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logbook of an exploration

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Den Haag - Zaandam - Helmond - Rotterdam - Zoetermeer - Amsterdam

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City Rhythm

Logbook of an Exploration

Caroline Nevejan
Pinar Sefkatli
Scott Cunningham

2018
Amsterdam

Foreword

Many large cities explore possibilities for enhancing social safety. Municipalities invest in local police and in surveillance, yet they realize that social safety is also the result of interaction between people. However, in many cities relations between people are anonymous and flexible. People easily move and do not engage with each other. As a result people feel less safe, even when figures on crime decrease.

This City Rhythm study, initiated by Caroline Nevejan, offers a new perspective on social safety. Social dynamics are also defined by rhythm, it appears. Rhythm in activities of people, rhythm in the urban structure of a neighbourhood, rhythm in nature's seasons and rhythm in social and cultural life among others, define the atmosphere in a neighbourhood. By analysing these rhythms, not anticipated avenues for (the design of solutions and) policymaking emerge. Secondly this study shows that social rhythms in a neighbourhood can also be identified in datasets generated by this neighbourhood without jeopardizing resident's privacy. Just as a GIS system shows a traffic jam without revealing who is actually in the traffic jam. The City Rhythm Data Model shows beats and base and street rhythms and seems to resonate with atmospheres people 'feel' when being present in these places.

Very special in this interdisciplinary study, and possibly part of its success, is the participation of over 30 civil servants of the 6 participating cities (Amsterdam, Helmond, Rotterdam, Zaanstad, Zoetermeer and The Hague) Together with the excellent researchers of the different participating universities and scientific institutes, the contributing artists and data specialists and the students of the minor Responsible Innovation, they have made this study into a success. This logbook document, this interesting research trajectory, not only offers insight into rhythm analyses as such, but also into the special interdisciplinary process between all these different participants in the research.

Rhythm is fundamental to our health, to life on the planet and to the cultures we are part of. As result of City Rhythm we now realize that rhythm is a new approach to policymaking that may turn out to be significant for our future.

Rabin Baldewsingh

alderman The Hague
The Netherlands

“Rhythm is variation in a pattern in a specific structure”

- Marli Huijer

Summary

Rhythm is fundamental to life. Rhythm can be perceived in the movement of the sun, the moon and the stars. Rhythm makes our hearts tick and defines our breath, in and out. And even the smallest particle in a microbe is part of rhythmic movements. Rhythm in activities is important for culture, for religion, and for sports, schools and hospitals for example. Yet in social situations, social analyses and in social policymaking, rhythm is not considered as a space of analyses or a space of design.

City Rhythm explores the potential of using rhythm analyses in the physical world and related data domain for enhancing social safety in neighbourhoods in the Netherlands. Rhythm in the physical world happens both in space as well as in time. Rhythm in data can connect to location (instead of persons), thus circumventing the issue of privacy. However, because the data addresses specific times and places, nonetheless the data still addresses significant social issues.

Founded in the social sciences, humanities, arts and computer science, the interdisciplinary research team also includes civil servants of six cities in the Netherlands who have engaged throughout the research. With the help of students, nine case studies are carried out.

Building upon methodologies from the social sciences and architecture, it is found that in seven cases rhythm analyses identified new design solution spaces. As a result, a methodology for doing rhythm analyses in the physical world is developed. More theoretical and artistic explorations are carried out. These enable the bridging of experience and insight from rhythm analyses to the data world.

The interdisciplinary research team formulates the basic concept and terminology for the City Rhythm Data Model (CRDM). This consists of beats, base and street rhythms. Beats are defined by the state of specific area at a specific moment in time, As an example of a state, a street might have lots of cars, few cars, or no cars at all. Street rhythms show significant transitions over time for the specific area. The base rhythm of an area is defined by comparison to other areas. These derived rhythms are like a musical meter. In this specific context, individual street rhythms develop. Street rhythms represent a variation around a few specific themes.

The City Rhythm Data Model (CRDM), based on mixtures of hidden Markov models, is built and run with open and linked data from the Central Bureau for Statistics (CBS) of the Netherlands. Areas can be represented using sizes in different datasets. City Rhythm worked with areas of 500 by 500 meters.

The choice of datasets is defined by mapping upon the YUTPA framework which indicates trade-offs for trust. In the validation session of the City Rhythm Data Model it is concluded that the general experience of social safety of specific areas is reflected in CRDM base rhythms. For being able to understand which specific data constitute a beat (or “state”) and for understanding specific street rhythms, further research is necessary. In conclusion to the one year exploratory study, City Rhythm indicates that rhythm analyses, in the physical world as well as in the related data domain, offer a potential new approach for policymaking.

The Research Team

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PhD Candidate
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Municipality of The Hague,

Hedwig Miessen

Program Manager ICT in the City

In 2015 a research was carried out in collaboration with TU Delft in the Bouwlust neighbourhood of Escamp, where the YUTPA model was used to reveal the urban DNA and to see where the interventions on improving safety could take place. The municipality of The Hague as the administrator of the Digitale Steden Agenda's (DSA) Safe City Program, helped City Rhythm project to kick off. With the help of the innovation facilitator Fatiha Alitou, five more municipalities agreed to participate in this exploratory research. The Hague, who had experience with the preliminary TU Delft research in Escamp where Caroline Nevejan was the principle investigator, engaged with the other municipalities in this challenge.

During the research year, a successful relationship arose within the participating cities, enabling a lot of knowledge exchange. This was a special experience with many learning moments and intensive cooperation. Also inside the municipality of The Hague new bridges have been built. With the support of the alderman Rabin Baldewsingh, the ICT departments, the districts, the neighbourhoods and the security department joined their forces. We would like to thank to the colleagues involved, the partners such as the police, the neighbourhood teams, and the students.

With the City Rhythm Methodology, we have developed a new way for data analysis. The developed data model teaches us that in all cities 7 base rhythms occur and that these similar blocks of grids (500m x 500m) can learn from each other. This gives an action perspective for a new and more detailed collaboration at the level of an urban block. More research and more data is necessary to prove the predictive value of the City Rhythm data model, which, like the TomTom, will not only describe our behaviour but also influence and change our behaviour. We are happy to hand over the next phase to Amsterdam.

Municipality of Zaanstad,

Mieke ten Bosch

Staff Coordinator Ember Quality of Safety and Enforcement

Big data offers new possibilities to use information in new ways so that it provides other useful insights. What does this mean for the policy process?

Traditionally, the policy process, in addition to political/administrative signals, is fed by (policy) research and, among other things, periodic, statistic and economic analyses. The information that results from this process is based on data from the past. In addition to power, intuition and experience, information is an important source on which policy choices are made.

Big data can lead to change. More and more data that can be important for policy making are available real-time (here and now) or near-time (almost now). Through big data instruments (including a monitor or a dashboard), there are opportunities to see the more complex patterns faster. Knowledge becomes, therefore, very up to date and the policy makers do not always have to wait for the results of policy research in which the information is first collected, then processed and then placed in a report. Policymakers and politicians can discover problems at an earlier stage through the up to date availability of more factual knowledge, and as a result earlier action can be taken. This available factual knowledge can be used throughout the entire policy process from identifying questions to decision making and evaluation. With this approach, the policy making process will also become technocratic in time. This means that decisions will be made on based on the knowledge of the civil servants or the computer systems. The signals from citizens may therefore acquire a smaller role yet in social networks citizens participate as never before.

Working with data is another field of activity that is rapidly developing. It is not simple but it is an interesting path which will be followed. Perhaps the change in the policy making process therefore, will not go so fast.

Municipality of Helmond,

Gooitske Marsman

Coordinator Data Analyses and Intelligence

Making the numbers speak requires a big effort. The combination between the explosively growing quantitative data and the new technological developments makes it possible to discover new answers and patterns in data which can be used for policy making in practice.

With this ambition, more than a year ago, we stepped into the innovative City Rhythm research in neighbourhoods to research how the rhythm analysis in a neighbourhood can contribute to finding solutions for social issues such as safety.

In this one year research many steps were taken, such as the development of a theoretical context and the methodology for looking at social problems in a street from the perspective of rhythms. Afterwards, we focused on how the insights of the changes that take place in neighbourhoods can be displayed through data analyses. The collaboration between the different municipalities and universities was inspiring and had an added value because all parties were enriched with additional information. Theory and practice are brought together in this research. However, at the same time, there are often issues to tackle such as receiving the data, preparing the analysis of the data, visualizing the data and building a data model. In this sense, one year of research is quite a short time.

The steps that taken are very promising. Hopefully, in the coming years we will know how to let the figures speak for themselves, since such interpretation is crucial to the policy practice.

Municipality of Rotterdam,

Suzanne van den Berge

Policy Advisor

Identifying rhythm in data has the potential to add a new dimension to information-driven work. A monitor or index shows the past and current state of affairs. Identifying a pattern - a rhythm - including a break of the pattern shows something that a monitor or index cannot. Rhythm approach shows the potential development in the future. This can provide new insights on which you can base policy. By discovering a pattern, you can consciously break or interrupt a pattern to correct it. This allows you to potentially prevent (further) problems.

These different ways of looking at data also have a common feature. The analysis or the final instrument is not the goal; it is a method for arriving at a goal. It is only the beginning of the story. Numbers do not give you a complete picture of reality. You also need the story behind the numbers. A safety index, for example, shows you - just like a thermometer - if a neighbourhood has a fever, but it does not indicate the cause or the solution to the fever. The received signals always have to be further validated through consulting other professionals, partners, residents and entrepreneurs. They can give colours to the bare numbers. Through the qualitative validation of the numbers, you get the best possible picture that allows you to tackle the fever. Do not expect numbers to give you all the answers. They are just the beginning.

Municipality of Zoetermeer,

Jerrel Denijn

City Marshall

City Marshall is a civil servant who plays the connecting role between citizens and policy. As the City Marshall of the Municipality of Zoetermeer, I always use methods that include data and area based research, and work together with citizens to make the neighbourhoods in Zoetermeer more liveable and safe. However, my work at the municipality has never had a scientific approach. By taking part in the exploratory research City Rhythm, we had the chance to integrate scientific methodologies such as urban and data analyses in our work.

Furthermore, Zoetermeer has always been quite progressive in gaining experience with new methods and ways of application. We always introduce new projects in the municipality that integrate citizen participation and apply data analyses in different contexts, especially in working on safety in neighbourhoods. In this sense, the experience we had with City Rhythm was really inspiring.

The results of the research showed us that using rhythm analysis in social situations creates a better dialogue between the police, city maintenance officers and other neighbourhood professionals. Such dialogue was provided by visually communicating when the rhythms are intense and in which location the intensity reaches the highest point. This approach created a new knowledge on the social issues related with the youth or with the elderly men, that take place especially in the Meerzicht neighbourhood. For this reason, as the key person of Zoetermeer municipality, I would gladly say that our overall experience in joining City Rhythm research was constructive.

Municipality of Amsterdam,

Tamas Erkelens

Program Manager Data Innovation

During the past year, with the City Rhythm research an exciting new approach in analysing data has been developed, based on exploring how all the rhythms in the 6 cities are shaped. This approach has the potential to influence the use of data for policy making. City Rhythm has linked the data science professionals to the academic rigour, and the policy makers' vision to the neighbourhood level workers' pragmatic approach. The exchange of ideas between the experts from different domains in the process of discovering new patterns has been a very valuable experience for all of us. Working with the data team resulted in a fruitful collaboration where data scientific approaches like the Hidden Markov Model, and the way new academic methods can be applied to policy challenges have been explored.

Until now the project has focused empirically on grounding the theory with large sets of data, finding patterns in the grids of the city. In the future, adding a temporal component will make it possible to track circumstances in space and time and to signal change in neighbourhoods; just like an early warning system. Another challenge is to check whether the inductive approach of this project can be validated with observations of policy makers.

Our experience in working with data shows that the people in the field need to indicate whether data driven early warning actually makes sense. The data scientific model should benefit from the feedback both from policy makers on the neighbourhood levels and from citizens. To what extent do these quantitative signals make sense to the citizens of Amsterdam? How can we find a way to bring their input to the heart of this project and model? To bridge this gap between the physical world and the data world is a very valuable exploration. As the Municipality of Amsterdam we are very excited to see how such a conceptual and theoretical idea can be brought to a more applied level in the next years.

Content

How to read this logbook

This logbook documents an interdisciplinary and exploratory research trajectory. Different disciplines interact and contribute across distinct moments in time. These different perspectives constitute this logbook. As a result, every reader of this logbook is confronted with the interdisciplinary nature of the research and will easily understand one section while having a much harder time understanding another. Nonetheless, disciplinary contributions are reported in relation to the other disciplines. Different authors have helped in editing each other's work, leading to better understanding by different readers.

Part 1 reports on previous research and the theoretical context that is foundational to the City Rhythm study. It describes the research design, including the different strategies which helped to make this interdisciplinary research successful. It reports on the gap between data and policymaking and formulates a data ecology for municipalities. This part is interesting for policymakers, social scientists and interdisciplinary scholars.

Part 2 reports case the studies in 6 cities in the Netherlands, which explore rhythm as a way to understand social issues in neighbourhoods. It is a very visual section that builds on methodologies from architecture, social sciences and policymaking. This part is interesting for diverse professionals who work in neighbourhoods.

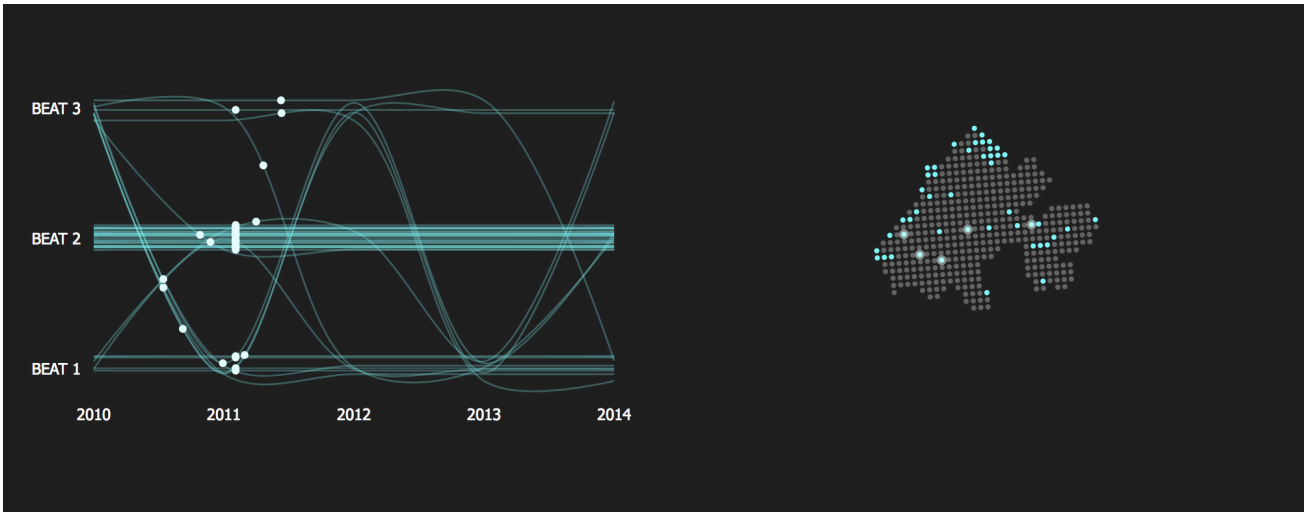
Part 3 explores understanding of rhythm both in scientific theory and artistic practice. Next to a short literature review on urban rhythms, it includes fragments of a transcript of a focus group with experts coming from music, visual art, design, psychology, computer science, biology, social science, economics and architecture. This part is interesting for people who want to better understand the nature of rhythm.

Part 4 describes in detail what is involved in working with data within a social and political context. It elaborates on different approaches to data, choosing data, getting the data and modelling data. The second section of part 4, on designing the model, offers reasons for why the model is designed in this manner. This part aims to be accessible for people who are not data scientists and is especially interesting for people who want to engage with data science in social contexts.

Part 5 describes the new urban terminology for City Rhythm and explains the process of visualization of the data model. It offers fragments of the transcript of the validation session and describes a successful experiment of running the model with data of different European cities over 20 years. This section is interesting for anyone who wants to engage with urban rhythms.

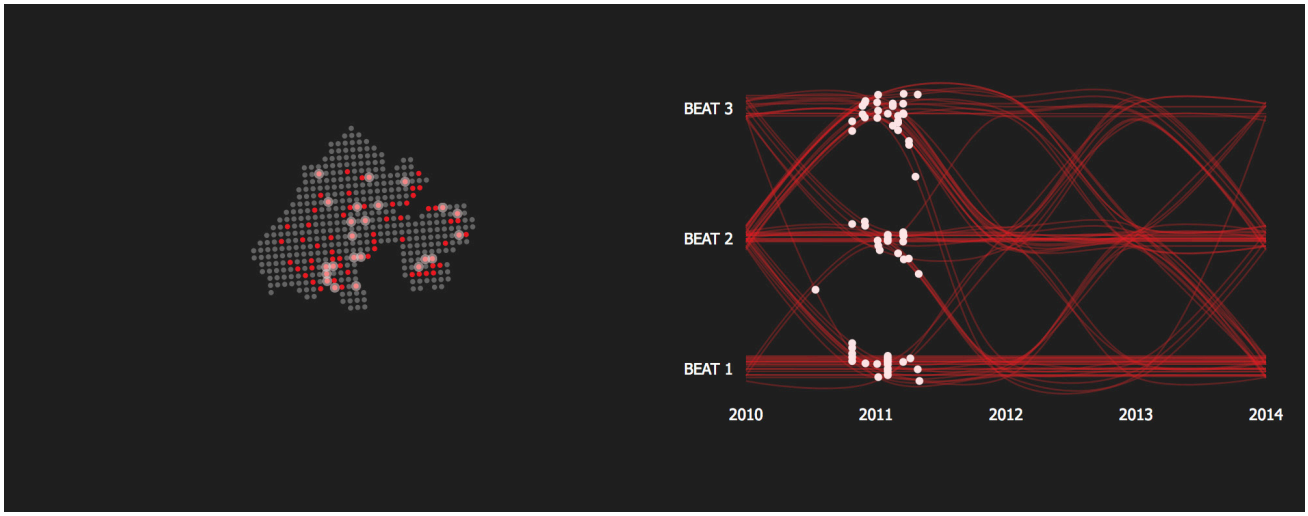
We hope you enjoy reading this logbook and we hope that the multiple perspectives of this logbook enable you to view the rhythmic character of cities in a new light.

You can use this logbook as a flip book and enjoy the computer animation of the City Rhythm Data Model by flipping the pages really fast.


BEAT 3
BEAT 2
BEAT 1
2010
2011
2012
2013
2014

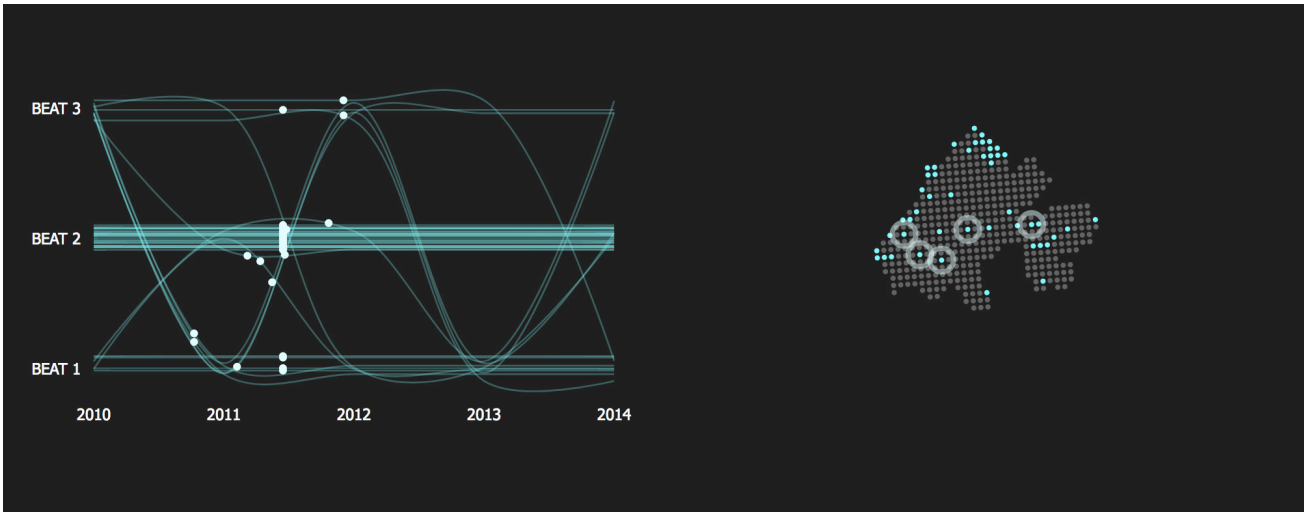
Part 1:

Rhythm:
why and how



Rhythm and the Design of Trust

by Caroline Nevejan



Rhythm and Social Safety

When sharing rhythm, people feel more at ease with each other. Such rhythms can be mundane for example in the activities we do every day: bringing the kids to school, walking the dog, being in the same train going to work, putting out the garbage, and so on. These mundane rhythms are at the heart of sustaining everyday life and shaping trust. As an example, the local policeman who passes by the school every day so that the parents can easily approach him, generates trust. The opposite, not sharing rhythm while being in the same environment, can be rather unpleasant and generates distrust. That is why this study introduces the concept of rhythm for policy making. Sharing rhythm, tuning rhythm, matching rhythm, and balancing rhythms, are significant dynamics in society and offer a new ground for policymaking.

Sharing rhythm for social cohesion

Preliminary research focused on social cohesion in a city neighbourhood in the Netherlands (Den Hengst, De Jong & Nevejan 2015). Underlying this study was the discrepancy that people do not feel safer even when figures of criminal behaviour go down. There appears to be a gap between the experience of safety and the data on safety. This study assumed that social cohesion and trust between residents affects the sense of safety.

In this preliminary study, a specific methodology, the YUTPA framework was used, which is discussed later in this section. Results of this study show that 'Integrating Rhythm' is significant in enhancing the social cohesion in a neighbourhood. It was found that people do not want 'to do' something for safety; they want to be safe. Residents do not want to have to negotiate in their home environment; residents want to engage in a reciprocal manner with neighbours and to share rhythm is crucial to this. When sharing rhythm, people feel safer with each other. Such sharing can be to meet regularly at the entrance of the school, to put the garbage out at the same hour, to meet in the same train every day. Sharing rhythm enhances trust. These findings triggered the research into City Rhythm.

New Paradigm for Human Experience

For thousands of years human beings were the measure of all things, where judgments of distance, speed, etc., were made from the experience of our bodies in the world. This human measure was of a rhythmic being experiencing life as part of a larger whole of natural and cosmic rhythms.

In the last few centuries, with the evolution of science as we know it today, human beings have come to be measured. Measuring time with the clock, for example, has had a profound effect on human experience, allowing for the mechanisation of society. This demands human rhythms to fit, and has caused different strategies for survival and well-being to emerge. From turning on the radio during work or taking a walk in the park afterwards, human beings have to recover from work. As Karl Marx argued, workers need to reproduce the energy they have sold (Marx 1867). When patterns at work are too mechanistic, the reproduction of the labour force will take longer, people need to recover deeper.

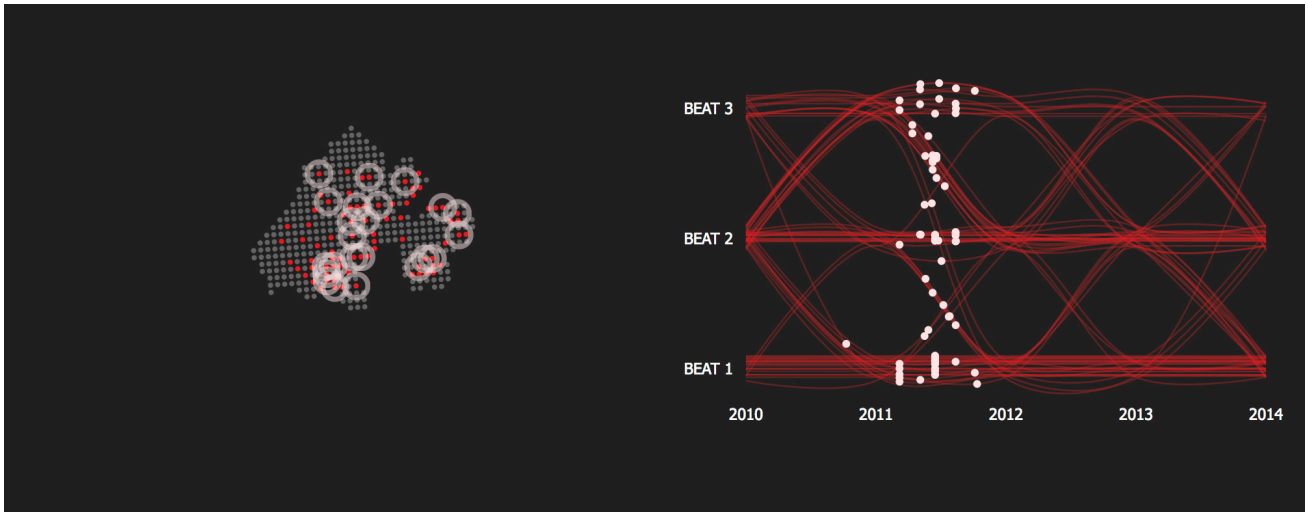


Diagram showing the three paragims of human experience and meta design paradigm, by Caroline Nevejan

In recent decades, the foundation for a new era of human experience has been created by digital technology, where connected data measures human kind in real time. The TomTom is a simple example of this. It can indicate if a traffic jam lies ahead on one's driving route in real-time. We are now in an era in which digitally mediated information about others affects our own behaviour and experience in profound ways (Castells 2009).

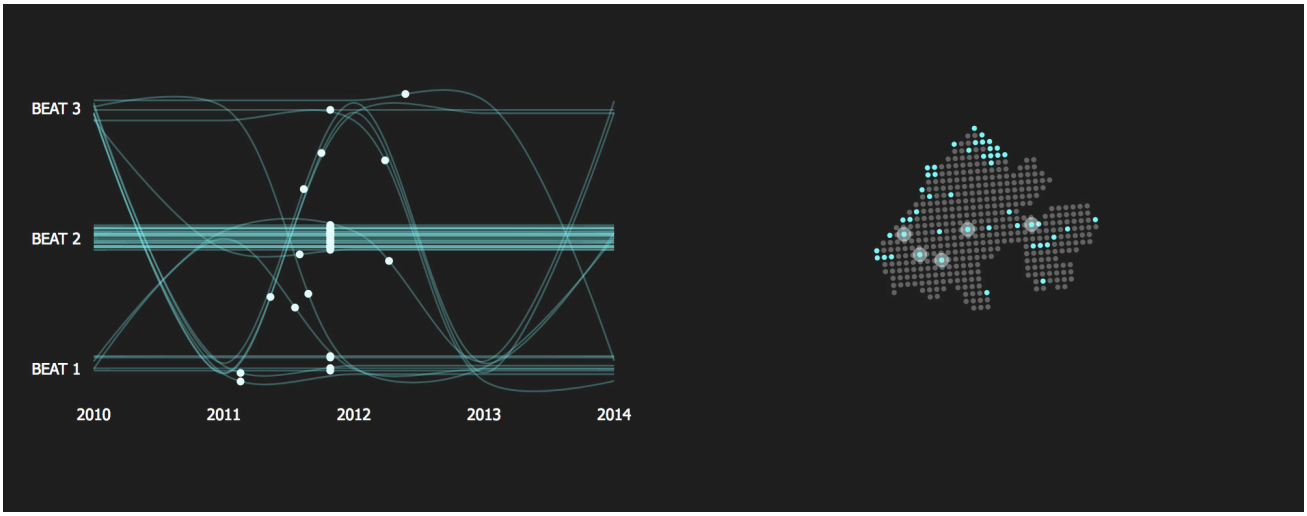
Societies have become communities of digitally mediated systems and people, and when we analyse or intervene in current situations and design future contexts, all these three paradigms of human experience have to be taken into account. Each paradigm includes specific requirements regarding the effective execution of power and the design of trust. In between participation and surveillance, between being open and closed, between high trust and low trust, communities of systems and people take shape. City Rhythm aims to contribute to integrating these three paradigms of human experience for participatory, open, and high trust societies by focusing on rhythm.

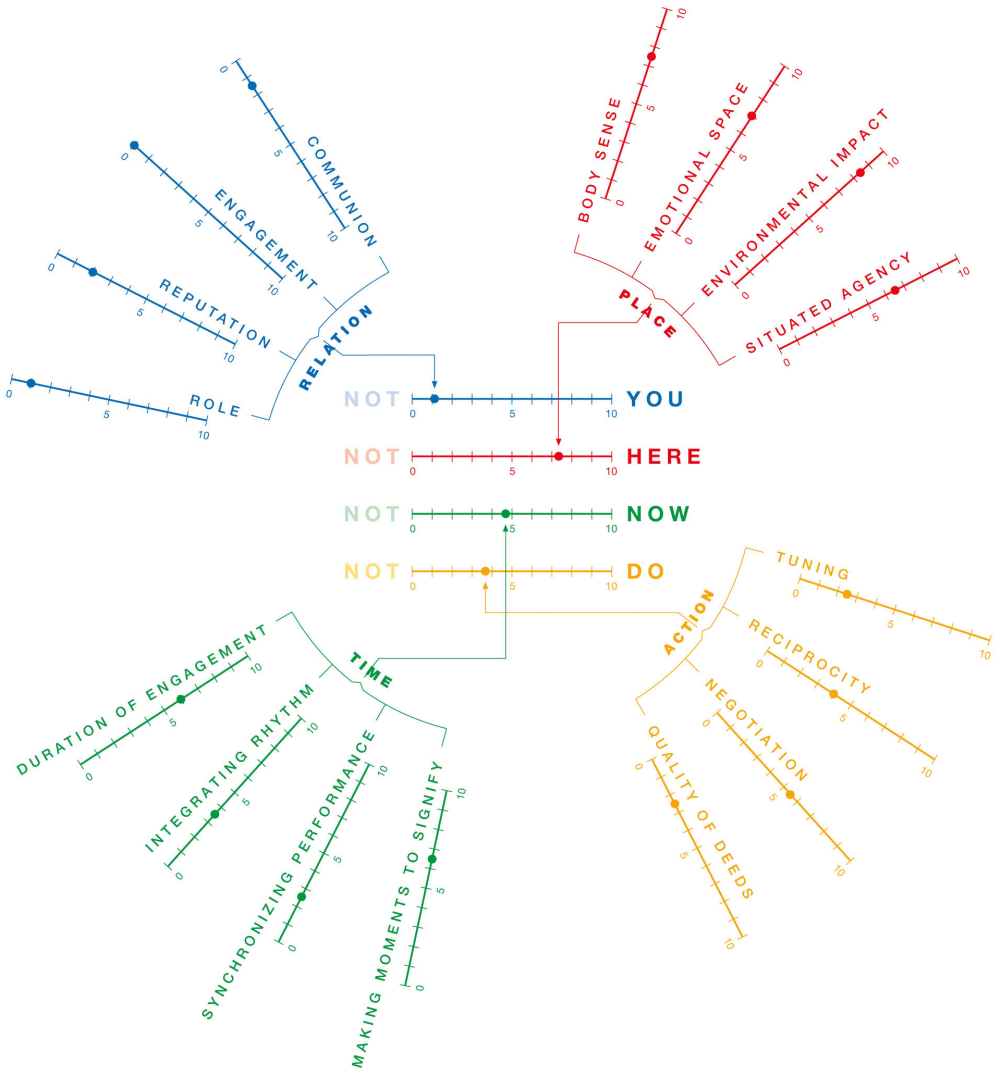
Recognizing each other

When people meet, we recognize each other's spatio-temporal trajectories; we see each other move and in our interaction we recognize how the other person moves in relation to oneself. A nurse moves differently than a construction builder; a bartender moves differently than a schoolteacher; a child moves differently than an elderly person, and a woman moves differently than a man.

According to Thomas Kuhn, this recognition is a requirement for developing shared concepts and a shared language (Kuhn 2000). When recognizing each other, people synchronize and tune their rhythm to each other (Gill 2015). Recognizing each other is important for feeling safe. Recognizing each other affects how people trust one another.

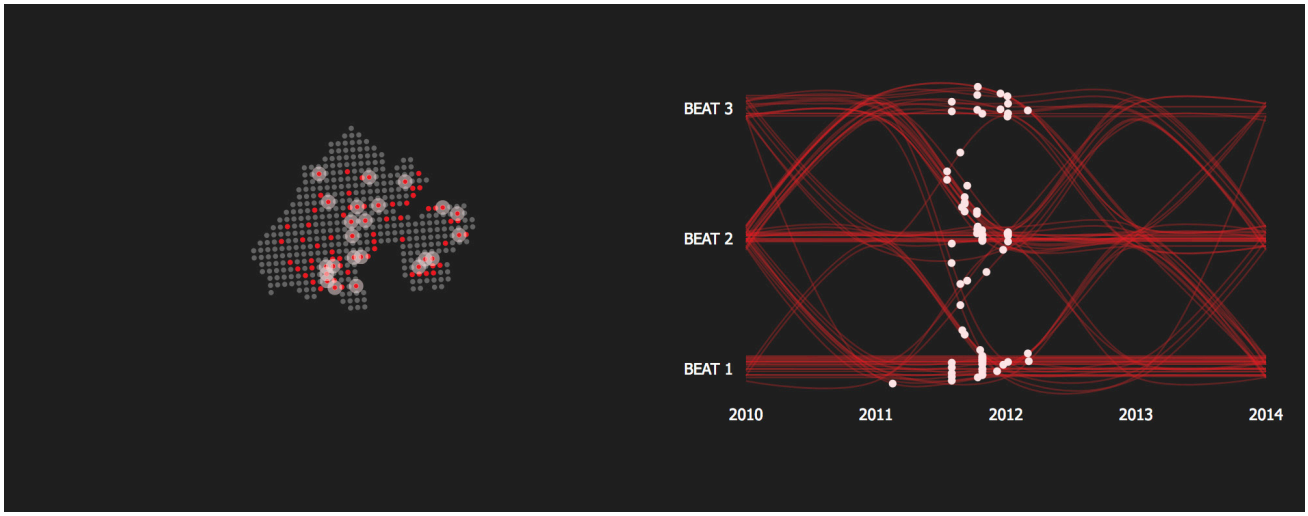
Today we live in 'communities of systems and people'. Systems recognize patterns but do not offer rhythm to which human beings can tune. People are having to adapt to mechanical patterns; we have to regularly. What is the effect of such adaptation? How does this affect our ability to recognize each other and develop a shared language?





YUTPA Framework Dimensions	Time	Place	Relation	Action
	Duration of Engagement	Body Sense	Role	Tuning
	Integrating Rhythm	Emotional Space	Reputation	Reciprocity
	Synchronizing Performance	Environmental impact	Engagement	Negotiation
	Making moments to signify	Situated Agency	Communion	Quality of Deeds

Illustration of the YUTPA Framework, graph by Chris Vermaas en Chin-Lien Chen



Systems contribute significantly to societies for energy, water, waste, transport, business, education, medical care, financial systems and more. How do people recognize each other in merging on- and off-line realities? How do people make trade-offs for trust in these complex environments? How do we perform our presence in ‘communities of systems and people’?

Trade-offs for Trust

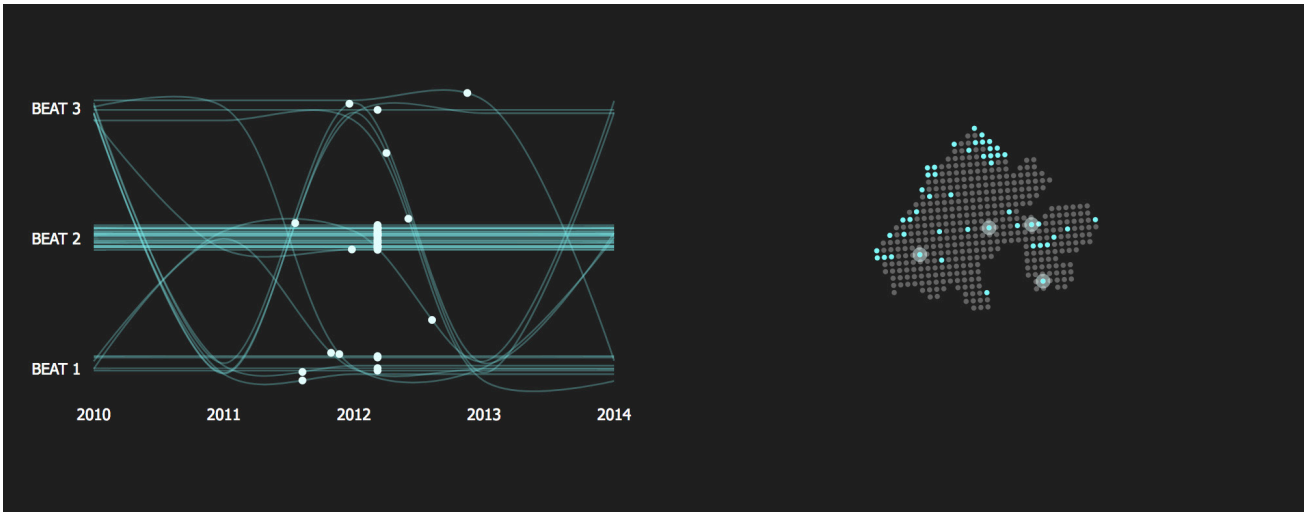
Presence is defined as the striving for well-being and survival (Riva Waterworth & Waterworth 2004). Being present in the world requires the performance of one’s presence. When being born as a woman, one is required to perform as a woman. In this performance of presence, trust is significant. When there is mistrusting in a person or a context, the performance of presence is very different as to when one does trust. Trust affects how presence is performed. We steer away from pain and unpleasantness with our senses, for example, we pull our hand away when the heater is too hot and we do not enter a small alley that smells bad. Sensations, emotions, and more complex feelings of friendship or hate, solidarity or disgust, define how we decide to trust situations and people or not (Damasio 2003).

Decisions to trust are based on trade-offs. One can never be sure because there is no end to detail. Trust is not a given, it is a trade-off and a choice (Nevejan 2007, Narayanan, 2009). It is argued that in this trade-off for trust in complex on- and off-line environments, not only ‘time’ and ‘place’ affect this trade-off, but also ‘relation and ‘action’ are dimensions that contribute to the trade-off. As a result, the YUTPA framework was developed in which different factors that affect trade-off for trust are identified (Nevejan 2007). One of these factors is “integrating rhythm”.

YUTPA Framework

In the YUTPA framework, there are 4 dimensions of Time, Place, Action and Relation, in which 16 factors that affect trade-offs for trust are identified (Nevejan & Brazier 2012). To each of these factors a value needs to be given. These are counted and added to the other 4 dimensions, in which also every factor is given a value. The outcome of these values and the outcome of the calculation, offer an indication of how trust is established or not.

A specific coding has to be made for giving value to the factors which contribute to establishing trust in a given situation. If one lives on a piece of land for 80 years, this ‘duration of engagement’ has a high value because the 80 years contribute to the trade-off for trust in the agreement that the land has a high value. However, when downloading a piece of software, the same people may agree that the shorter the download the better, so a short period generates a high score/evaluation for of the duration of the engagement. In relation to this, the YUTPA analysis is a ‘talking tool’ because it requires different stakeholders to agree about the coding of a value before this value is given to a factor. In other situations, in scientific studies for example, one can make a coding scheme beforehand and apply this to data one has gathered. In the case of City Rhythm, the YUTPA framework was also used to make social cohesion operational and used to map the micro data sets from CBS onto the different factors.



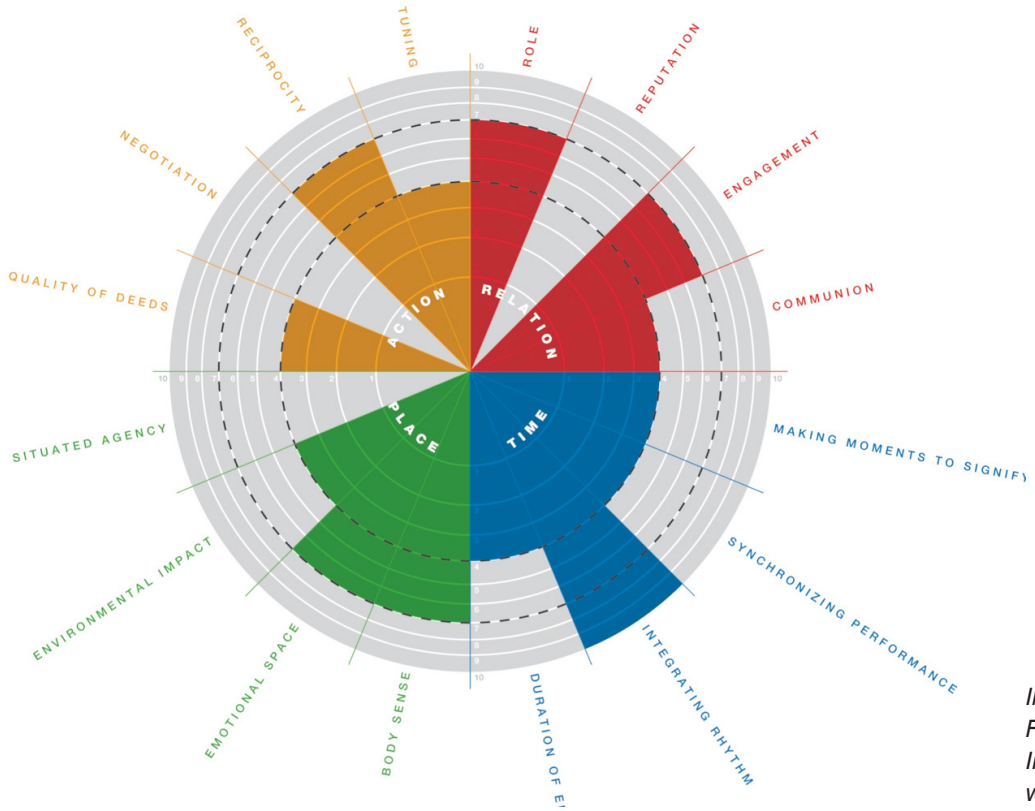


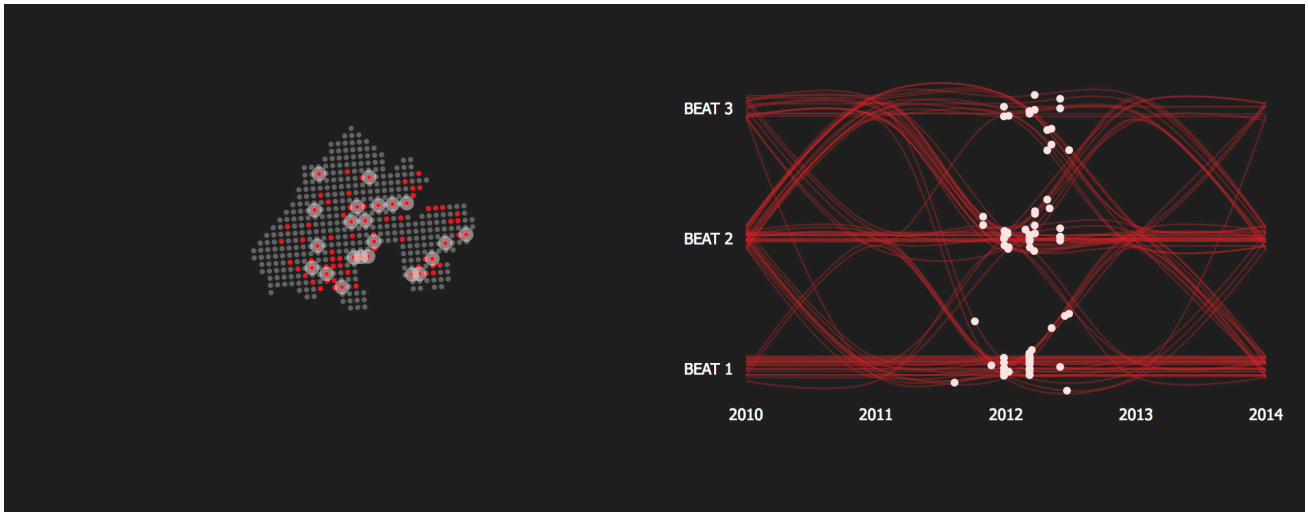
Illustration of the YUTPA Framework indicating the Integrating Rhythm factor with the highest value

YUTPA is the acronym for 'to be with You in Unity of Time, Place and Action', referring to the original and physical state in which people meet. New information and communication technologies have added a lot of value to new possibilities to 'stay in touch' and do business 'anytime and anywhere'. Also in local contexts, online realities merge with offline presence at home and in the streets. In these new technologies people's presence is formatted and as a result, new ways of establishing trust emerge. The YUTPA framework is developed to shed light on new trade-offs for trust that emerge in these merging realities.

Integrating Rhythm

The human body consists of rhythms, as nature and the universe: the rhythm of the sun and the stars, the rhythms of the seasons, the rhythm of the moon and the tide. We can feel these rhythms with our body, which is full of rhythms as well. We perceive rhythm both inside and outside ourselves.

In preliminary research into how trade-offs for trust are made several experts commented on rhythm as an important dynamic in the striving for well-being and survival, and in the establishment of trust



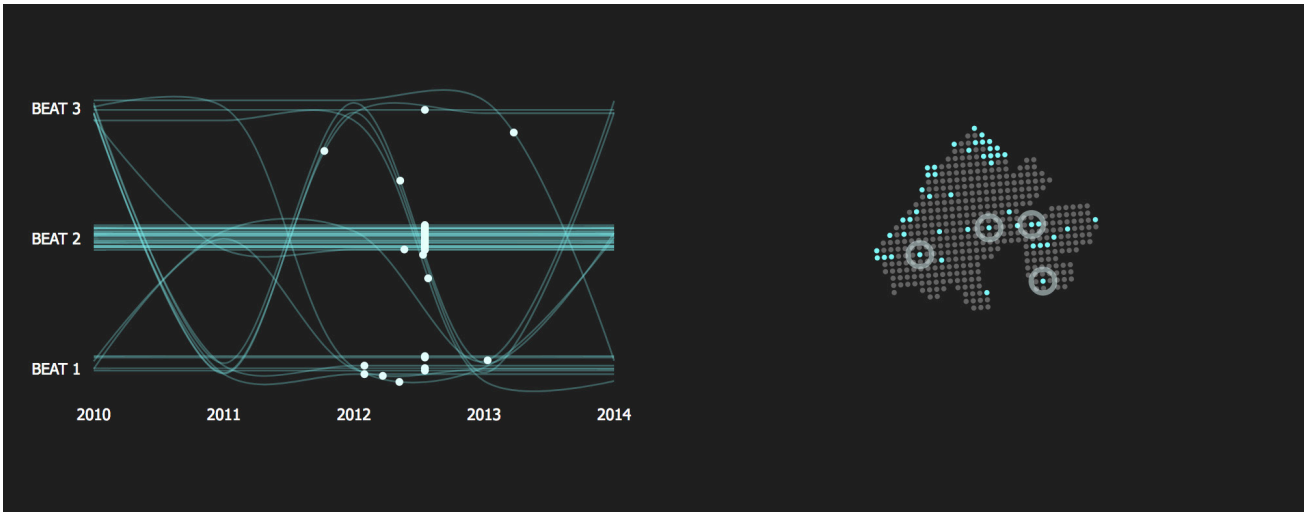
as well (Nevejan 2012). Rhythm is fundamental to communication (Gill 2009). In communication people synchronize rhythm. Without rhythm hardly any communication is very difficult possible. When a break in the flow of rhythm happens, a moment of attention emerges. Rhythm can function as a holding for atmosphere and supports people into participating in this atmosphere, as well as that it supports the getting of attention because a break in rhythm occurs. Also in theatre, rhythm in activities and actions is fundamental to making and communicating a theatre play (Lavery 2009).

In work rhythm is very important. One of the experts from India reports on communities of craftsmen, who have been practicing specific skills for over 2 millennia (Panghaal 2008). To these craftsmen rhythm is fundamental for being able to sustain the repetitive actions that some crafts demand. With the right movement and the right rhythm, energy is generated instead of consumed. Another expert told a similar story about a very different work setting in today's network economy (Wilson 2008). In her online software development firm, in which employees work from out in different countries and hardly ever meet In Real Life, the rhythm of meetings is fundamental to the success of development. Even when classical trust criteria like capacity, integrity, and benevolence, are met, the creation and production of shared rhythm is also fundamental to success in communication and transactions in the virtual world.

This insight is confirmed in a negative way in the outsourcing industry in which where services are provided for customers in other parts of the world (Ilavarasan 2008). Because the work is often too mechanical and does not provide any chance for tuning into one's own rhythm, new illnesses like depression and heart failure have spread considerably in these environments (Ilavarasan op cit.). From an artistic perspective experts report that to construct time, to construct a rhythm that is recognized and experienced, is more and more a challenge in this world where music is often played to ignore as happens in supermarkets and public spaces to (Feigl 2009, Twaalfhoven 2010).

Rhythm and Atmosphere

The image on right gives a first indication of the results of the research into rhythm and data, displaying the 7 base rhythms of the six participating cities. The City Rhythm Data Model identified street and base rhythms, which was run with the open micro data from CBS (Central Statistics Bureau). Base rhythms give an idea about the 500x500 meter areas who have had the same similar states and transitions over time. In other words, base rhythms give an indication of similar type of atmosphere in those grids. Explanation of the base rhythms can be found in Working with the City Rhythm Data Model section on page 120.



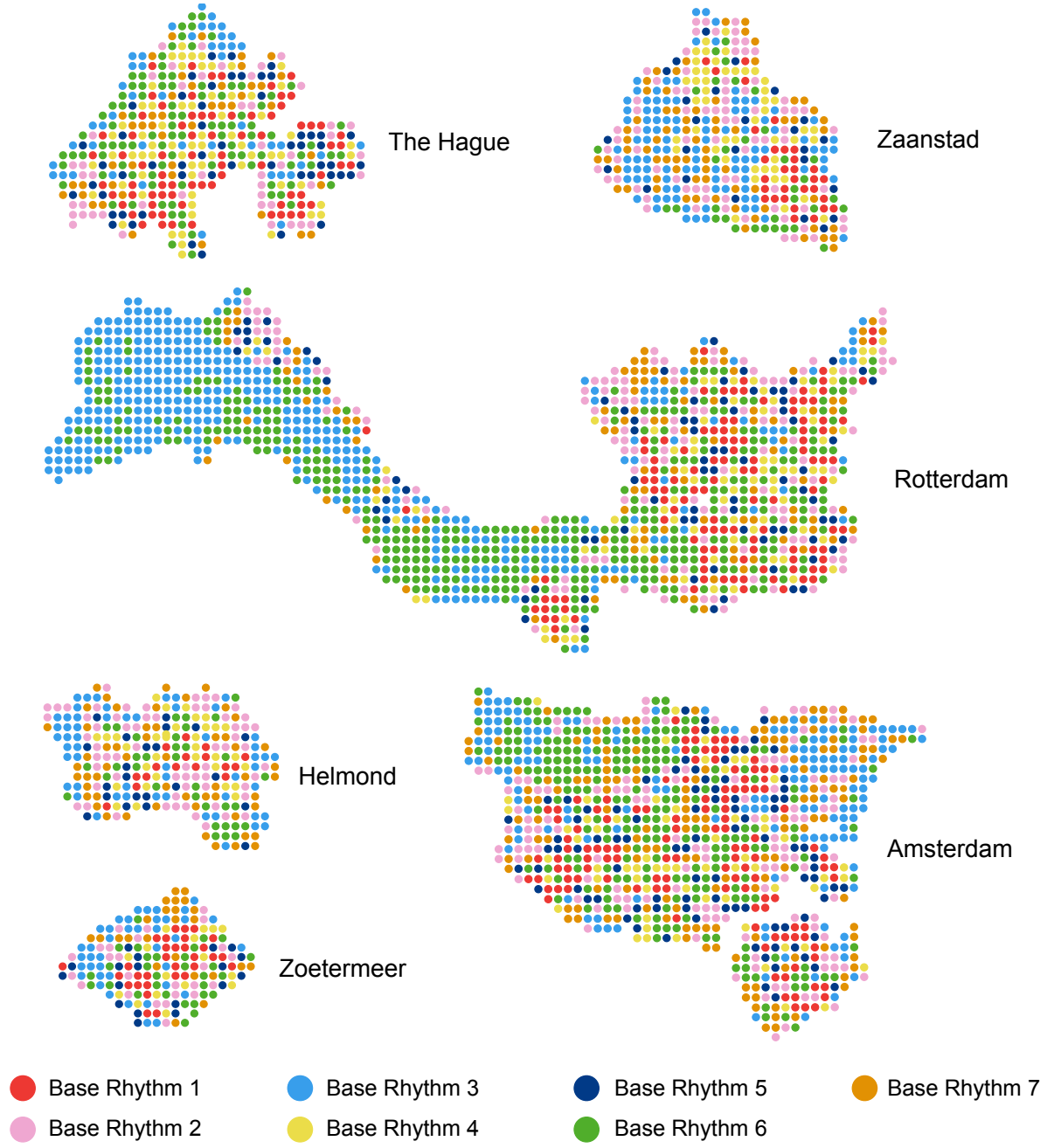
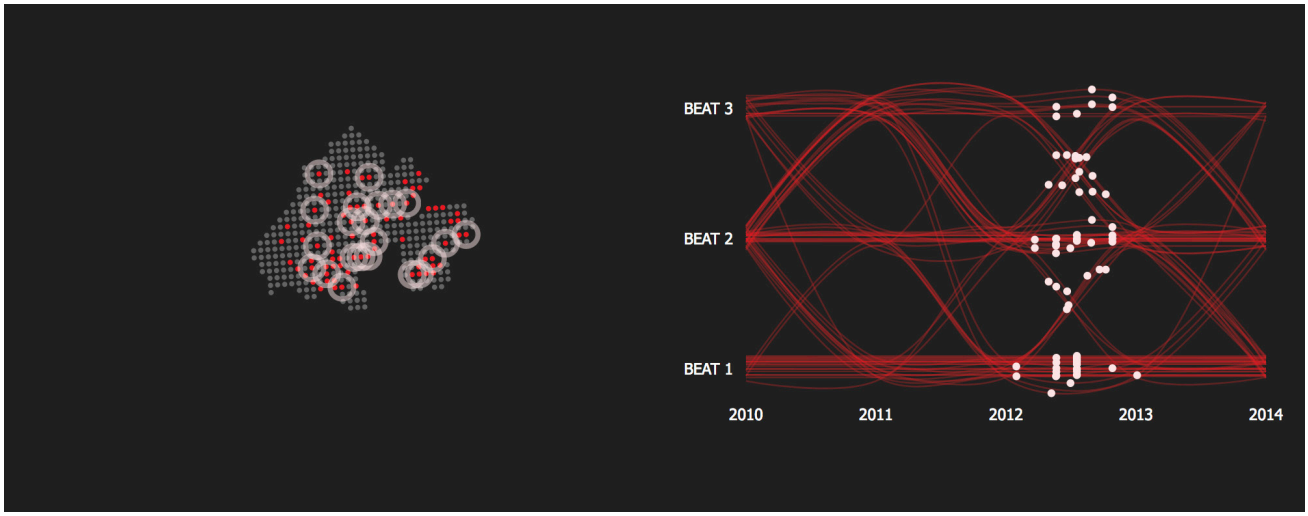
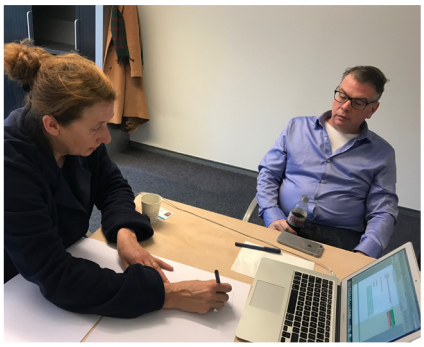


Illustration presenting the participating cities with 7 base rhythms, each base rhythm corresponding to an area of 500x500m, by Lene Böhnke, Thu Vu, Pinar Sefkatli.




VISUAL RESEARCH
RHYTHMANALYSIS
MEERZICHT

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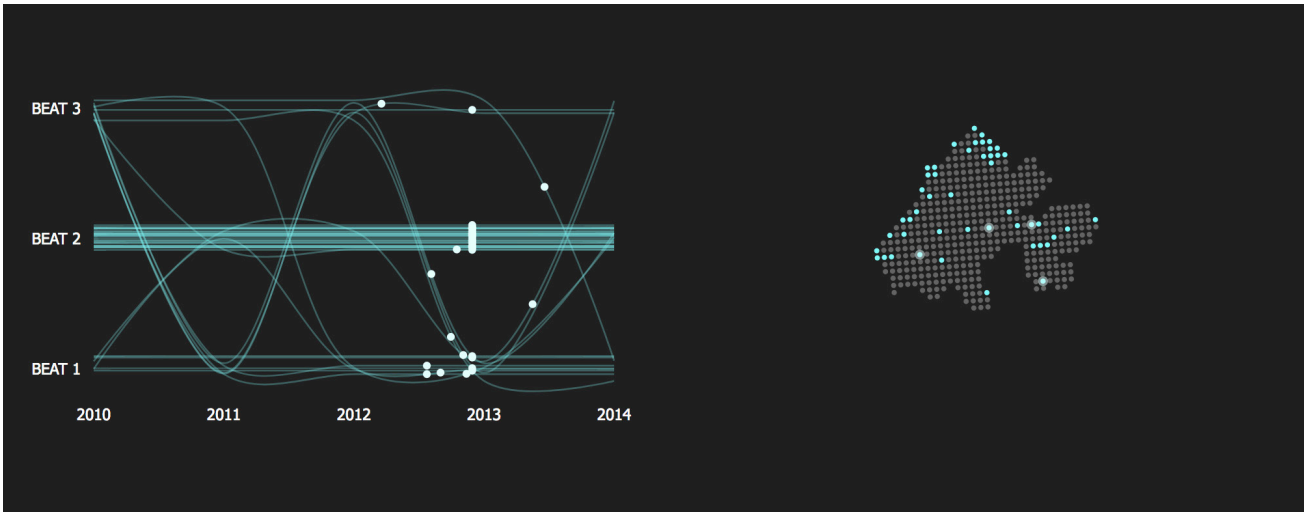
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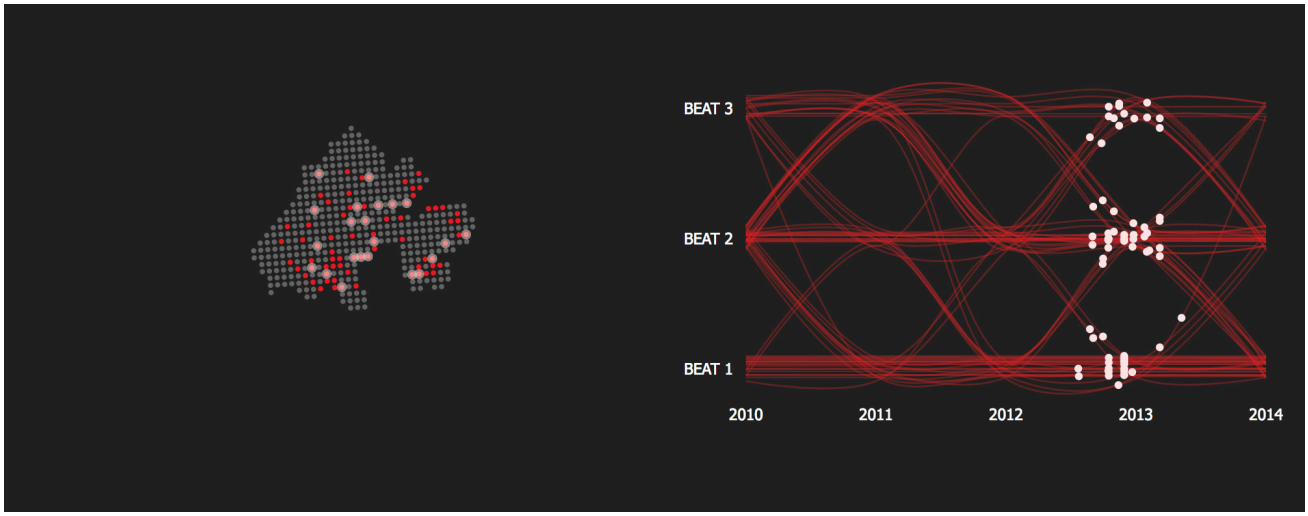
Together let's use ou
the Netherlands, for
AMS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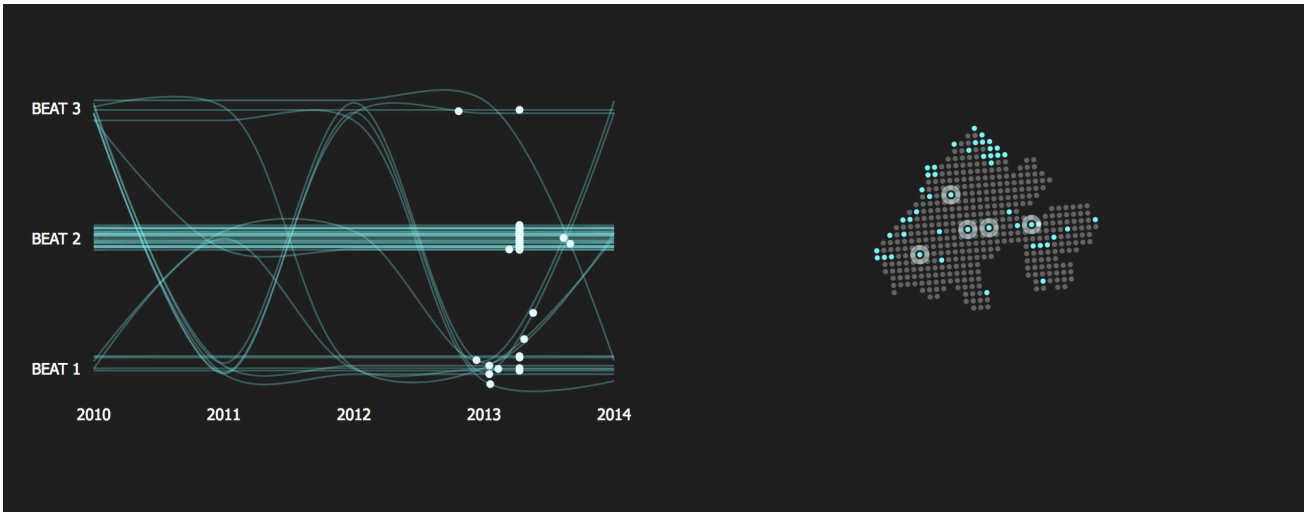
Research Design

by Caroline Nevejan



City Rhythm consists of several explorations: case studies by students, expert focus groups, workshops on artistic research and the development of a data model for identifying Rhythm in large urban datasets. All researchers, civil servants and students have worked in the online Open Research platform in which work in progress is shared.

Social Rhythms in the Physical World

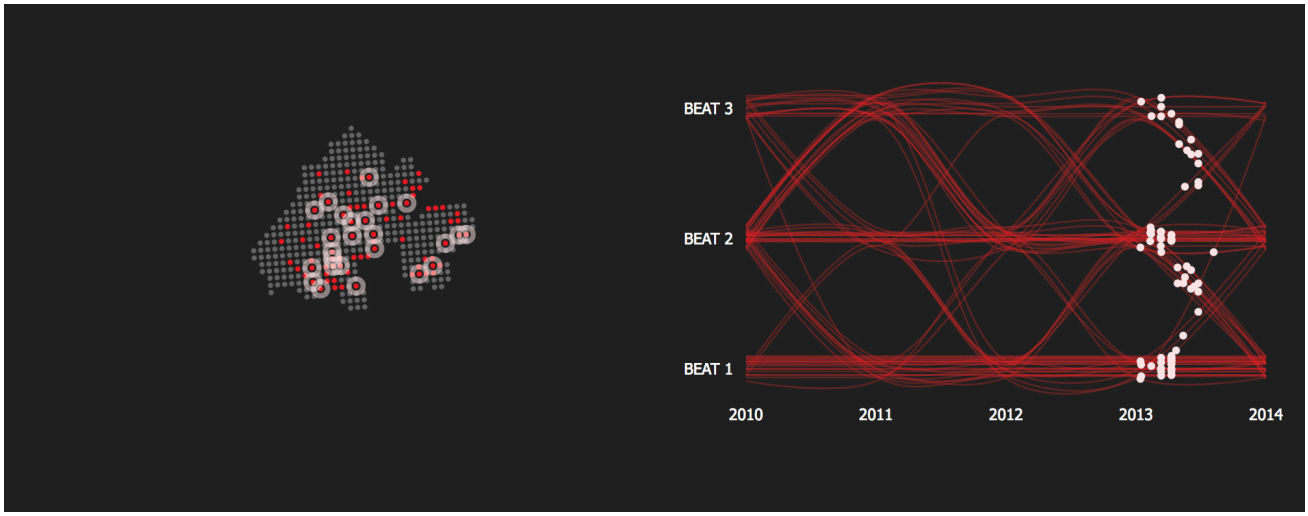
Data driven Policy: focus groups with civil servants
Several focus groups are organized in which over 30 civil servants from different municipalities participated. Civil servants who are working with IT and civil servants who are working in policymaking together analysed where and how urban data sets are currently used in policymaking processes. Obstacles for creating data driven policy are identified and potential for rhythm analyses of urban data is explored. Finally, the research question is formulated (for results see part 2).

Social rhythms in the physical world: Case studies with students
In 9 case studies students of the LDE minor Responsible Innovation have explored the potential of rhythm analyses for policymaking. Between civil servants, researchers and teachers specific research questions, in particular neighbourhoods of 500 by 500 meters in the 6 participating cities, are formulated. The students have worked on these questions under supervision of the professors from the universities and with guidance of the civil servants as well. The students are instructed to different methodologies from the social sciences and architecture for which they receive specific skill labs every week. These rhythm analyses are discussed in the different neighbourhoods with stakeholders and on the basis of these rhythm dialogues interventions are executed. The interventions are evaluated with stakeholders and final analyses are presented. The students conclude their assignment with a policy advice to the municipality where they executed their case study. At the end of the half year working with the students in the cities we conclude – between civil servants, researchers and students - that rhythm analyses provide new avenues for local policymaking provided questions are concrete (for results see part 2).

Modelling Urban Data

The nature of rhythm: expert session with artists on rhythm in artistic practice:
A special expert session with visual and musical artists explores the nature of rhythm in different artistic practices. Artists work with rhythm as part of the experiences they create or design for others everyday. In this expert session this artistic tacit knowledge on rhythm is explored in a long concentrated conversation.

Understanding the unfolding of rhythm over time: workshop on Tabla
In a special workshop between the artist Sirish Kumar, the principle investigator and the director of the data team of City Rhythm and curator Susan Benn, the knowledge on rhythm in the tradition of Tabla is explored. The Tabla drums are part of India's musical tradition and recognize more than 107 different rhythms. After the workshop, Sirish Kumar has visualized some of these rhythms (see part 3 for results).



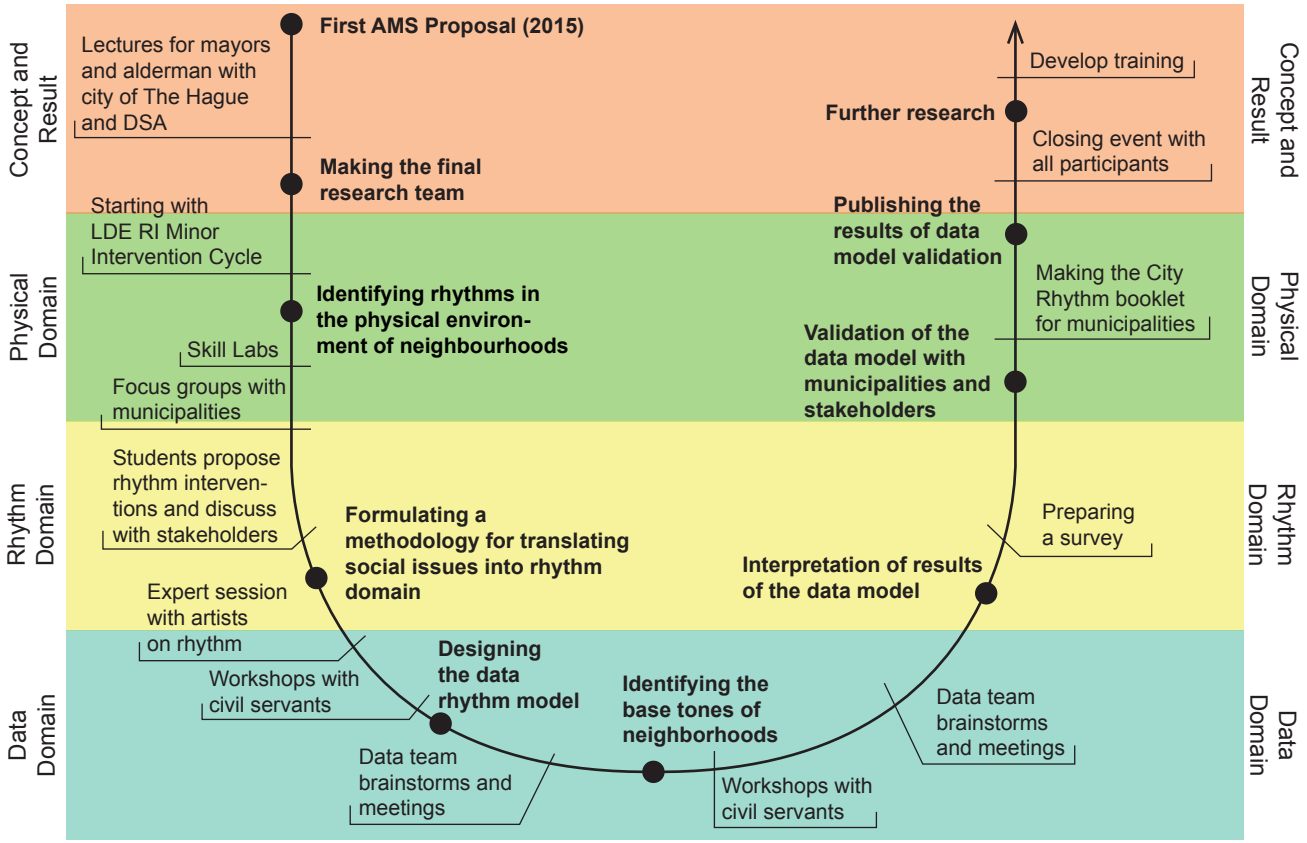


Diagram showing the research design process, by Pinar Sefkatli

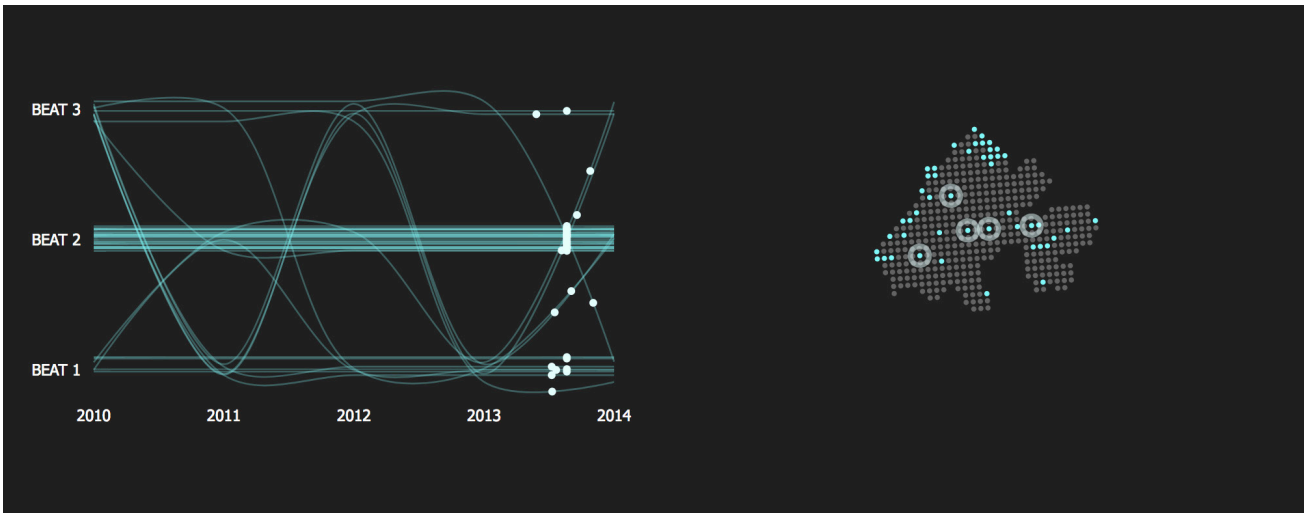
14

Data on social cohesion: workshops between researchers and civil servants

In several workshops the relation between data, rhythms, social cohesion and policymaking are discussed. When making an analyses with digital municipal data on social cohesion, specific datasets need to be identified that can be proxies for social cohesion. We also find that cities have different datasets in different formats. In the end it is decided to work with CBS data, so the to be developed model can be applied to all 6 cities. It is also decided to use the YUTPA framework on trust for mapping the micro data from CBS.

From Rhythm to Algorithm: developing a data model for rhythm analyses

The development of the data model requires new members to join the research team. Different approaches to data are discussed and finally the Mixed Hidden Markov Model was chosen to approach the question on identifying rhythm in large data sets. It allows for the data 'to speak' and to show transitions over time. The model is validated by discussing its output, on the same research questions as the students addressed, with civil servants and stakeholders involved (see part 3 for results).



Conclusion
The research concludes that rhythm analyses in the physical world and in the digital data world, opens up new avenues for policymaking. Further research needs to identify how these two kinds of analyses can be done in relation to one and other. Further research also needs to engage with more granularity in the data and needs to address how these kinds of analyses can become 'easy' to use.

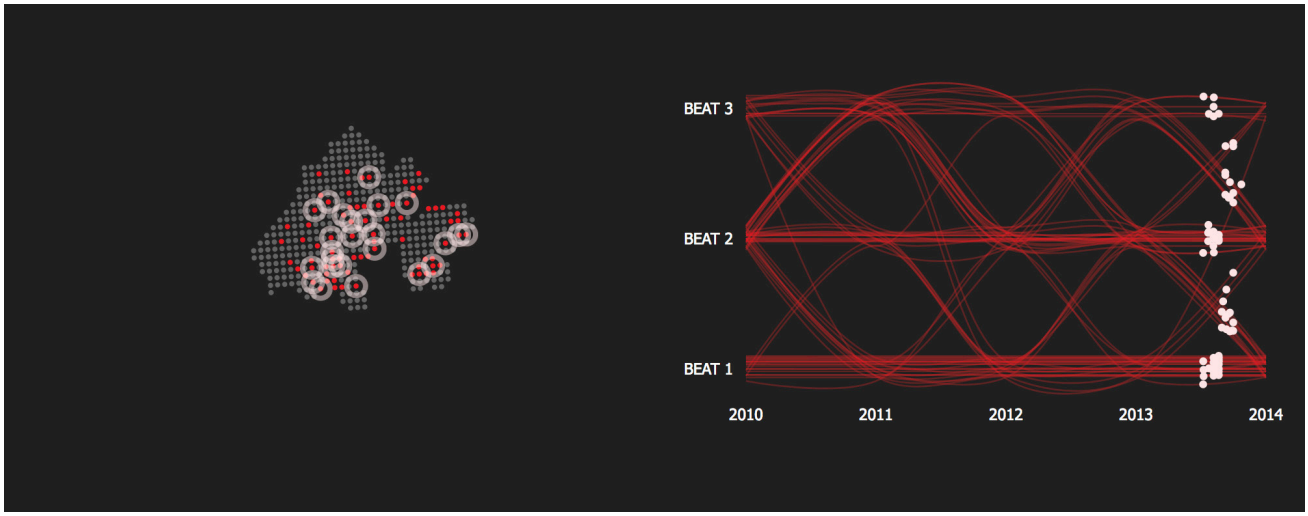
Commitment, Copyright and Finance

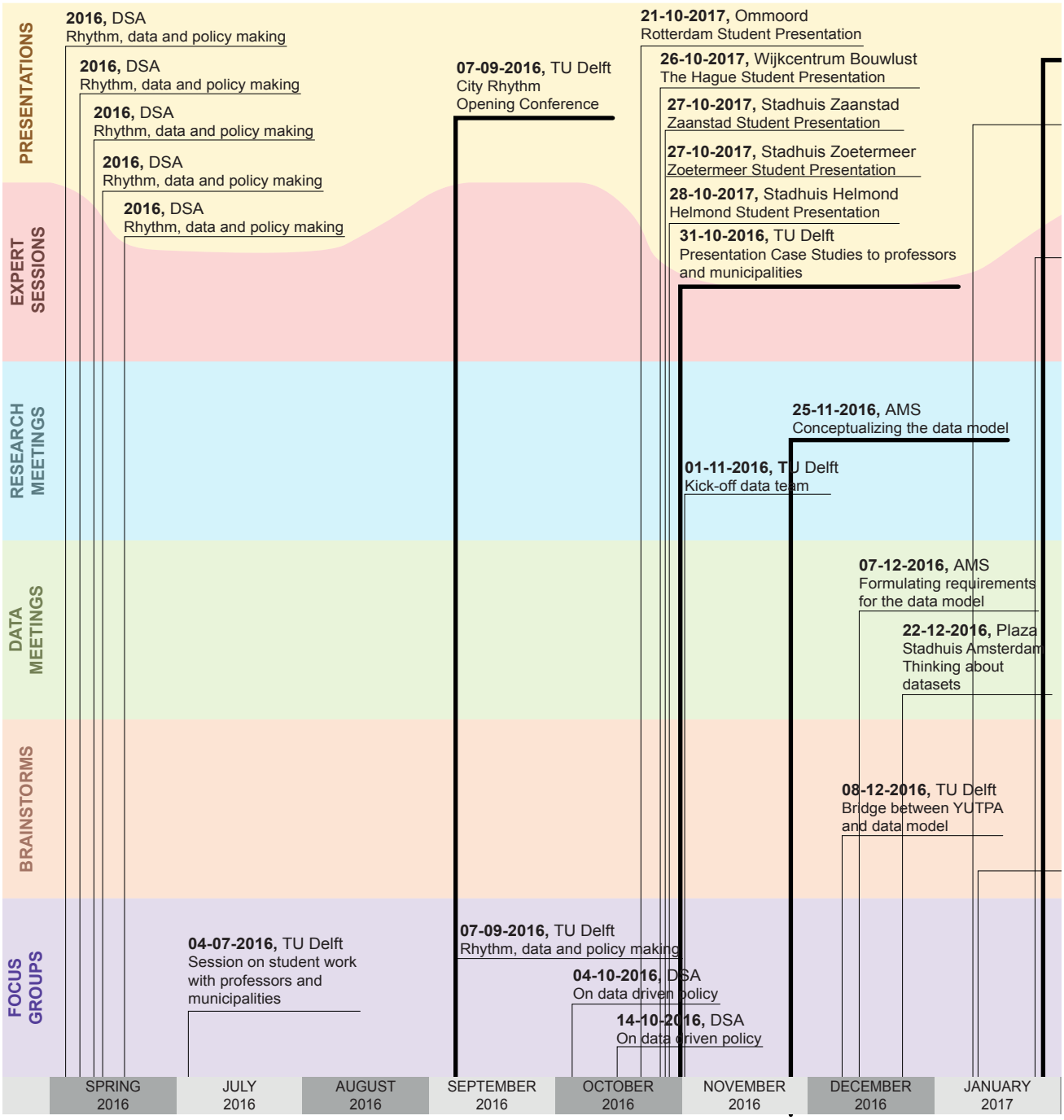
Understanding the processes for data-driven policy from a democratic perspective acquires urgency by the day. Therefore, it has been possible to request financial support from the cities as well as active participation and 'hours spent' by civil servants. The commitment of the municipalities and civil servants is significant to the outcome of the research. A 'key person' in each municipality is directly involved throughout the whole research process and invites other colleagues to specific meetings as needed. Apart from these deeply engaged individuals, we are supported by committed political administrators.

The Amsterdam Institute for Advance Metropolitan Solutions (AMS Institute) supports and facilitates the research from the start, providing a 'neutral ground' for the universities and municipalities. Whilst working in the public domain with public money and being involved in a shared effort to contribute to a positive input for policymaking, copyright has not been an issue. The researchers and municipalities agreed to work under the Creative Commons License, and others can use the results, provided that they cite the source (the project work) and do not commercially exploit it.

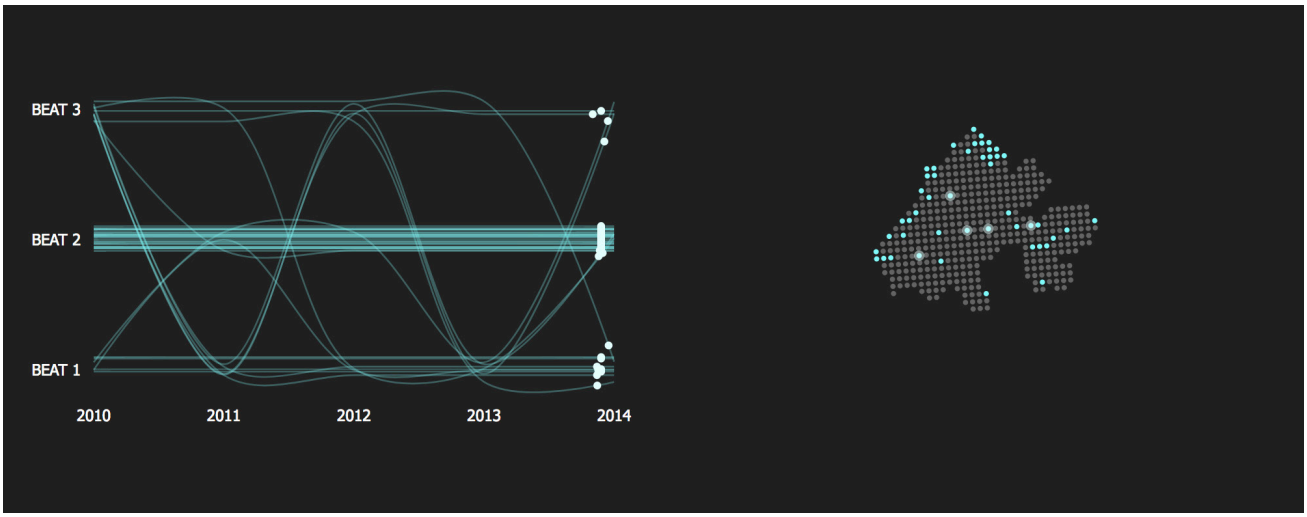
The contribution of Delft University of Technology was central. The Multi Actor Systems group of the Faculty of Technology, Policy, and Management offered initial support before all the finances were agreed upon and protected the exploratory nature of the research throughout the process. Having a finance department which is reliable, flexible, and dedicated to think with you in making things happen, is crucial for exploratory and interdisciplinary research design.

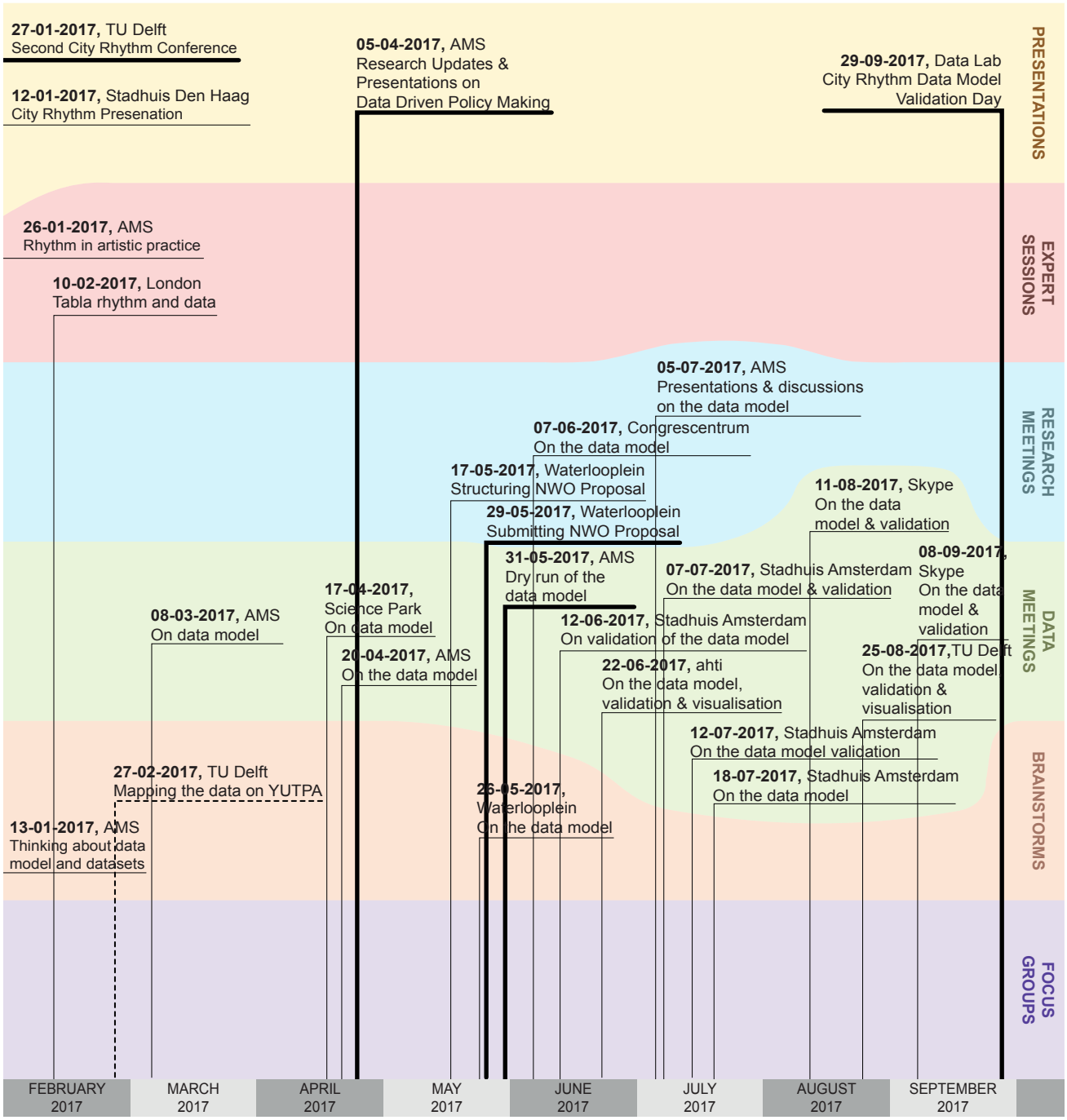
As is illustrated on the next two pages, smooth collaboration between so many different disciplines, stakes, and perspectives demands for a shared performance at different moments in time. Inventing the 'rhythm' of the City Rhythm research consortium has been a real challenge. Orchestrating this rhythm between focus groups, brainstorms, data meetings, expert sessions and presentations requires a delicate balance. Too much silence creates unrest, to fast a rhythm creates fatigue. The rhythm in research needs to facilitate thinking time, making time and sharing time and each of its moments has to be communicated in friendly and clear and accessible way.





City Rhythm time line showing the one year research trajectory.




27-01-2017, TU Delft
Second City Rhythm Conference
12-01-2017, Stadhuis Den Haag
City Rhythm Presenation
05-04-2017, AMS
Research Updates &
Presentations on
Data Driven Policy Making
29-09-2017, Data Lab
City Rhythm Data Model
Validation Day
PRESENTATIONS
26-01-2017, AMS
Rhythm in artistic practice
10-02-2017, London
Tabla rhythm and data
EXPERT SESSIONS
05-07-2017, AMS
Presentations & discussions
on the data model
07-06-2017, Congrescentrum
On the data model
17-05-2017, Waterlooplein
Structuring NWO Proposal
29-05-2017, Waterlooplein
Submitting NWO Proposal
11-08-2017, Skype
On the data
model & validation
RESEARCH MEETINGS
31-05-2017, AMS
Dry run of the
data model
07-07-2017, Stadhuis Amsterdam
On the data model & validation
08-09-2017,
Skype
On the data
model &
validation
08-03-2017, AMS
On data model
17-04-2017,
Science Park
On data model
12-06-2017, Stadhuis Amsterdam
On validation of the data model
20-04-2017, AMS
On the data model
22-06-2017, ahti
On the data model,
validation & visualisation
25-08-2017,TU Delft
On the data model
validation &
visualisation
DATA MEETINGS
12-07-2017, Stadhuis Amsterdam
On the data model validation
18-07-2017, Stadhuis Amsterdam
On the data model
27-02-2017, TU Delft
Mapping the data on YUTPA
26-05-2017,
Waterlooplein
On the data model
13-01-2017, AMS
Thinking about data
model and datasets
BRAINSTORMS
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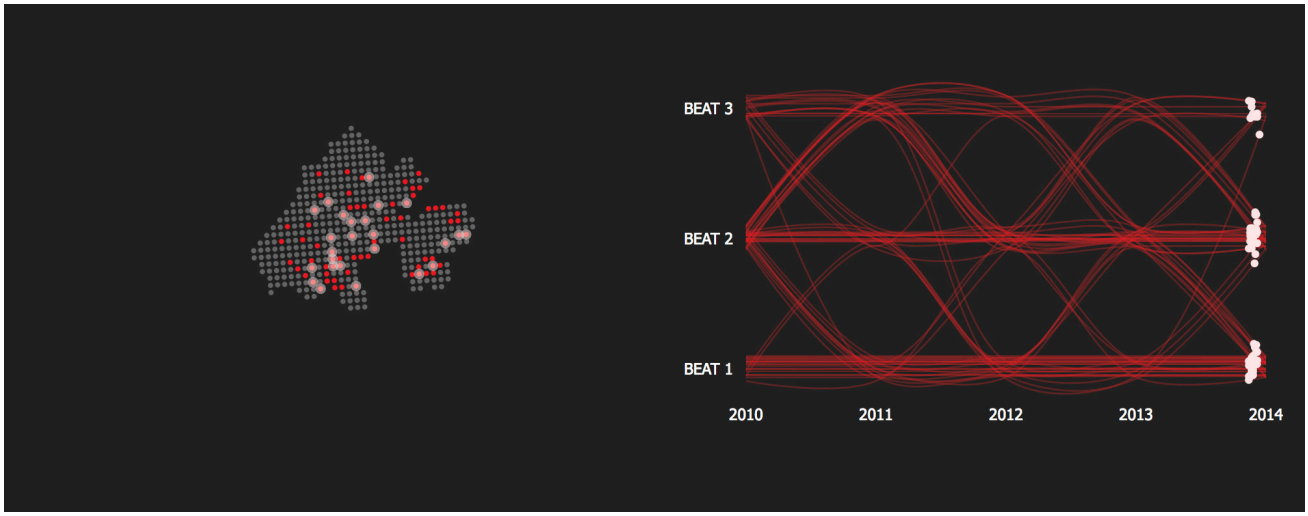
AUGUST 2017
SEPTEMBER 2017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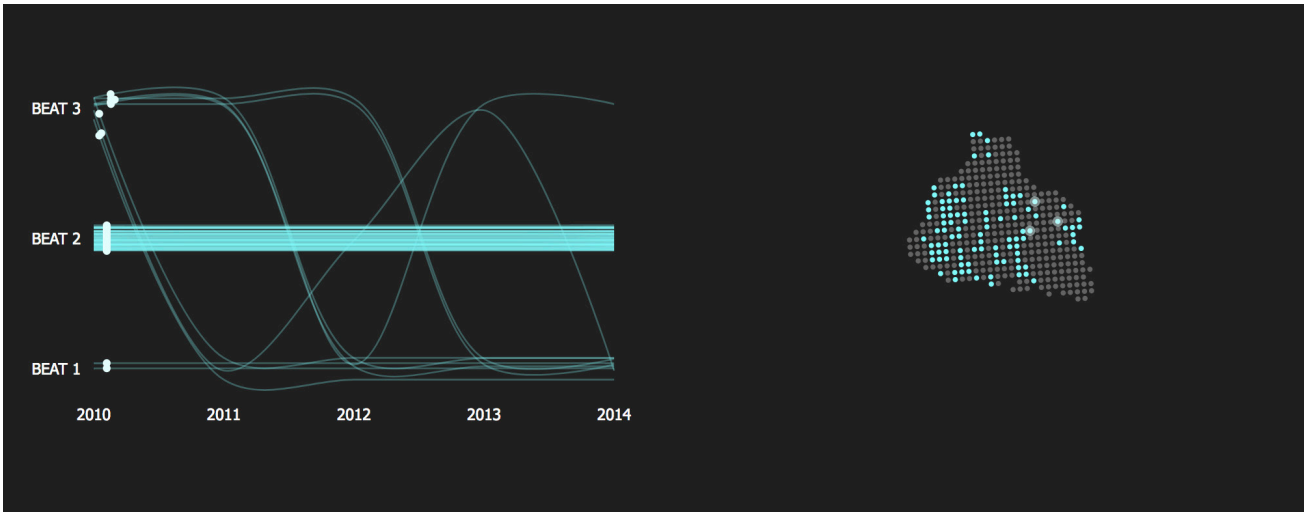
Photos from City Rhythm presentations, events and research meetings. From left to right: 7/06/2017 Workshop at Congrescentrum Amsterdam, 5/04/2017 Workshop at AMS Institute, 4/07/2016 Focus Group at TU Delft, 7/04/2016 Workshop at DSA, 7/06/2017 Workshop at Congrescentrum Amsterdam, 31/05/2017 Dry Run at AMS Institute

Interdisciplinary Research

City Rhythm has been an interdisciplinary venture from the beginning in which we had to build bridges between each others' language, practice and thinking. In such a process of co-creation one can intensely enjoy others capabilities and one can also be very annoyed by not being able to understand or be understood. Of course things also go wrong, which is an essential element of being successful. Each of the members of the research team has given this 'extra space' to others by enduring moments of 'incommensurability' (the not sharing of what one is sure about) and giving others the benefit of the doubt.

In day-to-day life knowledge about rhythm is mostly intuitive and hardly formulated. Personal taste, experience, culture, physical capacity and more all make a difference when perceiving and discussing rhythm. Professional knowledge about rhythm is very different in realms of, for example music, physics, policymaking or data science. In any of these disciplines there are again very different approaches to rhythm. A rock and roll guitarist has different knowledge, skills and insight in rhythm than an Indian Tabla player has. Yet at the same time, all and everyone recognize a rhythm instantly. It is part of the force of nature.

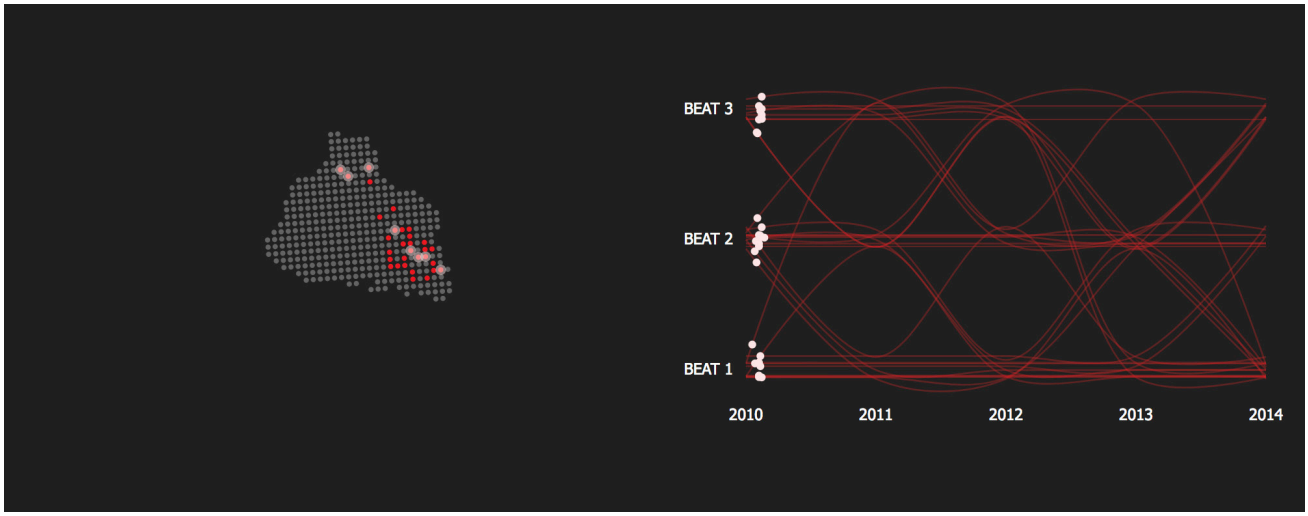
In the exploration of City Rhythm, we have had many conversations where we have had to ask

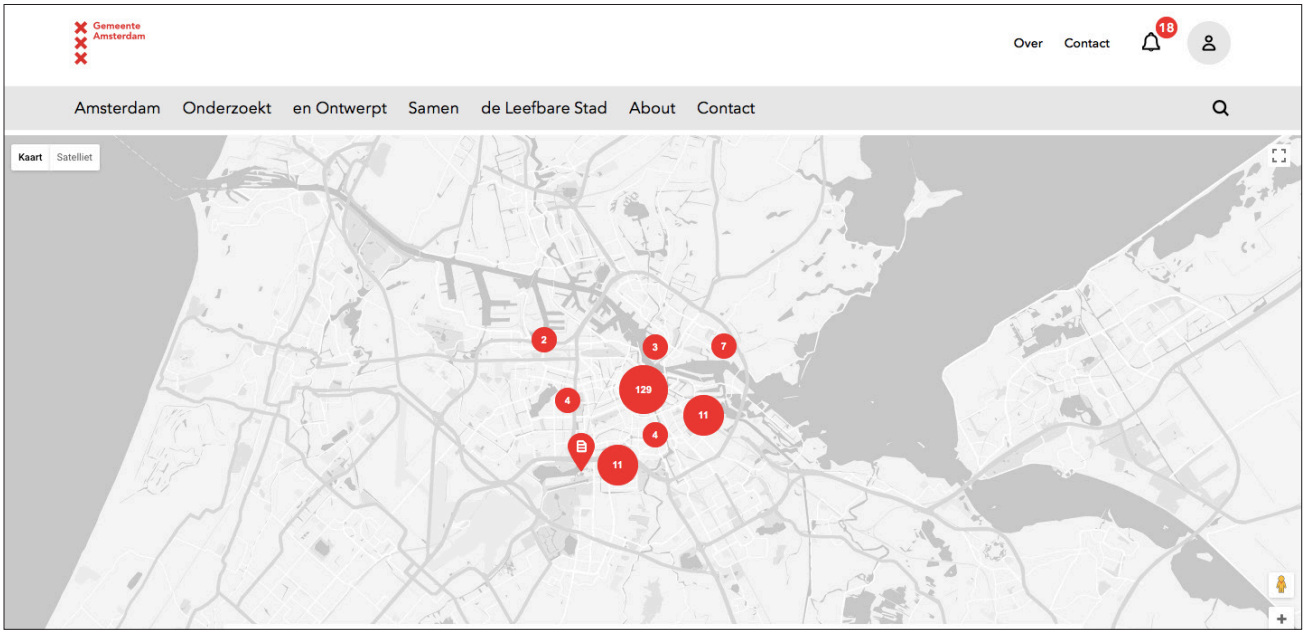


Photos from City Rhythm presentations, events and research meetings. From left to right: 5/07/2017 Workshop at AMS Institute, 26/01/2017 Expert session with artists at AMS Institute, 25/08/2017 Data Meeting at TU Delft, 26/01/2017 Expert session with artists at AMS Institute, 5/07/2017 Workshop at AMS Institute

again and again ‘what do you mean with this term?’ and if we forgot to ask, immediately communication decreased and people disengaged. This is why interdisciplinary research is so hard; one has to stop taking one’s own thoughts and ways of doing for granted. The tone of voice in an email, the tone of voice when formulating critique or appraisal, the time spent on keeping everyone on board by asking a question that may slow down the process of exploration, is fundamental to interdisciplinary collaborations. Only when such time is appreciated, the results of the research will have the depth of the different perspectives that engaged with the research in the first place.

When doing exploratory research, the full research trajectory is not known beforehand This ‘incommensurability’ – the not sharing of fundamental things one is sure of – has to be addressed throughout the process in every meeting we have. Civil servants, coming from different backgrounds with different insights and skills, and researchers from diverse disciplines, all have to agree on the steps of the process we are engaged with and the kind of quality each of us, and we-as-a-research team, expect. Also, every member of the research team is part of a municipality or a university to which one has to explain why the time is spent on such an exploratory study of which results are not visible yet. So, we have to address this occasionally to check whether we can still defend the work we do to the stakeholders at home



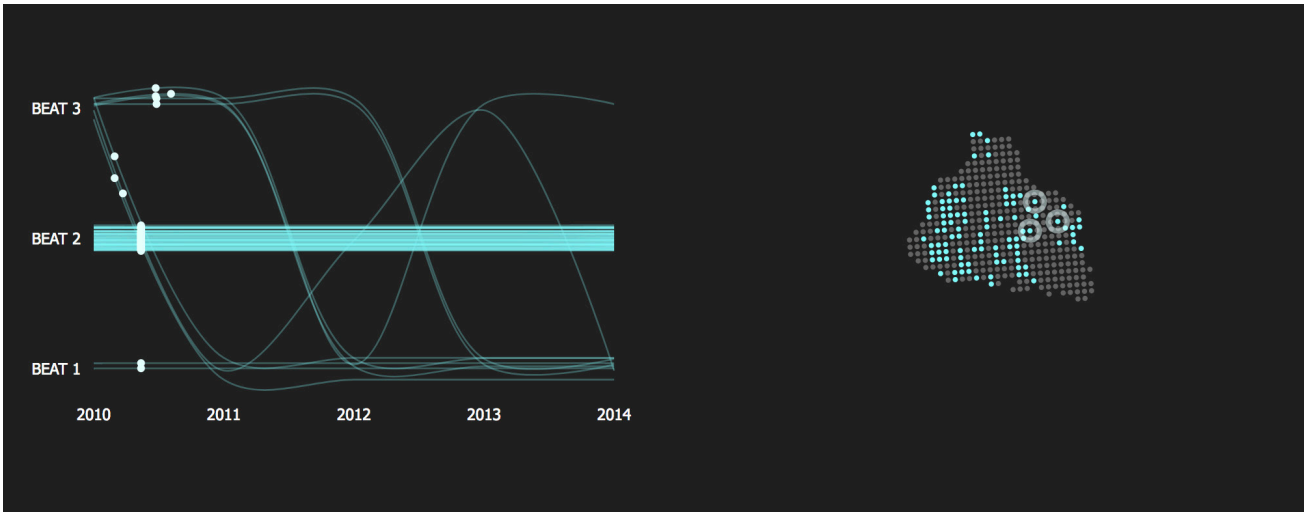


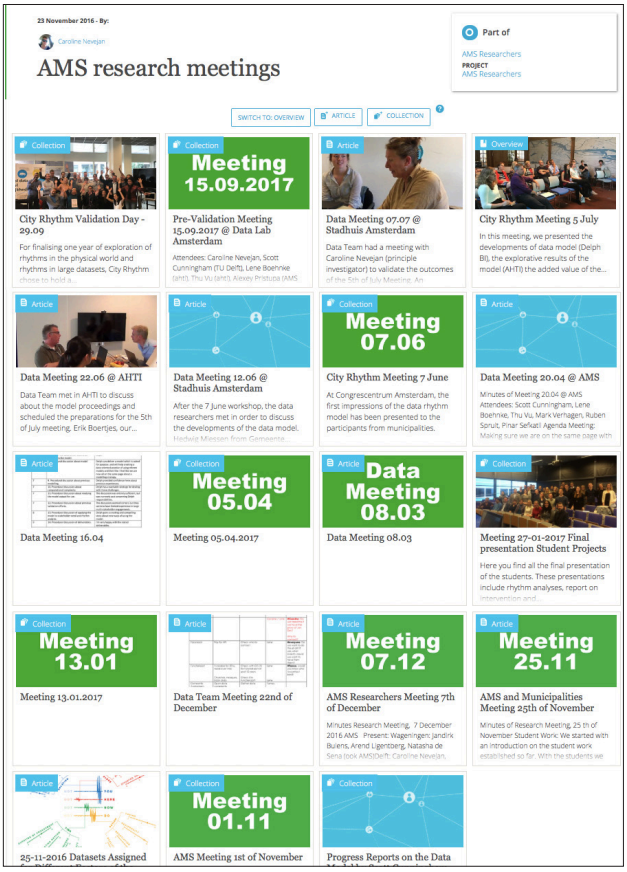
Screen shots from Amsterdam and TU Delft Open Research Platforms: Amsterdam Open Research Platform Home Page (left) AMS Researchers Project Group Workspace (right)

who are not involved.

In the effort to understand each other it was highly important to visualize and discuss at every step in the research process. We needed to ask each other 'Do you see what I see?', 'Do you agree with this quality of output?', 'Do you think this is the next step?' Meetings were prepared for and chaired by the principle investigator. At specific times, different members of the scientific research team and/or different members of the municipalities research team and/or the students present findings. Rhythm of a collaboration emerges yet needs to be orchestrated and co-authored all the time. Different methods for harvesting knowledge and insight are applied in workshops and the further down in the research process we get, the more fluent these meetings unfold.

It was a true pleasure to participate in so many unanticipated conversations with unexpected results. Even the moments where conversation scrambled and ideas were colliding, it was very exciting to be part of this. Of course a few times we also have had serious communication problems. Luckily some of us speak different professional languages between policymaking and research and could help to translate. Most important though, was the fact that every member of the research team was willing to engage and did not give up when things were unclear and/or difficult. In special meetings, with some of us mediating the different positions, these communication problems were solved and the quality of collaboration benefited from such moments very much.



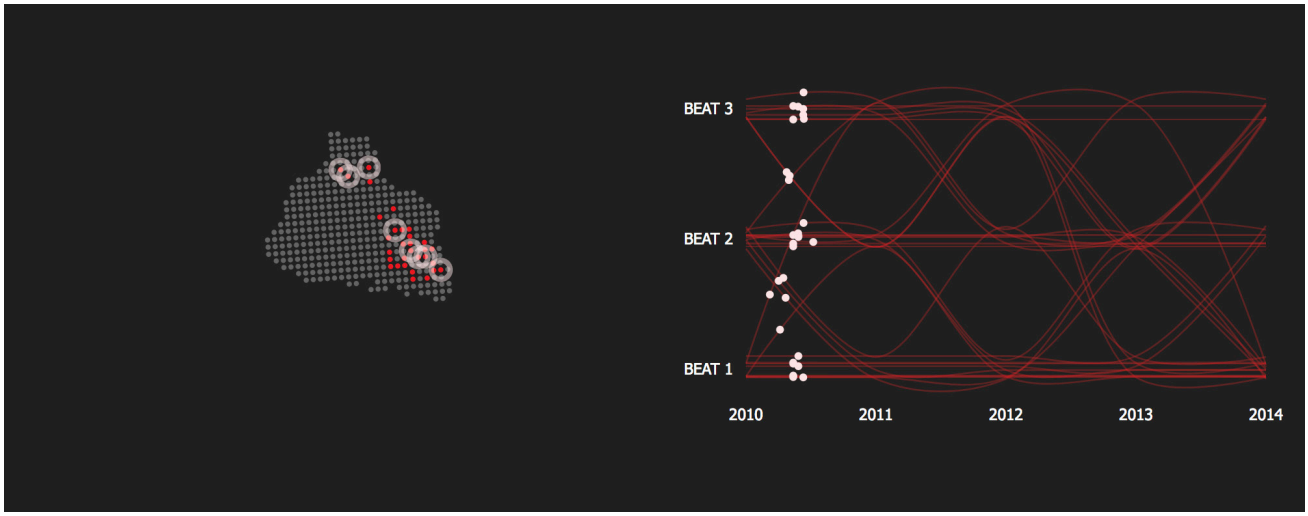


We have been developing a shared language together, learned to recognize and appreciate each other's effort in work and in formulating critique as well. We also learned about each other's 'meta-communication' skills. As principle investigator for example, it is important to embody the vision of the project and orchestrate the co-creation process as best as you can. Where in the beginning this PI position is easily perceived as a position of authority, later in the process other members of the team feel comfortable to comment and adapt the vision and fully participate in the co-creation process. It became a true 'collaborative authoring of outcomes' (Humphries & Jones 2006).

Documenting the Research

In view of the collaborative effort of the exploratory research trajectory, documentation of the work is of utmost significance. This helps to gather, to formulate, to summarize, and to inform people who miss a session. It shows previous conclusions and decisions to the people who are doing the work. Especially in interdisciplinary research one easily forgets the previous steps that have been taken and results that have been reached. When working outside one's own discipline, recognizing and acting upon results is more complex. The celebration of work both in presentation and in documentation, through visualizing as much as you can, and by taking care of good food and drinks as well, makes interdisciplinary work possible and the best there is after all.

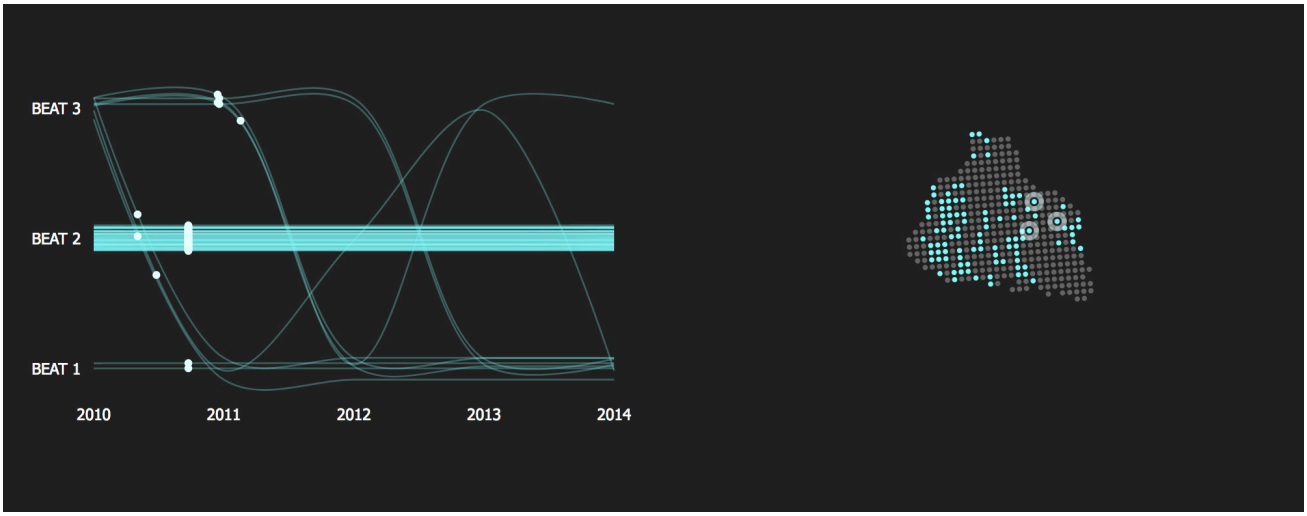
The documentation of City Rhythm has been done on the Open Research platform, which is especially developed in the CMS (Content Management System) Ginger with Driebit, a Small Medium Enterprise in Amsterdam. On this platform different project groups were created for civil servants, and for researchers, while students had their own online project group space. The platform allowed the users to create their own research material in articles, see the updates and each others research material, ask for feedbacks from other users and publish online final results. Thanks to these possibilities, the platform contributed significantly to interdisciplinary research. The City Rhythm Research documents and visualizations can be accessed through the following link: **https://openresearch.amsterdam**



Data for Policy Making

Expert sessions and focus groups with civil servants

by Caroline Nevejan



Exploring the Gap Between Policy Making and Data

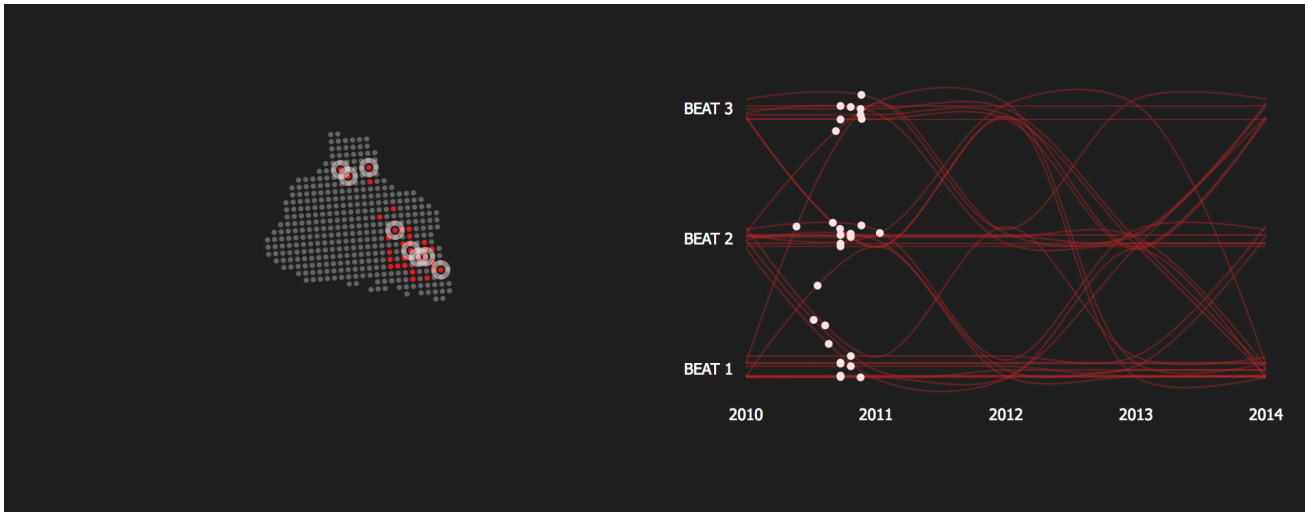
While many people talk about data driven policy, we have yet to invent the service models that are needed for making such a vision come true. There is a serious gap between practices of municipal data departments and the policymakers of the same municipalities who would like to use the data. During the one-and-a-half-year collaboration in the exploratory study City Rhythm, different focus groups, workshops and expert sessions are organized to better understand how data driven policy works.

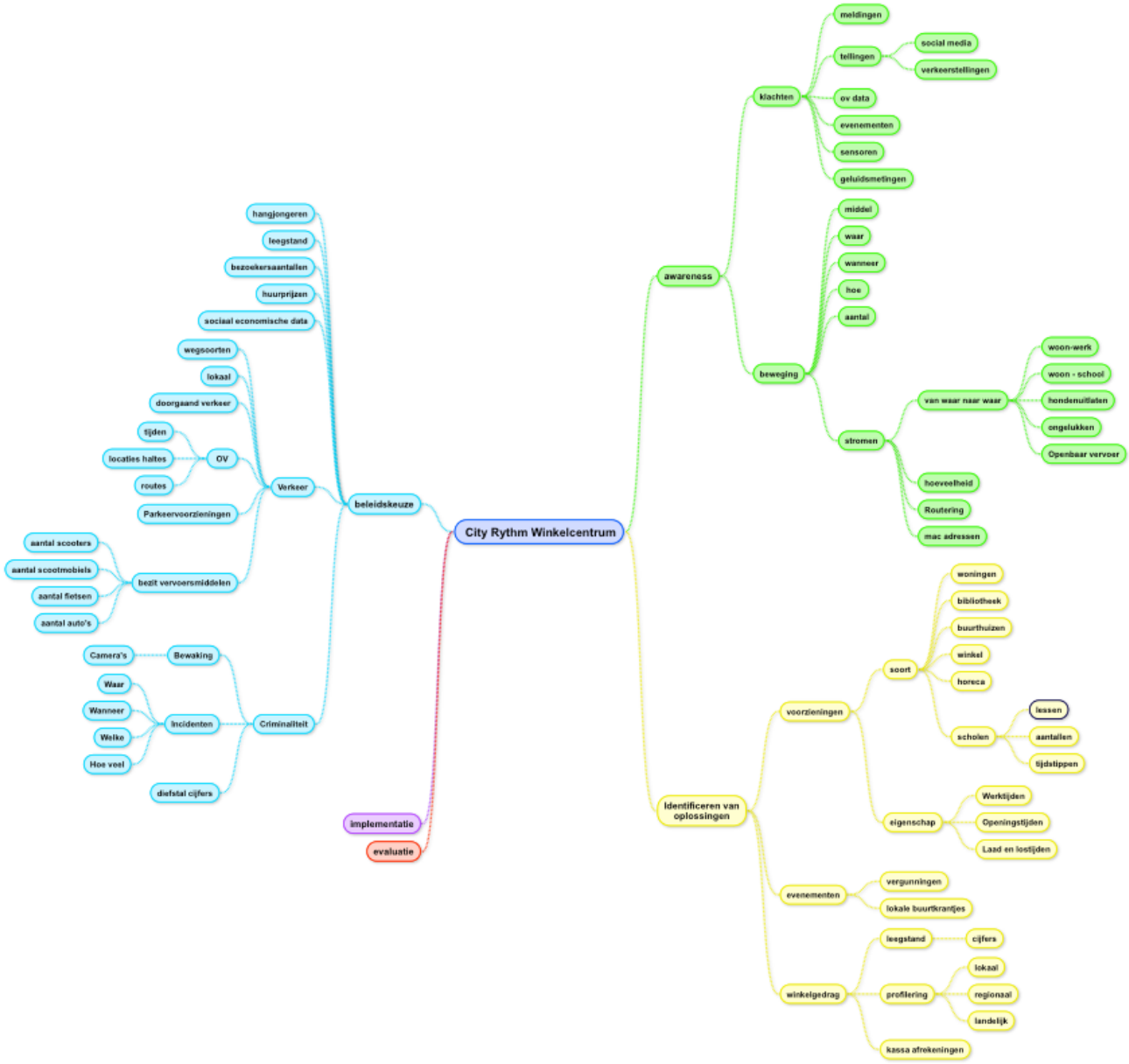
Current practices between the different Dutch cities are shared. The big cities with large IT departments have more statistical expertise in their own municipality, but we find that the smaller cities have more easy access to their data. Each of the larger participating cities (Amsterdam, Rotterdam, The Hague) has their own technical standard and visualizations of the data they gather. Colleagues who make policy in a large municipality are dependent on the IT or statistical department for data and it takes quite a lot of trouble to get these data. This is such an amount of trouble that most policy making colleagues do not make the time. In smaller cities (Zoetermeer, Helmond and Zaandam) the IT and statistical departments are smaller. There is less statistical expertise, yet data are more accessible. In smaller cities, it is much easier to offer data on a one-to-one basis between a data expert and a policy maker.

At the start of the research several focus groups were held in which current practice and future possibilities of data-driven policy making are formulated. The IT people were separated from the policy making civil servants to better understand the dynamic. While intentions of both groups are geared towards ‘data driven policy-making’, it appears that in all the 6 cities data-driven policy making is not in place. It even appears that the processes that can facilitate data-driven policy making, apart from statistical management information, have not been designed yet.

The focus group of policy makers agrees that they do not make much use of the data that are gathered. Sometimes when different stakeholders meet, requests for data input are formulated as part of the process. These are mostly statistical requests that need to shed light on numbers of events or people. Often policymakers are afraid to ask for more fearing they may jeopardize privacy. Legal contexts for working with data are still being developed if they want to include data; they hardly have the necessary time to spend on it.

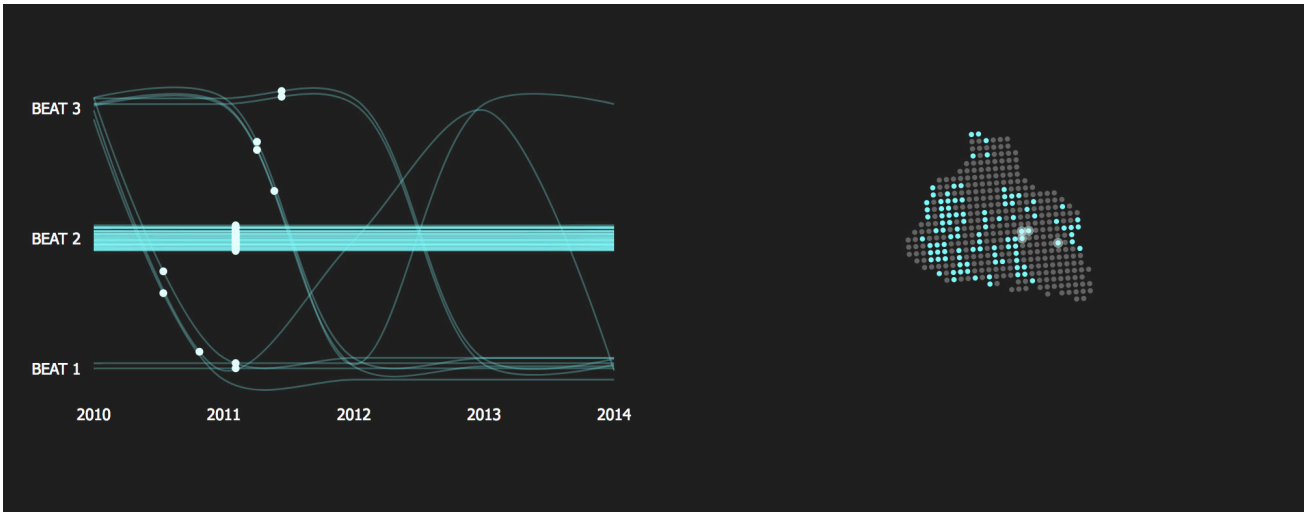
The focus group of policy makers also agrees that policymakers do not know enough about the use of data for being able to imagine how data can contribute to their work. Also in the middle of the political process, in which responsibilities can only be taken in relation to policy documents that are mostly thick reports, it is hard to imagine for policymakers how data driven policy may actually benefit their work. All agree though that data-driven policy will affect their work processes significantly in due time.





Mind map explaining how municipalities work with data, by Antoine Gribnau (Municipality of The Hague) and Rob Polhuis (Municipality of Zaanstad)

Graph explaining the summary of the workshops on data driven policy with the Data and Social Groups (on right)



Data Driven Policy

In the focus group with the data experts it is found that many municipal data departments in the Netherlands are focusing on ‘open data’. This is a new development and departments are adapting their processes to make good data available. It is already a challenge to gather proper and consistent sets of data over time. While the data departments are busy with this, they have little time and attention for studying how the gathered data can be used.

Municipalities are mostly supply driven in their gathering of data. They anticipate a broad target group to make use of their data eventually.
It appears that data departments make little connections to policy making practices. They also resist this for fear of privacy violations.

In different sessions inventories of policy related data sets for social safety are made. We find that both policymakers and IT people can think of many proxies for social safety. A proxy is a specific dataset, which can shed light on a specific issue in an indirect way. For example the amount of times a street bin is full can be an indication (or proxy in data terms) for the amount of people hanging around on a square. Such a proxy is not privacy sensitive yet offers the municipality significant information. Some current and future applications of big data also promise to generate useful information without violating privacy

For data driven policy one needs to identify proxies and combinations of proxies and one has to invent statistical or other models to apply to the data for getting meaningful results. For data-driven policy the choice of proxy for a specific issue is of vital importance. For choosing a proxy one needs to understand the policy issue and one needs to understand the construction of the dataset. Only then meaningful data-driven policy can emerge. For data-driven policy making, one needs both fields of expertise in collaboration with one another. In none of the participating cities such collaboration, as a standard process, is in place.

Data Group

Brainstorm on identifying data sets and understanding which social issues they shed light on.

How do data support policymaking today?
How can Rhythm Analyses help?

CURRENT
- Focus on Open data
- No connection to policymaking
- Supply driven
- Target group is broad
- Resistance for privacy reasons

POTENTIAL
- Value of Data
- Good interpretation is central
- Data analyses supports understanding
- External and open connections
- Municipalities start to organize themselves

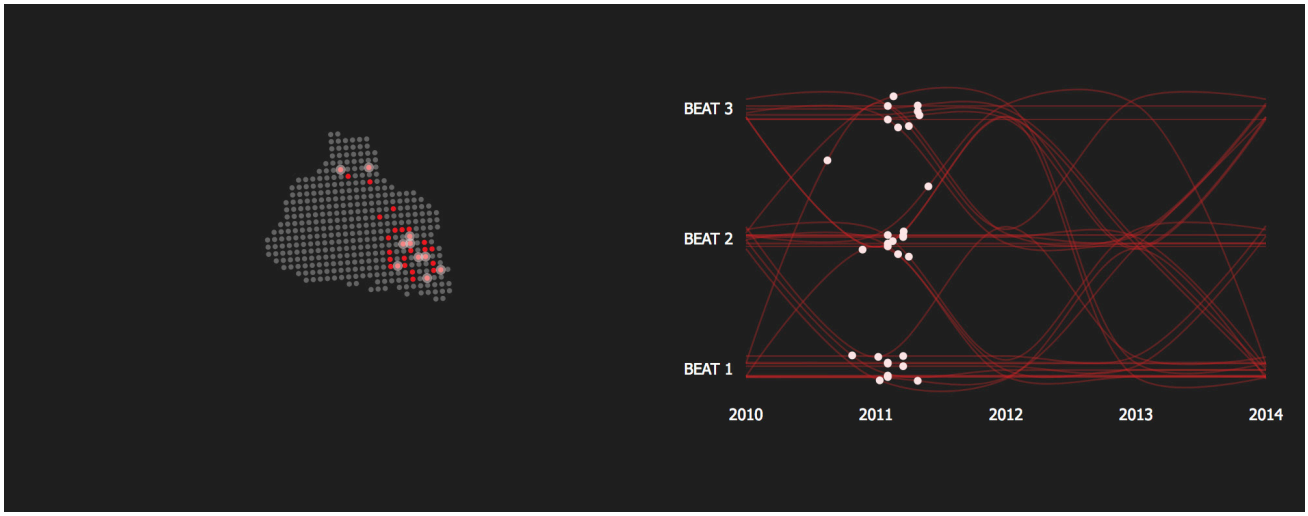
Social Group

Brainstorm on translating social issues into rhythm and identifying data sets that can be useful for the analysis.

How does policymaking make use of data?
How can Rhythm Analyses help?

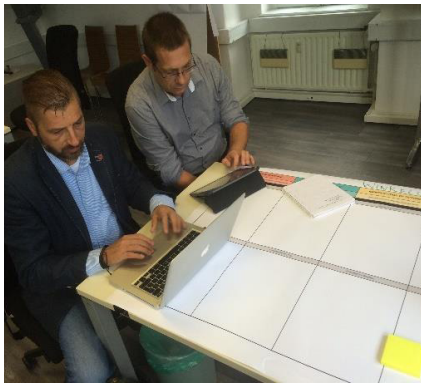
CURRENT
- Limited available data
- No data combinations
- Privacy prevents sharing
- No responsibility without policy document
- Too many thick reports

POTENTIAL
- Matching information municipality needs
- Control over different sources
- Sharing data
- Visualizations
- Anticipating new needs



Peace Around the House,
Data and Policy Cycle Workshop
04/10/2016

Gooitske Marsman (Municipality of Helmond) and Tamas Erkelens Municipality of Amsterdam)

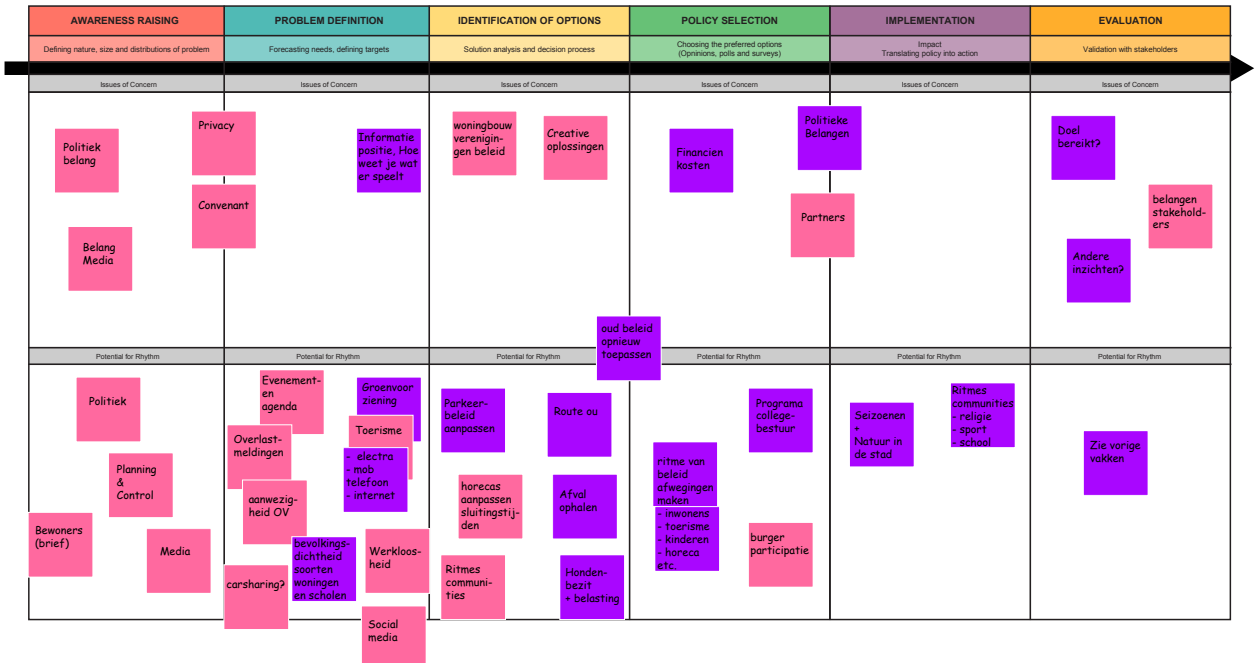


Shopping Centre
Data and Policy Cycle Workshop
04/10/2016

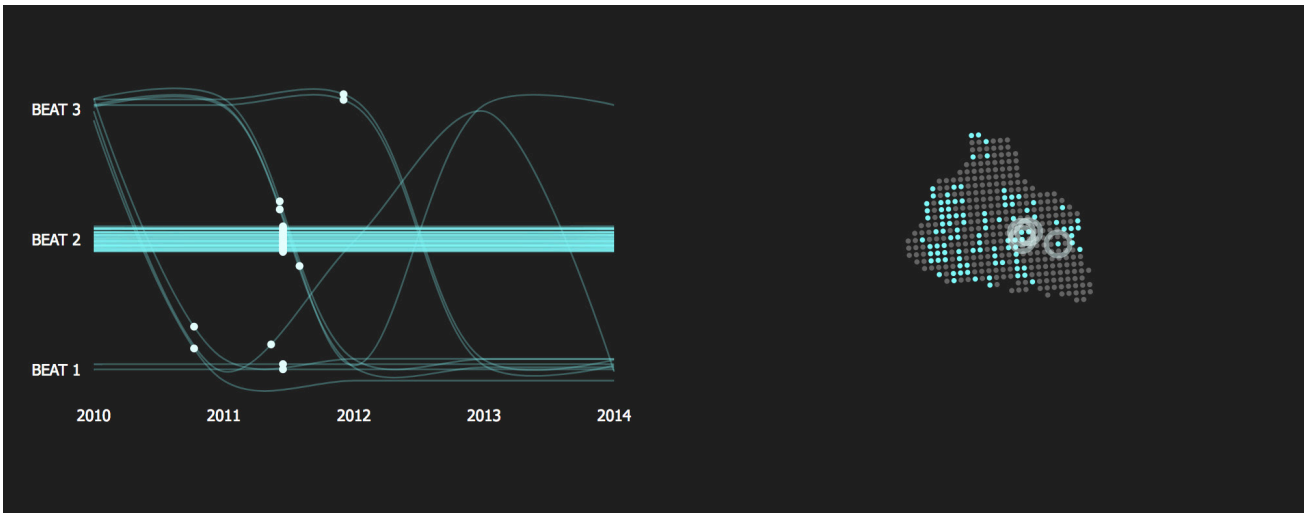
Antoine Gribnau (Municipality of The Hague) and Rob Polhuis (Municipality of Zaanstad)

Youth
Data and Policy Cycle Workshop
04/10/2016

Nicolette van der Slot (Municipality of Zaanstad) and Robert Jan Genzer (Municipality of Zoetermeer)



Policy Cycle Chart: Peace Around the House, Workshop 14/10/2016
Samuel Kaspers (Municipality of Zaanstad) and Yosha Kramer (Municipality of Zoetermeer)

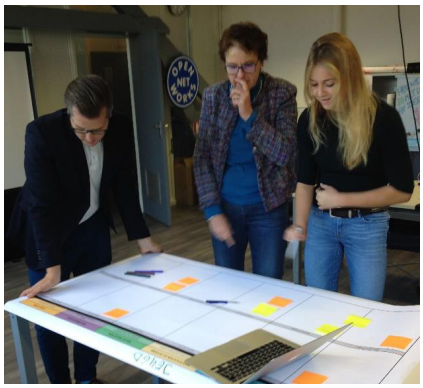


Peace Around the House,
Data and Policy Cycle Workshop 14/10/2016

Samuel Kaspers (Municipality of Zaanstad) and Yosha Kramer (Municipality of Zoetermeer)

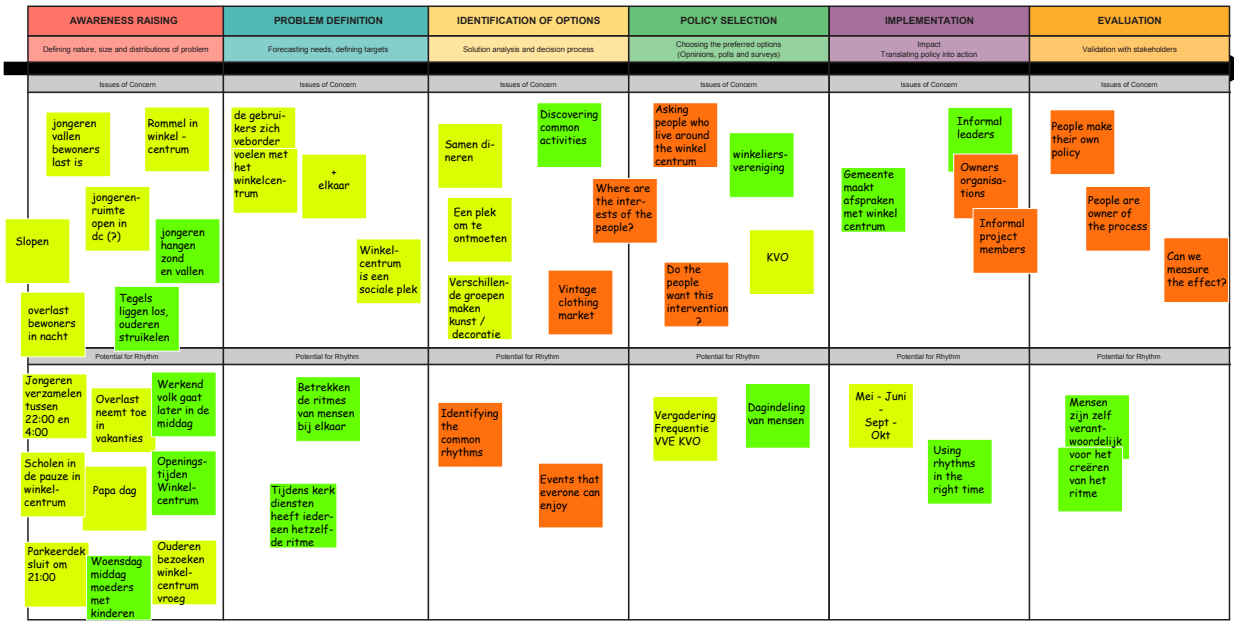
Shopping Centre,
Data and Policy Cycle Workshop 14/10/2016

Suzanne van den Berge (Municipality of Rotterdam) and Sandra Rob (Municipality of Zaanstad)

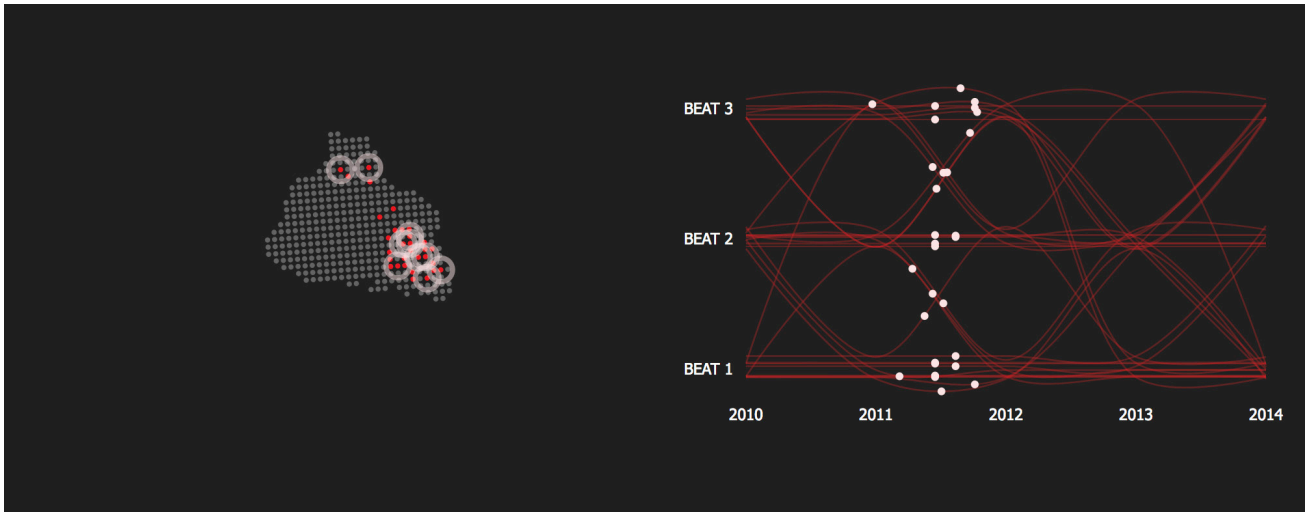


Youth
Data and Policy Cycle Workshop 14/10/2016

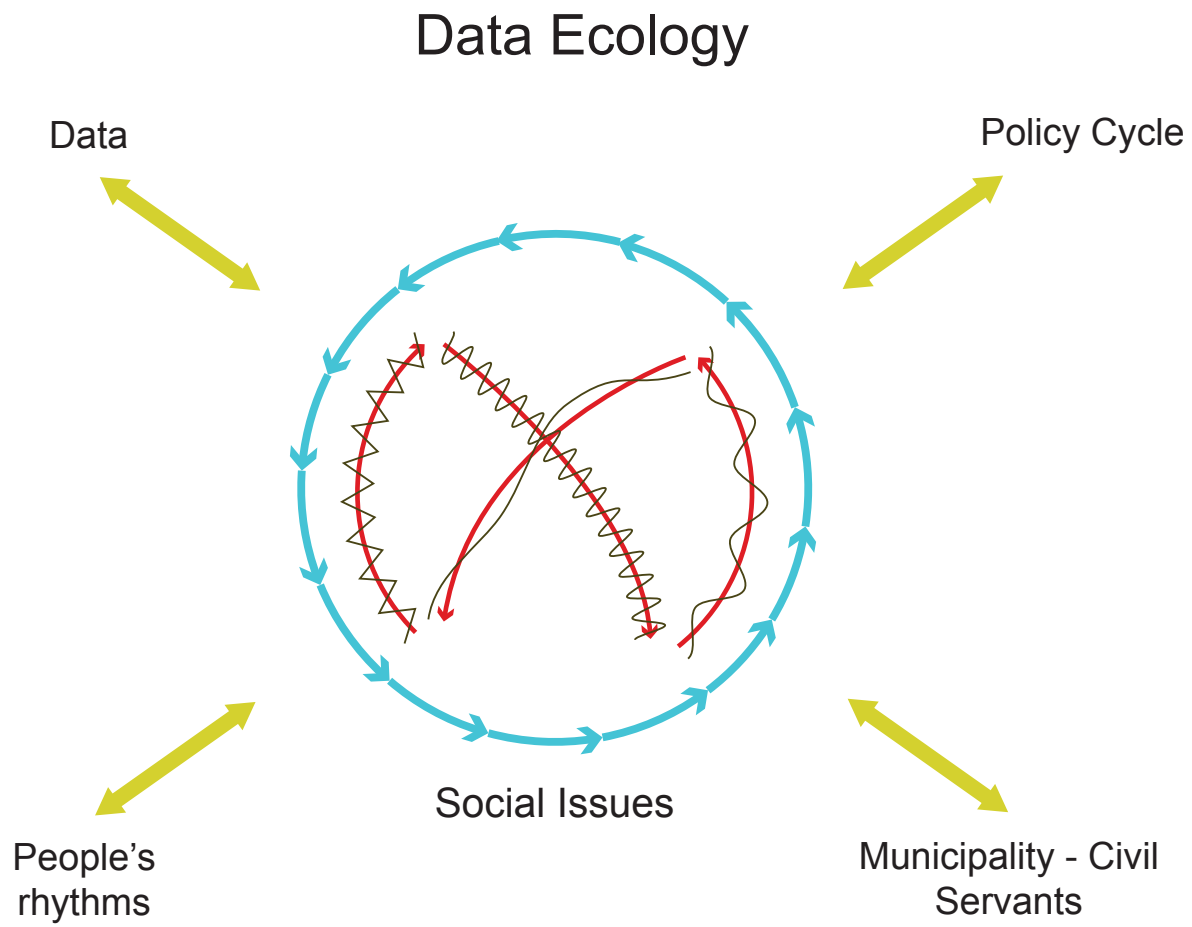
Mieke ten Bosch (Municipality of Zaanstad), Joost Hoedjes (Municipality of The Hague)



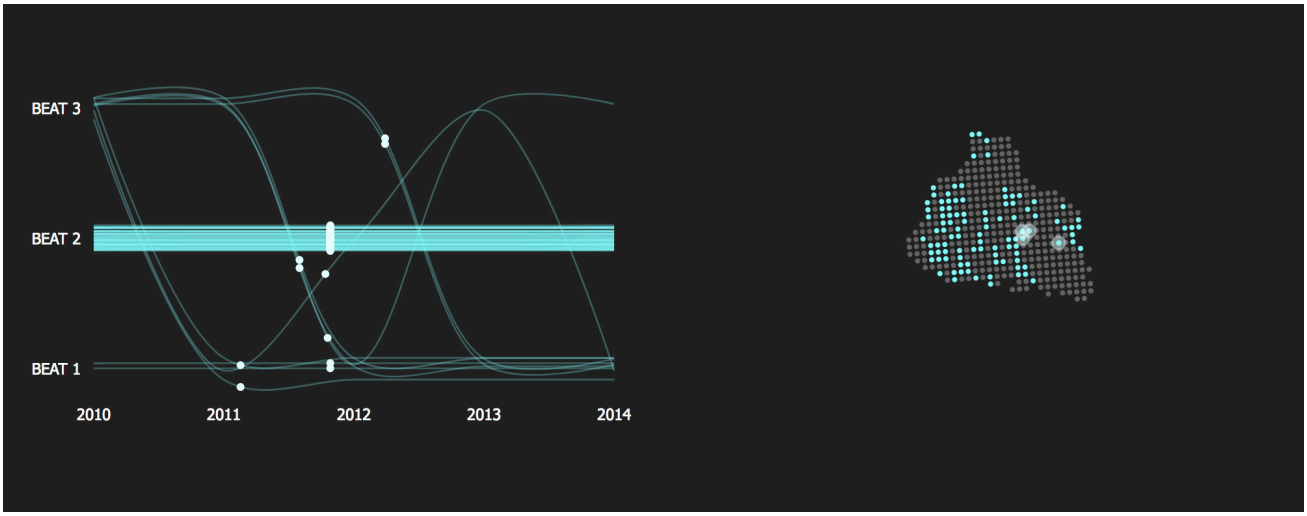
Policy Cycle Chart: Shopping Centre, Workshop 14/10/2016
Suzanne van den Berge (Municipality of Rotterdam) and Sandra Rob (Municipality of Zaanstad)



Data Ecology and Research Question



Data Ecology, an interpretation of the results of the civil servants focus groups, by Caroline Nevejan



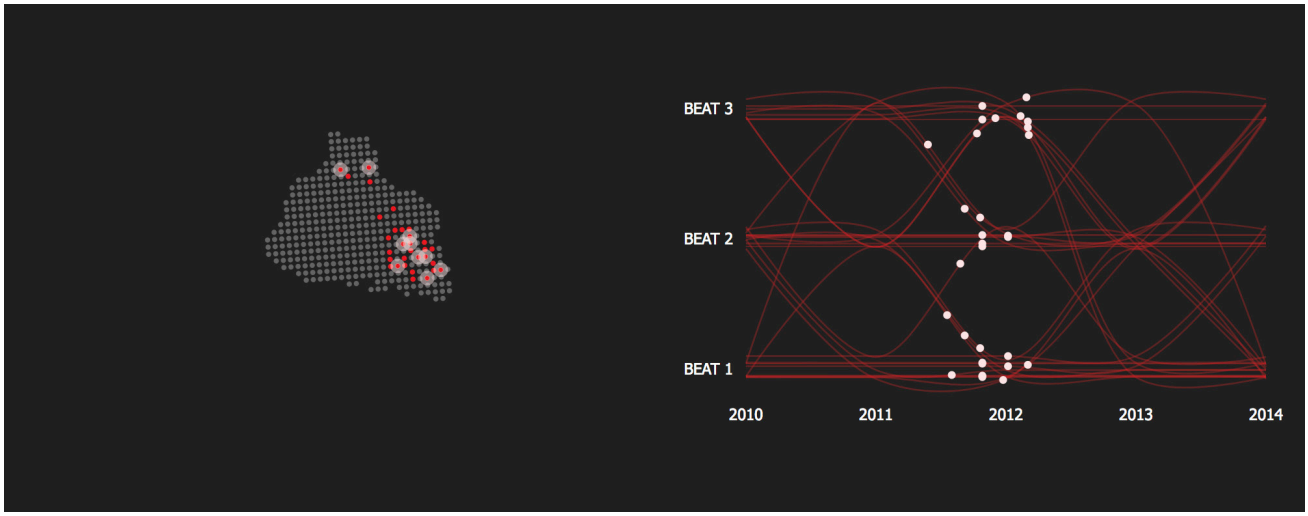
We then analysed the potential use of data in the different phases of the policymaking process:

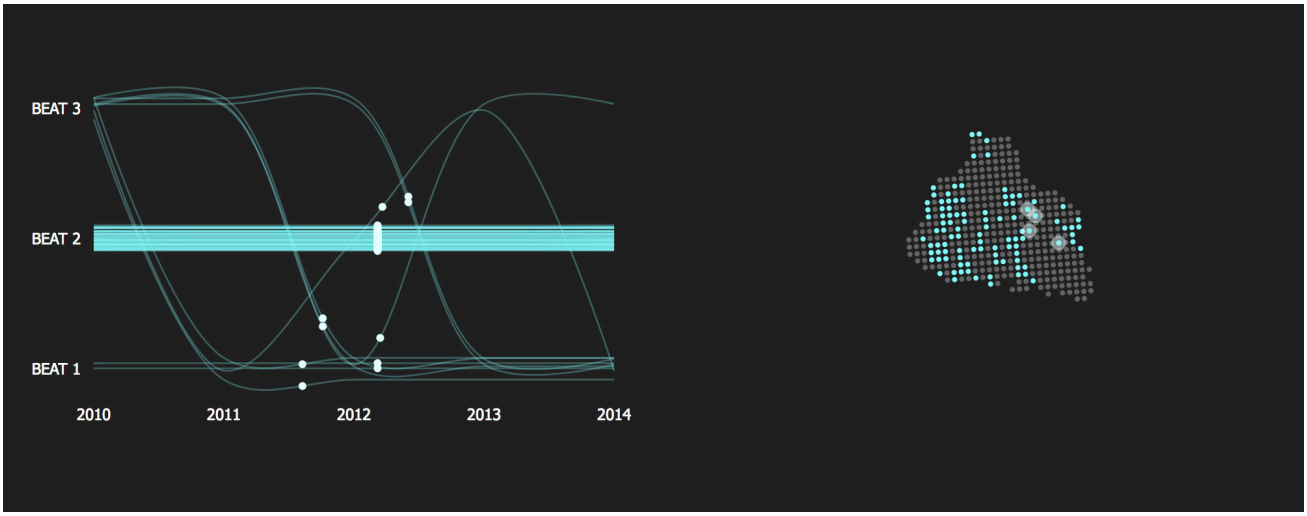
- **Awareness Raising:** In the Awareness Raising phase data can inform, signal and offer verification. In the future when dashboards with real time data become available, social network analyses will become more effective. Also the municipalities expect that when privacy issues are solved, that through combining data better prediction will become available.
- **Problem Definition:** During the phase of Problem Definition data offer information to better analyse the problem. Here data can also bring people with different expertise together. Many proxies for social safety are already gathered, the municipalities argue. They are just not properly disclosed. In the future, data will offer a more integral approach one agrees.
- **Identification of Solutions:** In the Identification of Solutions phase data help to communicate what is at stake now mostly. It is expected though that future data modelling can identify problems and dynamics to come. Data will help then to predict possible impact of a given solution will offer a new sense of causalities and inspire more creative solutions.
- **Policy Selection:** In this phase data can help to prioritize and be part of experiments and pilots. There was also a deep consensus between the municipalities in the focus groups that data will facilitate citizen participation and that the data approach will make problems more specific.
- **Implementation and Evaluation:** During Implementation and Evaluation, a data approach will allow for real time monitoring of what happens. An operational dashboard will make a lot of difference. This does raise questions on control and accountability versus trust and experimentation.

Between the civil servants of the participating municipalities we agree that recognizing Rhythm in large datasets may contribute to different phases in the policymaking process. A break in rhythm can signal in the awareness phase, during *Problem Definition* and *Identification of Solutions* rhythm analyses can be beneficial and open up new solutions spaces. During *Implementation and Evaluation* natural rhythms, people's rhythms and social rhythms of religion and community life should be taken into account. These findings are presented together with the student work in the different cities.

The conclusions of the civil servants focus groups indicate that research into data driven policy is necessary. Apart from exchanging statistical reports, both data departments and policymakers do not know how to interact right now. It becomes clear that rhythm has a potential for a new understanding of social issues. When looking at data for identifying social issues, many possibilities are mentioned. "Data ecology " as a concept is discussed to establish the relation between the social reality and the kind of representation of reality data offers. As a result of the different focus groups with civil servants, the research question is formulated:

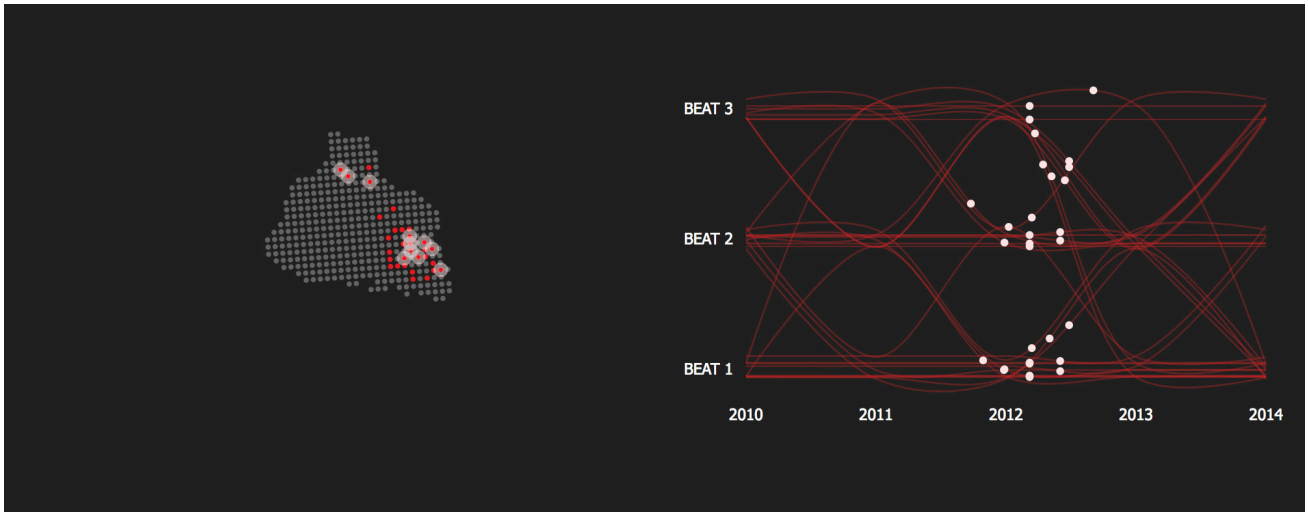
Can rhythm analyses of social issues in the physical and in the data world contribute to policymaking for enhancing social safety?




BEAT 3
BEAT 2
BEAT 1
2010
2011
2012
2013
2014

Part 2:

Exploring Social Rhythms



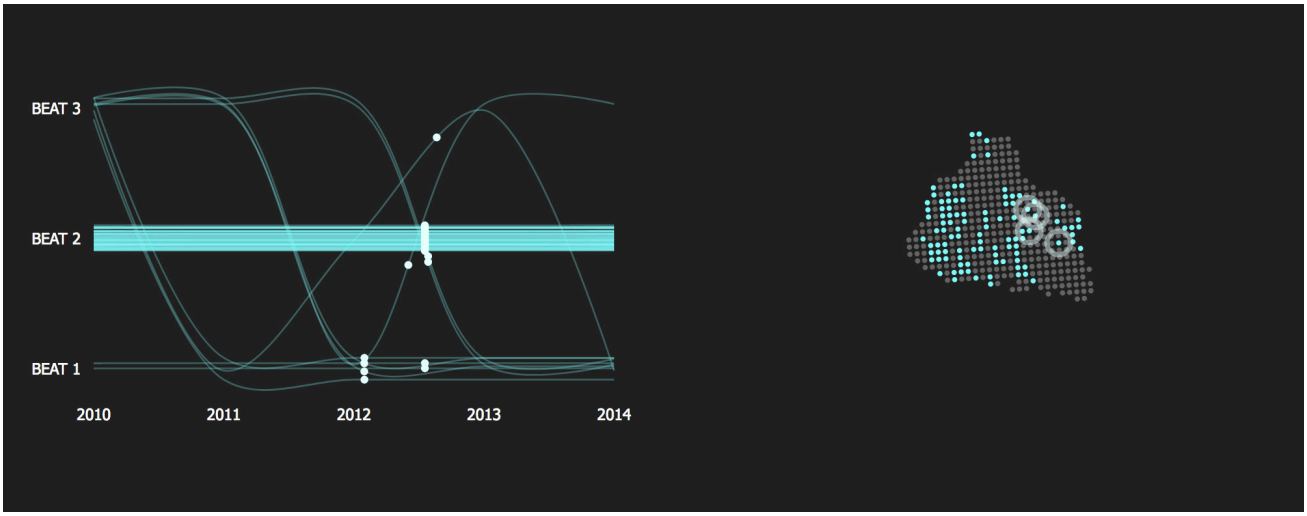
City Rhythm Opening Conference
TPM Faculty, Delft University of Technology
7 September 2016

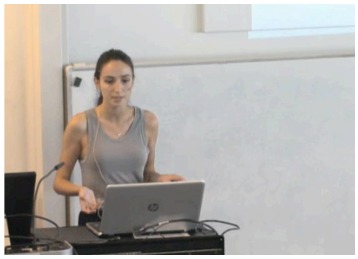
Chairing, Dr. Caroline Nevejan, Principle Investigator: City Rhythm conference create the first introduction about the research framework to all parties. 6 cities in the Netherlands, AMS Institute, TU Delft and Wageningen University engage to understand how to identify, analyse and visualise rhythm to make it part of decision making in municipalities. Teachers and students from LDE Minor Responsible Innovation will work with 6 municipalities on approaching different social issues in rhythm perspective.

What is Rhythm?, Prof. Marli Huijer: Marli Huijer presented different philosophical approaches to rhythm and elaborated on how rhythm is different than repetition. In a rhythm, there is something new and unseen introduced within its known 'self.' Following this, Huijer discussed that to study city rhythms one should not focus on one element of a city. She suggests to analyse a city like a psychoanalyst does with people by being aware of many different rhythms, and how they evolved through time.

Data Lab Amsterdam, Tamas Erkelens: Erkelens is member of the Amsterdam Innovation team and presented us the Amsterdam "Stad in Balans" (City in Balance) project in which rhythms of Amsterdam's visitors are analysed and visualized. According to Erkelens, rhythms are drivers of social change and indicate how cities can respond to these changes and improve the quality of life. Data Lab Amsterdam contributes to these innovative approaches by gathering the available data and connecting it with different professionals in Amsterdam.

Maintaining Rotterdam Air Quality through Rhythm Analysis, Marcel Koelman: Koeleman has been responsible for monitoring the air quality of the city of Rotterdam. This monitoring is based on detecting changes in rhythms in the air for which different algorithms are developed. These algorithms make it possible to predict what can happen to air quality under certain conditions in the future. By modifying rhythms of certain activities that we carry out during the day, we can change and synchronize human rhythms, industrial rhythms and atmospheric rhythm in beneficial ways.





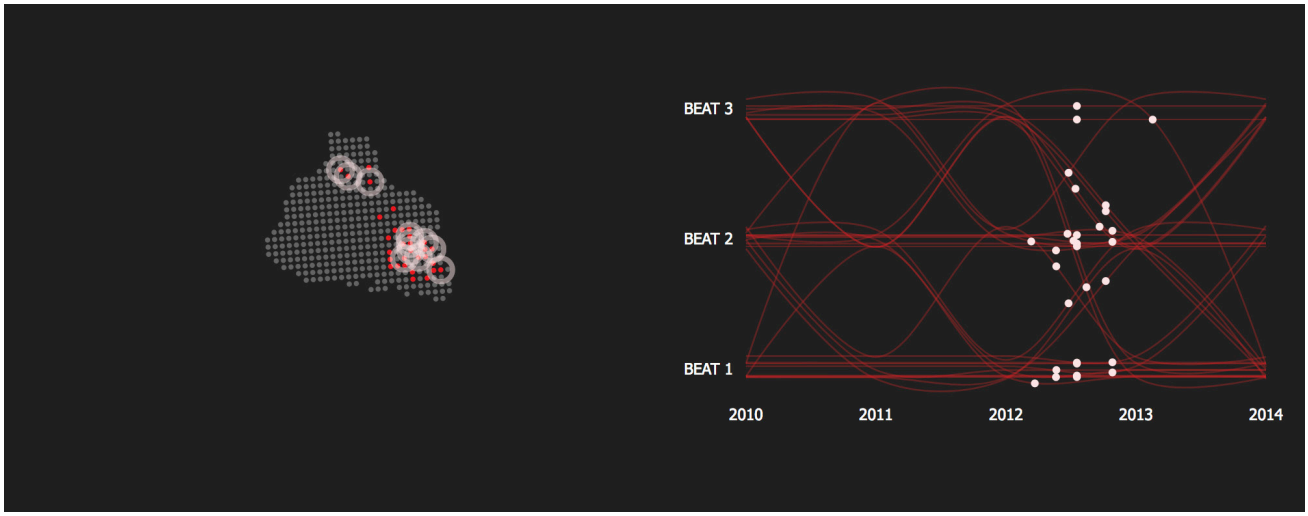
Urban Design and Rhythm in Addis Ababa, Pinar Sefkatli: Pinar Sefkatli is an architect. She presents the rhythm analysis that she carried out in her master's project at the architecture faculty of TU Delft, which took place in Addis Ababa, Ethiopia. By analysing rhythms in different neighbourhoods she found a way to express the different atmospheres one can sense when visiting the different areas. For this research she developed a methodology for documenting and analysing rhythms.

Tuning Rhythm, Dr. Satinder Gill: Dr. Satinder Gill is a scholar working on communication theory. According to Gill, rhythm and body are deeply connected, and our body is aware of rhythms that are played to us. On the other hand, when we tune into each other, our bodies engage and create something meaningful. Human greeting is a very good example to tuning rhythms, which appears differently in every culture. Such synchrony is necessary to create a social connection.

Intimacy in Public Space, Karen Lancel: Lancel is member of an artist duo who creates performances in public spaces in which mediated interactions and intimacy are explored. In public spaces people move together based on many rhythms. According to Lancel in this space we can distinguish various patterns and rhythms and we can choose where and when we engage, we mirror ourselves through rhythms. Lancel shows examples of the work in which different orchestrations intervene in public space, and break the rhythms of that space by inviting people to share personal rhythms.

Integrating Rhythms, Dr. Angelo Vermeulen: Vermeulen is artist and holds a PhD in Biology. Vermeulen talks about the biological rhythms in his artworks in which he includes social, technological and ecological systems. Biology is characterised by poly rhythms. In nature, every component is very much tuned, thanks to the simple fact that if they do not, they die. Human evolution has led to a controlling of rhythms. Vermeulens artwork explores new ways of integrating social, technological and ecological systems for finding new balances between these systems than the ones we know today.

Neighbourhood Profile Rotterdam, Suzanne van den Berge: Van de Berge is the project manager of Rotterdam safety index at the department of public safety of the Municipality of Rotterdam, and works on designing and implementing solutions for safety. Safety in each neighbourhood in Rotterdam is measured through a safety index. When the rates appear to be low, the neighbourhood is visited to research what causes that situation. Van den Berge also showed the Neighbourhood Profile of the city of Rotterdam, which gives safety information on a detailed level per neighbourhood.

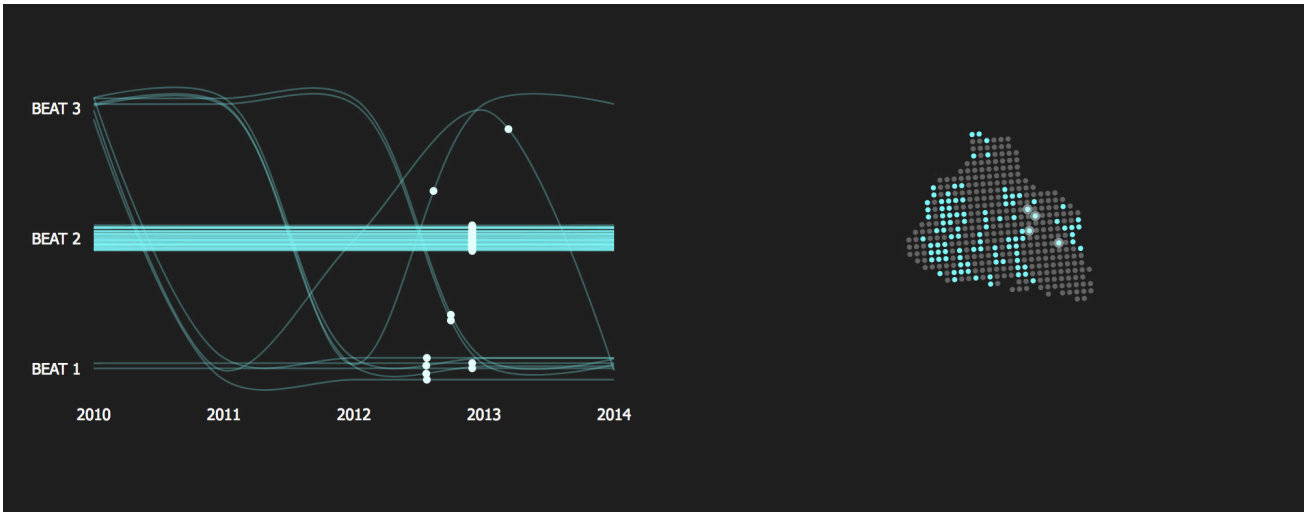


Case Studies in the Six Participating Cities

with Students from the LDE Minor Responsible Innovation (Leiden University, Delft University of Technology, Erasmus University)*

by Pinar Sefkatli and Caroline Nevejan

* During the first semester of the final year of their Bachelors studies, the students from the Dutch universities take part in minors. A minor is a unit of different courses that has its own program and agenda. LDE Minor Responsible Innovation is a cooperation of Leiden University, Delft University of Technology and Erasmus University Rotterdam. In this interdisciplinary minor, each university contributes its own specific focus and expertise on Responsible Innovation. The students and teachers come from the different universities, and bring with them specific knowledge and perspectives from their universities.



LDE Minor Responsible Innovation

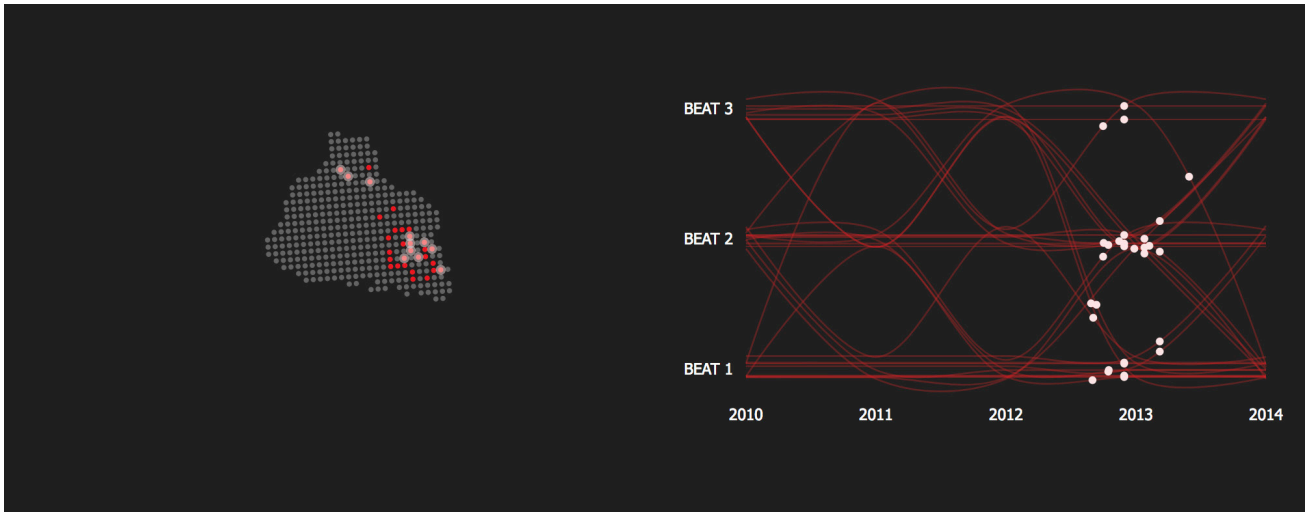
Case studies with students from LDE Minor Responsible Innovation confirmed that the translation of a social issue into the rhythm domain produces interesting results and discovers unexpected intervention spaces for policy making. Following the Responsible Innovation Intervention Cycle, together with civil servants from six municipalities, the students identified a social issue in terms of rhythm, conducted analyses, proposed a solution and evaluated it. This chapter will discuss the findings of student case studies.

At the beginning of the research, civil servants, researchers, teachers and student groups, came together to choose a social issue in the neighbourhoods of participating cities that would be later translated into a rhythm issue. The student project group in Amsterdam dealt with the question "*How can single mothers participate more actively in education, work and so on?*". There were two student groups in The Hague, dealing with the question "*How can conditions be improved in a housing block in which refugees and other residents live together?*". In Rotterdam, two groups focused on the question "*How can senior citizens feel safer?*", while in Zaanstad, two groups dealt with the question *"How can youth (between 15 – 20) be more integrated into the neighbourhood?*". The question for the city of Helmond was "*How can the sense of safety be improved in the specific neighbourhood of Beisterveld?*", where one student group was assigned. While in Zoetermeer, where also one student group was assigned, the research question was "*How can the sense of safety in the Meerzicht Neighbourhood be increased?*".

Responsible Innovation Intervention Cycle is carried out in 6 stages: problem identification (1), problem analysis (2), problem definition (3), solution design (4), solution implementation (5), and solution evaluation (6). In the problem identification stage research questions were chosen in each city. In the problem identification stage, the students carried out different types of analysis to identify the rhythms of their area of study. In the problem definition stage, their study moved on to the visualising of findings, and re-formulating the research question from a rhythm perspective. In the solution design stage, the students identified design solution spaces related to their case, and in the solution implementation stage, a rhythm intervention was proposed. Finally, in the evaluation stage, the proposed intervention was discussed with civil servants.

Skill Labs were organized throughout the intervention cycle to guide the students. At the same time, meetings with civil servants, studio sessions and conferences (at the end of each quarter) were organized where teachers and other guests participated. The skill labs included instructions on interview techniques, spatial analysis, functional analysis, visual analysis, ecological analysis, rhythm analysis, visualising techniques and presentation.

It is important to consider that the data that the students gathered together was based on their own observations rather than objective tools. Therefore, in order to make the student analysis more accurate, specific and valid information should be used. At the end of the minor the results of the students were gathered together and re-elaborated by research assistant Pinar Sefkatli.



Sharing rhythms Zwaardvegersgaarde / The Hague

How can conditions be improved in a housing block in which refugees and other residents live together?

1 **Stefan van Beiting:** 38 years old and works as a police officer. Stefan is married with Jet. They have been together for 19 years and married for 11 years. They have two daughters, the older one is 10 years old and the younger one is 7. In the weekends they like to do family trips with their motor bikes. His hobbies are sports, reading and motor cycling. He has been living in the area for 13 years.

2 **Azra Celik:** 31 years old and works part time as a desk clerk at ING Bank. She is married to Akif and together they have two children, Ahmet and Ela. Ahmet is 8 years old and Ela is 5. Her parents live close by and she is still in contact with her other family members in Turkey. She has been living in the area for 9 years. She likes to cook and to take care of her kids.

3 **Jeroen Timmerans:** 27 years old and works as a teacher in a junior high school. He lives with his girlfriend Sarah, who is also working in the education sector. They would like to have children together but they think it is still early. His hobbies are reading, doing volunteer work and travelling. He has been living in the area for 3 years.

4 **Rita Schilder:** 53 years old. She is a housewife. She is married to Pieter and they have been together for 34 years. Together they have two children. Her son is 29 years old and her daughter is 26. Their children are not living with them anymore. Rita and Pieter have a dog, whose name is Sproet. In her free time, she like to do gardening, to knit and to take care of her dog. She has been living

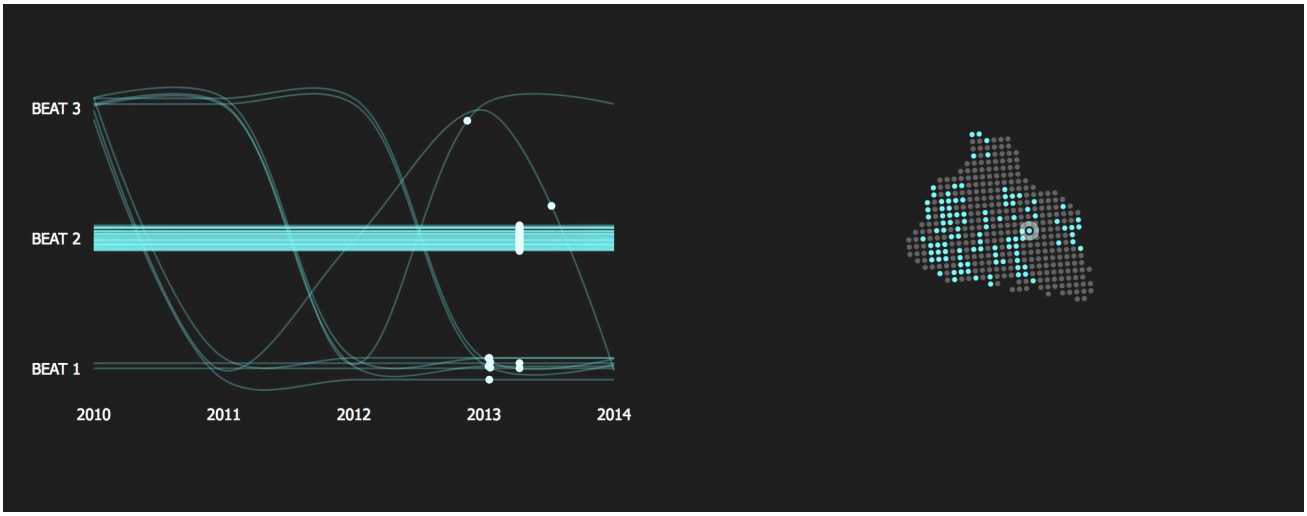
5 **Gerard Hoogveen:** 54 years old. He works in the municipality. He is married to Marjan, who is a housewife. They have been married for 27 years. Their children are not living with them anymore. One of them is 22, and the other 19 years old. His hobbies are watching football, fishing and automobiles. He has been living in the area for 17 years.

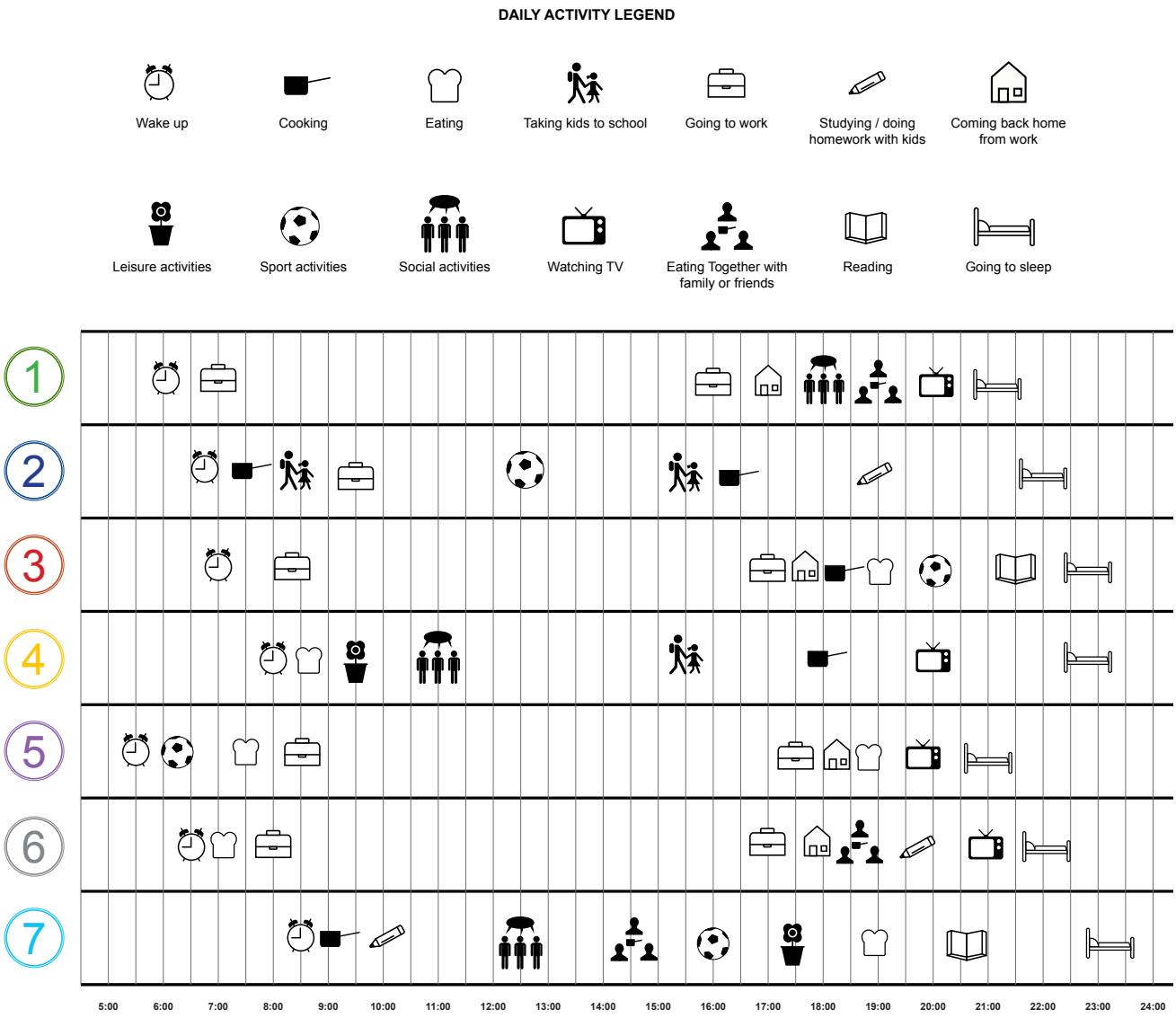
6 **Johannes Doornkamp:** 33 years old. He works at the municipality. He is married with Tess, who is working as an elementary school teacher. They have been married for 9 years. They have three children who are 11, 8 and 6 years old. Johannes's parents come from Suriname, but he was born and raised in the Netherlands. His hobbies are football, cooking and doing volunteer work.

7 **Ghazi Alfia:** 27 years old. He is unemployed. He has been married with Tira for six years. His wife stayed in Syria with their 5 year-old daughter. He is hoping to reunite with Tira and live together in The Netherlands. He has been living in The Netherlands for three years and he just received his residence permit to stay in the country. In his free time, he likes to play chess and football and he is learning

The Hague Image 1: Written description of each persona.

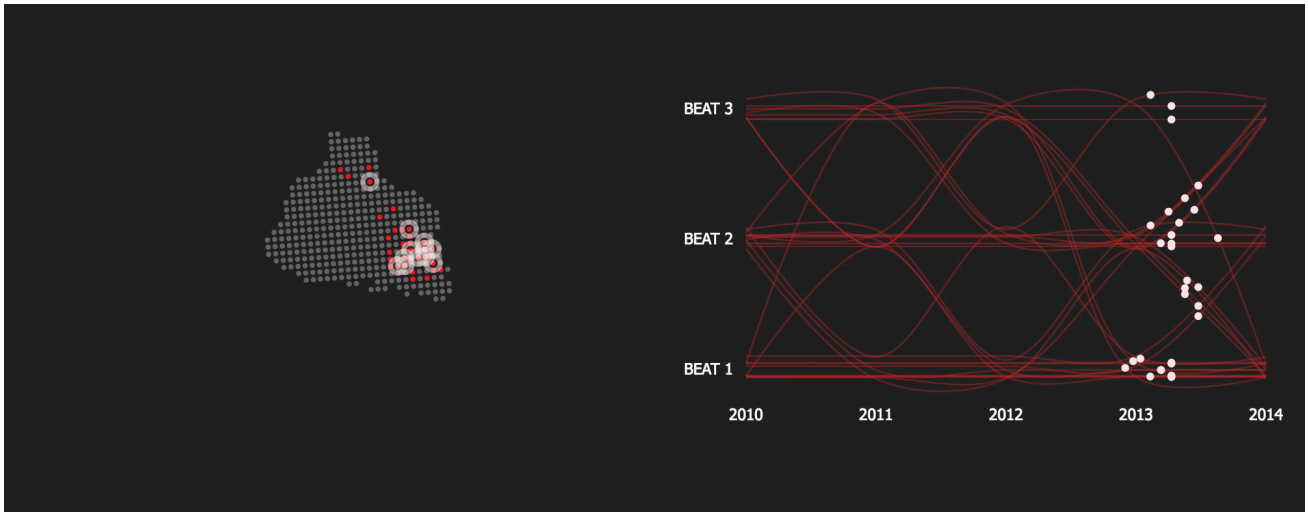
The analysis of The Hague 2 Project Group deals with social cohesion in the neighbourhood of Zwaarvegersgaarde. The residents in the neighbourhood have been living there for different time frames; some residents arrived in the neighbourhood 10 years ago, some of them 5 years ago, and some of them less than a year ago. This situation also affects their rhythms. The residents that have been living longer in the neighbourhood find it easier to adapt to the neighbourhood's rhythms. At the same time, a building in the neighbourhood is being emptied to host refugees, which causes confusion in the neighbourhood. Thanks to many interviews, the students create 7 different persona's with different age, household types, professions and backgrounds, and analyse





The Hague Image 2: Diagram showing the common daily activities in Zwaardvegersgaarde.

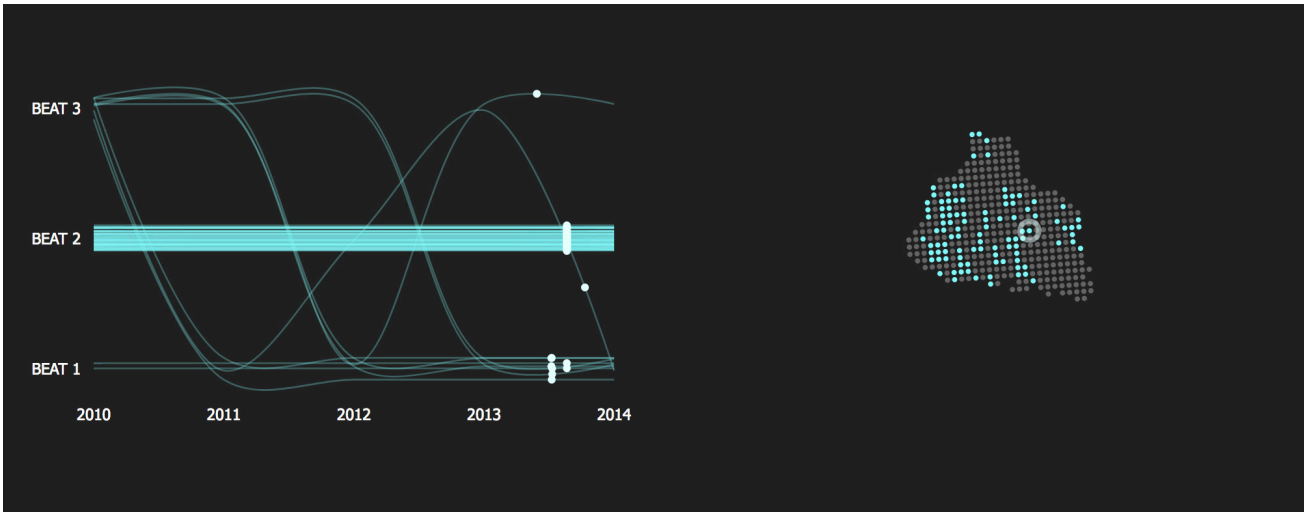
their daily rhythms. When the daily rhythms are compared to each other, the analysis reveals that there are already common daily patterns in the neighbourhood. Many residents come back from work, spend time with their children, or prepare food and eat at around the same time. Therefore, in the rhythm overview, the possibilities where rhythms can be shared are identified in activities that include sports, children and food.



The Hague Image 3: Diagram showing the spatial analysis in Zwaardvegersgaarde.

Then, the students analyse the neighbourhood from the spatial and ecological perspectives in order to understand how the residential spaces in the neighbourhood are structured. Their analyses show that in the area there are not many different functions and the public spaces consist mostly of open green areas, which appear to be empty during the day.

Although the rhythm analysis identifies many common daily patterns between residents, the spatial analysis shows that the environment does not offer enough possibilities to bring these rhythms together in terms of functions and public space. In order to create new shared functions in the neighbourhood, the students propose to initiate shared dinner activities.



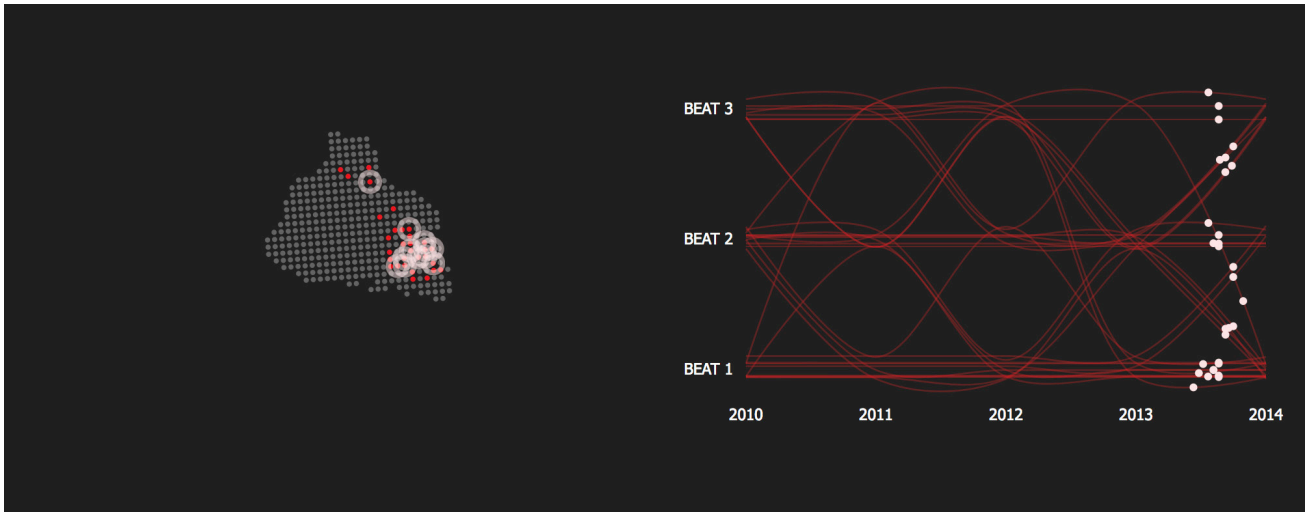
During the neighbourhood presentation, the students present the visualisation of the 7 fictional persona's and their daily rhythms in order to show the diversity of the neighbourhood they live in, and the significance of creating activities where rhythms can be engaged. The residents reply that it would be hard for everyone to participate in specific activities such as dinners, however, they mention that they would very much enjoy living in an environment where they share rhythms with other neighbours.

As a result, the students take into consideration the common activities that are analysed in the rhythm analysis, which are sports, children and food, and propose interventions to create new shared rhythms within the neighbourhood, through these activities.

The Hague Image 4: Diagram showing the spatial analysis in Zwaardvegersgaarde.

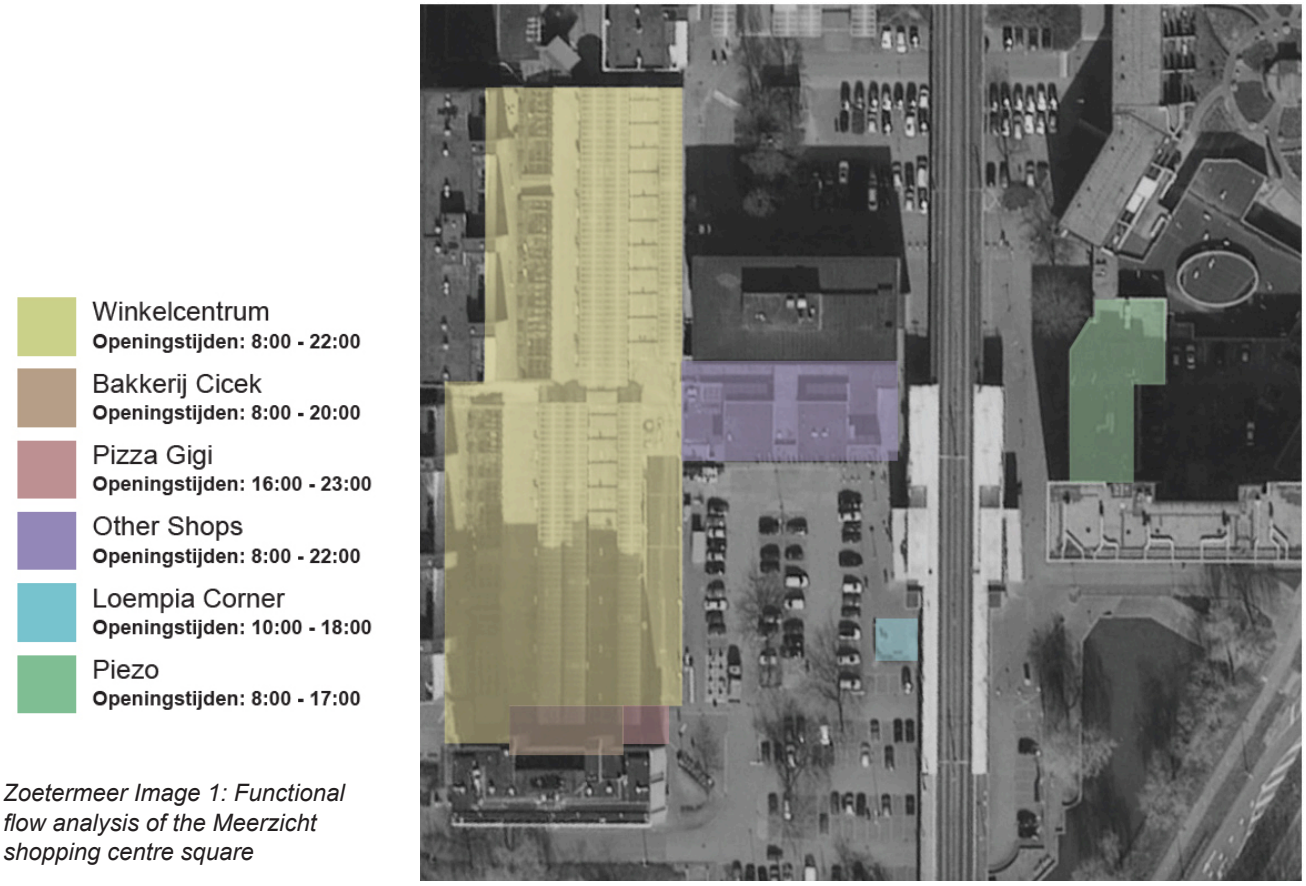
The Hague asks how rhythm analyses can help welcome and integrate new refugees and migrants in a borough that already is characterized by its many different cultures and fast moving people. While the site analysis and interviews show that Zwaardvegersgaarde is a diverse neighbourhood, the rhythm analyses reveal that the residents have many common rhythms. However, the spatial and ecological analyses show the absence of functions and activities that can influence the residents to share or to tune their rhythms.

To create new shared rhythms in the neighbourhood, the students identify three potential activities: sports, children and food. These happen in all cultures and happen also whether people live shirt or long in a specific place. Rhythm interventions in these three kinds of activities will help to integrate newcomers in the block. The students suggest to organize special dinner activities. The residents, however, state that they want to have occasions that are result of their individual choices, instead of specific collective orchestrated activities.



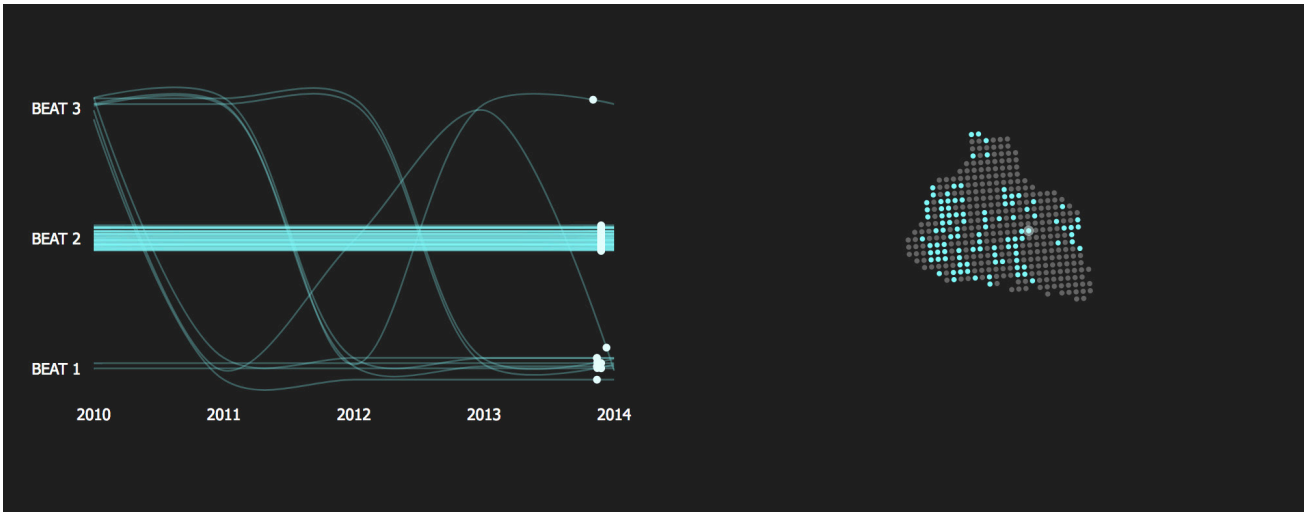
Enhancing rhythms Meerzicht / Zoetermeer

How can the sense of safety in the Meerzicht Neighbourhood be increased?



Zoetermeer Image 1: Functional flow analysis of the Meerzicht shopping centre square

The Zoetermeer case takes place in the Meerzicht neighbourhood where social cohesion between residents is lacking and sense of safety is low. In this case, the research assistant and the municipality conduct additional analysis in order to reflect further on the daily patterns that lead to this issue. A series of analysis are carried out, starting from the physical world with visual, functional and rhythm analysis, and moving on to the data world by taking into account the available datasets for understanding the social issue. This exploration talks about the rhythm analysis of the Meerzicht Shopping Centre. This location is the busiest area in the neighbourhood and understanding how rhythms are shaped in this public area give many insights for the analyses.



Legend:

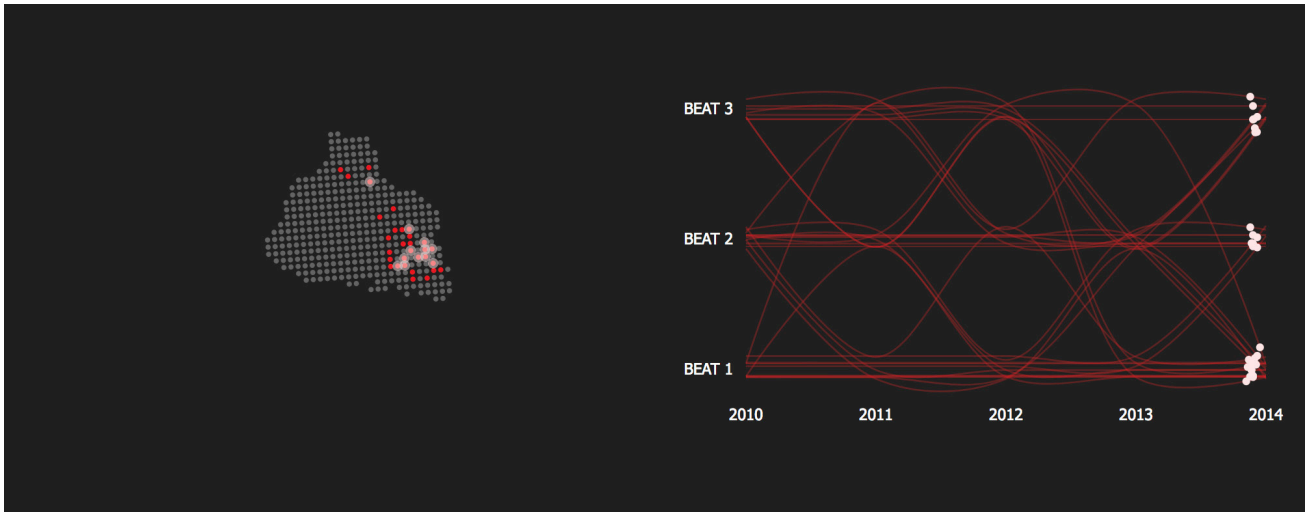
- Walking inside the shopping mall
- Walking out of the shopping mall
- Passers by
- Standing for 10 minutes and less
- Standing for 15 minutes or more

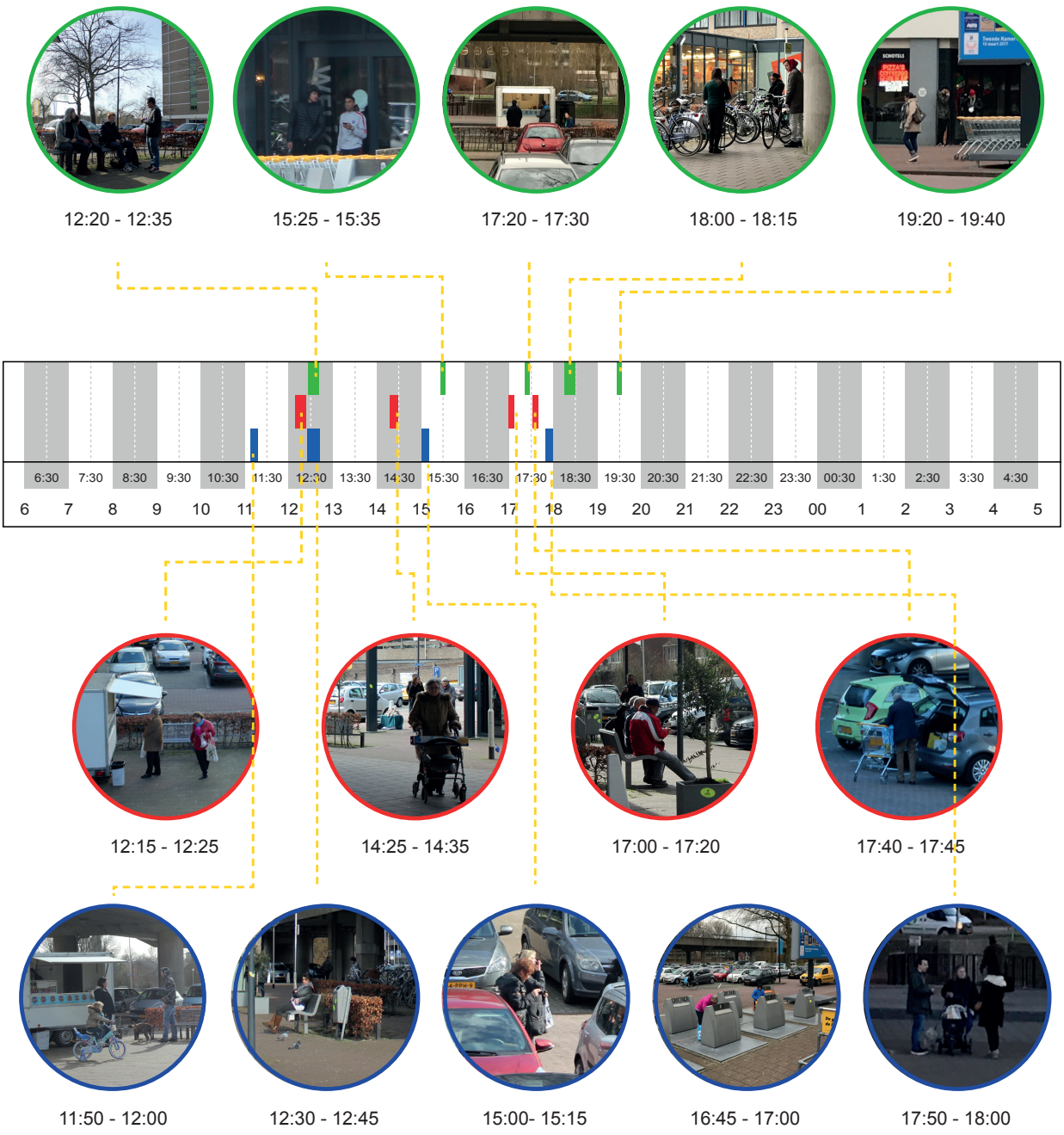
Zoetermeer Image 2: Spatial flow analysis of the Meerzicht shopping centre square

According to functional and spatial analyses, most movements are based on walking and standing for very short periods of time. The visitors to the shopping centre use this entrance thanks to the possibility of parking nearby. Other visitors arrive directly from the train station. Many people who work in the area, visit the shopping centre square during lunch break and the residents of Meerzicht stop there often to use the trash cans.

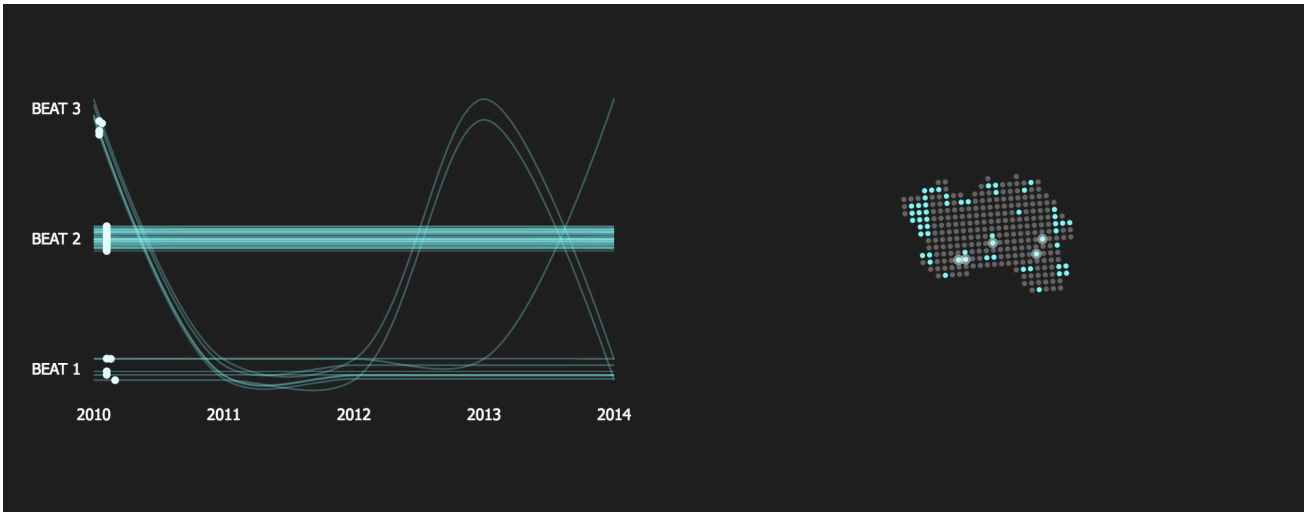
Although there are many visitors who walk and pass by, few people tend to spend time around the square. This situation invites illegal activities to occur, which create a negative impact on the sense of safety of the visitors and residents.

In order to look deeper into the issue of social cohesion in this location, a rhythm analysis is carried out. In this analysis, three different focus groups are identified who visit the square, and their engagement with the public space is measured. These are residents/visitors between 12-26 years old (group 1), residents/visitors between 60-80 years old (group 2), and residents/visitors between 26-60 years old (group 3).

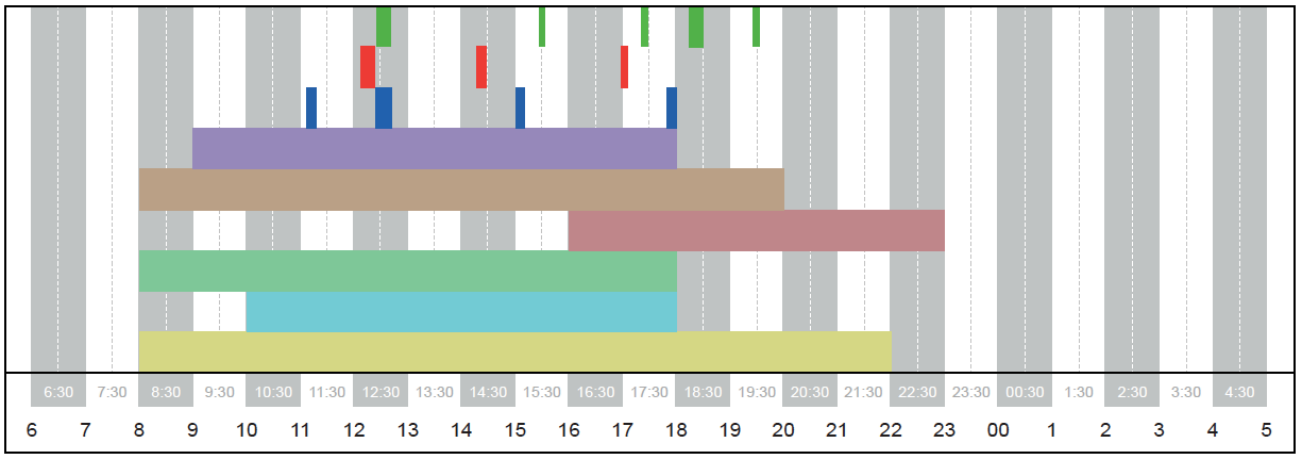




Zoetermeer Image 3: Documentation of the activities of focus groups 1, 2.and 3.



Zoetermeer Image 4: Diagram showing the focus groups included in the analysis.

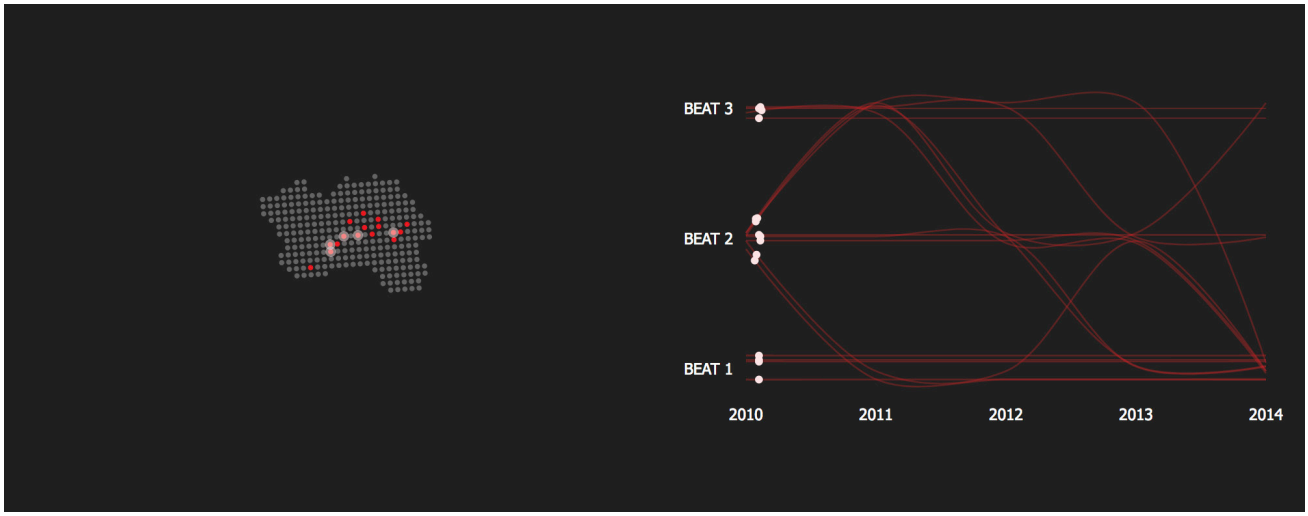


Zoetermeer Image 5: Rhythm overview of Meerzicht Shopping Centre square

The rhythm analysis reveal that the engagement between the three focus groups and their environments is limited only to a few minutes throughout the day. The time that the residents and visitors spend around the shopping centre is between 10 to 20 minutes. This time span remains the same in different hours during the day, in different days and on vacation and non-vacation weeks.

These findings are presented to the civil servants from the municipality of Zoetermeer. It is agreed upon during the discussion after the presentation that creating stronger engagement and ownership between the residents and their neighbourhood would indeed decrease unwanted behaviour that negatively effects the sense of safety in the area.

The case study in Meerzicht explores the unpleasant atmosphere around the shopping centre. According to the rhythm analyses, the functions in and around the shopping centre are not successful in establishing a territory (see chapter 3, Rhythm as Territory). The rhythm analyses studies the types of movements of the people (walking, standing), walking routes, speed and standing points. Results show that the amount of time the residents spend in and outside the shopping centre is too short to create engagement between the residents and their surroundings. The research team redefines this issue as enhancing rhythms of a territory in order to display an evident territorial rhythm. However, the translation into enhancing rhythms does not succeed in identifying a design solution space where a rhythm intervention can be proposed.



Tuning rhythms Keizerswaard / Rotterdam

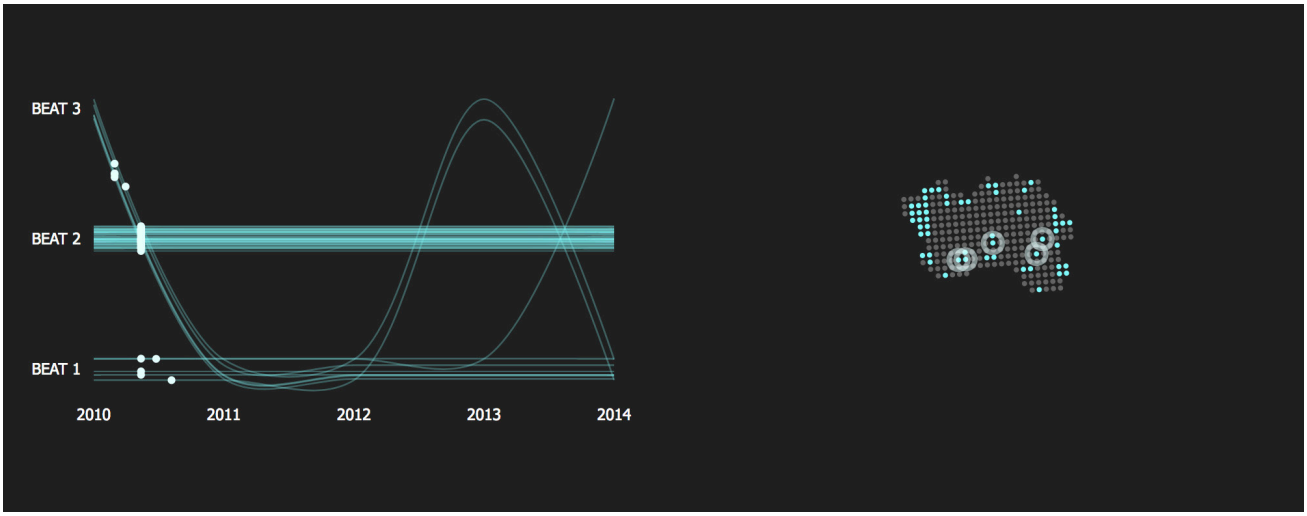
How can senior citizens feel safer?

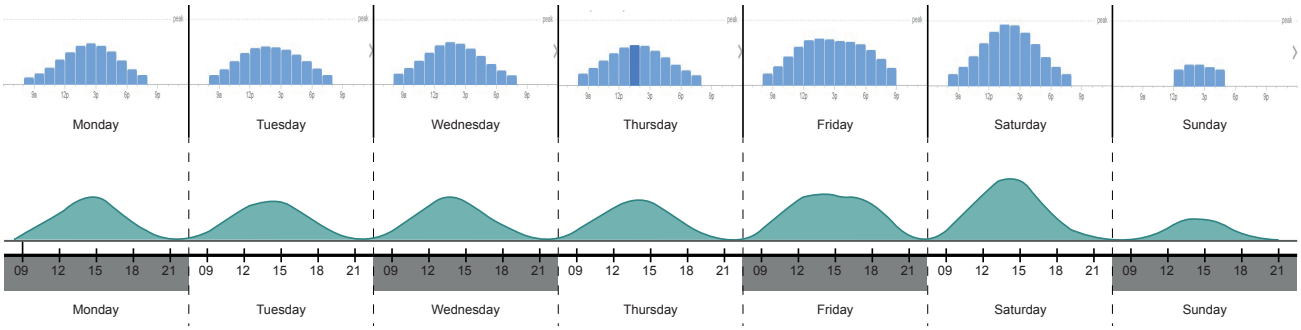
Rotterdam Image 1: Analysis through photos in Keizerswaard. From left to right: View of the shopping centre entrance, view from inside of the shopping centre, view of the elderly home, a photo of a police advertisement.

Keizerswaard is a suburban neighbourhood in Rotterdam, where the low sense of safety negatively effects the participation of the elderly in daily life. The students carry out many interviews in this case study, where they explore the daily activities of the senior residents, as well as the activities of the younger residents, with whom the elderly residents have problems in interacting. Furthermore, the students give importance to spatial analysis, where they observe how the public space can be suitable for the elderly.

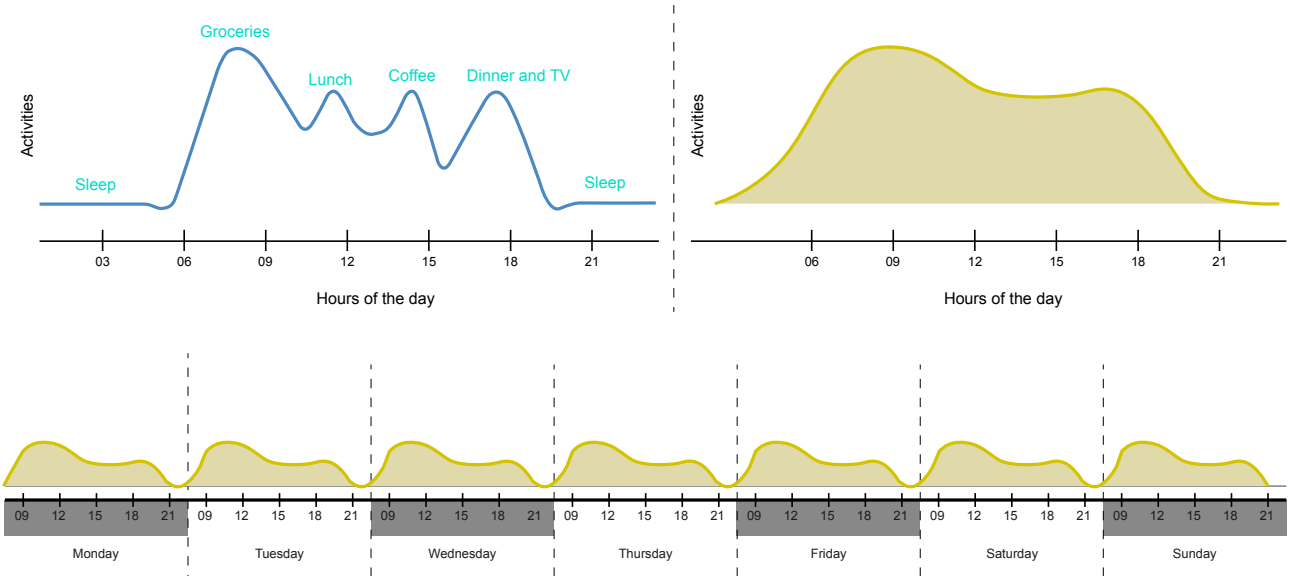
Thanks to spatial and functional analyses and the initial interviews, the students discover that the low sense of safety that the elderly residents perceive, is due to first of all the infrastructure of the area. The roads are too wide and busy, and the traffic lights are too short to cross the streets. This situation is reflected on the mismatch in the rhythms between the elderly and the rather fast rhythms that the neighbourhood presents. In order to make the elderly feel safer when crossing the street, it is proposed to make the traffic lights last longer, to widen the pavements and to place elements that can partially cover the tram tracks.

Following these findings, the students conduct rhythm analysis based on the weekly patterns of the elderly and the younger residents, and the rhythms of the shopping centre.





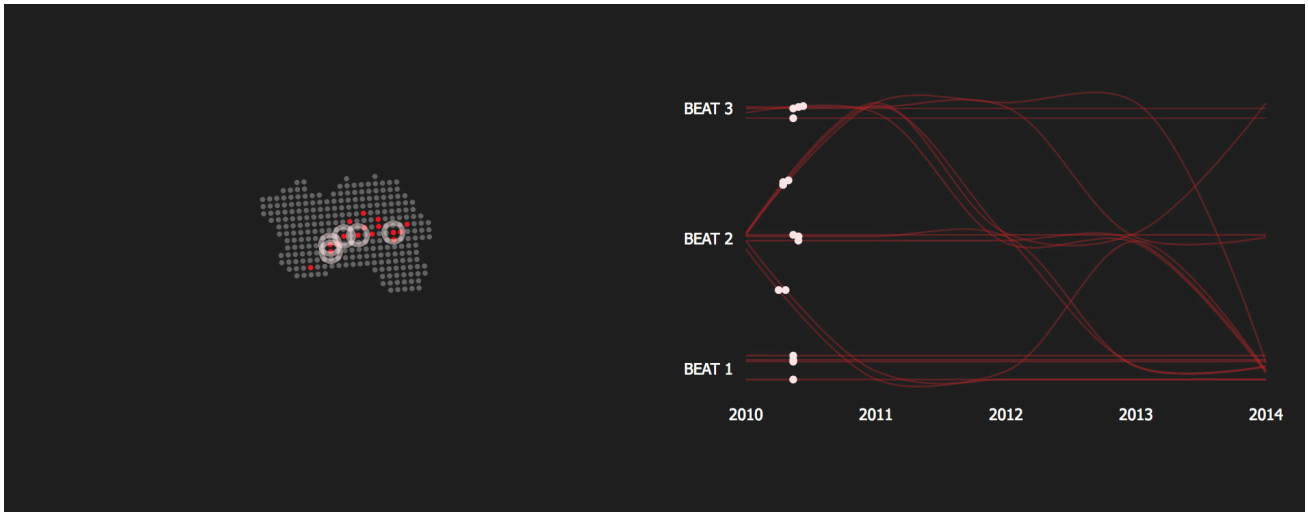
Rotterdam Image 2: Diagram made by using the Google data on the number of visitors during the opening hours of the shopping centre.

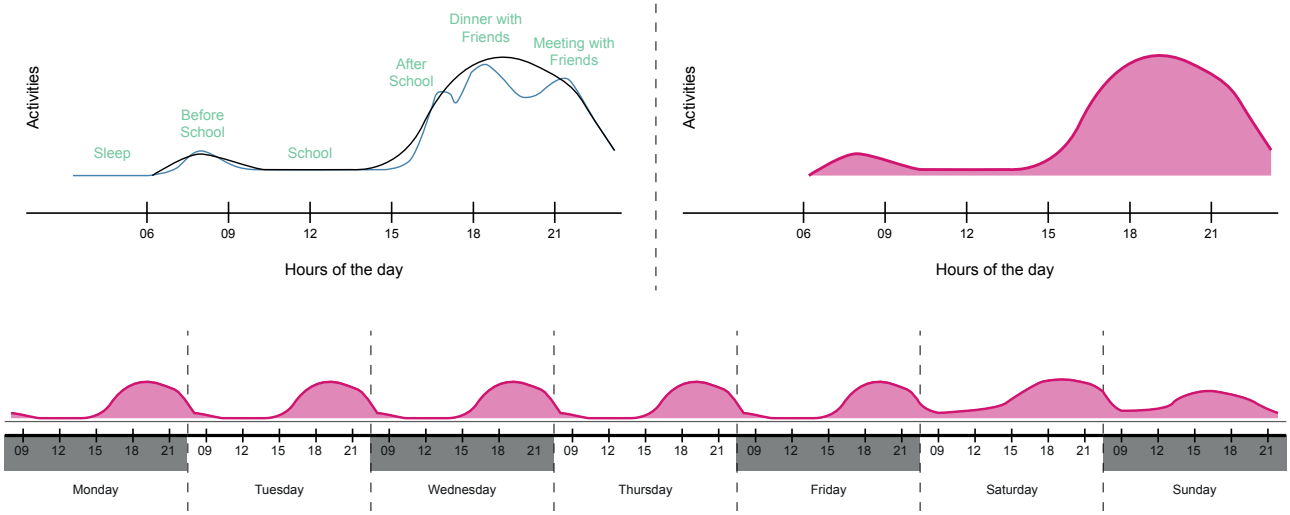


Rotterdam Image 3: Diagrams showing the rhythm of the fictional persona Jan; his daily activities and the repetition of these activities into creating his weekly rhythm.

The weekly rhythm of the senior residents of Keizerswaard:

The students carry out a rhythm analysis based on the daily activities of elderly residents. They create a fictional persona living in Keizerswaard, Jan, to tell about the daily life of an elderly person. The rhythm overviews show the different activities that Jan carries out during the day. In this analysis, the students give each activity an intensity based on the number of people who carry out that activity. The daily rhythm visualisation is then, repeated and a weekly rhythm visualisation is created.





Rotterdam Image 4: Diagrams showing the rhythm of a fictional young persona; their daily activities and the repetition of these activities into creating his weekly rhythm.

The weekly rhythm of the youth in Keizerswaard:

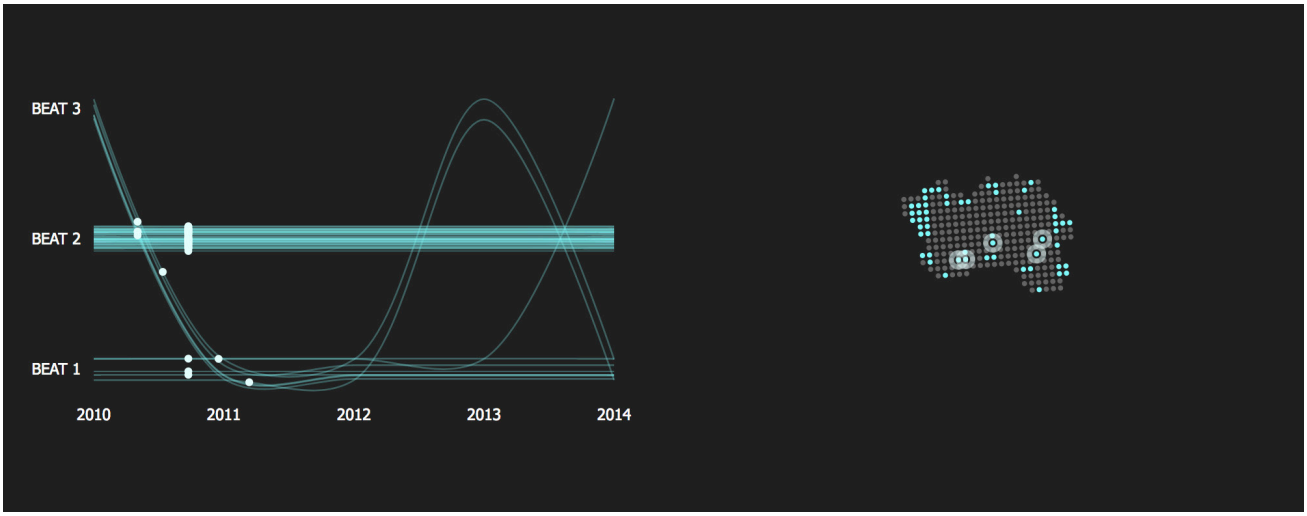
The students perform the activity analysis also with the youth living in the neighbourhood, producing the following daily and weekly activity graphs. The observations show that when the Keizerswaard shopping centre is closed, the youth prefers to spend time outside the shopping centre, but still on the same street. The elderly residents also report in the interviews that the younger residents' actions in these hours make them feel uncomfortable. When visualizing the weekly rhythms of the younger residents, this information is taken into account as well.

Rhythm in Keizerswaard:

In these graphs, different parameters are compared. The first one is the number of people visiting the Keizerswaard shopping mall throughout the week. Considering that the Keizerswaard Shopping Centre is one of the few public spaces in the area, this data can be read as the hours during the day in which the interaction between the residents of the neighbourhood take place.

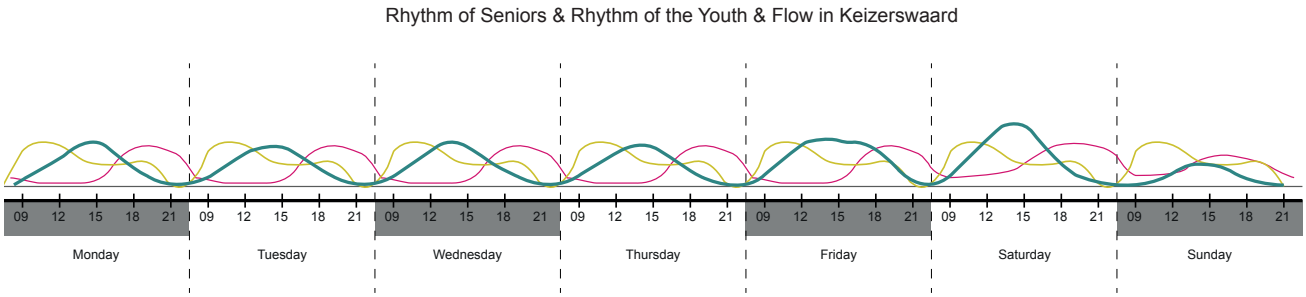
The second parameter shows the activities that the two analysed groups carry out; the elderly residents and the youth. In the activity graphs, the intensities of the activities are represented, in which the highest point of the graph represents the largest number of people doing that activity.

The findings become meaningful when they are compared to each other. The elderly people who report complaints of not feeling safe in their neighbourhood turn out to have very different daily rhythms to the young people living there. Later on, during the research, the flows of people in the shopping mall in this analysis are referred to as a base rhythm (Beats, Base and Street Rhythm, page 121).



The intervention that is developed is a creative proposal that addresses basic needs and that also includes a service model. The basic need of the elderly is to be able to go out feeling safe, while the basic need of the young people is to be able to earn pocket money.

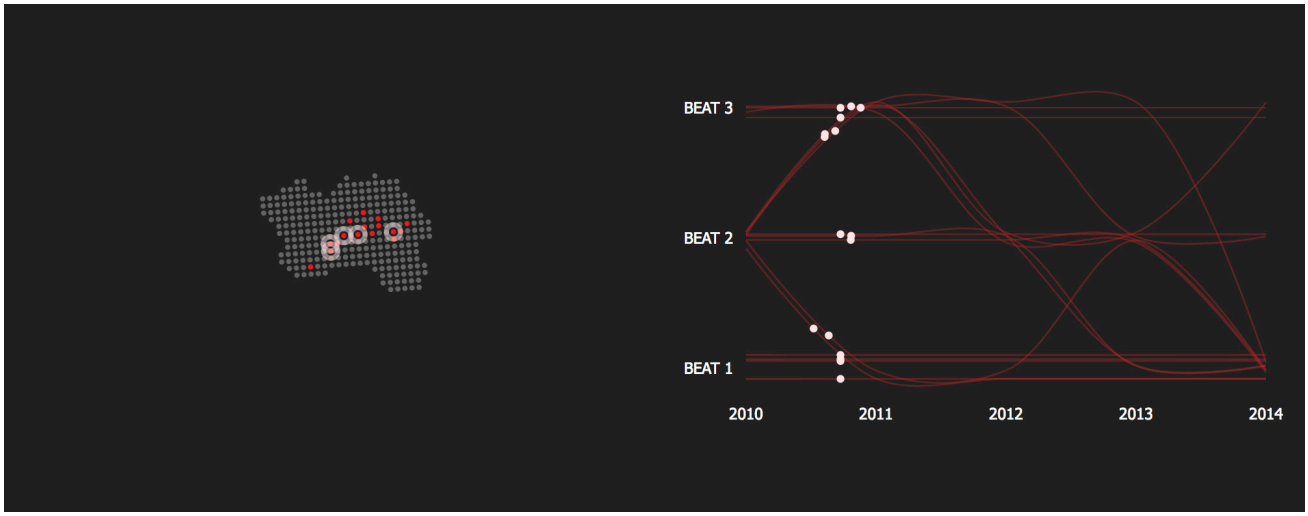
According to this, the students develop a website start up where the younger residents can take elderly residents out for a walk and earn extra money (**blokjeom.com**). The students' intervention also include a business plan and they try the idea out the by taking the elderly outside for a walk. This intervention, therefore, is beneficial for both groups, the elderly and the young residents. Thanks to this, the elderly as well as the young people are willing to participate. In conclusion, tuning the rhythms of these two groups is made possible.



Rotterdam Image 5: Diagram showing the comparison of different rhythms Keizerswaard, which is achieved through bringing together the rhythms of a fictional elderly persona (yellow), rhythms of a young fictional persona (red) and rhythms of the shopping centre (green).

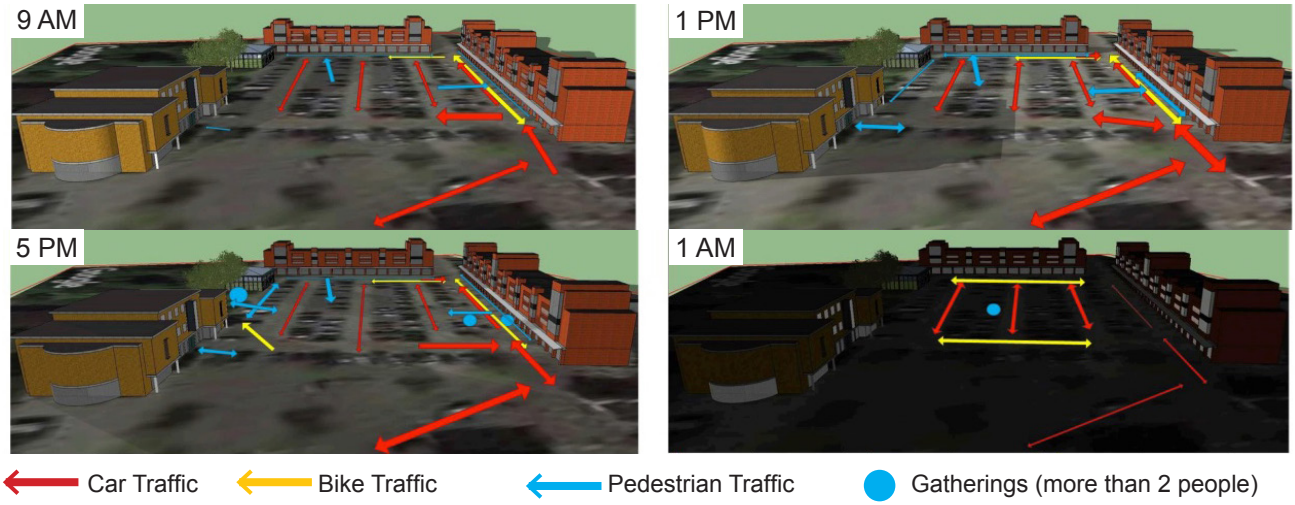
In a care home in Keizerswaard in Rotterdam residents do not feel safe and blame young people in the neighbourhood for this. The elderly do not take a walk anymore. Based on interviews with the elderly and the young, students visualize the daily rhythms of a fictional elderly person. These daily rhythms are compared to the rhythms of the younger resident. This comparison results in a mismatch in daily rhythms. For example, the elderly residents go to the shopping centre before lunch time, while the younger residents visit the same place in the afternoon. The students therefore, propose that these rhythms can be tuned into each other, by an online service that helps the young residents to earn pocket money by taking the elderly for a walk.

This case study shows how rhythm analysis contributes to improving social safety by tuning rhythms. The proposed intervention is designed to meet the basic needs of the elderly (taking a walk) and the basic needs of young people (earning extra money) in order to make both elderly and the young residents actively participate. This intervention also includes a service model and therefore it is evaluated as a high potential solution by the stakeholders involved.



Balancing rhythms Wormerveer / Zaanstad

How can youth (between 15 – 20) be more integrated into the neighbourhood?



Zaanstad Image 1: 3D Visualization of Town Square with the documentation of arrows indicating the direction and intensity of each traffic flow.

The Zaanstad 1 Group analysis is about the perceived safety in the Central Square in Wormerveer that is negatively affected by the presence of younger residents. Below are the first impressions of the students about the square:

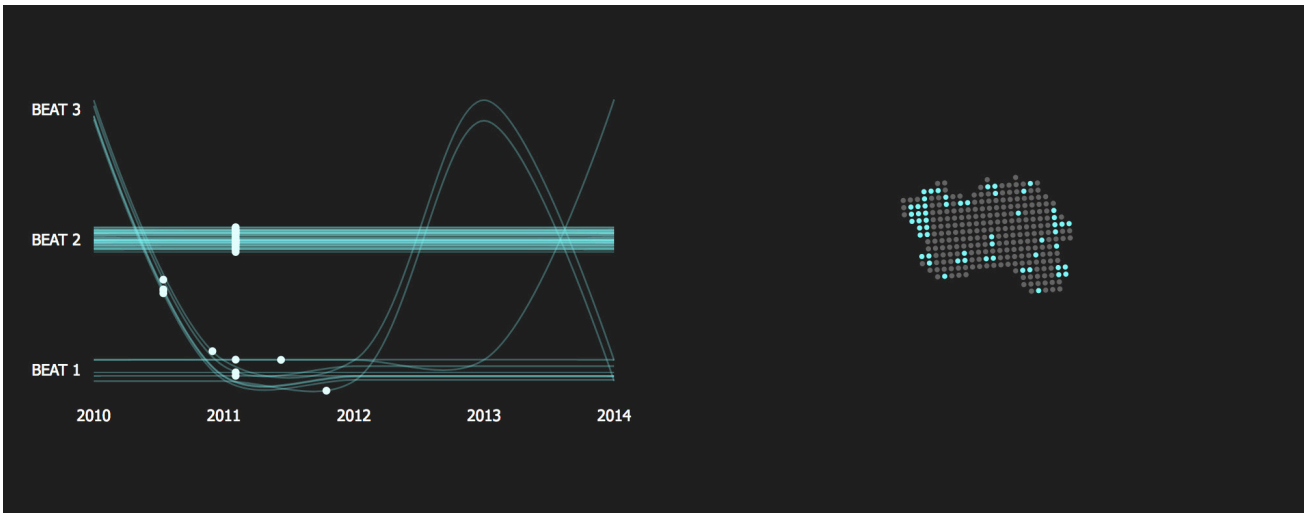
"The town square of Wormerveer has a central role in the village, all the streets lead to this place. In our opinion, considering the size of the population, this square is out of proportion. There are several shops around the square such as a Hema, a Bruna and two different supermarkets. There is a continuous flow of cars going in and out, since the whole square is actually a big parking area."

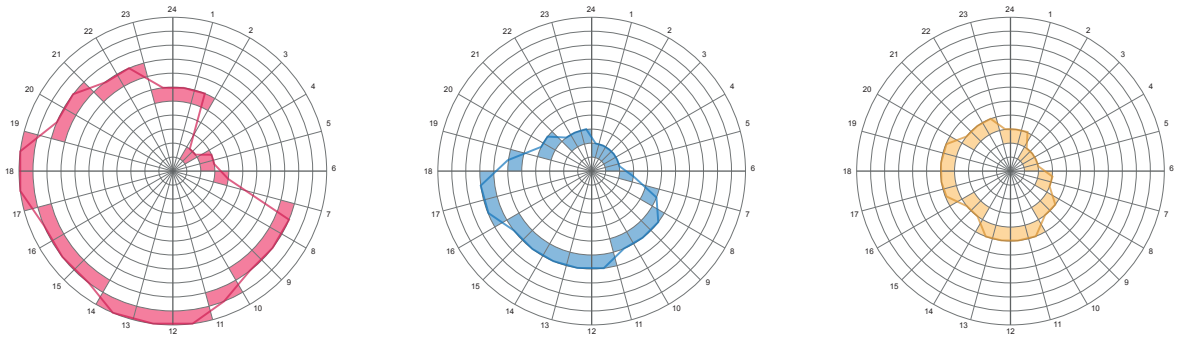
According to the municipality, the town square of Wormerveer is one of the areas where the citizens are supposed to come together; it is a public space.

Taking this into account, the students focus on showing different flows that take place in the square throughout the day: the people who visit the square, the flow of traffic in the square, the functions around the square, etc. In the image above, these findings are roughly sketched.

Based on the initial findings, the students observe and document four main flows according to their research question: car traffic, bike traffic, pedestrian traffic and gatherings of more than two people.

The findings, then, are documented on a 24-hour graph, in order to indicate how these flows change throughout the day. The graphs contain a scale from one to ten, making it possible to give an intensity to the observation on the four different flows.

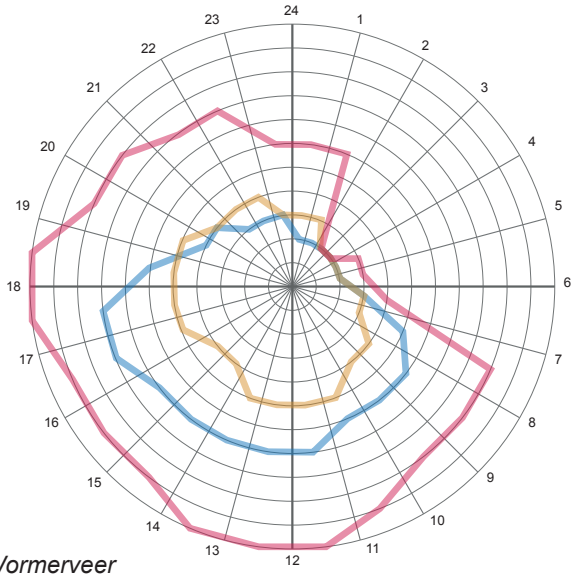




Zaanstad Image 2: Representation of flows in 24 hour graph. These three flows are car traffic (marked in red), bike traffic (marked in yellow) and pedestrian traffic (marked in blue).

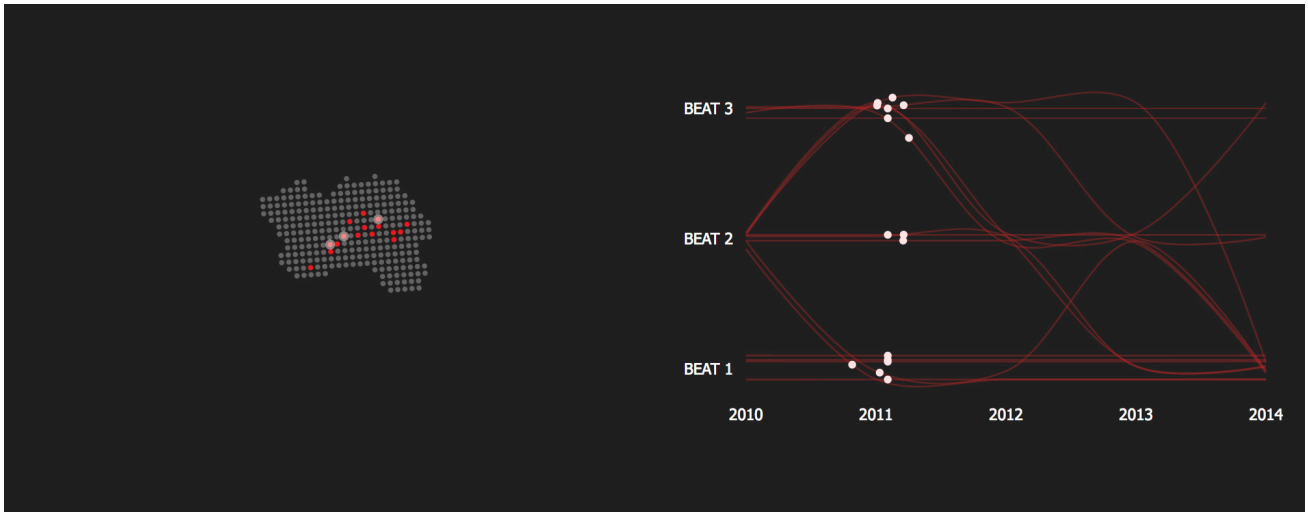
In these maps, it is evident that car traffic dominates the square, increasing throughout the day, while bike traffic and pedestrian traffic appear to be quite limited. Car traffic increases also during the day time, and dramatically decreases when the shops are closed.

The image on the right shows how a rhythm analysis can be established in the square, based on the three main flows that the students observed. When the representations of the three different flows in the square are transferred onto one graph, we get a base rhythm visualisation of the square.



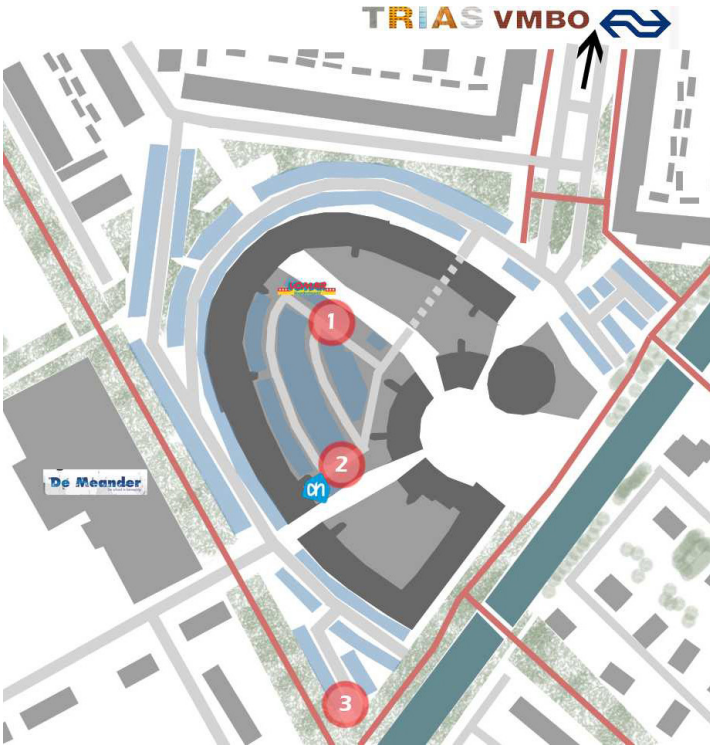
Zaanstad Image 3: Potential rhythm visualization of Wormerveer

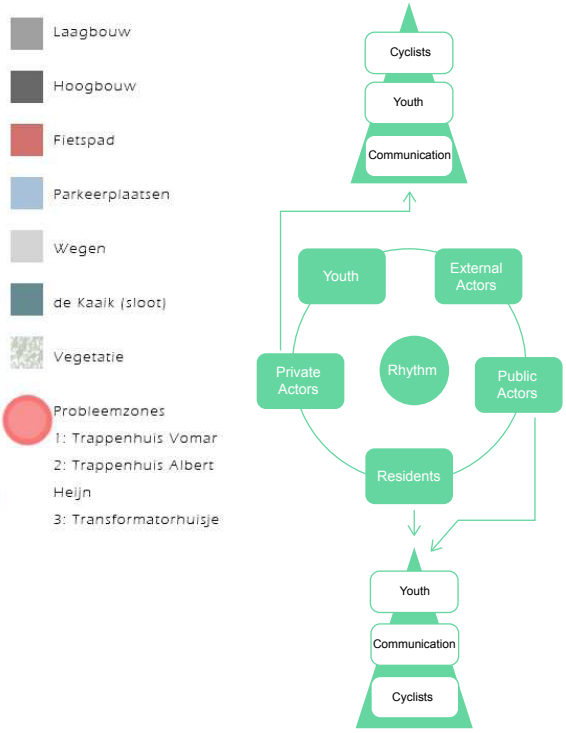
The Zaanstad case explores youth that linger on a square in two different neighbourhoods. The students analyse the rhythms of public spaces where the younger residents also spend time. In Wormerveer square which is a public space where residents are meant to come together, the flows are dominated by car traffic, making it hard for bikes to approach. Most of the pedestrians arrive in the square by car and walk from their cars to the shops, and only a few choose to gather and spend time in the square. The comparison of the different flows allows us to see that the younger residents choose to spend time around the square in the afternoon when all the activities are most intensive. As a conclusion, the students find out that the negative perception of younger residents depends on the intensity of the four analysed flows that take place in the square, which can be solved by balancing them more equally throughout the day.



Balancing rhythms Assendelft / Zaanstad

How can youth (between 15 – 20) be more integrated into the neighbourhood?





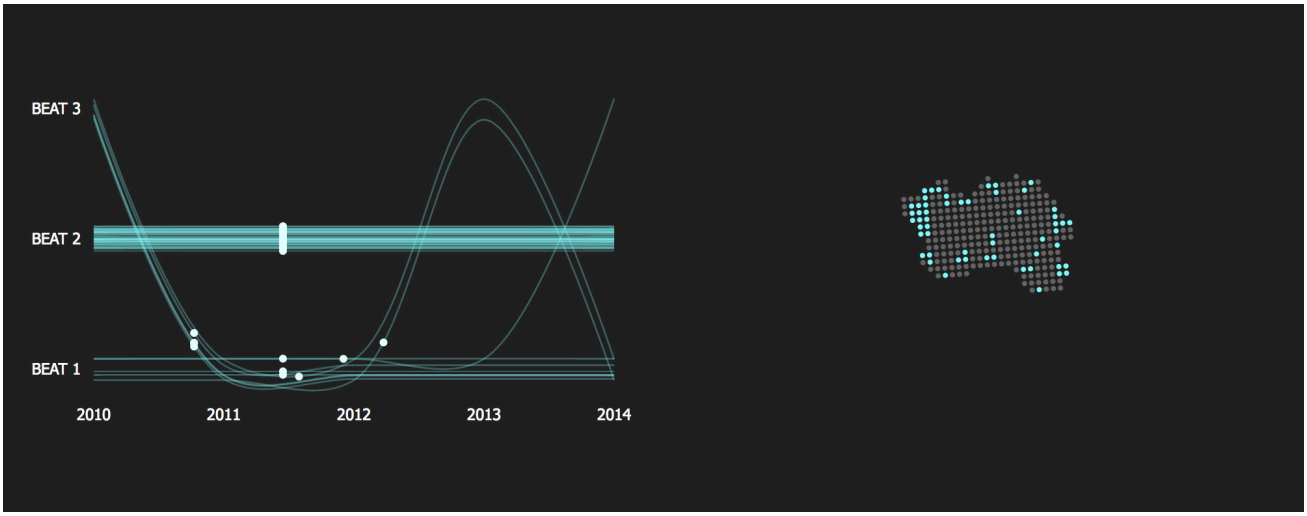
Zaanstad Image 1: Map of The Saen Shopping Center showing the spatial analysis

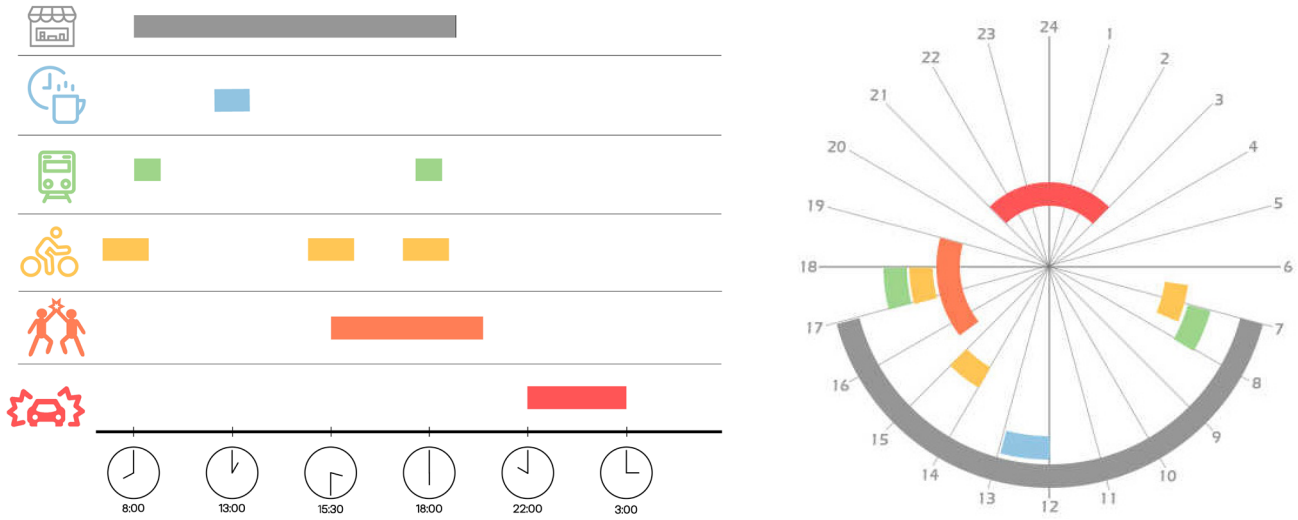
Zaanstad Image 2: Actor map

Zaanstad 2 Project Group's area of analysis is the shopping mall called 'The Saen' in Assendelft. Here are the students' first impressions on safety in Assendelft:

"The local residents indicated that at midday they feel safe, but not really in the evening/at night. This of course effects their well being, which they all characterized as moderate during surveys. The residents indicated that there are three main issues that cause their perceived safety to fluctuate and well being to be moderate; traffic safety, youth around the area and an unwilling municipality."

Thanks to the interviews on perceived safety in Assendelft, focus groups who are involved in creating negative perceived safety are identified in an actor map (image 2). The main actors are the young visitors and the cyclists, and there is also a perceived lack of communication between the residents and the municipality.





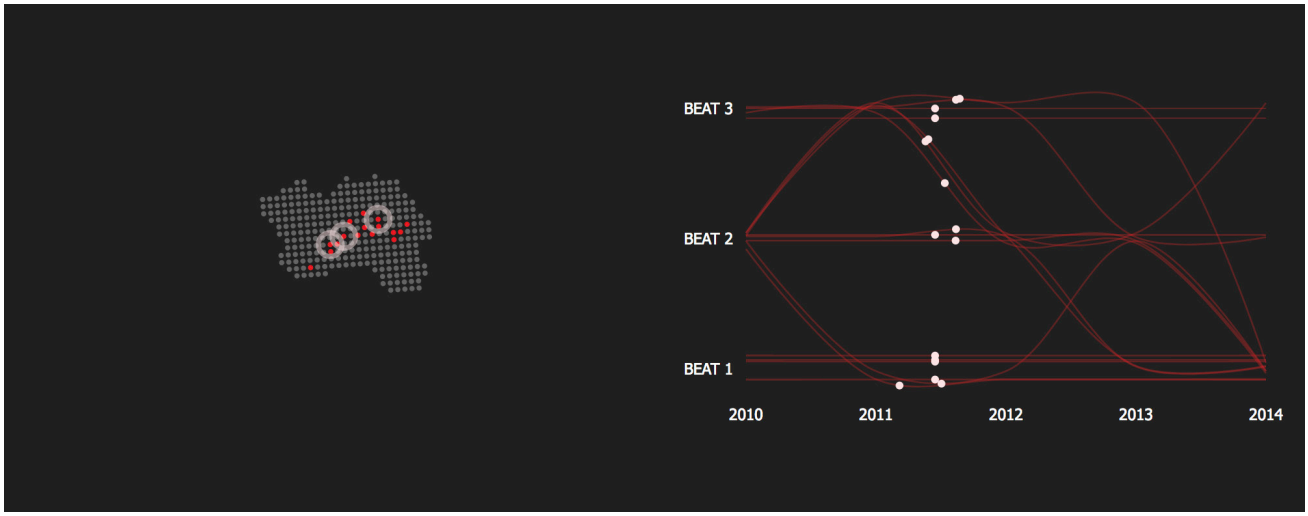
Zaanstad Image 3: Circular and linear documentation of the ground rhythm of the neighbourhood

Drawing an actor map influence the students to further explore the social situation in The Saen. Based on five activity flows that they observe at the shopping centre, the students carry out a rhythm analysis. These activity flows are: store opening hours (marked in grey), lunch break (marked in blue), transportation hours (marked in green), hours in which cyclists are frequent (marked in yellow), the time period in which the younger visitors are present (marked in orange) and the time period in which there is traffic (marked in red).

These time periods in which the five main activities take place throughout the day are indicated in a linear diagram. Later on, the data on the linear diagram is transferred onto a circular diagram, showing how these activities take place in the 24 hours of the day.

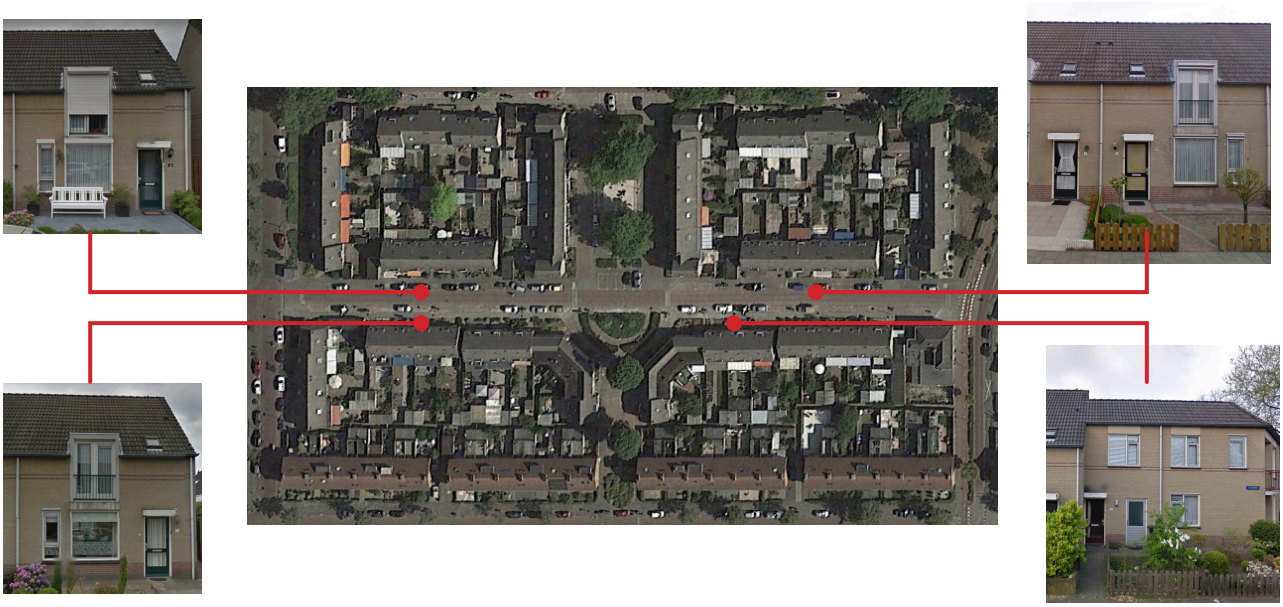
Also exploring the lingering youth in a public space, the Assendelft group studies the rhythms around the shopping centre The Saen. The rhythm overview of The Saen reveal the high intensity of rhythms between 17:00 and 18:00. In this time frame, bike traffic and public transport are more frequent, and the young residents are present. This situation creates an environment where the visitors do not feel safe, and the situation is reflected on the young residents. As a result, an intervention is proposed by the students for balancing the three rhythms by planting a little hedge to force bike traffic to go around the square instead of crossing it diagonally and as a consequence decreasing its intensity.

The Zaanstad project group cases are a great opportunity for City Rhythm, where the rhythms in specific locations are focused upon. In conclusion, we find out that the low sense of safety in public spaces can be due to the high or low intensity of rhythms, and can be balanced through creative interventions.



Quiet rhythms Tulpstraat / Helmond

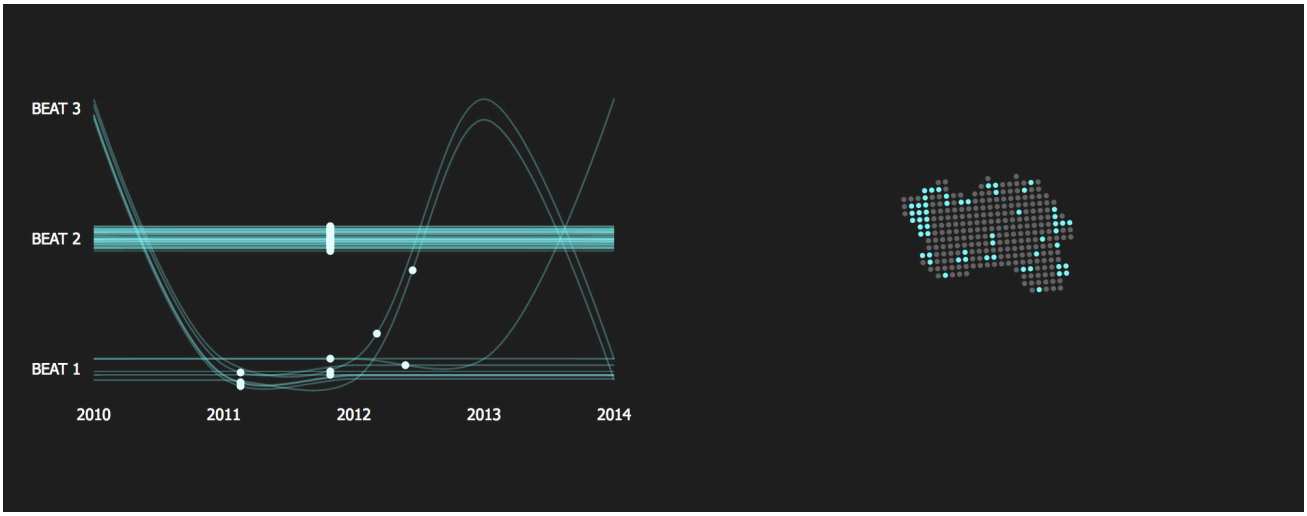
How can the sense of safety be improved in the specific neighbourhood of Beisterveld?



Helmond Image 1: Spatial analysis in Tulpstraat.

The Helmond group's project area is the Beisterveld neighbourhood. The students are given the research question of 'how to improve the sense of safety'. After the initial observations and interviews, the students discover that there is not a remarkable issue of safety, and the problem is then defined as the disconnection of residents among each other and with their environment. Here are the findings from their surveys on the sense of safety in Beisterveld:

"To get a better idea of people engagement with the neighbourhood, we carried out a survey in Beisterveld. An important aspect that is that the people of Beisterveld are relatively busy during their day with a 5,5 average out of 10. On the other hand, the people who carry out their daily activities in the neighbourhood scored an average of 2,6 out of 10. The score that came out the question of how engaged the people were with the neighbourhood, was a 4,7 out of 10. According to us, these answers give a good indication of the fact that the residents have a low sense of ownership of their neighbourhood."



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9.02				0
9.03				0
9.04				0
9.05		1		1
9.06				0
9.07				0
9.08				0
9.09				0
9.10				0
9.11				0
9.12				0
9.13				0
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9.16			1	1
9.17				0
9.18				0
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9.52				0
9.53				0
9.54				0
9.55				0
9.56				0
9.57	1			1
9.58				0
9.59				0
10.00				0

Tijd	Lopen	Auto	Fiets	Totaal avond
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19.01				0
19.02				0
19.03		1		1
19.04			2	2
19.05	2		2	4
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19.07				0
19.08				0
19.09				0
19.10		1	1	2
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19.13				0
19.14				0
19.15	1			1
19.16				0
19.17				0
19.18				0
19.19				0
19.20				0
19.21				0
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19.23				0
19.24	1	2		3
19.25				0
19.26	2		1	3
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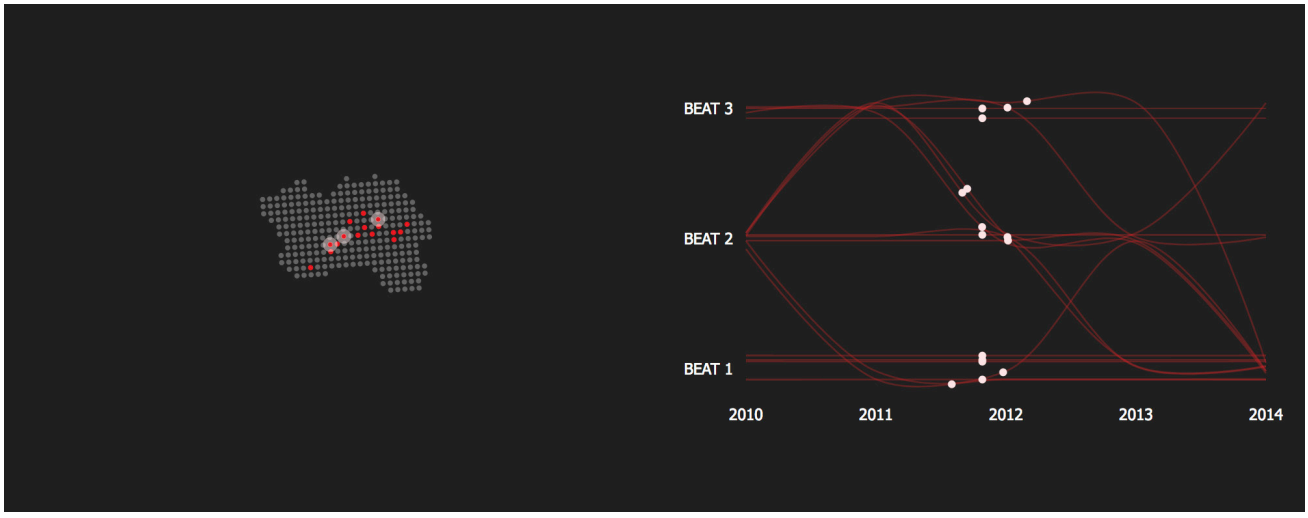
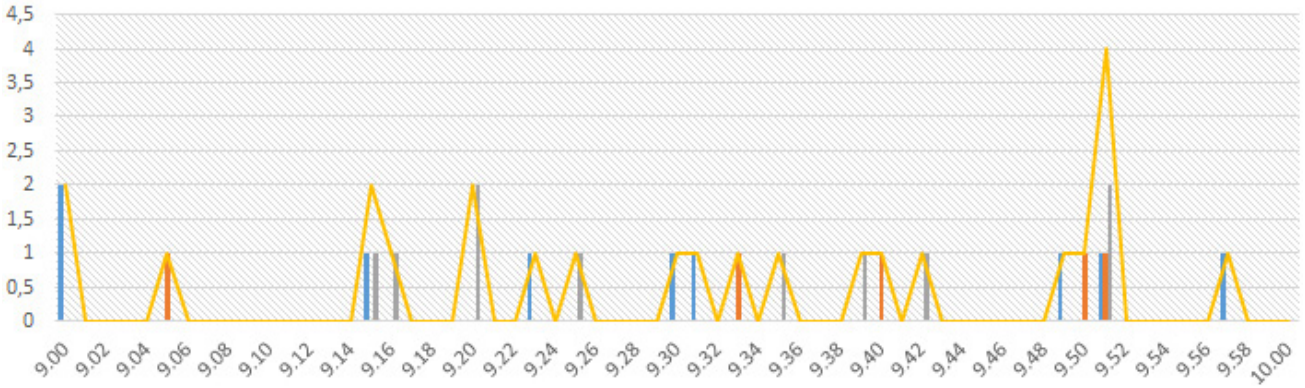
19.31				0
19.32				0
19.33		1		1
19.34			2	2
19.35	2		2	4
19.36	1			1
19.37				0
19.38				0
19.39				0
19.40		1	1	2
19.41	1			1
19.42			1	1
19.43				0
19.44				0
19.45	1			1
19.46				0
19.47				0
19.48				0
19.49				0
19.50				0
19.51				0
19.52	1	1		2
19.53				0
19.54	1	2		3
19.55				0
19.56	2		1	3
19.57		1		1
19.58				0
19.59				0
20.00				0

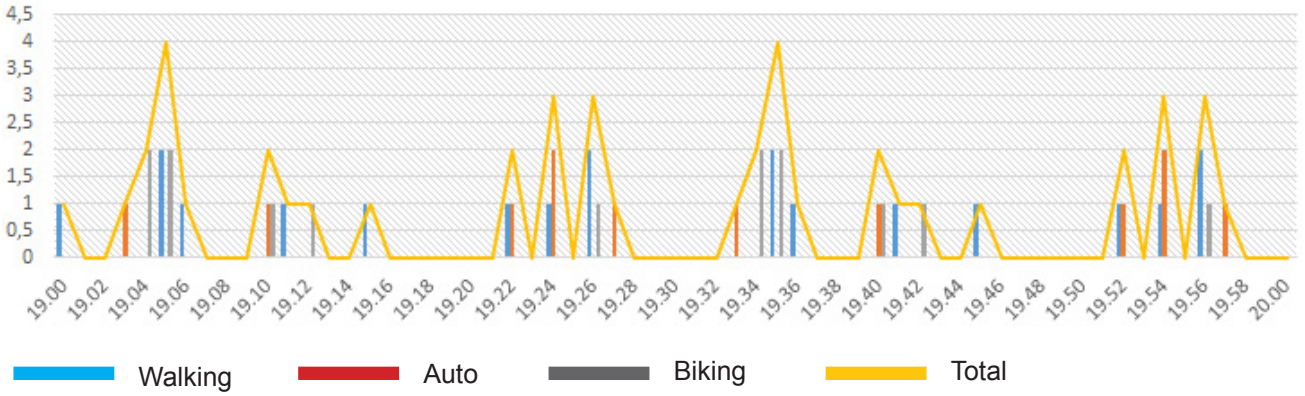
Helmond Image 2: Documentation of the activities in Tulpstraat



Morning Hours / 9:00-10:00:



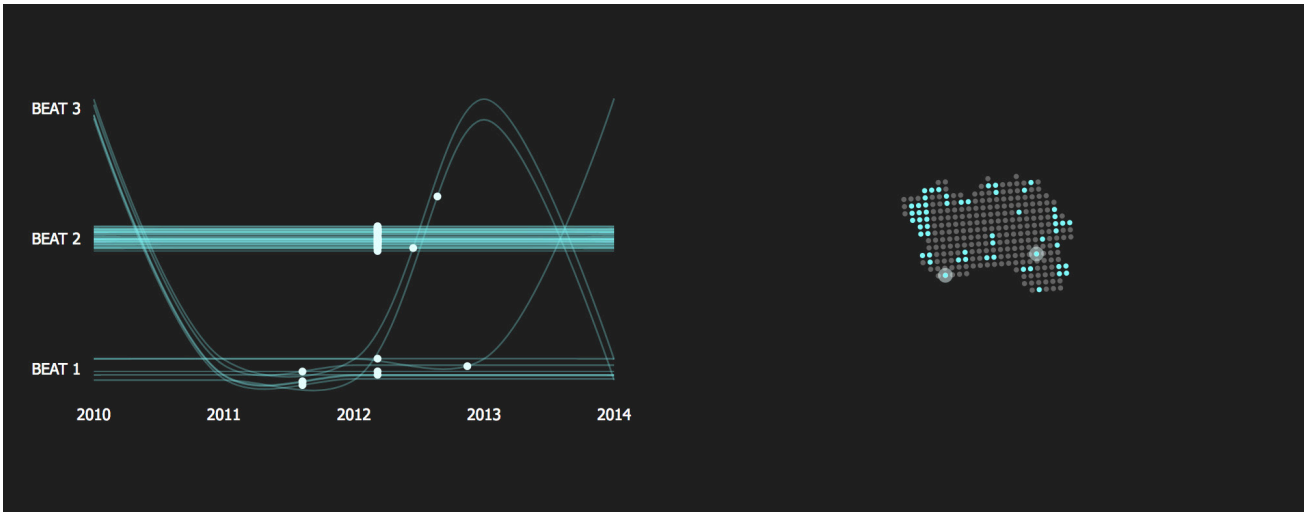
Evening Hours / 18:00-19:00:

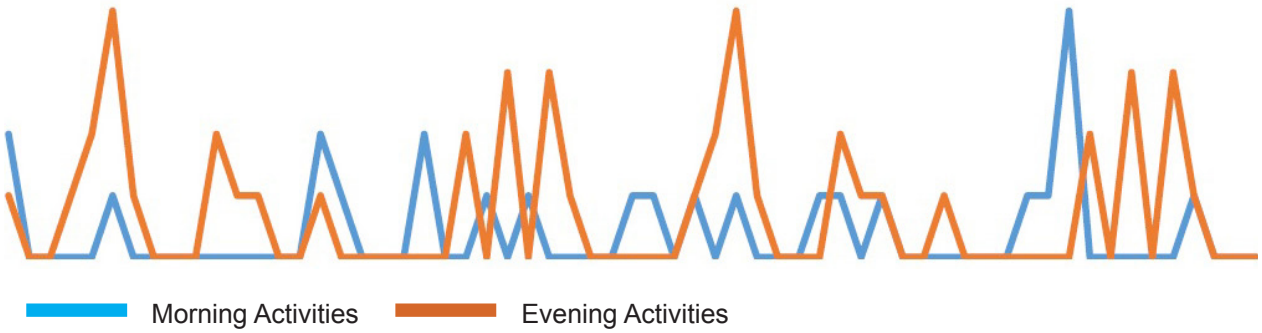


Helmond Image 3: Diagram showing the documentation of morning and evening rhythms in Tulpstraat

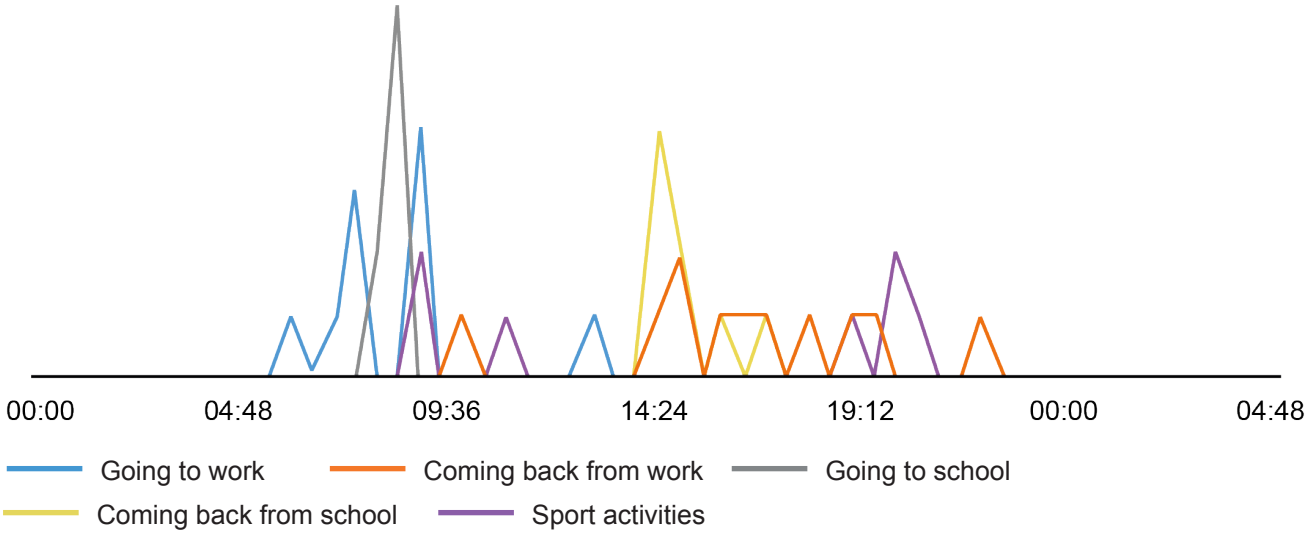
In order to observe better the disconnection between the residents and their living environment, the students established a rhythm analysis in a typical residential street called Tulpstraat. They do the analysis twice a day: from 9:00-10:00 in the mornings and 18:00-19:00 in the evenings.

The students visually observe and document the different activities in Tulpstraat. Three different types of activities are found in Tulpstraat; walking, biking and driving a car. After the site documentation, the findings of the morning and evening analyses are transferred into the graphs above. In these graphs, an intensity is given to each activity based on how many times per minute it happens. In addition to analysing the intensity of three types of activities in Tulpstraat, the students also analyse the destination of the different movements, based on 5 different common destinations as specified in image 5: Going to work, to school, coming back from work and from school, and sport activities.



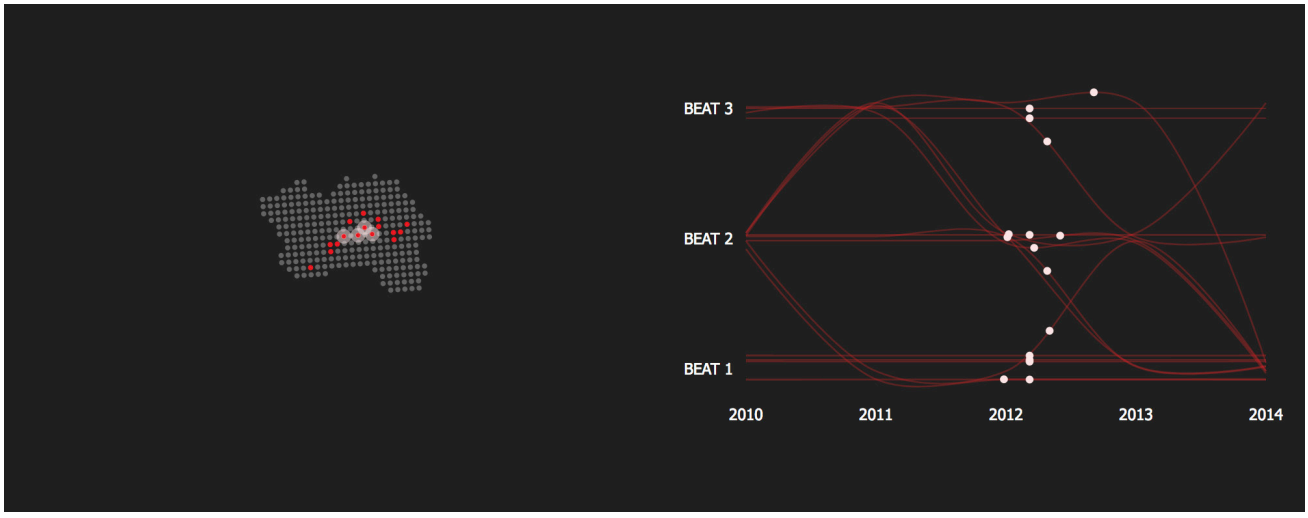


Helmond Image 4: Diagram showing the documentation of daily rhythms of Tulpstraat



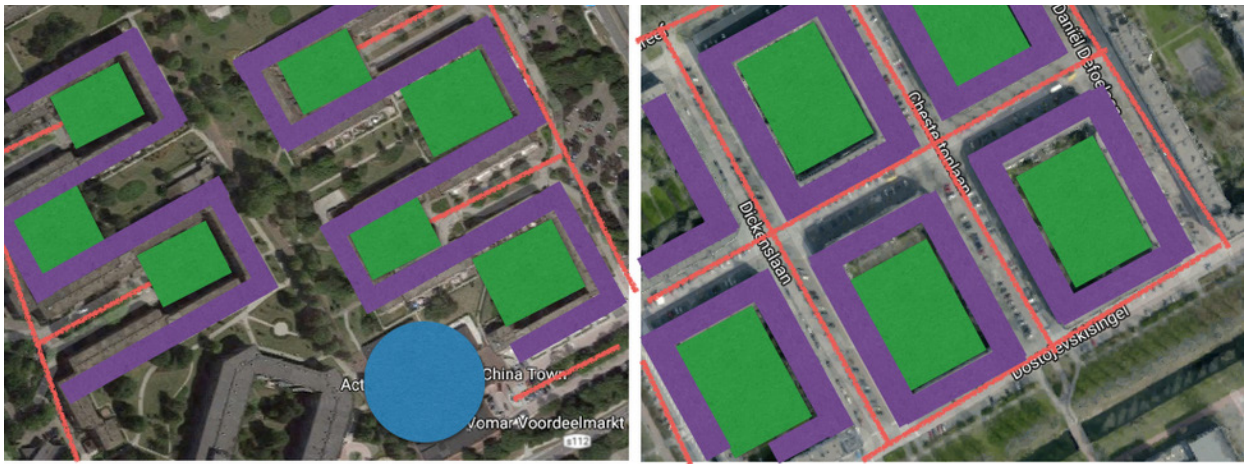
Helmond Image 5: Diagram showing the documentation of different destinations of movement during the day in Tulpstraat

In Tulpstraat residents experience a low sense of safety. Students notice that only activities related with mobility take place in this residential street and carry out a rhythm analyses based on three types of movements (bike, auto and walking). In addition, the origins and destinations of these movements are analysed, which are very different. In the final rhythm analysis, however, it can be observed that this finding does not influence the rhythms. In conclusion, City Rhythm defines the phenomena where the different types of movement do not create different rhythms as Quiet Rhythms. Just like the Zoetermeer case study, the result of the Helmond student group is about the quality of rhythms in an urban environment. From the perspective of rhythm intervention, identifying rhythms by mapping the movements into a geographic location does not result in the discovery of an intervention space.

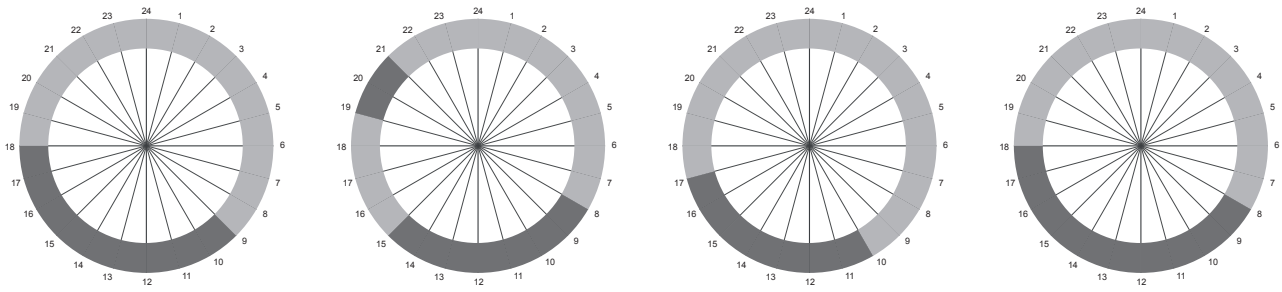


Matching rhythms Amsterdam Southeast

How can single mothers participate more actively in education, work and so on?



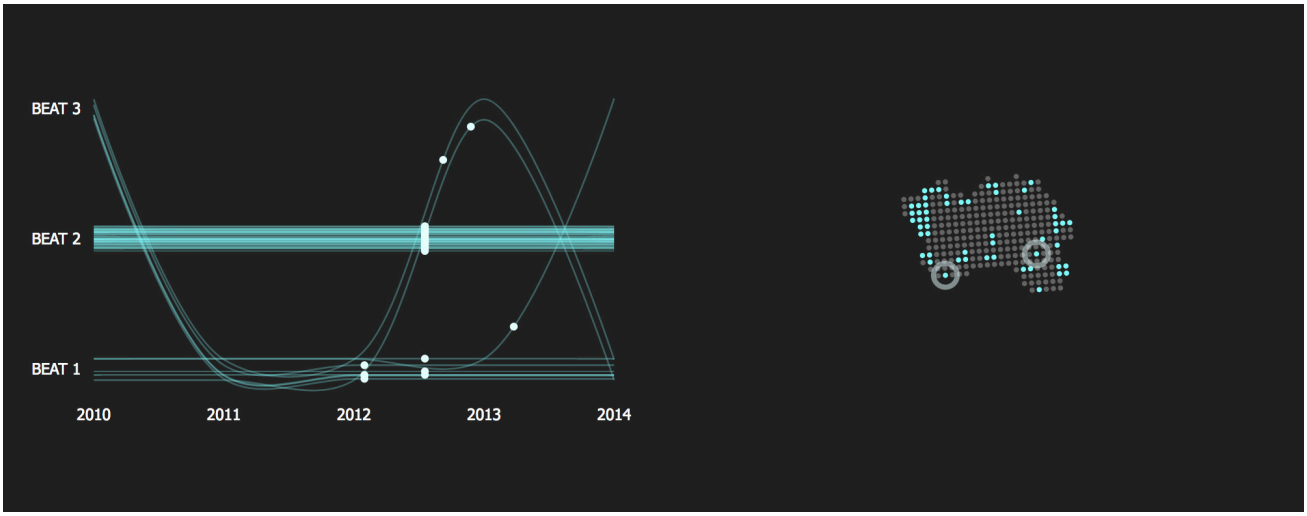
Amsterdam Image 1: Spatial analysis of Holendrecht and Venserpolder neighbourhoods

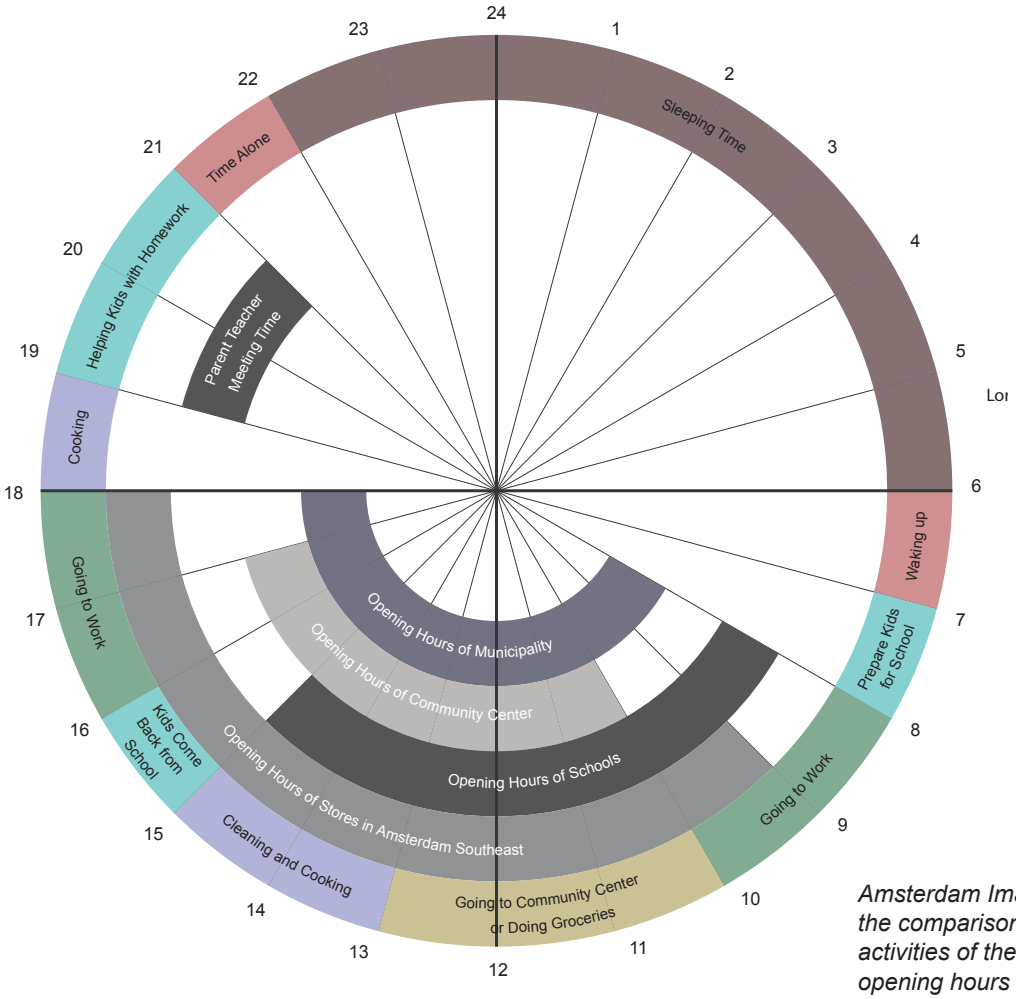


Amsterdam Image 2: Diagrams showing the opening hours of the main functions in Southeast

The Amsterdam Southeast case is concerned with how to influence single mothers to participate more actively in the daily life of the neighbourhood. This case study includes the Holendrecht and the Venserpolder neighbourhoods.

The students interview the single mothers in order to find out more about their situation. Following this, they conduct spatial and ecological analyses on the neighbourhood, to better understand the urban environment where these mothers live.

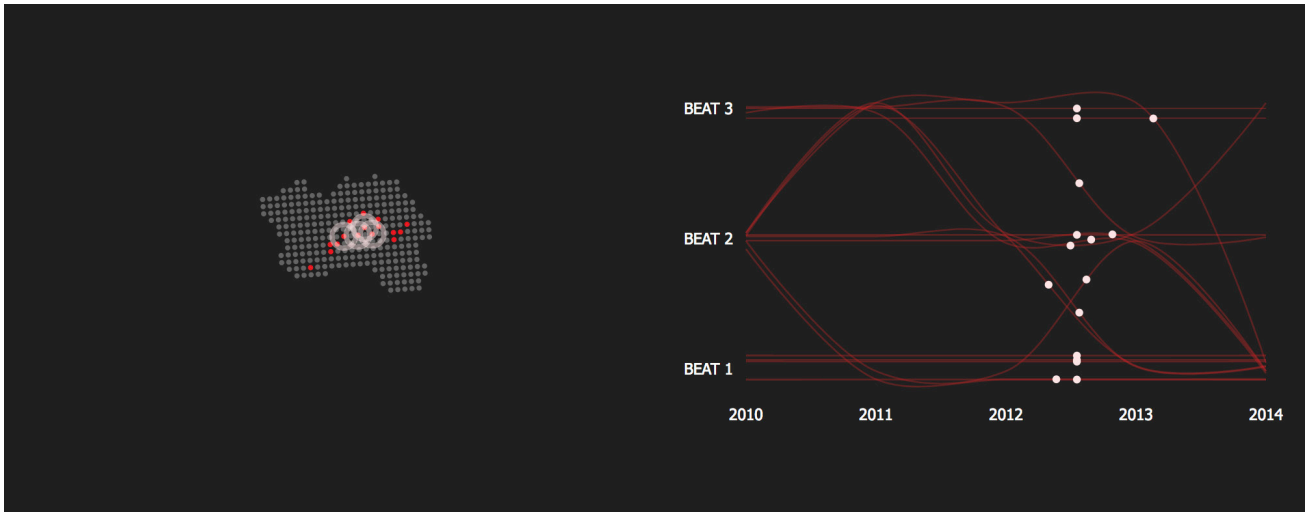




Amsterdam Image 3: Diagrams showing the comparison between the daily activities of the single mothers and the opening hours of the facilities.

The interviews show the difficulty the single mothers go through in matching their daily rhythms to rather formal rhythms in the neighbourhood, such as those of the municipality. The students analyse the daily life patterns of single mothers, the community organisations and other activities that they participate in, and those that they do not. These daily patterns are then compared to each other, in order to understand how the different rhythms affect each other. The conclusion of this rhythm analysis is a rhythm mismatch between the single mothers' and the neighbourhood's rhythms.

The rhythm analysis shows that the daily rhythm of the single mothers is defined by their children. In their daily schedule, they have to improvise all the time and even the teacher meeting (which happens twice a year, between 19:00-21:00) can become too much. A single mother reported in one of the interviews that she could not attend these meetings.



During the interviews, the Amsterdam group discover that informal networks such as local organisations are easily matched to the rhythms of the single mothers. They offer an environment where the children can play, no fixed appointment is required, so anybody can walk in at any time, and the people who work in these organizations are more welcoming to the single mothers and their children. Everyday there is someone present to give assistance on admin work or consultancy on other situations. For this reason, the single mothers can match their rhythms to the rhythms of the local organisations. The students analyse the rhythms of 5 local networks in the Holendrecht and the Venserpolder neighbourhoods: local foundations, neighbours, meeting spaces, community centres, municipality. They also document how these locations can be visited: informally, flexible appointments, free walk-in times, and only on appointment.

Single mothers in Amsterdam Southeast are having a hard time participating in education, work, administrative activities and even in the special services that are designed for them. The students analyse the daily rhythms of the single mothers and the rhythms of formal organizations. The comparison of these rhythms shows that the single mothers are unable to match their rhythms to formal rhythms of the institutions. Further exploration of the rhythms of the neighbourhood leads to the discovery that there are informal networks in which the single mothers are happy to participate. The students map these networks to show how their rhythms match. Their advice to the municipalities is to invest in these informal networks if they want to reach single mothers, which they have been doing since.

Community Center (Doen)

10:00 - 12:00	Meeting hours
12:00 - 15:00	Language and/or computer lessons for adults
15:00 - 18:00	Various activities for kids and teens
18:00 - 21:00	Sport and yoga for adults

Meeting Spaces (MultiBron)

09:00 - 10:00	Dutch conversation lessons
10:00 - 12:00	Walk-in hours (babbeluur)
13:00 - 16:00	Sessions for filling in formal documents
16:00 - 17:00	Courses for adults
17:00 - 18:00	Eettafel
19:00 - 21:00	Games night

Local Foundations (Stichting SES)

09:00 - 12:00	Meeting hours
12:00 - 15:00	Community activities
15:00 - 17:00	Activities for kids
17:00 - 18:00	Meeting hours

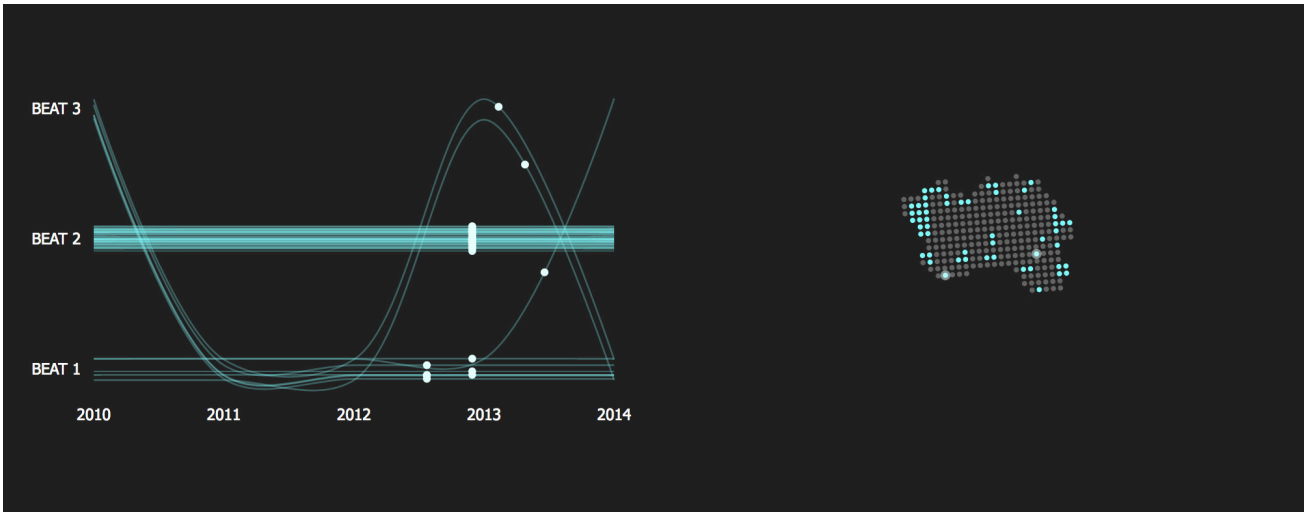
Neighbors

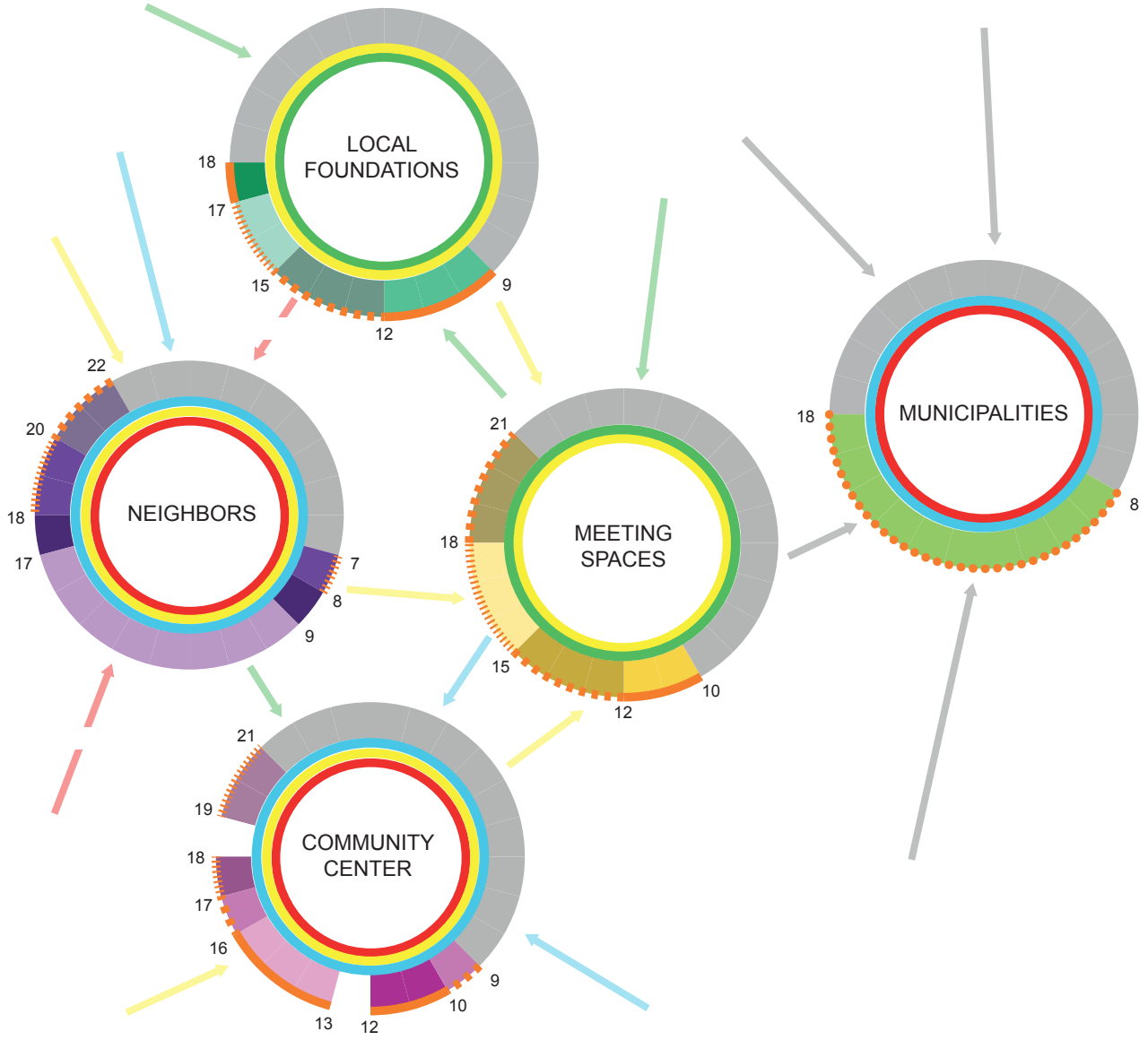
07:00 - 08:00	Waking up and breakfast
08:00 - 09:00	Going to work
09:00 - 17:00	Working
17:00 - 18:00	Coming back from work
18:00 - 22:00	Dinner and time with family

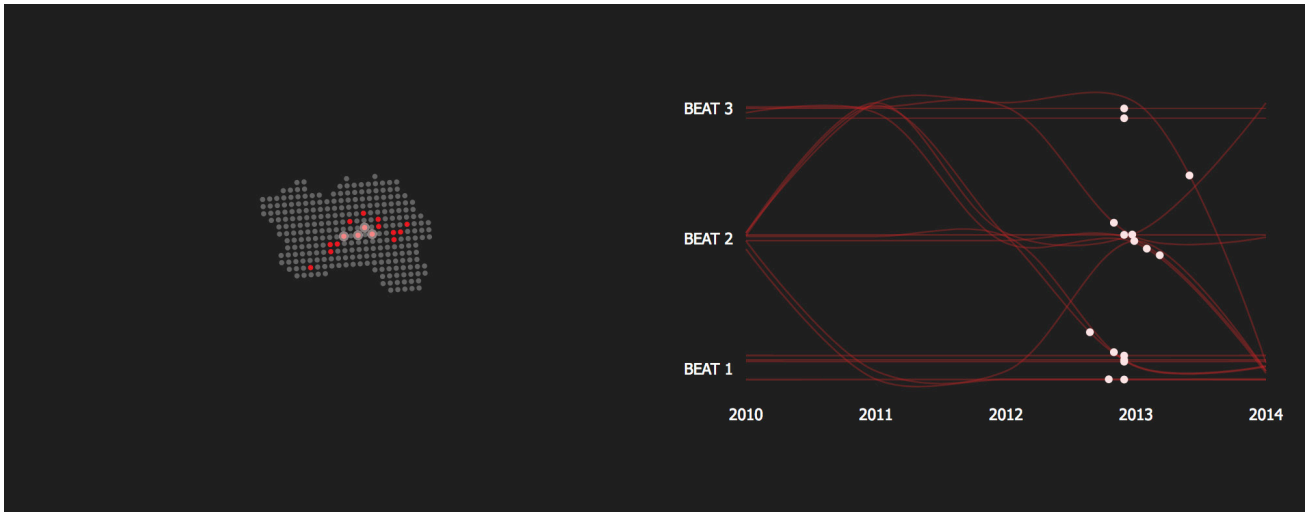
Municipality of Amsterdam Southeast

08:00 - 18:00	Office, appointment and contact hours

Amsterdam Image 4: Map of informal networks showing what kind of service the local organizations provide to mothers, and how the mothers can visit them.




LOCAL FOUNDATIONS
18
17
15
9
12
NEIGHBORS
22
20
18
17
7
8
9
MEETING SPACES
21
18
15
10
12
MUNICIPALITIES
18
8
COMMUNITY CENTER
21
19
18
17
16
13
12
10
9
How to visit
Informal activities
Flexible appointment
Free walk-in hours
Only on appointment
Reasons for visiting:
Social activities
Financial tasks
Administrative tasks
Activities for children


BEAT 3
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Evaluating the Case Studies

The work with students from Responsible Innovation Minor explored the process and outcomes of translating social issues into the rhythm domain. An important result in the case studies with students was that in order for rhythm analysis to be useful in policy making, the results have to be meaningful to the stakeholders. We found out that comparing the different rhythm analyses was fundamental to generating meaning. In order to do this, it is essential that research question pinpoints a specific social issue. The project groups who did not start with a precise research question oriented towards a specific focus group or a specific situation, did not obtain interesting results from the rhythm perspective, nor did they define rhythm intervention spaces.

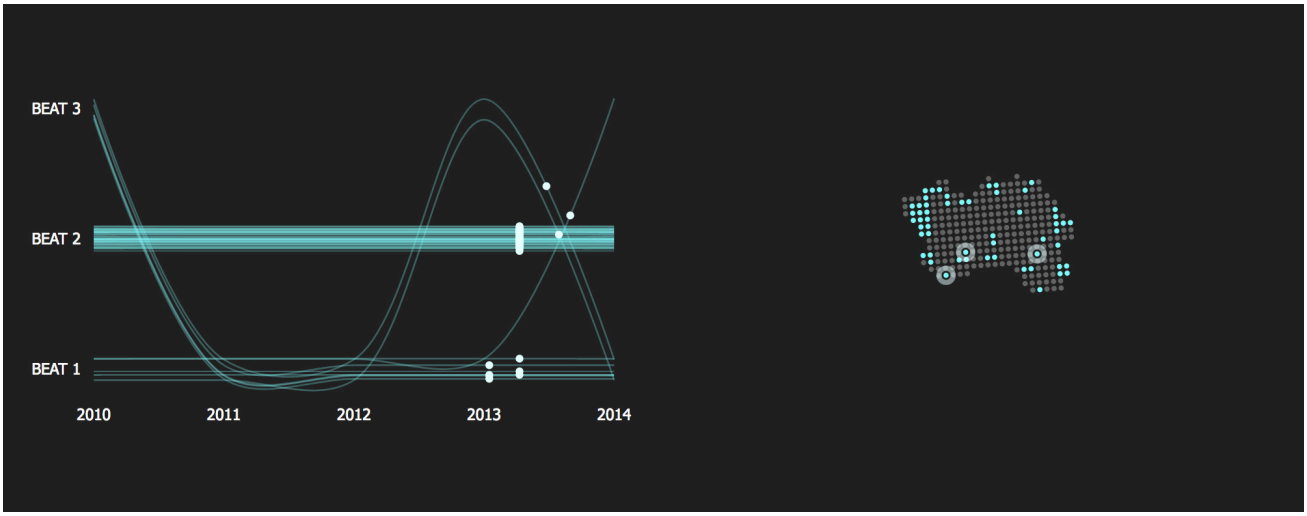
The case studies of Helmond and Zoetermeer were examples of this. Although the student analysis of Tulpstraat and the analysis of the Meerzicht Shopping Centre were thoroughly established, the research questions were not specific enough to compare identified rhythms with the rhythms of a precise actor group, or the rhythms of another street. Therefore, the results were not meaningful for policy making. On the other hand, the cases in which different rhythms were compared to each other, succeeded in defining rhythm issues such as a mismatch, tuning, sharing and balancing rhythms.

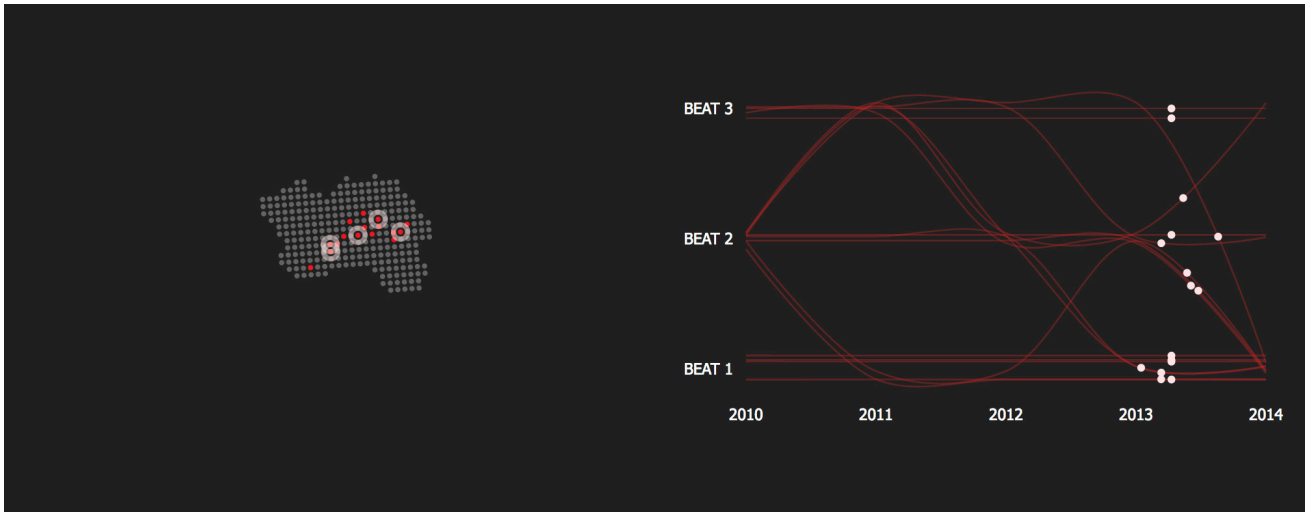
Another important result was to understand the role of different types of analysis for generating a rhythm overview of a social question. The students who worked with us had very different study backgrounds, and thanks to the Skill Labs and workshops, they had the chance to be trained in applying these methodologies of analysis.

We arranged weekly meetings with teachers, weekly and monthly meetings with civil servants, student presentations at the city councils and 3 conferences to introduce the theory of rhythm and to present student project results to stakeholders. All these meetings and events were helpful in creating good interaction between teachers, students and civil servants.

In frequent meetings with teachers, the students were able to discuss their weekly findings. During the presentations at city councils the students presented their findings to the municipalities that their analysis was part of, as well as to the residents of the neighbourhoods and other stakeholders. At the 3 conferences, which took place at the beginning of the year, after the first quarter, and at the end of the student work (end of the first half year of the research), the students presented their findings to all participators.

At the end of the case studies, the municipalities strongly acknowledged the benefits for policy making of translating a social issue into the rhythm domain. It was found very useful to focus on the rhythms of selected target groups and the rhythms of neighbourhoods, instead of the characteristics and behaviour of specific people, as it is usually done during the analyses of social issues. Finally, based on the work with the students and civil servants, the City Rhythm research team developed a methodology for translating social issues into rhythm issues. The methodology will be discussed in the next chapter.

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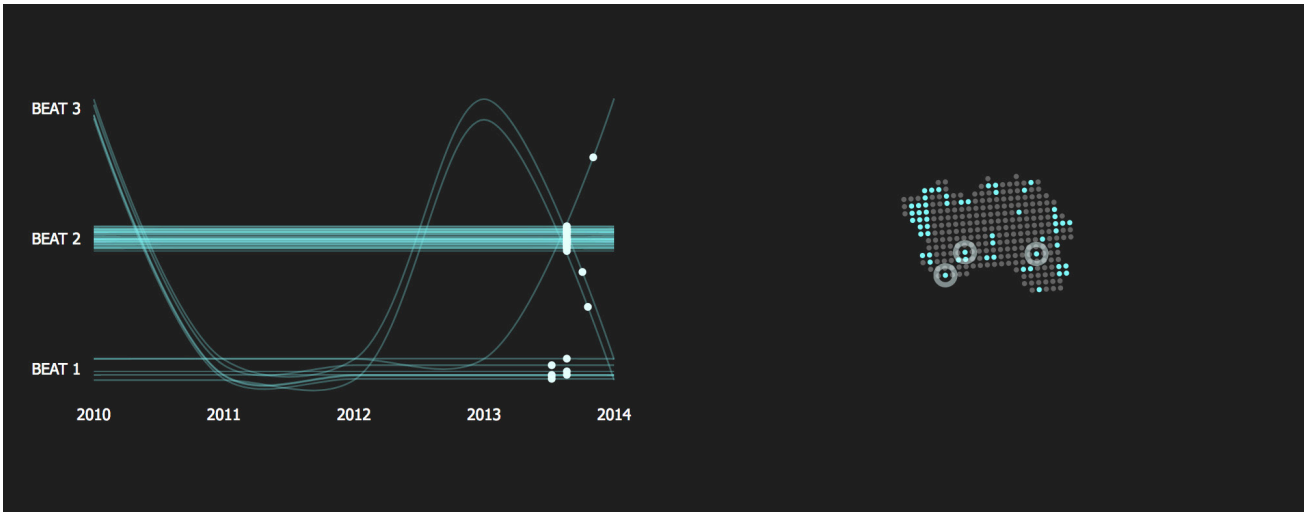
Methodology for Social Urban Rhythm Analyses

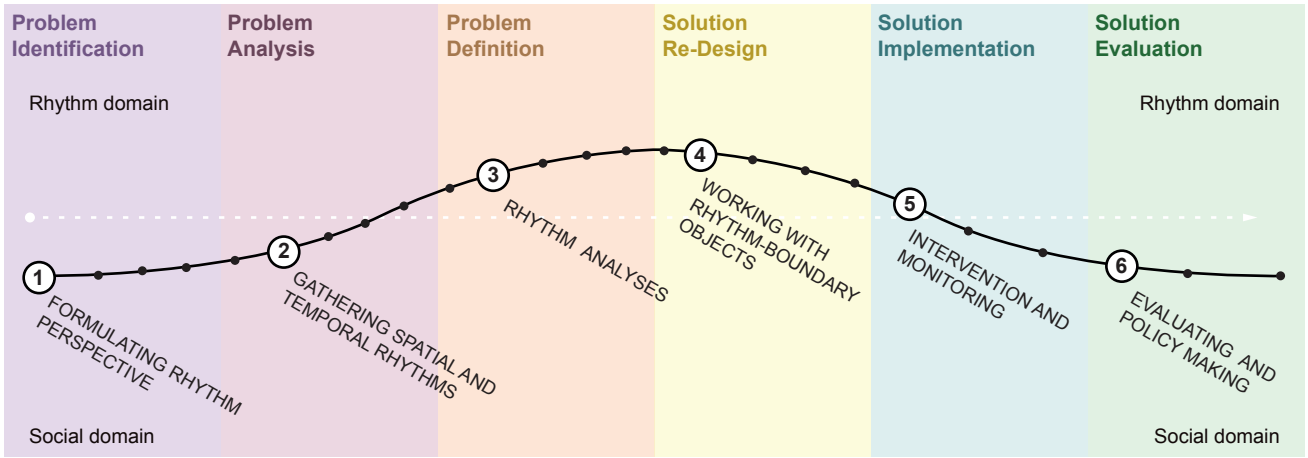
62 by Pinar Sefkatli and Caroline Nevejan



Introduction to the methodology

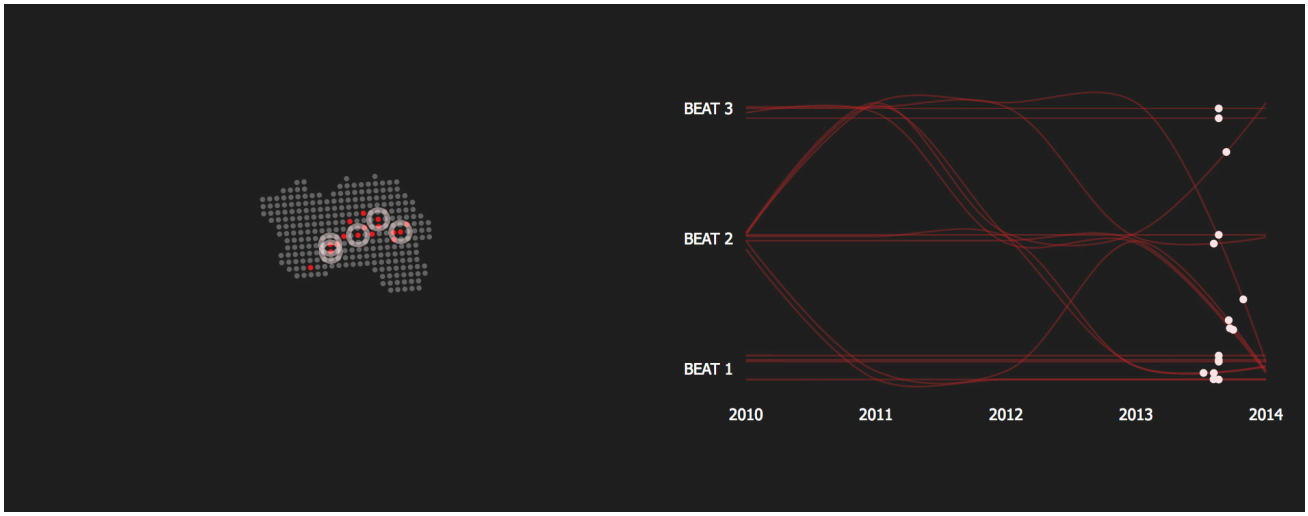
This chapter discusses the methodology for establishing a rhythm perspective on urban social issues in a neighbourhood in order to define new solution spaces and make conclusions for policy making. The student work in the six case studies shows that the rhythm perspective of an urban social issue works as a boundary object, creating new avenues for the social issues to be addressed. The making of boundary objects facilitates the sharing of a common language for enabling such collaboration (Leigh Star 2010). The different communities of practice make use of boundary objects in order to support their interaction and collaboration (Arias & Fischer 2000). City Rhythm case studies show that when a social situation is re-explained from the perspective of rhythm (as a result of rhythm analysis), more stakeholders collaborate in the identification of solution spaces, leading to new kinds of interventions. According to the discussions with the municipalities, such an approach opens up new fields of policy making.

The methodology is built upon the TU Delft Responsible Innovation Intervention Cycle (van de Hoven, Vermaas, van de Poel 2015), which consists of six stages; Problem Identification, Problem Analyses, Problem Definition, Solution Re-Design, Solution Implementation and Solution Evaluation. The rhythm methodology establishes six steps as well; Formulate Rhythm Perspective, Gathering Spatial and Temporal Rhythms, Rhythm analyses, Present Rhythm-Boundary Object to Stakeholders, Intervention and Monitoring, Evaluation and Policy Making. The graph below shows that during the Problem Identification step of the Intervention Cycle, the rhythm perspective of the social issue is formulated; in the Problem Analyses step, spatial and temporal rhythms are analysed; in the Problem Definition step rhythm analyses are carried out; in the Solution



Visualization of the methodology for translating social issues into rhythm issues, by Pinar Sefkatli

Re-Design step, the rhythm-boundary object is presented to stakeholders; in the Solution Implementation step, the rhythm intervention is carried out and monitored; and finally, in the Solution Evaluation step, the rhythm intervention is evaluated and conclusions are made for policy making. Each step of the methodology consists of different methods of analyses, documentation and validation techniques that come from the social sciences, architecture and even biology. In this chapter, the steps of the methodology are presented and the methods of analyses of City Rhythm are explained.



STEP 1

Formulating rhythm perspectives on the social issue

This is the exploration phase where the general framework of analyses is drawn, initial ideas about the social issues in urban contexts are developed, and rhythms which are significant to the social issue are explored. Photos, sketches, maps, videos or many other creative techniques can be used to document the findings. The first step includes four sub-steps.

Question articulation: Stakeholders engage in brainstorming sessions to discuss the urban/social issues that they want to explore, and which of those are interesting from the rhythm perspective. These stakeholders should be well informed about the neighbourhood's social and physical context. The sessions include sharing ideas on what rhythm is and what creates rhythms in neighbourhoods, how rhythm analyses can be carried out in the proposed contexts, and how it can shed light on possible issues to analyse.

Interviewing stakeholders: After deciding upon the research question, interviews are carried out to get initial ideas about the given issue. A social issue in an urban context can depend on many factors and the interviews help to understand the stakeholders' idea and position about that issue. Interviews also give information on what the people think about the urban environment, where they live, how they use it and interact with others.

Spatial, social, ecological and functional analyses: The social/urban context is further explored by different methods of analyses.

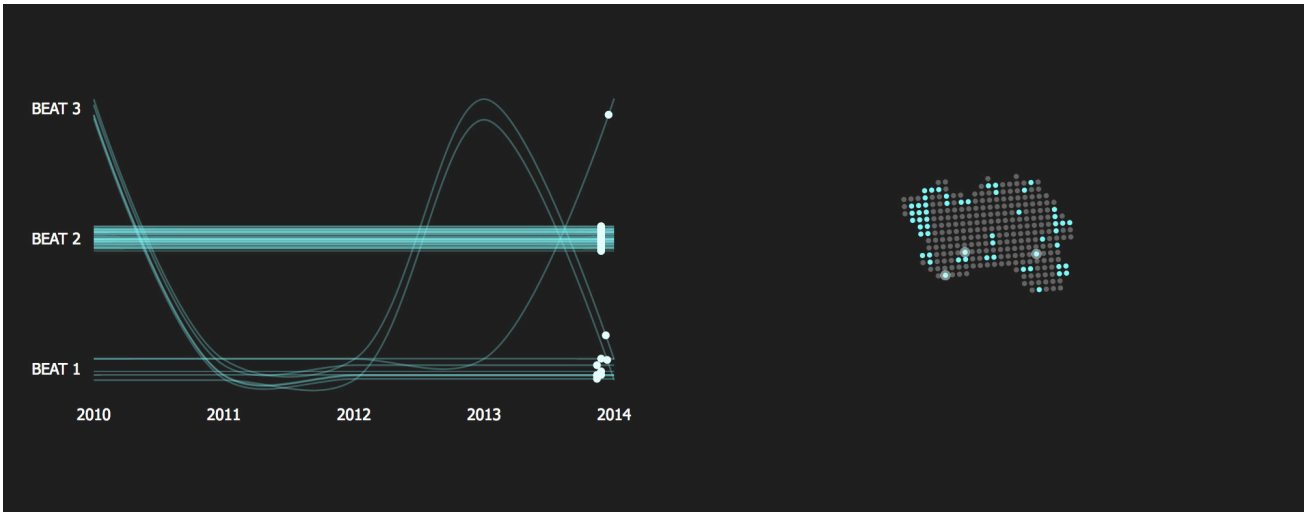
Spatial analysis is based on visual observation. In this analysis, the researcher visits the location of analysis and uses his/her 5 senses to answer the question "What am I looking at?".

Social analysis focuses on the demographic aspect of the urban area where the social issue takes place. There are big differences, for example, between the rhythms of young neighbourhoods and those where the elderly are a majority. The same for neighbourhoods where there are many large families or small households.

Ecological analyses reveal the environmental aspect of an urban area, how it is taken care of and how it is used. According to the case study in Helmond, for example, the litter in the green areas of the neighbourhood

and the absence of children in the same areas create a negative impact for the sense of safety.

Functional analysis is used to understand the activities that shape and vitalise an urban area, if they are functions specific to that neighbourhood or not. It can be carried out by visiting the area of analysis, or by using digital methods like online search engines or datasets from municipalities that indicate the different shops, businesses, parks, schools or other public and private amenities.



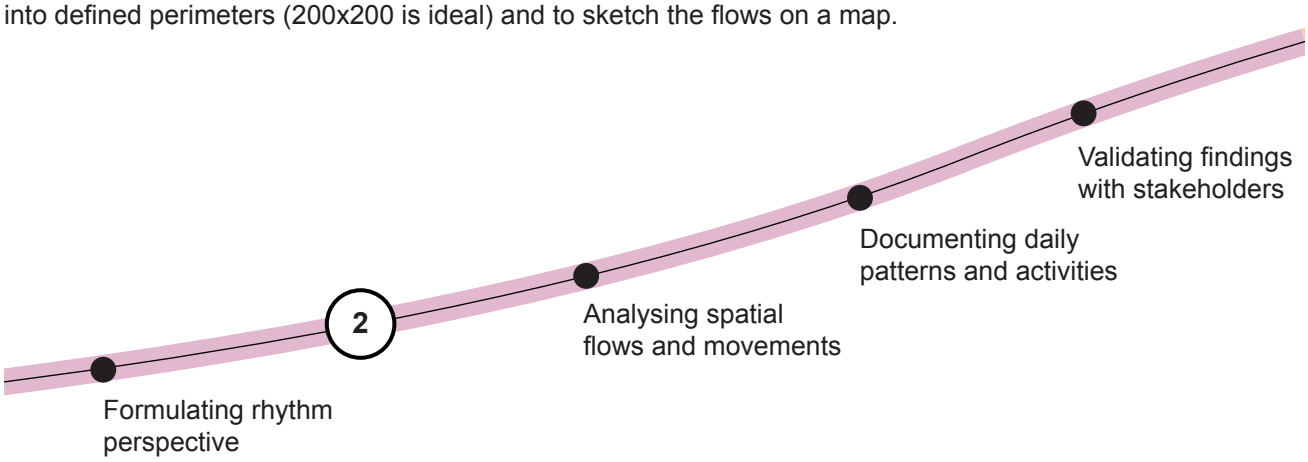
Formulating rhythm perspective: As analyses from different perspectives give various indications on the rhythm aspect of the social issue, in this step they are brought together to establish a redefinition of the social issue. The findings of the interviews, spatial, social, ecological and functional analyses are visualized and reflected upon, based on the initial research question. The visualization communicates the impact of the different rhythms of a given social issue to the stakeholders, establishing therefore, the rhythm perspective.

STEP 2

Gathering spatial and temporal rhythms

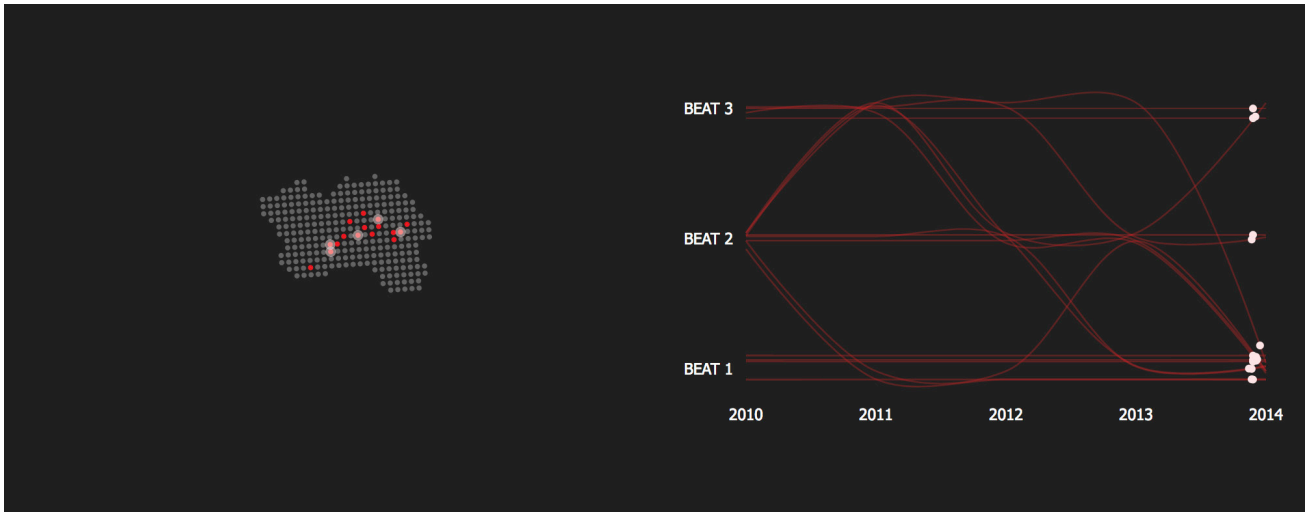
In this step, the focus is on the physical structure of an urban area, in relation to the daily patterns and activities that take place in the neighbourhood where it is part of. After spatial and temporal analyses and documentation, the findings are validated by the stakeholders.

Analysing spatial flows and movements: The people's movements and standing points in a neighbourhood are studied in relation to the functions. The analysis suggests that the character of the movement of the people influences rhythms. People who are walking towards a specific function like a school have different rhythms from the people who are just wandering. Streets where people tend to stand have very different rhythms to streets that are used only for mobility. In this analysis, functions, activities and street types are studied as well as the locations where people stand. These are then compared to people's routes and their walking speed, in order to understand how these flows are structured. It is best to divide the neighbourhood into defined perimeters (200x200 is ideal) and to sketch the flows on a map.



Documenting daily patterns and activities: Following the spatial flows and movements, the temporal aspect of the findings is explored. The time frame in which the intensity of the different movements changes, or the hours in which the functions in the neighbourhood take place are studied. For example, during rush hours the intensity of bike traffic can increase in a neighbourhood. When most of the stores are closed, the rhythms of a square will drastically change. The findings from this analysis are documented hourly or weekly.

Validating findings with stakeholders: The findings and documentations about the urban context of the social issue (graphs, photos, maps) are validated with the stakeholders in order to confirm whether the information gathered is accurate and insightful enough to make first conclusions about the research question.

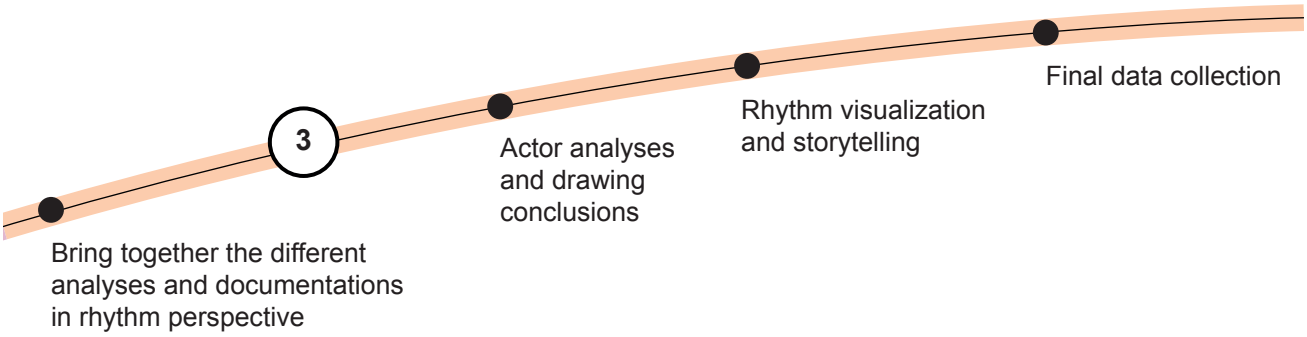


Bringing together the different analyses and documentations in rhythm perspective: So far the research has consulted different methodologies of analyses and documentation in order to gather data about the urban context where the social issue takes place. Going back to the initial research question, all findings are placed on the table and reviewed in order to validate how they are interesting from the rhythm perspective. The integration of the findings establishes the base rhythm of the neighbourhood.

STEP 3

Rhythm Analyses

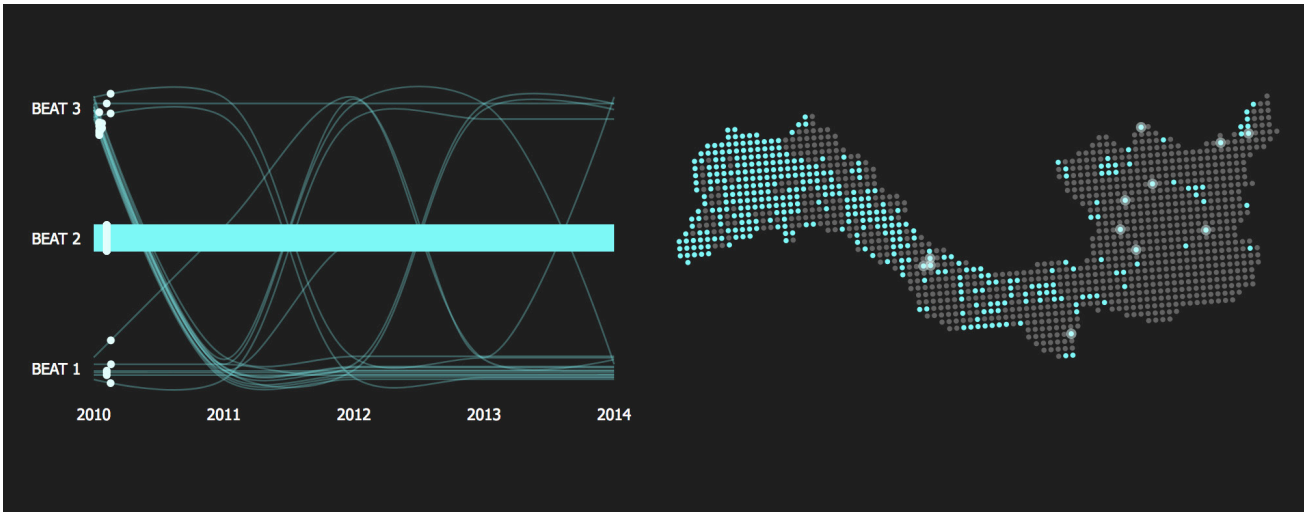
The rhythms related to the social issue are explored in detail and further data are collected regarding the urban context. Such detail enables the rhythm analysis to function as a boundary object in the next step, structuring the conversation of the stakeholders around accurate facts.



Actor analyses and drawing conclusions: Proceeding to the Problem Definition phase of the Intervention Cycle, the research team explores the actors that play a main role in the social issue in more detail. This is done by choosing target groups and analysing their daily rhythms. Based on the chosen target groups, personas may be created, which allow the detailed documentation of personal rhythms. Bringing together the information from the interviews and site research, the possible activities the target groups carry out during the day are listed with specific hours. Being as visual as possible from the beginning in this documentation helps to communicate the findings and see the rhythm aspect immediately.

Rhythm visualization and storytelling: In this step, the findings of the spatial and temporal analyses of the urban context are visualised. The time frame of the visualization may vary based on the research question as daily, weekly or monthly rhythm visualisations. Based on the visualisation of different rhythms, scenarios are created that explain the social issue from different rhythm perspectives.

Final data collection: At this stage, the researcher needs specific answers from the interviews. Having identified actors whose daily life patterns are important for research, the researcher can go directly to the people who are part of the chosen actor groups with pre-defined questions, or direct these questions to organisations or social groups that the actor group is associated with. At the same time, additional datasets (such as municipality maps) can be viewed in order to enrich the spatial and temporal analyses.

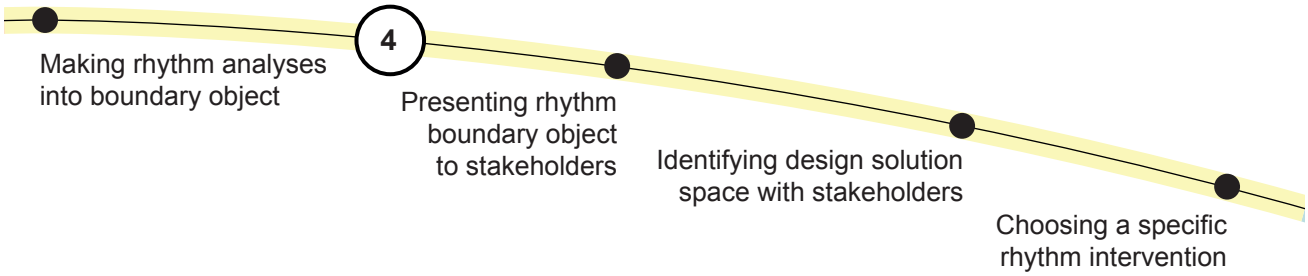


Making rhythm analyses into a boundary object: In this final step of bringing the social issue into the rhythm domain, the results are critically combined and compared, based on the initial research question. This can be done by comparing the rhythms of different people or persona's with the rhythms of selected areas in the neighbourhood, different rhythms of the neighbourhood, or altogether in different time frames. Representing these comparisons visually will make it possible for the stakeholders to collectively reflect on the rhythms that affect the social issue and make conclusions regarding the rhythm domain.

STEP 4

Working with rhythm-boundary objects

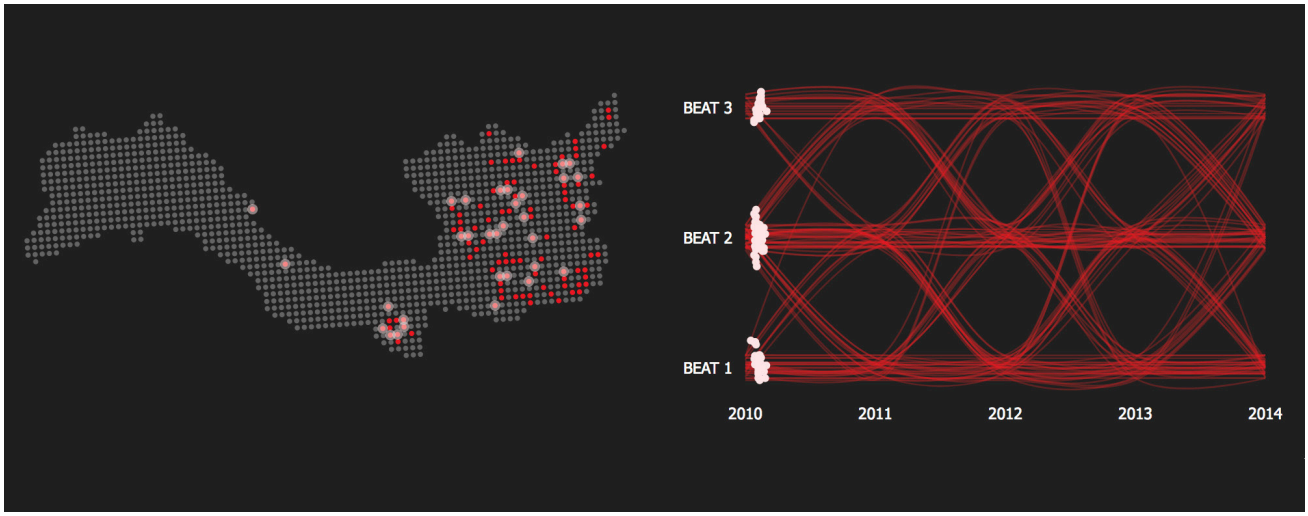
After the analysis is conducted and the translation has been made from the social issue to the rhythm issue, the next step is to define design solution space in collaboration with stakeholders. This presentation can happen in 3 steps:



Presenting rhythm boundary object to stakeholders: To present the rhythm analyses in an effective way, the researcher creates a visual narrative of the rhythms that define urban context where the social issue takes place (based on spatial, ecological and functional analyses and the analyses of flows), the rhythms of the actors that play a role (possibly based on the persona's). This narrative includes results of comparing these rhythms to each other. A series of workshops are carried out with stakeholders from different professions and/or with people who are informed about the studied social issues, in order to get feedback from numerous perspectives. As a result, new definitions of the social issue emerge.

Identifying design solution space with stakeholders: Based on the presentation of the rhythm boundary object, stakeholders reflect on how the different dynamics relate to each other in order to define the social issue from the rhythm perspective. Finding new definitions for social issues reveal at the same time new design solution space. In City Rhythm, where the goal is to enhance social safety, four dynamics are contextualised: rhythm intensity, matching rhythms, tuning rhythms and sharing rhythms.

When the observer is confronted with a large variety of rhythms, or the opposite, with one main very strong rhythm, the situation is explained as "rhythm intensity" (1). Different actor groups have different daily, weekly and monthly rhythms. Creating common rhythms is called "matching rhythms" (2). The act of "tuning rhythms" includes making a new contribution to existing rhythms, through introducing activities that adapt them to each other (3). Bringing a large group together in a neighbourhood around a common activity encourages the people to "share rhythms" (4).



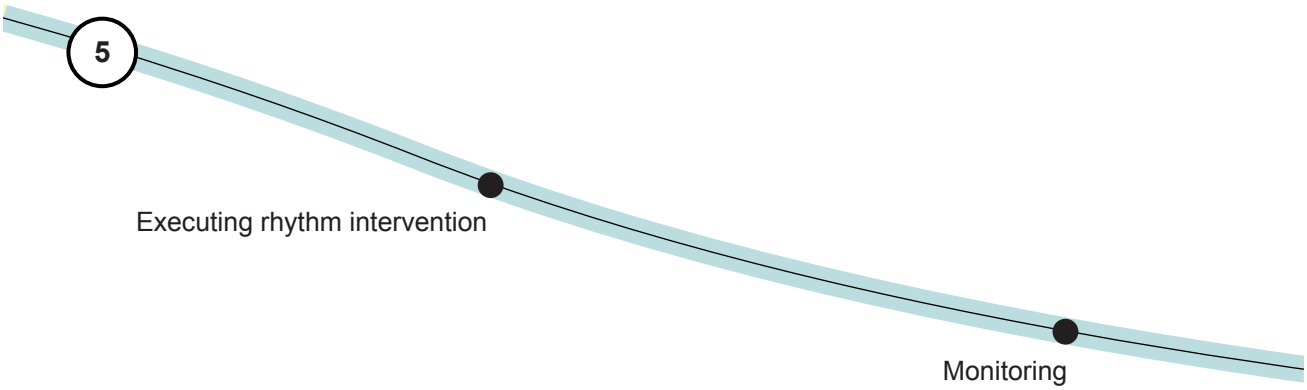
Choosing a specific rhythm intervention: The design solution space creates a framework for the design intervention. The articulation of the social issue from the rhythm perspective gives the opportunity for people from many different professions and interests to join the discussion and contribute with ideas. This way, unexpected design proposals emerge, enabling a variety of creative ideas. After presenting the rhythm boundary object and the design solution space, the research team proposes possible interventions that can enhance the rhythms. The stakeholders then, comment with their own ideas. As a result of the conversations that take place during these presentations, a specific design intervention is chosen.

STEP 5

Intervention and monitoring

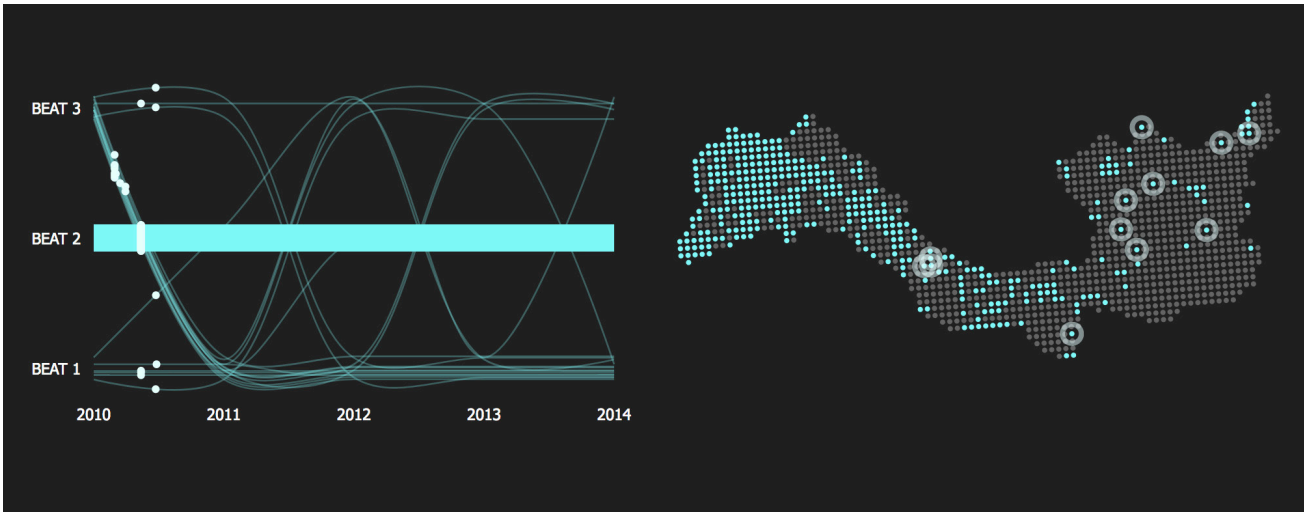
This is the stage where the proposed interventions are operationalised in collaboration with stakeholders. Following this, the interventions are monitored to validate the outcomes from rhythm perspective.

Executing rhythm intervention: The possibilities of implementing rhythm interventions vary depending on the type of intervention. If the rhythm intervention is concerned with the physical urban environment, such



as reducing the rhythm intensity by making re-arrangements in the public square to decrease bike traffic (intervention of the Zaanstad project group), regulations and costs need to be taken into account. If it deals with the rhythms of the residents in a neighbourhood (interventions of Rotterdam and The Hague groups), then many information sessions have to be carried out with the target groups to create engagement with the planned intervention. In the Rotterdam project group the approach of tuning the rhythms of two different actor groups worked out positively while in the case of The Hague, where the focus was on seven different actor groups, the residents refused to engage in the intervention. As a result, the project group went a step backwards and chose together with the stakeholders another intervention based on sharing rhythms.

Monitoring: The intervention needs to be assessed, adapted and assessed again. Conversations with



the stakeholders are important here, to get feedback on issues like: “To what extent was the intervention implemented? How do the people on site react to it, and do they find it meaningful? What is the response to the idea of carrying out a rhythm intervention?”

It is possible that the proposed intervention is implemented in a different way due to context, timing or other reasons, or, no rhythm intervention may take place. This needs to be monitored carefully. When successful, the step towards policymaking can be made.

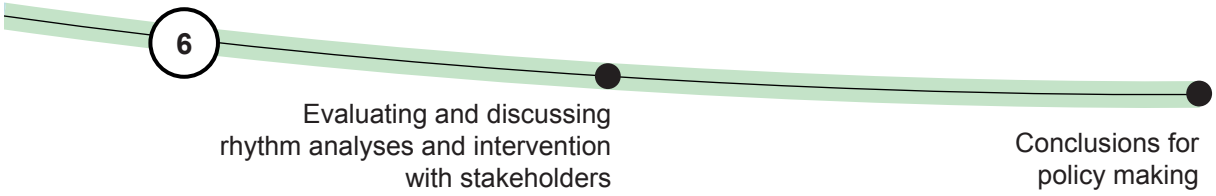
STEP 6

Evaluating and policy making

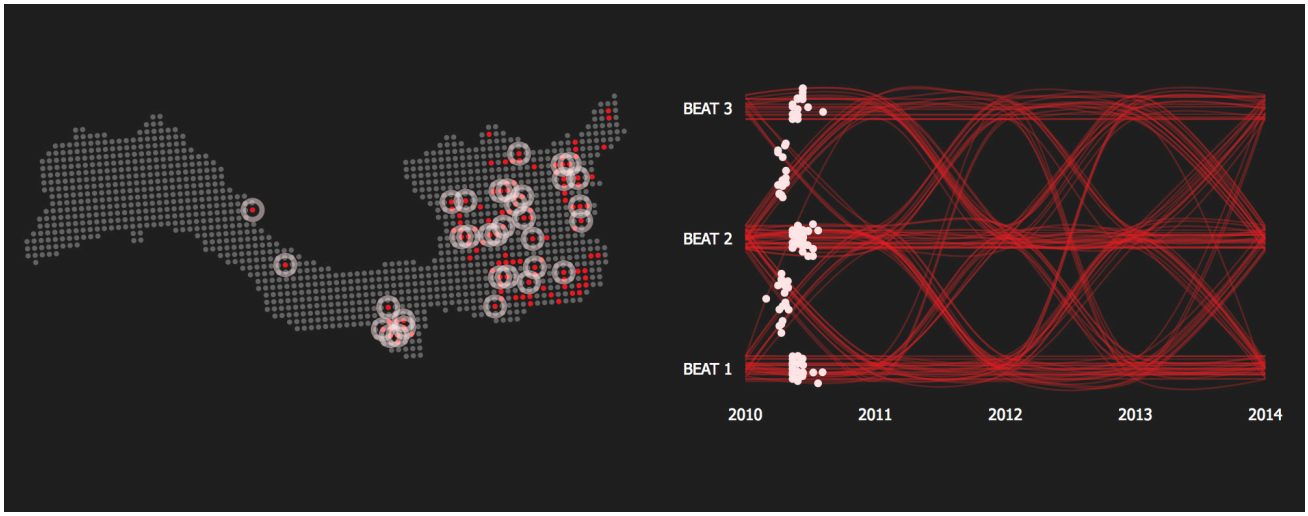
At the final stage, the researcher is concerned with the overall picture of the rhythm analysis, in order to receive feedback on the research trajectory and to make conclusions for policy making together with the stakeholders.

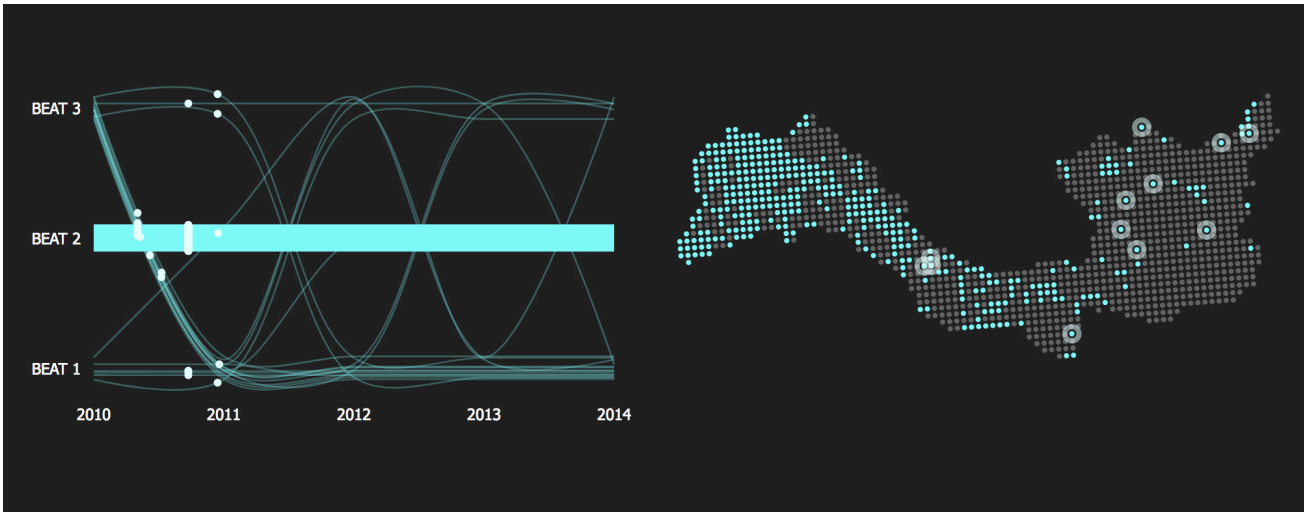
Evaluating and discussing rhythm analyses and the intervention with stakeholders: In this stage, an examination is carried out concerning the relevance of the rhythm analyses, the effectiveness of the defined intervention space and the impact of the proposed rhythm intervention. The idea behind this is to understand in which contexts rhythm intervention is meaningful, in order to create a more successful framework of rhythm analyses. An important goal the evaluation of rhythm analyses is to organise feedback sessions with the stakeholders so as to receive their feedbacks and recommendations on the research trajectory, the analytical methods, and how rhythm analyses has been bridged to rhythm intervention in neighbourhoods.

In City Rhythm Helmond and Zoetermeer case studies, it was not possible to identify a successful intervention space, and therefore, no specific interventions were proposed. In these cases, the evaluation was very important to understand how these case studied differed from the others. The result was to dedicate more time to choosing a research question that can be interesting from the perspective of rhythm.



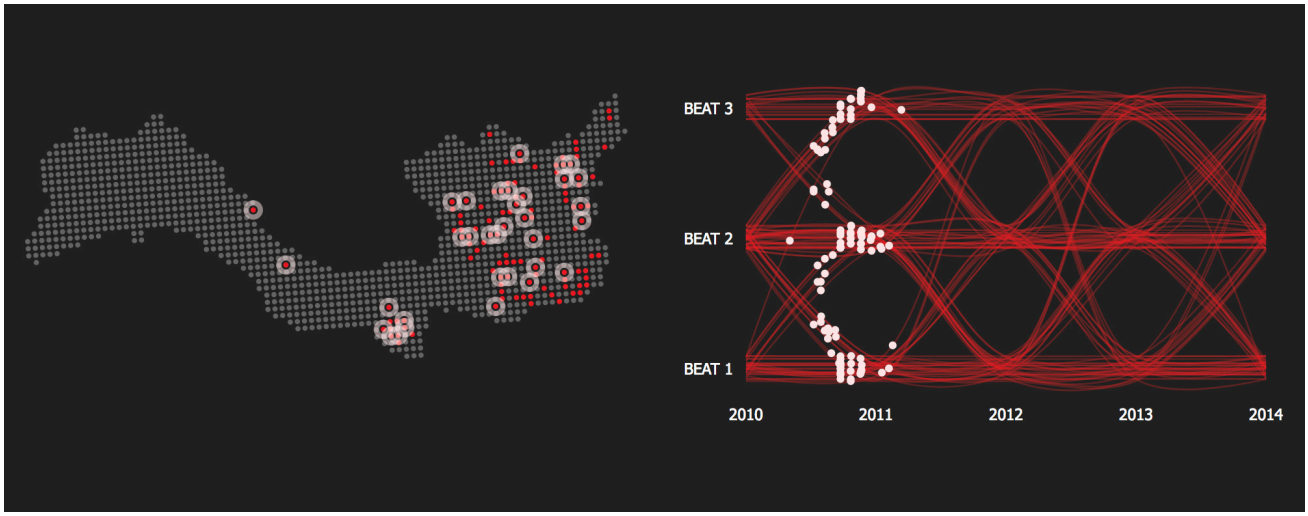
Conclusion for policy making: The research team and stakeholders reflect upon the rhythm perspective regarding the given issue, and how the interventions have enhanced or solved the issue. For example, the traffic lights in Rotterdam that changed too quickly for the elderly to cross the street after 10 AM, can be translated into policymaking such as “Traffic lights near homes for elderly residents need to offer slow changing lights between 10 AM and 12 AM”. When deemed appropriate, the results of rhythm analyses and interventions, can be translated into policymaking.




BEAT 3
BEAT 2
BEAT 1
2010
2011
2012
2013
2014

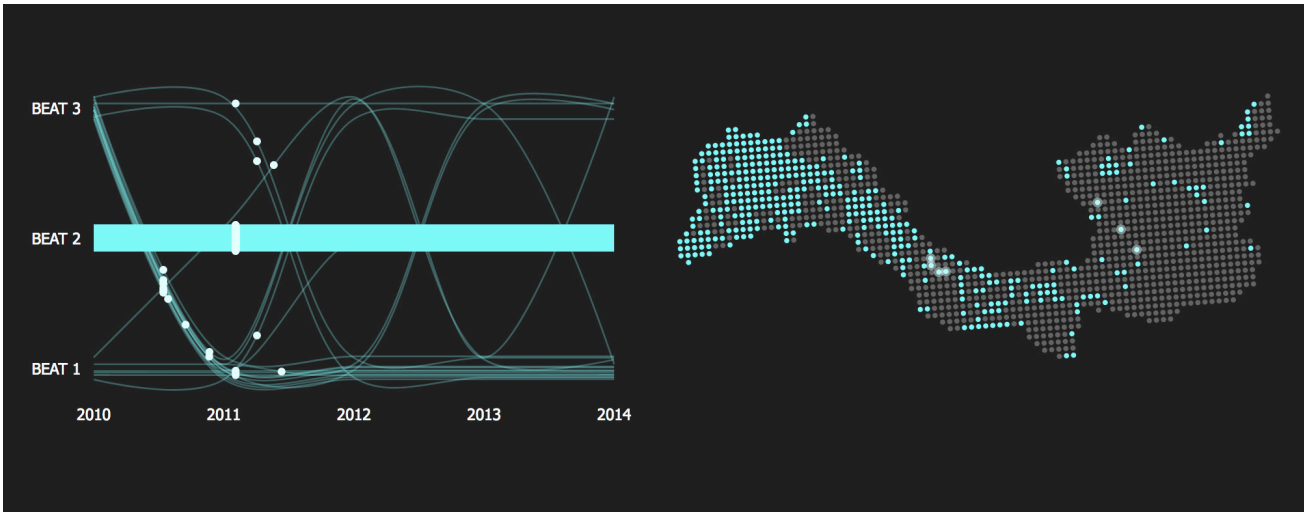
Part 3:

Thinking about Rhythm



Understanding Rhythm in Cities

by Caroline Nevejan and Pinar Sefkatli



When astronomers look for life in the far distance towards stars beyond, they use a mathematical formula to identify a sign of rhythm. Rhythm is part of the essence of life. When we do hard physical work, the effort is easier to sustain with a rhythmic beat, when rhythm offers a beat. Environments in nature, in the city and at home have rhythms that are perceived and recognized. When we take a walk through the city, we can feel the rhythm changing between different neighbourhoods. Rhythm is fundamental to human experience.

Human perception is sensitive to rhythm; colours, sounds are constructed from rhythms which we consciously or unconsciously perceive. Every human being responds differently to different kinds of rhythm. Some of us are very sensitive to smell, while others can see very sharply. Some can handle loud noises and some are very disturbed by the sounds of people speaking in the train.

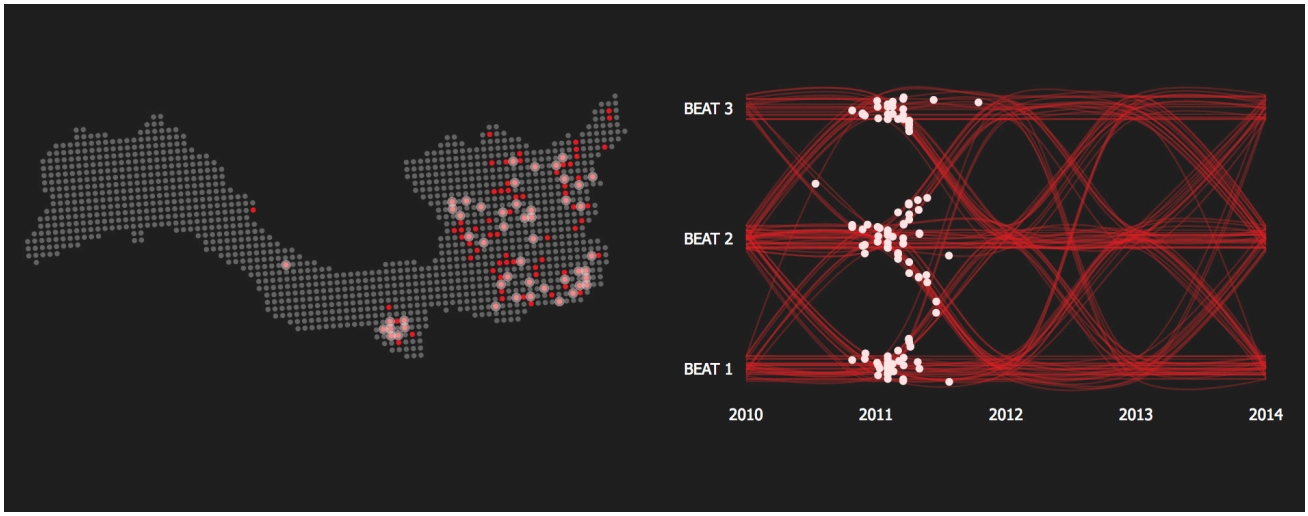
In different cultures and knowledge systems, people have been exploring rhythm for centuries. Here we present current contemporary academics and their vision on rhythm in relation to City Rhythm. We discuss how different rhythms come together and establish a territory (Deleuze & Guattari 1987). We elaborate on how variation in patterns creates rhythm (Michon 2016, Huijer 2015). We describe the distinction between mechanical space and rhythmic space (Lefebvre 1991) and between the consummation of movements and aesthetic experience (Dewey 1932). Finally we discuss the role of tuning and synchronization of rhythms in social interaction (Gill 2015). Each of these theories on rhythm has a significant impact for rhythm analyses. City Rhythm suggests that such analyses can create an input for municipal policymaking, which is explored in part 2, with the case studies.

Rhythm as urban territory

Different rhythms co-exist in an environment. According to Deleuze, this coexistence of rhythms establishes a territory. Many animals use rhythmic movements or actions to mark their territory, and many rituals involve rhythms (Deleuze 1987). Birds use songs and noises to mark their territory, or the sound that comes from the leaves of trees define another territory, the distinct colours of the animals create their special territory, or help them to blend better into the existing territory. People dress in special clothes with distinct colours, creating a territory of a festive moment for example. A wedding ceremony or a graduation ceremony has their own territory, marked by special dresses, gowns and movements.

Our cities are a result of multiple patterns; the shop opening hours, rush hours, public transport schedule, markets, tourists, they all contribute to creating different rhythms in a city. Rhythms tie together different moments and movements. When they unite to create a territory, one can perceive the rhythm of that specific territory.

In a city individual rhythms are affected by other rhythms (A person who is riding her bike will stop to let a tourist pass). Rhythms face different conditions, yet find ways to be carried out anyway (The person on the bike stopped for the tourist, and as soon as he has passed, she continues her way). At the same time rhythms create transitions from one entity to another (Deleuze 1987) (If the person who stopped to let the tourist pass, decides to cross the street as a pedestrian with the bike in her hand, she has transitioned from biker to pedestrian). In nature the transition between rhythms is often very

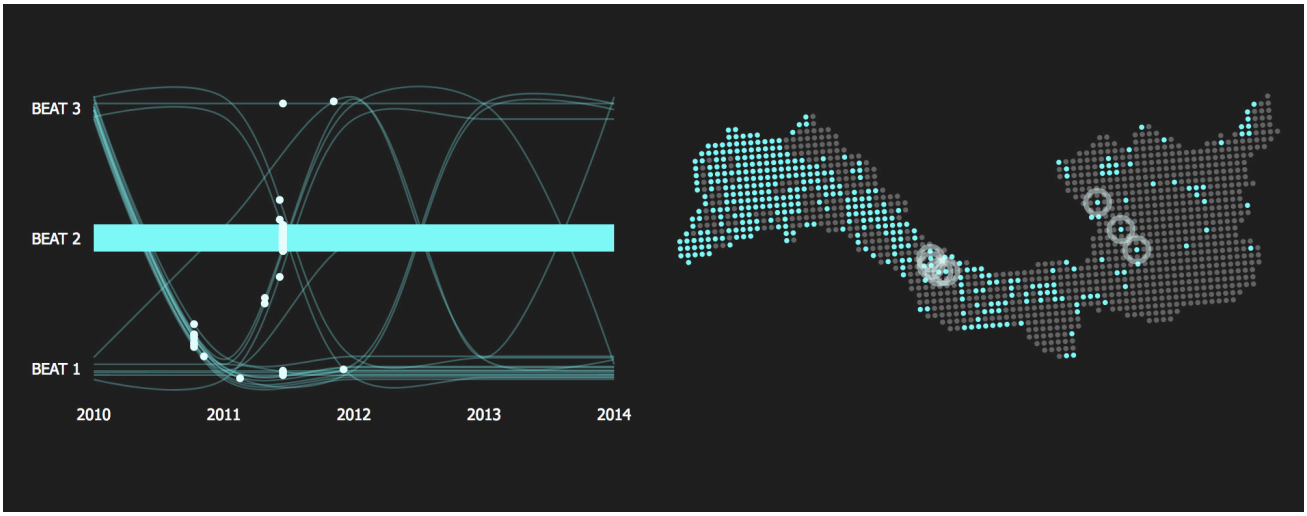


Rhythm of the square in front of the Rotterdam Central Station, 17:00 30 March 2018, by Pinar Sefkatli

smooth. One almost does not recognize that there is a transition in an ecological harmony. In more chaotic scenarios, such as city centres, the rhythms can appear to be very distinct from each other, and the transitions can be hard, fast and noticeable.

In seeing how rhythms create territory, the observer is mostly focused on the overall effect of the rhythm. A territory happens when different rhythms come together and they create their own expressive language (Deleuze 1987). Human beings can perceive and recognize the rhythm of a forest, in the same way as they can perceive the rhythm of Rotterdam Central Station.

Municipalities are concerned about the territory of their city. This identity of a specific territory can be framed as the base tone of a city. Municipalities want to influence, safeguard or enhance the base tone of their city. They make rules, for example, and give permits for building and renovation and organize transport and mobility, which can be considered as rhythm interventions that will affect the base tone of the town.



Rhythm as variation in a pattern

The engagement of different patterns generates a rhythm, which at the same time creates movements and differences in that pattern. National Dutch philosopher Marli Huijer defines rhythm as “variation in repetition in a specific context” (Huijer 2015). Huijer sees rhythm as an order given to time, or the organization of the day, in which the rather organic activities take place.

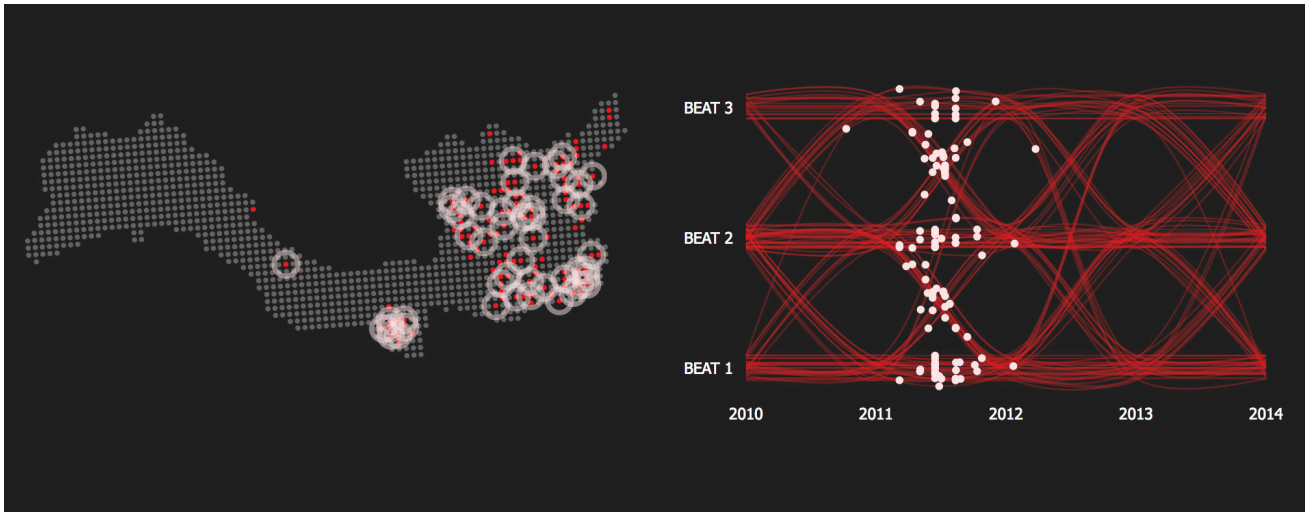
We all follow certain structures in our daily life; these structures can be based on programs, public transportation schedules, or work hours. These structures can be the same every day, however, what we do in between these arrangements will always be different.

Let’s say a young professional takes the train from Rotterdam to Amsterdam every day at 8:11. The series of events follows the same order and same time frame every day. However, when she is biking to the station, the weather will change day by day. When she reads the newspaper, she will read a different story every day. When she takes the train, she will hardly sit in the same spot, and a different passenger will sit next to her, every day. “The paradox of rhythm is that it brings about both stability and change in the repetition - in the repetition, which defines the order of existence, rhythms remain the same and they change.” (Huijer 2015)

Huijer in her book mentions that these changes are necessary for natural beings. As humans, we cannot handle too much repetition, but we can easily adapt to rhythm (Huijer 2015). The more daily lives are stripped down into a series of same events, or the more cities are reduced into specific functions, the more people start feeling bored and unhappy. French sociologist Henri Lefebvre, who is the author of the book Rhythmanalysis, also highlights the difference between repetition and rhythm. He refers to repetitive structures in our lives as man-made activities, and he calls them mechanical movements. According to Lefebvre, mechanical movements are linear patterns: they can go on and on, “defined by the consecutiveness and the reproduction of the same phenomena, which can be referred to regular intervals” whereas he positions the subject of rhythm in opposition to the mechanical as an element in the organic world: “only a non-mechanical movement can have rhythm” (Lefebvre 1996).

Pascal Michon explains that Plato considered rhythm as a motion with a certain order, while Aristotle gave rhythm the time factor, defining rhythm as “configuration of movements ordered in time” (Michon 2016). The configuration in this sense, creates a pattern. The time factor brings additional elements that come in between. The time factor creates the variation in the pattern; it creates the rhythm.

Rhythm is a quality we as human beings are sensitive to. That is why understanding rhythm better, including the various patterns that it connects together and what creates the variation in those patterns, may contribute to organizing the social life in cities in more beneficial ways for people. Huijer and Lefebvre suggest that causalities that occur in daily life contribute to the quality of city rhythms. Rhythm analyses therefore, can give insights on where new causalities of other specific phenomena’s may take place in order to enhance a specific context or territory.



Rhythm as aesthetic experience

An aesthetic experience happens when being engaged with the rhythms in our surroundings It does not have a start or an end, and for that reason it is not oriented towards specific tasks, but rather towards understanding the rhythms of this environment. Philosopher John Dewey analysed how humans respond to the different rhythms around them. Thanks to certain rhythms, we have an aesthetic experience, and thanks to other sorts of rhythms, we consume movements.

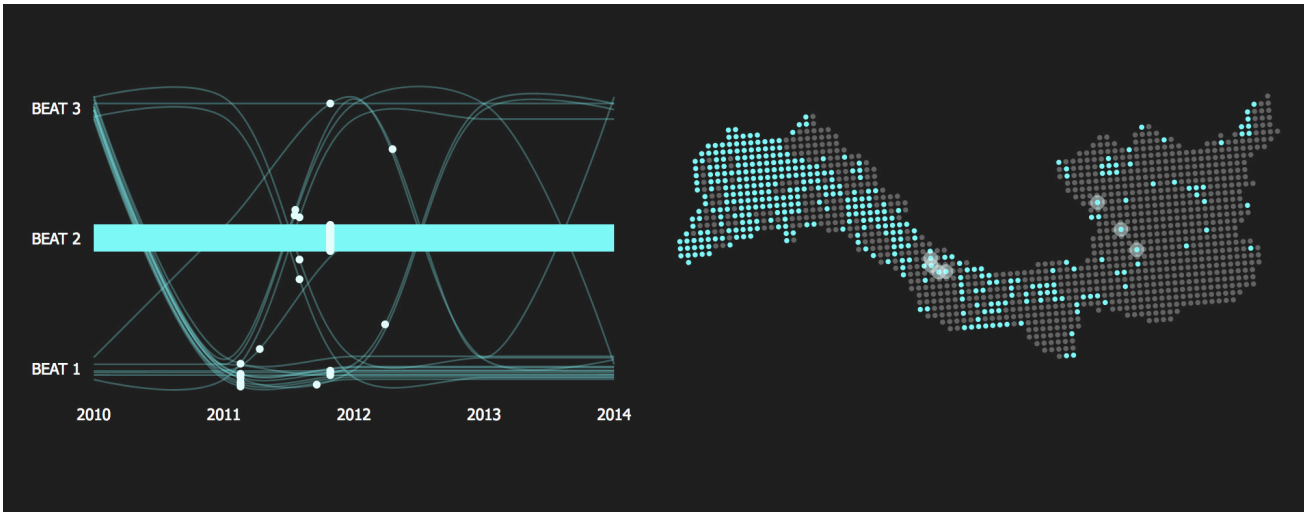
When we make a distinction between having an experience and consuming a movement in a city, we immediately make a distinction between rhythms which allow certain experiences to happen and rhythms that make us go through consumption of movement. Henri Lefebvre makes the same distinction in the urban environment, when talking about mechanical and social space. While the mechanical space is based on functional rhythms such as shopping, work and leisure, social space contains more organic rhythms, where the environment is dominated by social activities.

Different environments in cities offer different rhythms, and citizens or visitors engage with those rhythms, sometimes by having an aesthetic experience, and sometimes by consuming a movement. When we go to a supermarket we usually arrive there with the expectation of getting something done, i.e. shopping. Our engagement with the rhythms of a supermarket, therefore, will be limited to the function of shopping. We will not try to engage with the rhythms of other people who are visiting the supermarket. Sometimes the customers do not even make eye contact with the cashier. It is even possible to observe customers bumping into each other, because they fail to recognize each other. According to Dewey, this type of visit to a supermarket would be a consumption of movement rather than an aesthetic experience.

However, it can also be perceived as the opposite. A supermarket can appear to be a social space for another person, who would go there to talk to people and to reflect on what to prepare to eat for that evening. In this case, this person will have the chance to engage further with the rhythms of the supermarket, and eventually have an aesthetic experience.

To engage with rhythms and have an aesthetic experience or to consume a movement depends on an individual's own perception of rhythms, and their capacity to engage with other rhythms. In the context of City Rhythm, where municipalities presented issues about social cohesion and the lack of participation of different social groups in the neighbourhood facilities, it became important to create functions and activities where more people can have together an experience.

The distinction between rhythms that allow aesthetic experience and consumption of movements, or the distinction between social space and mechanic space, can be also viewed spatially, as spaces that influence the people to engage with each other or with their surroundings and some do not. Such background is significant for City Rhythm to understand what interventions to propose for generating an experience.



Rhythm as force for connection and engagement

Engagement is fundamental to live together in an environment or being part of a community. Engagement comes through various social processes. Satinder Gill is a scholar interested in the function of rhythm in human social life and sense making. In her work at the Centre for Music and Science, Cambridge University Gill studies the ways people tune their rhythms to each other to recognize and understand each other.

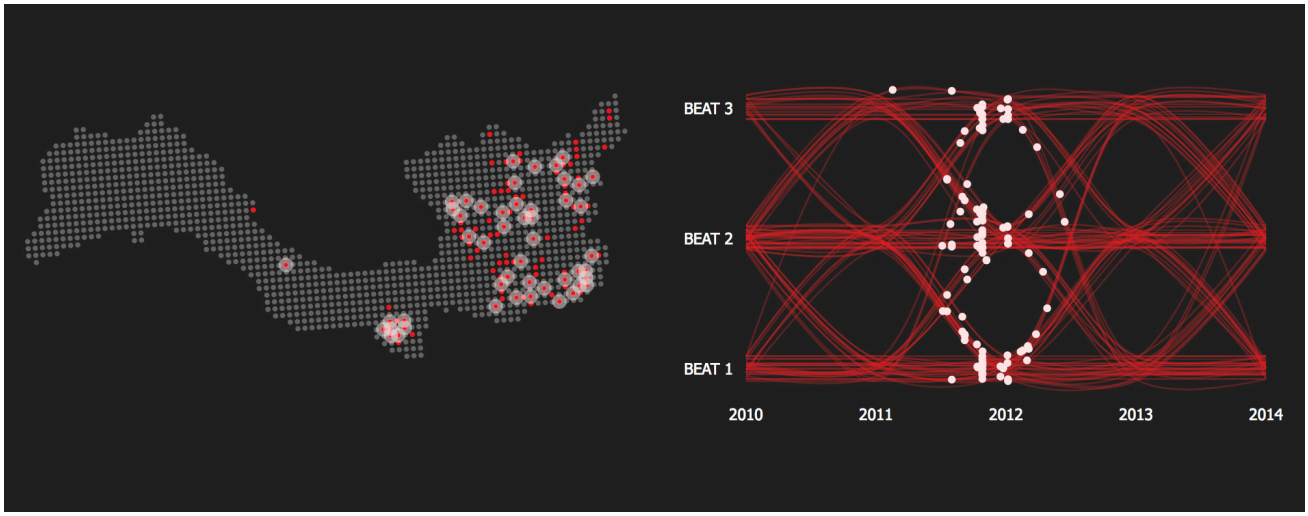
The concept of tuning rhythms is about synchronizing our rhythms to each other in order to create engagement. This synchronization, according to Gill, can happen in visible and invisible ways. When two people meet, they shake hands, and at that moment they have synchronized their rhythms (Gill 2015). A handshake therefore appears as the physical manifestation of synchronization between two people. However, when we sit next to someone, without realizing it our bodies start tuning with that person. We can become aware of this if we become conscious of our breathing together (Gill 2015). Tuning here happens in a non-visible way.

Sometimes in order to synchronise with others, we need to be in tune within our own bodies. People with mental conditions such as depression are less able to synchronise with their environment and experience a disconnection from the social world making it hard to engage with it and as a result have a hard time to synchronise their rhythms with their surroundings (Gill 2015). This results in insufficient engagement with their environment.

When a family has dinner every evening (after the parents come back from work and kids come back from school) in sitting together they have the chance to synchronise. Considering our modern lives, in which most family members tend to have very different daily rhythms, just making this small arrangement for dinner can be crucial for the family to come closer, by sharing their thoughts and engaging in a meaningful moment. At work, a short business meeting every Friday at the end of the work week can be a great opportunity for colleagues to engage, thus generating better team work.

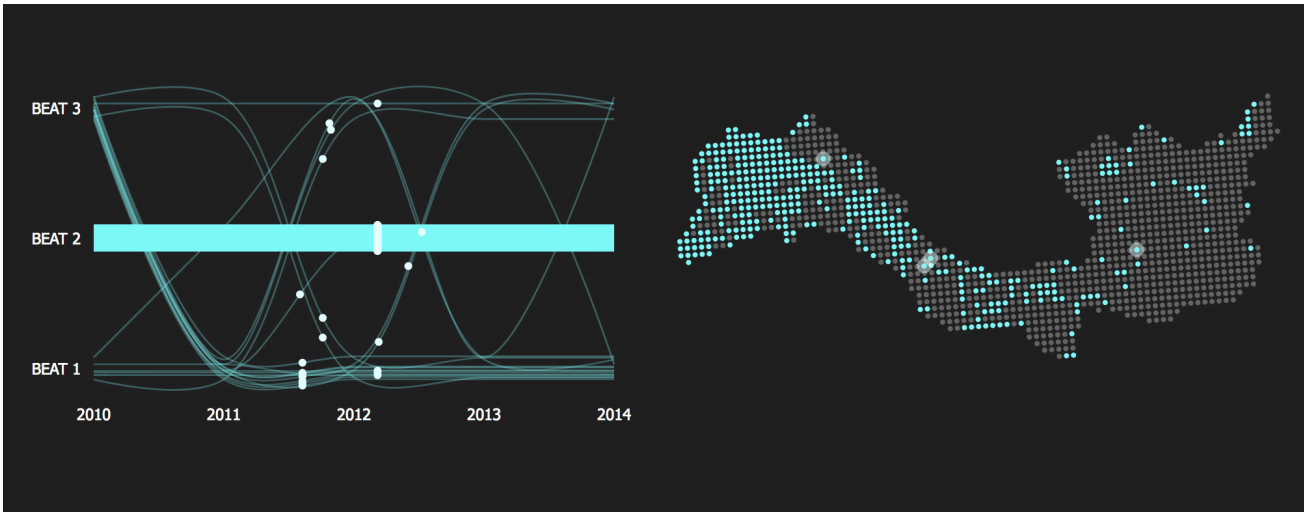
It would be common to expect that the individuals who are part of an urban environment have very different daily rhythms or weekly rhythms. If two people go out of their house at the same time they recognize each other's rhythm. We can live in the same building with a person but do not share any common rhythms at all. However, if we accidentally run into each other in the hall way, we can create an opportunity to connect and engage with each other. The concept of tuning rhythms is fundamental for acknowledging each other's rhythms and those of our surroundings. It enhances trust. For this reason, tuning has a significant role in being a part of a community or living in the same neighbourhood.

In the case of sharing rhythm for social cohesion, not being able to connect and engage in the same environment can create distrust. Tuning in that sense is an important factor for City Rhythm, and interventions in policymaking where these dynamics can be generated are favourable for enhancing the social relations in a neighbourhood.



Understanding Rhythm in Artistic Practice

Transcript of expert session with Sirish Kumar Manji



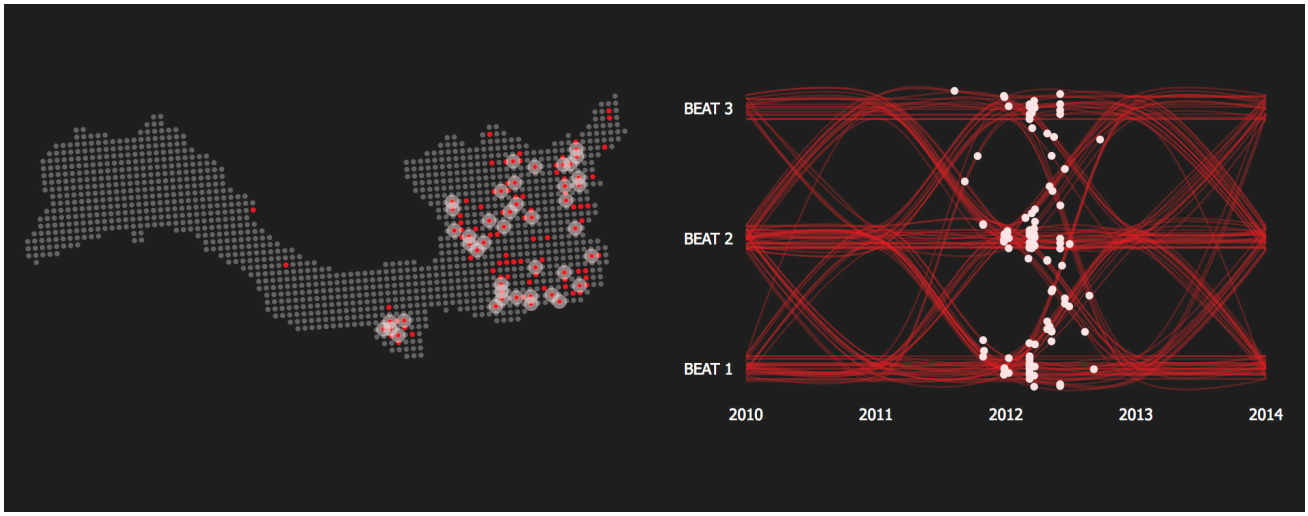
On 26th of January, 2017 City Rhythm organized a focus group to compliment theory on rhythm with insight and experience from artistic rhythm practice. The focus group started with an introduction by Sirish Kumar, a Tabla master from India who lives in London. Around 20 researchers from science and the arts gathered. Transcripts of these conversations follow hereafter. Secondly a workshop was held in London where Sirish Kumar worked intensely with data director Scott Cunningham, Performing Arts founder Susan Benn and Principle investigator Caroline Nevejan of which an account is given at the end of this section.

Sirish Kumar has been engaged with interdisciplinary research for many years. In the context of Performing Arts Labs (PAL) in London he collaborated for the first time with Caroline Nevejan.

PAL Founder/director Susan Benn: "*In 2001 Caroline was lab director of a Performing Arts Lab that focused on future of media developments with the BBC. In this PALLab several musicians participated. It was the time the Internet was exponentially growing and the music industry was changing fast. One of the big issues in online concerts and other artistic collaborations was the delay in time that happens when signals are sent. An experiment was created in which musicians of different styles all participated: classical music, pop music, reggae music and Tabla music. With composer Joel Ryan we set up a simulation of an online concert in which we could simulate different kinds of delays. The musicians agreed to play a simple song they all knew (unfortunately this experiment is not recorded, and the song that was chosen is not documented). When the musicians started to play, they enjoyed making music. Without any warning, slowly Ryan introduced a small delay. Immediately all musicians noticed. The classical musicians felt they had to stop immediately. Others carried on. When the delay was increased, the pop musician stopped and shortly after the reggae player stopped. The delay was now more than a second. Only the Tabla player kept on playing.*

In a next experiment we all witnessed how Sirish Kumar kept on playing while the delay manipulated and he was explaining how in his perception the rhythm was changing from a 27 beat, to a 63 beat, to a 7 beat back to the 16 beat. For Sirish Kumar delay is part of music and technology is part of nature. Being trained as a Tabla player since he was very young, he has an exceptional perception of rhythm as well as an intense curiosity for doing experiments in interdisciplinary research"

Photo of Sirish Kumar Manji, during the expert session with artists at AMS Institute



Introduction to Tabla

Tabla

Combination:

1) Ta and Ghe = Dha

2) Thin and Ghe = Dhin

3) Tirakita

4) Dhere dhere

Illustration of the different tabla beats, by Sirish Kumar Manji

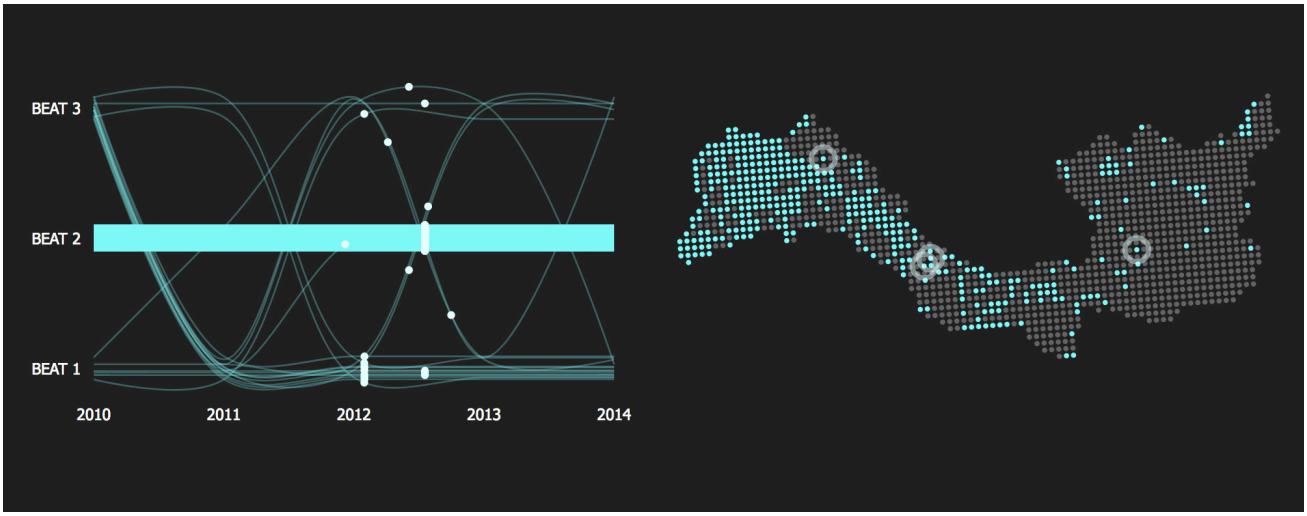
The expert session started with an introduction to Tabla rhythms by Sirish Kumar Manji. In tabla music there are 109 rhythms. These rhythms are created through numerous combinations of sounds, beats, different tempo's and silences. Sirish Kumar guided us through the different patterns that these rhythms are composed of.

In Tabla rhythms, the most important being is the first beat, which is called '*Sa'*. The reason that this beat is so important is because all the patterns in tabla music end up in the first beat, meaning that they are circular patterns that come back to their initial stage. The patterns can contain more and more variables, always ending up in the first beat.

Sirish Kumar guided us through several exercises on circular patterns, and experiencing the beat while performing the cycle. Another important element we were introduced to here was the silent beat, and the strong beat. Along with the tabla patterns, Sirish Kumar explained us rhythms in rhythms, which are very common in Indian classical music. Here, recognizing the tempo was fundamental for tuning the two rhythms at their first beat.

Notions such as different types of beats, elements and tempos gave us a lot of insight during the workshop to discuss further on rhythm theory and to generate insights on identifying rhythms in large datasets, thanks to the contributions of the City Rhythm data team.

With this workshop we started thinking conceptually on rhythm and its engagement with mathematics, data and the city. The contribution of different professionals and highly interdisciplinary thinking added a valuable artistic perspective to the theoretical studies on rhythm, and analysing large datasets through rhythms. In the next page, we introduce the names and backgrounds of the participants.



Photos from Expert Session with Artists, 26/01/2017 at AMS Institute. From left to right: Caroline Nevejan, Angelo Vermeulen, Rebekah Wilson, Sander Ijzenman, Mieke Gerritzen, Luna Maurer, Ino Paap, Satinder Gill, Leo Huberts, Lene Böhnke

Workshop Participants

(CN) Caroline Nevejan is a social scientist and associate professor at TU Delft. She is the principal investigator of the City Rhythm Exploratory Study.

(AV) Angelo Vermeulen is an artist and biologist and PhD researcher at TBM Faculty TU Delft on starship design.

(RW) Rebekah Wilson is a classical music composer and a network technologist. Her specialty is music and networks.

(SI) Sander Ijzenman is an ecologist. He works for the city of Amsterdam with the spatial data and to create the bridge to policy makers.

(MG) Mieke Gerritzen is a designer and an organizer of events, exhibitions and different kinds of projects around visual culture.

(LM) Luna Maurer is a designer and she has a design studio called Moniker. Her work is focused on crowd sourced design projects.

(IP) Ino Paap is a furniture designer at IKEA. He is doing is PhD research with Caroline, on orchestration of co-creation.

(SG) Satinder Gill is based in Center for Music and Science in Cambridge. In her work, she looks at rhythm in human sense making.

(LH) Leo Huberts is trained in econometry and statistics. He is part of data scientists team called Delph, who collaborate on City Rhythm.

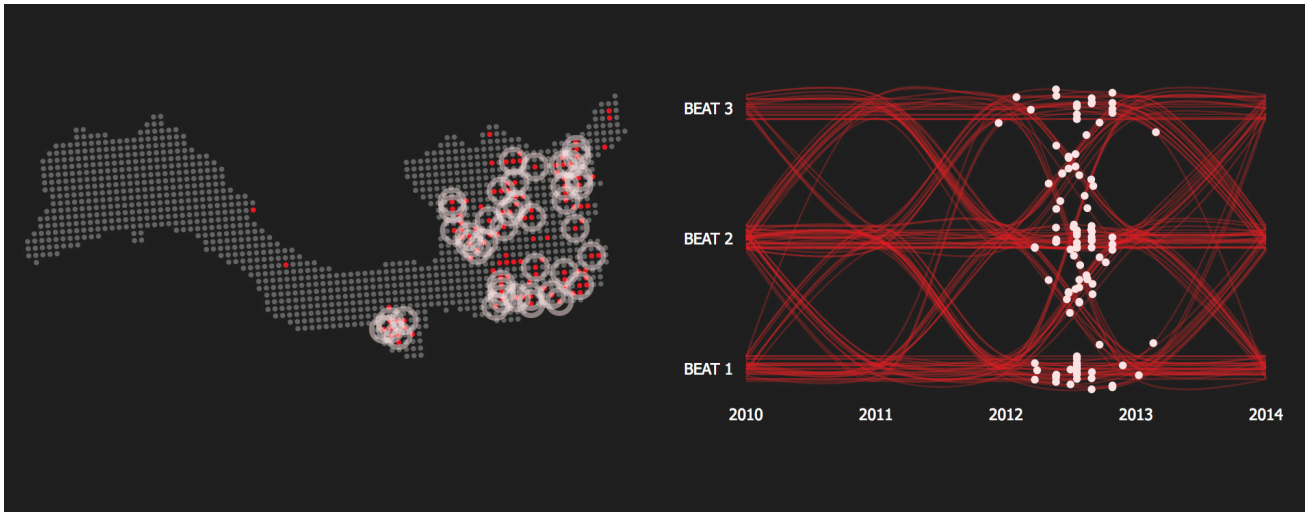
(LB) Lene Böhnke works as analyst at the Amsterdam Health and Technology Institute. She is part of the City Rhythm data team.

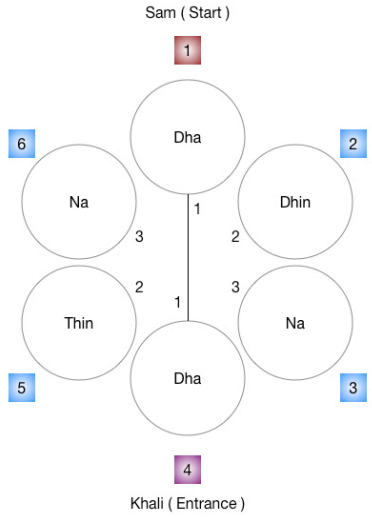
(NS) Natasha Sena is an urban designer by training. She is part of the organization team at AMS Institute who is one of City Rhythm collaborators.

(PS) Pinar Sefkatli is an architect. She is the research assistant for the City Rhythm Research.

(SC) Scott Cunningham is a data scientist. He is an associate professor at TU Delft and the director of City Rhythm data team.

(SM) Sirish Kumar Manji is a tabla player and composer based in London. He has worked in a wide range of projects and world music concerts with many artists.





Rhythm diagram by Sirish Kumar Manji.
Name of rhythm: Dara Tal (6 beats)

Synchronizing Rhythms

Satinder Gill gives us a great example to start our reflections on rhythm. In her example she highlights the difficulties the music students had in following the beats of the metronome, and found themselves in a continuous process of co-adaptation. This gave us a hint that as human beings we do need a certain beat that sets the ground tone, but upon that beat we will always establish our own rhythms.

SG: There was an experiment in the music and science group. We got music students in pairs, listening to a metronome What they had to do was to tap to the metronome. Their taps were recorded and they were wearing headphones to hear each other's taps. The challenge was to stay tuned with the metronome, while hearing each other. The task lasted few minutes. Later on, the results were shown, and they all had a similar pattern.

They start tapping to the metronome and then, they start moving away from the metronome, and they come back to the metronome. It is a continuous movement. They are completely unaware, that they are beating to each other. The metronome sets the background mark. This is the power of human rhythm. It is not something in a permanent conscious network, we also give up to other influences.

CN: So yes, we try to follow a pattern as human beings, we are not machines, but we always synchronize with each other. It is a different rhythm, which is very interesting. It is what we would like to explore. What we will hear form Sirish is that rhythm is not a pattern, yet it is a pattern and also something else. We are in an adventure today!

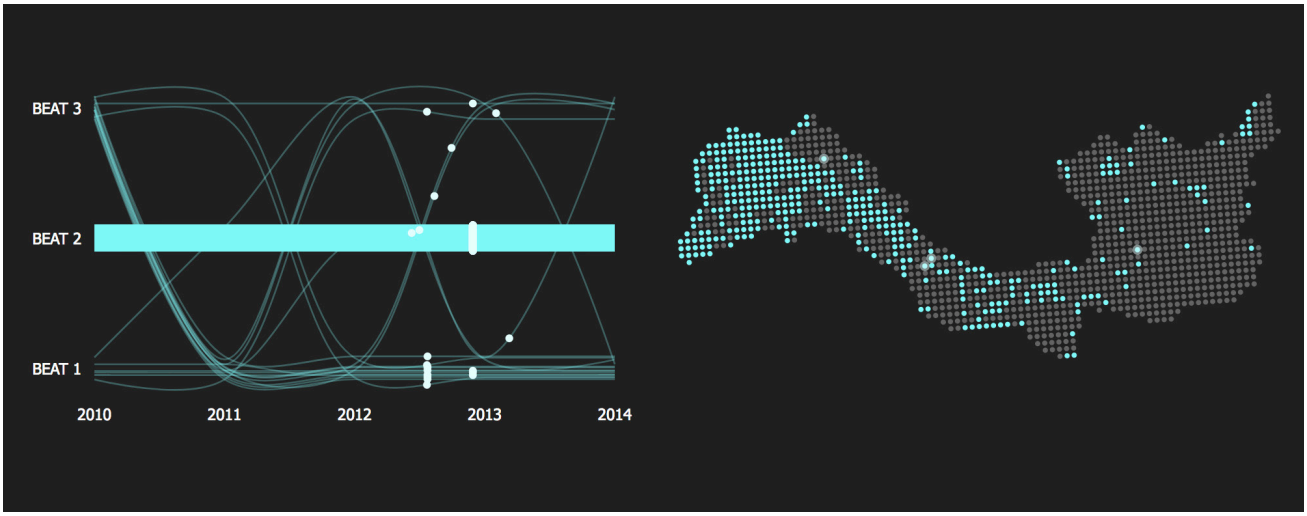
LM: Another interesting thing you mentioned is that, a pattern maybe is more mechanical, while a rhythm is a more human manifestation.

SG: This is something persistent to co-adapting, this is also something that cannot be predicted in a similar way as the automated systems.

RW: Pattern could be the marks you put on a page and rhythm the interaction. You can't either rotate a rhythm, it has to happen, it has to be active. A rhythm has to be created through motion, it is the movement in the pattern.

LH: We also look for patterns in data. A rhythm can be a more imperfect version of what you define as a pattern. Even though we are used to simplify the data, I think the challenge will be not to simplify it too much in order to reach the human variation in repetitive elements.

CN: Is rhythm always human? It is also cosmic



movements, or waves or nature. Sander, what is rhythm for you? Ecology itself is about different rhythms working together, right?

SI: I think the experiment with the metronome is a very powerful example. The way we follow rhythm is not as we think. If you look at evolution, there are different sorts of patterns that react to one and other.

Rhythm and Memory

Sirish Kumar Manji presented us examples of different beats that create rhythms. The beats are formed from different notes coming together, and Caroline Nevejan asked the question on the nature of a note, where does it go after it is being played. The musicians' answer for it was on keeping the note going by playing it again, and then achieve a certain beat. However this would also mean that one has to remember the note before in other to understand that there is a beat going on. Therefore for there to be rhythm we need memory, and the beats work as a reminder of the ground tone.

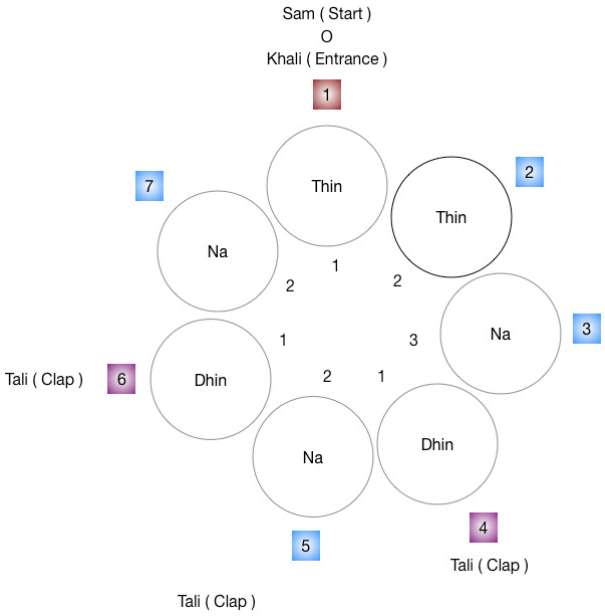
CN: I still have this question between the two beats. The way you now phrase it is like a beat cannot pass, it takes some time for it to go away. *Claps her hand.* So, by now it is gone. If I start again, *claps her hands again*, it suddenly becomes something. We are going backwards also in our imagination, right?

SM: The note is still flowing, isn't it? It is still going, and then at some point, it goes away.

RW: You can keep it going.

SM: You can keep it going, that's the thing! You can keep playing, and it keeps on happening. It's like being in a cave.

AV: But if your memory would be shorter than the beat, you would not perceive any rhythm.



Rhythm diagram by Sirish Kumar Manji.
Name of rhythm: Roopak TaL (7 beats)

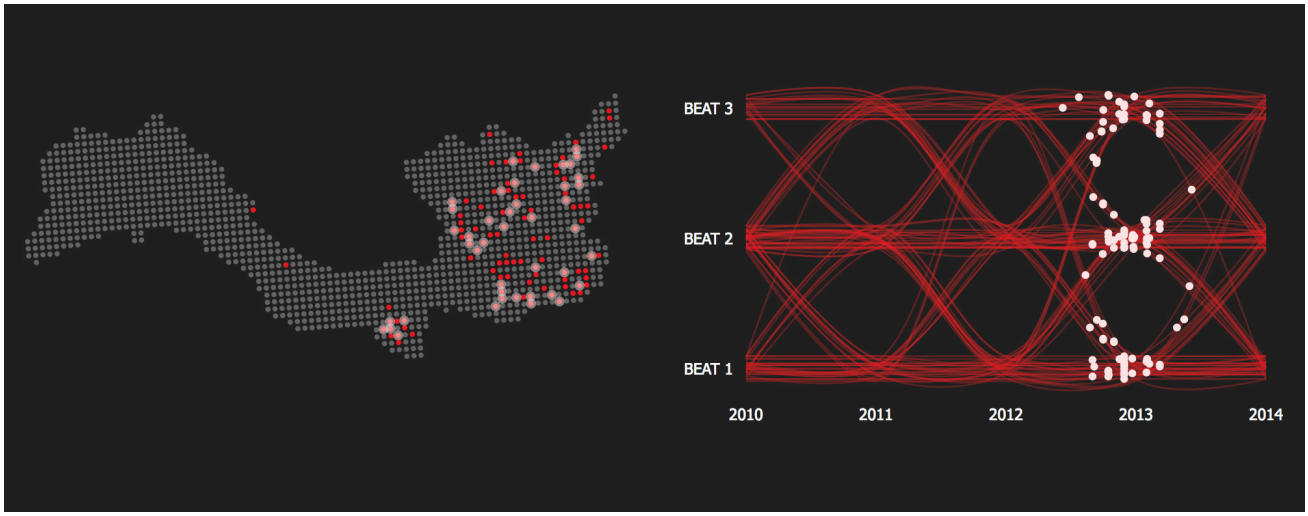
CN: So, the goldfish does not perceive rhythms!

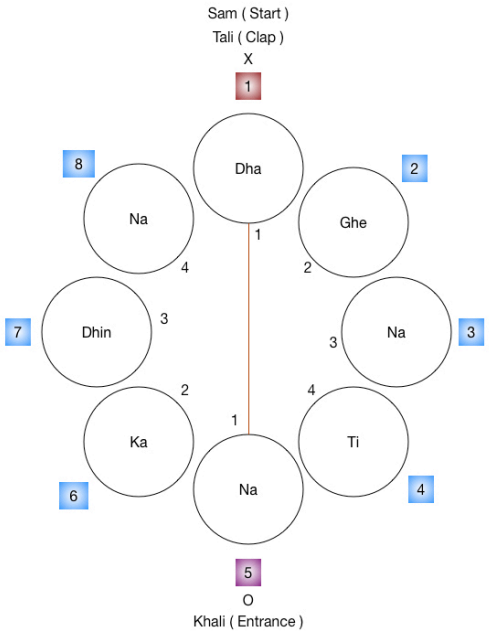
RW: We are talking about resonance. We use resonance to build force, which is an interesting thing when you are looking at these rhythms we have seen before, you could reinforce, you could bring more teenagers there, if you wanted to!

CN: Well, this is a very interesting first conclusion for me that there is no rhythm without memory. Because you have to be able to remember the note before, to be able to notice the rhythm.

RW: Could we say that rhythm is a time-based pattern?

CN: That definitely is, but the funny thing is that you need memory to hear it! Like you said [Angelo], if your memory is too short you will not remember.





Rhythm diagram by Sirish Kumar Manji.
Name of rhythm: Kharewa TaL (8 beats)

IP: It happened with the elephant walk. When the rhythm was very slow, there I really had difficulties in hearing the rhythm. So there, I felt like a goldfish.

LM: If you have only one repetition, would you call it a rhythm? Where does the rhythm start, how many engagements do you need?

SM: One repetition… You would need two then.

CN: You need 2. So, you need 3 minimal three moments. *Claps her hands three times.*

Function of Silence

Through all the beats we are hearing, Caroline Nevejan asks the question on the function of silence. According to Sirish, silence is an entrance.

If a musician keeps playing a rhythm without leaving any moments of entrance, he/she creates difficulties for the next musician to play along. If we are talking about entrance, it becomes immediate to think about who sets the invitation to participating the rhythm. We are talking about a sort of conversation and we need a certain relation for a rhythm to happen.

CN: I am still very puzzled by all the rhythm in rhythm, maybe we can talk about that later. It is really important but we are not there yet to handle it, at least I am not. What is the function of the silence?

SM: Just to be quiet, that's all. Everybody laughs. The function of silence… It is an entrance! For everybody to join in, the other side can come into that rhythm.

IP: So, it is an alignment marker, actually.

SM: You know if you keep on going, starts playing a fast and continuous rhythm in tabla, there is no silence. Instead of something like this, plays a different rhythm, this time introducing small intervals. I'm talking about that.

CN: So, it is an entrance, it is an alignment, or an invitation

SM: For me it is an entrance.

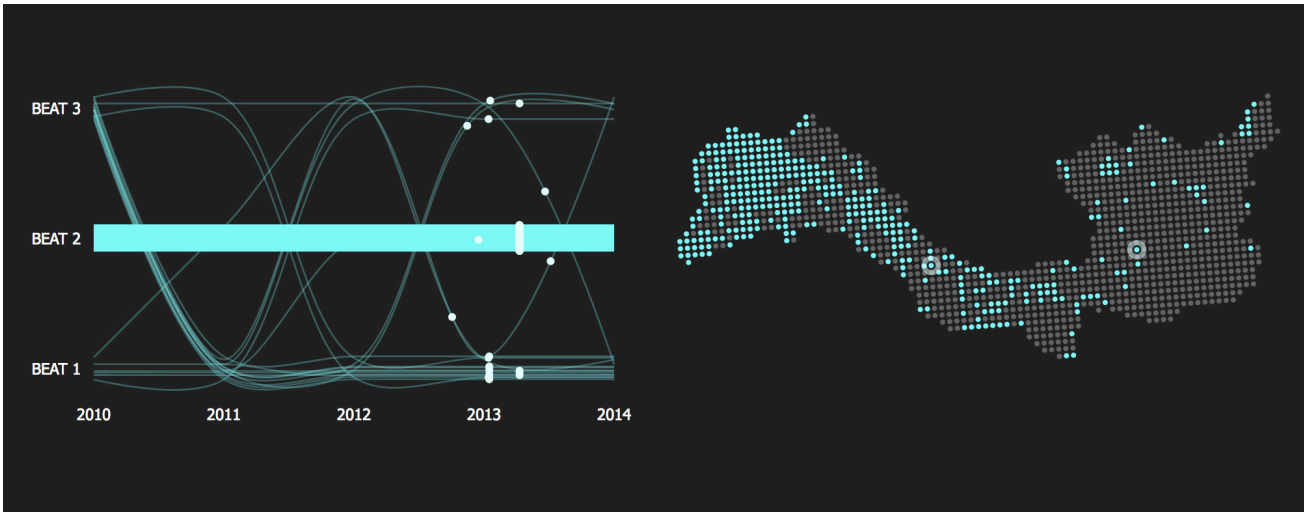
SG: An entrance is like becoming one, we become one, like uni-sound. But I like the word entrance!

CN: So, if I reverse that, how do I recognize an entrance?

SM: There is a door.

PS: But the silence itself is not the invitation. It is the moment of entering, but it is not the invitation.

SM: It depends on how you feel and how you take it. For me, it is an entrance, for somebody else, it can



be going out. It depends on how the feeling builds up individually. It is about how you go in, or how you go out. Because, we are not fixed, the repetition is never the same. We try to make it the same, but it is not going to be the same.

RW: It is a conversation.

LM: Yes, but now we describe it as something which is not a singular thing. That you only by yourself cannot execute or perceive, and enjoy, you need someone else, the exterior.

CN: A relation.

SM: You need the silence, because you have the first beat. It is very strong. So, then you have the in-between, and then you come to the entrance, and then you go from there, and then back, and then to you, or to me.

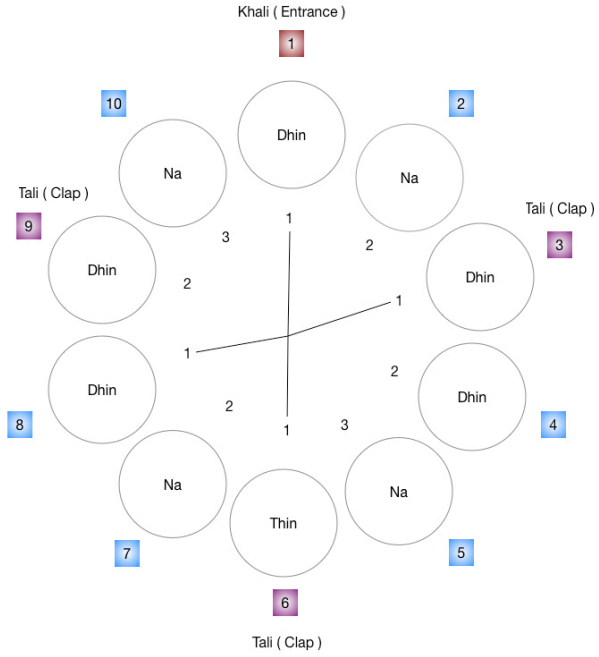
Silence and Engagement

Talking about entrance, a new word comes out: engagement. During our conversation on engagement we understand that both too much silence and too much noise create obstacles in engagement. We start acknowledging that in order for the engagement to manifest itself, we need a moment of introduction to the rhythm.

CN: Could I also say that you need the entrance as a requirement for the engagement to start?

SM: Engagements to start, yes!

CN: The engagement can be in mind, by listening, it can be a movement by dancing, it can be music, it can be anything. But the silence is where the engagement can start. For example, the mothers in Amsterdam Southeast, there is no silence where they can enter in the structure of the city council.



Rhythm diagram by Sirish Kumar Manji.
Name of rhythm: Jhap TaL (10 beats)

That's why they look at informal networks, there may be silence in there, where you can enter to engage. There needs to be space before you can engage.

SM: That's exactly what I thought, I saw a lot of things happening, but I saw not enough silence. You need the silence to come in. Everything is too busy.

CN: But, if I turn off a machine, is that silence?

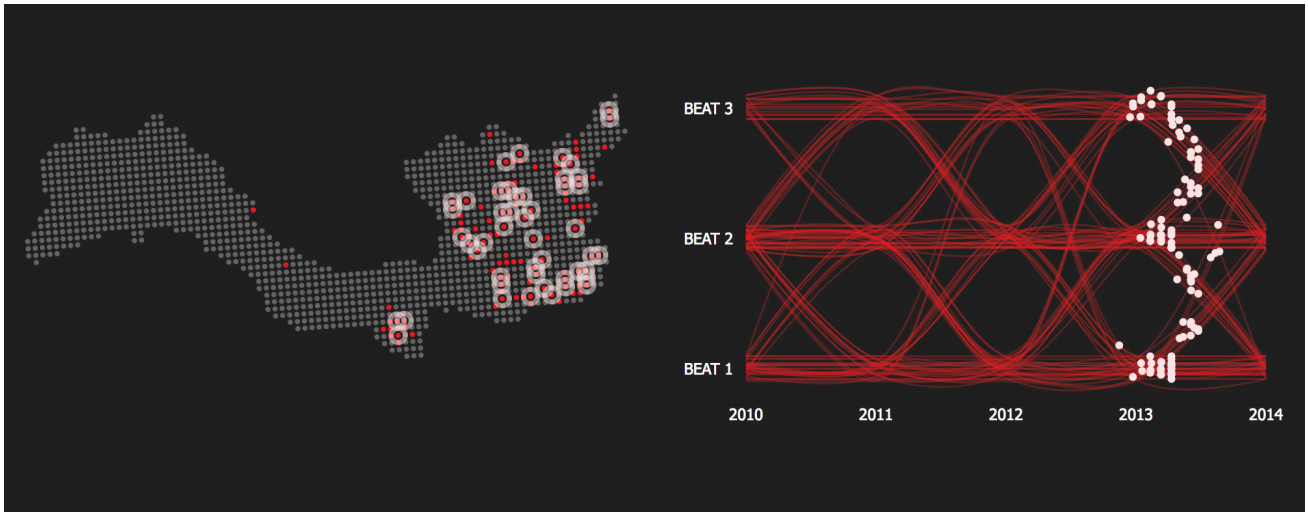
SM: No.

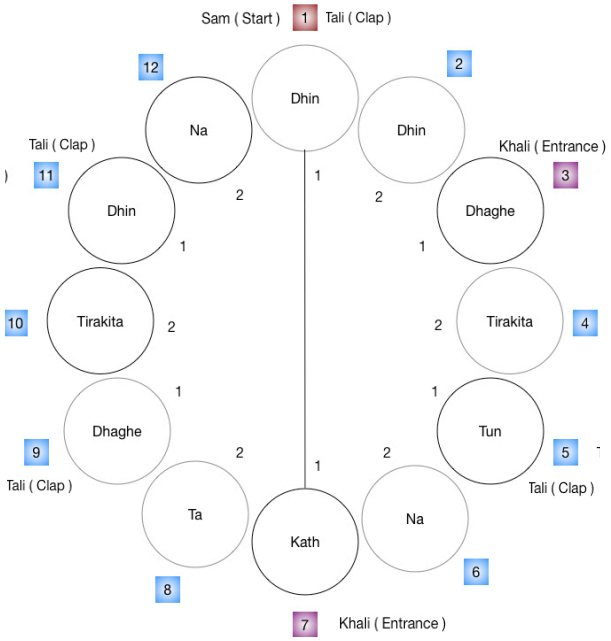
CN: So, what is silence?

LB: How is turning off a machine is not silence?

SG: You recognize the silence through rhythm.

CN: So, you would say, silence is engagement without doing anything.





Rhythm diagram by Sirish Kumar Manji.
Name of rhythm: Ek TaL (12 beats)

SG: It is not not-doing anything.

CN: Because there is silence, you do engage, but you don't have to do anything.

SG: We are attending, we are in attendance.

PS: But aren't there also different types of silence? For example, if you need an engagement, don't you need a hook, so that the engagement can happen? Can any kind of silence provide engagement? Or does it depend on something?

LB: You can also need the opposite of silence for engagement, you cannot engage if there is nothing. In a road with a lot of cars, if there is no space then cars cannot join. But you can also say, if there is nobody in the shops selling things, you cannot engage, because there is no communal happening.

AV: Or like a street festival, when there is lots of music and colours, it is very engaging, right?

NS: It depends on if you want to engage or not. If there is a lot of traffic and cars, you don't want to engage with cars but you might engage with others in the environments, and maybe the cars are bothering it. And maybe the silence could be good for that. While if there is no one else, then there is an unsafe feeling, and there is no engagement because there is no opportunity for starting the engagement. So maybe it is about what is silence and what it noise.

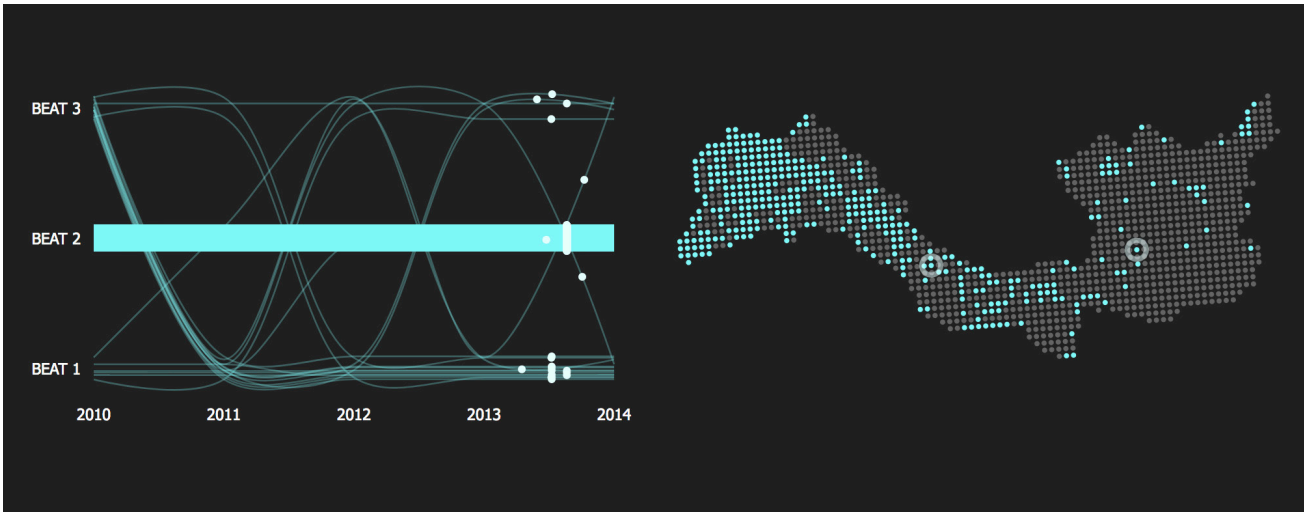
AV: Is it like you need to synchronize with the rhythm before you can engage, and that's when the silence comes in?

RW: You have to get to the amplitude, if someone plays music you don't just jump in, you have to feel the amplitude.

Every beat has a tempo, a specific time frame to per- from the beats

In this piece we do an experiment on cross-rhythms. According to Sirish, every beat has a certain tempo, a special time frame to perform the beats. Of course it would be possible to change this tempo, but it is not how it is supposed to be done. Talking about tempo, Ino Paap mentions that the DJ's connect together the beats through their tempos. And Sirish has the great idea to do an experiment with us on how it feels when you cross two different rhythms!

CN: Can I ask you, the difference between one rhythm to another, it's the first beat, then there are the strong beats, and the silent ones. It has nothing to do with the time in between, because you can do very fast and very slow?



SM: The 12 beat I showed, it is kind of slow, but it can also go fast. But a 16 beat, it can go not quite slow, as the 12 one.

CN: Oh funny, why?

SM: Because the 16 has a limit. Starts playing 12 and 16 beats very slowly.

CN: Sorry, I don't hear it even. So, you first did 12 slower and then the 16. Why can you just not play them in the same speed?

SM: Of course, you can do it, but the beauty about the 16 is that, it has an interesting starting point. And the beauty about 12, it has to be built up in a different way.

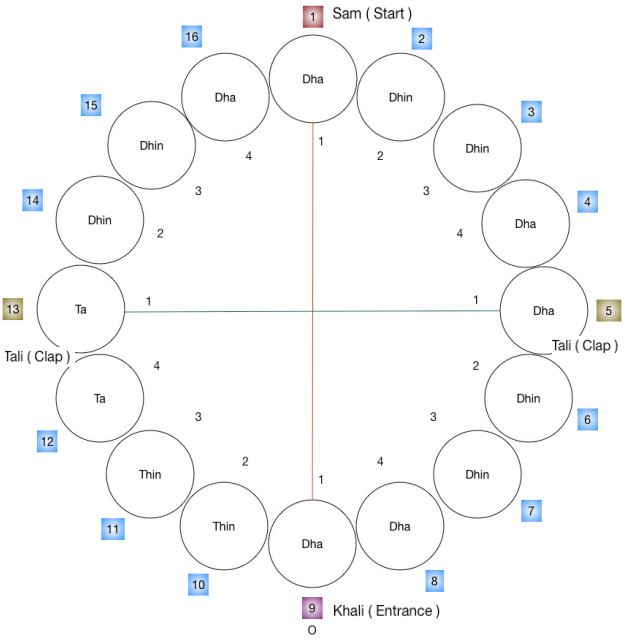
CN: So, every rhythm, has a certain tempo. In a city, you can say that the rhythm of a bike is different than a car, because it has a different tempo.

SM: Yes, exactly.

IP: Is there a path width of speed for a rhythm? So, if you can combine the rhythms when you are playing rhythms and change rhythms, or while you are playing from a 6 beat to 12 and play a 7 one on top.

SM: You can! Get ready for this! You are all playing 7 (clapping 1-2-3-4-5-6-7), and I will play 10 beat into 7. Ok, this is happening! Make sure that your 1 is very tight!

We all start to clap the beat several times and get used to it. Sirish instead, starts counting the 10 beat on top. We get confused already from the first one, and it gets quite hard to continue. But the experience is very interesting.



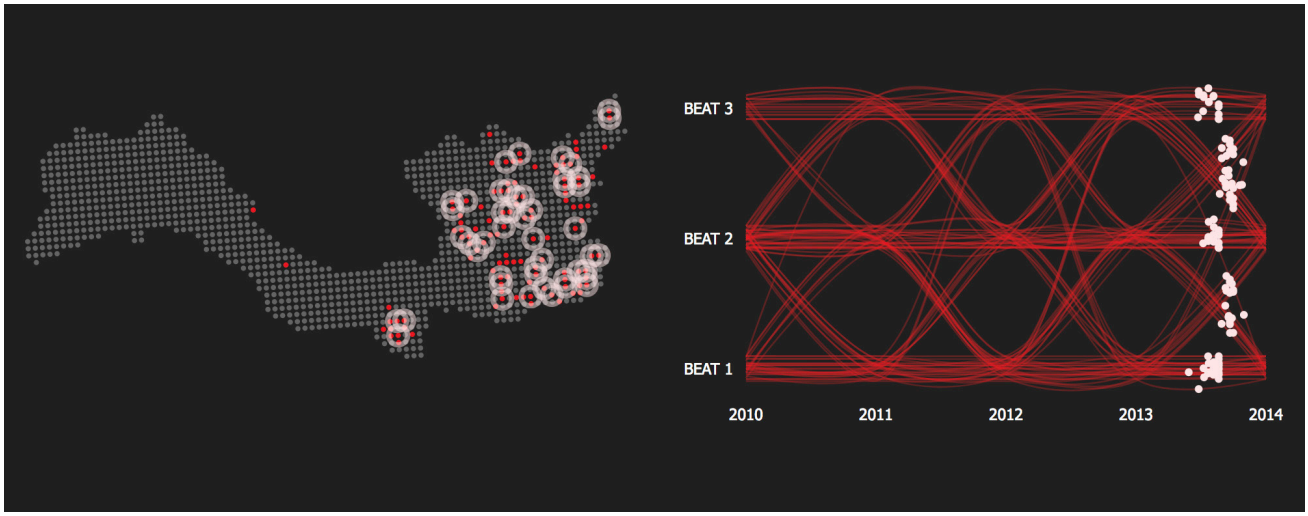
Rhythm diagram by Sirish Kumar Manji.
Name of rhythm: Teen TaL (16 beats)

Every Pattern Turns into 1

Sirish refers to beats as cycles, a beat cycle always has to go back to 1. The cycle can be infinitely variable, but the rule is going back to one. This is a big indication for us, in order to understand the difference between a rhythm and a repetition. When the conversation continues, the participants reveal that also exponential numbers have a circular pattern. This shows that the beats can work in other forms in different contexts.

SM: We have cycles in tabla. If you just keep going, you'll end up back to the 1. As an example, if I am going – *starts playing the tabla*, 16 beats several times. The beats always go back to 1 after 16.

CN: But does that mean that there is an underlying



tempo?

SM: This is just an example. The tempo was there, but I am going completely off rhythm. And with coming back to that 1.

PS: This is very interesting, so if it is a linear movement, it's not a rhythm. It has to be circular so that it's a rhythm. Is this correct?

CN: Does it have to be circular for it to be a rhythm?

PS: The pattern is a cycle, if it is a 16 cycle. It is not a linear movement, because if it was linear, you would go on with counting, but when it is circular, you come back to 1.

CN: So, a mechanical pattern would be a linear movement, and rhythm is circular.

SM: Are you saying that if the pattern is linear, there is no end?

SC: My way of phrasing would be just saying is it infinitely variable? How much variation can you permit before you come back to the first beat again? You showed us 12's and 16's, but would you go on to 100 before you come back to 1?

SM: You could, yes.

CN: But there is always a coming back. A computer clock, goes from here to eternity. It does not need to go back to one. It just goes on. So that is not rhythm, because it just goes on. Or is it rhythm too?

RW: A rhythm needs repetition, and it needs an ending point.

CN: It needs an ending point!

LH: So, if you start with a 4 beat, and then in the next cycle you add one rhythm, but you don't go back to the 4, there is still a rhythm, right?

Finding Rhythm in Data

Scott Cunningham asks a question that reveals the issue on rhythm from the data analyst perspective, who most of the time deal with giving a meaning to the many different noises they here. Mieke Gerritzen contributes to this discussion by talking about how she achieves rhythm in her work as visual artist, and how she disturbs the patterns through introducing different moments of silence, and making the pattern become more unique. This leads us to the role of variation in a repetition, which is the definition of the national Dutch philosopher Marli Huijer.

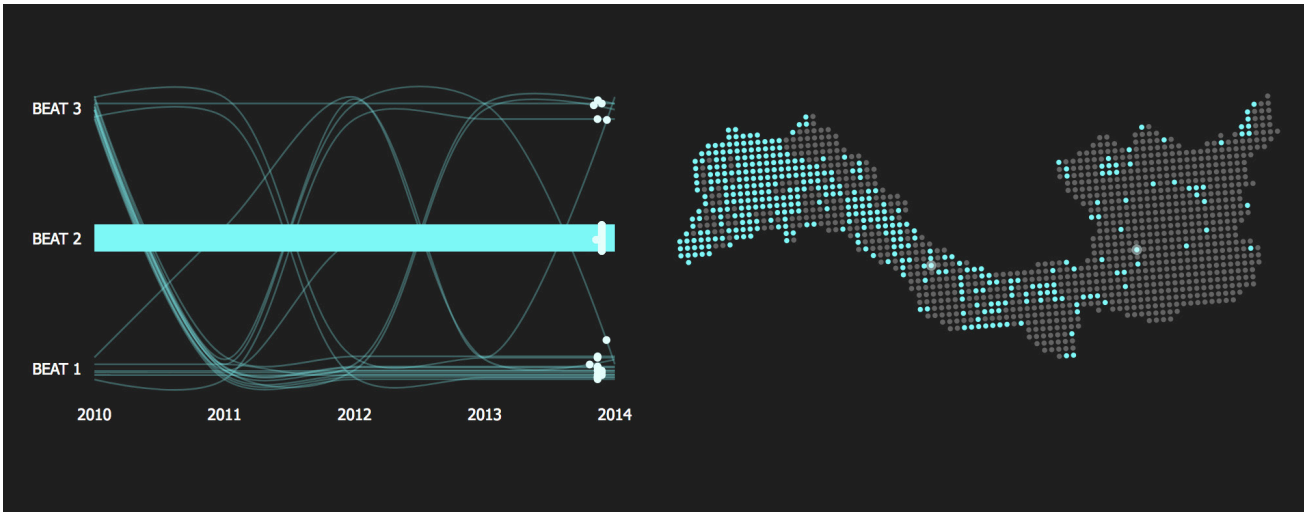
SC: The experience in analysing rhythm in cities, is like listening to three separate music groups play their own thing all at once, and we are looking for the ones we are interested in. We have to get rid of all those others and say: "That's interesting, but that's someone else's group". We are part of this one song, and we have to figure that out, that one song so we could participate. And worse someone shuts off the audio every now and then.

CN: Or, in the other terms, like the waves, we say there are actually three orchestras playing, and together they create a rhythm in our environment. But how can we hear the rhythm that they create, the noise they create?

RW: People with hearing implants, when they use it for the first time, it's so insane because you don't know what to listen to. You need to train yourself to hear someone over a crowd of people. Many people with implants they just turn it off because their brains don't have the filter. It's through familiarity, through living that this develops.

CN: Can I ask Mieke? Because you make very visually rhythmic work yourself.

MG: But I never compare it to music in a way. Silence, your moment of entrance, I think it's



more about disturbing. If you create these kinds of moments in your rhythm, it's about reflection and it's about identity. With the silent moments you create different rhythms or disturb the rhythms that are mainstream. I think that's an interesting way of creating more individual rhythm.

CN: So, you say identity is like memory and anticipation. It's cultural that you recognize an entrance, or not?

MG: Like, if you make it more exceptional, or more experimental, that's mainstream. I think if you make a rhythm, that's mainstream. In my work for example, I make graphic rhythms, if you don't disturb it, then nothing happens, it's flat.

LM: This connects to what we heard on familiarity. You have repetition, and you are familiar with it, you understand it, but you need a certain amount of disturbance or variation, otherwise, it's completely boring. So, you need to stretch this aggregation but at the same time not too far, otherwise it becomes unfamiliar, and you don't understand, and you are afraid. It's very cultural and education based, but I think it creates an interesting space where you can play with. This space between certain amount of-

IP: Unpredictability, or uncomfortable feeling…

CN: So, the function of the variation, going back to the definition of Marli Huijer, it is also about creating a disturbance, and unexpectedness in the repetition and in the anticipation.

MG: That's how you make it special!

CN: Yes, let's go back to Scott now, what do you think?

SC: Well, I want to give one more shot to that, to keeping it simple. Today Amsterdam is playing us a rhythm, and whatever rhythm it is, we can't hear it. The question is how do we do that?

How to Visualise Rhythm in Data?

Our discussions lead us to the finding that rhythm is an alive matter, and due to the delivery method of most of the datasets, an analyst can detect patterns in data and not rhythms. Since rhythm has to be in motion, this state can be achieved through providing that motion in visualisation. We need motion in order to perceive rhythm, because we need interaction; a pattern that provides interaction is a rhythm.

CN: I'm trying to understand the difference between notation and action. Are data only notations or also actions? What I hear is that rhythm is an action.

RW: There has to be a movement. Either your eyes are moving around the graph, you cannot see a rhythm in one glance. I don't believe you can experience rhythm statically.

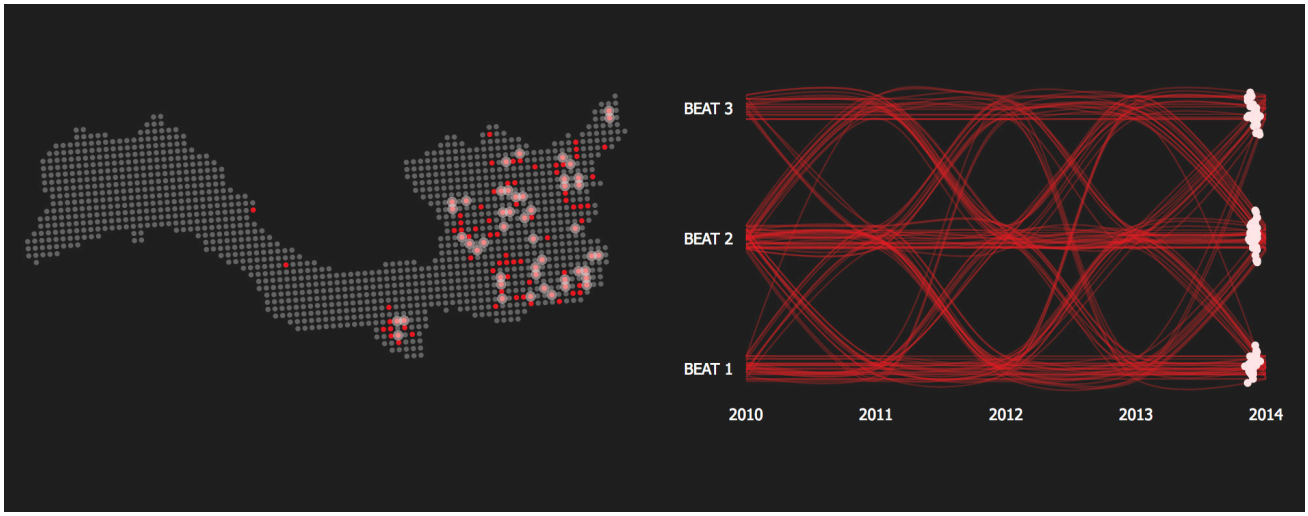
IP: I think the rhythm is a dynamic in itself.

MG: But it's the same thing as creating. If your eyes are creating the rhythm, it doesn't matter if it's an artist who is watching or if it's yourself who is trying to find something, trying to find the rhythm.

SC: I guess I completely agree with that. I was a bit puzzled that the data would be even mistaken with rhythm in your sense. You record it, and you play it back. I don't even press play. So, the data is just recording, but it's a mutual thing, it's about the matter.

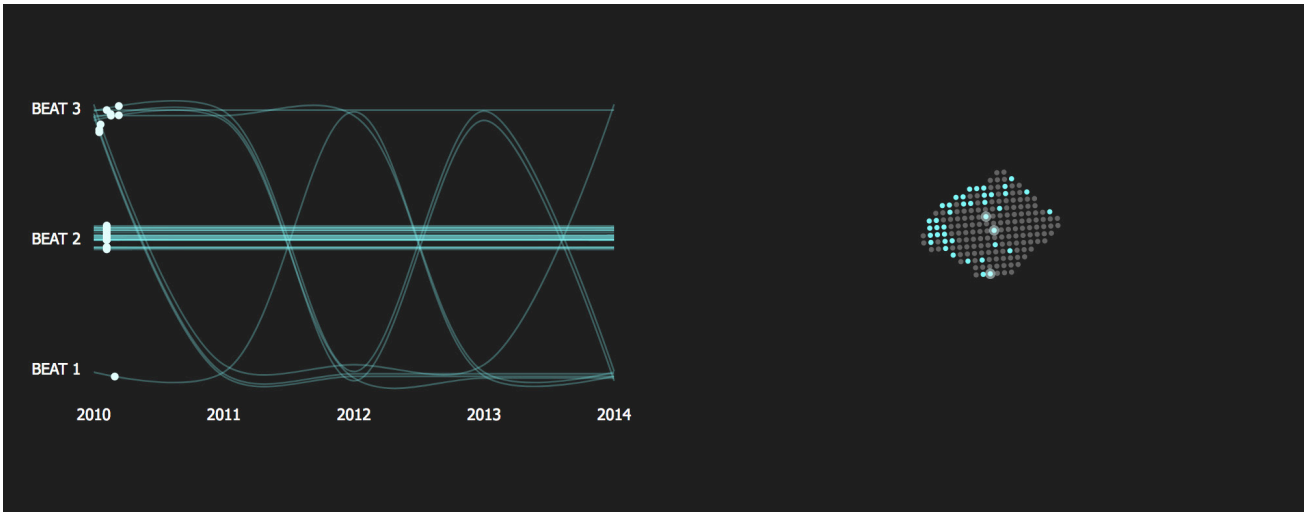
RW: There has to be interruption in some way, to refer it to music.

CN: So, what he just said, which would be very nice as a challenge for us, we can identify a pattern in data, but that's only starting point for an interaction with the community.



Merging of Rhythms

Workshop report, London, 10/02/2017



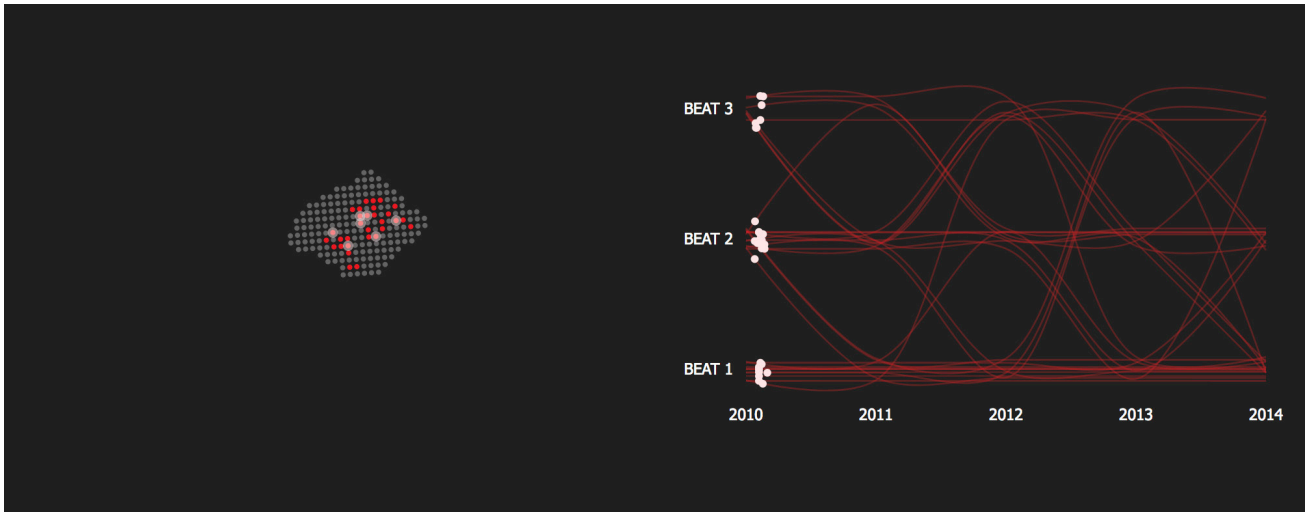
Photos from workshop in London. From left to right: Scott Cunningham and Sirish Kumar Manji; Caroline Nevejan and Sirish Kumar Manji

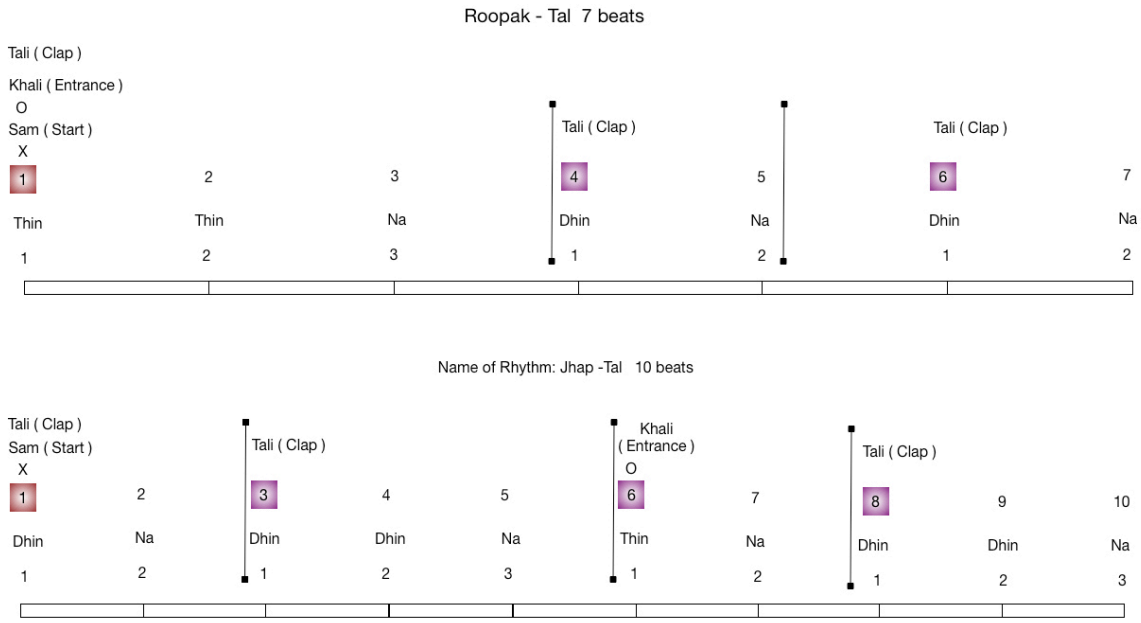
On 10th of February, principle investigator Caroline Nevejan and data team director Scott Cunningham met tabla player musician Sirish Kumar Manji and Susan Benn from Performing Arts Labs in London. They carried out a workshop investigating the nature of rhythms in rhythms.

In the Amsterdam tabla expert session, the participants were introduced to 109 rhythms of tabla. Each rhythm has its own circular pattern composed of different beats and silences. In the exploration that took place in London, the focus was on what goes on between each beat. According to Sirish Kumar, the rhythms can be very well structured at the beginning, as in classical music. Once the improvisation comes in, the musician starts adding more rhythms into rhythms.

Here are Sirish Kumar's impressions about this matter: " *I'm improvising what can be in between the beats. In the space between beats, I could be busy or not. - Some tabla players could be in one boundary, and some go beyond. What I do is to make it simple or more complex.*"

Rhythms in rhythms is how city rhythm happens. For this reason, deeply experiencing their structure gave the research more insights. Sirish Kumar underlined the importance of achieving the 'right sound', without making the rhythms deviate. Once there is a certain synchrony, the rhythm sounds clearly and meaningful. In tabla music, the quality of adding rhythms in rhythms and still sounding clear depends on the personality of the musician. In the context of a city, this would depend on the urban expression.





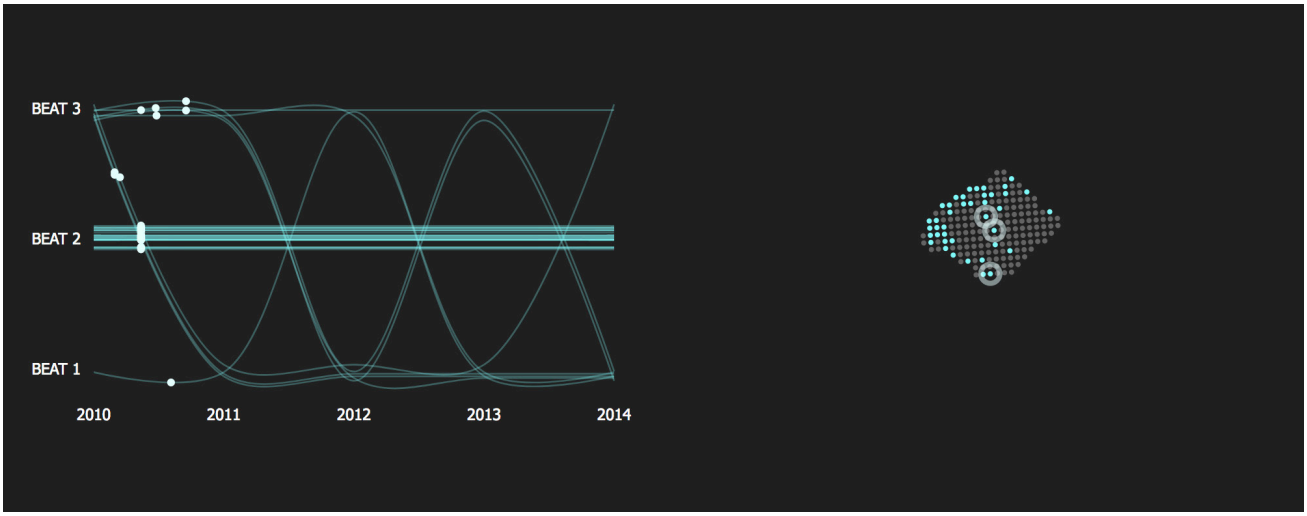
Cross rhythms visualisation by Sirish Kumar Manji. Roopak Tal (7 beats) into Jhap Tal (10 beats)

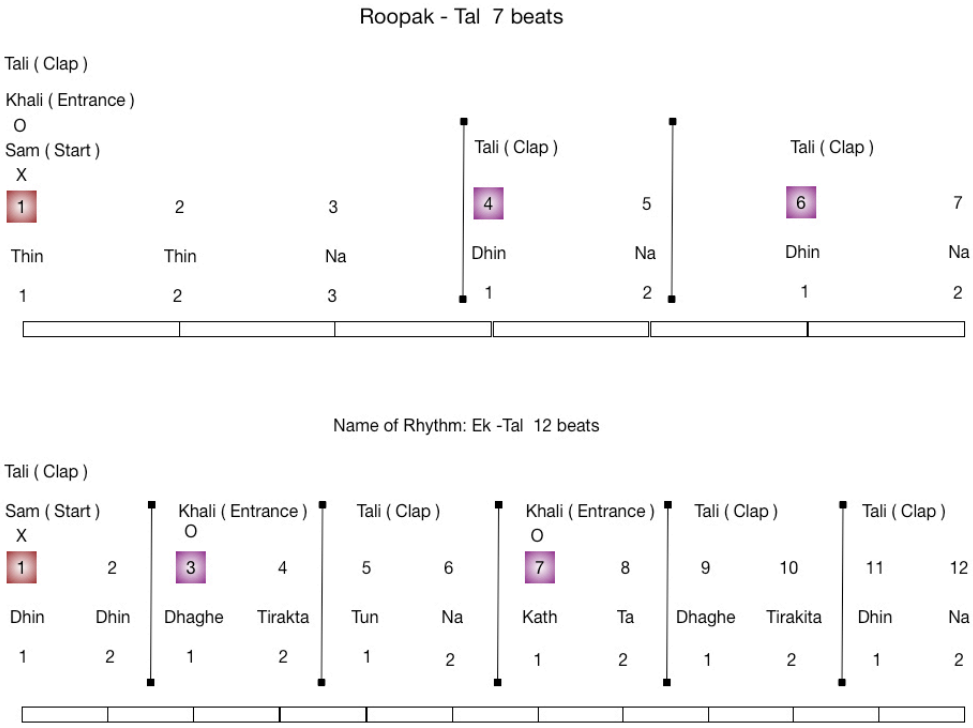
The main challenge for the City Rhythm Data Team was to bring together different sorts of data in a meaningful way, so that the municipalities can achieve useful results for policy making. Thinking of data from the perspective of rhythm creates advantages in this sense. If we consider having one sort of data as a certain beat, we can add another dataset and see how something else starts happening. In order to do this, we need to know where to place our material, in the same way, a tabla musician knows where to place his fingers on the instrument.

According to Scott Cunningham, the challenge is that the data acquired by City Rhythm are collected every month, and we have 10 years of data. If we consider that we get 10 years of data which is collected monthly, the result is one big complex sequence of beats of 120 moments.

The effect that the data team is trying to define is as if a 7 beat rhythm is being played within the tempo of a 12 beat rhythm. In the previous expert session with the artists, corruption in music was discussed. The data team experiences the corruption of rhythms in data in this sense, where the beats are easily lost because they are being played all at once, although they belong to different spatio-dynamic realities.

"*If everybody gets the sounds together right, you start hearing the sound in between, you get something unexpected.*" Sirish Kumar Manji.



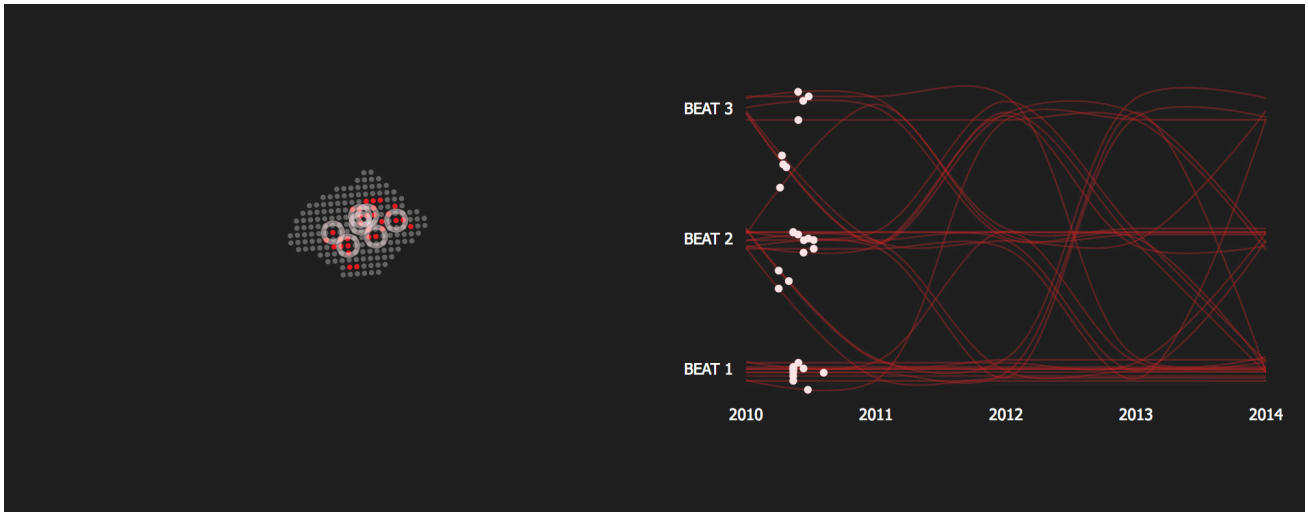


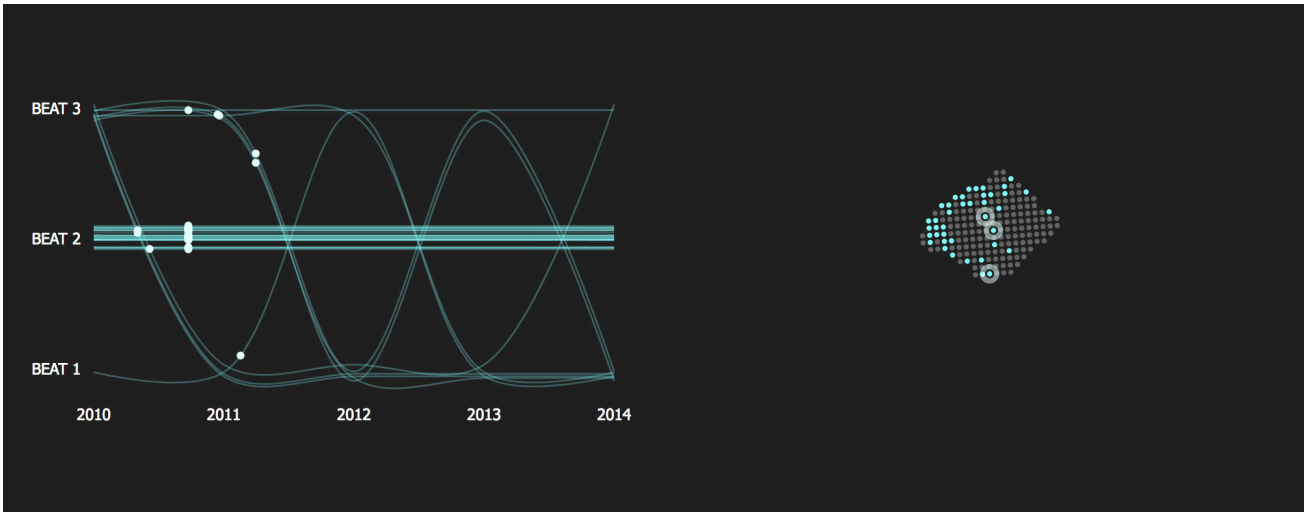
Cross rhythms visualisation by Sirish Kumar Manji. Roopak Tal (7 beats) into Ek Tal (12 beats)

In the London workshop, Scott Cunningham and Sirish Kumar performed experiments to understand how it feels to put rhythm into another rhythm. Two experiments were carried out, one where they merged 12 beat rhythm and 7 beat rhythm, and another one where 10 beat rhythm and 7 beat rhythm were brought together. However, within this merging, it was not very easy to achieve clear sounds. At the beginning everything sounded messy, but then the two participants found a way to engage sounds.

This example would take place in the data domain by defining a base, such as demographic data, which can be 12 beats because it is collected 12 times per year. On top of that, another dataset with 4 rhythms can be placed. Since each dataset will have a certain rhythm, when they come together unexpected results can be achieved.

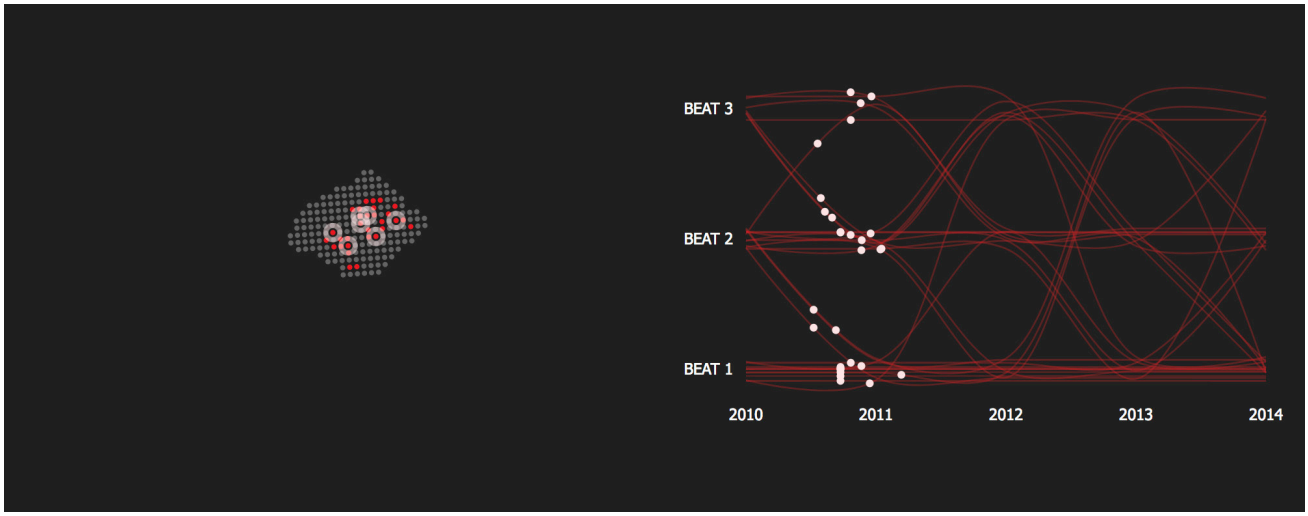
Sirish Kumar mentioned that it is possible to put any rhythm into any rhythm. Identifying the gap between beats is quite important. A tabla player who can make this happen knows his instrument and his sounds very well. As Sirish Kumar can define his own sounds, the challenge of the data team is to define the unit of rhythm for finding the right sounds to work with.




BEAT 3
BEAT 2
BEAT 1
2010
2011
2012
2013
2014

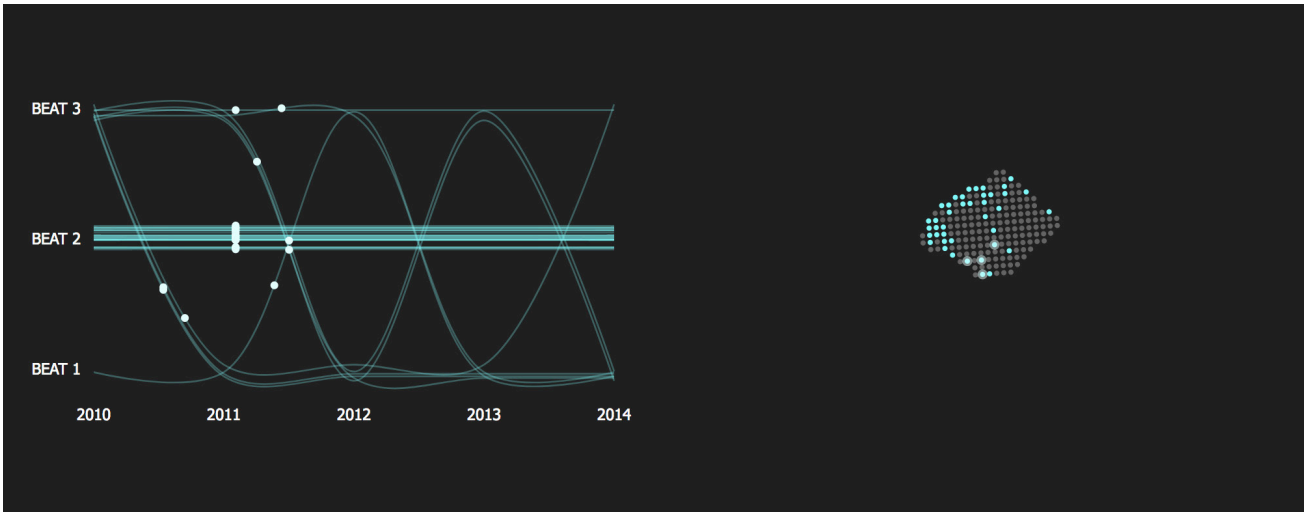
Part 4:

From Rhythm to Algorithm



Modelling Rhythm in Urban Data

by Scott Cunningham, Caroline Nevejan and Jandirk Bulens



Focus on Locations

Cities are built territories; they are defined by the fact that citizens live relatively close to each other and share space. Shops, bars and other services like doctors and judges for example, attract activity in cities. Originally cities host the market where products from the region are traded and people meet. Today's smaller and larger cities are still very much defined by their territorial lay-out. A main task of municipalities is to organize the sharing of space. Coastlines and rivers, hills and mountains, parks and squares, streets and market places, theatres and museums, affect local relations and the city's global attraction.

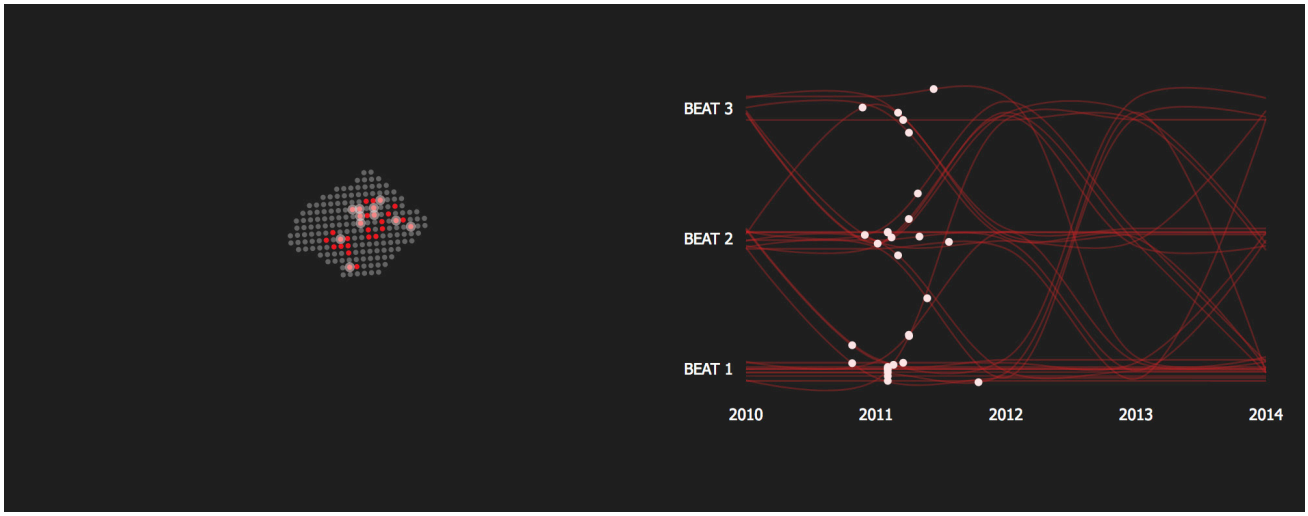
In cities in the Netherlands the organization of social life in the city is also defined by spatial distribution of services like schools, shops and hospitals. A child is supposed to attend school in the neighbourhood where the child lives. General practitioners accept only patients who live in a specific area. Shops are located in neighbourhoods -- unlike in some other countries where a family drives with a car to a mall to shop. Art and culture happen in the centre, yet many neighbourhoods of larger cities have a cultural hub in their neighbourhood as well. Even sport facilities are at 'bike distance' away.

Social issues that require attention from municipalities are happening at certain times in certain places. Municipalities like to be able to anticipate these social dynamics and predict what will happen next. It is expected that eventually rhythm analyses can contribute to predicting social dynamics and without violating the privacy of people involved.

In many cases predicting what will happen next, does not require personal details and only requires information that is attached to a specific place at a specific time. When the bars close late at night, the people in the neighbourhood who sleep by that time might be woken up by the people who leave the bar. It is not personal; it is a dynamic that is triggered by the opening hours of the bar. Policymaking often requires understanding the movements of people in the city in for example traffic, medical care, schooling, shopping, food and water supply, waste disposal, tourist activities or recreation and more.

In all these cases, one does not need personal information. Instead one needs to understand the collective dynamics that are the result of many people coordinating for themselves through space and time. For most policy making it is not necessary to use personal information. One needs to understand the dynamics that result from the many individual spatio-temporal trajectories. Especially repetition in such dynamics is interesting. When knowing a pattern, one can anticipate. Such anticipation can result in the development of specific services, like transport or food supply for example.

When knowing a pattern, one can try to influence the pattern. By building a school in a neighbourhood, the daily morning route of all parents and children changes and this can have implications for traffic lights, public transport, playground design, local shops and the café on the corner where the parents like to have a cup of coffee before they go to work. A new school is more than a pattern changer. It actually introduces a rhythm



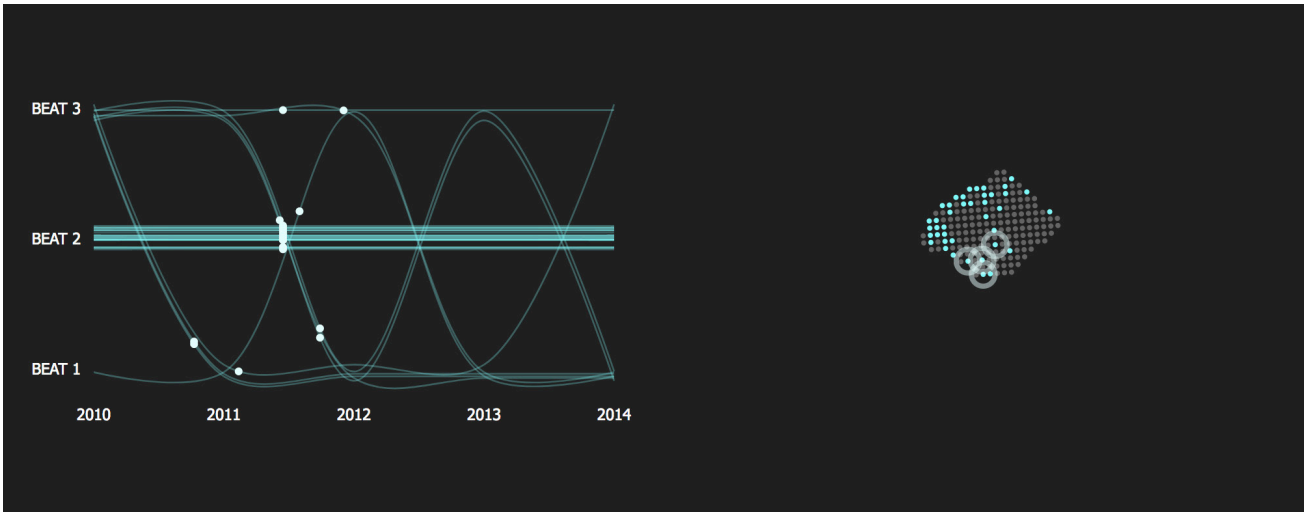
in the neighbourhood. Between 8:00 and 8:30 all parents and children make their way to the school to arrive around 8:15 for example. It is the variation in this pattern that makes the repetition agreeable with the people who have to engage with such a rhythm over many years. All children will arrive, yet it is not clear who will arrive first. All parents who bring a child will not stay at school, yet it is unclear who will leave first. Every morning when the doors of the school open, there is this improvisation happening in which individual spatio-temporal trajectories tune to the pattern of the school and to each other's movements as well. It is this rhythmic quality that nurtures endurance for human beings. It is this rhythmic quality through which people tune to each other's spatio-temporal trajectories in a given pattern. It is this rhythmic quality through which social cohesion in a neighbourhood emerges.

When trying to explain self-organization in a complex distributed system like the Internet, the dynamic is often described as "local coordination for global performance." Neighbourhoods can be understood as self-organizing complex systems with a dynamic that could be described as "individual coordination for collective performance." People tune their spatio-temporal trajectories to each other in the given spatial pattern of the neighbourhood. In this tuning to each other, rhythm emerges. The rhythmic quality then generates different intensities of engagement and results in higher or lower levels of social cohesion.

For policy making the understanding of the rhythmic qualities in a neighbourhood is of vital importance. In Dutch cities, every neighbourhood has specific professionals who not only attend to the rules and regulations of the city, but who attend to the atmosphere and the changes in the atmosphere of the neighbourhood as well. In Amsterdam, for example, there is the central municipality which works in direct collaboration with the seven boroughs of the city which each have a Borough Secretary. In each borough, there are several neighbourhoods identified which each have a neighbourhood manager. Every neighbourhood is divided in several areas which each have a street manager, who in the end knows exactly the rhythms and breaks in rhythms of the specific area he or she is responsible for. Policymaking at these different levels affect the rhythms in the street.

This can be the result of international business developments and/or of national policies and/or of regional and municipal planning outcomes. Whether people have work in a neighbourhood affects the rhythms in the streets significantly. Rhythm here is an affect one can perceive of these larger complex political interventions. A local rhythm intervention will not easily affect these complex political decisions. However, for the people who are out of work, rhythm interventions can help to make the daily atmosphere in the neighbourhood better.

The student work has shown that exploring rhythms in activities of people offer new design solution spaces for policy making. Policy making is here understood as planning of interventions in a given situation. The student work also indicates, as did previous research, that for residents the scale of the street or area is most important when discussing sense of safety. Traffic lights that are too short on green, prevent elderly to take a walk in the park across the street. The youth that meets between 17:00 and 18:00 on the square after work are experienced as too much in their numbers because

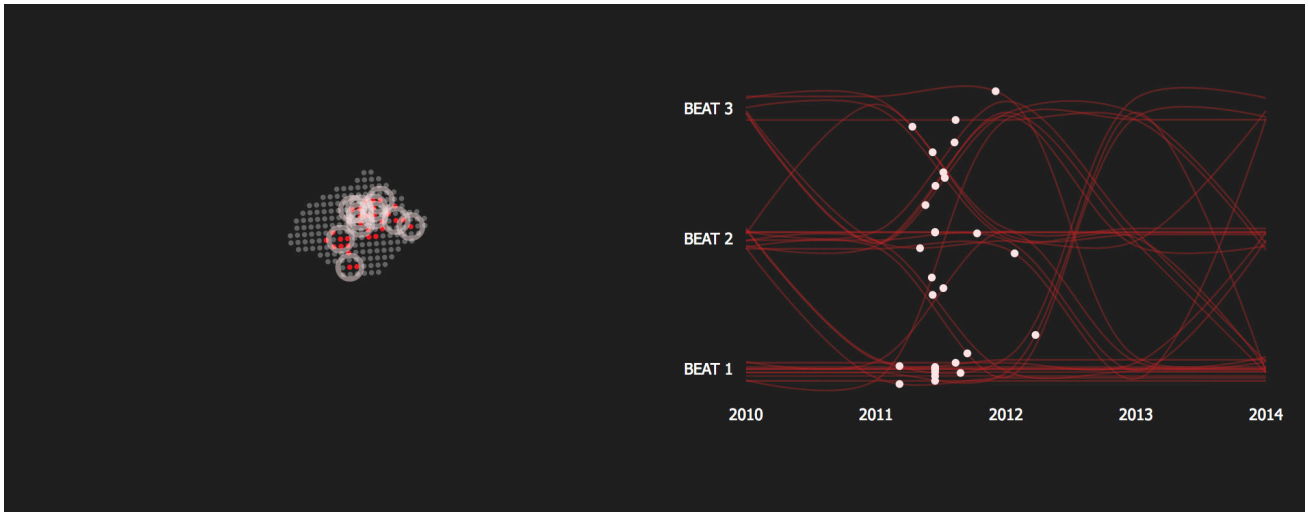


traffic and shopping are also maximally intense at the same time. In another example, young, single mothers do not use the municipal services that are made for them, because the institutional rhythms do not match their rhythms with the children. Their own rhythms demand constant improvisation in a very strong and physical pattern of taking care of small children). Mothers prefer to attend a shared space in their own area where kids are welcome and people help each other for free.

Social cohesion is related to the emerging rhythms that are the result of many location based spatio-temporal trajectories of residents in an area of several streets. Even though they are affected by many dynamics from outside the neighbourhood, the sense of social safety and social cohesion are experienced in the streets one lives in. As human beings, we are often not aware of the rhythms we are part of. Especially in the city where natural and cosmic rhythms are less prominent, capacity for noticing rhythm is less necessary. Yet at the same time, most people can sense whether they feel safe and connected or not. When visiting other neighbourhoods, or when visiting other cities, one can feel an atmosphere but does not know exactly what elements constitute the atmosphere. One can read signs, notice movements or recognize certain patterns and rhythms to which one needs to adapt because they are different than the rhythms one is used to. So in the comparison of different rhythms they can become more visible.

In the physical social world rhythm analysis has offered a new approach to policy making. Is it possible to have a similar approach by using data attached to location for social issues that occur in neighbourhoods? Data are like a photograph. They indicate a reality that was there, yet they are not this reality themselves. They are a representation and as such offer a specific perspective on this reality. Like with a photograph, there is an ‘hors cadre’; there is a reality outside the frame that is not captured in the data. By combining datasets over time, as with film, new insight in reality is created. Again, this has an ‘hors cadre’ that always needs to be taken into account. When analysing data that are attached to location, there are elements in this location that will never be captured in the data: the breeze around the corner, the squeak of the wheelchair of my neighbour, or the song that is being played in the shop across the street

In applications like TomTom, patterns of mobility are constantly being translated into data to create better flows of traffic. Municipalities gather many data at different levels of detail and different levels of policymaking. The Central Bureau for Statistics (CBS) of the Netherlands gathers data all over the country based on 100 meters by a 100 meters territorial grid for example. Even here most data are based on personal details and need to be aggregated to a different level and perspective for rhythm analyses based on location. As became clear in exploration 1, participants from the municipalities argued then that often these data cannot be used by policymakers because this will jeopardize rules and regulations for privacy protection. Is it possible, realizing that quite some social issues in a city are bound by location, to offer a new approach to policymaking for social issues by finding rhythms in data that are attached to location and not to people? This question guided the exploration of the data rhythm model that is described hereafter.



Different Approaches to Data

Developing the City Rhythm Data Model by the City Rhythm Research Team, Start-up Company Delph BI and the Amsterdam Health Technology Institute (ahti).

The City Rhythm project assembled a diverse group of professionals to collect data, and to propose a model capable of answering the research objectives. Team members took on different roles. Scott Cunningham from Delft University of Technology took on the role of a systems architect. Members from the Delph start-up worked at the back-end of the modelling processing, producing and estimating a model. Members from ahti worked at the front-end, reporting on the model and the data, and serving as an interface with the cities. Jan Dirk Bulens from Wageningen provided much needed expertise on geographic computing.

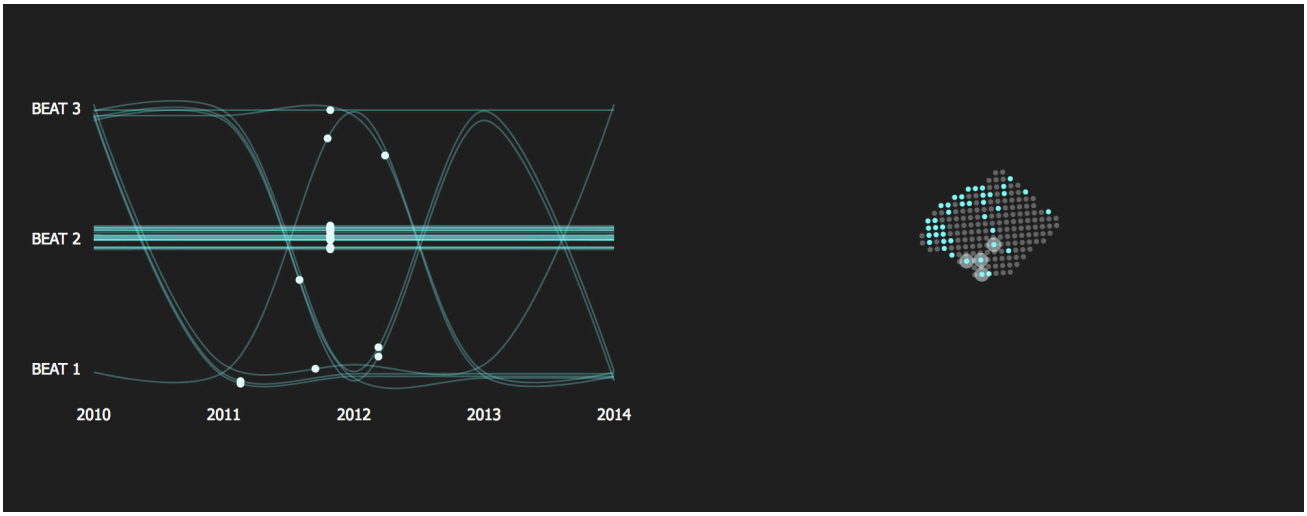
It quickly became apparent that there were three distinct approaches to data in the team. And, perhaps most seriously, that these different perspectives on data differed on important matters including the role of the analyst, the kinds of models which are to be considered, and the criteria by which a model could be judged. These three approaches are shown below (table 1).

One of the perspectives is based on classical statistics. The analysis is based on rigorous (if idealized) assumptions about probabilities and distributions. The role of the analyst is to confirm or deny hypotheses, using rigorous tests of statistical significance. The data itself is assumed to have come from a controlled, experimental setting.

This is a hugely influential, and hugely successful approach, and is in large part responsible for the wide spread use of data in government, industry and science today. These kinds of approaches were particularly endorsed by our colleagues at Delph BI (Mark Verhagen, Leo Huberts and Ruben Spruit), and at ahti (Lene Böhnke and Thu Vu).

An alternative perspective was endorsed by Scott, coming from TU Delft, and previously from industry. Computational power has enabled the wide spread use of computational experiments. This enables us to experiment with data, entertaining a wide variety of different models and assumptions. The role of the analyst from this perspective is as an interlocutor. That is, the analyst builds constructive dialogue between different forms of knowledge. A successful model is one which is used, and which is actionable. This kind of perspective is very sympathetic to Bayesian statistics. In Bayesian statistics data is ultimately subjective – gathered for a purpose, and interpreted in light of a particular social or political context.

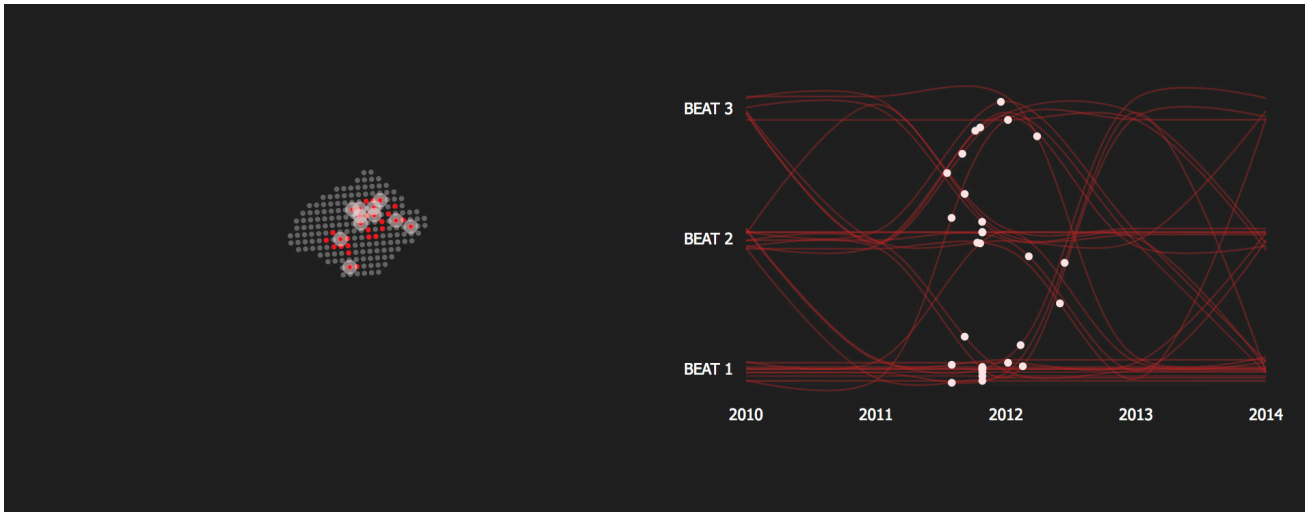
The third perspective was endorsed by Jan Dirk Bulens, a member of the City Rhythm research team. His approach as a natural geographer is deeply empirical. For him data is inherently partial and incomplete. It is all too rare when we can capture data using a cleanly designed experiment. Therefore it is best to examine the data using multiple perspectives, and at multiple scales. Spatial statistics, and descriptive statistics, are often the go-to techniques for this style of analysis.



	Classical Statistical Approach	Policy Analytic Approach	Open Systems Approach
General Framework	Mathematical	Computational	Natural Systems
Role of the Analyst	Rationalist	Interlocutor	Empiricist
Nature of Data	Objective	Subjective	Partial, Incomplete
Typical Models	Classical Statistics	Machine Learning	Spatial and Descriptive Statistics
Successful Models	Falsify Hypotheses	Useful for Decision-Making	Enable Exploration and Learning
Ascribed	Mark Verhagen, Leo Huberts, Ruben Spruit, Lene Boehnke, Thu Vu	Scott Cunningham	Jan Dirk Bulens

Table 1: Explanation of Three Perspectives on Model Building, by Scott Cunningham

The project ultimately took something from each of these three styles of analysis. The project benefited from the rigour and hypothesis framing of the classical statistical approach. The policy analytic approach helped form a bridge between different styles of knowledge. The model selected was also selected based on this style of machine learning research. The open systems approach kept us alert to new ways of thinking about open systems of people and nature.



Mapping Urban Data for Trust

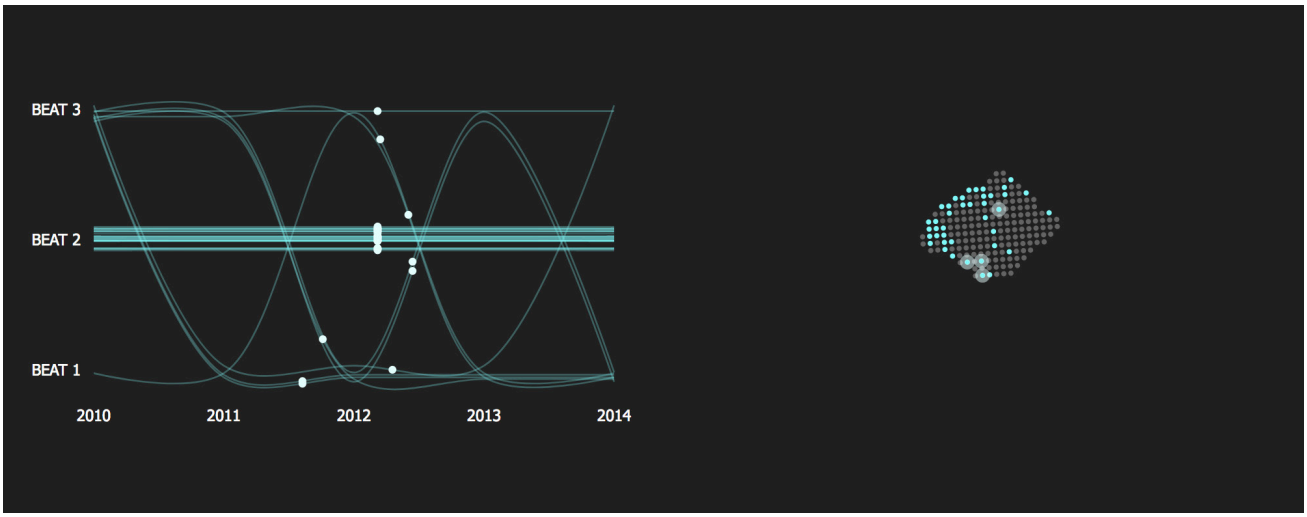
Screen shot from CBS Micro data catalogue. Image source: **https://www.cbs.nl/en-gb/our-services/customised-services-microdata/microdata-conducting-your-own-research/microdata-catalogue**

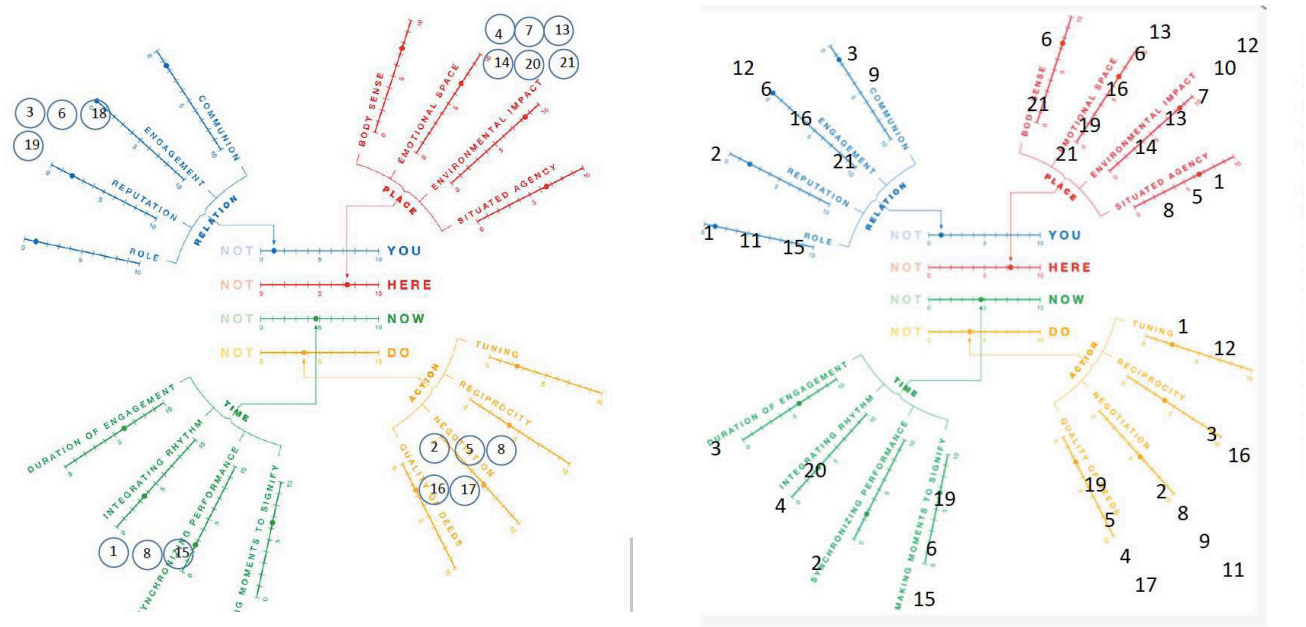
It's claimed by some that plentiful sources of big data eliminates the need for theory. After all when you have a comprehensive selection of data there is little need for speculation – you simply look it up. Nonetheless the truth of working with data is very different. In this section we discuss how a bridge was built between theories of trust, and available sources of data at a national level. The CBS (Central Bureau of Statistics) is an attractive source of data for measuring social cohesion given its exhaustive and standardized collection of data resources. (See the sample catalogue, at left.)

The YUTPA model provides structured guidance about what sorts of urban data to collect. The model provides four broad dimensions in which to situate trust relationships including you/not you, here/not here, doing/ not doing, now/not now. Such guidance proves necessary when navigating the extensive and highly granular data available from the CBS.

The challenge stems from mapping the dimensions of the YUTPA framework to specific, concrete data sets. The YUTPA model itself consists of sixteen more targeted constructs. But these constructs may not perfectly relate to the data as collected by the CBS. For this reason (Scott and Caroline) attempted a rating procedure to prioritize the collection of data. Each of the broad inventories of data collected by the CBS is assigned an number and is mapped onto the YUTPA model. The results are shown below.

Scott's results (shown at left) are both concentrated and balanced across the four YUTPA dimensions. Previous experience working with data professions





CBS datasets mapping on YUTPA Framework by Scott Cunningham (on left), CBS datasets mapping on YUTPA Framework by Caroline Nevejan (on right).

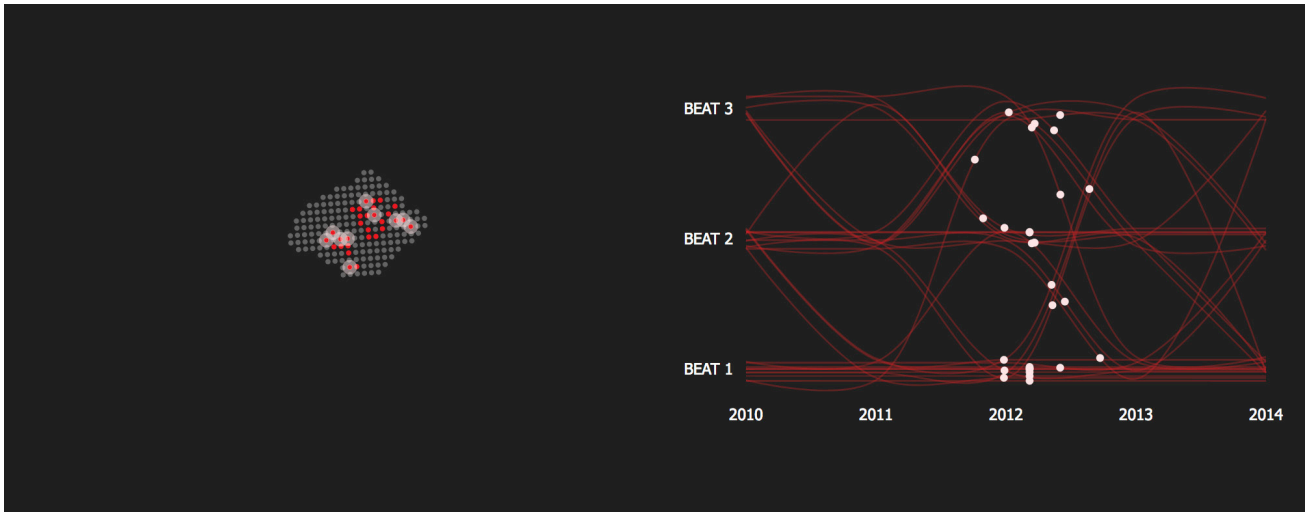
meant that he wanted a sharply focused discussion on relatively few data sets. Privacy concerns and justifications of use were strong guides for his choice.

Caroline's results (shown at right) are based on rich understanding of the YUTPA framework, and experience in applying in multiple cases and domains. Caroline readily made multiple matches, foreseeing opportunities were a single data set could provide useful insights into multiple areas of the framework. This also led to some dimensions in the framework foreseeably being much better instrumented than others.

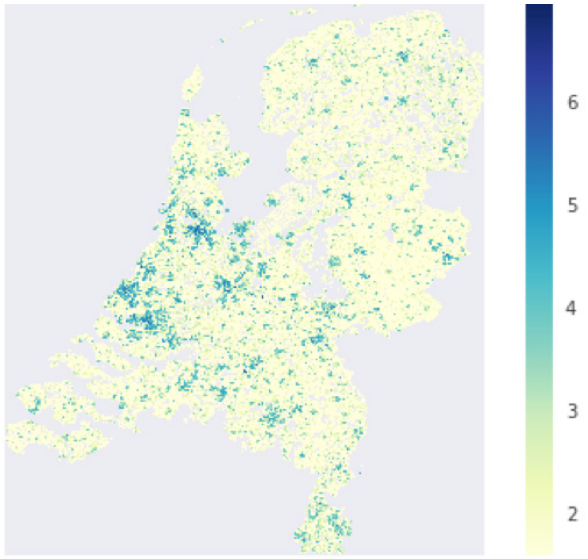
There is a seeming disparity in the two approaches to the selection of data. Despite this a strong basis for collecting and prioritizing data emerged at the intersection of two ratings. The ratings given by Scott and Caroline strongly emphasize the importance of the demographic and health variables available through the CBS archives.

The results also immediately suggest careful attention be paid to the time and space dimensions in across available data sets. Indices of time and space are a routine means of linking and organizing information. They are also natural dimensions of concern when protecting the privacy of individual citizens.

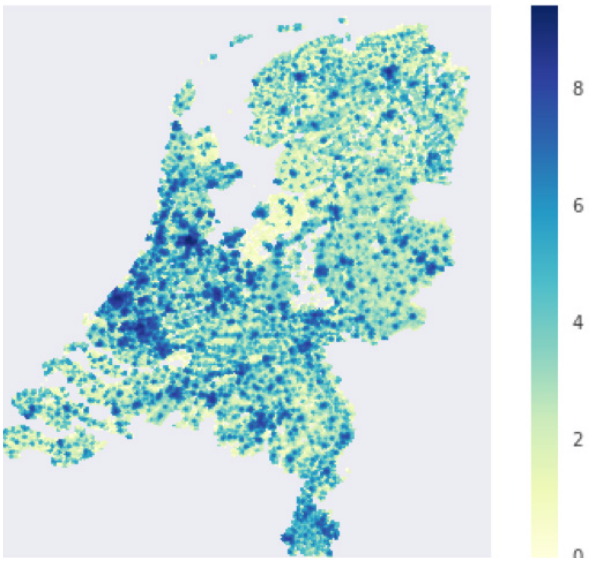
Ultimately the principled approach to data collection as described here enables the project to better generalize its findings, and to better match modelling results to known social theories of trust and social cohesion.



Getting the Data



Urban Population Centres in the Netherlands
(Own cartography; data CBS 2018)

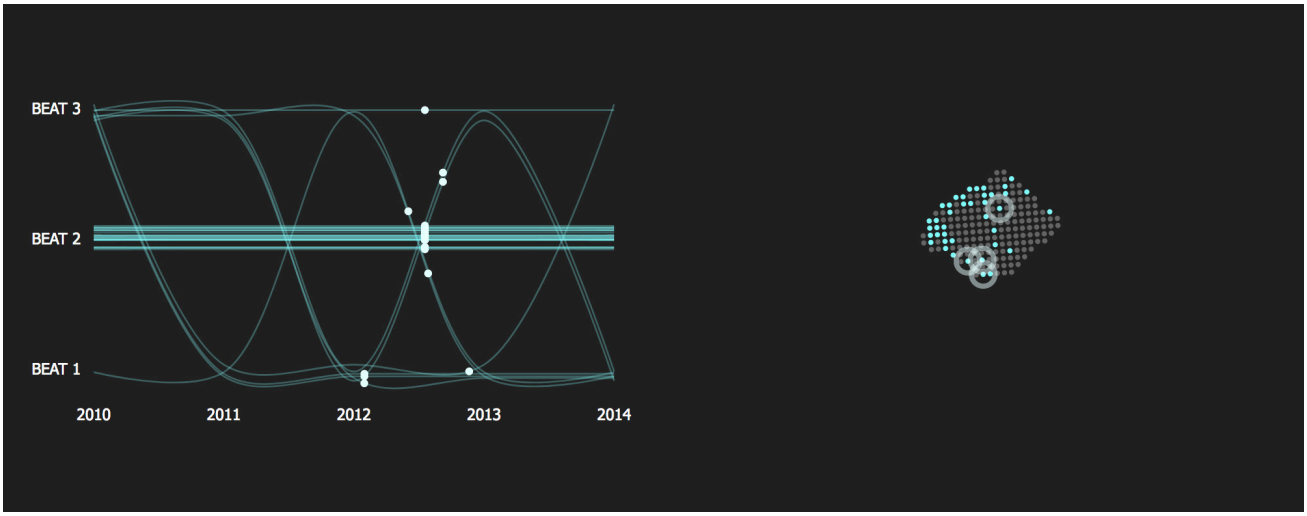


Urban Character of the Netherlands
(Own cartography; data CBS 2018)

It is being stated by many experts that there is a large availability of data, however we found out through a phase of trial and error that this is not the case. In data sector, there is a big illusion of reusing data, as well as an illusion that the data will be shared and that it is actually the 'new gold'. Along with accessing the data, another big illusion is that the data reveals itself, that it has meaning. Furthermore, many professionals think that data arrives to the clients in a usable format, and that it can be easily linked to each other.

The figures at left show the spatial distribution of two important measures of the Dutch population. Both maps are at a resolution of 500 meters by 500 meters. The top map shows the number of legal addresses at each grid cell. The data has been rescaled to highlight the medium density features of the Netherlands; otherwise the highly agglomerated urban centres of Dutch cities and the countryside would be the primary features shown on the map. The bottom map shows the urban character of each grid cell. The urban character variable shows the built environment of the Netherlands in terms of five major categories. Since the variable is already scaled it more clearly shows the urban and rural distinctions of the Netherlands.

In the process of finally getting the data, there is the trustworthiness of a professional as a part is very important. That professional who is willing to access the data has to prove that he/she has the right amount of money, and at the same time he/she is an institutionalized traditional entity. An interested party who is willing to access the data needs to have



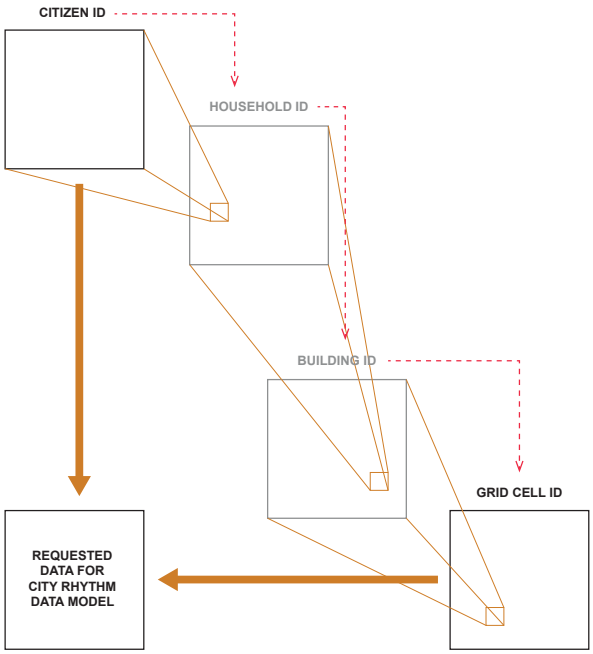


Illustration showing how City Rhythm data team approached data acquisition, by Scott Cunningham and Pinar Sefkatli

the technical expertise, and has to prove in his/her process of working with the data that he/she will not violate privacy.

Our purpose for accessing micro data was very different from the purpose of other businesses, and finding the right language of negotiation with CBS required a lot of time. As shown in the graph on right datasets from CBS are structured in four tables; citizen ID, household ID, building ID and grid cell (vierkant) ID. City Rhythm was never interested in reaching to information on individuals, we only needed the grid cell ID in a detailed level, which would reveal more dynamism. However, to reach meaningful information is very sensitive to privacy and required many negotiations.

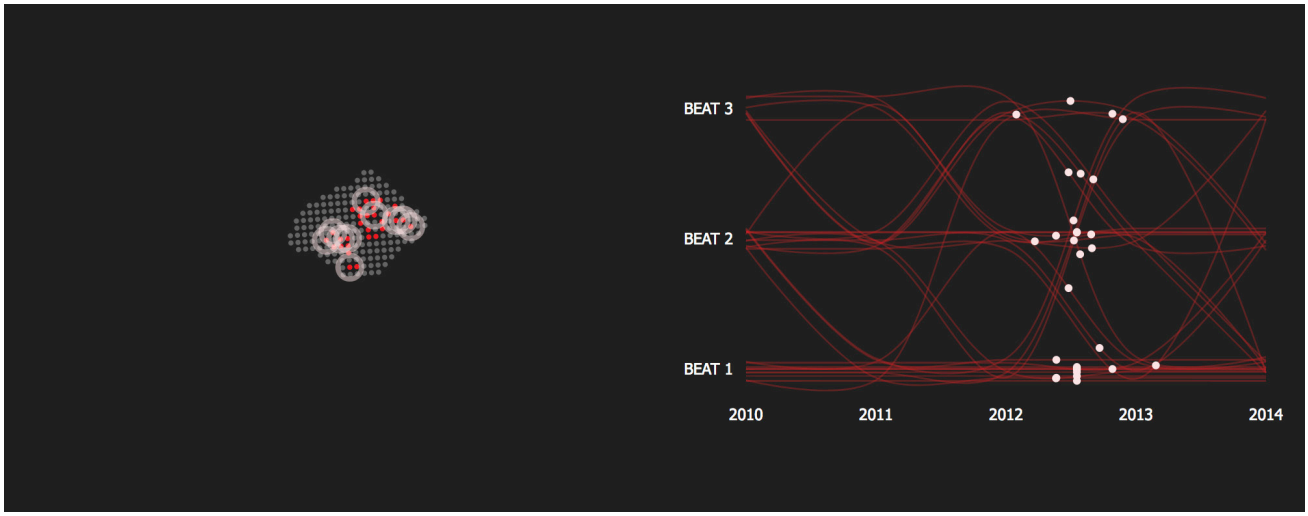
The figure shows, in an interpretative manner, how the data is rolled-up from legal residences, to households, and further to grid cells or administrative districts such as areas (wijken) or neighbourhoods (buurten).

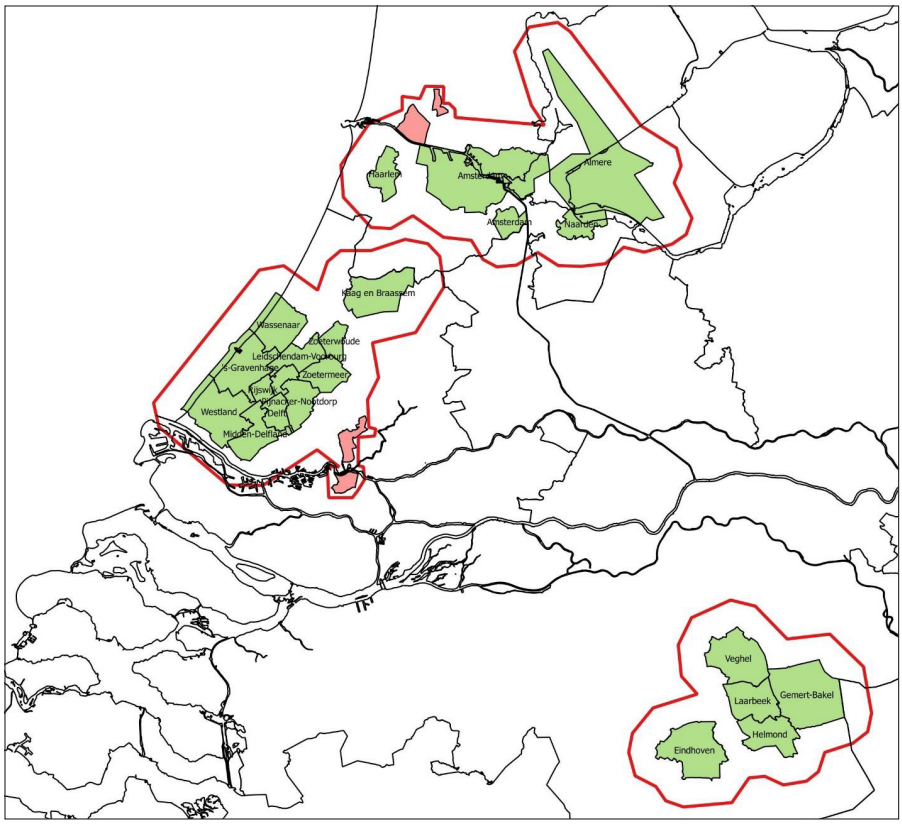
Nature and Land Use Data

One of the outcomes of mapping CBS datasets of YUTPA framework was the impact of nature in people's mental well-being and presence with their surroundings. On the other hand, nature is the most fundamental rhythm of human life. Therefore, City Rhythm data researchers wanted to see how people connect to nature.

Although the nature data is publicly sourced from Natuur.nl, it is only available for external use through high payments. In order to tackle this big negotiation took place in order to get the data, and as a result, we decided to make use of the data from Natuur.nl only within the boundaries of neighbourhoods which were part of our initial research. Above, you can find an image of our selection of these datasets.

Different functions in urban areas have different impacts on the ground rhythm of neighbourhoods. Land use data is Kadaster (land registry) data, which is a public service for maps. The land use data includes roads, highways and public transportation areas (verkeersterreinen), buildings of different purpose of use (bebouwing), recreation, agricultural and natural terrain, and water. The land use data is structured in shape files, where every shape gets an attribution based on 13 categories of land use. The Kadaster also produces publicly available gridded datasets, which we will talk about in the next section.



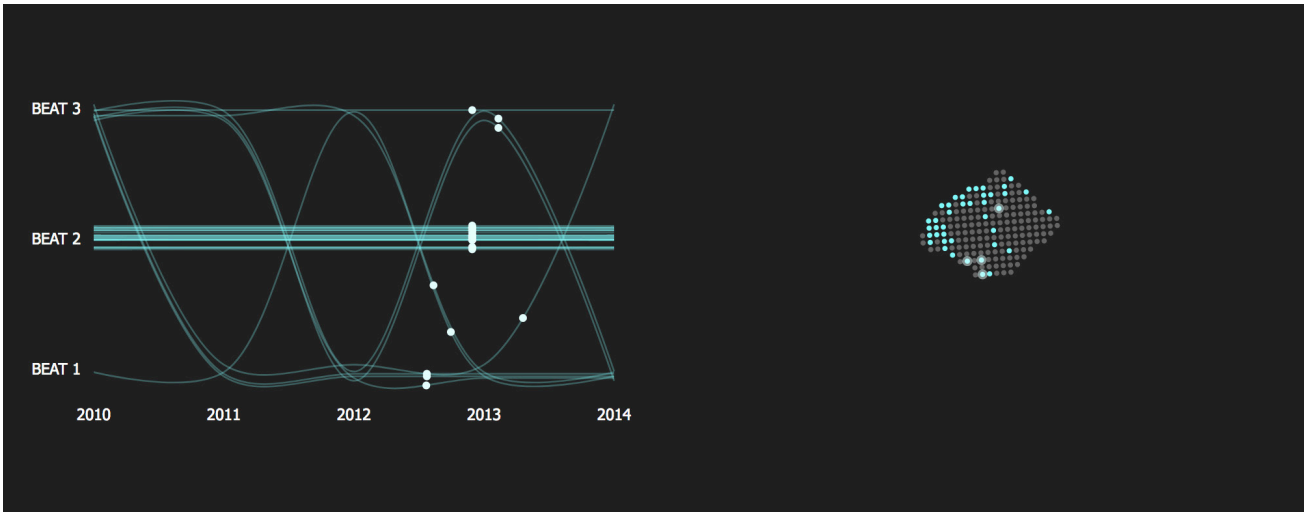


Map of the Netherlands indicating the areas which City Rhythm bought the Nature (Flora and Fauna) data.

Open, Micro and Proximity Data

The Netherlands has a wealth of publicly available geographic and demographic data. We found 'vierkant' gridded dataset especially useful. The dataset shows at a very fine level. A grid cell represents an area where 28 people live, and what the urban character is according to that information. In these datasets, each cell is assigned an id. Then, the dataset registers the day a cell is assigned to a certain attribute and the day it gets out of it. This information is dynamic, and has the possibility to reveal a rhythm. Both Micro data and Open data are structured in grid cells. Furthermore, the Netherlands has extremely detailed accounting for citizens' households at buildings and their living conditions. Naturally, such detailed information requires extensive privacy safeguards.

As an addition to open and micro data, City Rhythm was interested in proximity data (nabijheid). Arrangement of functions and facilities in a neighbourhood and their association reveals a lot from the perspective of social safety, which can be seen in rhythms of that area. Proximity data shows which functions are present in a neighbourhood and in which distance they are placed from each other.



Streaming and City Data

City of Amsterdam wants to have new ideas and methods to manage their micro data. For civil servants who are involved in data management in the city of Amsterdam, City Rhythm would create a lot of asset levels of data. Private companies such as NS or Vodafone collect many sorts of data, however the representations of the collected data remains not so relevant for any purpose when there is not enough social context.

City Rhythm is interested in understanding the dynamics in cities through the use of large datasets, in order to draw conclusions for social safety. The data model developed by the data team has a high impact for commercial data or in other words, asset data or streaming data, because it connects the datasets in order to display the ground rhythm of neighbourhoods. Thanks to this approach, City Rhythm proposes a new way of handling streaming and city data.

What went wrong?

The table below lists the data acquisition challenges faced by the project in more detail. Technical challenges include the availability and suitability of tools and software (items 1 and 2), and the capacity to consume big data (item 3). There were project management issues including requirements, contracting and schedule (items 1, 2, 3 and 9). There were also social, legal and economic challenges (items 5, 6 and 10).

By the end of the project, the scope entailed creating a full data analytic warehouse. Such projects often run for tens of person-months, and entail budgets of many hundreds of thousands of Euros. As a result the project team created a stop-light system which attached a status or readiness level to each table in the final product. This enabled the better tracking of the cleaning and transformation of the data. In principle it could allow a fuller discussion or negotiation over the scope of the data to be consumed.

Technical Challenges

1. The sandbox of the CBS was slow and limiting.
2. The R environment was not ideal for my purposes of joining and roll-up.
3. There was too high of an ambition to consume data.

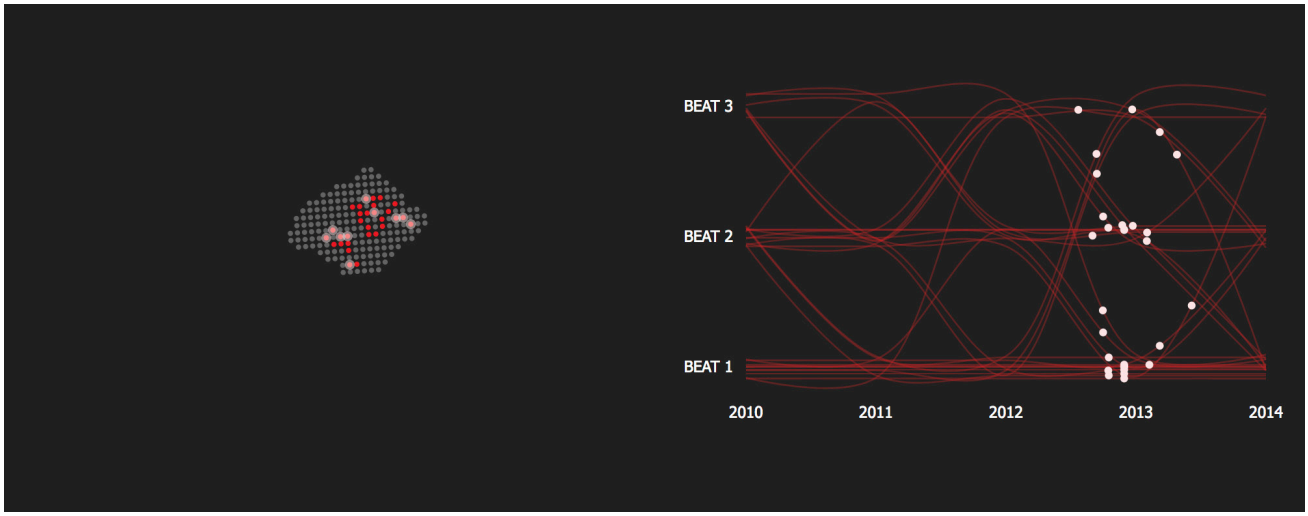
Project Management Challenges

4. Careful requirements and problem statement should have been implemented.
5. There was an unrealistic schedule.
6. The project suffered from scope creep.
7. Data is not a fixed product, and cannot be contracted for as such.

Social, Legal and Economic Challenge

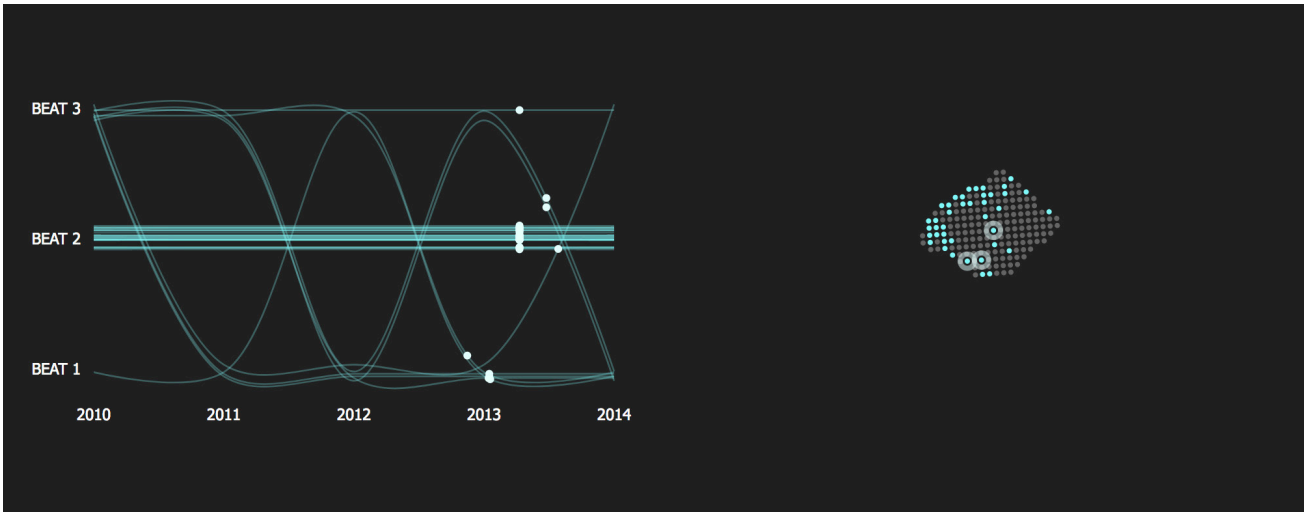
8. There were mismatches between our desires to analyse and our desires to co-create results with stakeholders.
9. There was ambiguity about the range and extent of the spatial analysis.
10. The reporting risks of the project were difficult to assess.

Top Ten Data Acquisition Challenges, table by Scott Cunningham



Designing the City Rhythm Data Model

by Scott Cunningham



Designing the Model

The very first thing to be considered when designing the model is to determine which kind of model is best given the objectives of the project. There are many different kinds of models. Some are based on human judgment and preferences. Others are non-judgemental, and can be directly derived from empirical evidence. Predictive modelling is the right design choice given the aims and objectives of the City Rhythm project. Predictive modelling, and its alternatives are discussed further below.

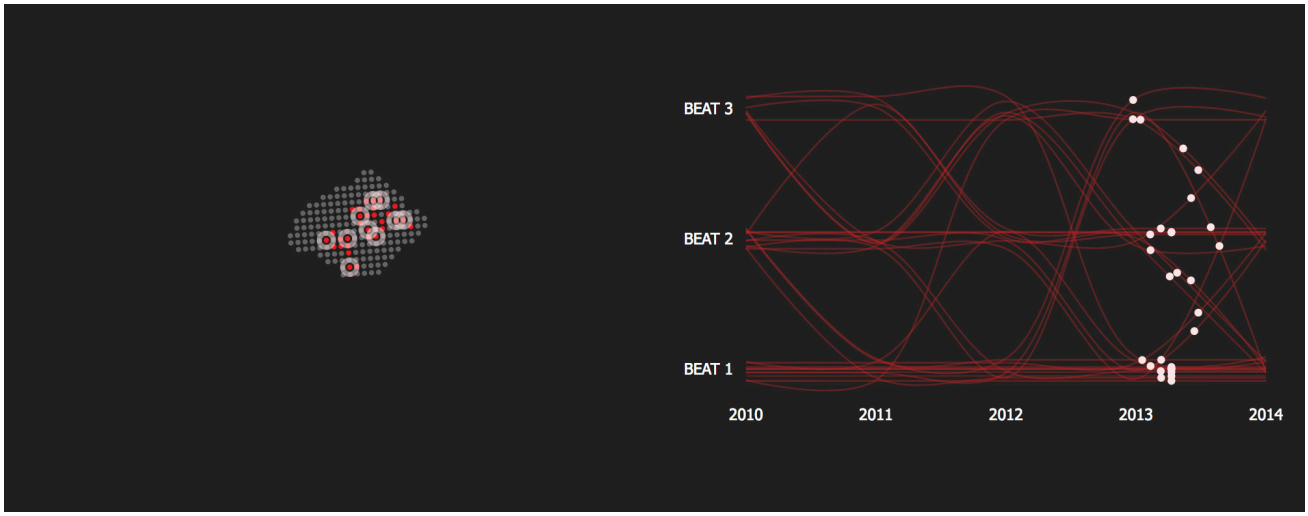
The clearest alternative is to use scorecards or monitors. Such techniques are used for instance in the veiligheidsmonitor (safety monitor) used by many municipalities. The technique used behind these monitors is multiple criteria decision analysis (MCDA). This technique consults relevant stakeholders or decision-makers to create a subjective weighting of the evidence. This weighting reduces the complexity of the underlying data down to a single score which can be easily understood and visualized.

While entirely appropriate for many situations, MCDA reduces the social complexity of Dutch neighbourhoods down to a single score. Furthermore, the weighting used in MCDA is necessarily the output of relatively few stakeholders. This limits participation and buy-in for the results. In contrast, the predictive modelling used in the City Rhythm process objectively reduces the data to a smaller set of indicators. This permits a wider understanding without imposing the value schemes of only a few decision-makers. There are many ways to design a statistical model. The most proven method however is to find, identify and address the most significant features of the problem. Each of these features serves as requirements for further model building. In the City Rhythm case, there are four over-arching features of the problem which need to be address. The City Rhythm environment is dynamic, latent, spatial and stochastic. In the next paragraphs these features are described. The more features are required, the more specific and incisive the resulting model requirement.

Earlier we discussed the spatial character of urban life. This in turn requires that the model incorporate spatial analysis into the general approach. There are multiple spatial statistical models which could be considered. It takes a further consideration of the other aspects of the model to set a tighter set of criteria on the model.

The selected model, a Mixtures of Hidden Markov Model (MHMM), is described in a qualitative fashion. The mapping between the social environment, and its technical representation is discussed. This effectiveness of this mapping is known as ecological validity. As a final note, alternative modelling choices are described. These are lesser features of the environment worth considering, but which need to be set aside to make a practicable model. Potential drawbacks of the selected model are discussed.

Rhythms underpin and permeate social action. This means that when we instrument rhythms using commonly collected variables we cannot directly measure or observe the rhythms in the data. In statistical language, the rhythm is a hidden variable. Despite the fact that rhythms are hidden to analysts these rhythms can be measured indirectly. Analysts can examine the effects of rhythm, and determine the influences these rhythms play across a wide range of measured variables. Indeed, the effects of



rhythms are felt widely across many demographic, economic and social domains. Likewise, these channels of data also demonstrate the effects of rhythm. Thus, while we cannot directly observe this variable, when present the rhythm can still be statistically inferred from large collections of data. There is a wide class of statistical techniques designed for modelling hidden variables in data. These models are called latent variable or latent class models.

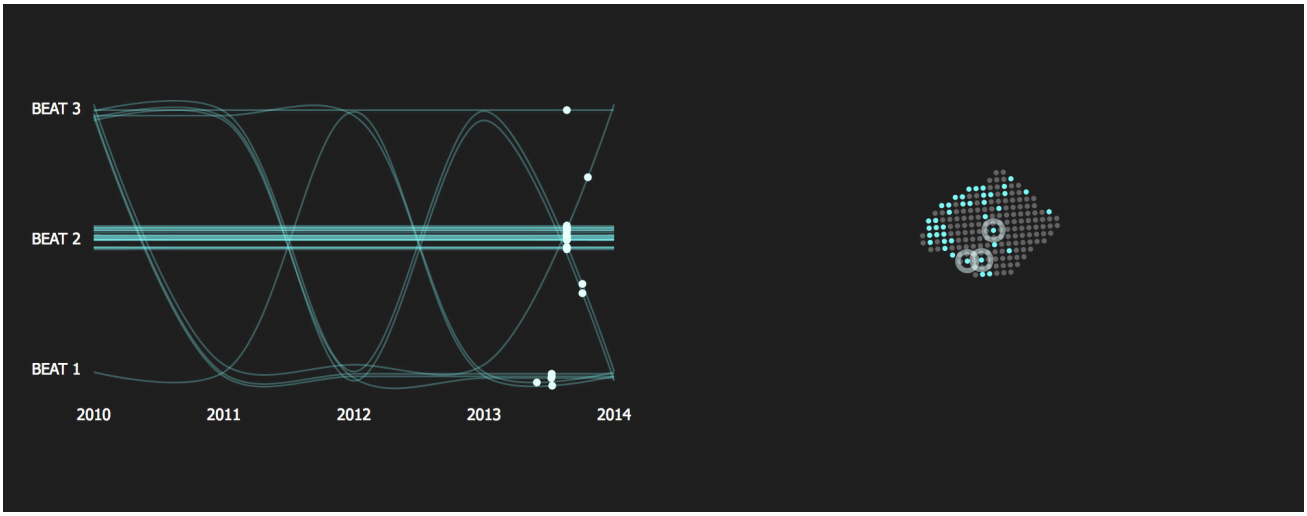
Rhythms are also inherently dynamic in character. Rhythms unfold over multiple time scales. The rhythms most easily instrumented from census data occur at the level of generations. It may be possible also to observe seasonal effects as well. Faster rhythms will occur at monthly, weekly and daily time scales. To identify these sorts of rhythms we need to use streaming data – from cars, smart phones, and social media. Regardless of the data or the time frame there is also a wide class of model suitable for modelling dynamics.

A final aspect of rhythms is the fact that they embody repetition and variation of a pattern. The resultant pattern is not random, but neither is it wholly ordered in character. We cannot observe or collect the rhythm of all Dutch citizens, and nor do we seek to do so. We instead are looking for broad patterns of behaviour over space and time, which nonetheless are broadly correct without singling out any individual citizen. The fact that we cannot identify the characteristics of any individual citizen means that we need to incorporate randomness into our data. Randomness permits us a further veil, protecting the privacy of Dutch citizens. Randomness obscures the identity of individuals by adding noise on top the characteristics of individuals. What an individual might call noise, randomness or chance, the statistician calls stochastic. Stochastic models enable a mix of structure and randomness useful for reflecting upon a variety of real-world processes. All statistical models are stochastic, and many machine learning techniques are stochastic as well.

Specifying the Model

The intersection of latent, dynamic, spatial and stochastic models provides a fairly incisive set of requirements for choosing a model. It is best to choose the simplest model available which still meets these requirements. The selected model is a mixtures of hidden Markov model. The mixtures part of the model reflects that the model is spatial in character. Rhythms are localized in neighbourhoods and city blocks. But rhythms can combine and mix at the borders of our neighbourhoods. This may give a neighbourhood much of its unique character.

The hidden part of the model reflects the latency of the model. A hidden part of the model enables the model to capture the rhythms which underlie disparate facets of life within an urban environment. The Markov model part of the model captures the dynamism of the city rhythm construct. The model captures and automatically reports the dynamic evolution of rhythms as observed in the data. The model is able to capture and represent individual beats, as well as transitions between beats in the data. Finally, the model is stochastic in character. It preserves privacy by admitting uncertainty about individuals. It acknowledges realistic variation across neighborhoods. It captures the variety of possible variations and transitions observed in complex, real-world data.



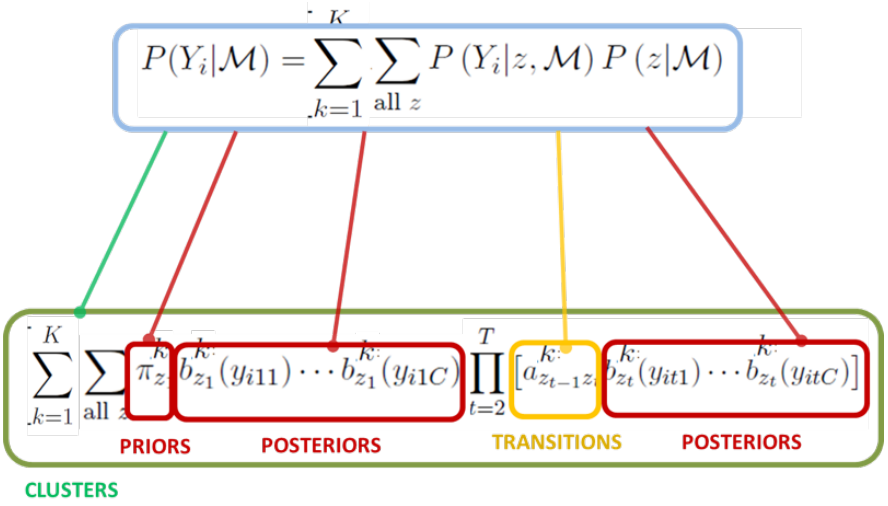


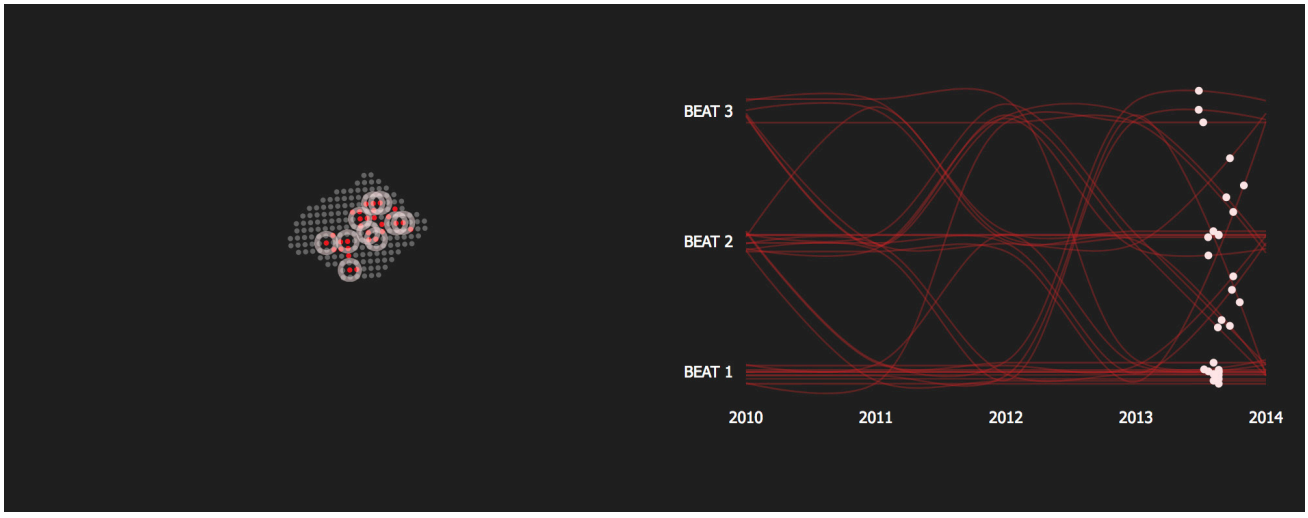
Figure 1: Breakdown of the MHMM

This a predictive learning model. Like many predictive learning models, it incorporates networks of probabilities. More importantly the data is a generative model. This means it understands the data it is given. Furthermore, it can generate new and realistic looking neighbourhood profiles that it may never have actually seen before. Consider the generative model a recipe for creating new data out of more simple components. The following material briefly describes the components and equations which represent the model.

In order to begin let's look at a set of coloured components of the model. First an over-all orientation to the model is presented (figure 1). In blue is the high-level description of the model. In green there is the latent component of the model, which are the clusters or mixtures of the model. In yellow the dynamic and latent parts of the model are presented. This is the Markov model component of the model. In red the probabilistic part of the model is presented. These are the generative parts of the model. Each is a recipe for data which can be tuned to be an ever closer match to real-world evidence.

The green part of the model offers multiple competing explanations. Often only one of these explanations is sufficient. How we can turn to the red, or probabilistic part of the model. The prior part of this model asks us to recognize that some rhythms are far more common than others. The model strives to find a commonly experienced pattern when that pattern is sufficient to capture the rhythm at hand. The posterior part of the model incorporates the current socio-economic profile of the neighbourhood. It also incorporates all previous socio-economic profiles. A good model is consistent with what we know today about the neighbourhood, but is also consistent with everything we have experienced in the past concerning the neighbourhood. The final component of the model are the yellow transitions. A good model hits the correct beats, but it also sequences the beats in an appropriate fashion to reconstruct a genuine city rhythm.

The table on the next page lists the vocabulary elements of City Rhythm, and highlights the modelling elements used to express the City



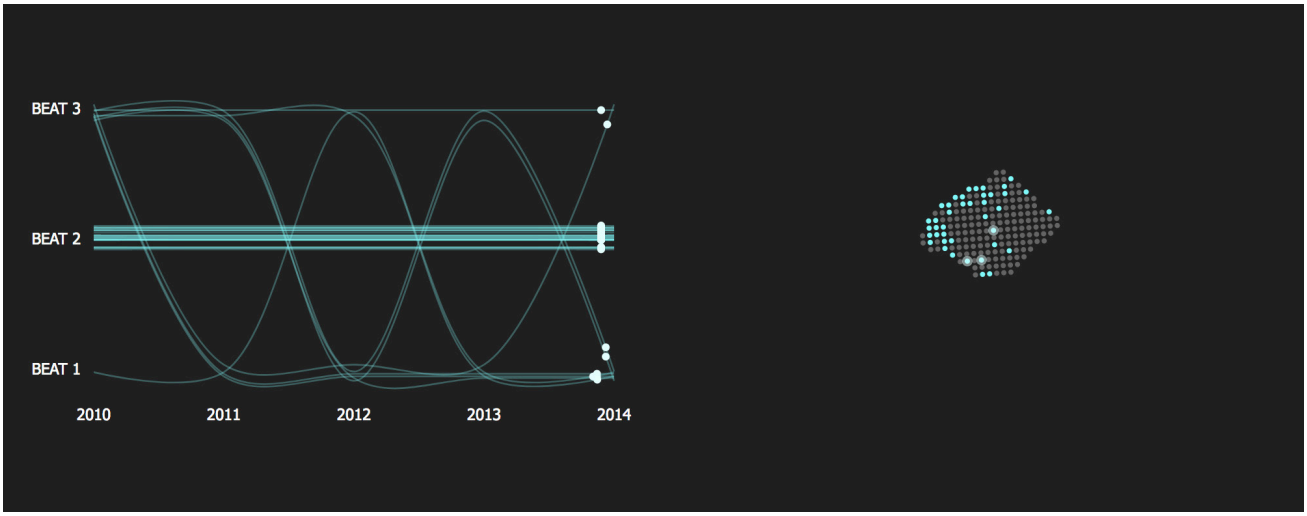
Rhythm vocabulary. The model incorporates various modelling features, and describes their purposes. The final column of the table is the colour of the element, and can be used in reference with figure 1 to see the underlying equations.

There are many simpler models than the mixtures of hidden Markov model. The model reduces to all these simpler models at the margin. For instance the mixtures of hidden Markov model reduces to a spatial clustering of data, as appropriate. The mixtures of hidden Markov model is a cousin to factor analysis methods, a technique which can find hidden relationships between disparate measures of data. The mixtures of hidden Markov model also collapses to a simple time series analysis model, as appropriate. The mixtures of hidden Markov model can be reduced to simple histograms of a single channel of data for a single time period and region, as appropriate. There are fewer models which are more complex.

Further more complex models are related to neural network techniques such as long-term/short-term memory models. These techniques are best able to represent real world processes operating at multiple time scales. For instance real patterns of human speech, motion, and music are exemplified by long-term patterns which are punctuated by sudden shifts in tempo or rhythms. Rhythms within cities may also have this character of longer-term memory and shorter-term punctuations. Nonetheless the

Vocabulary Element	Modeling Element	Feature	Purpose	Color
Rhythm	Clusters or mixtures	Spatial	The model seeks to find the best available rhythm with which to summarize experiences in a neighborhood. Through clustering the same kind of rhythms are identified.	Green
Base Tone	Priors	Probabilistic	The model seeks to use the most commonly experienced base notes where and when these are appropriate. Base note identifies the common rhythm and its specificity on area level	Red
Beats	Profile	Latent	The model generates realistic socio-economic profiles for now and also for the future. These profiles are specific states a areas can go through.	Red
Meter	Transitions	Dynamic	The model sequences between different beats, introducing pauses, where appropriate. Pauses reflect transitions in different states (beats) of the area.	Yellow

Table showing the Vocabulary and Modeling Elements, by Scott Cunningham



ecological fit of the model is quite high. This is evidenced by validation efforts with stakeholders. It is valid therefore to begin with a simpler model, and as understanding grows, to selectively introduce even more complex assumptions if it is warranted.

Implementation Details

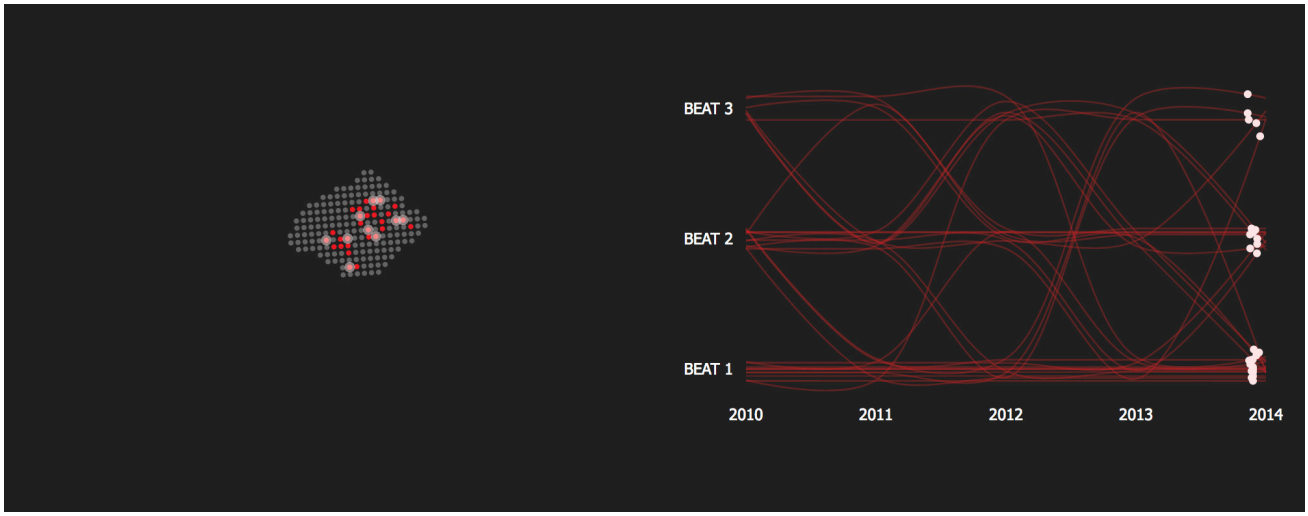
The mathematics of mixtures of hidden Markov models (MHMM) has long been understood. Nonetheless it is a separate task to translate the mathematics into operational software which can be used to model real-world data. Fortunately, it is not necessary to implement the mathematics from scratch. The open source software community is a prime location to look for existing software packages. Open source software permits more openness, innovation, and cost accountability. It is not surprising then that many of the emerging machine language techniques have been adopted more readily in open source software than in standard statistical packages.

Two of the leading candidates for fitting MHMM can be found in the R language. Although packages are both written for the R language, they differ somewhat in their modelling assumptions. The two packages differ according to how they represent the data outputs. They also differ in how they model the transitions between beats (or states in statistical language). These two packages are reviewed below and differences along these two axes are further discussed.

The first package is known as seqHMM ("sequence hidden Markov model"). The package is documented in Helske and Helske (2017a, 2017b). As usual this R package can be found through the usual distribution channels such as CRAN. The seqHMM package accepts and models categorical variables. For instance if we were modelling population density in a neighbourhood it might be necessary to encode these variables into separate states such as "very low," "low," "medium," "high," and "very high." Even this recoding maintains an ordering between the categories. In other words the variable remains ordinal, even after its recoding. Multiple variables (or channels) of data can be captured using the model. The seqHMM model is a classic Markov model; at each time step the potential for transition to a new state or beat is measured.

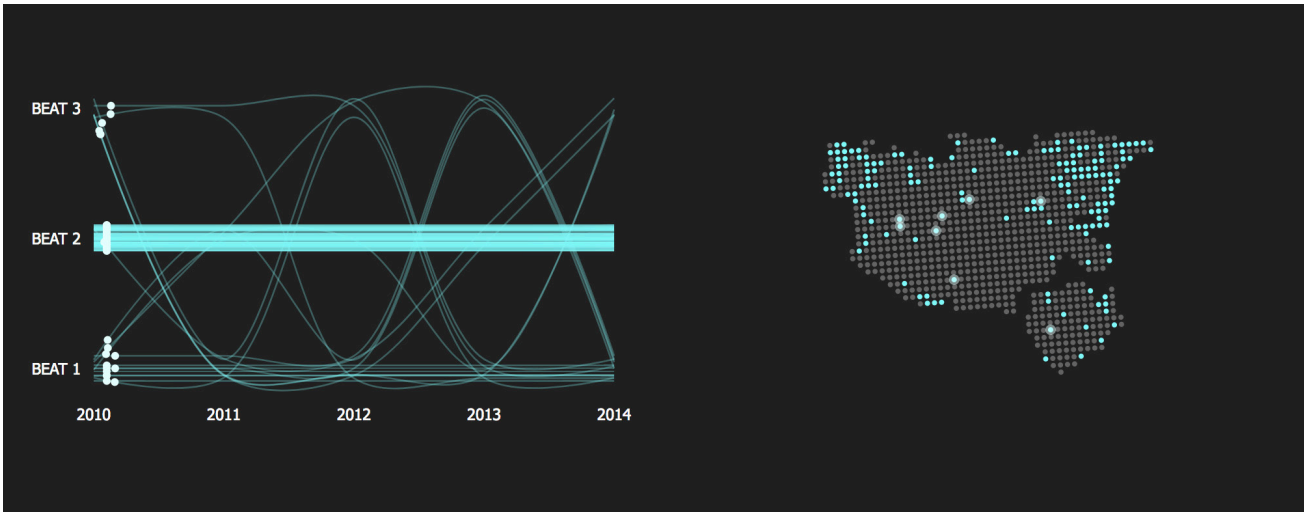
The second package of note is mhsmm ("mixtures of hidden semi-Markov models"). The package is developed by O'Connell (2011, 2017). This package is more flexible in terms of the variety of different data types it can represent. In particular it may be used to model ratio-scaled variables, which are common in urban data sources. Furthermore the package models not only the probability of transition from one beat to the next, but the potential duration a neighbourhood is likely to stay in a given state. The modelling of durations is what makes this a semi-Markov, rather than a classic Markov model.

Both packages are to be recommend, although they have their respective strengths and weaknesses. The documentation and ease of use of seqHMM is somewhat higher. Nonetheless the model is somewhat less flexible in the kinds of outputs it can represent. The mhsmm is a little more difficult to use in terms of the data format. It is not clear that the added flexibility of modelling makes up for the additional hurdles of data input and formatting.



Choosing the Right Trade-Off: Exploring the Metaverse of Models

114 by Scott Cunningham



In the designing the model section we described how a Mixture of Hidden Markov Model (MHMM) captures the essential features of rhythm analysis. The model expresses the spatial, dynamic, latent and stochastic character of the problem. Even though a particular model has been selected, there are many different possibilities within the MHMM model. The analyst could, for instance, select a model which best captures the social or economic diversity of a population. Or, the analyst could also capture a model which shows the rhythmic complexity of social experiences. It is also possible to capture both – social as well as rhythmic complexity. Enabling both requires some difficult modelling trade-offs. These trade-offs are discussed next.

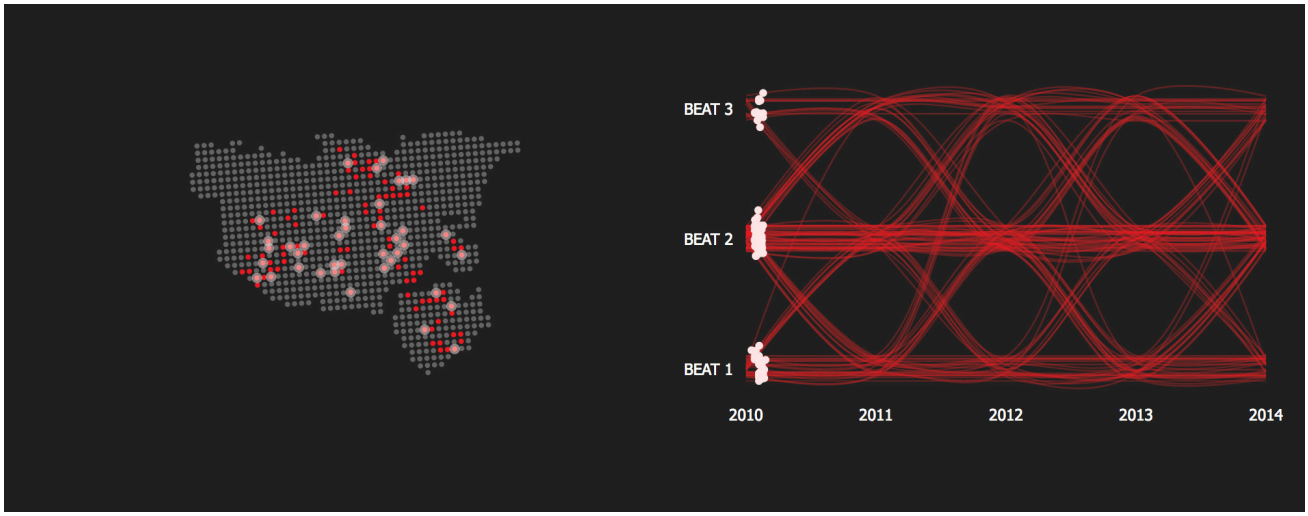
Trade-offs can be captured using a formal statistical criterion, known as Akaike's Information Criteria, or AIC for short. The AIC encompasses two competing forces. Both direct us towards the best possible models. The first criteria are the most likely models. These are the models which most accurately reproduce – or even parrot – the data. The more complex the model in terms of clusters and transitions, the more likely it can capture the data as observed. These most complex models are at the bottom right of the figure.

The other metric is the parsimony of the model. The simpler the model the more likely it is to be better understood and better communicated. A more parsimonious model is also more robust, and more likely to capture real features of the data rather than memorizing specific features. For the purposes of the City Rhythm project we must place a particularly high premium on the more parsimonious models. These two countervailing forces direct us to select a model which represents the complex demographics of Europe, but the rather static character of five socio-economic variables as they evolve over the longer term.

A model which fully reproduces all the input data is not necessarily a good model. The best models help decision-makers understand and embrace the diversity of their neighbourhoods, and the uncertainties present in the futures of these neighbourhoods. It is unrealistic to believe we can perfectly capture all social and rhythmic phenomena. The analyst must capture and model this intrinsic uncertainty in the model, and not attempt to eliminate it in its entirety.

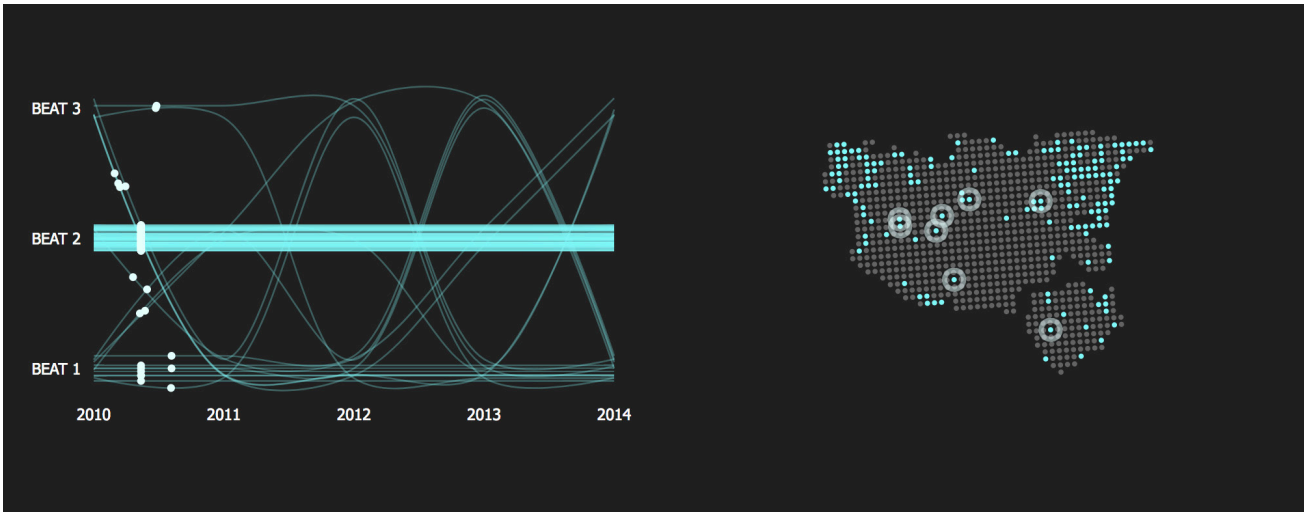
There are many possible alternatives when fitting this data, even assuming we use a mixtures of hidden Markov model. For instance, we could select models which permit a lot of temporal variation. These would have more states. Or we could fit a model which recognizes the demographic variability across Europe, while not necessarily caring about the temporal variation within a single district over time. The question to be addressed is which of these models is likely to be more suitable to fit our

Figure 2 shows the search for a suitable model across a space of nearly 100 possible model. As you look up and down the columns, a range of different models capturing social complexity are explored. As you look across the rows a range of different models capturing rhythmic complex are being explored. A single metric, the Akaike Information Criteria, is used for the purposes of evaluation. The higher the value of the metric the more suitable the model. The lower quality models are shown in green and the higher quality of models are shown in orange or red. And indeed some models, which involve both high



Number of Clusters	Number of States													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	-10443,6	-9415,5	-8350,3	-7861,4	-7786,6	-7183,0	-6804,4	-6735,8	-6716,0					
2	-9430,4	-7963,7	-7158,9	-6704,4	-6581,1	-6335,5	-6274,6	-5882,8	-5836,2	-5796,8	-5692,8	-5679,9	-5838,5	-5644,4
3	-8490,0	-7322,3	-6641,4	-6199,6	-6079,9	-5727,8	-5575,4	-5409,2	-5594,1	-5488,9	-5436,3	-5597,9	-5578,3	-5772,4
4				-5956,1	-5703,5	-5490,1	-5361,0	-5482,2	-5407,8	-5335,8	-5580,3			
5				-5657,7	-5212,1	-5290,5	-5291,7	-5157,1	-5348,4	-5384,1				
6				-5549,4	-5136,2	-5089,9	-5161,1	-5309,8	-5495,5					
7			-5471,8	-5520,4	-5254,4	-5169,8	-5304,3	-5309,6						
8			-5590,6	-5263,1	-5051,7	-5011,6	-5213,6	-5294,4						
9		-5568,5	-5380,3	-5022,2	-5063,8	-5165,0	-5092,7							
10		-5553,4	-5143,6	-5039,9	-4941,8	-5060,9	-5657,0							
11		-5656,2	-5239,3	-4904,4	-5008,5	-5186,8	-5202,7							
12		-5579,3	-4989,8	-4962,2	-4925,3	-5141,4	-5381,2							
13		-5367,0	-4941,9	-4880,1	-4964,4	-5063,0	-5410,2							
14		-5244,7	-5009,6	-4936,1	-4964,1	-5202,1	-5520,5							
15		-5236,0	-4815,0	-4902,0	-5083,3	-5267,0								
16		-5443,4	-4927,3	-4873,3	-4956,2									
17		-5187,8	-4883,1	-4927,0	-5124,2									
18		-5168,1	-4897,0	-4848,9										
19		-5073,3	-4823,3	-4988,0										
20		-4951,3	-4958,0											

Figure 2: Fitting the Metaverse, by Scott Cunningham



social and rhythmic complexity, are not explored at all.

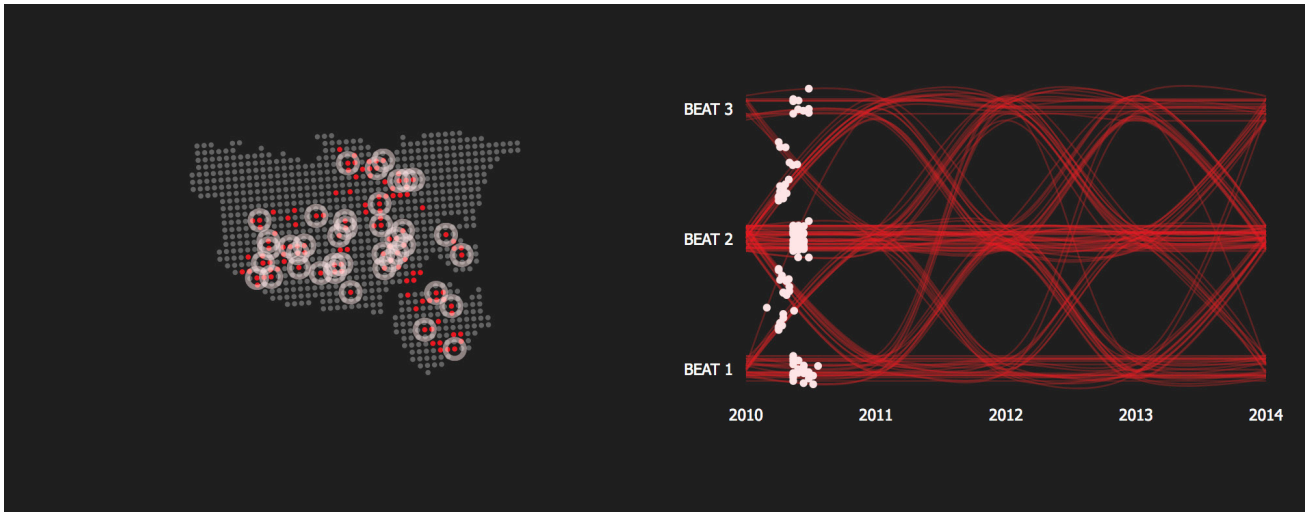
This is because the model evaluation enables us to converge early on the best possible models. The cells represent a sort of landscape, where the plateau or mountain (shown at the left of the figure) indicates a space of higher quality models. The best possible models, at least for this data set, involve high levels of social complexity and relatively low levels of rhythmic complexity. I suspect that there is a lot of rhythmic complexity across Europe, but the data used is somewhat limited, and certainly very aggregated. Therefore the full complexities of rhythms have not been revealed. The results do not explore the full space of possible models. Nonetheless there is a clear indication that models with many clusters, and with few states, best capture the source data. To better translate this into the rhythm vocabulary, the data is rich with base rhythms. There may be as many as thirteen distinct base rhythms identified in the data. The data entails relatively few beats. For the data set considered, as few as four states or beats are necessary to model the dynamics of the data.

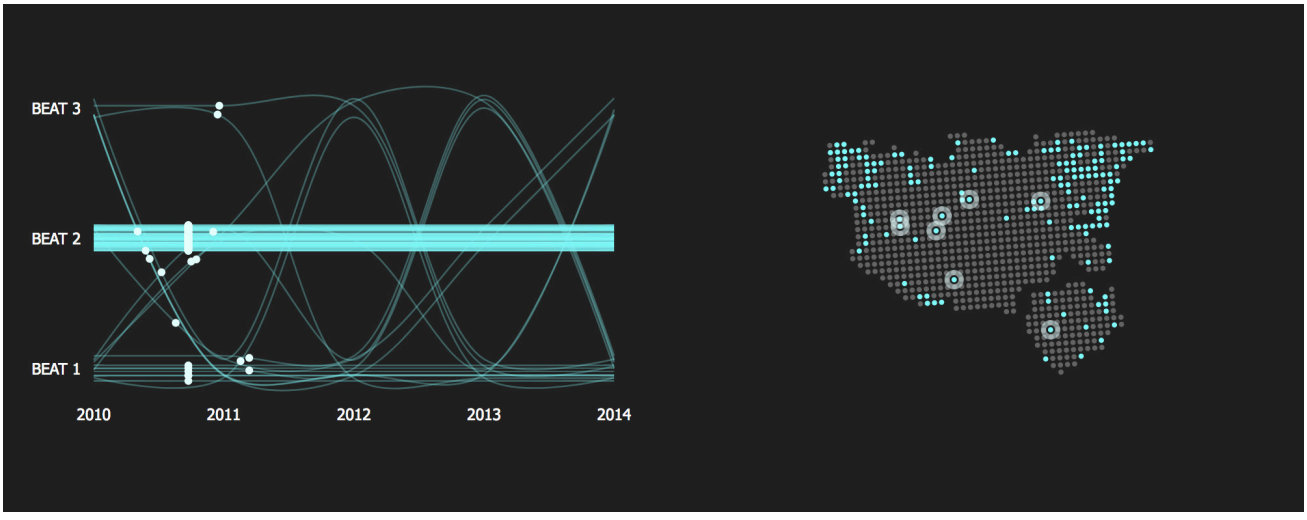
Using this data the model enables to perform a comparative rhythm analysis of the Netherlands, searching for other regions in Europe with similar beats and transitions. Visualizations help better understand and interpret the model outputs. Figure 2 displays outputs of the model in a heat map format.

Here's how to read the data shown in figure 2. This simple model contains five different channels of data. Each of these channels has a different heat map, stacked one on top of each other. Each of the channels contains the outcomes of a particular state or beat. These can be read by looking down the columns. There are four states or beats to the model, all expressing different rhythmic possibilities for a neighbourhood. (Note that there is no particular order to the states as given. State 4 is not more desirable, than state 1, nor does it necessarily occur any later in time than state 1.)

In addition to the state or beat, the model measures the outcomes which result from each beat. These are the street rhythms of the model. The outcomes from each beat are measured by a five point scale ranging from very high outcomes (at the top row of the chart) to very low comes (at the bottom of the chart). Having now described channels, states and outcomes it is time to describe the actual values given in each of the cells.

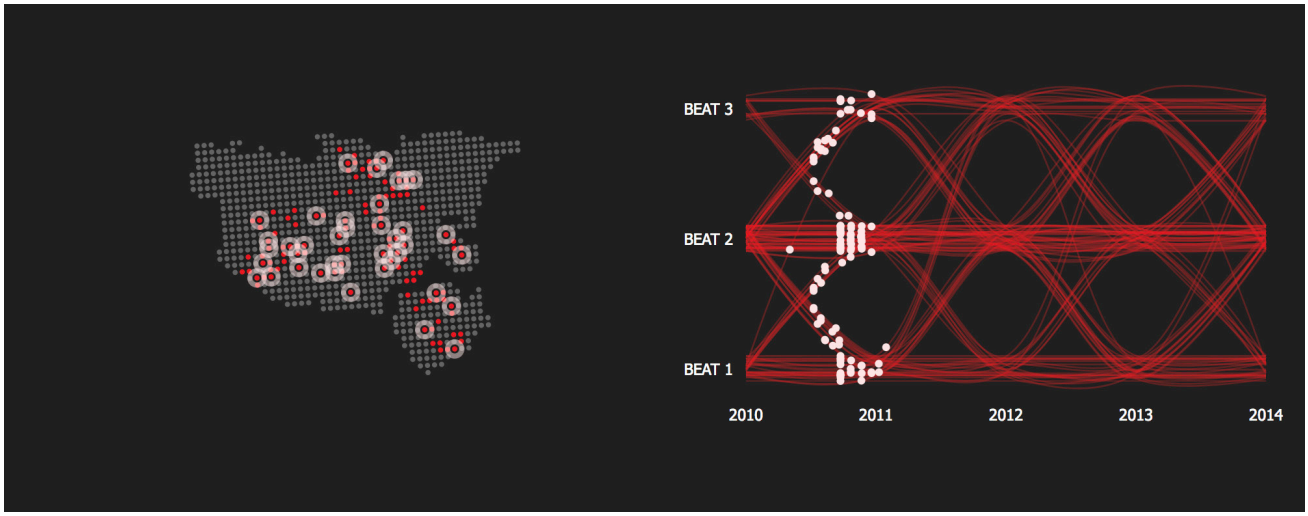
There is a range different outcomes which result from each state. For instance some street rhythms achieve very high levels of GDP very often, while others rarely or ever do so. The range of potential outcomes are shown in the chart by means of colours. The heat chart shows a range of colours ranging from yellow (very high likelihood) to dark purple (extremely unlikely). These colours also correspond to ranges of probabilities, which can also be read directly in each of the cells. These probabilities sum to 100% down each of the columns. In other words, a street rhythm will deliver a particular outcome on a five point scale with 100% confidence.




BEAT 3
BEAT 2
BEAT 1
2010
2011
2012
2013
2014

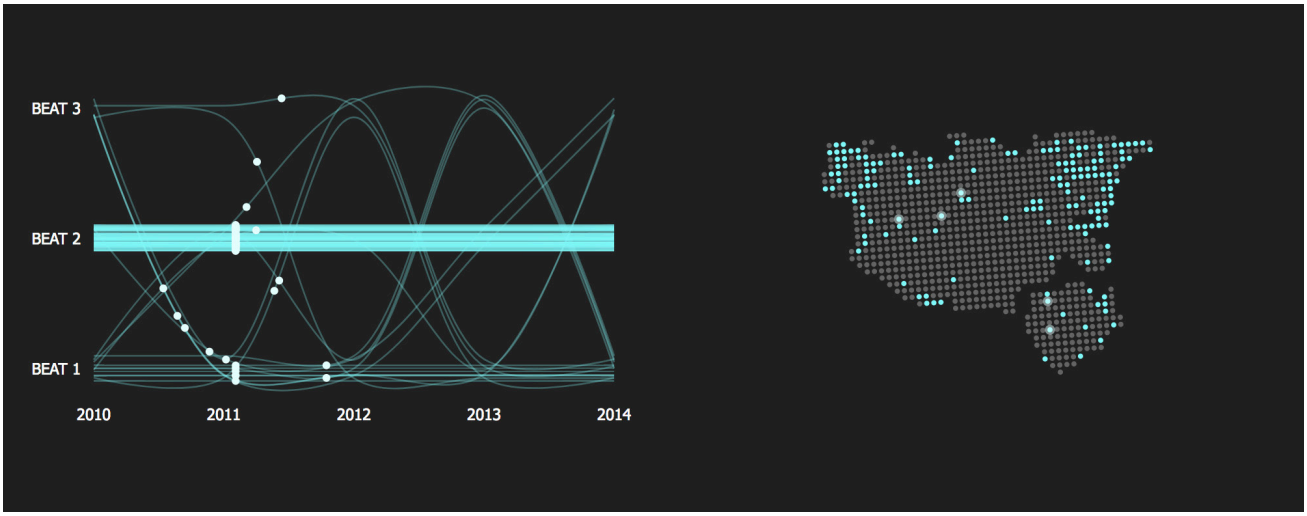
Part 5:

From Data Rhythm Back to Neighbourhood



Working with the City Rhythm Data Model

120 by Lene Böhnke, Thu Vu and Erik Boertjes



Beats, Base and Street rhythm

Using the open data from CBS, we took several steps to explore the results, as well as to visualize in order to create meaning from the data. This data on a 500mx500m grid level included information on different age groups, gender, ethnicity and urbanity for Amsterdam, Rotterdam, The Hague, Helmond, Zaanstad and Zoetermeer between 2010 and 2014.

The model classifies and compares grids into one of the seven different clusters and defines the state of an area in a specific year. In City Rhythm terminology, the girds are referred to as (street) areas, on two dimensions: geographically and over time. While the geographic dimension (clusters) will be referred to as base rhythms of (street) areas, the time dimension (state) refers to beats that (street) areas go through.

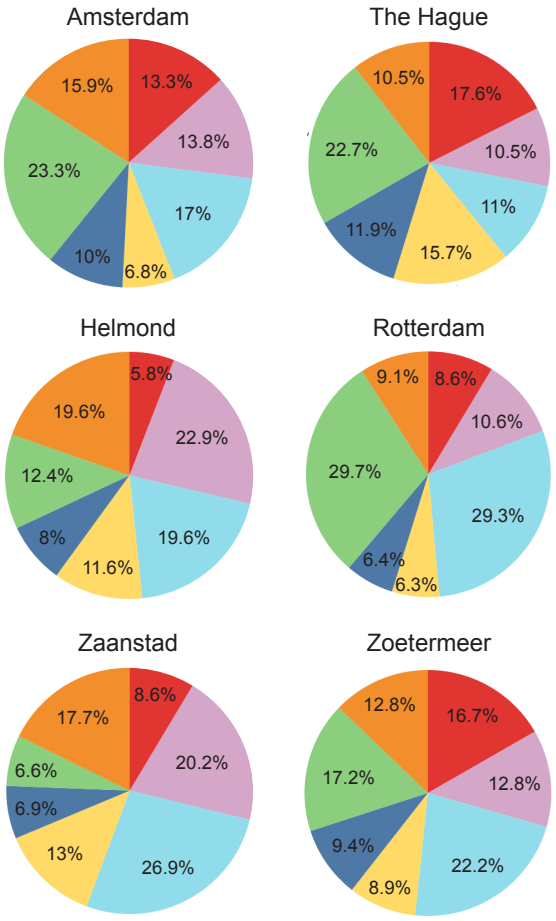
Clusters and states identified in the model summarize a large amount of information, but due to lack of time, reverse engineering is missing to translate the results into actionable knowledge. However, the model has precisely identified the bases rhythms beats and street rhythms. The idea of correlation that we achieved in this exploration enables us to use the model as a boundary object to talk about the indication of the results between the different neighbourhoods.

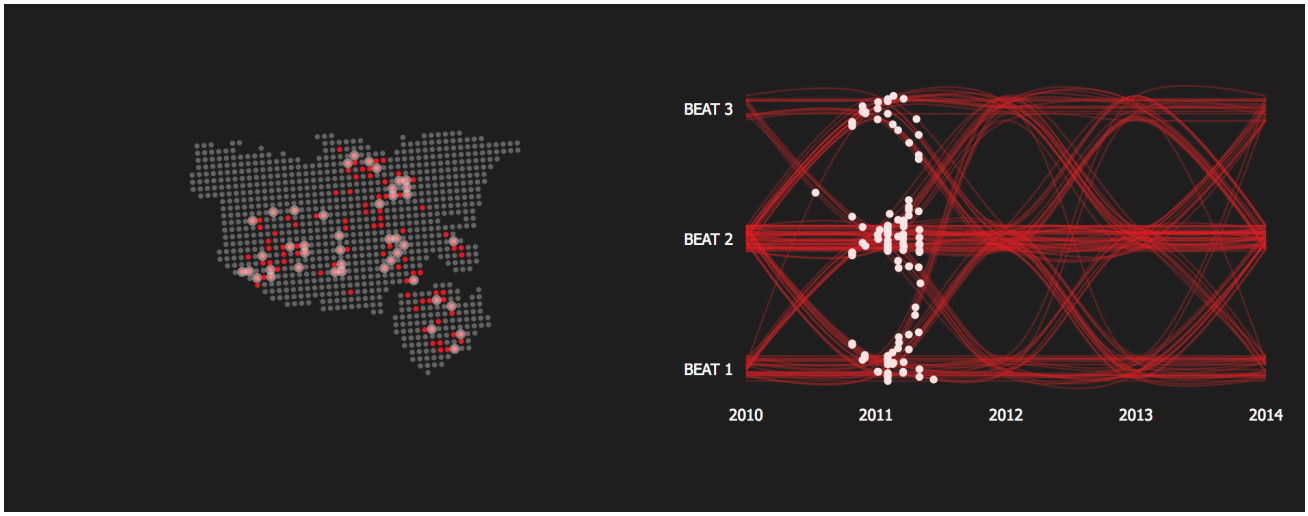
- Base Rhythm 1
- Base Rhythm 2
- Base Rhythm 3
- Base Rhythm 4
- Base Rhythm 5
- Base Rhythm 6
- Base Rhythm 7

Figure 3: Base rhythm composition of the six cities; by Lene Böhnke, Thu Vu

Base Rhythms

Base rhythms account for the fundamental differences between (street) areas and do not change easily over time. For example, the base rhythm of a shopping neighbourhood is expected to be fundamentally different from the base rhythm of a business district. Our exploratory model resulted in seven distinctive base rhythms for the six cities.

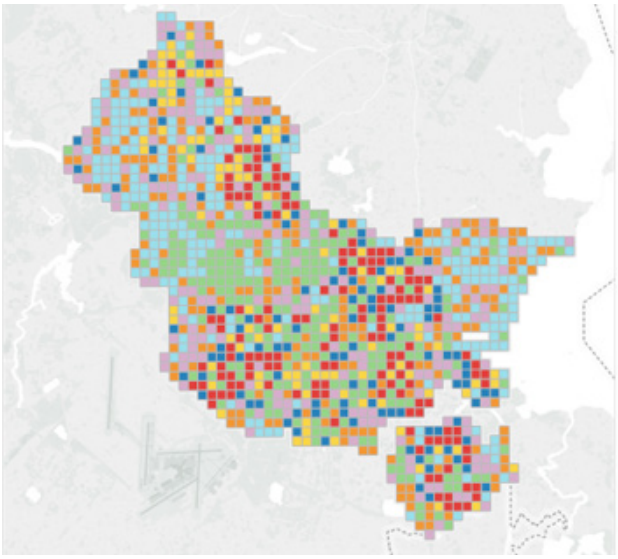


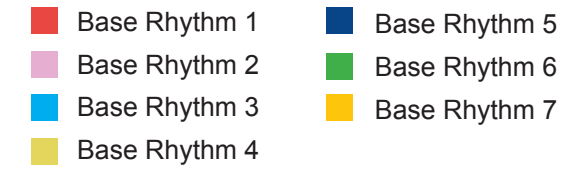


The pie charts (Figure 3) show the base rhythm composition of the six cities, with the seven colours representing the seven base rhythms. It is evident that the three bigger cities (Amsterdam, Rotterdam and The Hague) have a similar base rhythm composition. On the other hand, Helmond, Zaanstad and Zoetermeer have a relatively similar composition as well.

The following maps illustrate how base rhythms are distributed geographically across the six cities. With a relatively small set of underlying variables, the resulted base rhythms can already represent the essential differences between (street) areas in the cities.

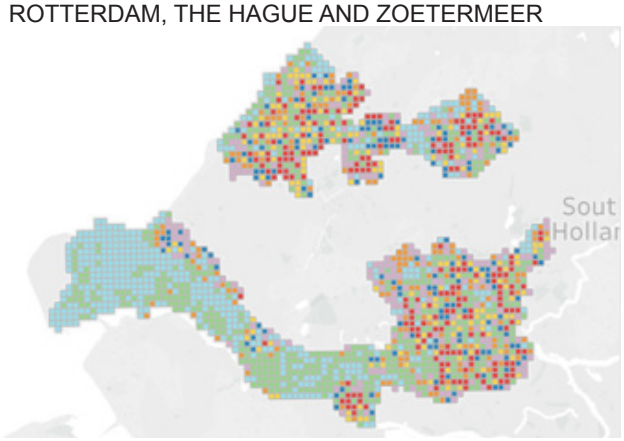
AMSTERDAM AND ZAANSTAD



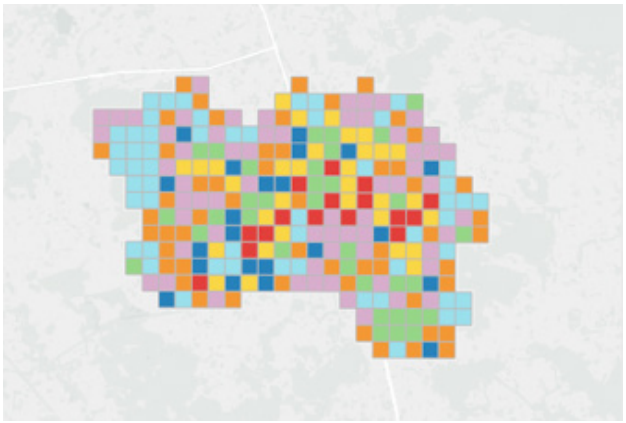


Base rhythm composition of the six cities; by Lene Böhnke, Thu Vu

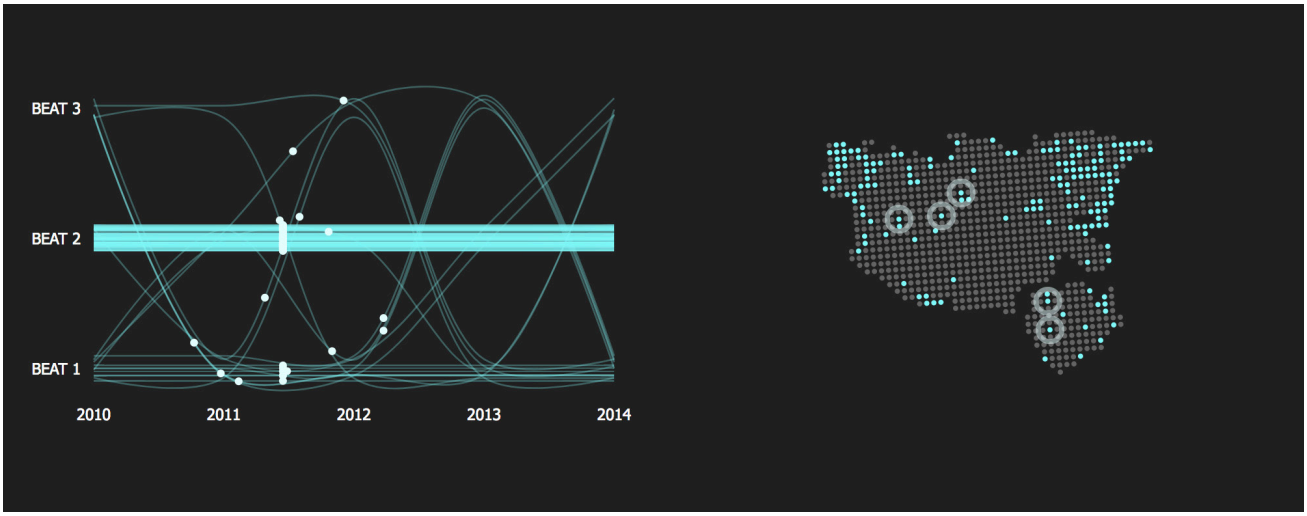
ROTTERDAM, THE HAGUE AND ZOETERMEER



HELMOND



The distinction between the different base rhythms can be based on the location of the street area (sub-urban neighbourhood, inner city neighbourhood, etc.), on the population characteristics (student neighbourhood, expatriates neighbourhood, business district) or density (low rise neighbourhood, mass housing neighbourhood). To get an understanding of what characterizes the base rhythms, the observable and spatial characteristics of (street) areas in the different base rhythms are compared to each other and to the average of the 6 cities, through statistical analysis. Only through this comparison we can add meaning to the data.



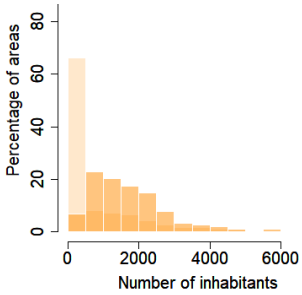


Figure 4: Number of inhabitants in base rhythm 1 compared to the average

All 6 cities

Base rhythm 1

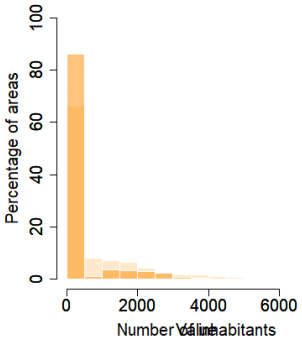


Figure 5: Number of inhabitants in base rhythm 2 compared to the average

All 6 cities

Base rhythm 2

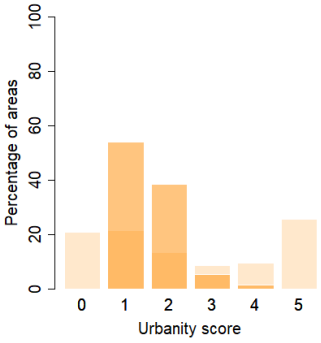


Figure 6: Urbanity score of base rhythm 1 compared to the average

All 6 cities

Base rhythm 1

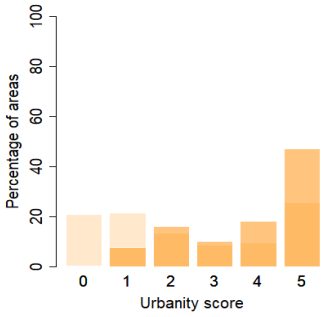


Figure 7: Urbanity score of base rhythm 2 compared to the average

All 6 cities

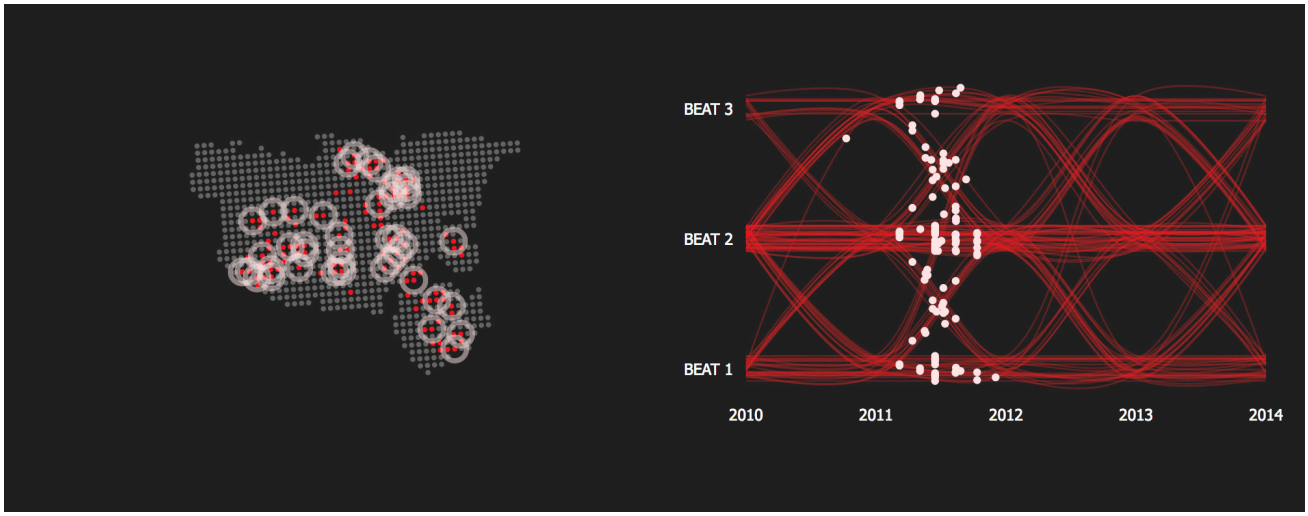
Base rhythm 2

Number of inhabitants and urbanity score in base rhythms 1 and 2 compared to the average; by Lene Böhnke, Thu Vu

The histograms in the next page show how base rhythm 1 is different from base rhythm 2 in terms of population and urbanity. The light orange bars represent the average across all 6 cities, while the dark orange bars represent (street) areas in base rhythm 2.

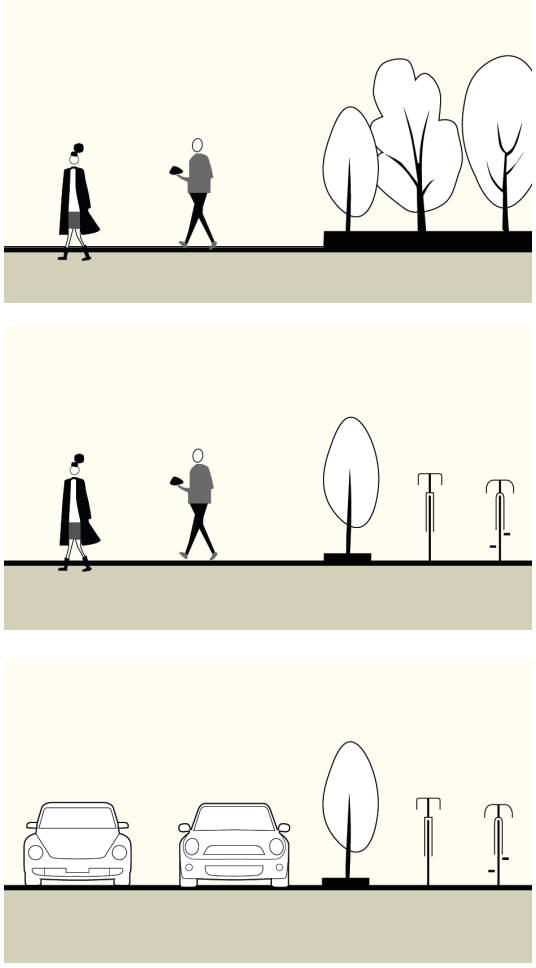
Looking at base rhythm 1, around 90% of all (street) areas have more than 500 inhabitants which is more than the average across all six cities. In base rhythm 2, 80% of all (street) areas have less than 500 inhabitants. Overall, we can say that (street) areas in base rhythm 2 tend to be less populated. Figures 7 and 8 show the urbanity score for base rhythms 1 and 2, where a higher score indicates a more urban (street) area, thus a higher density of addresses. Clearly exploratory results suggest that (street) areas in base rhythm 1 are less urban than those in base rhythm 2. The average across the six cities seems more evenly distributed. Combining this information, the exploratory findings suggest that less urban areas (e.g. outskirts of a city with less houses) are more populated. This could for example be explained by bigger household sizes and more residential houses.

The model itself only shows correlations of different characteristics without giving information about the causes of certain patterns. The interpretation above is therefore something that should be done by neighbourhood experts and policy makers. Thanks to the fact that results are produced in detail, this is already possible, leading to the conclusion that the model works as a boundary object to be used by city professionals. Also, if we would add more base rhythms to the comparison, we could get a more complete overview of what characterizes them and how they differ from each other.



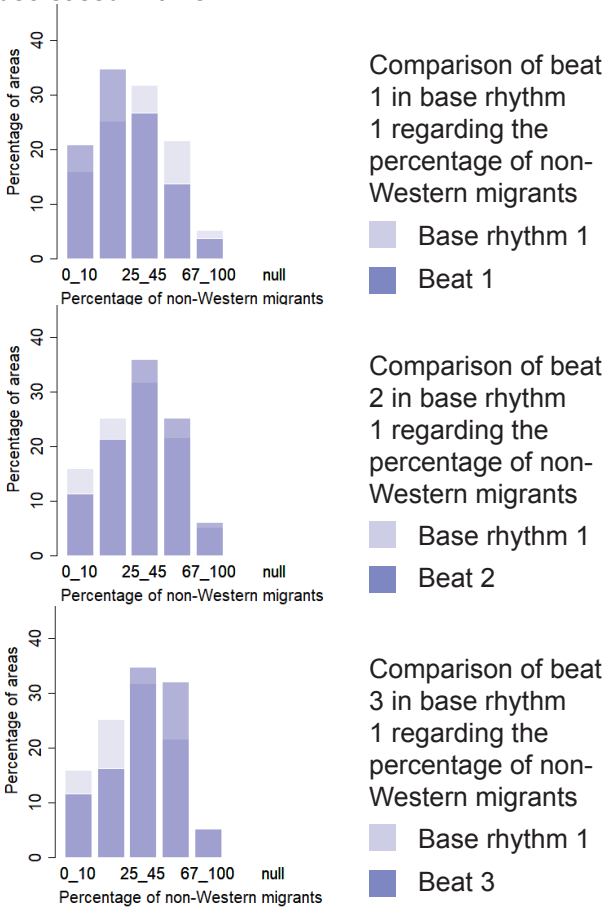
Beats

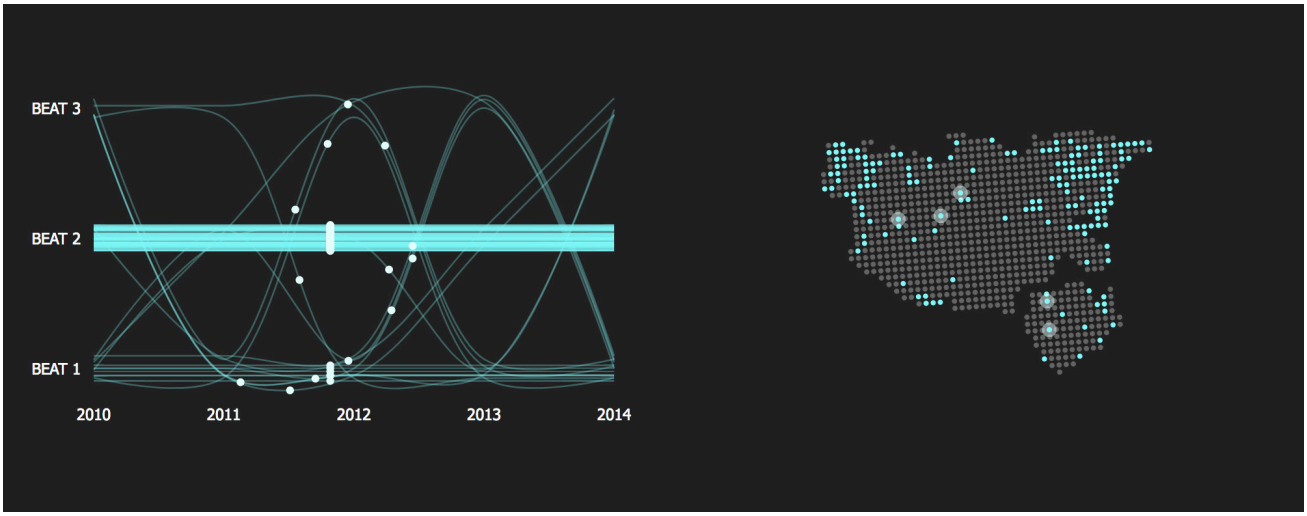
To see how dynamics in a (street) area change in time, we analyse the beats. The visualization below shows an example for the different possible beats in a specific (street) area. In the example below, the beats show how the (street) area is developed in time from a pedestrian street, to also having bike paths and finally having a street for cars.



An impression of the different beats of a neighbourhood; by Pinar Sefkatli

Each beat represents the change in time of the dynamics of the (street) areas. The characterizatino of beats are revealed when they are compared to each other. Again, only through this comparison we add meaning to the data on different beats. The bar charts (Figure 9) below give an example of the comparison of beats regarding the percentage of non-Western migrants in base rhythm 1. We see that of these three beats, beat 3 contains the most areas that have a high percentage of non-Western migrants (25-67%) while beat 1 contains the least. This means that the percentage of non-Western migrants in these areas first increased and then decreased in time.





When looking at the age group of 15-24 years (Figure 10), we see that beat 1 is associated with less young people than beat 2 and beat 3. The latter is characterized by the highest number of young people in this age group (this can be seen by the fact that the peak of the histograms move from left to right of the value axis). The charts show how the percentage of young people in the selected districts changed overtime.

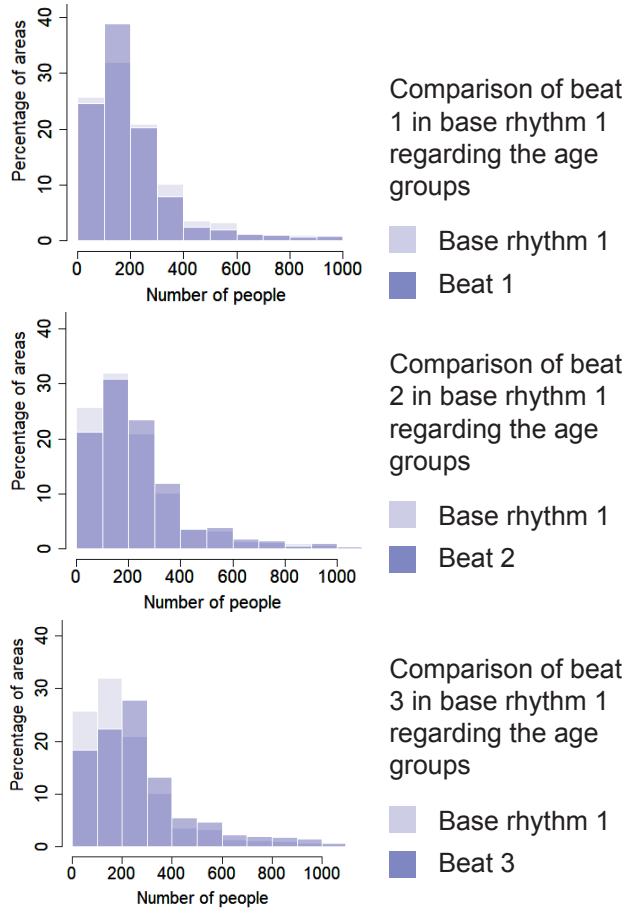


Figure 9 (left): Comparison of the three beats in base rhythm 1 regarding the percentage of non-Western migrants; by Lene Böhnke, Thu Vu (on left)

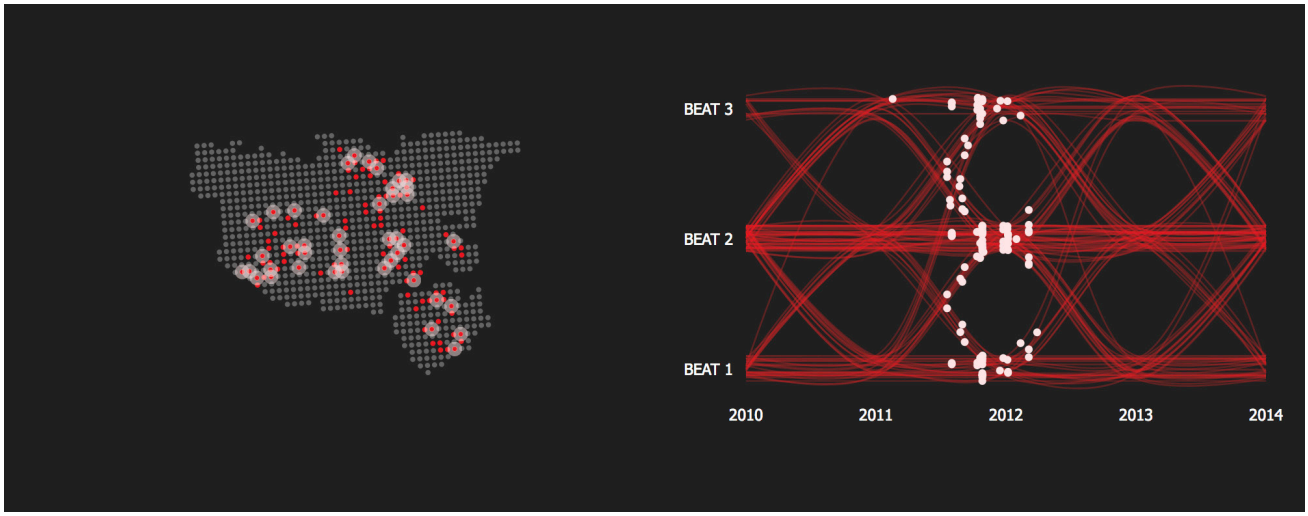
Figure 10: Comparison of the 3 beats in base rhythm 1 regarding the different age groups; by Lene Böhnke, Thu Vu (on right)

Street Rhythms

This exploratory research shows that based on profiling of base rhythms, we can see the most defining characteristics of (street) areas which do not easily change over time. On the other hand, based on beat transitions, we can see per base rhythm how more dynamic characteristics have changed over time, and how they are likely to change in the future. The transition from one beat to the other creates the (street) rhythm. It is expected that it would be possible to learn from other (street) areas that are in the same base rhythm, because they are fundamentally similar and therefore, most likely to have the same response to a policy change.

The future outcomes of the model can be to predict the next transition of a (street) area by looking at other (street) areas that have gone through the same transition in the past years. In addition, knowing which (street) area was the 'first mover' to a new state in a base rhythm might inform us about the potential effect of a policy change.

This model allows us to learn from other (street) areas in the same base rhythm that have gone through a 'desirable' transition. Policy makers or neighbourhood professionals can get in contact with like-minded people in other (street) areas to find out what has been done in the past. This potential of learning from other (street) areas in the same city, but also learning from similar (street) areas in other cities, was the reason to validate the model in a workshop with all participating cities instead of validating per city separately. The next chapter will give more insight into the validation and discussion of the model.



Visualising Beats and Base

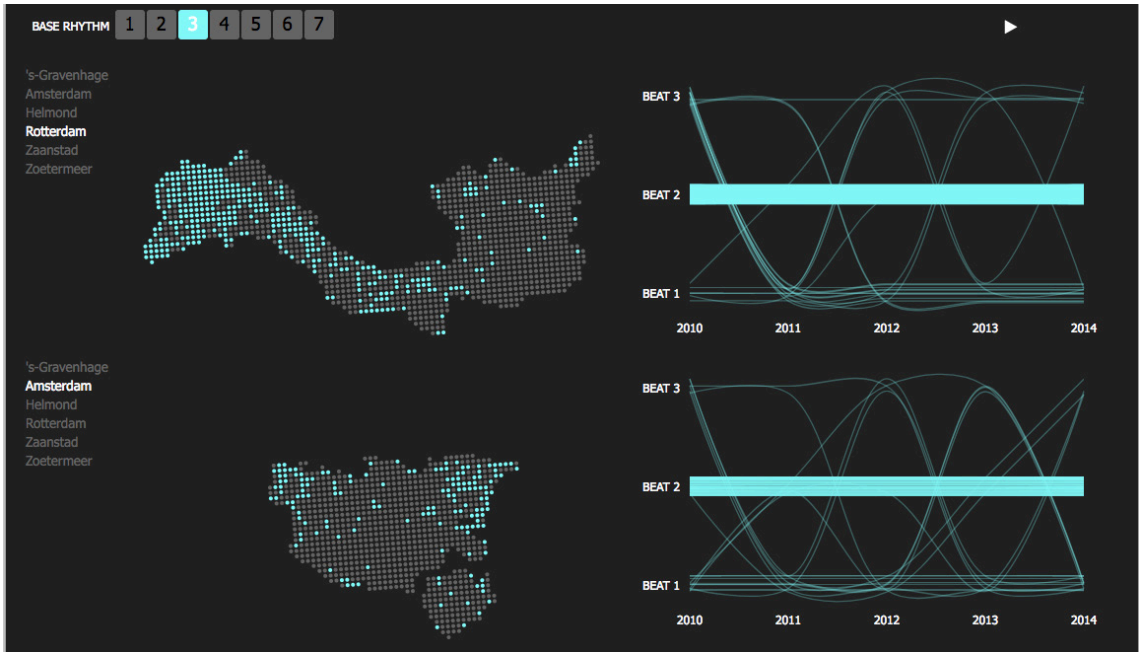
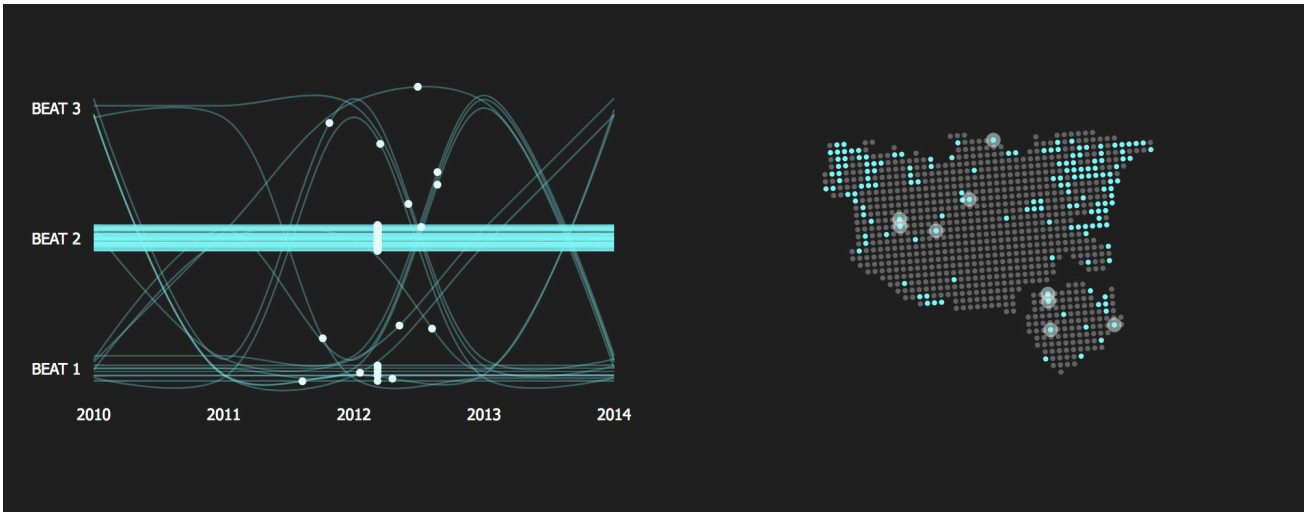


Figure 11: City Rhythm data visualisation showing the transitions in time that areas with base rhythm 3 go through in Rotterdam and Amsterdam, by Erik Boertjes

The primary way in which humans consume and process information is by sight. Our visual system is enormously powerful in processing lots of visual information very fast. That is why data visualization is so powerful: by representing data in a visual way (by means of graphical concepts like shape, colour, transparency, movement), we are able to see patterns, correlations, trends, and outliers in the data, in the blink of an eye. We literally 'see' (i.e. understand) the data.

In the City Rhythm research we use data visualization to give insight to the outcomes of the data model. The model clusters areas in base rhythms. Within a base rhythm areas change over time from one state (referred to as 'beats') to another. 'Base rhythm' and 'beat' are still fairly abstract concepts. By visualizing the model's outcome, we aim to make these concepts less abstract, and to answer questions like: "Do areas in the same base rhythm are close together? Can we 'see' why they share the same base rhythm? What do beats look like?"

The visualization is a web-based interactive tool that has two separate (but coupled) views to show base rhythms and beats. One view is geographical: this grid map view highlights for each base rhythm the areas that have been assigned this base rhythm by the model. Each colored dot corresponds to an area



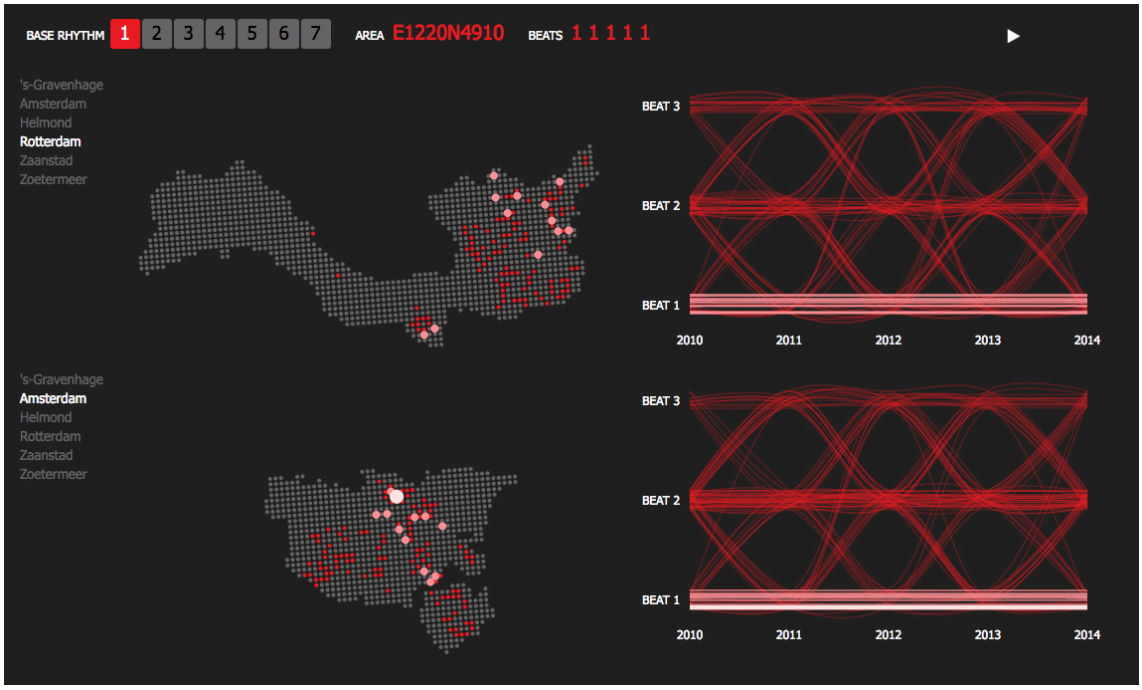


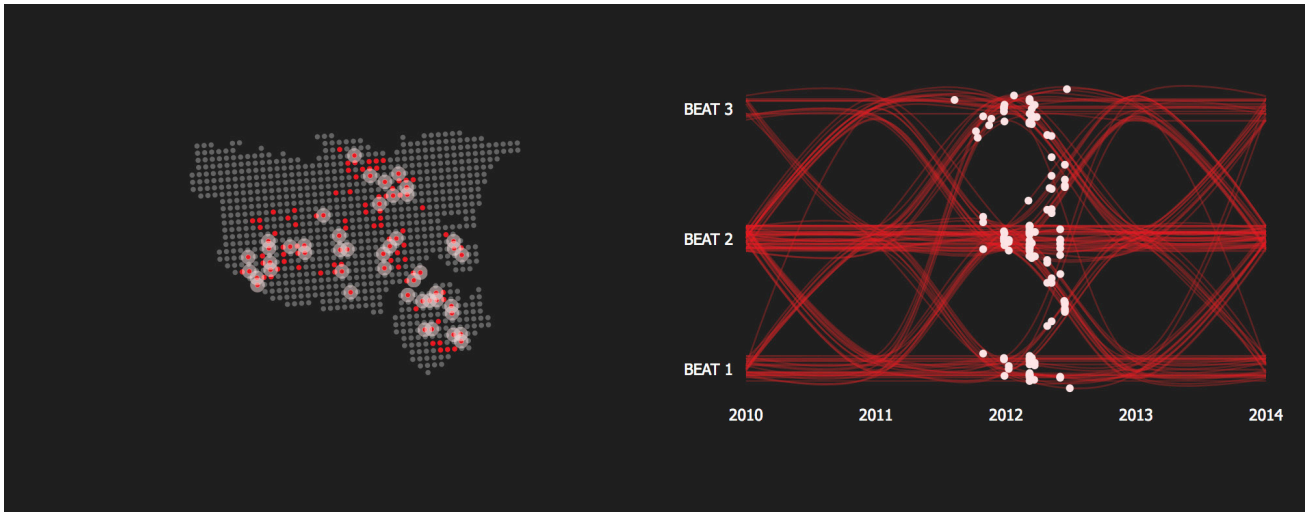
Figure 12: City Rhythm data visualisation showing the transitions in time that areas with base rhythm 1 go through in Rotterdam and Amsterdam, by Erik Boertjes

that has the selected base rhythm. Figure 1 shows that most areas in base rhythm 3 in Rotterdam are in the harbour area, outside the city centre. The same holds for areas with base rhythm 3 in Amsterdam: they tend to be outside the city centre as well.

The other view is temporal. It shows over time the beats that are assigned to areas. Each line corresponds to a geographical area that is seen in the map view. It becomes clear from this view that areas with base rhythm 3 tend to be (and stay) in beat 2, both in Rotterdam and The Hague. Only relative few areas change beats over time. To see this temporal aspect in the geographical view, we added animation. Areas that change beats pulsate while those that do not change over time do not pulsate. We added frames of the animation at the bottom of each page of this book.

Figure 12 shows the visualization of areas in Rotterdam and Amsterdam that have base rhythm 1. Those areas are more in the city centre and change beats a lot more than those with base rhythm 3.

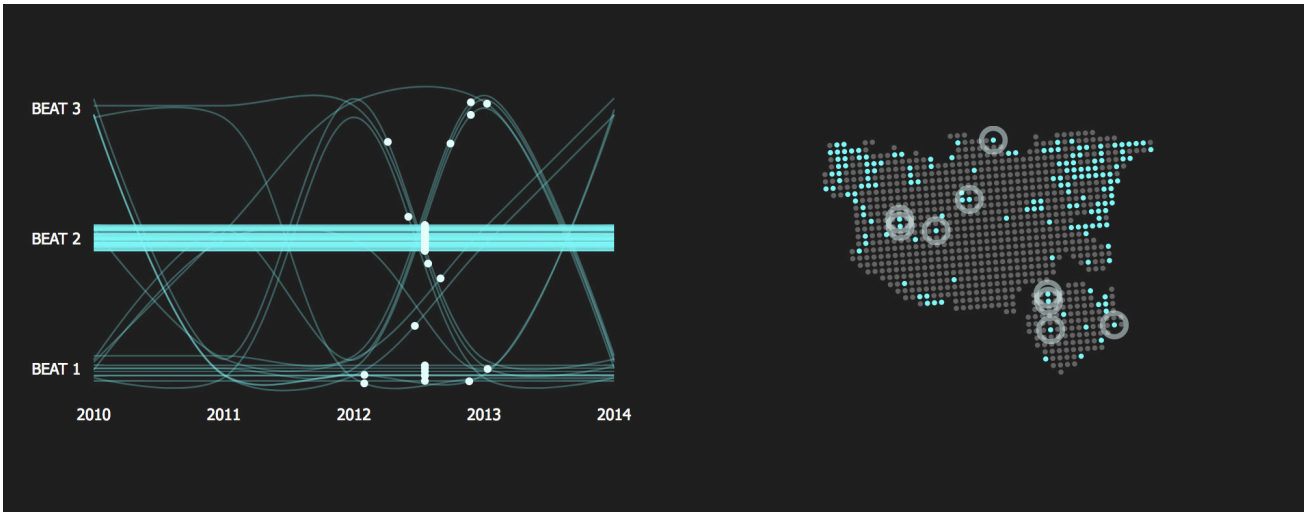
When clicking on a line in the temporal view, the corresponding area in the geographical view is highlighted (and vice versa). In addition, all other areas with the same beats over time are highlighted. The geographical view shows that these areas are not necessarily close together. By exploring the model's outcome with this interactive visualization, the user gets a better understanding of the concepts and data in City Rhythm.



Validating and Evaluating the City Rhythm Data Model

First validation

by Caroline Nevejan, Pinar Sefkatli, Lene Böhnke and Thu Vu

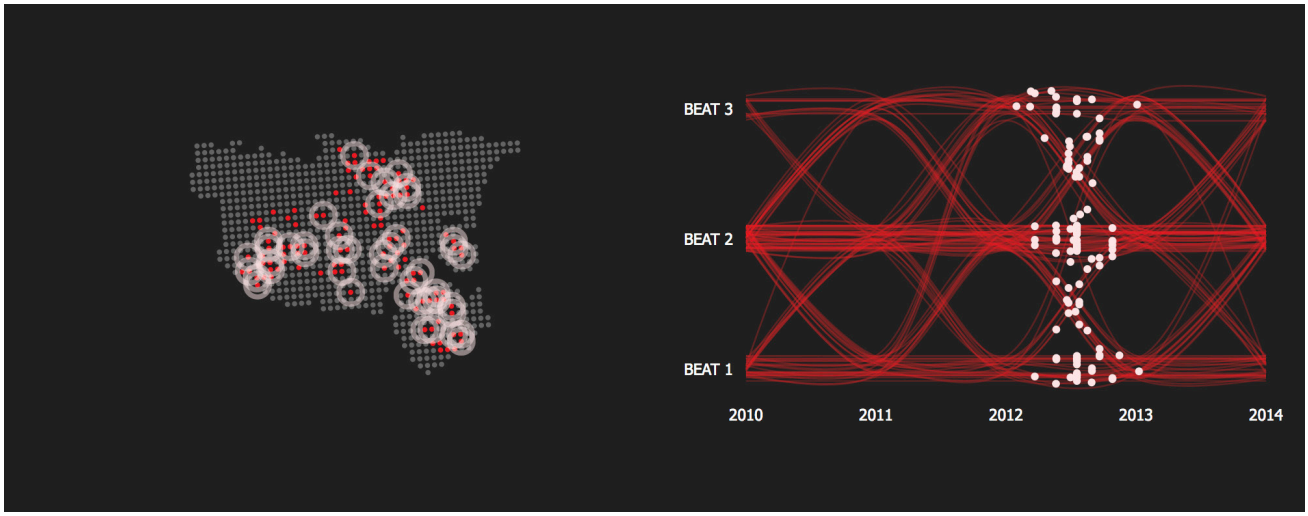


City Rhythm validation day survey, questions A4 and A5, making a visual comparison between the streets that appear to be in the same base rhythm with Tulpstraat in Helmond, in the other cities, by Caroline Nevejan, Lene Böhnke, Thu Vu and Pinar Sefkatli

It is important for the final interpretation of the model output to combine the quantitative information with existing knowledge and experience. Data can then be used as a starting point in a multidisciplinary group and allow everyone to rise above his or her own perspective. The validation day focused on validating the theory and the concept (idea), and not the model itself. It is agreed by the researchers that the model has to be better understood. The understanding and further exploring the model will be carried out in future research.

The original idea for introduction and validation was a workshop per every participating city, focusing on the local context of a specific neighbourhood and going more into depth with the stakeholders of that neighbourhood (citizens, care and welfare professionals, etc.). However, at the final stage of the research it became more important to emphasize the value of learning from other cities and neighbourhoods by looking at the rhythms they have gone through and by talking to each other. We wanted to know whether this model and the potential visualization tool could be useful in supporting local policy making and encourage the exchange of experiences across cities. Therefore we chose to hold one workshop with all six cities at once.

Since the process of identifying, analysing and visualizing rhythm in data has been very complex, we decided to deliver the information with the help

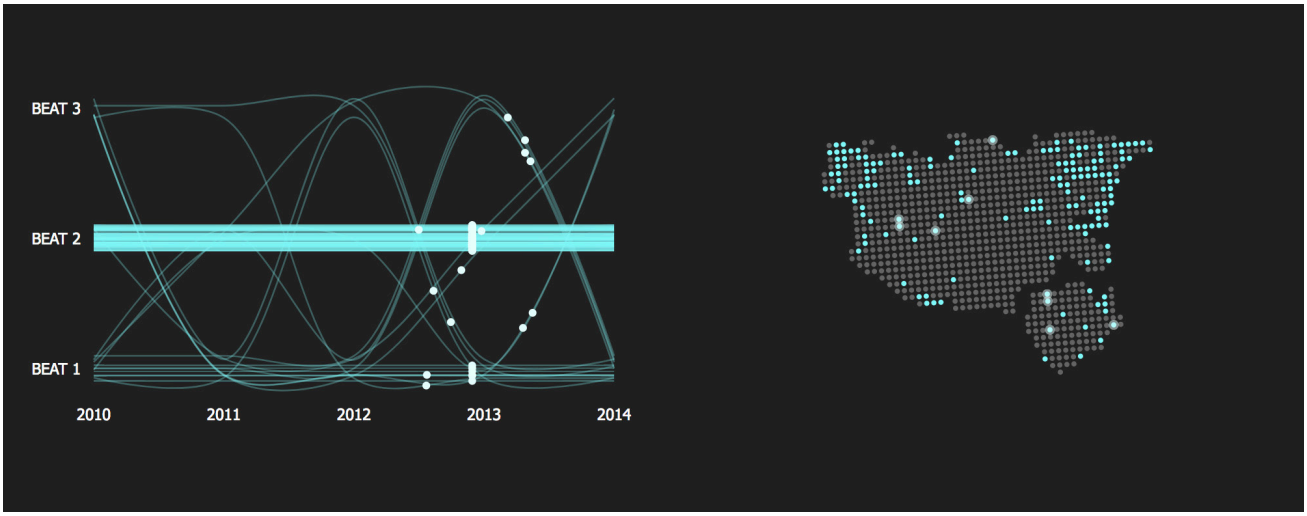


of a survey. This allowed us to slowly build up the knowledge on what we did, to give insights into what is possible now and also with more data in the future, and to tell our story in a consistent manner. While the survey consisted of suggestive questions that were simply asked to deliver information, the actual validation of the idea took place in the form of a discussion after the survey.

The survey was organized in 3 main rounds. In the first round, we validated Base Rhythms for Social Safety (Helmond and Zoetermeer cases), then we moved further to Tuning and Balancing Rhythms for Social Safety (Rotterdam and Zoetermeer cases), and we finalized the survey with Matching and Sharing Rhythms for Social Safety round (Amsterdam and The Hague Cases).

Some questions touched upon the fact whether the data used resonates with the sense of social safety in a neighbourhood. Of course, the survey was also used to identify areas for further improvement in the

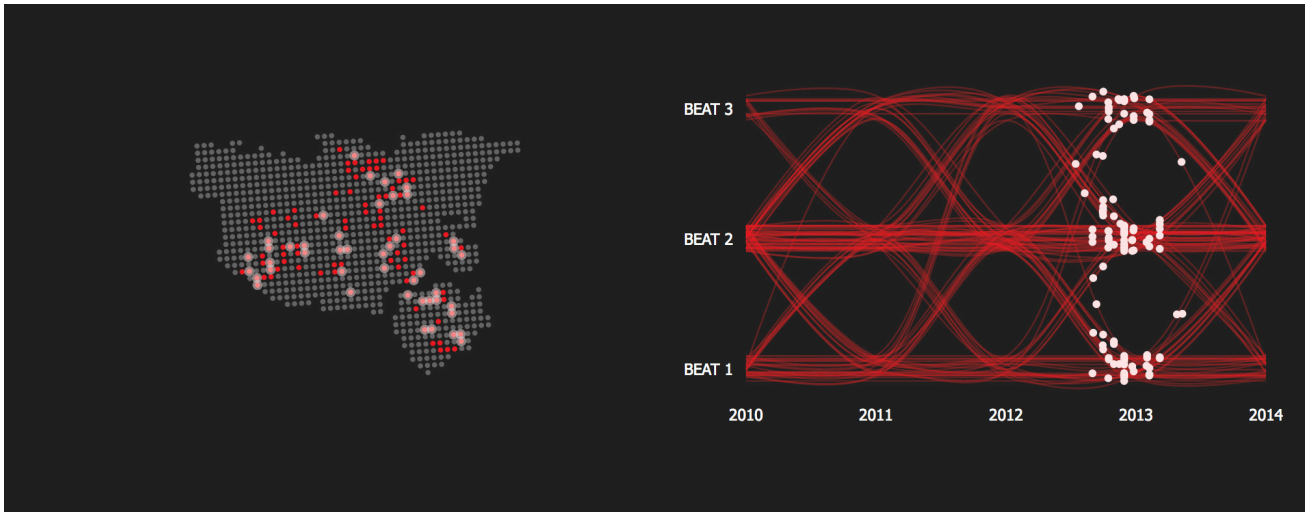
Photo during the discussion after the validation of the City Rhythm data model, listing the participants



future. Below are two example questions that give an idea of what type of questions were asked to the audience.

The survey had a following-the-witness approach, which the participants found easy to engage with. Although certain concepts in the data model were not defined in detail, thanks to many examples the idea behind the model, and the impact in working with rhythm came out during the validation day. Clearly most people saw the value of rhythm in policy making, although the exact potential still needed to be proven.

We were lucky to have a quite diverse audience from different professions and municipalities, who contributed with their comments. After the survey, we had a fruitful discussion with all participants on our work so far and our next steps. The following pages will show highlights from the final discussion. The entire results of the survey and results can be found in the appendixes.



Jandirk Bulens (Wageningen University): “The power of this concept is that it contains information that you would not expect. On the other hand, we are in a very low level to try to find the model, catch the rhythm there, and we had to start with some kind of problem related with social cohesion, but we did not explain what defines social cohesion either. We also had a lack of data, to get deeper information. So from my perspective, I agree like everyone else that this is promising, and it generates a new way of looking at the world. This way we get new information that we would not got with a classical way. It is a new dimension. The power is that you visualize something that is happening in a continuous time line, we can see that it is static. But yet, this abstract level creates confusion.”

Gooitske Marsman (Municipality of Helmond): “We believe in the idea and we would like further research, however the model is not one step further yet. For understanding what are the 7-base rhythm, what the beats mean.”

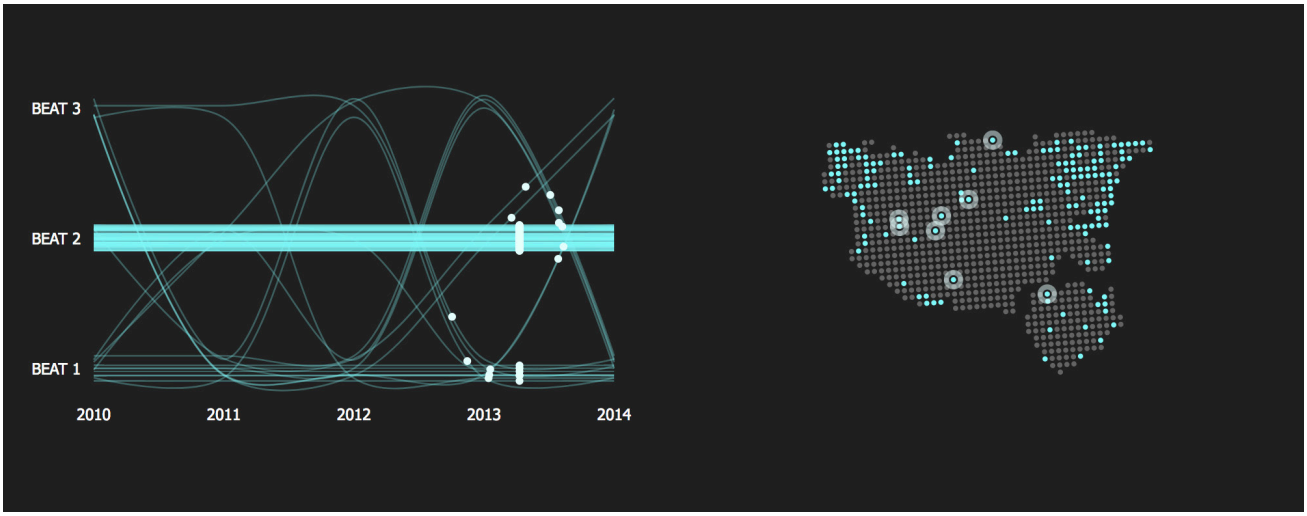
Mieke ten Bosch (Municipality of Zaanstad): “It is also interesting to think if in the similar clusters there are the same problems or not. For example, if you are in a green base rhythm and another neighbourhood red, what is the relationship between them? Can you have a cluster that can be influenced by the people coming in this cluster?”

Suzanne van den Berge (Municipality of Rotterdam): “I agree with the theory and I do believe that this works but it is also about the next step, on convincing the other people that this works. The point that the research has arrived right now still remains too abstract. We talk about base rhythms, but not about what it really means for that neighbourhood, for the people who work there. The civil servants need to relate to something, and I don’t think they will do it with an abstract base rhythm, we need to give it more colour to show them what it can mean for them.”

Hedwig Miessen (Municipality of The Hague): “More of that! I really liked the survey, I think the people will relate to that. I’m planning to write a memo about what happened today, and ask our mayor to come when we present the book. Also, then, I need terms that they can relate to, otherwise they won’t want to join.”

Robert Jan Genzer (Municipality of Zoetermeer): “I think the results are promising and really interesting, but it takes a long time to connect all the dots together. By looking at the comparison side it is very interesting, if it can get to a more specific level. For example, if the base rhythm and beats in two different locations are the same, but the perception of safety is different, it can be very interesting to approach the situation, and make policy interventions.”

Martijn Kriens (ahti): “What I think that is interesting in this approach is that you create new ways of discovering how the city is organized and how it functions. For example, by looking at what you expect from certain areas of the city, it’s interesting to see where it differs. So you can see where the city is functioning much better than you would expect, or the opposite. Maybe you will find that in some areas the rhythm is created by the influx of refugees, has the same rhythms as the areas where there is the influx of gentrification. Then the findings become very interesting for policy making on how to make an intervention. It is a different way of looking at the reality.”



Ida de Freitas (Municipality of Amsterdam): “For me the comparison is a very beautiful aspect. We always think we are so much different but if we look at the daily activities of the people, we see that we are not so different. So it is very good to have a model where you can unite and learn from other interventions. It is also interesting to learn that there are different base rhythms in each city.”

Annemarij Kooistra (Municipality of Amsterdam): “I think the parts that you investigate the difference in rhythm in one neighbourhood is very interesting, because they might be conflicting, or people just have different relations between each other. You can go to one neighbourhood and find that there are different base rhythms in that neighbourhood, and want to find out what is happening. For example the elderly people have one rhythm, the children have a different rhythm, the people with a religion will have a specific rhythm, and it is interesting to discover how they come together, where do they collide.”

Alexey Pristupa (AMS Institute): “I think this project is quite a challenge because you offer a new language to people at the municipality to talk about. With the range of terms that you introduced you can have very good results if it is possible to make a step further in making it happen. People can already imagine the new way of communicating with each other.”

Sander Ijzenman (Municipality of Amsterdam): “Identifying the same beats create a connection between cities, so nobody keeps on focusing on their own problems, but by looking at each other we learn something new. Some issues which are not so evident at the first place can be revealed.”

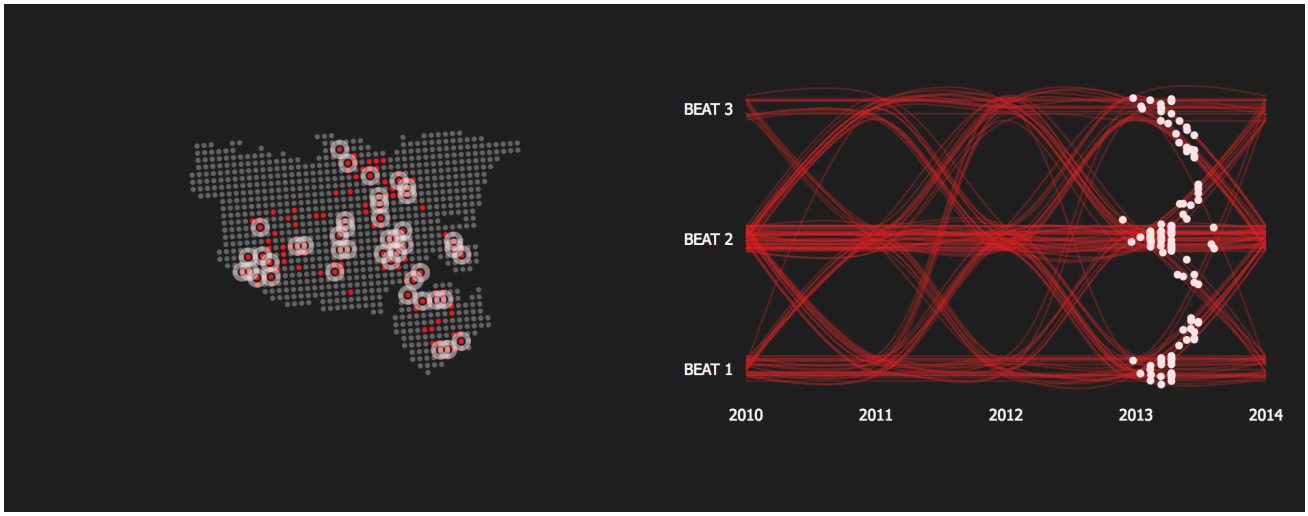
Kees Dignum (Municipality of Amsterdam): “The results were very promising, and I’m very much interested in the change of neighbourhoods and the possibilities of interaction between the neighbourhoods, which show their changing composition. So I hope it can be successful in the future.”

Alex Pixley (Municipality of Amsterdam): “As a next step, it would be interesting to also see which locations have similar policies, and also when a policy changes a signal can be given.”

Matthijs Verschraagen (Municipality of The Hague): “What I’m still looking for is to explain why it is feasible. When you present findings like this, you need to explain the people better what they are seeing. I totally agree that the people will make use of the findings until a full extent. As for comparison between several beats that have the same base rhythm, I’m not entirely convinced that the people will see that, or the residents will agree with it.”

Richard Defourny (Municipality of The Hague): “This makes me think of the realistic evaluation method, which basically says what works for whom, and in what circumstances. It says indeed to focus on the context where the policy is being made. This will help you to find out which contexts are similar to each other, and talk with each other about what policy the compared cities make. This brings the realization that different cities with different contexts can have the same problem.”

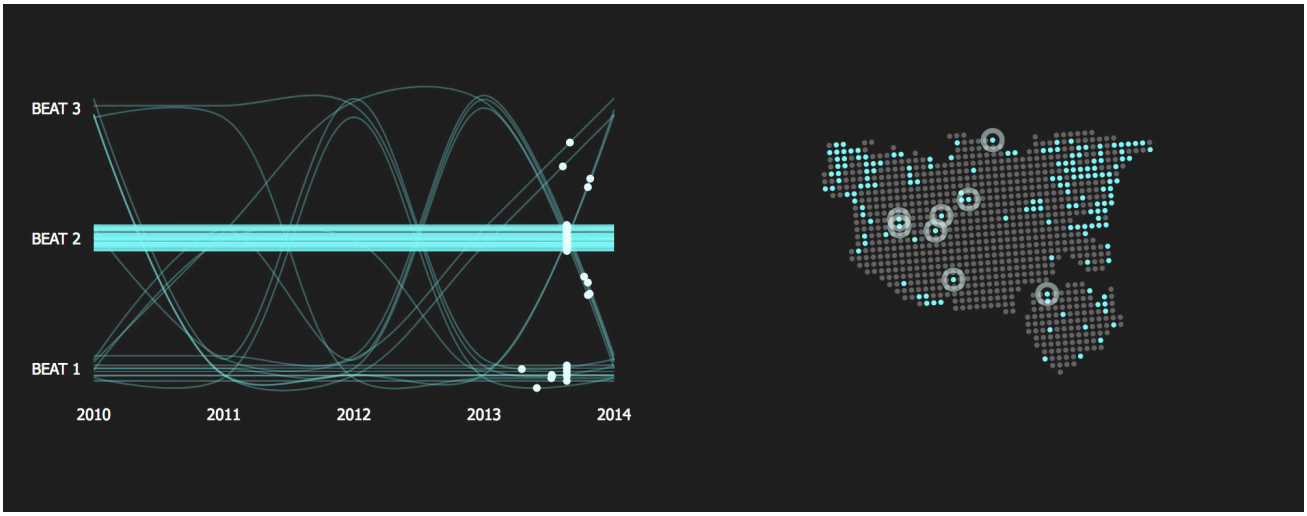
Rosemarie Aben (Municipality of Amsterdam): “I think what comes out of this analysis is very interesting. Also, it suggests questions for policy. But then, you would need a very good validation to confirm that this works, that the analysed cases are real. Relation with the real world is important.”



Epilogue:
Data Rhythm in European Cities

Inspired by the validation session and wanting to check once more if the model does indeed give correct indication about rhythms in different locations, data director Scott Cunningham did a last extra experiment.

by Scott Cunningham



The following exploration has four objectives. To externally validate the City Rhythm model in a relevant and related case of European regions (1), to gain some insight into the specifics of Dutch rhythms in light of potential European peers (2), to gradually enhance the volume and complexity of data being analysed (3), to further demonstrate the artefacts of the model building process (4). The dynamics of Dutch areas and neighbourhoods are richly documented with vast quantities of data at many scales of resolution. While the heat map discussed in the *Choosing the Right Trade-Off* section selects the appropriate family of model for further analysis, this heat map the rhythms which are revealed by the model are further explored.

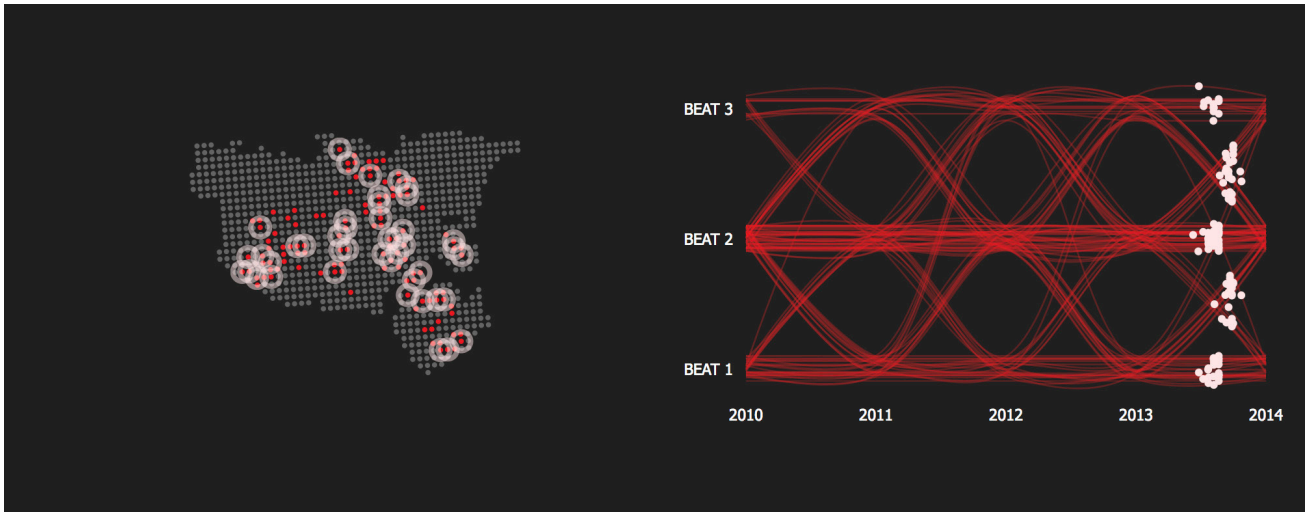
This exploratory model gives additional insight into the performance and properties of the statistical models being used in the City Rhythm project. Nonetheless the model could be extended both horizontally as well as vertically. A horizontal model extension would involve adding more channels, and lengthier and more granular time series. A vertical model extension would involve translating the model to a finer spatial gradient – the city level rather than the NUTS 2 district level. It's clear that the distinctive dynamics of a city are likely to be different than the larger districts in which the city is embedded.

European data over 20 years

The data in this case is provided yearly, for a period of almost twenty years. Five variables are used from the EuroStat database (EuroStat 2018). These variables are population, employment, regional income, education and mortality figures. Population, employment and regional income are relatively straight-forward. Regional income is measured using a measure of gross domestic product. The educational variable measures the percentage of the population which is school-aged. The mortality figures show what percent of the population died in the previous year. This could be as a result of disease, or injury, but also a result of old age. The educational and mortality variables in particular

		State 1	State 2	State 3	State 4
Education	Very high	0.00	0.33	0.00	0.25
	High	0.00	0.31	0.11	0.25
	Medium	0.00	0.04	0.11	0.00
	Low	0.44	0.27	0.44	0.50
	Very Low	0.56	0.04	0.33	0.00
Mortality	Very high	0.00	0.00	0.00	0.13
	High	0.00	0.18	0.07	0.88
	Medium	1.00	0.50	0.07	0.00
	Low	0.00	0.32	0.33	0.00
	Very Low	0.00	0.00	0.53	0.00
GDP	Very high	1.00	1.00	0.00	0.88
	High	0.00	0.00	0.00	0.13
	Medium	0.00	0.00	0.00	0.00
	Low	0.00	0.00	1.00	0.00
	Very Low	0.00	0.00	0.00	0.00
Population	Very high	0.00	0.86	0.00	0.00
	High	0.15	0.01	0.00	0.00
	Medium	0.85	0.13	0.00	1.00
	Low	0.00	0.00	1.00	0.00
	Very Low	0.00	0.00	0.00	0.00
Employment	Very high	0.00	0.40	0.00	0.00
	High	0.00	0.30	0.03	0.00
	Medium	0.92	0.14	0.44	0.00
	Low	0.08	0.16	0.53	1.00
	Very Low	0.00	0.00	0.00	0.00

Figure 13: Transition Tables for North and South Holland, by Scott Cunningham



help show the changing age profile of regions. Collectively these variables enable the model to represent significant demographic and economic transitions within the region.

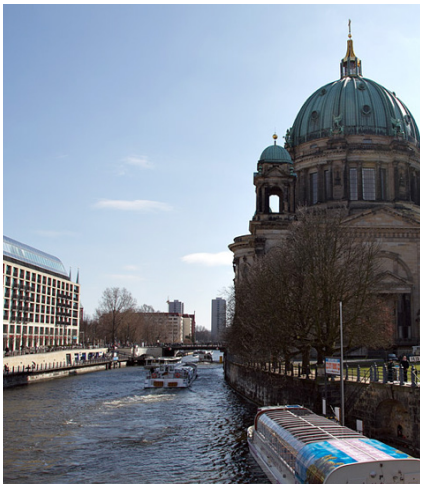
The following section provides sample results from a mixture of hidden Markov model. This section reports on a European wide comparison of NUTS 2 districts. NUTS stands for the nomenclature for territorial statistics, and is a common standard for European data reporting. Level 2 data in the Netherlands largely corresponds to Dutch provinces.

The resultant model is highly aggregated, but encompasses many diverse regions within Europe. The time period considered is quite lengthy, and enables longer-term and generational changes in European districts to be considered. This model is not built on the City Rhythm data set. Nonetheless it serves as a useful and simplified proving ground to demonstrate concrete results from the model before stepping up to Dutch municipal data. The model contains five channels of data captured over nearly twenty years.

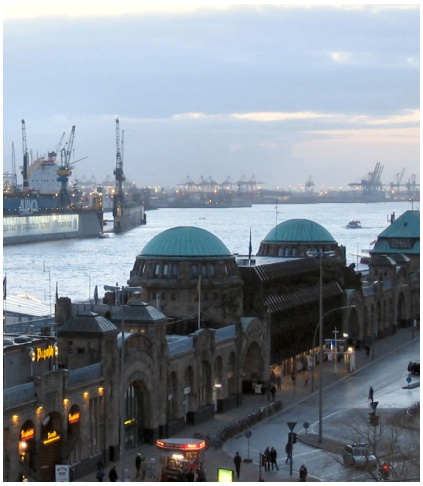
North & South Holland – Hamburg - Berlin

North and South Holland initially began in state 4, but then transitioned to state 2 in the last decade or so. This resulted in increasing numbers of school aged children, a general reduction in the age of the population, and a firming up of regional GDP. The population and employment levels also increased dramatically. In addition to Holland, state 2 also exemplifies several German towns and regions, including those of Hamburg, Berlin and Kiel.
An alternative transition path which was possible for the Holland but nonetheless skipped is a transition to state 3. This state entails a lower number of school aged children, lesser employment levels, lower mortality, and lower population levels in general. GDP levels nonetheless remain high. Vienna currently expresses this base rhythm.
The final state in the model is state 3. This is a low mortality, low income, low population density state, best exemplified by the cities of Umbria and

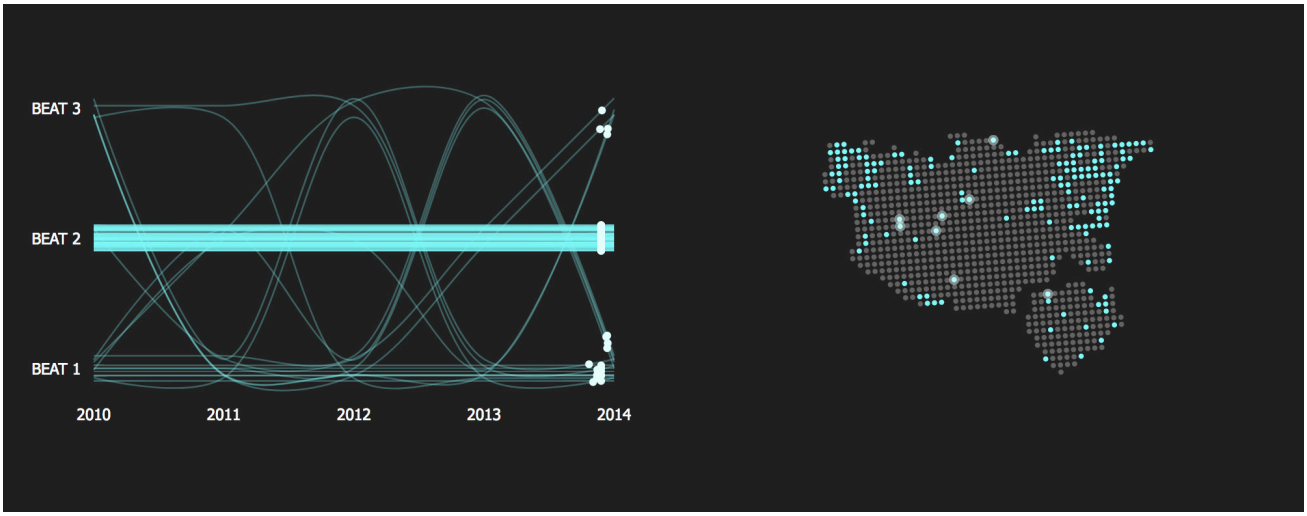
Amsterdam, Pixabay (2018)



Berlin (Wikimedia 2018a, Collective Commons License)



Hamburg (Wikimedia 2018b, Collective Commons)



Limousin. Judging by the history of these cities this state represents a sort of economic divergence, resulting from a failure to fully industrialize in the mid to late 20th century.

The rhythm data analysis summarizes huge quantities of data into relatively few patterns. The resultant patterns are very data rich, and data intensive. The City Rhythm project has therefore used a range of visualization outputs to better understand and communicate these patterns. Discussed in the previous page is a heat map (figure 13). A transition network, showing which beats are likely to be sequenced one after another, is a useful supplement to the heat maps as shown above.

Noord-Brabant and the Rest of the Netherlands

The rest of the Netherlands displays a very different rhythm than that of North and South Holland. The dynamic is much more strongly dominated by generational cycles of child rearing, as well as retirement. For instance, Noord-Brabant and Limburg are currently in a beat which entails low population densities, relatively high wealth and employment, and mixed but aging populations. This beat is shared in common with Vlaams-Brabant and West-Vlaanderen in Belgium.

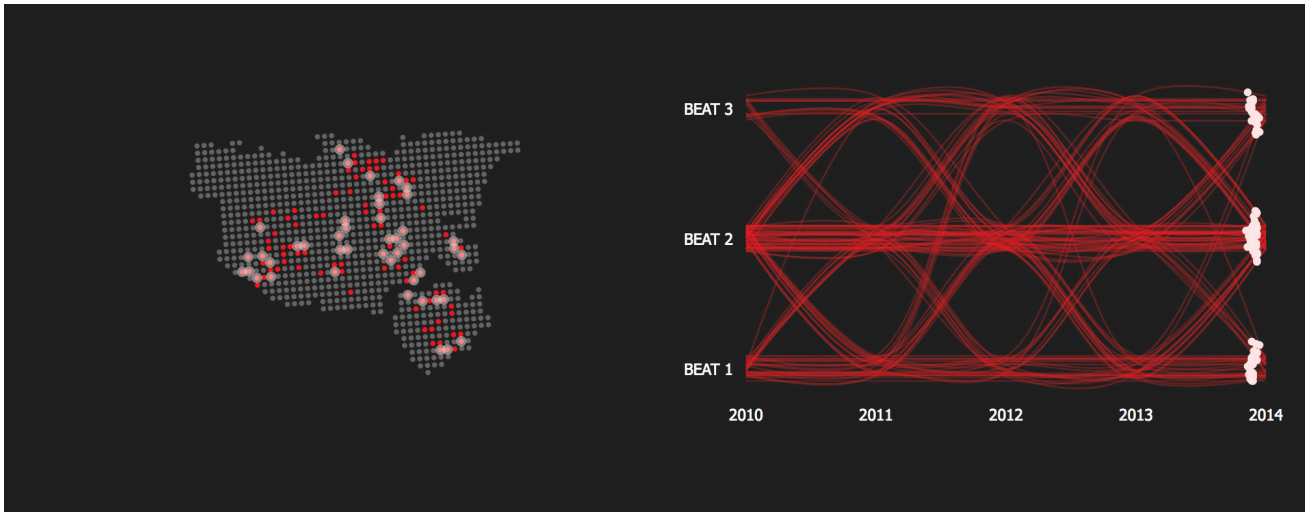
Much of the rest of the Netherlands also experience the same rhythm, if not the same beat. The dynamic may be characteristic of other comparatively rural regions throughout Europe. Other European regions experiencing similar socio-economic conditions are Luxembourg and multiple districts across Norway.

Concluding Remarks

The needs of modelling are at odds with the needs of co-creation and stakeholder engagement activities. Modelling requires an incremental process of testing, sense making, and validation. Data intake should therefore be gradual, and in pace with the process of understanding the outputs of the model. Ideal model outputs are high fidelity representations of the data set as a whole. Although the predictive and pattern matching processes of model building can be automated, the interpretation of the data requires a team of scientists and experts.

Co-creation activities must permit engagement with a wide segment of stakeholders. The very idea of “data” often means something very different for stakeholders than it does for the data scientist. The appropriate setting for co-creation is facilitated workshop setting. Using visualizations allow sudden moments of insight, and permit multiple narratives to be constructed with the audience. The apparent conflict between machine learning and co-creation activities may entail joint model building exercises, facilitated by computer. While the empirical foundations of the model should sound, participants may help direct the search for more ecologically valid, and contextually appropriate uses of the data.

The City Rhythm model is, in this light, a success. Additional work and research is certainly needed to continue to grow the model in light of available data sources and to better develop urban analytic models in participation with relevant stakeholders. The challenges inherent in communicating complex models to stakeholders were made highly apparent in this project. Future challenges lie in building a better bridge between the stakeholders.



Conclusion

The exploratory study City Rhythm aims to understand whether rhythm analyses of social issues in the physical and in the data world can contribute to policymaking for social safety in neighbourhoods. Previous research in The Hague is concerned with social safety in a neighbourhood in which lots of migration happens. Results indicate that the sharing of rhythm enhances trust between residents.

When discussing these results with civil servants of several cities in the Netherlands, the potential of rhythm analyses for tackling issues of social safety appears to be interesting for municipal policymaking. As a result, six cities have decided to participate in a one year exploratory study with TU Delft, Wageningen University and the Amsterdam Institute for Advanced Metropolitan Solutions. The cities invest money and time, and civil servants are engaged in all phases of the research.

Rhythm analysis is a service design for data driven policymaking

A first set of explorations is focused on current experience of civil servants with data driven policy (Part 1: Rhythm, Why and How). Data often serve as a proxy for deeper social issues. Looking at different kinds of proxies for different kinds of social issues, it becomes clear that dynamics of social issues are well-reflected in data. However, most of the available data are not used because of privacy reasons. It is agreed that rhythm analyses, in which data are attached to locations and not to people, possibly solve some of these issues and provide new avenues for data driven policy. As a result, several focus groups are organized in which social policymakers, street-level social workers, data and ICT professionals jointly analyse current practices in different phases of the policy cycle.

Urban policy professionals raise awareness about significant social issues. A break in urban rhythms may signal something significant is changing. Data, in this awareness phase, can inform, signal and offer verification. In next phases, when defining the problem and identifying solutions, data can offer detail. Different kinds visualizations built with data can function as boundary objects to facilitate the conversation between different fields of expertise. Policy-makers may offer special attention to the sharing and communication of rhythms during phases of policy implementation and evaluation.

As result, civil servants and researchers formulate the concept of the ‘data-ecology’, in which people’s activities create data, which then inform policy making, upon which decisions are taken by local government and politicians, which then inform people’s activities, and which then create further data. It is realized that each of these processes has distinct rhythms as well, which have to be taken into account in any data-driven policy making. The focus groups conclude that data-driven policymaking needs specific service designs which have not been invented yet. Rhythm analysis can potentially contribute in a significant manner. It may be able to predict future developments and it may be able to analyse and evaluate policies in hindsight. Rhythm analyses may help to circumvent issues of privacy while giving considerable information on dynamics within streets and neighbourhoods that reflect issues of safety and security in those streets.

Rhythm analyses function as boundary object for identifying design solution spaces

A second set of explorations focuses on establishing the potential of developing a rhythm perspective of specific social issues while working within the physical world (Part 2: Exploring Social Rhythms). These explorations are carried out with the help of students of the Universities of Delft, Leiden and Erasmus in Rotterdam who are doing the LDE minor Responsible Innovation. Between professors and civil servants, specific social issues in specific neighbourhood in each of the six cities are identified for students to work on. These include elderly who do not feel safe to go out; single mothers who do not use the municipal services which are made for them; refugees who need to be welcomed; youth that linger on a square; an unpleasant atmosphere in a shopping mall, and a quiet streets with little things happening.

Functional, ecological, spatial and visual rhythm analyses are made and rhythms in people's activities and networks are mapped. The rhythm analyses are then discussed with different stakeholders in the neighbourhood and in the municipality. In these conversations, the rhythm analyses appear to function as boundary object. As result, thanks to rhythm analyses, new solutions for the social issues emerge in four out of the six social issues that were asked to solve.

The rhythm analyses of the shopping mall and the quiet street do not generate any new perspective. In the other four cases, interventions have helped to match rhythms, tune rhythms, balance rhythms and share rhythms to the satisfaction of municipalities involved. It is concluded that for specific social issues rhythm analyses can function as boundary object and offer unanticipated solutions spaces. As result, a methodology for urban rhythm analyses in the physical and social realm of the neighbourhood is created.

Rhythm in neighbourhood's data consist of beats, street and base rhythms

For being able to translate rhythm analyses to the data world, several theoretical and artistic explorations into rhythm are carried out (Part 3: Thinking About Rhythm). Any territory, any neighbourhood, has distinct spatial and temporal rhythms, which define the borders of the territory as well. Rhythms are fundamental to day-to-day aesthetic sensorial experience (sound, colour, movement, shape, smell, taste) and affect how people engage with each other. Actually human beings constantly tune to each other, co-adapt rhythms in breathing, in movement and more. Rhythm can be considered as a pattern, yet not every pattern is a rhythm. Rhythm is the variation in the pattern.

Breaking patterns creates rhythm and interesting aesthetic experiences, artists argue. In tabla, the Indian tradition in which deep knowledge about rhythm is created over several millennia, rhythm is considered to be a circular movement that always goes back to the beginning. It emerges in minimally two beats. Memory facilitates that the second beat is heard in relation to the first beat.

Silence between beats offers the entrance for others to engage. Both in

theory and in artistic practice, experts agree, rhythm emerges from interaction and its perception changes with experience. Experience of rhythm is culturally defined in this sense. How is it possible to listen to the rhythms in the data of the city, which constitutes of lots of rhythms within rhythms?

The research team first focuses on identifying beats in urban data. Every neighbourhood has a specific “state” (population, work, health, ecology, built environment, proximity to services) at a particular moment in time. The state of a particular area changes -- both faster and slower -- and may eventually make the transition to another state at a certain moment in time. The City Rhythm research team proposes that a beat can be defined as a moment of transition in a neighbourhood. A series of beats (transitions) creates a street rhythm for a particular area.

For being able to perceive or recognize a street rhythm, memory is fundamental. Therefore only datasets over a period of time can offer insight here. Similar street rhythms create a “base rhythm,” which reflects the musical meter in which the street rhythm takes place. Base rhythms emerge through comparing and clustering the many street rhythms which are apprehended in data.

City Rhythm Data Model visualizes the interaction between beats, street – and base rhythms

For making the City Rhythm Data Model both the selection of datasets and a method of modelling is chosen for identifying beats, base – and street rhythms. This is a process in which the research team has to tackle lots of confusion and ignorance of each other’s fields of expertise, while at the same time invent a new conceptual vocabulary together. Meta communication between team members, personal engagement of each of the researchers and a principal investigator who safeguarded trust and understanding between team members throughout the process, makes this possible.

For choosing datasets that give insight in social safety of the neighbourhood, the YUTPA framework is chosen which was foundational in the preliminary research case as well (Part 4: From Rhythm to Algorithm). The YUTPA framework indicates factors for trade-offs for trust; it is upon these factors that specific datasets are mapped. It is clear from the beginning that data sets are chosen that can be attached to location, and which need not be attached to people.

When choosing data sets and deciding upon the way the model will be built, different approaches to data science are identified in the data team. Between a classical statistical approach (mathematical), a policy analyses approach (computational) and an open systems approach (natural systems), the City Rhythm data team chooses to make a Mixture of Hidden Markov Model for identifying rhythms in urban datasets. Using this model, the outcomes are dynamically visualized.

City rhythm researchers create inventories of possible datasets and conduct negotiations with data providers during the course of the project. Here the City Rhythm research team has to learn about the complex market of data anno 2017. Data are valuable, expensive (in different categories), hard to access, in need of lots of formatting and aggregation before one can work with them. Time and money for data acquisition, formatting and aggregation have been seriously underestimated in the original planning for the City Rhythm Data Model as significant factors for success. Albeit in a different

way than anticipated, and because the data team is very experienced, the final demo of the City Rhythm Data Model performs in a satisfactory way.

The final model that is validated runs with open micro data of Central Bureau of Statics of the Netherlands, which offers data in 500 by 500 meter grids. The City Rhythm Data Model is programmed to identify seven base rhythms over three years' time in the six cities that are studied. Exploratory results are first graphically visualized showing grids with similar base rhythms in different colours. Secondly, results are dynamically visualized showing base rhythms and the different street rhythms within the base. As result, it is possible to find streets which have similar base and street rhythms in different neighbourhoods. This means that these streets go through similar transitions over time.

Rhythm analyses and interventions potentially enhance social safety in neighbourhoods

To validate the City Rhythm Data Model, different stakeholders are invited to participate in the ultimate validation session (Part 5: From Data Rhythm Back to Neighbourhood). For understanding the new urban rhythm vocabulary, a survey is made that explains the possible use of the City Rhythm Data Rhythm Model using 19 questions (in appendix). After the online survey, participants have a chance to look at the graphical visualization of the base rhythms and play with the base and street rhythms in the dynamic visualization. Lots of conversations take place trying to understand the model in relation to personal knowledge in the six cities.

Then, a structured validation discussion is held. It is agreed that several base rhythms seem to resonate with people's personal knowledge of specific areas. For example, there is one base rhythm that seems to happen in industrialized and/or harbour areas in all cities. This raises the question which datasets are responsible for this effect.

Several stakeholders emphasize that they need to understand why a street has a particular rhythm and how this relates to others street and base rhythms as well. The research team argues that such an understanding requires to reverse engineer back to the data, which this one year exploratory research does not facilitate. Stakeholders agree that the current City Rhythm Data Model is promising and definitely legitimises a further pursuit of the research.

In the validation session, stakeholders agree that rhythm analyses in the physical world can be a tool for professionals who work in neighbourhoods. The developed methodology can be the foundation for such a course, which is of relevance for professionals who work locally in neighbourhoods (local policeman, health, care and education professionals). The City Rhythm Data Model has potential for municipalities as a signalling device that can be included in future dashboards which monitor the city. All stakeholders agree that possible societal impact of rhythm analyses, in both the physical and data world, has only become more promising and needs to be thoroughly studied soon.

As a last validation effort by the data team, the City Rhythm Data Model is run with different sets of open micro data of several European regions over 20 years. Results show again similar base rhythms between different regions and these seem to resonate with personal knowledge of these regions. The outcome supports the idea that rhythm analyses, after rigorous future research and design, is a new approach to policymaking.

Future Research

City Rhythm exploratory research indicates that rhythm analyses offer new design solution spaces for social issues in neighbourhoods. Future research needs to establish if and how rhythm analyses can deliver significant contribution to policymaking on local and regional level.

Scientifically, rhythm theory is receiving renewed interest in different academic communities. In media studies, in cognitive psychology and interaction design, rhythm is studied as a force for engagement. City Rhythm research shows that artistic research can significantly contribute to theory development on rhythm. Future research needs to embrace this potential offering a deep understanding of rhythm, which will allow other disciplines to build upon. Future research definitely needs to position itself in the extensive library of urban studies (Harvey 2012, Boano et. al 2008, Kaika 2005, Jacobs 1961).

Secondly, identifying and analysing rhythm requires more research. Perceiving rhythm, documenting and visualizing rhythm, analysing rhythm and validating these analyses with stakeholders, are currently only explored in simple ways. More research is needed before principles of verification and falsification can be applied to rhythm analyses as such. So far, theory on rhythm has mainly been developed in the humanities. Bridging these insights to the social sciences, including political sciences and the data sciences, requires considerable research effort. City Rhythm research, which is a first effort in this realm, indicates it is worthwhile and promising.

Thirdly, rhythm – as a dynamic that connects different natural, social, technological processes happening at the same time – sheds new light on emerging networks between people, systems and organizations. Further research can explore how rhythm analyses can contribute to Actor Network Theory (Latour 2005), and to theory on network society (Castells 2011)and social networks as well (Turkle 2005), to help explain why certain networks and organizations are successful while others are not.

For having societal impact City Rhythm research indicates that rhythm analysis has a great potential. While developing the scientific research into rhythm, future research also needs to study paradigms, strategies and tactics of visualization and documentation of different data approaches. This is fundamental to societal use and essential for rhythm analyses to better function as a boundary object. Also, requirements of democratic governance come into play here. Both model and use of data need to be transparent, safeguard privacy, yet contribute meaning and significance.

The following research questions are raised from a policy-making perspective:

- Is it possible to develop a methodology for rhythm analyses and intervention in urban/social dynamics?
- Is it possible to develop a methodology in the physical world that can be executed by different levels of expertise? For instance, is this a methodology which could be taught to MBO students?
- And further, what are the requirements and foundations needed to train and transfer the methodology to others?

From a data science perspective rhythm analyses invites new questions. These include the following:

- Is it possible to develop a model that can handle diverse datasets and offer insight in urban dynamics over time, in which both the creation and the deconstruction of datasets can be transparent for the civil servants who work with the model?

- Can we model with different datasets, at different resolutions of time or space, different channels of data for providing a comprehensive view of the life of in a city district?

- Can we tap into rhythmic sources of long-term memory in city districts that contribute to shared culture? These long-term correlations in space and time provide particular challenges for capture, interpretation and understanding through data analysis and techniques offering historical perspectives that contribute to the emergence of shared culture.

Future research, which is funded by NWO (Dutch Scientific Research foundation) for 2018 – 2022, focuses on Designing Rhythm for Social Resilience. In this study two PhD candidates, one from architecture and one from data science, will jointly explore several social issues in Amsterdam Zuidoost (District of Amsterdam Southeast). This joint effort is expected to result in a framework for making data driven policy that is based on making rhythms analyses effective. The focus on social resilience in urban contexts proposes that rhythm potentially enhances shared culture and therefore social resilience.

Rhythm is a dynamic that is fundamental to human experience. It offers discipline without effort, it offers aesthetic experience before pleasure, it offers engagement beyond interaction. When communities share rhythms, they are stronger and more resilient. When individuals need to engage with a task on a regular basis rhythm makes it easier.

The future research is expected to inspire a variety of applications in creative industries and in health, education, travel, transport, business, circular economy, social work and more.

City Rhythm Colophon

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LDE Minor Responsible Innovation

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Appendix

City Rhythm Validation Day Survey

by Caroline Nevejan, Lene Boehnke, Thu Vu, Pinar Sefkatli

29 September 2017 Data Lab Amsterdam

Survey for Validation City Rhythm Data Model for Recognizing Neighborhood and Street Rhythms for Social Safety

- YUTPA Framework
- Based on CBS open data
- Mixed Hidden Markov Model

Gemeente Helmond · Den Haag · ZNSTD · Gemeente Amsterdam · AMS · Zoetermeer · Gemeente Rotterdam · driebit

How the Survey is Structured

(A) Helmond Case — (B) Zoetermeer Case

Base rhythm
Entire model is collection of beats

(C) Zaanstad Case — (D) Rotterdam Case

Beats
In a base, what beats are identified

(E) Amsterdam Case — (F) Den Haag Case

Specific character of beats and bases
Combination of datasets through time result in different beats and bases

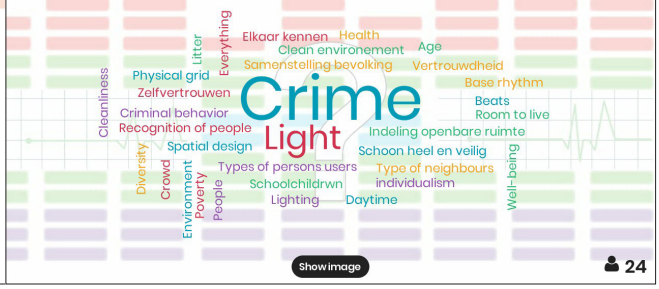
Question A1 on Social Safety

What factors influence social safety?

Please add maximum two factors:
a)
b)

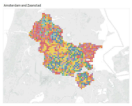
Mentimeter

A1. What factors influence social safety?



Question A2 on Base Rhythms in the Netherlands

The model finds 7 types of base rhythms in the Netherlands.

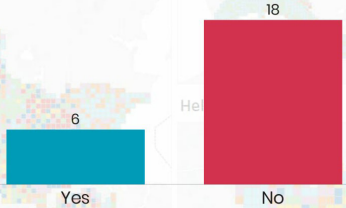




If you were to divide your city into neighborhoods and color them, would this be the pattern that you would come up with?

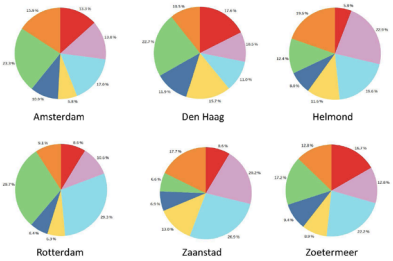
Yes ☐ No ☐

Mentimeter

A2. If you were to color the different areas in your city, would this be the pattern that you would come up with?



Question A3 on Base Rhythms in the Netherlands



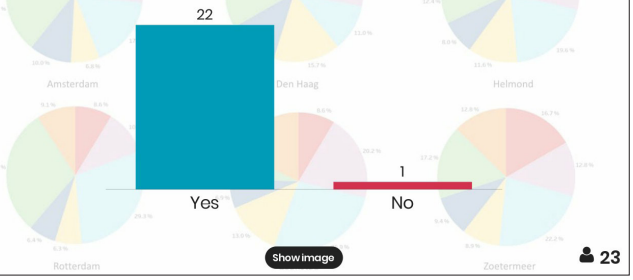
The previous work showed that in rhythm analysis comparison adds meaning.

Would you like to know which other cities have the most similar distribution of base rhythms compared to your own city?

Yes ☐ No ☐

Mentimeter

A3. Would you like to know which other cities have the most similar distribution of base rhythms compared to your city?

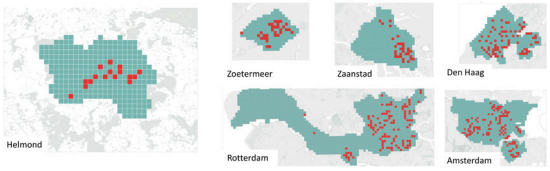


Show image

23

Question A4 on Base Rhythms (Helmond)

The model spotted that the Tulpstraat in Helmond has the red base rhythm.
Neighborhoods in other cities have red base rhythms too.

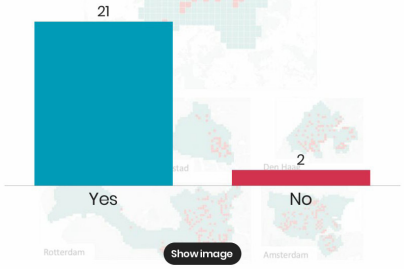


Do you also think that the Tulpstraat can be found in other cities?

Yes☐ No☐

Mentimeter

A4. Read the text below and look at the images. Do you also think that the Tulpstraat can be found in other cities?



Show image

23

Question A5 on Base Rhythms (Helmond)

Is it interesting to see the visual comparison between neighborhoods with same base rhythm? ☐ Yes ☐ No

Mentimeter

A5. Is it interesting to see the visual comparison between areas with the same base rhythm?

Show image

24

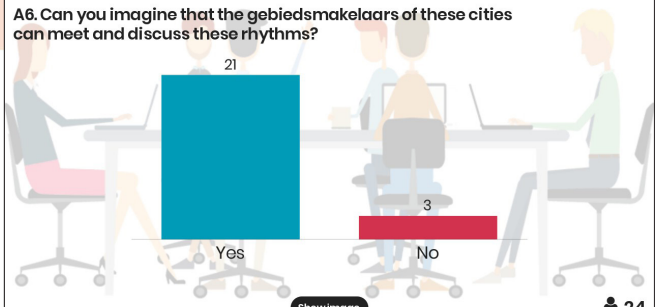
Question A6 on Base Rhythms (Helmond)

Given all this input on the Tulpstraat in Helmond and all over the Netherlands, can you imagine that the gebiedsmakelaar of Zaandam, Den Haag, Zoetermeer, Amsterdam, Rotterdam and Helmond can meet and discuss these rhythms?

Yes ☐ No ☐

Mentimeter

A6. Can you imagine that the gebiedsmakelaars of these cities can meet and discuss these rhythms?



Show image

24

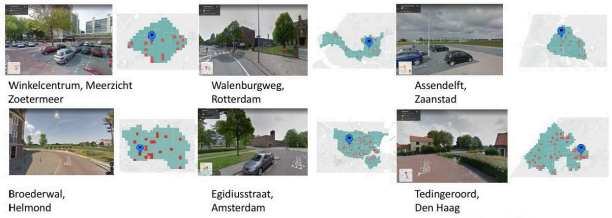
We have established that:

- There are a limited amount of base rhythms in the Netherlands.
- Base rhythms can be seen visually as well.
- Data do relate to actual areas.
- It is interesting to compare base rhythms.

(B) Zoetermeer Case
Social Safety in Meerzicht Winkelcentrum

Question B1 on Base Rhythms (Zoetermeer)

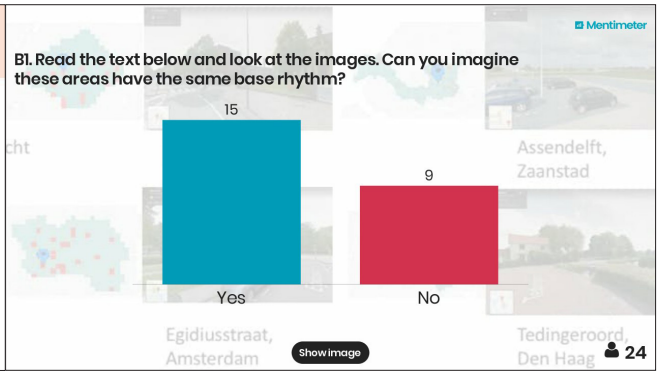
The model has spotted neighborhoods in other cities with the same base rhythm as Meerzicht. Here are pictures of some of these neighborhoods.



Winkelcentrum, Meerzicht Zoetermeer | Walenburgweg, Rotterdam | Assendelft, Zaanstad

Broederwal, Helmond | Egidiusstraat, Amsterdam | Tedingeroord, Den Haag

Can you imagine they have the same base rhythm? Yes ☐ No ☐



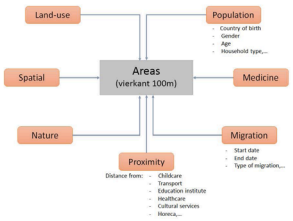
154

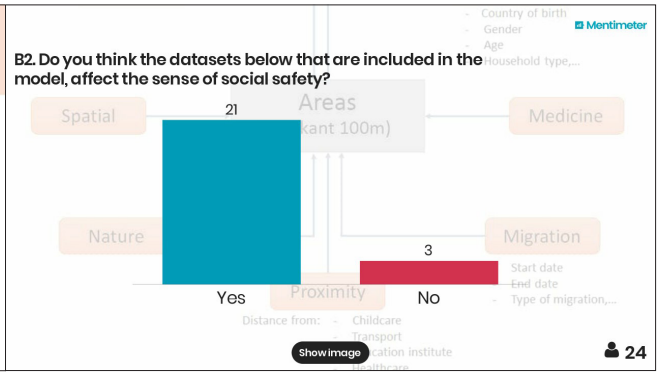
Question B2 on Data and Social Safety

The beat is constructed by comparing data and mapping it on a location.

Do you think these are the datasets affect the sense of social safety?

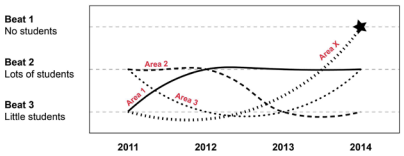
Yes ☐ No ☐



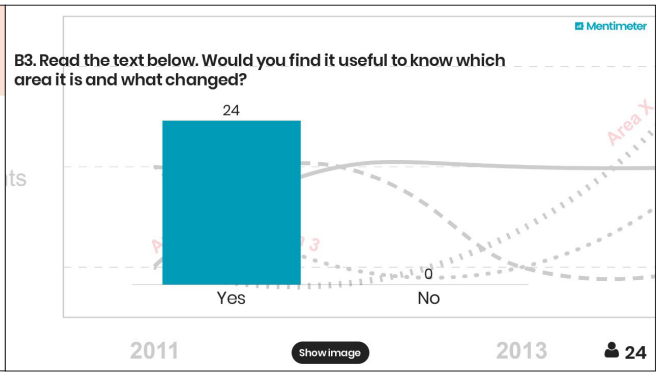


Question B3 on Base Rhythms and Beats (Zoetermeer)

Looking at the areas that have the same base rhythm as Meerzicht, area X saw the new beat first. This new beat is associated with big changes in an area's dynamic.



Would you find it useful to find out which area it is and what changed?
Yes☐ No☐



We have established that:

- A base rhythm consists of different beats.
- Beats emerge from the change of areas over time.
- A series of beats construct a street rhythm (een driekwart maat bijvoorbeeld).
- Beats emerge from location based data in relation to other data.
- Beats reflect what happens in an area.
- Beats do not reveal anything about individuals.

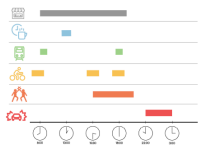
(C) Zaanstad Case

Balancing Rhythms in Wormerveer Marktplein and in De Saen Winkelcenturm in Assendelft

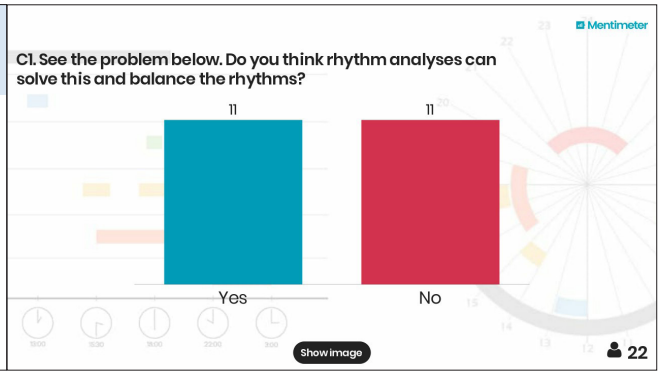
Question C1 on Rhythm Analysis (Zaanstad)

The market square in Assendelft is very busy between 4pm and 7pm. This creates a negative perception on hangjongeren, who are on the square then. Actually, many other activities are going on, such as public transport, bike traffic and shopping.

See the problem below:

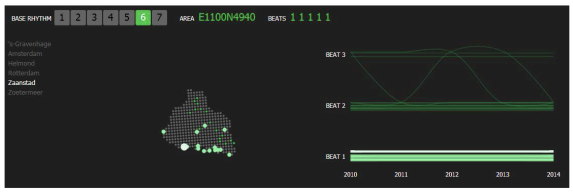


Do you think rhythm analyses can solve this problem and balance the rhythms?



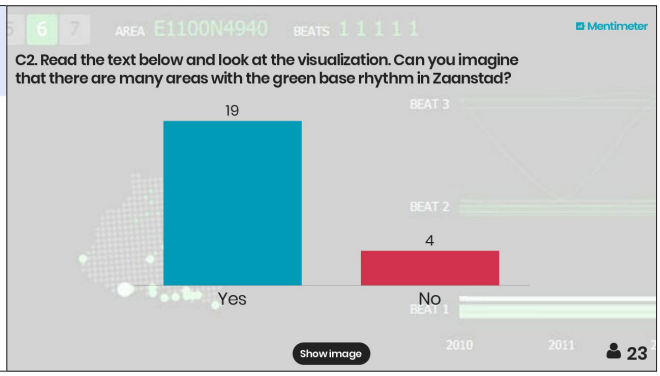
Question C2 on Base Rhythm and Beats (Zaanstad)

Assendelft has the green base rhythm. The green base rhythm has 3 beats.



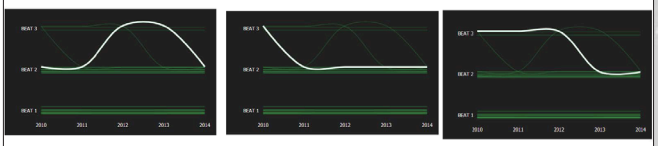
Can you imagine that there are many street areas with the green base rhythm in Zaanstad?

Yes ☐ No ☐

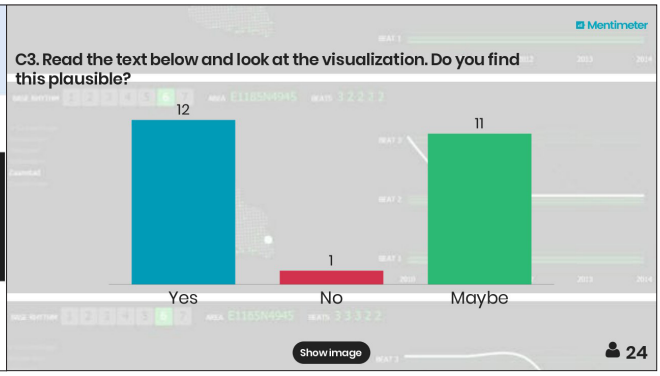


Question C3 on Rhythms and Social Safety (Zaanstad)

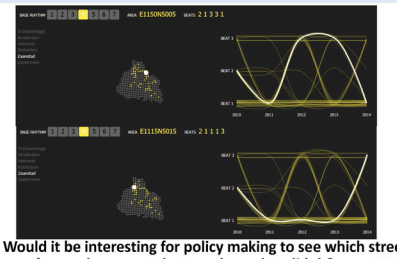
Street rhythms are very different over time. Yet, it is possible that they have the same base rhythm and generate the same sense of social safety.



Do you find this plausible? Yes ☐ No ☐ Maybe ☐



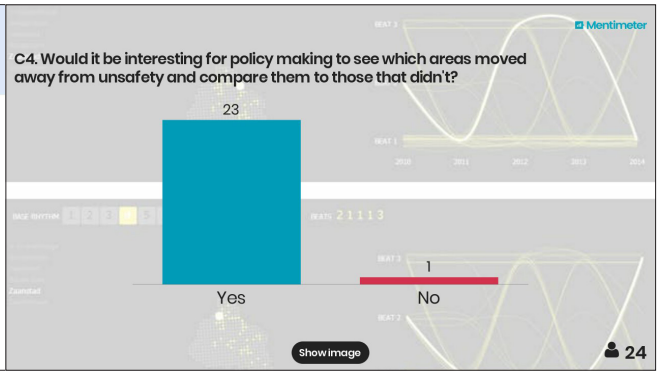
Question C4 on Beats for Unsafety (Zaanstad)



Unsuccessful street area

Successful street area

Would it be interesting for policy making to see which street areas moved away from unsafety and compare them to those that didn't? Yes ☐ No ☐

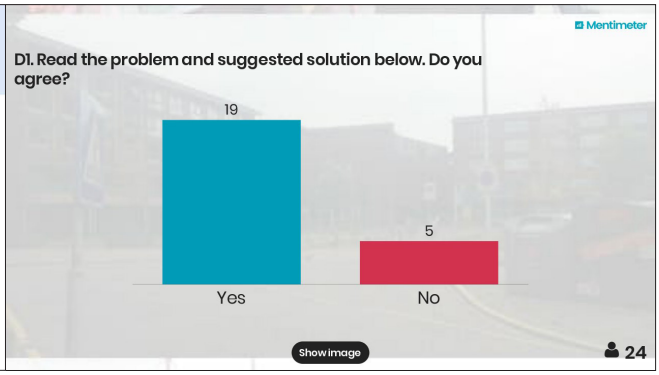


(D) Rotterdam Case
Integrating Elderly in Keizerswaard

Question D1 on Introducing Keizerswaard Case (Rotterdam)

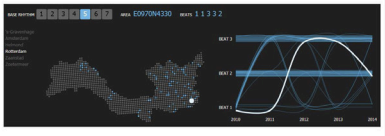
- Rhythm analyses of interviews shows that elderly cannot cross the street because the traffic light is too short on green.
- The traffic light is fast because of morning traffic.
- Elderly only leave the house after 10.
- So we can adapt the rhythm of the traffic light after 10.

Do you agree? Yes ☐ No ☐



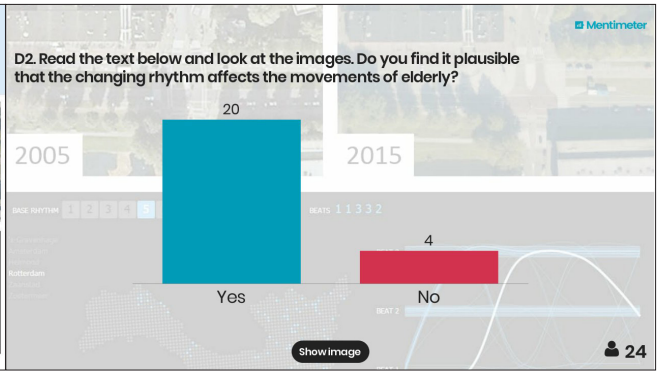
Question D2 on Tuning Rhythms (Rotterdam)

In the aerial images from 2005 and 2015 we see how the beats have changed over time because of the modification of the road. The other rhythms were adapted to this change. Such a change is a result of policymaking.

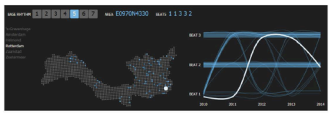


Do you find it plausible that the changing rhythm affects the movements of elderly?

Yes ☐ No ☐



Question D3 on Base Rhythm and Beats of Keizerswaard (Rotterdam)



Keizerswaard is part of blue base rhythm. There are 3 beats in this base rhythm.

The image on the left shows the transformation that Keizerswaard went through.

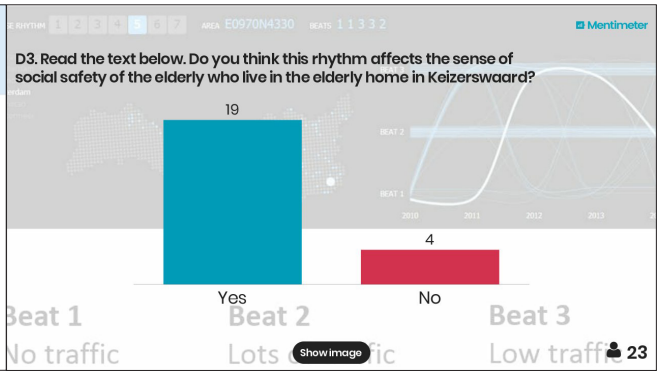
Beat 1
No traffic

Beat 3
Low traffic

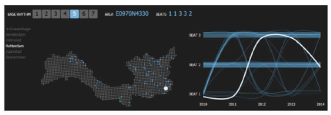
Beat 2
Lots of traffic

Do you think this rhythm affects the sense of social safety of the elderly who live in the elderly home in Keizerwaard?

Yes ☐ No ☐



Question D4 on Tuning Rhythms (Rotterdam)



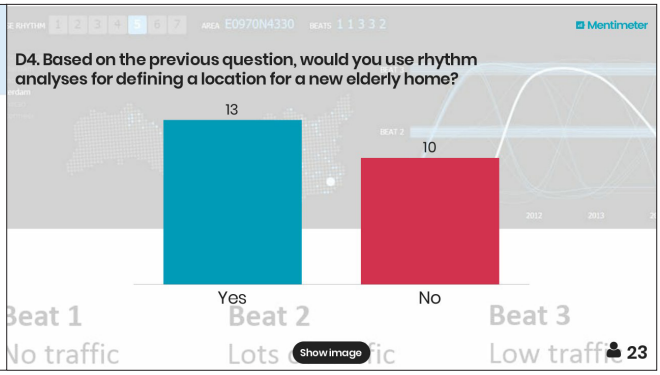
Would you use rhythm analyses for defining a location for a new elderly home?

Beat 1
No traffic

Beat 3
Low traffic

Beat 2
Lots of traffic

Yes ☐ No ☐



3rd Session - Matching and Sharing Rhythms for Social Safety

(A) Helmond Case (B) Zoetermeer Case

Base rhythm
Entire model is collection of beats

(C) Zaanstad Case (D) Rotterdam Case

Beats
In a base, what beats are identified

(E) Amsterdam Case (F) Den Haag Case

Specific character of beats and bases
Combination of datasets through time result in different beats and bases

(E) Amsterdam Zuidoost Case

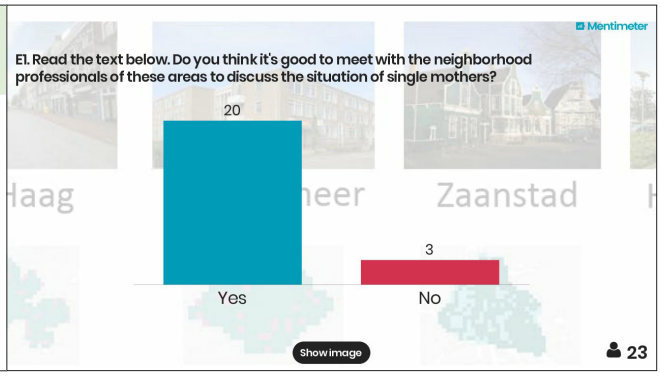
Matching Rhythms of Single Mothers in Holendrecht and Venserpolder to Neighbourhood Rhythms

Question E1 Imaginary case Single Mothers (Amsterdam Zuidoost)

Imagine the following: Single mothers in Venserpolder live in a orange base rhythm. In both Helmond and Zaanstad they mainly live in turquoise base rhythms. Here are the street areas where single mothers may live in your city:

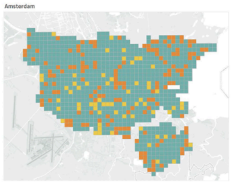
Can you imagine it is good to meet with the neighborhood professionals of these street areas to discuss the situation of single mothers?

Yes ☐ No ☐



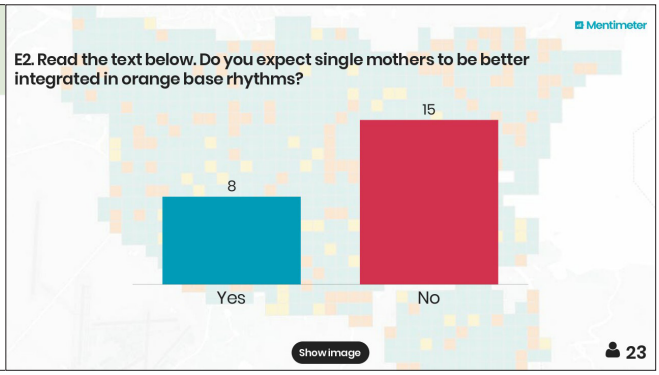
Question E2 on how proximity affects Single Mothers

- *Street areas with an **orange** base rhythm* are located relatively far from schools/ shopping areas/public transport.
- *Street areas with a **yellow** base rhythm* are located close to these services.



Do you expect single mothers to be better integrated in orange base rhythms than yellow base rhythms?

Yes ☐ No ☐

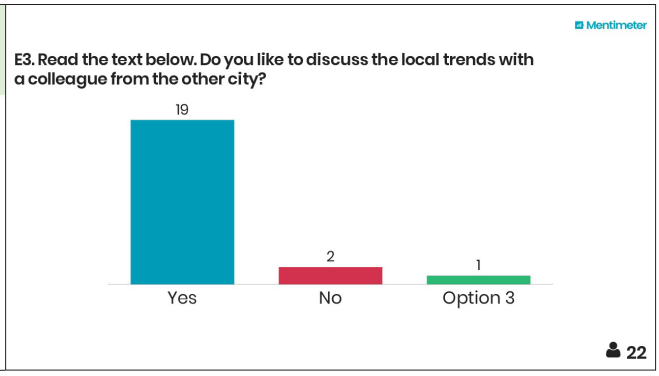


Question E3 Single Mothers in Zuidoost

Previous research in Amsterdam shows that single mothers' rhythms do not match the municipality's rhythms and therefore the single mothers do not make use of municipal services.

In Helmond, single mothers living in the same base rhythm, have no problem matching their rhythms with municipal services.

Do you like to discuss the local trends with a colleague from the other city? Yes ☐ No ☐



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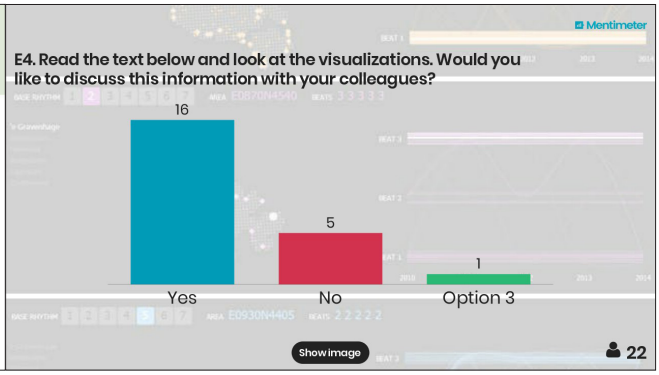
Question E4 on bases and Single Mothers

In Amsterdam single mothers have lots of poverty and low proximity (beat 3).

In Den Haag and Rotterdam they have less poverty and more proximity (beat 1 and 2).

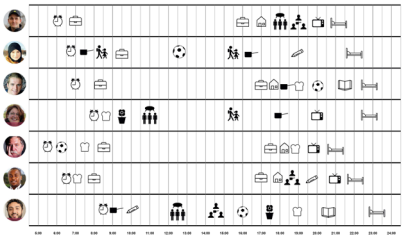
Would you like to discuss this information with your colleagues?

Yes ☐ No ☐



(F) Den Haag Case
Sharing Rhythms between migrants and residents in Escamp

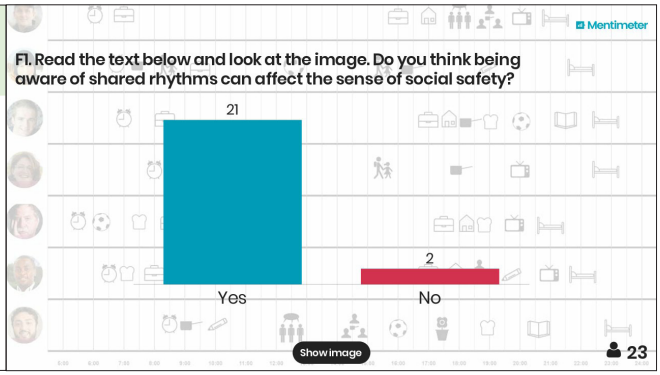
Question F1 on migrants (Den Haag Escamp)



In Escamp, residents generally share similar daily rhythms without being aware of it. When being informed about the shared rhythms, their sense of social safety improved.

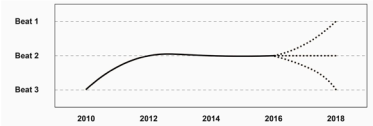
Do you think being aware of shared rhythms can affect the sense of social safety?

Yes ☐ No ☐

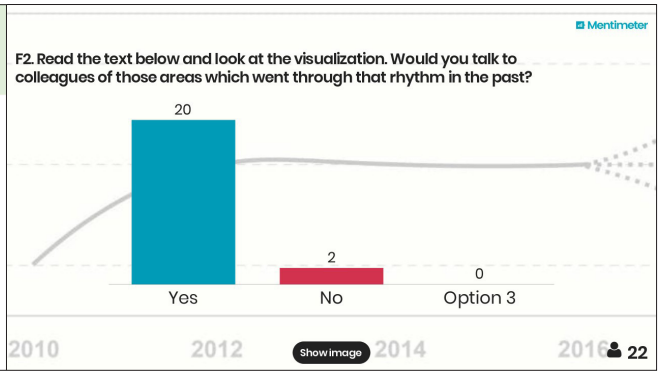


Question F2 on migrants (Den Haag Escamp)

Escamp is a neighborhood where many people move in and out. A housing project for refugees is planned for the coming year. The current residents are worried about how this will affect the future of the neighborhood. The model found several street areas in the Netherlands that went through that rhythm in the past.



Would you talk to colleagues of those neighbourhoods which went through that rhythm in the past? Yes ☐ No ☐



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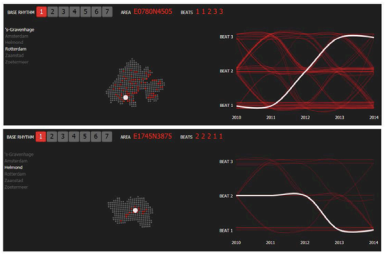
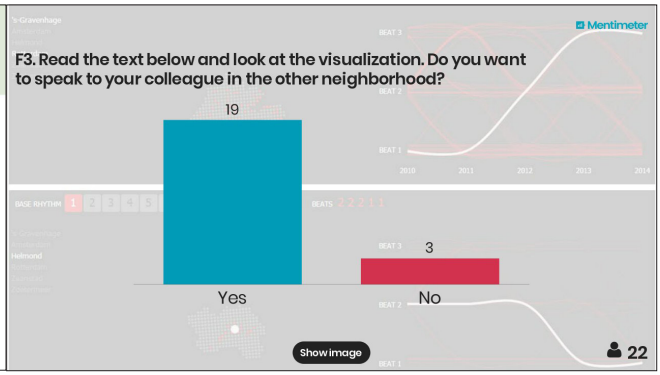
Question F3 on Beats for Sharing Rhythms



Two neighbourhoods (Escamp in Den Haag and Bijsterveld in Helmond) with different histories have each managed to create a sharing of rhythms between residents.

Do you want to speak to your colleague in the other neighbourhood?

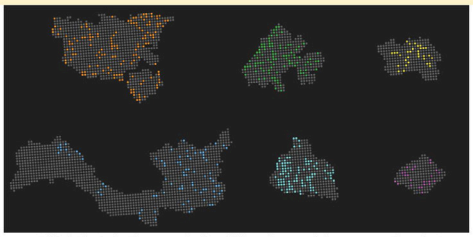
Yes ☐ No ☐



We have established that:

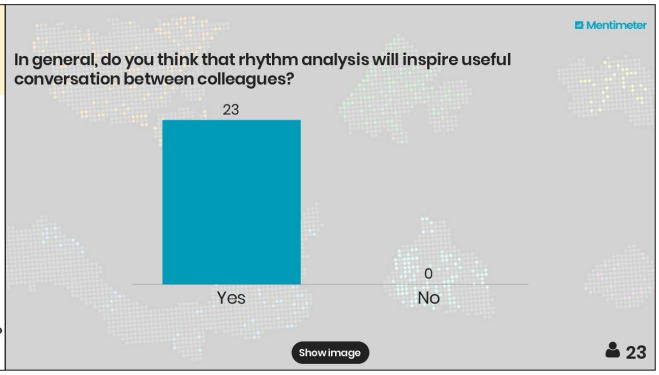
- Every street rhythm consists of different beats.
- Beats are defined by a specific configuration of datasets created by the model.
- Comparing different street rhythms in one base rhythm and linking this to specific characteristics can create input for policymaking

Future Question 1



In general, do you think that rhythm analysis will inspire useful conversation between colleagues?

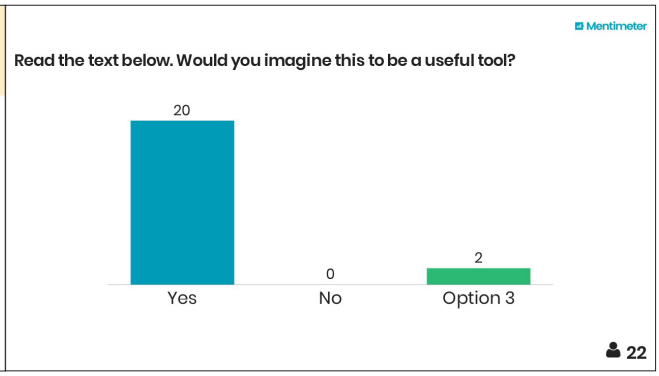
Yes ☐ No ☐



Future Question 2

Imagine if we have real-time data about neighborhoods from Google, TomTom, etc., we could track the daily rhythms of neighborhoods using this model. Would you imagine that it is an useful tool?

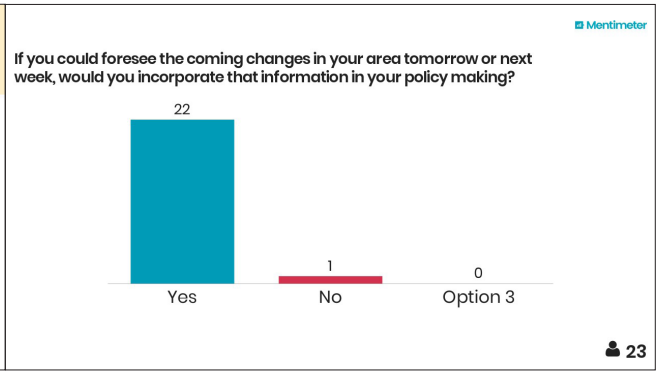
Yes ☐ No ☐



Future Question 3

If you could foresee the coming changes in your area tomorrow or next week (e.g. transport), would you incorporate that information in your policy making?

Yes ☐ No ☐



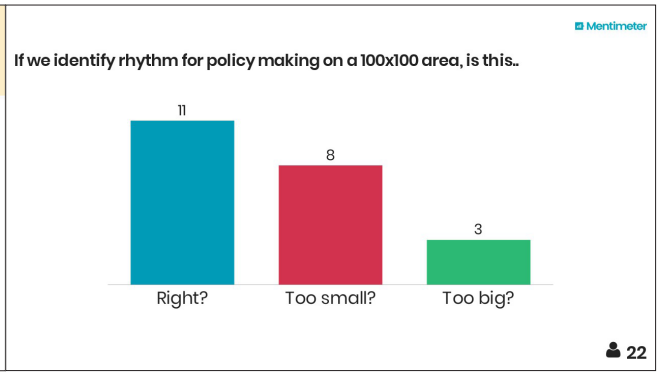
Open Question

If we identify rhythm for policy making on a 100x100m street areas, is this:

Right ☐ Too small ☐ Too big ☐

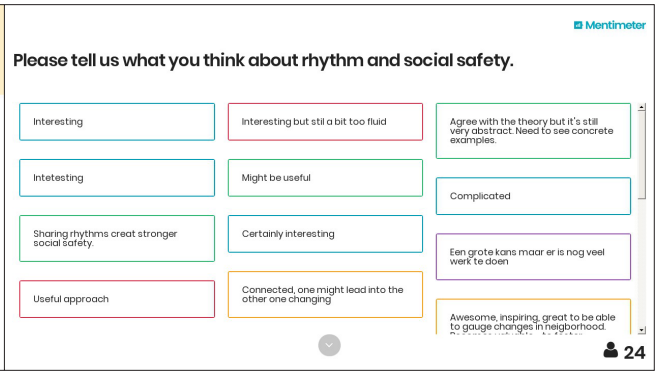
If we identify rhythm for residence to experience social safety on a 100x100m street areas, is this:

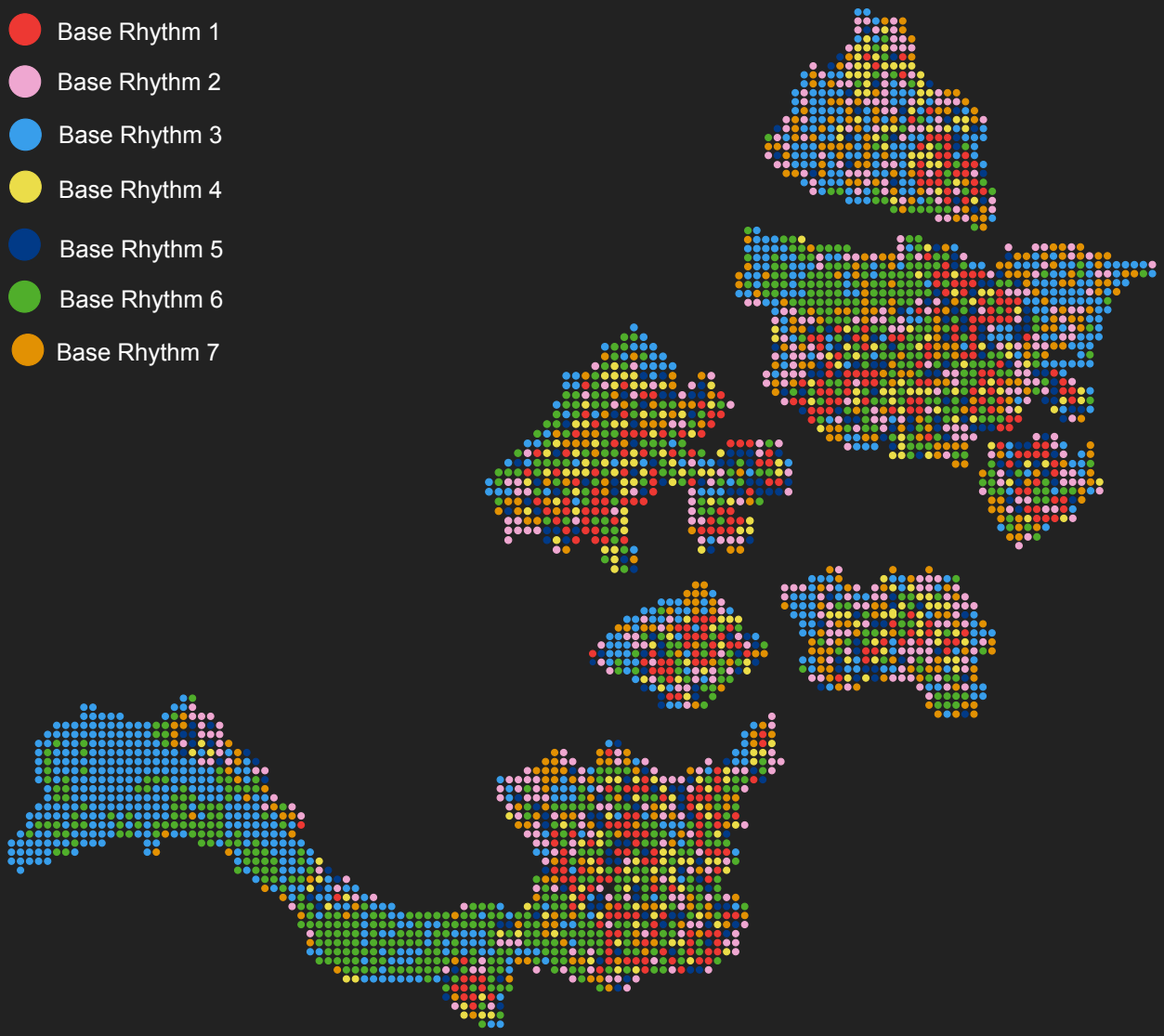
Right ☐ Too small ☐ Too big ☐



Open Question

Please tell us what do you think about rhythm and social safety?





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