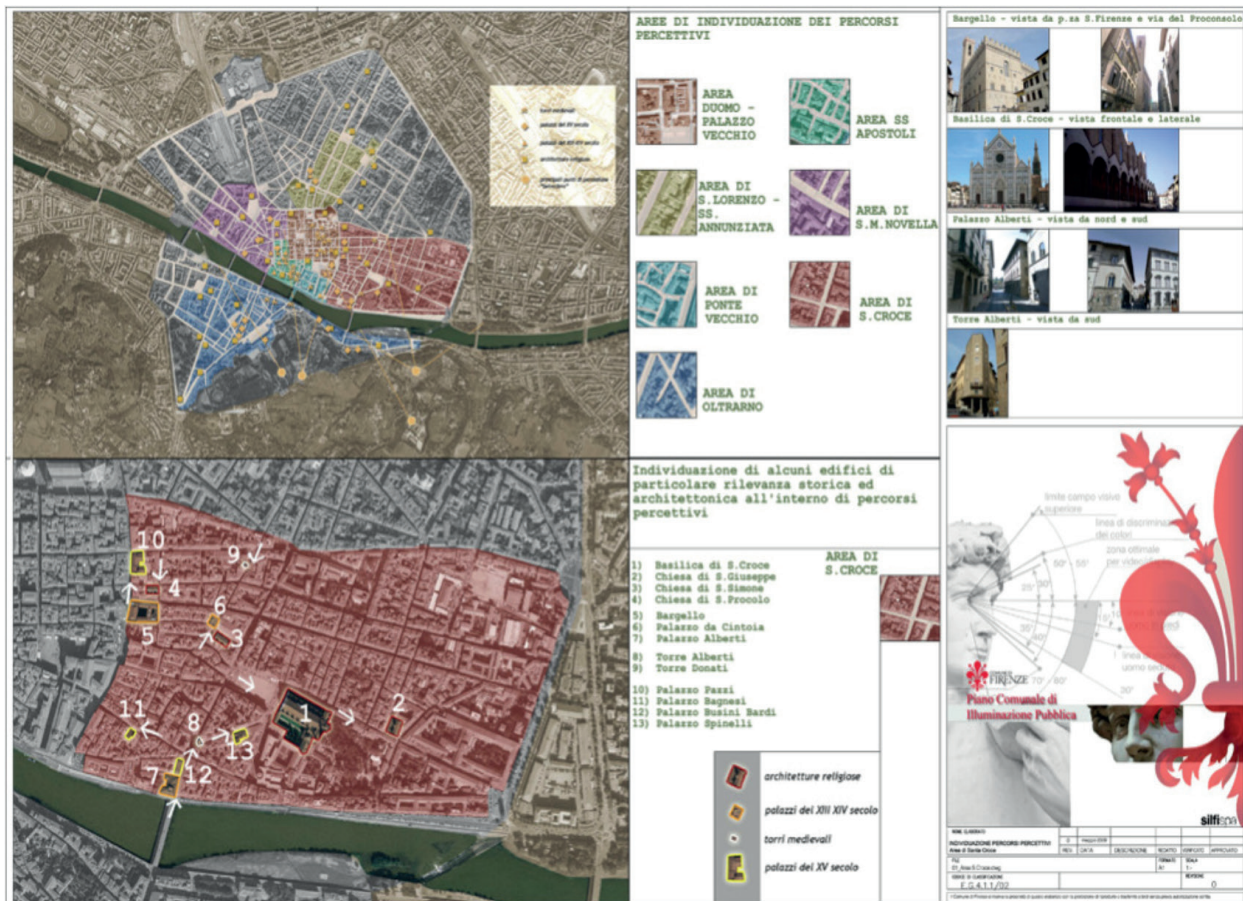

Fig. 27: Identification of perceptual pathways and scenic spots for Santa Croce area.

Last but not least, the relevant regulations that play an important role on the city level of **Berlin** are listed below:

- "Berliner Straßengesetz" (Berlin Street Law)
- "Lichtkonzept" (Light Concept)
- "Lichtmasterpläne" (Light master plans)
- "Berliner Bauordnung" (Berlin Building Regulation)

In general a sufficient lighting of public streets and places is in line of the public service, which is one of the main tasks of the municipality. (Dena, 2015, p.5) The Berlin Street Law is the relevant legislation, which states that public streets have to be illuminated as far as it is necessary in the interest of transport and security. Outside the "geschlossene Ortslage" (closed settlement area) lighting of the public roads is generally not necessary. (Berlin Street Law, Article 7) As the Senate Department is responsible for public street lighting itself (according to "ZustKat AZG: Allgemeiner Zuständigkeitskatalog"), an implementation regulation is not necessary to implement paragraph 7 of Berlin Street Law. The "Berliner Straßengesetz" (Berlin Street Law) provides further regulations on lighting by the private. The "Straßenbauamt" (Berlin Road Construction Office) can approve lighting installations on public roads, which are used to illuminate buildings, unless public interest would oppose (paragraph 11, Berlin Street Law, see "Straßenrechtliche Sondernutzung").

In Berlin the "Lichtkonzept" (Light Concept) states how the European Standard EN 13201 should be applied. (SenStadtUm, 2011, p.9) It contains the necessary provisions for public street lighting and the binding requirements for the renovation and construction, as well as fundamental guidelines on environmental and spatial aspects to apply the light concept. (SenStadtUm, 2011, p.4) The Light Concept was compiled by an advisory board of experts of a variety of fields, e.g. light experts, biologists, traffic security experts, somnologists. (SenStadtUm, 2011, p.4) Although the Senate Department is responsible for public lighting, the planner has to work in coordination with the local district authorities. (SenStadtUm, 2015, p.15) For the planning of public lighting, the urban road network is divided into 6 road categories (see Fig. 29), according to the Berlin Urban Traffic Development Plan (Stadtentwicklungsplan Verkehr). These categories differ in terms of traffic, speed limit and the separation of traffic lanes. (SenStadtUm, 2011, p.12)

By comparing the required illuminance for public street lighting of the Berlin Light Concept and the European Standard, differences can be found. (compare: Trilux, 2005, p. 9-19; SenStadtUm, 2011, p.12) For instance, whereas 10-12 lx is set as the brightest illuminance according to the Berlin Light Concept, the illuminance level according to the European Standard can be up to 30 lx for main roads (≤ 60 km/h). Within the Light Concept, a declaration is made that the aim of the development of an energy efficient as well as

Street Category	Speed Range	Illuminance level
Main Roads	> 60 km/h	12 lx (fluorescent lamps, halogen vapor lamps) 15 lx (sodium vapor lamp)
Main roads, single-lanes, no separation of traffic lanes	≤ 60 km/h	10 lx (fluorescent lamps, halogen vapor lamps) 12 lx (sodium vapor lamp)
Main roads, separation of traffic lanes	≤ 60 km/h	8 lx (fluorescent lamps, halogen vapor lamps) 10 lx (sodium vapor lamp)
Access roads	≤ 30 km/h	3 lx (fluorescent lamps, halogen vapor lamps) 5lx (sodium vapor lamp)
Traffic reduced zones	≤ 7 km/h	2 lx (fluorescent lamps) 3 lx (halogen vapor lamps) 4 lx (sodium vapor lamp)
Squares, pedestrian zones (no vehicles allowed)	≤ 7 km/h	3 lx (fluorescent lamps, halogen vapor lamps) 4 lx (sodium vapor lamp)

Fig. 29: Illuminance levels related to the urban road network

a nature and health compatible light infrastructure let to a different weighing of the European Standard. (SenStadtUm, 2015, p.9) However, the Senate Department does not perceive the provided illumination levels in the Berlin Light Concept as coming below the European Standard for street lighting. (C.Reich-Schilcher, interview, January 9, 2017, own translation) According to Reich-Schilcher, the European Standard on street lighting provides a wide range for interpretation, so that the thresholds provided by the Berlin Light Concept still conform to the European Standard. In contradiction to this statement, Diakite and Buschmann pointed out, that the European Standard serves as minimum standards. Furthermore, both experts of the Faculty of Electrical Engineering and Computer Science approved, that the illumination levels set by the Berlin Light Concept are falling short of the target to provide a sufficient level of illuminance to ensure traffic safety. (A. Diakite & S. Buschmann, interview, January 9, 2017) This shows that there exist conflicting perspectives on how to deal with such vague thresholds.

Fig. 30: Light master plan "Unter den Linden".

Light master plans deal with different aspects of lighting in the city: orientation, technology, design and social aspects for one specific area (see Fig. 30). The scale and level of detail of a light master plan always depends on the demand. (A. Diakite, interview, January 13, 2017) According to the Berlin Light Concept light master plans should be solely used for places with a significant importance of illumination. In these places, street lighting as well as the illumination of buildings are to be planned jointly (e.g. Lichtmasterplan Unter den Linden). (SenStadtUm, 2011, 9)

Illumination in cities depends not only on public street lighting. Concerning outdoor and illuminated advertising the "Berliner Bauordnung" (Berlin Building Regulation) contains several regulations. In according to this, constructional illuminated

advertising systems need permission, but the law contains many exceptions. For example lighting advertisement at pillars, in shop windows or advertising, which is smaller than 2,5m2 need no permission. (Rehmann, 2013, p.14f) This implicates, that in practice there are almost no regulations about how bright lights are allowed to shine or how many illuminated advertisements a shop is allowed to have etc. As explained above (see National Level), the Federal Immission Control Act and the light directive are to be applied in Berlin.

Fig. 31: "Orte besonderer Lichtbedeutung" excerpt KottbusserTor.

The not binding light concept of Berlin contains among others the plan "Orte besonderer Lichtbedeutung" (places of lighting interest), in which important monuments and public spaces with landmark-character are marked (see Fig. 31). These places are shaping the city and are therefore places with special lighting importance/significance as well. It has to be stressed that the plan focuses only on public street lighting. In regard to the Kottbusser Tor area the train station and the station forecourt are mentioned in the category public sight buildings. Furthermore, as 'concise public street spaces and places' the main road network with special landmark function is marked, the traffic space and a few streets around the Kottbusser Tor are highlighted as 'informal" shopping streets', which can be seen as a district center. In the category 'layers of history in the urban layout' we can see that the area was part of the ancient Akzisemauer and that the smaller streets in the north were part of the street-development-network from before the so-called "Gründerzeit" (SenStadtUm, 2011).

According to these places of lighting interest the light concept recommends to develop 'smaller scaled light concepts', which pay attention to the local urban conditions. How these smaller scales light concepts should look like, is not defined. It is only mentioned, that the design of the street lighting should be based on the general lighting regulations. (Rehmann, 2013, p. 18; SenStadtUm, n.d.)

In the light concept of Berlin a map, which shows strategic activity areas for the future development of public street lighting, can be found (see Fig. 32). For the Kottbusser Tor Area the municipality of Berlin is planning to replace the old gas lamps by electric lamps. (SenStadtUm, n.d.)

5.2.3. Citizen participation

Citizen participation is considered as highly important in urban planning, within the design of light concepts and other policy documents, which have an influence on the urban design. Therefore, participation should be understood as a major tool to produce general agreements in society. It is not the objective of the following chapter to explain the statement above provided, but to analyze the current situation of the lighting design and its relationship with the citizens of Berlin and Florence.

The involvement of citizens in light-related policies is in comparison to the sound/noise-related policies outlined in chapter 5.1 less multi-layered. Citizen participation takes mostly place in form of

Berlin
Senatsverwaltung
für Stadtentwicklung

Plankarte 27   Handlungsschwerpunkte und Zielorientierung in den Strukturräumen

Perspektives Handlungsfeld	Zielorientierung [abschnittsbezogen]
Elektrifizierung der Gas-Aufsatzleuchten in Erschließungsstraßen [ES] von Gründerzeitgebieten West	Erhaltung des äußeren, typengleichen Erscheinungsbildes und der gewohnten Gaslichtatmosphäre
Elektrifizierung der Gas-Hängeleuchten in ES von Gründerzeitgebieten West	Erhaltung des äußeren, typengleichen Erscheinungsbildes und der gewohnten Gaslichtatmosphäre; Alternativ: Einbau von zeitgemäßen, historisch bzw. bauzeitlich hergeleiteten Elektro-Hängeleuchten
Elektrifizierung der Gas-Hängeleuchten in ES von 1920er- bis 1970er-Jahre-Gebieten West	Sukzessive Einbau von zeitgemäßen, bauzeitlich hergeleiteten Elektro-Hänge-, Ansatz- oder Aufsatzleuchten
Elektrifizierung der Gas-Leuchten in sonstigen, z. T. strukturell gemischten Gebieten	Anpassung des Leuchten-Ersatzes an die lokale Gebietsstruktur

Fig. 32: Focuses of action and lighting types for the renewal of public street lighting.

formal processes, which are organized by state institutions and focus on one specific small-scaled project. On the legislative European level, citizen participation is neither named nor intended. As the analysis of actors and of the dynamics in the responsibilities on this level already showed, general decisions on public lighting are mostly made by administrations, members of the industry and scientists. Also on the national level (Germany and Italy as well) no regulations or activities on citizen participation can be identified. The main light related policy instrument of the municipal administration of Berlin is the light concept stated above, which was developed without involving any citizens. Mrs. Reich-Schilcher, who is working for the Senate Department for Urban Development and was in charge of the light concept, explained this fact with the complexity of the topic and its abstract level: "The light concept contains very general matters. Not everything can be discussed with citizens! [...] Everyone has a different perception, for some people public street lighting is too dark, for others it's too bright, tastes are disparate." (C.Reich-Schilcher, interview, January 9, 2017, own translation.) From her perspective it seemed to be quite obvious, that the meaningful light concept has been developed by experts, who were educated in this field and familiar with the process of consideration, which goes beyond subjective preferences. This practical approach coincides with the situation, which can be observed in the case of Florence. Requirements and the planning of public lighting are mainly implemented by experts, represented by S.IL.FI., who have developed a light concept without any citi-

zen participation as well. Nevertheless, the general Management Plan for the World Heritage site of Florence intends to be a fully integrated system fostering direct collaboration between the UNESCO Ad hoc office, other institutions and the citizens. The process of active participation of the community plays a very important role. Therefore, the involvement of citizens is acknowledged as one of the principal strategic objectives. The aim is to infuse a greater awareness in relation to the heritage and to address the global challenges in a sustainable management of this UNESCO site, the vision is the construction of "a living, thriving and welcoming city". Even though, the Management Plan is not exclusively dedicated to the matter of light, it is understood how the UNESCO regulations are above any guideline provided, for example, by S.IL.FI. This approach can be then understood to offer the possibility of creating indirect effects on the city Lighting Plan.

However, on the **district level** first steps towards a more transparent light planning process, which include also the not be negligible aspect of citizen participation can be observed in Germany. Due to the renewal of the ancient street lighting techniques and the upcoming comprehensive change to LED, a few district authorities of Berlin have started to do some **small-scale pilot projects** on citizen participation. For instance the district Moabit enabled citizens to test and value an elected range of street lighting designs (see Fig. 33). The project had been a big supplementary effort for the employees of the district authority and accompanied with a huge promotion campaign, in

Fig. 33: Flyer of the participation pilot-project in Berlin Moabit.

relation to the "not that satisfying outcome". (E. Hoffschröer, presentation, November 3, 2016, own translation.) Less people than expected took part in the multifaceted participation activities and the result of the vote wasn't congruent with the favorites of the experts. Also Mrs. Reich-Schilcher noticed, that this project was not successful in each respect, but can be seen as a first attempt and nevertheless they pursue the aim to enhance this approach. In her view citizen participation can only be done in this small-scale framework, because then the citizens are directly affected and are able to create imaginations, even though they are not formally educated. (C. Reich-Schilcher, interview, January 9, 2017, own translation.) The so far presented procedures are comparable with the first two top-down types of citizen participation and their assessment as forms of tokenism in terms of Arnstein's ladder of participation. (Arnstein, 1969.)

But within the last years further actors and methods have enhanced the one-dimensional and predominantly top-down approaches. This development accompanies with the already mentioned renewal of public street lighting, as well as with the rise of relatively new occurrences like light pollution and other general trends in form of touristification and festivalisation. In reference to "type 3" of chapter 5.1.3, some kind of **grassroots initiatives** can be also found in the field of light-related participation processes. For instance when the municipal administration of Berlin started a few years ago to replace the frequently used inefficient gas lamps, many citizens were complaining and established local action groups against the disappearance of the old styled lamps with the well-known warm colored light. In reaction to this huge and unexpected protest, the municipality developed in cooperation with some researchers of the TU Berlin a technique, which consists of a preservation of the old lamp-case and a replacement of the inner lighting type. (E. Hoffschröer, presentation, November 3, 2016, own translation.) In this special case the formation of a bottom-up initiative was in some way effective, because it led to a mutually satisfactory result. Another example of the interference of citizens in the light planning process can be illustrated by the many different complaints, which reach the municipal and district authorities eve-

ry day. (C. Reich-Schilcher, interview January 9, 2017, own translation.) This clarifies, that citizens are participating in the public illumination development, even though they were not directly asked. It could be a proof, that also 'normal people' are affected consciously by public lighting, even though in the institutionalized light planning landscape this discipline is still dominated by experts.

In reference to the above mentioned lack of 'basic light knowledge' of local citizens, the TU Berlin institute of electrical engineering has developed a project, which should help to sensitize and educate citizens by showing them practical examples of the state of the art in street lighting technologies. With the public "Lichtlaufsteg" (Light Catwalk) citizens can experience different possible ways of street lighting and get further information by a guided tour. The project has been implemented in cooperation with EU funding programs (e.g. ERDF), selected leading companies in the production of illuminants and the city administration. (A. Diakite, interview, January 9, 2017, own translation.)

In Florence a comparable occurrence of such an approach can be currently observed. The First Museum - Firenze Scienza e Tecnica – is planning an event in cooperation with S.IL.FI, which can be seen as a slight attempt to awake citizen participation. The proposed "Public Lighting Event – Science, technology, innovation and urban landscape" will take place on the 18 May of the current year. The initiative consists of three blocks: An explanation of the public lighting's evolution, a city tour and a visit to S.IL.FI's office, where an explanation of the characteristics of the current public service will be offered. This action can be considered as a way to enhance citizen education by the development of recreational activities, and encourage their participation on future matters. It is a dynamic way to introduce a "new" topic that influences citizens' everyday-life.

Furthermore, there do exist a few more examples on kind of bottom-up participation, which do not only address the field of administrative light planning. Since a couple of years **"guerilla lighting"** groups are using light in the public space as a tool to create awareness for general trends like gentri-

fication and to express the interests of minorities by the illumination of suitable public buildings without any legal permission. Such progressive underground initiatives can be found in several big cities, like Hamburg, Munich and Berlin as well. (A. Diakite, interview, january 9, 2017, own translation.; Guerilla Lighting München, 2015.)

In summary, it can be said that nowadays there are existing several approaches on citizen participation in Germany, but they are at the very beginning and in comparison to other city planning fields or even in comparison to noise-related policies not that far established. On the administrative state level participation has still a very informative character and reaches maximum step five of the ladder of citizen participation. Well in cooperation with other actors, like the 'Light Catwalk', the topic could reach a wider audience and contribute to a higher level of citizen participation in the future. In the case of Florence the involvement of citizens seems to be on a very early state. Almost no participatory projects have been implemented until now. S.IL.FI. is only reacting on individual, small scale complaints and expresses the position, that light planning should be done by experts only. The above mentioned for this year intended event can be seen as a first step, but remains also on the informative level and doesn't include citizens in decision-making processes.

5.2.4. Understanding of light (-planning) and light pollution

Light can be understood in different manners: on the hand as a **positive resource**, which supports and enables our modern digitalized lifestyle, on the other hand as a **negative expression of pollution**, which seems to be more and more inevitable/unavoidable in our everyday life. During the evolution the 'homo sapiens' has learned to use light more and more effectively. There was a change from 'natural illumination' in form of daylight, by the distribution of 'artificial illumination' in multilayered fields to the modern illumination techniques we use today, which leads in some cases to an 'over illumination' in cities. (Posch, 2013, p. 17-18.)

In the early history energy and therefore artificial light was expensive and not naturally available for everyone. Light was understood as a **powerful and valuable good**, which represented progress and in some respects prosperity. Due to several technical innovations in the course of centuries this resource got constantly cheaper and the relationship towards this former good changed. People were now able to practice all their ordinary activities at any time, the meaning and peculiarities of the night had changed. (Posch, 2013.) Furthermore, lighting techniques became not only cheaper but also more effective and in the case of the LED environmentally more sustainable. Even though nowadays most people seem to take light and especially public street lighting or commercial lighting for granted. The illumination of cities worldwide is increasing in a largely unbounded way. (Meier, 2016.) For instance in the northern part of Italy the astronomer Pierantonio Cinzano observed and calculated a growth rate of heaven-illumination of around 10% per year since the 1960s. (Posch, 2013, p.32.) For this phenomenon a new term has been established in the last years: **light pollution**. The term of light pollution aims to put attention on the negative impacts, which accompany an thoughtless use of light. For economical reasons but predominantly for environmental issues light should be used more rationally and consciously in the future. As already described in chapter 2.2. light pollution has impacts on humans health, as well as on the flora and fauna.

Another important aspect is the understanding of light and **light planning-related responsibilities by the municipality's administration**. In the case of Berlin it can be observed, that most plans and fields of competence are limited to the domain of public street lighting. Other light sources, which illuminate the city (e.g. car headlights, commercial lighting) are taken less into account, even though they contribute a great extent to light pollution and the **understanding of a 'reasonable degree of lighting'**. This results in a lack of integrated thinking, when one wants to talk about the causes of light pollution and complicates the debate on how to avoid these negative impacts.

Furthermore, in the course of research it became apparent, that especially on the European level

public street lighting is often understood as a **question of setting minimum requirements**. Predominately street lighting should fulfill the task to guarantee **traffic safety**, nevertheless which impacts these artificial lighting levels have on the environment. Therefore light or illumination is understood on an one-dimensional level, even though it touches many areas and competences more. In this context it becomes apparent, that also the opinions towards the questions of "What is good light? What is bad light?" differ from each other. These issues can't be answered easily, because it depends on the circumstances and positions one takes. For instance Reich-Schilcher mentions, that for an "appropriate illumination" the criteria of orientation ability and traffic safety for all road users have to be fulfilled. (C. Reich-Schilcher, interview January 9, 2017, own translation.) Other persons may have a different, subjective shaped perception and understanding of "appropriate lighting".

Besides the understanding of street lighting as a way to guarantee traffic safety by the provision of specific illumination levels, throughout the study, the importance that light portraits in the development of artistic illumination was noticed, specially in Florence. Here, technical aspects are defined in order to achieve a lighting quality that enhances not only different historical monuments but also the city as a whole. The luminance is measured quantitatively and associated with the perception of the observers, thus providing a measurable and correct amount of light intake. It is of a major importance, that the perception of each individual can be guided and conducted throughout the city, enhancing the cultural and historical meaning of the place. Therefore, this can be understood as a positive approach towards light, as it contributes to the protection and preservation of cultural heritage.

Another aspect regarding the understanding of light are the difference between **quantitative and qualitative understandings of light**. On the one hand, lighting levels or light colors are measurable and therefore exists a quantitative site of light. On the other hand, humans can perceive and rate light in different, subjective ways, depending on their experiences, age or individual preferences. In this case one can talk about a qualitative aspect and understanding of light. This subjective part can't be normed without contradiction. The existence of quantitative and qualitative aspects is similar to sound/noise (see chapter 5.1.4.).

5.2.5. Main Narratives in the discourse

As presented in previous chapters, actors with different aims and motivations contribute to the discourse on lighting in the open space. Light planners, public employees, researchers, enterprises and also citizens are subject to different priorities including matters of efficiency, profitability, security, regulations, perception, beauty or else. After reviewing literature and the press, as well as conducting interviews with a member of the Senate Department of Urban Development and Housing, and two experts of the Faculty of Electrical Engineering and Computer Science, we are able to identify a variety of narratives within the debate of light in the open space:

- Safety and orientation as matter of transportation
- (In)security as a subjective perception
- Energy consumption as a target of the European Energy Efficiency Directive
- Economic aspects
- Health issues
- Disturbance of the natural environment
- Design and art: for the purpose of entertainment; light to draw attention on sights and heritage buildings
- Light pollution/"Loss of the Night"
- Environmental justice
- Light as a question of power
- Light as a tool
- Modernity
- Video surveillance

The central point, which led to the standardization of public street lighting (END, ISO, DIN) is the issue of traffic **safety**, more exactly the safety of all traffic participants, whereby the car can be identified the core element as the levels of illuminance for roads and lanes derive from speed limits and traffic density. For this aspect, the automotive industry can be identified as one relevant actor. The issue of security and the amount of **crime** acts linked to darkness is a highly discussed

social issue. (Posch, 2013, p. 39) Apparently, people tend to be afraid of dimly lit or dark spots in the city. One typical characteristic of so called places of fear ("Angsträume") is a lack of sufficient illumination. (Kober/bpb 2012) Although better illumination leads to a **subjective feeling of (in) security**, no statistical evidence can be found that there is a higher risk of crime in dark sites. (A. Diakite, interview, January 13, 2017, C. Reich-Schilcher, interview January 9, 2017.) Empirical studies on the relation of crime and lighting can be summarized in the way, that "Lighting may be effective in some places, ineffective in others and counterproductive in still other circumstances". (Eck, 2006, p. 273) Light became relatively seen a cheap commodity so that today we face less economic reasons to reduce street lighting (e.g. between 1883-1992 light became 6,000 times cheaper) (Posch, 2013, p. 29) However, **energy efficiency** of lighting products remains an important part also for **economic aspects**. Besides, it is obvious that infrastructure costs of building and maintenance of light posts is of relevance to the municipality's budget. Today, it is widely acknowledged that light has a crucial influence on the biological clock. Sleep disturbance and deficits are claimed to be connected to many diseases of civilization, such as cancer, adiposity, diabetes and depression. Humans, but also many animals, are especially sensitive to blue light, which emits for example from monitor screens or LED light posts. (Meier, 2016, p. 117) As a result, nocturnal birds collide with illuminated high-rise buildings, migrating birds lose orientation, singing birds change their behavior (BUND, n.d.), just to name a view effects on the **natural environment.** In Germany, arguments regarding the environment are mainly put forward by organizations like NABU, BUND, etc. Beneath public street lighting and lights of private households, commercial use of light is growing.

It became a worldwide trend to use light for **entertainment**, such as city branding and tourism (e.g. Festival of Lights Berlin, Firenze Light Festival), as well as advertisement in the public space. Here, benefits for private enterprises but also aims of the municipalities' revenue play a role. Especially in Florence, regulations to protect and to draw attention on heritage buildings seem to be very important. Here, institutions like

the UNESCO ad hoc Office are involved. In recent years, an increasing usage of light has let to the debate of **light pollution** or "**Loss of the Night**". (Forschungsverbund Verlust der Nacht, n.d.) It deals with the problematic nature that streets, squares, windows, facades and advertisements shine not only earthwards, but are increasingly brightening the night sky. (Posch, 2013, p. 32) Because of that, researchers and also environmental organizations like the "International Dark Sky Association (IDA) are pleading to "stop light pollution and protect the night skies for present and future generations". (IDA, n.d.) Until now light is no object of the field of **environmental justice**, but it might become a part of the discourse as depending on the location people are exposed to light pollution differently. In the past, but also today, public lighting is used for purposes of **power**. One famous example where light was used to produce imposingness might be the light dome by the National Socialist German Workers' Party during the Nuremberg Rally ("Reichsparteitag") in 1938. Different examples, which are of a more subconscious nature, can be found in the use of bright light on public squares to banish undesirables such as "undesirable" drinkers[24]. **Light as a tool** refers to the usage of light to call attention on certain other problems and developments. A similar dynamic is at play in situations where noise production is used as a tool to gain attention for certain political demands. One example is the so called "guerilla lighting" of protesting citizens (see chapter 5.2.3); The equivalent example for sound are the noise marches of the tenants´ initiatives (compare chapter 4.1.1). In general, illumination of the cities is and was in the past a symbol of **modernity**, which is of further interest for the smart city vision and other new technologies. Within the debate on **video surveillance** in the public space one have to consider that if it comes to an agreement for an extensive application of cameras, light posts of brighter illumination are needed.

5.2.6 Interim conclusion

The comprehensive analysis of the various approaches on light planning related issues brought several interesting findings and raised open questions for future developments. So far, light is ob-

viously not of much consideration in urban planning as an integral part. Even though artificial light is omnipresent, shapes the city and correlates with the public as well as with the private space, it seems to be often considered as secondary. The comparison of both cities shows that in the field of public street lighting different motivations by the decision makers are at play. Although in both cities tourism and light design can be determined as relevant aspects, it can be stated that in the historic center of Florence tourism and heritage concerns are of a much higher importance than in Berlin. As stated in chapter 5.2.2, the UNESCO regulations are above any other regulations; therefore the Europe-wide directive on public street lighting is of less relevance on the historical lighting system. In Berlin, according to the Light Concept orientation and traffic safety are most relevant, with the addition that the concept also defines places of lighting interest (such as monuments or public spaces) and requests small scale Light master plans for those areas. In general, the regulatory framework in Italy, the region of Tuscany down to the city of Florence gives the impression to be of a higher complexity. In both cities the European directive plays a certain role, although (as stated above) it competes with different legal situations in the cities analyzed. Confronting current problems like the impacts of light pollution, it becomes apparent, that the EU Directive needs to be renewed and reconsidered. As already described, the EU directive provides only minimum requirements on public street lighting, which are actually much higher than they need to be. On the European level uniform and fixed lighting levels should get implemented. Against this backdrop the so-called Loss of the Night Network recommends an "avoidance of blue light [...] and [a] scientific justification of illuminance levels in EU standards, such as 13201". (Loss of the Night Network n.d.)

Since the build up of a collective understanding of light pollution as a threat, **awareness building** is to be encouraged by politics, but also by actors of informal authorities. To achieve a better awareness, politicians are advocating a **better cooperation and networking of the relevant actors** to pull together both knowledge and power. (e.g. Brinkmeier, 2013, p. 109) In the same way as current regulations for pollution control of air

and noise give specific guidance, more precise **regulations for light pollution and light emissions** should be developed. Nowadays, a gap between the different regulations and their implementation is noticed, since Italy is considered one of the most polluted countries in the world and Berlin is found below the suggested standards. Furthermore, emissions by private sources should also be considered as relevant within the regulatory frameworks dealing with emission (e.g. "Bundesimmissionsschutzgesetz" - Federal Immission Control Act). Until now, in both cities private lighting (e.g. by shops, residential buildings) are less regulated than light of public sources, even though both have an impact on the shape of the city. Another field, which should be target of improvement, is the implementation of **participation projects for citizens**. Although the servants being in charge of light planning in Berlin and Florence (S.IL.FI., Florence and Senate Department, Berlin) claimed participation isn't feasible on a city-wide level, small projects could improve both awareness and contentment among people.

Endnotes

[1] That regulations are put in the same line in the table does not necessarily mean that they have an equivalent function in Berlin and Florence, although sometimes this is the case. The table is not complete and has to be interpreted carefully. That a certain law is not included here does not necessarily mean that it does not exist, but that the authors had limited resources for the research and furthermore language barriers which made it a challenge to understand the Italian legal framework. For a full overview over the Italian spatial planning system see the EU compendium of spatial planning systems and policies by the European Communities, published in 2000.

[2] The second part of the ISO standard on soundscapes is now under development and will focus on methods and data collection. (B. Schulte-Fortkamp, interview, January 17, 2017.)

[3] For an explanation of the instruments required by the directive see chapter 2.1.

[4] There are limits for the noise emission by vehicles since decades. But they have not been updated since the mid-1990s. Furthermore, there have been press reports showing that the tests used to control the compliance to the limits were ineffective due to their strictly defined procedures focusing on one specific situation in driving only. This situation could be easily detected by the software of the vehicles causing the use of a defeating device channeling all the noise into the exhaust pipe opposed to the instruments used for measuring the noise levels (the side from which the measurement had to be taken was defined in the regulation). This way of rigging of the tests was not illegal and was practiced by many manufacturers of vehicles on a regular base (Schweizer Radio und Fernsehen, 2015). After a long period of preparation, in 2016 there was a new legislation established (for more information on lobbyism in this process read Spiegel Online, 2013). In general, it includes decreasing noise limits for new vehicles, although the period for this slight decrease is stretched until 2030 and due to pressure from the German government there are exceptions for vehicles with big engines. But the most irritating fact is that there are no practical

measurements designated. The manufacturers are asked to show technical documents to the authorities and state that they are complying with the limits in general. And even if there is a national authority that becomes suspicious there is only one permission of a single member state needed to get a permission for the whole EU territory (due to the legal priority of the single market policies) (Auto BILD, 2016).

[5] To harmonize the two complex legislation systems and to develop an "accurate and balanced approach able to emphasize both European requirements and peculiarity expressed by the national contexts, especially to safeguard the existing knowledge and experiences gained over the years" (Borchi et al., 2016, p. 72) the HUSH project was conducted in Florence between 2010 and 2012 (Harmonization of Urban Noise Reduction Strategies for Homogeneous Action Plans). Part of the results were proposals on European and national legislative updates.

[6] Furthermore, the influence/power of citizens is limited because the projects follow a predefined agenda and must comply the requirements of the authorities granting aid. In the case of the Nauener Platz this would be the Federal Ministry of Transport, Building and Urban Affairs by the Federal Office for Building and Regional Planning which is responsible for the research program "Experimental Housing and Urban Development" (ExWoSt).

[7] The concept of citizen science is used in ambiguous, sometimes even conflicting ways. A "citizen scientist is a volunteer who collects/and or processes data as part of a scientific enquiry". Particularly in ecology and the environmental sciences the concept is gaining in importance. "Today, most citizen scientists work with professional counterparts on projects that have been specifically designed or adapted to give amateurs a role, either for the educational benefit of the volunteers themselves or for the benefit of the project." (Silvertown, 2009.) The European Citizen Science Association (ECSA) defined ten principles of citizen science, such as citizens can participate in multiple stages of the scientific process and citizen science programs are evaluated for their scientific output, data quality, participant

experience and wider societal or policy impact. (For the full list see ECSA, 2016.) Since the debate about the involvement of citizens in science is still going on, there exist different understandings of the concept and the above-mentioned criteria might be contested by other researchers/institutions that deal with the topic (e.g. sound mapping projects are in contrast to noise mapping projects not recognized as proper citizen science by some researchers). For more insights in the field of citizen science check out the multidisciplinary journal "Citizen Science: Theory and Practice", which is a publication of the Citizen Science Association. The current state of the debate in Germany is reflected in the Green Paper Citizen Science Strategy 2020 for Germany which is a result of the GEWISS Program (Citizens Create Knowledge - Knowledge Creates Citizens; BürGEr schaffen WISSen - Wissen schafft Bürger).

[8] The listed projects either regard themselves as citizen science projects or a classified as such by the Citizen Science Center. The authors of this report did not examine if all of them comply to the above mentioned principles of citizen science.

[9] www.recordtheearth.org

[10] www.soundaroundyou.com

[11] www.noisetube.net

[12] www.verlustdernacht.de/Loss_of_the_Night_App_engl/articles/loss-of-the-night-app-356.html

[13] Nevertheless, there are a few examples where tools of the soundscape research were applied partially: E.g. soundwalks at the acoustically most critical hotspots in Berlin during last Anti-Noise Day or the discussion about the implementation of new "quiet areas" in the district of Wilmersdorf. (B. Schulte-Fortkamp, interview, January 17, 2017).

[14] "We tried that, but it was not very productive. They presented their position and we ours. [...] The noise abatement people from the administration must deal with the problematic sounds, with noise. They have their well-tried strategies and approaches. And we have the feeling the

sound scapers despise often the technical noise abatement, the engineers. In their view the engineers just focus on decibel. There is a lack of understanding, I fear there is also depreciation." (M. Jäcker-Cüppers, interview, January 5, 2017, own translation.)

[15] With the Italian National Institute for Environmental Protection and Research (ISPRA) and the German engineering company Müller-BBM GmbH the international project has also an Italian and a German partner institution. (ISPRA, n.d.)

[16] A good example for this narrative is the already mentioned Nauener Platz that was formerly seen as a "difficult area with high crime rates and drug use. It was a dangerous area concerning social issues." To change the atmosphere of the place "so that people feel safe and at home" it was rebuilt and is known today as "one of the very few examples (worldwide) where soundscape ideas and attention to the acoustic environment have played a major role in planning and design." (B. Schulte-Fortkamp, interview with berlin sonic places, 2012.)

[17] For more thoughts on the association between power and noise/sound see Schafer who analyzes how loud noises evoked fear and respect already in very early times of the human history. This is an important tool that "descends from God, to the priest, to the industrialist, and more recently to the broadcaster and the aviator. [...] Wherever Noise is granted immunity from human intervention, there will be found a seat of power." (1977, p. 76.) More recently, also other authors like Atkinson dealt with this topic. Very interesting is the approach to apply a Foucauldian perspective: "Listening becomes an essential means of surveillance and social control." (Attali, as cited in Atkinson, 2007, p. 1908)

[18] "Functional music" (muzak) can be used in many ways as tool for territorial control of commercial and public space: "This low-volume background music is designed to fill uncomfortable conversational gaps but also to amplify purchasing behaviour through subtle uses of tempo and the tastes of desired lifestyle groups. Muzak is thereby used as an auditory territorial marker, effectively to brand space and lubricate consumption as

well as manipulating an environmental variable which may also have been used to influence the rhythms of work." (Atkinson, 2007, p. 1910)

[19] As observed in March 2016 by the Zitty journalists Martin Schwarzbeck and Jens Hollah: https://www.youtube.com/watch?v=ZVLAOhpmfJs. They quote one of the musicians: "Fighting is old. doesn´t work. We want that the people are nice to each other." The journalists describe the situation as follows: "Down here suddenly hipsters are dancing with homeless people, residents with drug dealers." (Schwarzbeck & Hollah 2016, own translation.)

[20] The interactive and open source Firenze Sound Map aims at mapping the soundscapes of the city as citizens, tourists and city users perceive them emotionally. They can be accessed here: www.firenzesoundmap.org. It follows the idea of "tender" cartography which "allows us to put the human beings at the very center of the theoretical discourse, to reclaim intimacy as a space for interpretation and to place Sensuous Urbanism and Soundscape Studies in the atlas of emotion" (Radicchi, 2013, p. 169; for more insights in Italian see also Radicchi, 2012).

[21] In the Management Plan for the Historic Centre of Florence (approved by the City Council in 2016) soundscapes are for example not directly mentioned (at the most indirectly while talking about pavement material or the decentralization of touristic activities).

[22] www.favouritesounds.org

[23] "Stadtklang 2015" focuses on five main topics: Urban hits and urban music, psychoacoustics and noise research, favorite place & favorite sounds, animal sounds in the city and children in the city. (BMBF, 2015.) Over a period of five months 407 citizens recorded more than 1,400 typical sounds of their cities which are collected in an interactive sound map (https://www.wissenschaftsjahr-zukunftsstadt.de/index.php?id=376). While the sounds researcher Prof. Dr. Brigitte Schulte-Fortkamp and the company Head Acoustics analyzed the collected sounds, the sound artist Marcus Beuter created a sound collage for each German Federal State. That´s how Berlin sounds like: ht-

tps://www.wissenschaftsjahr-zukunftsstadt.de/stadtklang/ueber-die-aktion/klanglandschaften-gesamt/stadtklang-2015-so-klingt-deutschland.html

[24] e.g. in the case of Hansaplatz (Hamburg), to "solve" problems of alcoholism, drug and noise in the night time (Hamburger Abendblatt, 2016).

6. Empirics of the case study areas

The following section presents the results of the empirical work in Berlin and Florence. The study group uses a combination of qualitative and quantitative methods to collect empirical information to compare both cities. In order to make differentiated statements in this regard, it was necessary to find spots with different characteristics in each of the case study areas (see chapter 4). At first those spots were compared among each other. The spots were selected according to the criteria loud, quiet, bright and dark in Berlin as well as in Florence. For this purpose, the group performed sound- and lightwalks (see chapter 3.1) and then decided on their main characteristic by their own perception for the respective spot. The perception of the study group thus represents a first data basis.

The topics light and sound are treated in succession. For each of them, the results of the two cities are described before a comparison is made. These descriptions are subdivided referring to the different applied methods.

The first subchapter for each topic in each of the cities is about people's **perceptions**. It was intended to compare the spots which were defined as loud and quiet for the topic of sound, and the spots which were defined as bright and dark for the topic of light. In order to find the perception of the people, surveys were carried out. However, it turned out, that the respondents rated the in-tensity of sound and light in the respective spots partly differently than the study group. If this was the case, the comparison between the individual spots was expanded. In Berlin, for example, the bright and the dark spot were perceived a little louder by the interviewees than spot 1, which was previously defined by the study group as the loud one. Therefore, the results of all three perceived as loud spots, were compared with the results of the quiet spot. Thus, the perception of the respondents is also used as a data basis in this context.

The different perceptions of the study group and the interviewees could be due to the fact that the study group's perception is a snapshot from the sound- and lightwalks. Many respondents are better acquainted with the respective spots as they use the public space more frequently. On the other hand, it is also possible that the perception of the study group was more explicit than that of some respondents as the sound- and lightwalks allow a focus on sound and light, while other factors are neglected.

In order to make an objective approach possible, measurements were carried out in addition to the surveys. As these measurements have only been carried out once and do not follow a strict protocol due to the limited time required, they are referred to as **sound/light impressions.**

In the respective chapter, these measurements are compared both to the perceptions and to the

Investigation of urban sounds		Investigation of urban lights	
Berlin	Florence	Berlin	Florence
•Perceptions (surveys) •Sound Impressions (measurements) •Observations	•Perceptions (surveys) •Sound Impressions (measurements) •Observations	- Perceptions (surveys) •Light Impressions (measurements) •Observations	Perceptions (surveys) •Light Impressions (measurements) •Observations
Comparison Berlin - Florence		Comparison Berlin - Florence	
FINDINGS			

Fig. 34: levels of comparison.

official data of the respective city (if available). As those are differentiated calculations (noise maps) or data that refer to a minimum of artificial lighting of streets, the sound/light impressions are used to create a further component for the comparability of the individual spots and cities.

Another step of the empirical work were **observations** of the people at the respective spots. This served to verify the statements regarding the perception of people at the spots regarding their behavior i n the public space. In addition, further conclusions were drawn regarding the effects of sounds and lights in this context.

The table helps to understand the different levels of comparisons and therefore used methods. (see Fig. 34).

6.1 Investigation of urban sounds

6.1.1 Berlin

Fig. 35: Location of the sound spots in Berlin.

6.1.1.1 Perceptions

The investigation of urban sounds in Berlin shows some interesting results regarding the perception of the people who spend time in the investigation area.

As against the study group's estimation who choose the square between Kottbusser, Skalitzer and Reichenberger Straße as the loud spot 1, the interviewees rate spot 2 (bright spot) and 4 (dark spot) as the very loudest with an average intensity rate of 3.6 out of 5 (see also Fig. 35). The

intensity of the sounds in the formerly as loud determined spot 1 is rated 3.3.

However, the interviewed people around *Kottbusser Tor* agree with their rating to the study group's evaluation of the quiet spot 3. The interviewees in Dresdener Straße rate the intensity of sound with 2.1 out of 5 which is by far the lowest rate compared to the other spots and the total average of 3.18 (see Fig. 36).
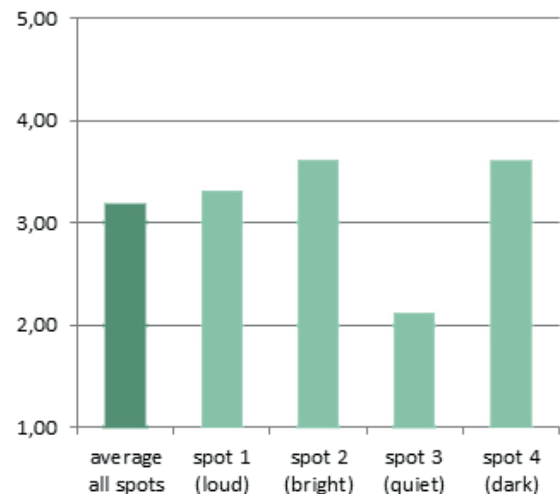
Fig. 36 : Perception of the intensity of sound.

Those results become even more interesting when they get linked to the feelings people associate with the sounds at the different spots. While 70 % of the passers-by at the quiet spot (3) implicate positive feelings with the sounds at this place, about 60 % of the mentioned feelings in the other three spots are negative. Moreover, most of those expressed feelings are related to insecurity, car traffic and (too many) people.

When it comes to general connotations without reference to the place of the survey, the term „quiet" is most often associated with nature. Moreover, several terms are mentioned which are related to the former one. For example, *countryside, country, snow, park, tree* and *field*. Besides this, *home* seems to be a quiet place and *night* the quiet time for many of the interviewed people as those terms are given repeatedly.
The term *loud*, on the other hand, is most frequently associated with *traffic* and related terms such as *cars* and *horns*. In addition, several places of the closer urban environment are mentioned, including *Kreuzberg, Kottbusser Tor* and *Oranienstraße*.

This shows that the direct urban environment is at least partially perceived as loud, while a more rural, rather natural environment is presented more quietly. In addition, the perceived soundscape in the vicinity is dominated by traffic noise. As already described, those kinds of sounds are rather associated with negative feelings.

Another difference between the quiet spot 3 and the other, rather loud spots, was in the information which is generated by the sound to the users of the street area.

70% of respondents in Dresdener Strasse (spot 3, quiet) make a reference to the people in the area by describing their use of the space (e.g. *living area, information about what people do*) and saying they get informed about their mood (e.g. *information about their own emotions, information about how other people feel*), which was thereby the most popular category.

At the spots 1 and 4, information about the strong (car) traffic is most frequently mentioned. In each case, 50% of the interviewees refer to traffic as the source of sounds which gives them information. This is often connected with security-related adjectives like *dangerous* (two times mentioned) and *careful*.

In Oranienburger Straße (2, bright), the ratio of the most frequently cited aspects between these two categories (people, traffic) is balanced. In each case, 60% of respondents refer to information related to people and/or car traffic (multiple answers were possible). Besides those categories, 50 % of the interviewees described information which could also be merged as "culture", stressing the identity of the area (*cosmopolitan, busy, fast and intense*) and the diversity (*mixture of different people, people speaking other languages*). The soundscape is generally not perceived as predominantly negative.

As a result of the information transmitted by the sound in the urban night, it is important whether this information affects people's behavior. 80% of the interviewees indicate that their behaviour is influenced by sounds, 20% argue that not. A clear difference in the statements between the different spots could not be established. Those per-

sons who, on the other hand, affirm an influence, are asked in a further step how this would take place. Once again, the core subjects, which have an impact on the behaviour are related to car traffic. About 50 % report a change in behavior due to this, which was often associated with the terms *wait, stay, careful, stop* and *look.*

According to the interviewed persons, favorite sounds often relate to people, mainly to their voices and friendly communication between them, for example when they are *talking* or *laughing*. But also, cars and traffic are indicated by a few. The most unpleasant sounds are related to traffic, especially to cars. But also, sounds of people are felt as unpleasant when they are *fighting* or *yelling*.

A clear difference in the statements between the different spots could not be made.

6.1.1.2 Sound Impressions

While focusing on sound impressions in Berlin it is important to take the different data sets into account. During the research four different sets could be detected. The measurements that have been taken by the study group, the perception of the interviewees, the perception of the study group and their estimation of the spot in one loud and one quiet spot and the provided data of the Berlin Senat. Those different data sets will be compared to each other.

With the help of measurements, a concrete comparison between the perception and the measured data is possible. With regard to the choice of the four spots in Berlin by preselection of a loud, a quiet, a bright and a dark spot, the measured data agrees with the first estimate of the spots very well.

The following section will enable a closer view on the real intensity of the sound at the spots in Berlin. A special focus should have been placed on spot 1, the square near the Kottbusser Tor station as the loud spot and spot 3 in Dresdener Straße, which the study group defined as quiet. But as the study group's previous estimation neither does match the perception of the interviewees

(see 6.1.1.1) nor the measured values, all spots are considered more closely.

The noise level measured with the dB-Meter shows significant differences regarding the different spots. In the estimated loud spot 1 was an average of 60,7 dB measured. The estimated quiet spot had an average sound intensity of 54,7 dB. It was the quietest spot of all. Whereas the loudest spot is spot 2 with 64,2 dB. Even spot 4, where 62,4 dB were measured, was louder than the estimated loud spot 1 (see Fig. 37).

Looking at the results of the interviewed people who rated the intensity of sound in the four different spots in Berlin, the diagram looks quite similar to the measured data. The area in Dresdner Straße (spot 3) was clearly rated as the quietest place with a big distance to the others. The perception of noise regarding loudness on the other hand, shows some slight difference between the rated and the measured data. The sound level in spot 4 was even higher rated than the actual measured data. But it also turns out that the perception of the interviewees was more accurate than the estimation of the study group concerning the taken measurements.

In the following the gathered and beforehand described sound impressions will be compared to official calculations of the city of Berlin provided in a noise map of 2012 which focusses on road noise. The collected data is in general lower than the provided data. Especially the loud spot 1 is, concerning the noise map, around 15 dB louder than the gathered data of the sound impressions. These differences can occur due to the different method of taking the measurements, the different calibration and the different frame of time. The other measurements almost agree with the provided data.

According to the data of the noise map, the loud spot 1 is the loudest spot and the quiet spot 3 is the quietest. This shows, that the study groups estimation of the spots is coinciding with the data of the noise plan, whereas the data of the taken sound impressions differs. This could evolve because of the short period of time in which the study group took the measurements and that the way they have been taken deviates (Senatsverwaltung für Stadtentwicklung und Wohnen, 2012).

The perception of the interviewees is according to the evaluation of the noise impressions (see Fig.

Fig. 37: average Sound intensity in Berlin in dB (M 1:5000).

Intensity (0-5) ■ Perception ■ Measurements dB- level

38). Which shows, that the data from the noise road map is similar to the estimation of the study group whereas the taken sound impressions are similar to the perception of the interviewees.

6.1.1.3 Observations

The observations were taken to rate the public space in all 4 spots in Berlin. Comparing the four different spots of Berlin to each other, there are already striking differences in the number of counted people. The number varies from 28 counted people at the bright spot 2 to just two people at the dark spot 4. The main reasons for their stay outside in public space are smoking, calling with their mobile phones and meeting each other (talking).

Concerning the observation of the loud spot at the Kottbusser Tor and the quiet spot in Dresdener Straße, it's visible that the number of people who are using the public space at these spots are quite similar.

The activities which have been observed, show that the loud spot is a spot where people meet and smoke as well as waiting for each other.

These activities are as well done in the quiet spot. It is recognizable that in the quiet spot larger groups of people stay together in groups, which could possibly be explained by the fact that there are some bars where those people go to or come from together (see Fig. 39).

Legend
● smoking
▲ calling
■ waiting
○ talking
△ others
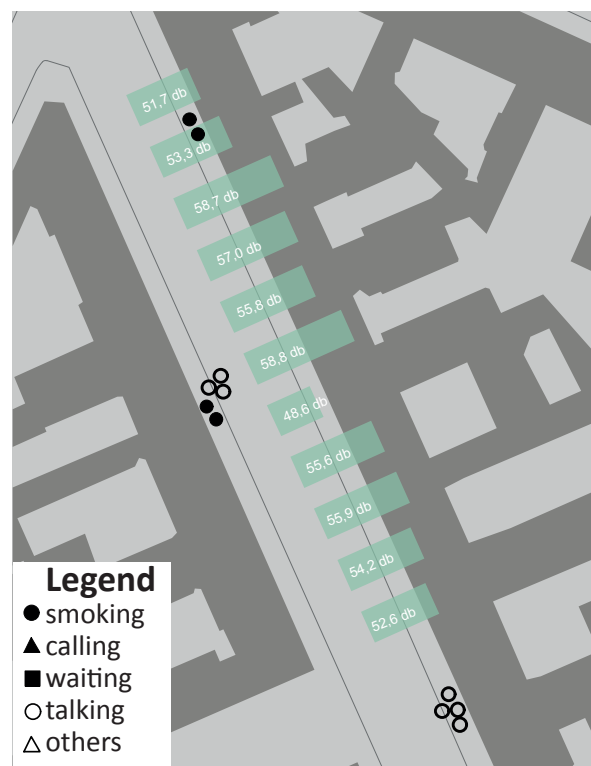
Fig. 39: Observation in Spot 3 (M 1:750).

In comparison to all other spots, the people in the loud spot 1 are mostly by themselves (see Fig. 40).

Legend
- ● smoking
- ▲ calling
- ■ waiting
- ○ talking
- △ others
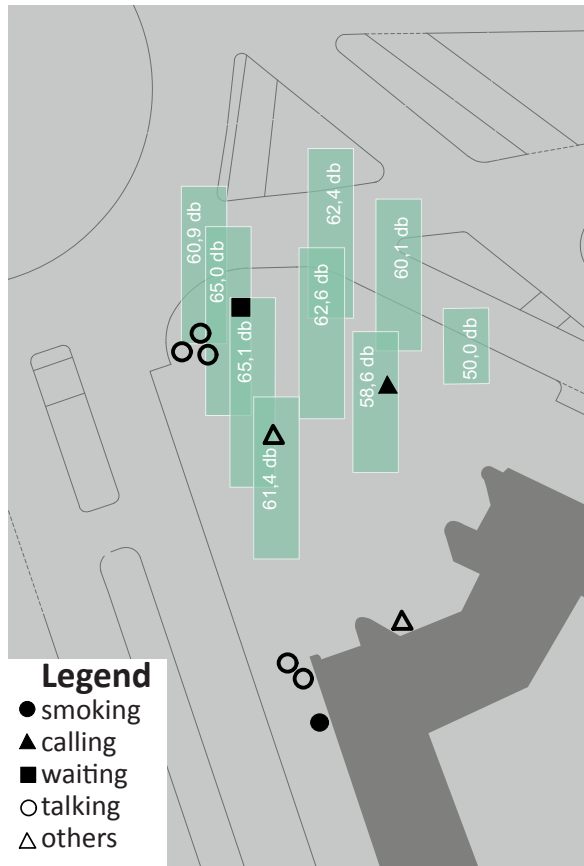
Fig. 40: Observation in Spot 1 (M 1:1000).

The interviewed people in the loud spot were mostly going home or going to the nearby U-bahn station. In the quiet spot the activities varied a little more. People were going to bars, having drinks, went home or walked their dog.

6.1.2 Florence

Fig. 41: location of the Sound spots in Florence.

6.1.2.1 Perception

The choice of the categories of the spots by the study group and the estimation of the interviewees shows clear results. The study group estimates spot 1 as the quietest and spot 3 as loudest spot in the investigation area (see also Fig. 41). The interviewees support this perception with their ratings of the sound intensity. The different level in the rated intensities by the interviewees between those two spots is significant. Spot 1 (quiet) is rated with 2.0 and spot 3 (loud) with 3.4 out of 5 what contrasts also a lot with the average intensity of 2.45 (see Fig. 42).

In relation with the feelings generated by the sounds of the surrounding, the quiet spot 1 generates practically only positive feelings. Within the interviewed persons at this spot, only one answer expresses an explicitly negative feeling. The others associate the sounds with *rural areas, feel relaxed, enjoy the peaceful atmosphere* and *familiarity*. Whereas in spot 3 (loud) the answers are much more mixed.

About 50% of the interviewees associate clearly negative feelings with the sound and only 40% have rather positive feelings. A conclusion that can be drawn out of this results is that the higher the intensity of sound is, the more negative feelings emerge. The interviewees express their mood of the high volume with *annoying, chaotic, nervous, uncomfortable* and *nasty*. Those who relate the sounds with positive feelings relate to the sounds made by people which make them *feel good* and *not to be alone*. As against any expectations of the study group, traffic sounds are not mentioned - although the fact that spot 3 is located in a narrow street where the sounds of cars and scooters create loud echoes due to the morphology of the area. More about sound levels is described in the following chapter based on measurements.

As against the results of the relation between sounds and feelings, while asking people's connotations to the term "loud", they associate *traffic, cars* and *street*. But also, terms like *music* and *disco* are mentioned. One explanation could be, that the area is also used for nightlife, so they relate to what they see and hear or going to do.
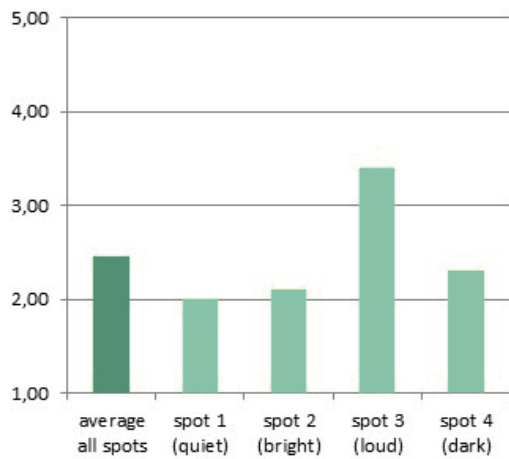
Fig. 42: Perception of the intensity of Sound.

Asking about the term "quiet", the answers are quite similar to those given at the quiet spot 1 about the feelings generated by the sound. Once again, nature lexis appears. It seems that people relate a quiet atmosphere a lot with a green surrounding and weather conditions like rain. Answers like *peace, room* and *night* also remind to the answers given before (*peaceful, relax, familiarity*). All these indications are positive and somehow idyllic.

The received information from sounds in the surrounding concern in particular and once again other people. It is remarkable, that about 50% of the interviewees in spot 1 (quiet) specify the

received information referring to other people's behavior (information about *people around, people's life, what the people are doing*), but no one mentioned traffic. Other information relates to the place and time (see Fig. 43).

The results in spot 3 (loud) are a little bit different. People and traffic are both mentioned by 40% of the pedestrians. Besides those categories, 50 % of the interviewees described information about the culture and the identity of the place (e.g. *active nightlife, a place to spend time, lively*) and their feelings about it (*tension, feel good*).

Another difference between the loud and the quiet place may be the perceived influence of the sounds on the behavior. At the quiet spot 1, only 50% of the asked people thought that they are influenced by the sounds surrounding them. This corresponds approximately to the average of all four places in Florence (53%). In most cases, the influence is attributed to sounds that are generated directly by humans. The effects are partly described as negative and partly as positive.

At the loud spot 3, 70% of the interviewees think they are influenced by the perceived sounds in the area. Both sounds directly caused by humans and sounds relating to traffic are indicated. It is noticeable that the sounds are almost exclusively
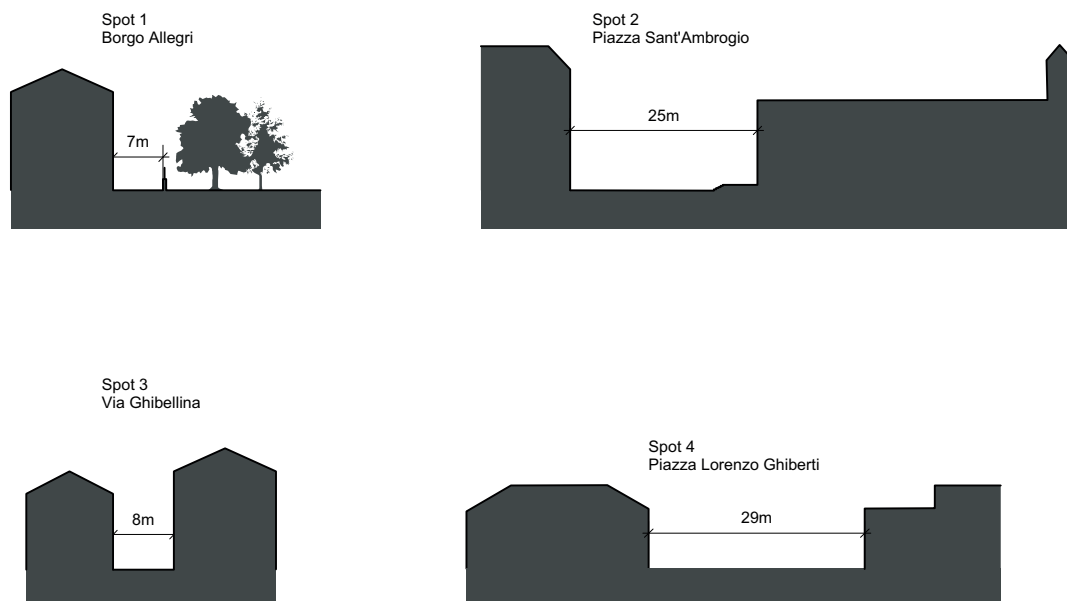
Fig. 43: Street sections in Florence (M 1:250).

perceived as disturbing or negative. If the interviewees mentioned the uncomfortable sound of traffic, they describe that their behavior becomes influenced as in the following: *way of speaking (louder, interrupt), step aside, not enjoy the walk, walk faster, get rid of the place, don't want to breathe the pollution,* etc.

Both the pleasant as well as unpleasant sounds differ a little between the quiet spot 1 and the loud spot 3. 80% of the people at spot 1 describe the most pleasant sounds emanating from people. Among them *love of people, voices, children, Italian students going to school, laughter* and *steps.* At the same time 50% of respondents perceive sounds caused by people as unpleasant. In this context, however, noise is often mentioned as a result of conflicts, like when people are *fighting, shouting, swearing dirty or screaming* (kids). 40% also list traffic sounds as unpleasant, while 20 % say that *there is no unpleasant sound at this site.*

At the loud spot 3 the sounds of the humans are also felt as mainly pleasant. 70 % appoint the *voices of people* respectively *people talking.* In addition, 30% call the *bell* [of the church] the

most pleasant sound. The difference between the sounds perceived as unpleasant is clearer. 90% call sounds of traffic, especially from cars as unpleasant. Only 20 % list sound produced by people (*different languages, people that argue*).

6.1.2.2 Sound Impressions

In Florence, the different data will also be used to have a broad overview over the different data sets and their similarities and differences.

The estimated quiet spot in Florence is the via Borgo Allegri and the loud spot is the via Ghibellina. The first estimation of the four spots in Florence concerning the sound intensity generally agrees with the measured data. Regarding all four spots the measured sound level shows, that there are huge differences in the actual sound intensity. The dark and the bright spot have a similar sound intensity, whereas the difference between the loud and the quiet spot is very big (see Fig. 44).

In the estimated loud spot 3 of via Ghibellina was an average of 62,2 dB measured. In the quiet spot

Fig. 44: average sound intensity in Florence in dB (M 1:5000).
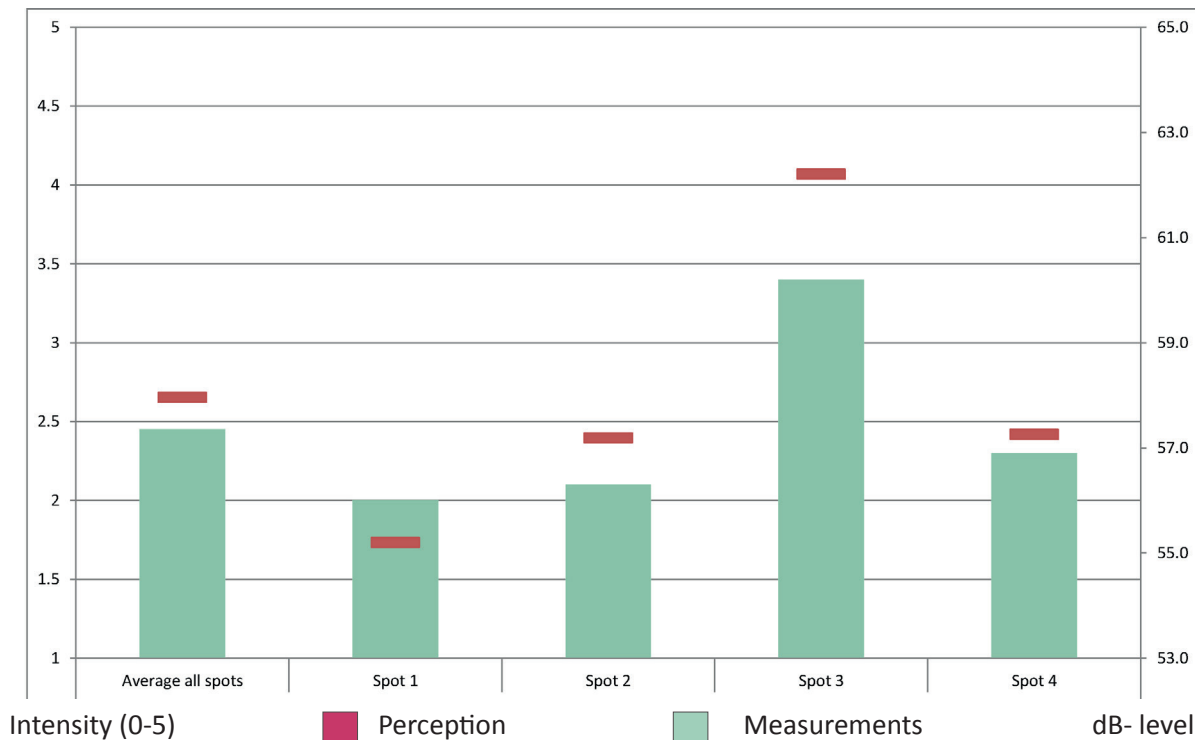
Fig. 45: comparison between perception and measurements of sound in Florence.

1 a sound level of 55,2 dB was rated. In comparison to all 4 spots in Florence the other 2 spots are similar to spot 1. They have an average sound level of about 57 dB.

In the following the measured data is going to be compared with the results of the surveys in those two spots. The main focus will be the rated intensity of sound of the interviewees in those spots. Looking at the results of the interviewed people who rated the intensity of sound/noise in the four different spots in Florence the diagram looks quite like the measured data. It shows that people do perceive spot 3 as the loud spot and Spot 1 as the quiet spot. The other spots were rated quite similar. It's recognizable that there's just a small difference between the quietest spot and the rated intensity of sound at the bright spot in Florence (see Fig. 45).

Furthermore, the taken measurements will be compared to the results of a Florentine noise map provided by the agenzia regionale per la protezione ambientale della Toscana. These noise maps are categorized in the sources of noise relating to the assessment and management of environmental noise (END). One is about road noise mapping, another about rail noise mapping and the third one is about airport noise mapping. The used map is the road noise map, which can

be applied on the case study area.

Comparing the mapped road noise levels of Florence in the four spots and the collected measurements of the study group, it's recognizable that the average of the measurements that have been taken by the study group are less high than the provided data. This is similar to the data of the Berlin Senat and could be because of a different calibration of the decibel meter, the different time or the different form of taking the measurements. Especially spot 1, which was estimated as the quiet spot by the study group, is above the measured data. In comparison to the spot 2 the average sound level is higher, which shows that against the study groups estimation and the taken measurements, spot 2 is the quietest spot in Florence. The estimated loud spot 3 is the loudest in both of the inquiries (SIRA, n.d.).

The results of the interviewees are congruent to the evaluation that spot 1 is the quiet spot and spot 3 is the loudest spot. The difference between the gathered measurements and the data that was provided in the road noise map as well as the difference between the interviewees perception and the data could be explained by the difference in taking the measurements. Spot 2, which is the quiet spot concerning the road noise map, is a very prominent place for people to meet. The human noises are effecting this spot a

lot, which leads to the assumption, that this data would change when including them (SIRA, n.d.).

While comparing the provided data with the interviewees perception the same result as the comparison with the measurements occur. Spot 1 was perceived as much more quiet than the data from the road noise map shows. The same appears with Spot 2.

6.1.2.3 Observation

The observations in Florence were also taken to rate the quality of the public space in all 4 spots. Comparing them to each other, the number of counted people varies strongly. The number varies from 30 people which were counted at the Piazza Sant´Ambrogio and just two counted people in Spot 1 the via Borgo Allegri. The main reasons for their stay outside are mostly smoking, calling with their mobile phone and to meet each other. Concerning the observation of the loud spot at the via Ghibellina and the quiet spot in the via Borgo Allegri, it's visible that the number of people who are using the public space varies. Just 2 people are meeting in the quiet spot in comparison to 14 people in the loud spot in this ten-minute time frame.
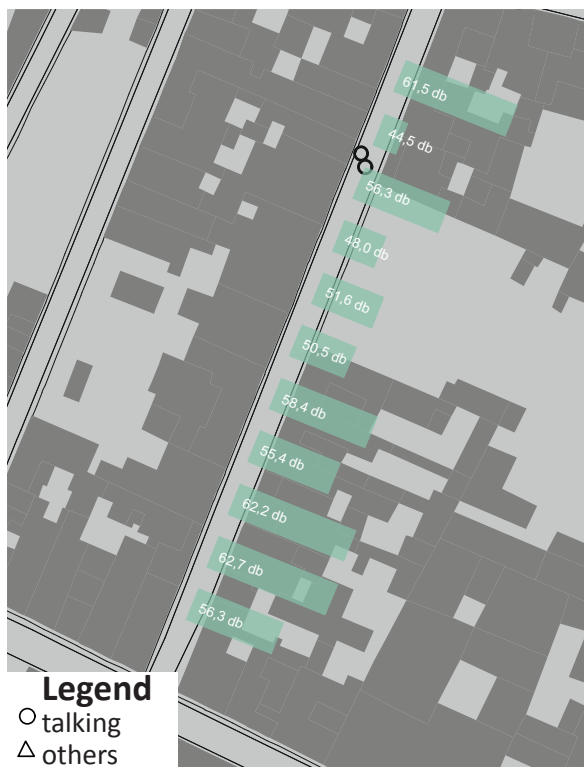
Fig. 46: Observation in Spot 1 in Florence (M 1:1000).
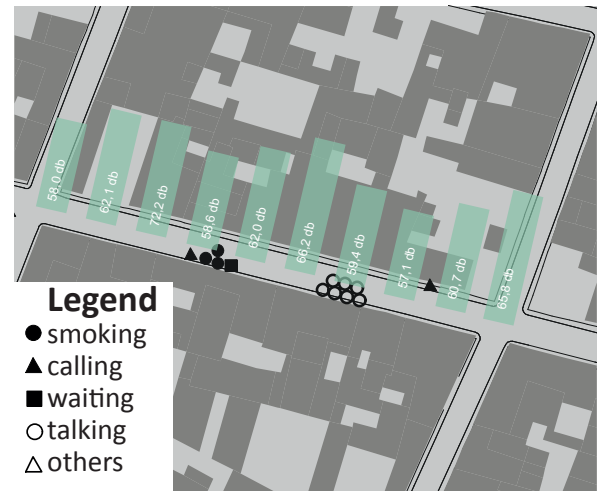
Fig. 47: Observation in Spot 3 in Florence (M 1:1000).

The activities which have been observed show, that the two people in the via Borgo are meeting each other (see Fig. 46). The activities in the loud spot vary a bit more. Here the people are smoking, talking and meeting each other in the public space (see Fig. 47). In comparison to all spots in Florence the via Borgo Allegri is the less used public space.

The interviewed people in the loud spot were doing free time activities like walking their dog or going somewhere and working. The main activities of the people in the quiet street is very different. Those people mostly use the space, because they live nearby and go home.

This shows that our perceived loud spot is a place to pass through and meet in this area, as well as the perceived quiet spot. Both spots are due to their characteristics not a place for a longer encounter.

6.1.3 Comparison Berlin -Florence

The following section attempts to compare the case study areas regarding to sound. It should be considered that a completely objective comparison between the areas under investigation in Berlin and Florence is very difficult as they differ due to many factors, such as urban morphology and use as well as heuristic methods, which can not be fully taken into account. Nevertheless, similarities and differences between the case studies can be recognized and at least partly explained using the results of the different empirical tools.

Regarding the feelings that the sound in the two cities seemingly evokes, both similarities as well as differences can be seen.

In this respect, the similarities refer to the feelings that appear in the loud and also the quiet spots. In both cities, quiet places predominantly evoke feelings that can be seen described as positive, while loud places generate more negative feelings. However, this is more evident in Berlin than in Florence, where many positive feelings are also mentioned in the loud place. In this context, the sound source might play a role. While the feelings in Berlin refer primarily to *traffic*, this relation is not produced in Florence. Instead, the sounds that come directly from people seem to play a bigger role.

With regard to the general associations without reference to the place, however, in both cities the term „loud" is used to refer to terms which clearly belong to the category "traffic". In Berlin, descriptions of the immediate urban environment are also the first to be identified, while in Florence, terms are sometimes used, which can be classified as in the category "nightlife".

It seems as if the surrounding area around the Kottbusser Tor in Berlin is generally perceived as loud, whereby the high sound level can be attributed mainly to traffic noise. In Florence, on the other hand, „loud" is also associated with traffic, but in the explored area, however, is more a reference to the nightlife and the people as a source for the volume produced.

The quiet spots are perceived as more pleasant in both cities and seem to produce mainly positive feelings. The general connotations with regard to the word „quiet" are also very similar and are often associated with forms that can be classified in the category „nature" or describe a pleasant, idyllic atmosphere.

The gathered measurements help to find some conclusions as well. They show, that all streets with traffic, in Berlin three spots and in Florence only one spot (spot 3), have a higher sound intensity than the ones where not so many cars pass by. This distribution explains the actual slightly higher level of sound intensity in Berlin.

Even though the noise in Florence is similar to the noise in Berlin with just a slight difference, the Florentine people perceive the intensity in general lower compared to Berlin. Throughout the evaluation, it was recognizable that the source of noise in Berlin is from traffic in opposite to the sound of people in Florence.

The distinction between sounds caused by traffic and sounds, which are directly attributable to people, is also clear with regard to the perceived information. Both in Berlin and in Florence, it is clear that the information that the interviewees draw from the sounds in the area are strongly oriented on what sounds there are. The overall intensity of the sounds in the sense of the volume seems to play hardly a role.

While the much more traffic-affected area at the Kottbusser Tor in Berlin gives people a lot of information about the traffic, which is often accompanied by a description of adapted behavior regarding the safety on the street area, the information in the livelier area of Florence, mainly relate on information about other persons. No adaptation of one's own behavior becomes clear. Instead, the behavior of people in the environment seems to influence their own mood. If the people in a place tend to be cheerful, this seems to have a positive effect on the mood of many respondents.

Also with regard to an influence on the behavior by sound, it seems therefore primarily important to what kind of sound it is and not as how loud it is felt. This is also confirmed by the respondents of the influence of sound on their behavior. While in Berlin about 80% stated that the sound had an influence on their behavior, whereby the majority made a relation to the road traffic, in the less traffic-affected area in Florence only about 50% indicated that the sound in the surrounding area would influence them. This influence was mainly described due to a necessary adjustment because of many people in the closer environment.

The measured data and the people's sound impression show, that their perception is according to the measured data. Which demonstrates, that the people could hear the different sound intensities of these places even better than the study group.

A comparison between the measured data of the study group and the noise intensity levels which are provided by the Berlin Senat and the "agenzia regionale per la protezione ambientale della Toscana" helps to show their differences and similarities. Both of them offer a differentiated map of the areas in which the research has taken place. In Berlin, a general noise map of sound is provided by the city, whereas in Florence the maps are divided into the sources of noise in the city. To make a valid comparison both of these maps focus on the road traffic noise that affects the urban space, which can also be compared to the measurements of the study group.

While comparing the measured data with the data of the traffic noise plan in berlin and the road noise map in Florence, it was recognizable, that the sound intensity of the different plans is always higher than the measurements that were taken by the study group. In Berlin, the average noise level concerning the maps is 66 dB. The average noise level in Florence is 4 dB lower. That implies that the noise level in Berlin is higher than in Florence. This can also be visible in the study groups measurements where the sound level in Berlin is 3 dB higher than in Florence.

In general, the data of the noise maps is higher and shows differences to the measured and estimated intensity of sound in this area. In Berlin, the difference is not as noticeable as in Florence. There the quiet spot is not classified as quiet, but as one of the loud spots. As mentioned before, this could be due to the different forms of calibration or the different form of taking the measurements.

The estimation of the interviewees varies in comparison to the provided data. They are matching more to the taken measurements than the provided data. This could be due to the time the measurements and the surveys have been taken, because the road noise maps show the average of the whole daytime.

6.2. Investigation of urban lights

6.2.1. Berlin
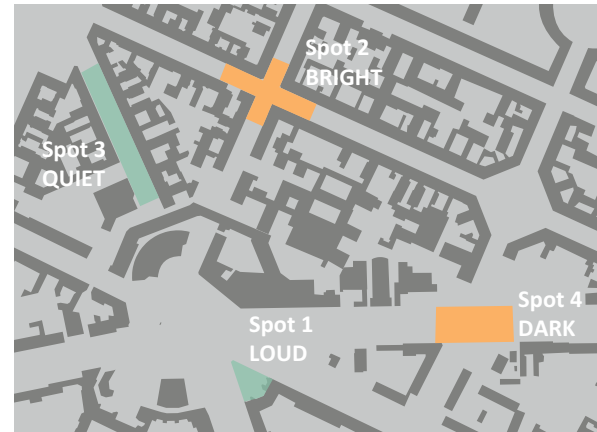
Fig. 48: location of the Light spots in Berlin.

6.2.1.1 Perception

The investigation of urban lights at Berlin's Kottbusser Tor area refers to two chosen spots. Those are the spot 2 at the crossroads of Oranienstraße and Adalbertstraße, which was classified by the student group as particularly bright and the spot 4 under the high line of the U1 at the crossroads of Skalitzer Straße and Mariannenstraße, which was classified as particularly dark (see also Fig. 48).

The interviewed persons support this perception with their ratings of the light intensity. While spot 2 is considered with a 3.5 of 5 as average punctuation, spot 4 is the darkest with a rated intensity of 2.5 of 5 (see Fig. 49).

The difference in lighting becomes even clearer when the feelings which the light in the two different places mediate is respected as well.
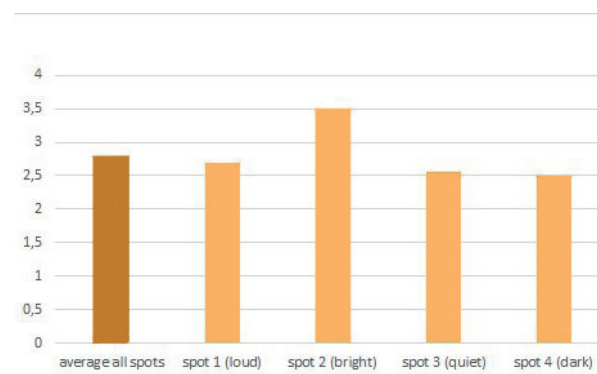

Fig. 49: Perception of intensity of light in Berlin.

50 % of the people at the bright spot 2 refer to their feelings to the type of building use and activities in the area, which is mostly associated with a good attitude. Someone *likes the place for party,* while a different person mentions that it *is good for shopping.* Further given examples of feelings conveyed by lights are *nightlife* and a *lot of activities* as well as clear positive expressions like *security* and *i love it.* Only 30 % of the passers-by are opposed to lighting with a rather negative attitude. They call it *cold, disturbing and strange or indicate to prefer darker places.*

In the dark spot, there is no connection between perceived feelings and the type of building, but also to no other possible source of light. However, in 50% of respondents, the light emits negative feelings. It makes them feel *a little scary, dizzy and strange, hectic, stressing* and also *gives a bit of insecurity*. Only 20 % perceive feelings which could rather be described as positive, like *cozy* and *calm*, while others *don't care* about the light or have *no idea* about their feelings on it.

The first connotations people have on the terms of "bright" and "dark" without reference to the place of the survey show likewise results. While "bright" is often linked to terms like s*un, day, summer, joy and good;* "dark" is at least sometimes linked to rather negative terms like *insecurity, danger, evil, criminality and fear.* The most common answer, however, was *night.*

With regard to the information, which are transported through light, there is no clear difference between the two spots. A large proportion of the respondents think that the light is mainly used for commercial purposes, for example, to *show what kind of shops are around*. Rarely, information is also given which indicates an orientation function, for example *when to stop and when to walk (traffic lights)*.

The similar statements on the two spots are also reflected in the perceived influence of light on one's behavior. Although 70% (dark) to 80% (bright) of people are aware that light affects their behavior in both places, there are many different statements about how this could occur. In some cases, statements are made which are related to the orientation or preferred routes. Most of these are referring to brighter places or streets

as favored, for example when saying *This is the way to walk home more enlightened, I'd rather walk further to get home than walk in a darker spot* or *Always prefer the bright street instead of a dark one*. But too much light is partly also criticized. Some people *don't like them* and for example say not to *go to places where there is too cold/hard light*

A uniform assignment of certain statements to the two different spots is again hardly possible. According to the interviewed persons, favorite lights are often colourful or described as *warm/ yellow.* The word most associated with unpleasant light is *white,* which shows that most people prefer the old lighting technology to the new LEDs.

At the same time, it is interesting that some lights like "Blumen Dilek", which is the name of one nursery on spot 2, are experienced as unpleasant by some people as well as pleasant by others.

6.2.1.2 Light impressions

The study group chose Spot 2 in Oranienstraße as the bright spot in this area and spot 4 in Skalitzer Straße as the dark spot. The first estimation of the four spots in Berlin concerning the light intensity is according to the measured data. The measured light intensity shows, that there are huge differences concerning the different spots. The measured intensity in the particular measurement points at the spots varies from 1 lx to 370 lx.

The estimated bright spot 2 has an average light intensity of 45,7 lx. Whereas the dark spot has a measured light intensity of 3,8 lx. This shows the huge gap concerning the light intensity between those two spots. In comparison to all 4 spots in Berlin, the perceived bright spot is by far the brightest. The other measurements are close to the intensity of spot 4, but not as dark (see Fig. 50).

In the following the measured data with the results of our surveys in those two spots will be compared. The main focus will be the rated intensity of light, which the interviewees perceived in this

spot. The results of the interviewed people show, that the bright spot 2 in Berlin was also rated with the highest intensity of light. The dark spot 4 and the quiet spot 3 were rated with the same low intensity in average. This shows that the intensity of light in the quiet spot is similarly perceived as the intensity in the measured dark spot. Whereas the measurements (see Fig. 51) also show, that spot 1 which was the second darkest spot, wasn't perceived as dark by the interviewees. A possible connection between the perception of dark and quiet can be drawn.

Spot 4 at Skalitzer Straße is underneath the U-Bahn railway and in between two roads of the streets. The street is wide and the Aral Tankstelle as well as a car seller is situated there. Because of their aggressive lighting, the Aral Tankstelle in blue and the car seller in a bright white light, they could influence the perception of the interviewees. Spot 1 was also rated very bright. This could also be because of the view and wideness of this place. From spot 1 you can see the whole Kottbusser Tor as well as enclosing streets. The surroundings of a place might influence the perception of lights at a place. These sections show the actual structure of the streets in Berlin.

The light concept of Berlin provides a chart in which different categories of roads and their illuminance levels are listed. As mentioned in chapter 5.2.2 the light concept is not binding, but offers necessary provisions for illuminance levels (SenStadtUm, 2011, p.12)

Spot 1 in Berlin is situated at the Kottbusser Straße in the west and the Reichenberger Straße in the east. At Kottbusser Straße a speed of 50 km/h is allowed, whereas the Reichenberger Straße has a speed limit of 30km/h. Consequently, light intensities are between 3 and 10 lx. Spot 2 in Oranienstraße has a speed limit of 30km/h, whereas the light intensity should be at least 3 lx. The Dresdener Straße has no superior meaning so that there is no illuminance provision. The presumed dark spot 4 is a street with a separation of traffic lines and a speed limit of 50 km/h. The resultant light intensity is about 8-10 lx (SenStadtUm, 2011, p.12).

Because these illuminance levels are for street lighting it's difficult to compare them to the taken measurements. In the estimated bright spot 2 the light intensity is much higher than the proposed illuminance level. In the bright spot 4 the measured data is much lower than the proposed
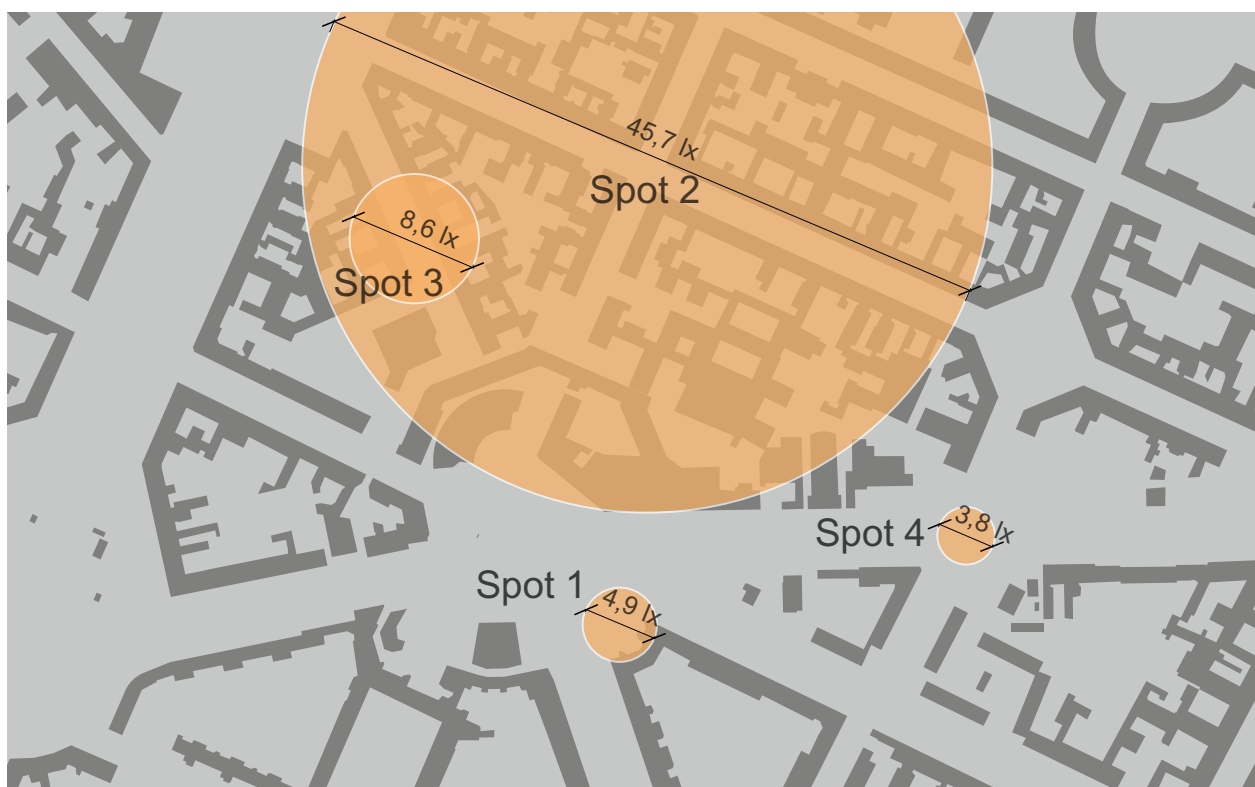

Fig. 50: Observation in Spot 1 in Florence (M 1:1000).

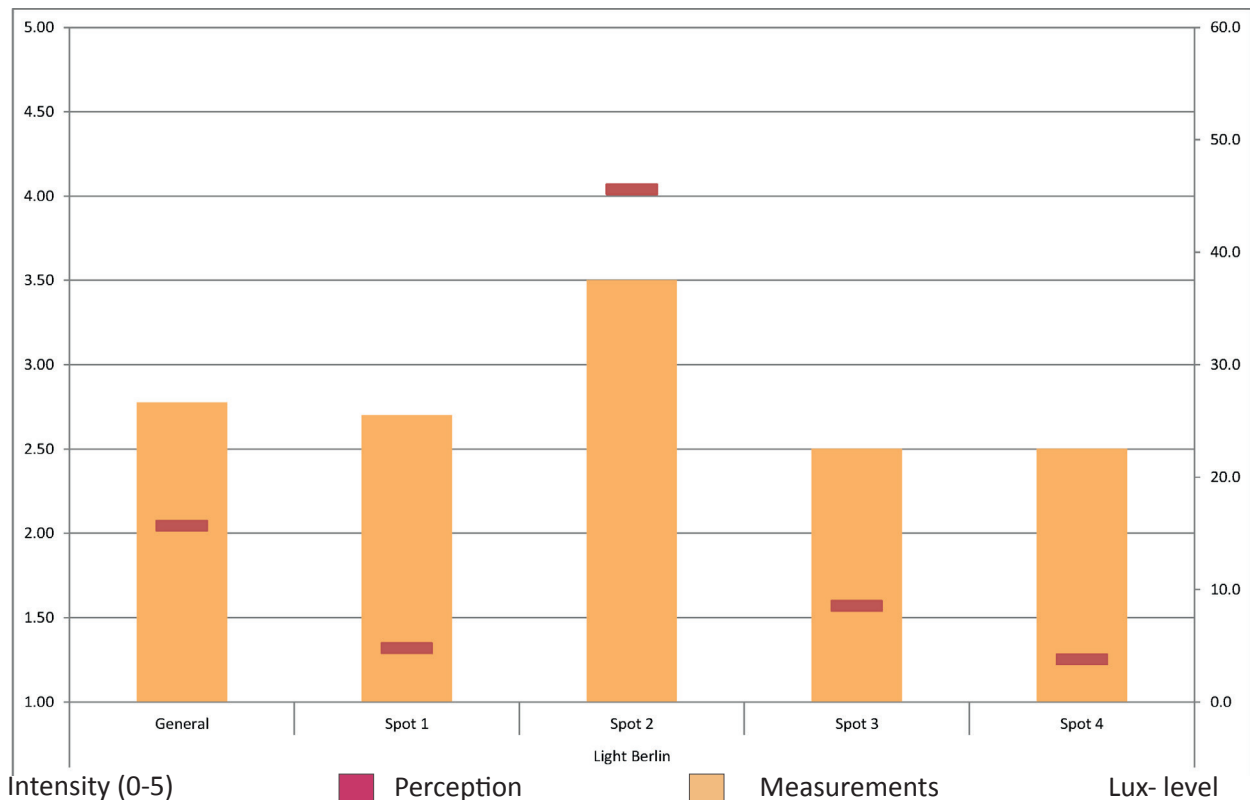Intensity (0-5)   ■ Perception   ■ Measurements   Lux- level

Fig. 51: comparison between perception and measurements of light in Berlin.

data. These differences can occur due to different forms of the luxmeter or different forms of taking the measurements.

6.2.1.3 Observations

The Observations in Berlin were made in a time-frame of 10 min. As mentioned before in Chapter (6.1.1.3.) the number of counted people varies strongly between 28 and 2 people smoking or meeting each other.
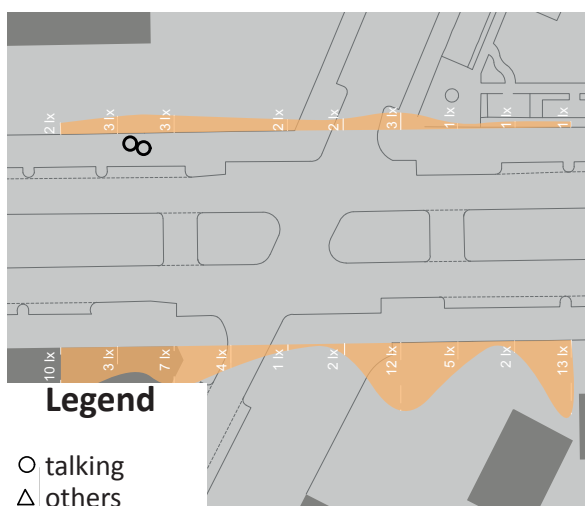

Fig. 52: Observation in Spot 4 in Berlin (M 1:1000).

Concerning the observation of the bright spot at Oranienstraße and the dark spot at the Skalitzer Straße, the number of people using the public space in these areas varies intensely. In spot 4, the dark spot, 2 people are meeting each other (see Fig. 52). In the bright spot, spot 2 at Oranienstraße, 28 people are meeting each other, smoking outside or using the telephone. It is recognizable that in the bright spot many people are spending time alone outside, next to groups of people that are meeting each other (see Fig. 54).

The results of the survey show the actual activities of people in this area, which helps to show the some uses and characteristics of this spot. The interviewed people in the bright spot were going to eat or had already eaten as well as people living there. In the dark spot, most of the people were going home or going somewhere.

In the following paragraph the observation and the results of the surveys concerning the activities of the interviewed people are going to be compared. The informations of the different methods will be connected. The bright spot is used by many people for eating in bars or restaurants (see Fig. 53). The dark spot is only used by few people to meet. This shows that our perceived

bright spot is more a place to use as public space which concludes that our observed bright spots in Berlin are more used than dark ones.
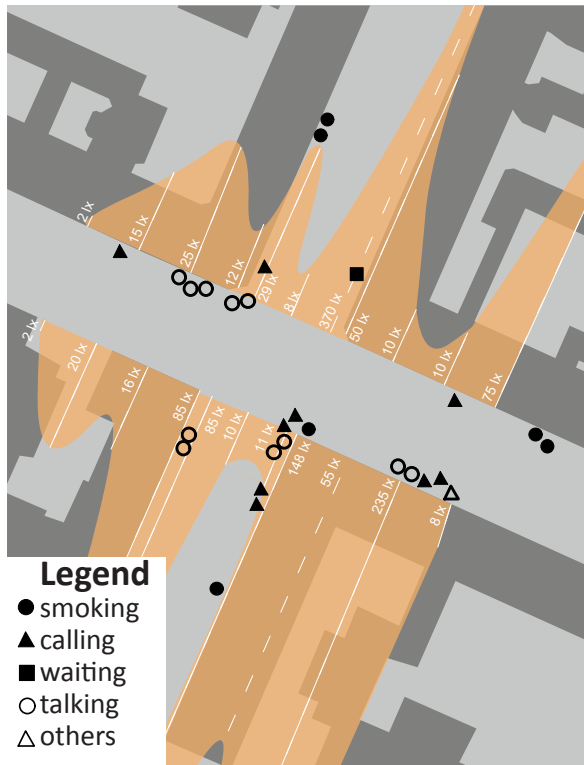

Fig. 53: Observation in Spot 2 in Berlin (M 1:1000).

6.1.2 Florence

Fig. 55: location of the Light spots in Florence.

6.2.2.1 Perceptions

The investigation of urban light in Florence is carried out using three of the four spots instead of just two. The reason for this procedure is again a difference between the perception of the study group and the perception of the interviewees (like there has been in terms of sound in Berlin, see 6.1.1.1) regarding the intensity of the light. While the first choice of the study group, which
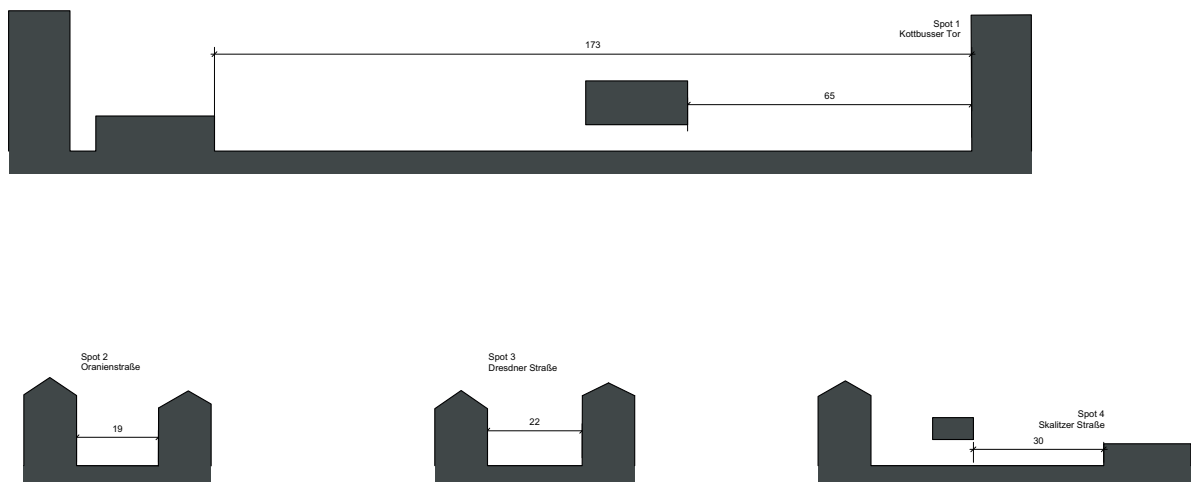
Fig. 54: Street sections of the Spots in Berlin.

defined spot 2 in Via Ghibellina as the brightest, was confirmed by the interviewees (average light intensity rate 3.5 of 5), this was not the case with the spot, which was defined as a particularly dark. While the study group chose spot 4 in "Via della Mattonaia" (2.4 of 5), spot 1 at "Piazza Sant'Ambrogio" was perceived as even darker (2.3 of 5) by the people. For this reason, the bright spot 2 is subsequently compared with the two clearly dark spots 1 and 4 (see Fig. 56).

The emotions triggered by the light differ strongly between the bright spot 2 and the dark spots 1 and 4. 80 % of the interviewees in spot 2 list positive feelings regarding to the light at this place. Half of them argues that the light makes them feel *safe*, while others use terms like *cozy, beautiful* and *warmth*.

This is in clear contrast to the feelings that people sense at spots 1 and 4. There, about 60% of people call negative feelings. They often do feel *not safe* and describe the rather weak lighting as *scary* or their feeling regarding the light for example as *sadness* and *insecurity*.

When it comes to general connotations without reference to the place of the survey, the term „bright" is most often associated with the sun, while "dark" is most often associated with the night. In addition to these two connotations, which are clearly mentioned most often, many different other terms are given, but a clear assignment with regard to more negative or positive feelings is hardly possible. With regard to the information, which are transported through light, there is only a rather small difference between the bright spot 2 and the rather dark spots 1 and 4. In all cases, the passers-by describe often that the light makes it possible for them to see where certain shops are and make them aware of the christmas time. Some also mention information, which could be categorized as *orientation,* for example a *sense of location.*

The only significant difference is the relationship to safety. At the bright spot 2, no reference is made to it, while at the dark spot 1, 30 % of the interviewees indicated that the light would give them information about the security respectively the insecurity of the place. However, this reference is not established at the other dark location (4).

On the one hand, this suggests that a good lighting of the public space actually helps to make people feel safer. This statement is confirmed by the perceived influence of light on one's own behavior. While the light at the bright spot 4 has an positive effect (*makes me feel happier*) or even activating results (*animates to go out, mood to go out*) on the people, 50 % of the respondents at spot 1, who indicated that the light would influence their behavior, said they would move faster due to the weak lighting. Another participant just answered with the word *unsafety*, whatever this could mean in terms of behavior. Only one interviewee said the effect on his behavior is *positive*. On the other hand, the perceived influence of the light on the people's behavior is not so clear in the also quite dark spot 4. Some argue, that the light would give them a rather *positive feeling*, while it makes other people *sad*. But no one mentions to walk faster because of the weak light at this place.

Approximately 70% of the respondents stated that the light would influence their behavior both in the bright and dark places.

With regard to the lights that are perceived to be pleasant or unpleasant, a clear differentiation is hardly possible, since many lights are perceived as pleasant by some persons and unpleasant by others. Only at spot 4 there is a quite clear preference. There, white lighting is perceived as pleasant in 40% of the cases, while 50% of the respondents perceive the yellow street lighting
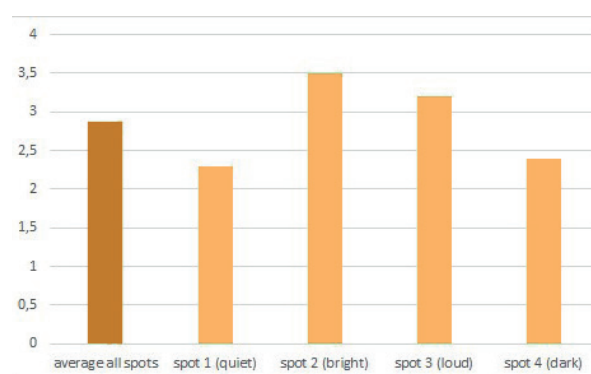

Fig. 56: Perecption of intensity of Light in Florence.

as unpleasant. The sensation is the other way around in only one case.

6.2.2.2 Light impressions

The study group chose spot 2, Piazza Sant´Ambrogio, as the bright spot and spot 4, via Santa Verdiana, as the dark spot. Comparing our estimation with the measured results, spot 3 is even brighter and spot 1 even darker than our chosen sites. This shows that the perception of the study group does not fit with the taken measurements.

The measurements show, that Spot 3 is the brightest spot of all four spots with an average of 49,7 lx. The second brightest is the estimated bright spot 2 with an average of 40,3 lx. The difference between those two measurements is very big. The darkest spot was estimated to be spot 4. If you compare the actual measurements, spot 4 is the second darkest spot with an average of 15,9 lx. The darkest is spot 1 with 11,0 lx. The intensity of the light in the area varies from 1 to 261 lx (see Fig. 57).

In the following we want to compare the measu-

red data with the results of our surveys in those two spots. The main focus will be the rated intensity of light, which was perceived by the interviewees. Comparing the results of the survey with the results of the measurements some differences do appear. The interviewed people perceived the presumed bright spot as the brightest spot as well. But the measurements show, that the spot 3 which was lower rated is the brightest one. Spot 4 and spot 1 were rated similarly but a slight difference was recognized, so that spot 1 is the perceived darkest spot of all four spots. This shows that the perception of the interviewees of the bright spot was similar as the study group, whereas the dark spot could be identified (see Fig. 58).

The difference between the perceived bright spot and the measured data could occur, because the morphology of the streets influences the perception, as well as the measurements. Spot 2 seems to have a much brighter intensity than Spot 3, which is actual the measured brightest one. A supposed reason for that could be the morphology of the street or square. In Spot 3 the walls of the narrow street probably reflect the light of the sources much more, whereas in Spot 2 the christmas lighting seem to light the square even more. In Florence, the lighting system is managed by Sil-
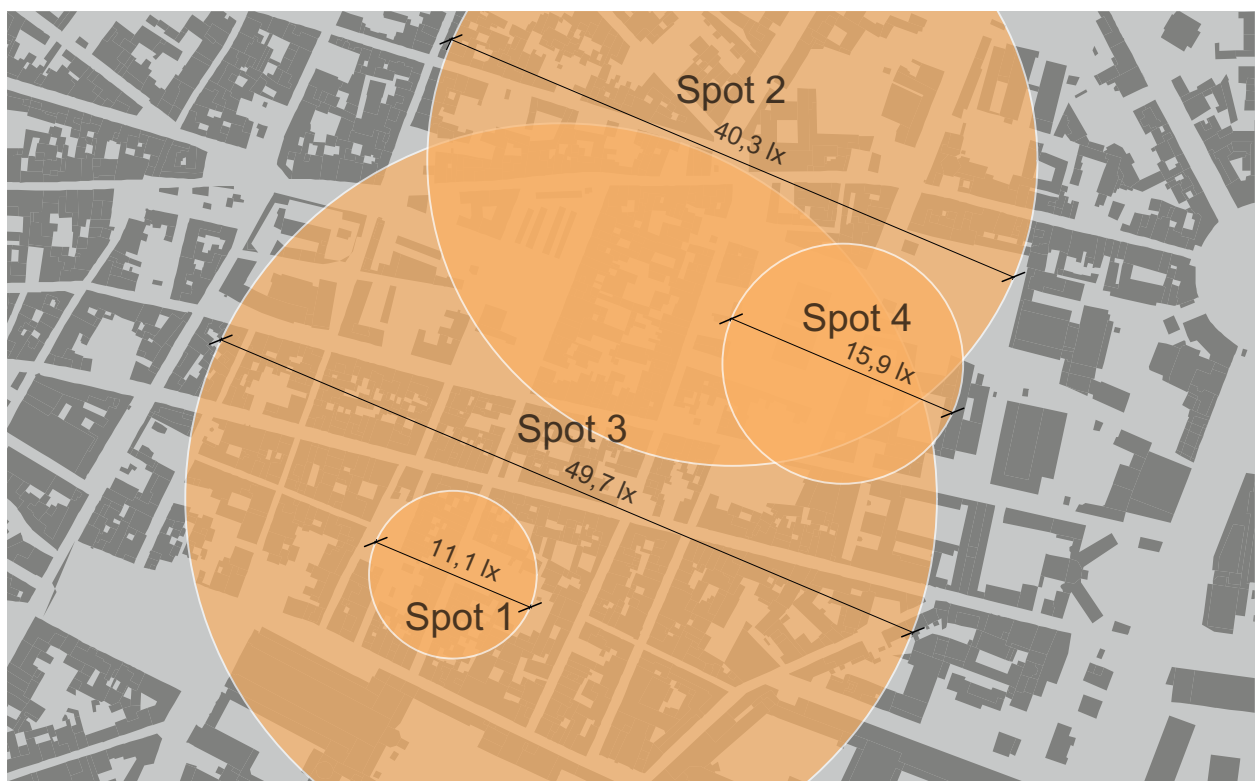

Fig. 57: comparison between perception and measurements of light in Florence.
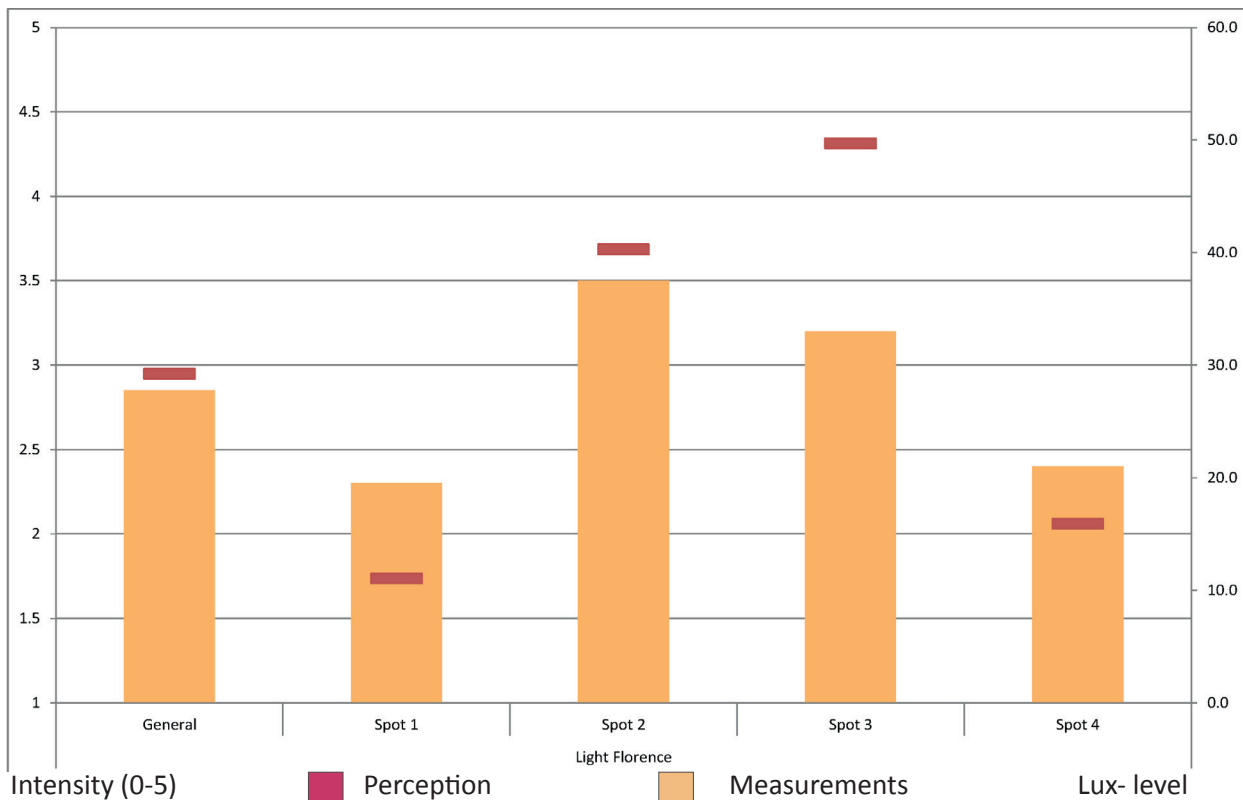
102

Fig.58: comparison between perception and measurements of light in Florence.

fispa. They developed the Piano Comunale di Illuminazione Pubblica – P.C.I.P. ("Urban Light Plan"), which is the main document in providing elements to streamline the planning and interventions regarding the lighting systems of Florence. The current instruments are the Urban Light Plan for Functional Lighting and the Urban Light Plan for Artistic Lighting. In the study area, the Urban Light Plan for Artistic Lighting has to be applied to show the prescribed relevant regulations related to vehicular mobility, walking and cycling. During the time of the research there was no appropriate material available for comparing these different results. So the comparison between official data in Florence and Berlin concerning Light is not possible.

6.2.2.3 Observations

As mentioned before, the Observations in Florence were also taken to rate the quality of the public space in all 4 spots. The number of people varies strongly between 2 and 30 people.

Concerning the observation of the bright spot at the Piazza Sant Ambrogio and the dark spot in the via Santa Verdiana, it's visible that the number of people who are using the public space varies. 6 people are using the dark spot in the via Santa Verdiana. The bright spot is used by 30 people. As observed they are using the public space at the bright spot to read, talk, smoke and meet people. The dark spot is used to smoke and meet as well, but the people that were observed here meet at one bright spot at a junction (see Fig. 59 and Fig. 60).

Fig. 59: light intensity and observation Spot 4.

The answers in the survey regarding the activities of the interviewees in this actual moment, help to show the main use and characteristic of this spot. The interviewed people in the bright spot are mostly going somewhere like going home, going to eat pizza, going to drink something. The interviewees in the dark spot are going to university, to work to eat or home. The activities in these areas are both very diverse. The dark is more used to go somewhere to work.
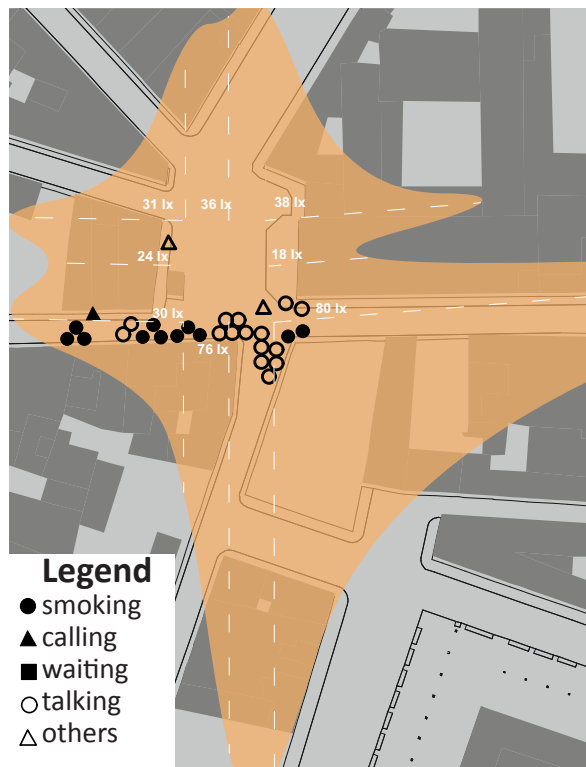

Legend
● smoking
▲ calling
■ waiting
○ talking
△ others

Fig. 60: light intensity and observation Spot 2.

In the following paragraph the observation and the results of the surveys concerning the activities of the interviewed people are going to be compared. The information of the different methods will be connected. The bright spot is used by larger groups as well as single persons, who are going somewhere to eat or who are talking on the phone or smoking. The dark spot is not so frequented. This shows that our perceived bright spot is a place which people use actively in contrast to the dark spot.

6.2.3. Comparison Berlin-Florence

The following section attempts to compare the case study areas regarding light. It should be considered that a completely objective comparison

between the areas under investigation in Berlin and Florence is very difficult as they differ due to many factors, such as urban morphology and use as well as the heuristic methods, which can not be fully taken into account. Nevertheless, similarities and differences between the case studies can be recognized and at least partly explained using the results of the different empirical tools. Concerning the feelings caused by the different lighting conditions in the urban context, there are similarities between Berlin and Florence.

In places that are rather sparsely illuminated, people tend to experience negative feelings that are often associated with the feelings of fear and insecurity. On the other hand, brightly lit places evoke rather positive emotions which, depending on the type of light source, can vary considerably. If the light comes from a source that is associated with a use which is rather connected with positive feelings just as shopping or nightlife, the light is often perceived as even more pleasant.

The sensation of positive or negative feelings due to the intensity of light, however, is only supported in Berlin by the general connotations. The word „bright" is often associated with positive concepts, while the term „dark" is frequently associated with negative terms, which are often related to fear and insecurity. In Florence, on the other hand, there is no clear assignment of connotations to positive or negative feelings.

This could be related to the higher brightness at the spots in Florence. The measurements show, that those are in average twice as bright as the spots in Berlin. Research of satellites and ground observations show that Italy is the most light polluted country in the world besides South Korea (see Griffiths 2016). The comparison between the measurements in Florence and Berlin does not at all contradict this statement. Whereas the brightest spot in Berlin has the same lux level as the brightest spot in Florence.

With regard to the information transmitted by the light to the users of public space, the results in Berlin and Florence are also very similar. The mainly perceived information in both cities refer to the uses in the surrounding buildings. Frequently, reference is made to illuminated lette-

ring which either serve as advertising or indicate certain shops, restaurants, etc. In addition, partial informations are perceived, which are used for orientation in the city.

A difference between the two cities will be seen regarding the influence of light on behavior. The people in Berlin partly for example choose their route dependent on how much light there is. In most cases, it is pointed out that places with a higher illumination are preferred, but some places are also avoided, which are perceived as unpleasantly glaring.

In Florence, on the other hand, the influence of behavior is once again linked to the emotional world. It is often stated that the behavior would change because the light could trigger positive or negative feelings depending on the type and intensity. The extent to which the behavior changes exactly is hardly answered. A possible explanation for the fact that the light in Florence seems to have little effect on the selected paths could again be the fact that there are hardly any places that are really dark.

The interviewees rate the spots similar as the measured data. Recognizable is the fact, that the perception of light intensity in Florence is similar to the perception of the people in Berlin.

In Florence, the perceived intensity of light in spot 2 seemed higher to interviewees and the study group than it actual was, in comparison to the measured brighter spot 3. Reasons could be the morphology, because the narrow streets with its yellow walls in Florence reflect light, for instance. Another reason could be the traffic in spot 3 which makes temporarily brightness through vehicles.

The perception of light regarding the darkest spots was also different than the actual measured light impressions. Regarding the dark spots, the interviewees were right with their estimation by choosing spot 1 as the darkest while the study group chose spot 2.

In Berlin, the most quiet spot 3 and the by the study group chosen dark spot 4 were both rated quite dark by the people, while in case of the bright spot study group as interviewees agreed in choosing spot 2 as clearly brightest spot in Berlin, confirmed through light impressions.

This leads to two conclusions: Firstly, the quiet spots are perceived even darker than they really are and the results about the quietest rated spot are very close together in both cities. Secondly, all people (study group and interviewees) agree in their choice of the brightest spot, even though the chosen spot is not really the brightest spot compared to the light impressions.

A comparison between the perception of the people, the perception of the study group, the measurements and the official data was not possible, because only data for Berlin was available. In both cities, the bright spots are always more used by people to meet and stay. This could lead to the conclusion that this behaviour is due to safety issues. In spot 1 in Berlin is a public space with seating possibilities, but not many people stay there during the observation. This could lead to the conclusion, that the space could be too dark, so people feel insecure using this space. Other reasons could be the climate or the fact that there are no shops or restaurants around.

6.3 Findings

The results from the two study areas and their comparison among themselves show that both sound and light have a strong impact on the inhabitants of cities and should therefore be more integrated into planning. Both can have a significant impact on the well-being of the people in cities. Not only does the intensity play a role, but also the quality of sound and light. Some sounds and some lights are perceived as more pleasant or unpleasant than others. However, official data on noise often indicates only a total value. The actual quality of the sound, which is dependent on the sound source, is not considered. Especially since the term „noise" is often used, a negative association is already generated.

It is also possible to criticize the handling of official data on the light intensity. In this case, the problem is more that there is not much data, which can be easily accessed by the public. How-

ever, since light can be a decisive factor in urban planning, and light pollution is a major problem, this data should be provided.

The results have shown that both sound and light can play an important role for the feeling of security within the city. Regarding the sound, the feeling of unsafety due to traffic is more present. The noise caused by cars for example serves as a warning function. This should be considered when testing new forms of mobility. If cars become quieter as other drivers are used to, alternative protective mechanisms have to be found for the pedestrians, as otherwise there will probably be more accidents. Also sufficient lighting of the road area contributes to a higher sense of security. On top of that, people in the city often choose their routes by the intensity of lighting.

Regarding the use of public space, sound seems to play a less important role in the city than lighting. In both cities, Berlin and Florence, people have mostly met and stopped in well-lit areas, while the volume has varied widely. However, the source and therefore the quality of the sound probably plays an important role in this context.

Also with regard to the identification with the place, sound and light seem to play an important role, since this is linked, among other things, to certain activities and uses. In addition, both factors contribute to the formation of atmosphere and thus to a re-recognition of places.

In both cases it can be said that certain sound and lights can be very important for the city and its functions. On the other hand, places of silence and darkness are also important. Regarding the sound in the city, a distinction between (traffic) noise and pleasant or functional noise should be made in planning.

With regard to light, on the other hand, the quality of the light is also important. But in this context the degree of lighting of cities is probably decisive. While light has important functions, it can also make people in the city feel uncomfortable. Not to mention the hugely damaging effect of light pollution in a wider context where it can have a negative impact on whole ecosystems.

7. Integration of the findings

Although being different phenomena, sound and light share a number of basic features that relate those two issues to each other. They share the characteristic of being forms of waves that are in part accessible to human sensory perception. Resulting from this fact is the double-sided nature of sound and light as something that on the one hand can be quantified using measurements while on the other hand having a subjective side of perception. Both sides are relevant at any point, while they do not necessarily have to fit each other - the subjective perception of a certain light or sound situation can differ a lot from measured intensities and characteristics, which became clear while comparing the strongly differing light intensity measurements in Florence and Berlin with the ratings from the surveys which were mostly the same in both cities. Possible explanations could be the acclimatization to certain light/sound situations (which, however, do not prevent e.g. long term negative health effects), influences of the general pleasantness or mood of the situation, which does not need to be limited to the influence of light and sound. Another, yet very different aspect of this kind was observed in the connotations of darkness related to gender, although one has to keep in mind the small number of participants and therefore the limitations on the limited representativeness of the surveys results on such complex issues. Whereas many men that participated in the surveys expressed negative feelings related to darkness too, many women expressed these feelings even more. This hints at the relevance of the various forms of individual socialization, experiences and vulnerabilities that need to be taken into account for a sound and light planning that fits the needs of all users of urban spaces, especially at nighttime.

Due to the fact that under normal life conditions sound and light are always present - although those terms are frequently used, there is no absolute darkness or silence - one is always exposed to perceptions of sound and light at the same time. Therefore, it is hard to make a clear cut between the single issues when dealing with their positive as well as negative effects ranging e.g. from interaction with a person's mood (as experienced in the group's light and sound walks) to long term health effects.

Opposed to this basic connection there is a very different approach to those topics from a perspective of human action on/and understanding of sound and artificial light. Light is something that is actively produced for different reasons. This is done in a more or less conscious way, although this consciousness normally does not cover the whole range of the effects induced, but is limited to a more narrow set of objectives. Beyond that light is often related to a series of aspects generally seen as positive in the first place, like the possibility to use the nighttime due to artificial light, aspects of subjective security and a long-established language relating light to such diverse concepts like progress and religion.

For sound a very different picture can be drawn. Although sound has in many instances an important informative function that can not be easily substituted (think e.g. of the discussion on the need for sound effects in the context of relatively quiet e-mobility), at least in the context of urban spaces artificial sounds often are more a side product of human activities than something consciously created. This understanding of sound as a waste product is supporting the widespread understanding of many urban sounds as noise. Opposed to this natural sounds are often seen as more positive and natural soundscapes viewed as something desirable. But at the same time there are also narrative connections of urban noise levels to vibrant city life - a perspective that adds a more positive drive than mere noise. As mentioned above the perception of sound has an informative component. Starting from this point interestingly and opposed to the issue of light, the intense practical connection of sound and language is not very much represented in the terms and images used in at least the Western languages.

But as shown above both sound and light are not necessarily negative or positive in the first place. They include positive, negative and ambiguous elements and effects: There is for example also the issue of light pollution, like there is a more positive side to sound. Based on these insights a more reflected understanding of artificial light

and sound in the urban night is growing. But until now it has only partially reached the widespread understanding of sound and light as well as policy actions. A fact which is for example represented by the difficulties soundscape studies face in the translation into practice and their integration into established noise abatement policies.

Due to the relatively well established awareness for sounds´ potential negative effects and the regular occurrence of conflicts about noise pollution, especially noise policies aiming at reducing or limiting noise levels are quite advanced compared to light/light pollution policies. Noise policies are established in many areas of policy-making, often combine mandatory powers and recommendations and by these circumstances create an enormous complexity. In contrast to this, light policies still stick very much to recommendations only and can be seen as less complex than noise policies. Here the number of actors and scales involved in the policy making process is lower. Additionally, the light pollution abatement policies yet do not relate that much to other policy fields and are mostly a concern of light planning in a more strict sense. Opposed to this noise limits are partially incorporated in many established policies like land use zoning.

Furthermore, in light policies the recommendations in part tend to promote even higher levels of illumination which is very different from noise policies, where no actor actively promotes higher levels, although relaxing limit values is an interest of industrial lobby groups, too. This internal struggle in policy-making on the question whether to push for an increase or a decrease of lighting levels/intensities etc. is unique for the regulation of artificial light. It turned out that these dynamics have led to very different situations in the case study cities/areas. Berlin is said (and found) to be a rather dark city in international comparisons, a fact that can be connected to the conscious local decision to go below recommended lighting levels which are seen as unnecessarily bright. A different finding can be made in the area of Santa Croce - Sant'Ambrogio in Florence, which showed light intensity measurements that exceeded those in Berlin twofold. These observations are far from being representative but they do fit other findings and sources that show the additional relevance of specific aspects like staging the historic center of Florence by artificial light for touristic reasons, potential path dependencies due to two parallel lighting systems and the fact that Italy as a whole has the highest percentage of territory affected by sky glow of all G20 member states (although one has to keep in mind, that there are several other ways to measure the extent of this particular aspect of light pollution and that this result is tightly connected to Italy's polycentric settlement structure resulting in high population densities in most parts of the country. This connection can also be drawn for Germany, that ranks 3rd in this comparison, although its cities are generally described as rather dark. Therefore, most other rankings would not necessarily put Italy first) (Falchi et al. 2016)

In theory, it should also be possible to provide a comparison on noise levels between cities and countries, but unfortunately there is no data available for Italy as a whole which is easily comparable to other european cities. Therefore, the project group relied on own calculations based on data of various documents on noise abatement planning in Berlin and Florence. These datasets show a number of differences in their approaches which distort the results. But what can be said is, that the percentage of population exposed to high sound pressure levels is relatively low in Berlin. This is true when compared to other major European cities (an insight resulting from the EU-wide official comparison), as well as when compared to percentages of exposed citizens in Florence (based on own calculations. Here the difference is striking, but the different approaches and assumptions behind the cities datasets hint at an overstatement of the real difference between the levels of exposure). Still one has to keep in mind not to give all the credit for a certain position in a ranking of this kind to effective/ineffective noise abatement policies, but to consider the relevance of aspects like city morphologies (for illustrative examples on this read chapter 4.1.2 and 4.2.2) and frames of territories on such comparisons, too.

But the project also found general similarities in the policies on noise and light. Furthermore, it became obvious that traffic related regulations are in different ways involved in the persistence

or production of negative impacts of light pollution and noise on a general spatial level. However, one has to remark that situations that can be interpreted as pollution are not in every case limited to traffic. A fact that could be especially observed in the case study areas where issues of intense commercial lighting, staging and nightlife activities play a relevant role.

Another similarity are the problems occurring because of a lack of internal integration on light/light pollution respective sound/noise as single issues even before those could be integrated as a whole. Often there is little consistency between certain established fields and scales of regulation that are yet interrelated in their practical outcome that affect urban space and its users. Sometimes this leads to open contradictions where the objectives of single regulations are obscured by other policies. Additionally, it can be observed that neither sound nor light policies are sufficiently integrated into the various procedures of urban planning that they often do not explicitly deal with sensory components in space even though they have a broad practical relevance.

Recommendations

During the project's work on light and sound in the urban night, it turned out that there is a need for further development of how sound and light are dealt with and are understood. What is needed is a sensible discussion of the positive and negative effects of sound/noise and light/light pollution in urban areas. It should include quantitative as well as qualitative aspects, combining a push for more effective regulations in a traditional sense with new approaches that help addressing better the complexity of visual and sonic perception, which would also include further development of the methods to obtain more meaningful data and knowledge on light and sound in specific places. From a traditional perspective this means, that there should be initiatives for improving the existing approaches of noise policies while something like light pollution policies even needs to be developed yet. Effective general limit values and the deliberate protection of places of relative quietness and darkness are and will remain of great importance. But as hinted at above such approaches need to go along with wi-

dening the scope to include aspects like quality, perception, beauty and wellbeing to represent this equally important side of sound and light.

This study project contributes to such a debate which already started, although its outcomes are not yet satisfying in many instances. It is not enough to trust in mere technological innovation to solve the manifold challenges related to sound and light in urban contexts, but it is necessary to address those challenges in a sensible and critical way. One current example of the need for such conscious approaches can be found in the field lighting, where there is a major technological change in lighting technologies under way for some years. In many cities street lights are subsequently changed to LED lighting (a very striking example is the city of Milan) which is often described to bring about only positive effects - a fact that is related to the dominance of certain narratives in light policies described in chapter 5.2. But the change often had distinctively negative effects regarding issues like light pollution or various environmental impacts related to the new colours of artificial light which would not have been necessary if they were taken into account before.

A central aspect of the development of new ways to deal with sound and light in urban context is the integration of various issues and approaches. Especially a better integration of visual and sonic aspects into urban planning is needed to make a difference at local levels of the urban fabric. Therefore in the following, the project group will try to give recommendations although those would of course require more specification by future research and practice.

The research showed that there is already a huge amount of approaches that could prove to be even more useful if their strengths are to be combined, benefiting each other's knowledge and effectiveness. This is true for several levels of possible integration that need to be addressed at the same time.

First, there is the need for both sound and light issues to integrate internally - a fact that was widely agreed on by several interview partners of the project (e.g. Jäcker-Cüppers 2017, Schulte-

Fortkamp 2017). The different understandings of sound respective light offer relevant insights and approaches, yet work in parallel causing new ideas to have difficulties reaching the sphere general practical action. This disconnect seems in part to be related to a lack of mutual understanding and appreciation on a personal level, a point that is enhanced by the reliance of the development of light and sound issues on expertise, initiative and networking by certain individuals. This importance of the initiative of groups and individuals to overcome disconnect and improving light and sound policies at the local level became visible in the two case study cities, where productive local networks are seen as one of the reasons for the relative strongly developed policies on light and sound. The findings underline the project´s impression, that there is already a base that can be used for proceeding.

Another level of integration can be seen in the connection between light and soundscape planning as well as traditional issues of urban planning. As shown above, in several instances light and sound share a number of aspects and do affect urban space in many different ways. The fieldwork in Berlin and Florence as well as the sound and light walks hinted at the fact that especially the perceived qualities of sound and light can not be separated in many cases. The perceived qualities of a place are always a complex mix of impressions that are interrelated.

Nonetheless, even in the expert communities the awareness of the complex issues debated in the respective other fields seems to be relatively low. Here the challenge is even more about connecting the expert communities on a more basic level, to facilitate processes of integration. Perhaps the formation of shared platforms, networks and common projects can help to bring a higher dynamic in this field of exchange. As a very first starting point the project "Light and soundscapes of the urban night" contributes to this process and promotes the combination of quantitative and qualitative as well as light and sound related methods in research to be developed further. Another step that could derive of such research could be the identification of possibilities for productive and comprehensive light- and-sound related actions.

The pushes for exchange inside the expert communities needs to be accompanied by further development of the framing and structuring policies at major scales. This is especially true for light policies which today for example lack a general institutionalization of light pollution abatement policies. Policy initiatives in this direction could help to establish the aspect in cities that are less advanced in this respect. Such an initiative in the field of noise policies, namely the END, has proven to trigger action on the local scale although the actual legislation of course has some strengths and some limitations too that have been shown in chapter 5.1. For sound/noise policies an interesting development of the next years will be the amendment of the END regulation to include aspects of the soundscape approach. It will be interesting whether this initiative will prove to be helpful to include more qualitative aspects into noise policies and make a pioneering step in the direction of more broad sound policies.

A third necessary component in developing urban soundscape and light planning can be found in a more intense participation of the general public. We have to keep in mind that the expertise of individuals, however far reaching this may be, cannot substitute the active participation of the people using and living in urban areas. Processes of bottom-up mobilization already proved to be necessary and relatively effective in cases like traffic noise-related pushes for improved noise abatement policies (Jäcker-Cüppers 2017), to name just one of many possible examples. So empowerment of citizens becomes a very important aspect in sound and light policies, both in terms of including participatory practices in formal sound and light planning as well as the promotion and support of bottom up participation by interested people.

But while the issues of the often abstract and specialized policies deal with are at many points generally accessible to daily life perception, it is not always clear how to relate the great variety of citizen's concerns (which is e.g. shown even in the project groups small sample of surveys) to urban soundscape and light planning actions. To help drawing new connections awareness creating tools can be used by everyone who is interested in this field. The range of possible ways

to contribute to a more conscious way to look at urban soundscapes and lights is very broad and open to anyone's imagination. In this context, the project group experienced very different approaches ranging from participatory designs, art projects to light and sound walks.

As mentioned above powerful citizen participation has the potential to push forward initiatives and new objectives in light and sound policies that have been less powerful before. Possible topics for such a civic struggle for a better visual and sonic situation in the urban night could reach from the preservation of certain desirable places of relative quietness and darkness to environmental justice or gender sensitive design from a sound and light perspective. Therefore claims at local and major scales are both relevant in order to complement each other.

Imagine a city life where you can hear the sounds of the birds, the kids in the neighbours garden, the bicycles rattling. Imagine a city where you can see the milky way. The sound and lightscapes of this city will be diverse and inspiring, ranging from relaxing to intense giving you the possibility to experience manifold different impressions. Of course there will be still some aspects one could experience as noise or light pollution because such an estimation is in many cases highly subjective. But we got much more conscious about the ways we produce lights and sounds. The issues have become a matter of broad discussions - as well in urban planning as in the general public.

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