CHRONOTOPIA

Exploring the potential of polychronic design towards a more efficient and flexible mixed-use urban environment in the neighbourhood of oud-Hoograven, Utrecht.

Master thesis landscape architecture

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In fulfilment of the requirements for the Master of science degree in Landscape Architecture at the Wageningen University, Landscape Architecture Group

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ABSTRACT

In the context of an increasing scarcity of urban space in the Netherlands, monochronic spaces can be considered inefficient and harmful for spatial quality. Such spaces may be programmed more efficiently and flexibly to encourage use throughout the day. The research explores methods for bridging the application gap between knowledge on urban activity patterns and the practical applications thereof in urban landscape design. The thesis evaluates how polychronic design solutions can contribute to more efficient and flexible urban environments.

For the neighbourhood of oud-Hoograven, containing a diverse range of public and private spaces, spatial and temporal data is gathered by means of spatial analysis, and time-use studies. It explores how temporal data can be gathered and made applicable as a design input. This results in an overview of rhythms that provides insight into which activities are temporally compatible. For 4 distinct urban typologies within the neighbourhood, the thesis applies several strategies of temporal design which are deduced from conclusions based on the temporal data. This results in spatio-temporal design programmes which are then translated into spatial designs. These designs are then evaluated on their performance with regards to efficiency and flexibility, after which conclusions are drawn on the effectiveness of polychronic design and the design process is reflected upon.

The results suggest that polychronic design by means of a temporal data-driven programme has a generally positive influence on both the efficiency and flexibility of urban public spaces, when compared to their original, monochronic counterparts. The thesis also identifies, mostly through the lens of affordance theory, likely relationships between design choices and the eventual efficiency and flexibility of designs that can be purposefully influenced to attain different results. The most notable variables found are the prescriptiveness of the designs, the method of alternating between functions (passive, interpretive, or active), the balance between spatial functions and their respective scales, and the effects of temporal stacking versus the temporal spreading of activities in a space. A more active consideration of (daily) rhythms in the field of landscape architecture in both research and design is ultimately encouraged.

PREFACE

During the entirety of my studies and career, I have been fascinated with the notion of successfully combining functions, the multiplicity and complexity of spatial uses and the passive functions of natural landscapes. Over time, I have come to realize that spatial problems are always co-defined by a temporal component. It is often unclear where the spatial problem ends, and the temporal problem begins. Some examples of topics which have fascinated me in my studies include permaculture (How to make full use of the available soil, water, and sun year-round?), aesthetics (how do concepts of temporality, decay, and seasonality fit into the notion of beauty?), ownership and services economy (do we need to own things or do we merely require their service at certain times?), the energy transition (how to deal with the temporal mismatch between the production and consumption of renewable energy?) and climate-adaptive city design (how to adapt cities and landscapes to diurnal and seasonal cycles?). Designs and topics of interest have often been about flexibility, multifunctionality, and space optimalisation. I believe my generation of landscape architects has been generally imprinted with the importance of functionality, systems thinking, and performativity. Multidisciplinary thinking allows the generalist designer to think in different scales and fields, and in doing so, create opportunities and links between different spatial needs. To fully explore our creative options, I believe we need to recognize that spatial design is always temporal design. Actively thinking, not just in different scales, but in different times as well will allow access to a more elaborate array of design options and uses of space. This may provide designers with new ingredients for more effective and vibrant spaces, and for creating more space(time) for water, vegetation, and social life in exactly those locations where space is most scarce.

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"A larger number of people want more,
on a diminishing usable surface area,
with a decreasing number of raw materials"

- Tillie et al. (2014).

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1.1 PROBLEM STATEMENT
A POTENTIAL SOURCE OF VALUABLE SPACE

Monofunctional spaces are often monochronic spaces: they are specialised for certain activities which tend to take place at specific times of the day. This leads to lee moments of use, moments of temporal vacancy. During these periods, such spaces could be used for other activities, ones that tend to take place at those specific times. The reliance on human rhythms is true for any type of anthropogenic space but is especially interesting considering an increasing pressure on public urban spaces. This pressure is caused by population growth, urban infill development and an increasing amount of physical and cultural spatial claims. Dealing with temporal vacancy presents a way of finding space in time. It could alleviate spatial scarcity and lead to a more efficient use of space.

SPATIAL SCARCITY IN EVER GROWING CITIES

In 2018, an estimated 55.3 percent of the world's population lived in urban settlements, with an expected increase to 60 percent in 2030 (United Nations, 2018a). The Netherlands is currently one of the most urbanized countries in the world, with over 90% of the Dutch population being categorized as being an urban dweller in 2018 (United Nations, 2018b). Diminishing household sizes (van Ark, 2005) (Haccoû, 2007, p21) and population growth incite a growing infrastructure and sprawling city fringes which fragment and brutalize the cultural components of the Dutch landscape in a rapid colonization of nature (Geuze, 2020). In order to protect the city fringes from such sprawl, Dutch municipalities are encouraged to look within the city borders for ways to fill in the city, rather than expand it, working towards more dense, compact cities (Rijksvastgoedbedrijf, 2010, p18).

MORE SOCIO-CULTURAL SPATIAL DEMANDS

There is an increased pressure on urban open spaces to accommodate a multitude of uses and cultural demands. (Cannon Ivers, 2018a). As our available free time remains relatively stagnant, the ambitions on what to achieve within that time increase substantially (Achterhuis, 2003). Technology has increased our capacity for travel and activities, but this has led mainly to more movements to and from those activities, (RMNO & Habiforum, 2000) while average travel time has remained nearly constant (Haccoû, 2007, p189). As time-saving processes, products and services

Image 1.1 (mono)functionalism in agriculture has lead to scaling advantages, saving time and money. However, the efficiency of the space itself has arguably dwindled with regards to ecosystem services, compared to the more healthy and diverse agricultural landscapes of the past. (image from Pariona, 2017)

Image 1.2 The netherlands is rife with (mono)functionalistic infrastructure, designed for saving time, at the cost of space. The more monofunctional the space, the more it corresponds with certain specific shedules. Parking lots for example hardly ever function at full capacity, but offer little other use of the space at less busy times. (image from freepik, 2022)

Image 1.3 Ensuring the ability to use a space at a certain time (in this case, a loading dock used sparingly on weekdays), is often done through ownership. In the proces, potential public space is closed off for any other use at any other time, such as evenings and weekends. (image by author)

are becoming increasingly important, the time saved with it is spent on more and more events and experiences. *"Time has never been so scarce"* (Galle et al., 2004, p13).

ADDITIONAL SPATIAL CLAIMS

The claim to space in general is also increased by relatively new spatial claims such as those of peak water discharge, water storage and renewable energy, (Rijksvastgoedbedrijf, 2010) (van Ark, 2005).

HIGH DEMAND, HIGH CONTESTATION

A growing number of residents, cultural demands and spatial claims lead to a high demand of space. *"A larger number of people want more, on a diminishing usable surface area, with a decreasing number of raw materials"* (Tillie et al., 2014). Land is an increasingly scarce commodity, and this mirrors a derived demand (Rodenburg & Nijkamp, 2004). If we consider the land use map of the Netherlands as being full, in the sense that every location already has a function, it presents an ever-decreasing number of suitable locations for new projects (RMNO & Habiforum, 2000, p4-11). It represents a zero-sum game in which every new function must displace an existing one. *"We practice forms of ownership, maintenance and planning in which spaces get assigned specific and often exclusive functions. This leads to rigidity, exclusion and displacement of other functions, and often to an impoverishment of spatial quality. Value is added for one user at the expense of another"* (Haccoû, 2007, p37).

A HISTORY OF URBAN OPTIMALISATION

Theories on space optimalisation are almost as old as architecture and planning itself. Roman cities, for instance, have been shown to already apply vertical city building. Likewise, compactness and walkability seem to have naturally evolved in European medieval cities (Batty, Besussi, Maat, & Harts, 2004). This compactness lasted up until the industrial revolution after which the increasingly chaotic and unsanitary cities inspired the shift to a separation of functions characterized by Ebenezer Howard's garden cities and the car-centric modernist paradigm of CIAM and the Athens charter (Haccoû, 2007, p20). Following the paradigm of form follows function, functionalism in architecture led to the specialisation and subsequent separation of spaces for specific purposes. Time was seen as a scarce commodity, solely from the perspective of the user, rather than the space. As such, (mono)functionalist spaces often mean to optimise human schedules, rather than to make optimal use of space itself (RMNO & Habiforum, 2000). Modernism eventually proved the inefficiencies of separated functions, urban sprawl and the car-dominated city over time. These inefficiencies were first discussed by thinkers such as Jacobs and lynch (Feldhusen & Poerschke, 2016) Who posit that densifying and mixing urban quarters is more economically viable, more socially stable, more culturally and aesthetically interesting and safer than monofunctional living or working environments (Rodenburg & Nijkamp, 2004).

MIXING AND MULTIFUNCTIONAL LAND USE

The discussion on the mixing of urban functions continues today, and many concepts regarding urban mixing have been developed over time (Feldhusen & Poerschke, 2016). The distinctive difference between theories on mixing land use, and theory on multifunctional land use is its emphasis on the creation of synergy due to the interaction between activities (Vreeker, de Groot, & Verhoef, 2004). In order to provide in multifunctional land use in the Netherlands, the government funded Habiforum research program was originally founded (Bayer et al., 2009). According to Habiforum, multifunctional use serves both to contribute to the quantitative spatial demand, as well as to the qualitative demand (Hooimeijer, Kroon, & Luttik, 2001). Multifunctional space, as defined by Habiforum, can be achieved through intensifying, interweaving, and stacking in the third dimension or by sequential (temporal) use of space in the fourth dimension. (Hooimeijer et al., 2001) (Lagendijk & Wisserhof, 1999) It is precisely the temporal aspect this research is interested in, that seems to be underrepresented in design theory and representation (van Dooren & Nielsen, 2019).

TEMPORAL VACANCY

Whomever has had a stroll through a residential neighbourhood in the middle of the day during the working week knows the sense of abandonment and uselessness which can be produced by a space which is nonetheless a fully planned and filled-in spot on a land-use map. Land-use maps project potential, primary or intended land-uses rather than performed or lived land-uses. Many residential streets, parking lots and even parks

and squares exist at times in an empty, expectant stasis, awaiting their moment of performance. It is logical that the most vacant time-spaces lie outside of our lived experience the most. In a paper on urban abandonment and vacancy by Nassauer & Raskin, (2014), Abandonment in general is defined as the 'phenomenon of uninhabited structures'. *"The dynamic of urban landscape abandonment and vacancy is both social and environmental, and understanding it requires a temporal perspective."* (Nassauer & Raskin, 2014, p246). Urban landscape is in constant flux and vacancy is inherently connected to these flows and developments, which occurs at various spatial and temporal scales (Lokman, 2017). Therefore, urban fluxes and flows produce vacancy even in the smallest scales and timeframes. *"We have tended towards a greater precision of activity timing and greater time specialisation: weekends, office hours, peak travel and the like. Many spaces are used intensively for certain periods, then stand empty for longer times"* (Lynch 1981, p452).
Temporal vacancy on a daily basis is thus caused by monochronic spaces: spaces designed for specific use with little to no regard of their use outside of these peak moments. The modernist legacy of separated activities resulted in a widespread use of monofunctional, and by extension often monochronic spaces. These spaces often mean to optimise human schedules, rather than to make optimal use of space (RMNO & Habiforum, 2000). However, such spaces continuously influence the world around us. Unused midday pavement heats up our cities, hinders water from refilling aquifers, fails to produce energy and does not aid flora and fauna in any significant way. Likewise, it may have had the power to provide social encounters to groups with diverging schedules, such as children, the elderly or the unemployed.

TOWARDS POLYCHRONIC SPACES

Therefore, we may no longer wish to spatially separate activities so rigorously. Multifunctional spaces have the potential to utilise the variety of rhythms of different users and activities as an asset. Monochronic spaces could then make way for polychronic spaces. A polychronic space is one that provides in the needs of these different rhythms and makes optimal use of its space in time. Mapping urban rhythms and the vacancies they produce could provide valuable insight in designing spaces that are functional for a larger portion of their time. Polychronic spaces could then be achieved by combining temporally compatible activities.

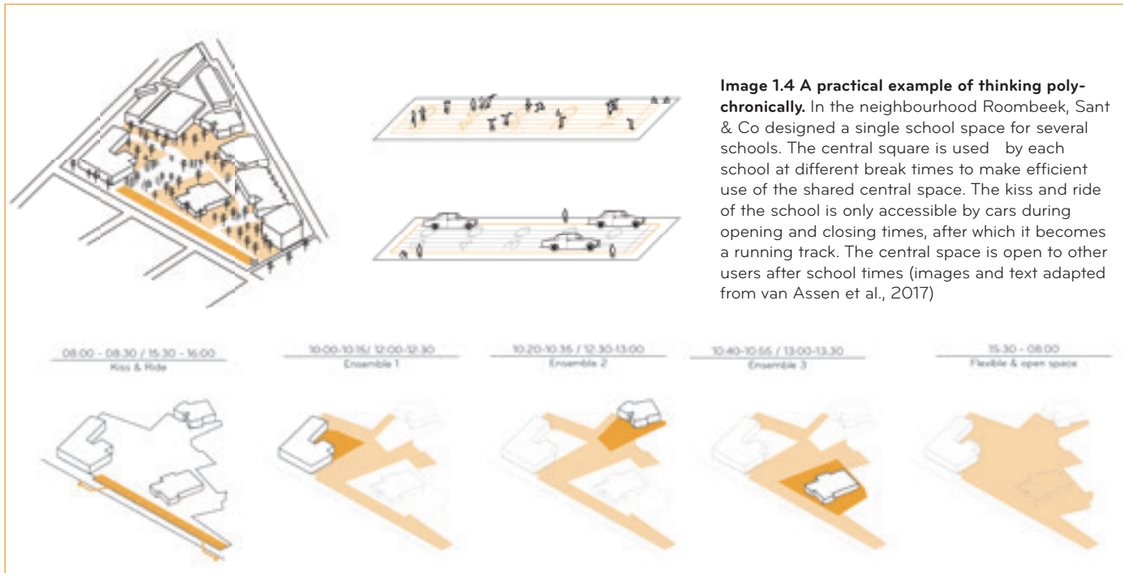


Image 1.4 A practical example of thinking poly-chronically. In the neighbourhood Roombeek, Sant & Co designed a single school space for several schools. The central square is used by each school at different break times to make efficient use of the shared central space. The kiss and ride of the school is only accessible by cars during opening and closing times, after which it becomes a running track. The central space is open to other users after school times (images and text adapted from van Assen et al., 2017)

1.2 THEORETICAL FRAMEWORK
TIME-SPACE RELATIONSHIPS IN LITERATURE

TIME AND SPACE AS TWO PARTS OF A WHOLE

The discussion on the integration of time and space in the sciences is relatively recent. Most surveys in traditional geography regard space and time as separate entities (Mulíček, Osman & Seidenglanz, 2015) in which space is understood as an independent and static opposite to the unceasing one-way flow of time (Crang, 2005). Several attempts have been made towards unifying time and space in the fields of geography and sociology. However, these produce often abstract discussions which prove hard to implement in empirical research (Mulíček, Osman & Seidenglanz, 2015). The concept of the chronotope however, seems to effectively combine time and space. Crang (2005) understood the chronotope as a unique combination of a specific place and specific time. (Mulíček, Osman & Seidenglanz, 2015)(van Schaik, 2011: 47), "a specific joint timespace" (Crang, 2005: 214). From this we can also conclude the spatial borders of such a chronotope are as fluid as its temporal borders. Urban space may be regionalized into areas with a similar rhythmical make-up, i.e., places with similar timing: particular chronotopes (Mulíček, Osman & Seidenglanz, 2015, p311). Crang's notion of chronotopes can therefore be used to understand a space as a product of its spatial features and the temporal reality, which are only meaningful in relationship to one another. This is similar to 'places', which according to Tuan (1977) do not contain observable boundaries and is a visible expression of a specific time period. The chronotope is preferred over the concept of place in the context of this research, due to the human-centric, constructivist focus of 'place' against the more objective, temporal focus of the chronotope.

RIGIDITY WITHIN URBAN RHYTHMS

The theory that *does* couple time with space mainly describes the way urban rhythms are formed and maintained. Hägerstrand (1970) introduced the idea of time geography, which relied on 'action spaces' and 'time budgets.' Individuals, according to their social role, income, and level of technology are subject to various types of constraints and thus command action spaces of different sizes and durations. These constraints include personal restrictions such as budgets, biological needs and abilities as well as restrictions of access by means of ownership, opening hours and entrance fees. People can only operate within their respective constraints. The focus of time geography on the individual (Latham, 2020) makes it difficult to apply to an entire neighbourhood, but the theory serves to illustrate that individual daily rhythms can typically only diverge up to a certain degree. Likewise, "Pace-makers" were introduced by Parkes & Thrift (1975) and taken up within time-geography where Hägerstrand referred to them as "pace-setters" (Hagerstrand & Morrison, 1982). "Pacemakers constitute collectively shared, often institutionalized and above all stable sources of particular rhythms. They include institutions, structures, technologies or activities that set the timing for a given urban environment" (Mulíček, Osman & Seidenglanz, 2015, p311). Additionally, the concept of Dressage, describes the system through which rhythm is learnt and becomes evident in the body over time, for example through social practices (Lyon, 2019). It can be understood as the production of path-dependency and is another testament of the rigidity and repetitive nature of urban rhythms. Constraints, pacemakers and dressage underline the fact that rhythms perpetuate themselves, their repetition making them predictable and therefore usable.

THEORY ON MAPPING RHYTHMS

To what extent is it currently possible to map urban rhythms? We have established that Hägerstrands time geography is too focussed on the individual (Latham 2020), and that pacemakers describe major influences on rhythms (Mulíček, Osman & Seidenglanz, 2015), rather than the rhythms themselves. Around the same time period of time-geography, public life studies were introduced by thinkers such as Jane Jacobs, Jan Gehl and William H. White. Around this time, Landscape architect Lawrence Halprin developed 'motation', as a method for documenting and designing movement and animation through a space in a diagrammatic representation. This was built upon later by William H. Whyte to provide valuable insight into human behaviour and patterns of occupation in public spaces through time. (Ivers, 2018c) These methods link to the ideas of French philosopher and urbanist Henri Lefebvre in his last work: "rhythmanalysis, space time and everyday life", which was published a year after his death in 1992 and translated to English in 2004 (Lyon, 2019). Rhythmanalysis is not an off-the-shelf technical research method. Rather, it is inventive thinking bringing together techniques fit to address spatio-temporal relations. Important to Lefebvre was

being present at the site in order to provide full access to the multisensory experience of rhythms. This is closely linked to both phenomenological as ethnographic styles of conducting research (Lyon, 2019). While these experiential types of analysis can help to pinpoint temporal vacancy and better understand human behaviour within spaces, they can only observe spaces as they currently are being used. Public life studies are generally more interested in influencing existing and already present rhythms by enhancing the length and probability of social interactions and optional activities, rather than utilising knowledge on urban rhythms. Rhythms that are not yet present in the space that is researched cannot be mapped by these types of analysis. As such, it lacks an overall view of activity patterns. A more practical problem with this type of mapping urban rhythms is the fact that at the time of writing, the corona pandemic has greatly influenced daily rhythms and public life, making field observation a poor indicator of urban rhythm for the time being.

A more positivistic and complete method of researching human behaviour through time is by means of a time use study. Time-use studies are conducted based on the data gained from time-use diaries. These diaries seek to overcome the measurement errors (experienced time and clock time are wholly different things) and normative, representative biases (I am the sort of person who works late, so I probably did that) that often plague simpler time-queries (Gershuny & Sullivan, 2019). Time-diaries compile to form large datasets of precise activities through time. These diaries are often used in a more social than a geographical sense, but the information within time-use studies could be an extensive source of information. The information from time-use studies is less location-specific than the experiential methods of describing rhythms. However, it is far more complete in its description of activities during the day. It presents a more matter-of fact manner of representing spatio-temporal rhythms and has yet to be practically explored for its usefulness in design-oriented research.

KNOWLEDGE ON SPATIOTEMPORAL DESIGN

The current discourse on time within landscape architecture itself focusses a lot on programming, temporary landscapes and pop-up uses of space. The book "staging urban landscapes" (Cannon Ivers, 2018a), describes the importance of the curation of urban landscapes, but also provides a warning of overstating programming and neglecting the everyday use of space. There is a need to explore the relationship between permanence and temporality to ascertain how a space operates on a daily basis and how it could function during events (Cannon Ivers, 2018a). Corner (2018) adds that design should not rely on temporary programme alone. Design that respects and expresses sense of place is still of great importance. Rather, truly changing, adaptive landscapes are "likely to become the future evolution of public spaces that are fundamentally designed to be performative as much as they are decorative, ecological, sustainable and democratic" (Cannon Ivers, 2018b, p35). In the end, programming in the sense of events is still at the mercy of human time schedules. We cannot be expected to visit events or participate in creating public spaces if we are constrained by work or school. Events still mostly adhere to archetypical time schedules and take time and effort to set up. They are therefore not the ideal tool for dealing with small-scale, day-to-day temporal vacancy. What is missing from the discourse is how knowledge of daily activity patterns can be practically applied in urban landscape designs. (van Schaick, 2011) The small group of, mostly Italian, researchers and urban planners who do focus on urban rhythms have developed the 'times of the city' or the 'chronotopic' approach to urban planning. Still, this approach mainly focusses on developing time-policies for cities or urbanised regions rather than concrete physical transformations, ultimately resulting in an applicability gap of urban rhythms in design practice. (van Schaick, 2011: p154-156).

MULTIFUNCTIONALITY AND TIME

Priemus, Nijkamp & Dieleman (2000) Define multifunctional space use as: 'fulfilling multiple functions in a certain space in a certain time'. They elaborate on the problem of scope, as with a sufficient scale, temporal period or a specific enough distinction of what counts as a "function" anything can be regarded as multifunctional. The term therefore loses its meaning when the parameters of these definitions are not strictly defined every time the term is used.
additionally, this definition lacks the emphasis on the creation of synergy due to the interaction between activities, which is mentioned by Vreeker, de Groot, & Verhoef (2004) to be an important aspect of theory on multifunctional land use. Multifunctionality however is not so much a goal in and of itself but rather a tool that should lead to a larger amount of use of a singular space over time. In theory, even a monofunctional place could be polychronic if that single function could keep the space occupied throughout the entire day, and a multifunctional space could be monochronic if all its functions were to peak at the same time.
Priemus, Nijkamp & Dieleman (2000) elaborate on multifunctional use of space in the fourth dimension specifically. According to them, the fourth dimension is utilised multifunctionally either by flexible, simultaneous and/or sequential use of a certain space by one or more functions. Despite a lack of further elaboration on these three methods of combining functions in time, it proposes two interesting points of distinction between design strategies. The first point of distinction is the question whether functions are able to function at the same space and time. Assuming activities of similar scales and timeframes, almost all human activities can be considered mutually exclusive. For instance: a person using a field to play soccer will conflict with a person having a picknick on that exact same space. Passive spatial functions such as planting may not necessarily be excluded by the other activities taking place in a specific space. A field for instance, has a more beneficial passive functionality than a paved soccer court. In a way, this function is still alternated between by the soccer game, as the players temporarily block out the sun when traversing the field. In that sense, even these functions alternate on the tiniest spatial and temporal level. These 'simultaneous' functions may thus be best described as a passive means of alternating between functions. A passive function resumes instantly as soon as the activity is ended.
The second point of distinction is whether the alternation between functions are planned and controlled or free and spontaneous. We could account this to spaces that can freely alternate between human activities based on interpretation and spaces that require active interventions to do so. As such, we could redefine the terms to describe passive, interpretational and active alterations between functions. In order to better understand how spatial functions can be combined or alternated between, especially with regards to interpretational alteration between functions, it is important to understand how individual spatial uses are communicated and interpreted in the first place.

COMMUNICATING FUNCTIONS

An object can be interacted with in several ways. The type of interaction is determined by its material properties: shape, size, surface, colour, etc. This is referred to as the materiality of an object (Innis, 2008). The materiality in turn determines, regardless of the intent of the object, compatible and incompatible interactions. For instance, the lines in a sports hall can be seen as demarcations for a game of football, but also as a line to balance oneself on. These possible interactions through materiality are described by Gibson (1979) as affordances and by Norman (1999) as "action possibilities" To Gibson (1966), affordance and action possibilities are independent of human interpretation. Agency, is whether and how people understand this affordance, how they use it for their own purposes: the extent of influence an object's affordance has on the users. Agency, or perceived affordance, is relational, and depends on the capabilities of the user and how the space is seen by the user (Gibson, 2014). From groups of objects, group affordances emerge. As a result of interdependence, objects are often grouped together within a single unit (Carmona et al., 2012) (Potter & Wetherell, 1987) as people search for a logical story in the environment in which they find themselves (Gehl, 2011). Collins & Yearly (1992) describe this tendency of meaning-making as a means of dealing with an overload of information. Making object groups is also a process in which boundaries are constructed (Latour, 2005). These boundaries can be based both on both physical as social characteristics within a space. In this way, people and groups can appropriate a certain piece of public space and maintain it in a certain way. These territorial claims form an important part of "reading" and understanding public space (Kärrholm, 2007). John Urry's (2011) "Tourist Gaze" shows how having a different set of goals and expectations of a certain area generates a different kind of use and experience of a place. All these processes are important to consider when designing spaces with multiple functions and multiple intended users.

EFFICIENCY AND FLEXIBILITY

The problem statement describes monochronic spaces and the vacancies they produce on a daily basis, and proposes a more intensive use of space

by making clever use of urban rhythms. As such, spatio-temporal efficiency is the primary design aim to counteract this lack of use.

Spatio-temporal efficiency in this thesis is understood as the (anticipated) use of a space compared to its potential use during a given recurring time period.

Efficiency in this sense entails both human and non-human functions and activities. Spatio-temporal efficiency should also consider the quality of the individual spatial functions, which may decrease as a result of conflicting affordances between combined functions. The immediate problem that comes to mind when imagining a hypothetical world in which public spaces are perfectly designed to always be in use and every activity is pre-imaged and catered for at the exact moment it is required, is the loss of flexibility and spontaneous use of spaces.

Flexibility in this thesis is understood as the ease with which a space can be freely interpreted and used by any given person at any given time.

The term efficiency is criticized in the Habiforum publication 'nova cura' for being too instrumental and economic in nature. In fact, it proposes to replace the notion of efficiency with flexibility entirely in the context of polychronism. (RMNO and Habiforum, 2000) However, too narrow a focus on flexibility can present its own problems. Corner and Ivers (2018) describe the balance needed between the undefined open ended-ness of flexibility and design choices that deal with the day-to-day uses of space.

As such, both flexibility and efficiency are considered important markers for the success of polychronic design solutions, in which an optimum should be pursued.

1.3 KNOWLEDGE GAP
POLYCHRONIC DESIGN

KNOWLEDGE GAP
When considering tactics of achieving multifunctional land use, intensified, mixed and stacked uses are arguably already manifold in design thinking of contemporary urban development. However, the fourth method of multifunctional design of space: time, seems to be relatively overlooked. This is odd as *"time, and the related changes a place undergoes over years, seasons, days, and hours, are a given reality of landscape."* (van Dooren & Nielsen, 2019) *"Landscape is time materializing: landscapes, like time, never stand still"* (Bender, 2002, p103). While one would expect time to be central in landscape architectural theory and representation, this is not the case. (van Dooren & Nielsen, 2019) The integration of the temporal perspective into research and planning is not yet well established, while it could help to understand and improve upon societies and cities. It lacks attention on the level of everyday practices (Henckel, Thomaier, Könecke, Zedda, & Stabilini, 2013, p302). While practicing landscape architects do see time as a key feature, true focus on the topic is made difficult due to the lack of support from theory and best practice (van Dooren & Nielsen, 2019). Lynch already argued that urban designers need to understand activity patterns, how to encourage activities through different time periods, and how to achieve synergies from activities happening in the same space and time. He noted that, *"While activity timing is as important as activity spacing, it is less often consciously manipulated"* (Lynch 1981, p452). While long term change, seasonality, ephemeral events, public life studies, weather and climate are temporal components of landscape present in landscape architectural discourse, exact daily rhythms have yet to be properly explored as a practical design input. (van Schaik, 2011) Research on exact daily rhythms is required to produce a more practice-focussed discourse, to go beyond philosophical debate by bringing temporal discourse from different fields into a practical application. The expected beneficial impact upon spatio-temporal efficiency and the relationship this has to the flexibility can then be further examined.

1.4 CONCEPTUAL FRAMEWORK
LEADING THEORY IN THE RESEARCH DESIGN

USE OF THE CHRONOTOPE
Chronotopes can be understood as "a specific joint timespace" (Crang, 2005: 214). By using the concept of the chronotope, the thesis attempts to look at locations in time as equally dependent on their temporal as their spatial makeup. A morning park therefore belongs to a different chronotope than that same park in the afternoon. Chronotopes are partially repetitive and re-occurring as they are dependant of rhythms.

TIME-USE STUDY OF AN AVERAGE DAY
After consideration of several ideas on temporal data collection and representation among which time geography, Lefebvres rhythmanalysis and public life studies, time-use studies were selected as the most viable theoretical and practical approach to this research. This means that time is considered primarily by means of mechanical, clock-time, rather than by natural diurnal rhythms. For important diurnal rhythms such as dusk and dawn, average times will be used as well.

RIGIDITY IN SPATIO-TEMPORAL RHYTHMS
In this thesis, we are interested in the daily dynamics of how many people are expected to partake in a specific activity or to be present in a certain location at a given moment, in order to design places that can facilitate in these changing demands over time. The rhythms within the thesis therefore mainly consist of activity patterns. While design undoubtedly impacts these rhythms (e.g., having playgrounds near the house may increase the total amount of time children play during the day), this cannot be measured or estimated within the research and design processes. Therefore, they are perceived as being rigid and unchanging within this thesis.

TYPES OF FUNCTIONAL ALTERATION
If temporally compatible functions and activities are derived from the activity patterns, spaces need to be designed to fulfil these various spatial functions at different times. Three distinct types of alteration between these functions are suggested by means of passive, interpretational and active alterations between functions.

AFFORDANCE THEORY
In order to understand and describe how functions are made possible and communicated to their users, the thesis looks at urban landscapes through the lens of the affordance theory of Gibson (1979). This is done primarily through the concepts of affordances (what the space allows) and agency (how these affordances are communicated).

EFFICIENCY AND FLEXIBILITY AS AIMS
As described in the theoretical framework, efficiency and flexibility are defined as the criteria on which the design will be tested. A more in-depth description of these criteria is to be provided in order to fulfil their function as tools towards a qualitative design. evaluation.

1.5 DESIGN CONTEXT AND SCOPE
DAILY AND WEEKLY RHYTHMS OF OUD-HOOGRAVEN

SPATIAL SCOPE
The Netherlands is highly urbanised and contains many spaces of a relatively high building density and types of mixed-use urban spaces that nonetheless experience temporal vacancy. While any Dutch landscape deals with conflicting spatial claims in its own way, urban landscapes are among the most contested. Cities are dynamic, complex structures and therefore present the most interesting test cases with regards to polychronic design.
For the design case of this thesis, the south-west dock of the Vaartsche Rijn in Utrecht, the Netherlands is considered. This originally industrial site along the historical main industrial waterway of Utrecht has developed into a mixed-use neighbourhood containing still-functioning industry and city maintenance plots. Due to the ongoing expansion of Utrecht, the neighbourhood has, and will become increasingly central. This gradual transformation from industrial to residential neighbourhood has produced a strange collage of private and public functions, building types and styles, as well as a series of diverse, underused, and ill-connected public spaces and playgrounds. These add up to a waterfront with little to no connection to the waterway from both an experiential as a functional point of view. While the functions are diverse, they do not interact. Following a national trend (Vereniging Deltametropool, 2020) businesses gradually continue to leave the area and are usually replaced by housing, missing opportunities of coupling working and living functions. As the waterfront currently achieves little of the benefits mixed-use neighbourhoods potentially provide, it presents an interesting case for researching a transition from a mixed-use neighbourhood to a polychronic one. There is an opportunity for interweaving functions and rhythms through design, due to the untapped temporal variability of the different types of space and the different users of the area. Furthermore, the Merwedekanaalzone, which is currently being developed as a highly densified housing development, will be connected to the neighbourhood, potentially bringing forth a new stream of users and commuters, increasing the pressure on the public urban spaces.

The neighbourhood contains several typical spatial features for the Dutch urban context. Four such typologies are distinguished in this research. They contain a neighbourhood park, narrow living streets, wider living streets with central open green spaces, and local business spaces.

TEMPORAL SCOPE
Due to the knowledge gap presented, time and rhythms will be regarded in the context of a typical, single day, both in the week and the weekend, as the daytime rhythm is expected to be very different during the weekend. Deep deliberation about seasonality, annual occurrences, events, or temporal perception lies outside of the scope of this research. While aware of the subjective nature of time and the tension between natural cycles and mechanical cycles, for the sake of clarity, time will be referred to in hours, minutes and days. Rhythms are regarded as completely repetitive in nature, in a certain state of rigidity, in order to explore the potential of overlapping them. How spatial design influences daily rhythms also lies outside the scope of this research.

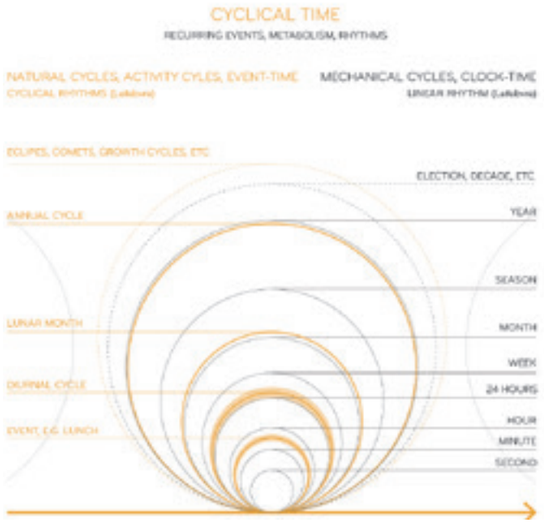


Image 1.5. A depiction of the relationship of two dualities within the concept of time: linear and cyclical time, and natural and mechanical cycles. This thesis will focus on cyclical time, with emphasis on the weekly cycle. (image by author, based on (Zerabuvel, 2003: preface))

1.6 RESEARCH STATEMENT
OBJECTIVE AND CENTRAL QUESTION

RESEARCH OBJECTIVE
The research objective is to explore polychronic design in a practical sense. It aims to understand how daily urban activity patterns can be utilised to inform design choices that result in a more efficient and flexible use of space.

In order to achieve this, the research aims to gather and describe relevant urban rhythms. The analysis of these rhythms should lead to temporal design strategies. This should lead to polychronic design programmes for individual typologies in the neighbourhood of oud hoograven. Making use of this programme, the research then aims to explore the practical side of polychronic design processes. The research finally aims to evaluate the outcomes of this design process in terms of their efficiency and flexibility.

This research aims to draw attention to the temporal aspect of designing spaces by exploring practical methods for designing polychronic spaces. It thereby aims to help bridge the application gap between knowledge on urban activity patterns and the practical applications thereof in urban landscape design as described by van Schaik (2011).

CENTRAL QUESTION

as such, the following question is leading within the thesis:

How can polychronic design solutions contribute to more efficient and flexible urban environments?

This question can be subdivided in 3 research questions and a design question:

research question I
what are the relevant urban rhythms for designing polychronic public spaces in the urban context of oud-Hoograven?

research question II
How can these rhythms be employed in designing polychronic programmes for oud-Hoograven?

research question III
How can the efficiency and flexibility of polychronic design solutions be assessed?

Design question
How do the polychronic programmes translate into polychronic design solutions for the selected urban typologies in the neighbourhood of oud Hoograven, and how do these contribute to more efficient and flexible urban environments?

METHODOLOGY

"time, and the related changes a place undergoes over years, seasons, days, and hours, are a given reality of landscape."

(van Dooren & Nielsen, 2019)

2

2.1 METHODS AND MATERIALS
THESIS RESEARCH DESIGN

The central question of this thesis is as follows:

How can polychronic design solutions contribute to more efficient and flexible urban environments?

This question has been subdivided in three research questions and a design questions, which are answered in turn.

research question I
what are the relevant urban rhythms for designing polychronic public spaces in the urban context of oud-hoograven?

Regrouping a time-diary dataset
In order to answer this question, a reliable method has to be found for the analysis of rhythms, several of which have been discussed in the theoretical framwork already. Field observation has been determined as being an unreliable source of information, as this thesis was written during the corona pandemic. This has severly altered how and when people use public spaces during this time. Therefore, demographic data will be combined with the most recent large-scale national time-use diary study (SCP, 2016). This data describes the weekly time expendature of over 4000 respondents of varying ages, economic backgrounds and living environments, recorded during different weeks throughout the year. This data can be used to understand the rhythms of individual activities throughout the week. These activities can then be grouped together to reflect information relevant to the design of public spaces. This produces a model of how people of the neighbourhood spend their time in public spaces during an average day, both during the week as in the weekends.

Conducting semi-structured interviews
Additionally, some semi-structured interviews will be conducted during the analysis phase with local business owners and associations, to give an addittional impression of (spatio-temporal) needs and requirements of each stakeholder. An interview was also conducted with an urban ecologist.

research question II
How can these rhythms be employed in designing polychronic programmes for oud-Hoograven?

SPATIAL ANALYSIS
This research question requires addittional insight into the spatial situation of hoograven in order to approach the temporal design process. Standard geographical data is obtained through open source GIS-clients such as topotijdreis, pdok viewer and opentopo. This includes data on the history and development of the area, the soil, hydrological aspects, height and topography, vegetation pattern and ecological relations as well as existing built and constructed elements. Additional understanding of the space is gathered by a wide range of site visits at different times of day all throughout the year, made viable by the proximity of the design area to the authors home. The site analysis produces additional starting points for the design, as part of the brief for this design excersise.

SITE ANALYSIS
For the design question, 4 urban typologies have been selected:

1. An urban park (the van Arkelpark)
2 A work environment (The municipal harbor)
3. A narrow residential street (v. hoogravenseweg)
4. A wide residential street (Julianaweg)

Each typology will have different spatial challanges and contexts, requiring different solutions. These specific challenges are also adressed for each typology as part of a more site-specific design brief.

Defining design strategies
The analysis of the urban rhythms will contain two steps. One regards problems and potentials with regards to the overall use of public space throughout the day. The second step is to dive deeper into the individual rhythms, in order to define temporally compatible rhythms methodically. This analysis is expected to result in several useful polychronic design strategies. In combination with spatial information on the the individual typologies, polychronic programmes can be devised by combining temporally compatible activities.

research question III
How can the efficiency and flexibility of polychronic design solutions be assessed?

In order to answer the central question of the thesis, evaluation of the design is required. This evaluation needs to be transparant, and in light of this indicators are used to represent the concepts of efficiency and flexibility. These indicators have been described by means of an evaluation rubric that is elaborated upon in the analytical framework (chapter 5).

In this thesis, the hypothesis is that polychronic design can positively influence both the spatio-temporal efficiency and the flexibility of urban spaces in different capacities. A fully efficient space is likely detrimental to certain aspects of flexibility, and vice versa. This tension between the outcomes of the indicators is expected to be observable in the evaluation of the designs.

Design question
How do the polychronic programmes translate into polychronic design solutions for the selected urban typologies in the neighbourhood of oud Hoograven, and how do these contribute to more efficient and flexible urban environments?

SITE DESIGNS
By implementing the polychronic programmes in the spatial context of oud hoograven, a design step is made to explore design solutions in respective urban typologies.

EVALUATION
By means of the analytical framework, the designs are evaluated and compared.

EXPLORATIVE RESEARCH
Due to the explorative nature of the research, the idea is to provide many different practical examples of spatio-temporal design to review, in order to get a grasp of its limits and capacities. As such, the outcomes consist of individual designs for various locations, rather than a research-through design setup in which the best possible outcomes for specific markers are explored. This step of optimalisation is interesting to explore in further research, once the general potential of chronotopic design for the the fields of landscape architecture and urban design is better understood.

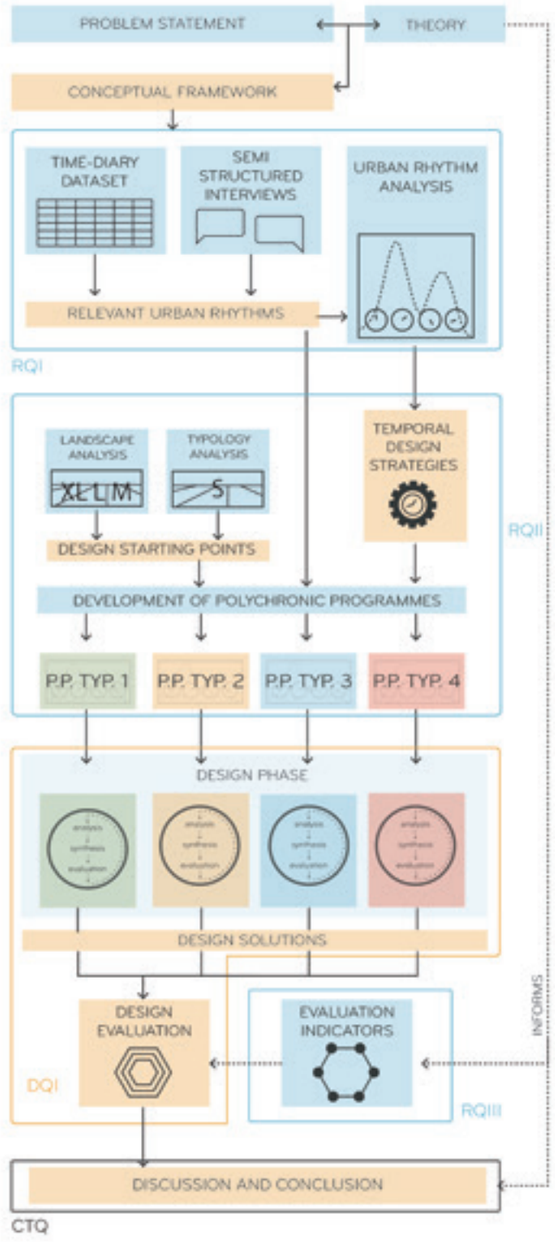


Image 2.1. A schematic overview of the different steps within the thesis. (image by author)

SPATIAL ANALYSIS

"The path dependencyof human activity means that the current spatial organization is a logical starting point for analysing the future or potential use"

(Rodenburg & Nijkamp, 2004).

3

3.1 SITE ANALYSIS
HISTORICAL ANALYSIS

A HISTORY TIED TO THE VAARTSCHE RIJN

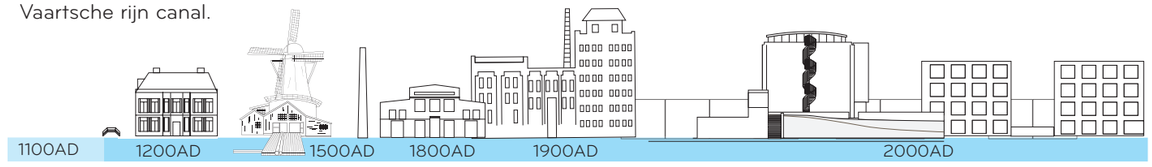
The city of Utrecht was founded as a roman settlement around 47 A.D. The campaign of preparing the lower-lying soils of Utrecht for agriculture took place in the 11th century by means of the cope system. The area stayed thinly populated for a long time as the farmers exploiting the land generally lived at some distance of the land. While the heavy clay soils were mostly used for grassland, some exploited the land for crops which eventually led to land subsidence and super-fluous water. One of the first water-pumping windmills was built to tackle the problem (Santen et al., 2005). For a long time, Utrecht was connected and supplied by the Kromme Rijn. This water-way became unnavigable due to the placement of a dam around 1122. The Vaartsche Rijn, one of the oldest still existing artificial waterways of the Netherlands, was dug, connecting to the Hol-landse Ijssel. The canal also helped drain surrounding polders. Farmers would produce vegetables at their homesteads and would sell and trade their farm goods for goods with urban craftsmen in the city (Aorta, 2006). As the canal became an important route into the city, a fortress was built along the canal: "de Engelenburg". This triangular construction first mentioned in 1541 was used to showcase those who were executed by the gallows by the city of Utrecht until the end of the 18th century, as a warning to those who entered the city. On the western bank of the canal, the Jutfaseweg became part of the 'route imperiale' under Napoleon's rule. On the eastern bank, an informal path, later dubbed "the church path" was used.

In the 16th century, the banks of the Vaartsche Rijn became dotted with sawmills. These were fol-lowed by a rich and enduring history of brick and (roof)tile industry. These factories were often accompanied by small estates belonging to the business owner containing luxurious buildings and gardens. The factories also often included housing for the workers. As technological ad-vancements continued, the Vaartsche Rijn became home to other industries benefiting from the water connection such as chemical cleaners and factories for tools, machines and even lingerie. Due to the fact that Hoograven was a part of the distant municipality if Jutphaas instead of Utrecht for a long time, almost no investments were made in the area by either municipality. This left the area without running water, roads, electricity and education for a long time. Due to this neglect in the public realm from both municipalities, the local industry started to invest in public works, health and education, albeit minimally. Throughout history, education was partly financed by the brick factories, local companies invested in a health fund, the first running water was pro-vided by the water company instead of the municipality, and the first bridge from Hoograven to Rivierenwijk, the Juliana bridge. was constructed by the local industry (Santen et al., 2005).

Around 1870, The Nieuwe Hollandse Waterlinie (NHW), was constructed to include the city of Utrecht. The NHW was built up from a series of inundation systems such as sluices as well as defensive fortresses and bunkers. Due to the relatively high and dry placement of the city, little land could be naturally inundated, leading to a high density of defensive structures. The fortresses were surrounded by a "forbidden circle zone", in which strict building codes ensured a free firing zone for the fortresses. Due to these building codes, the eastern part of Utrecht remained unbuilt for a long time. During the construction of the Julianalaan in the 1930's was built, it was done in a way to be as unobtrusive to the forbidden circles as possible.
The Vaartsche Rijn canal had become an important connection between Amsterdam and Cologne over the years, but soon proved insufficient. Therefore, a new canal was dug in 1881: the Merwede canal, connecting Amsterdam, Utrecht, Vreeswijk and Gorinchem. The northern part of the Vaartsche Rijn lost its function as a trade route. Up until the end of the 19th century the water continued to be the most reliable mode of (personal) transportation but lost its importance with regards to personal travel as well. In 1952 The Amsterdam-Rhine canal was opened. De Vaartse Rijn had now completely lost its trade function and housing slowly started to replace the waterfront-oriented businesses (Aorta, 2006).

Image 3.1
The waterways of utrecht have defined oud-hoograven throughout the years. Now, the canal has largely lost its original function and meaning. Still, the history of the canal has had a mayor impact on the built environment.

Image 3.2
A timeline of the Vaartsche rijn canal.



1100AD	1200AD	1500AD	1800AD	1900AD		2000AD
land brought into culture	The Vaartsche rijn canal was dug and taken in use as main tranport route	canal attracts busines, many of which saw-mills, as well as estates.	development into an industri-al area, mainly brick and tile factories	NHW in-cludes Utrecht as part of the line.	The Merwedecanal has been dug and the Julianaweg is built with the NHW in mind.	factories make way for office buildings and warehouses. Nieuw-hoograven is built behind the Julianaweg.	Oud-Hoograven is less and less a peripheral zone. Business makes way for housing

Image 3.3 The design site itself lies almost exclusively within the original terrain of the van Arkel brick and tile company. The aerial photograph shows the spatial make-up of the terrain as having large factory buildings with smaller compounds of elongated buildings meant for drying the bricks. The terrain also included housing for the workers. The highlighted building still exists, and marks the northern border of the design site. (image by Utrechts archief, 1928)

Image 3.4 The julianalaan is the other pre-war backbone of oud-hoograven besides the canal. It got its unusually monumental elongated shape as a result of the NHW. Its central axis served as a water connection for the inundation system, causing the wide profile. Its length is due to proximity to the forbidden circles of the many eastern NHW fortresses. The new neighbourhood had to be as unobtrusive to the free firing zone as possible. The van arkel terrain and the white house are marked in white and red respectively. (image by Utrechts archief, 1938)

3.2 LANDSCAPE ANALYSIS
DESIGN STARTING POINTS ON A CITY SCALE

The history of Oud hoograven is still visible in the current land-use map of the city of utrecht. Its most telltale signs are the strong axis of the canal and the Julianaweg, with the mixed characteristics of the former industrial strip logded between them. The Engelenburg and the churchpath are no longer present today. Today, Hoograven is mostly a living environment containing some private and public functions. Its distance to the inner city make it possible to cycle there quickly, but for pedestrians it lies relatively far away. As such, qualitative local public spaces, public functions and shops are of importance to the inhabitants of Hoograven, who cannot be expected to rely solely on the inner city amenities. At this scale level, four observations are made relevant to the design.

Image 3.5 →
A land use map to provide an overview of oud hoograven and its location in the city.
(OSM, 2020)

Image 3.6
analysis and related design starting points.
↓

Water
Roads
Paced spaces
Buildings
Open green spaces
Natural spaces/woods
Sports fields
Borders Oud-Hoograven
Design site

INCREASING URBANITY
With the development of Tolsteeg and the planned development of the Merwedekanaalzone the design site is situated in an increasingly central urban position with an increasing number of inhabitants and users of increasingly diverse socio-economic backgrounds. This will increase the pressure on public spaces in the area.

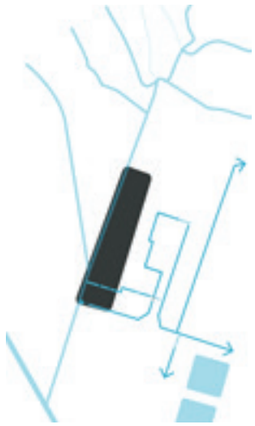
▼
INCREASE POTENTIAL OF PUBLIC SPACES FOR VARIOUS USERS

A PLACE OF MOVEMENT
the area is situated in short distance to both the ring of Utrecht and the city centre, resulting a high connectivity for slow and motorized traffic alike. There are suitable main arteries to divert the traffic away from the living environment, but there is a danger of cut-through traffic due to the welcoming road systems of the neighbourhood.

▼
EMPHASIZE LIVING FUNCTION OF STREETS OVER THE MOBILITY FUNCTION

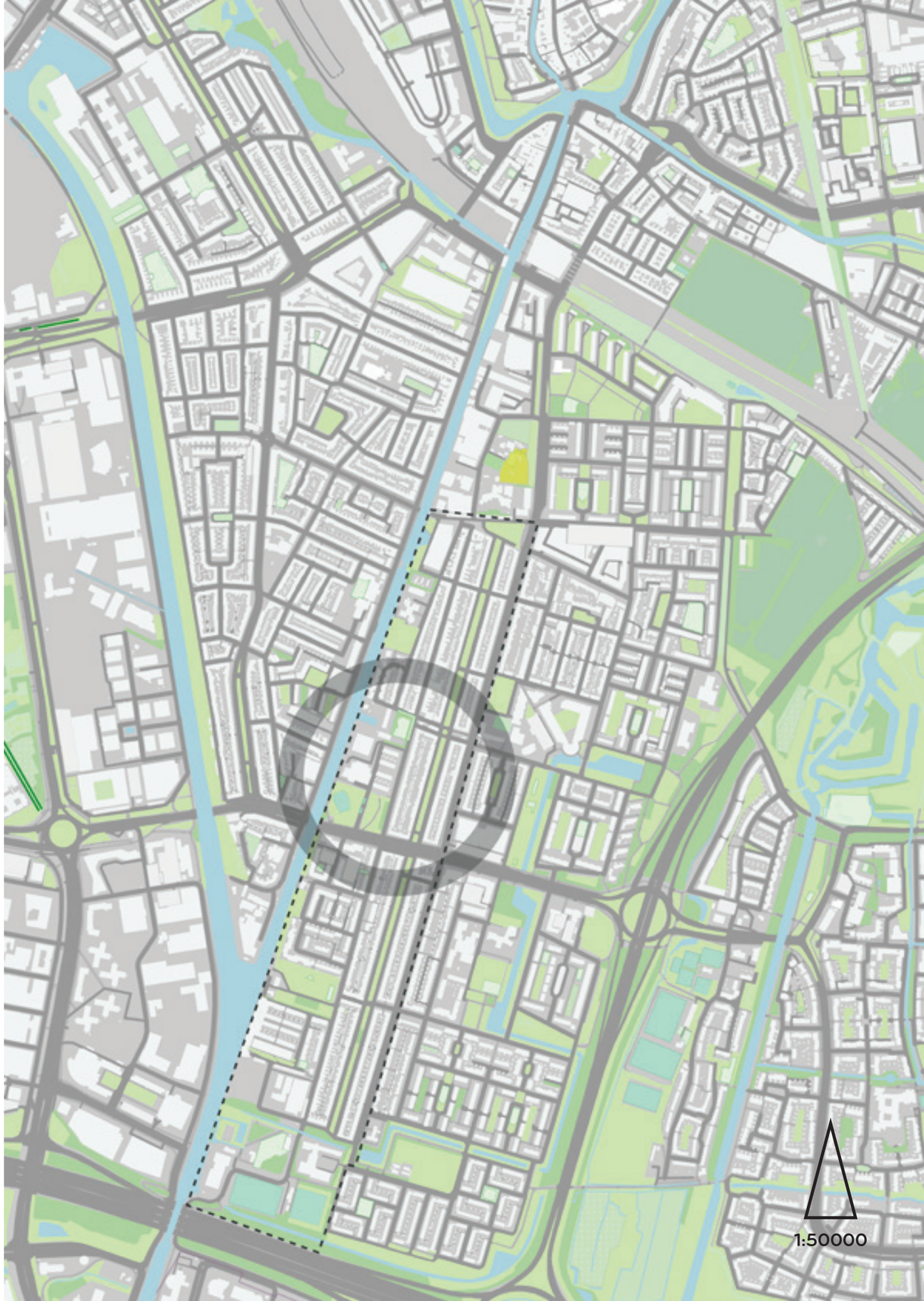
FRAGMENTED GREEN
While the area contains several dedicated green spaces, mostly along the canal, yet they are disconnected from one another for humans and nature alike. The potential of the waterway and the julianalaan as a green zone are largely unexplored and the green zones are scarcely layered, consisting largely of lawns and trees.

▼
CONNECT GREEN STRUCTURES OF THE CANAL AND THE JULIANAWEG



WATER CONNECTIONS
The main waterway is quite rigid with steep edges, barring the ecological function of the canal. The human connection to the water remains largely unexplored as well, as there is no continuous route along the water, and the design of the public space is largely unconcerned with the waterfront experience.

▼
CONTINUOUS ROUTES AND SPACES LINKED WITH THE WATER



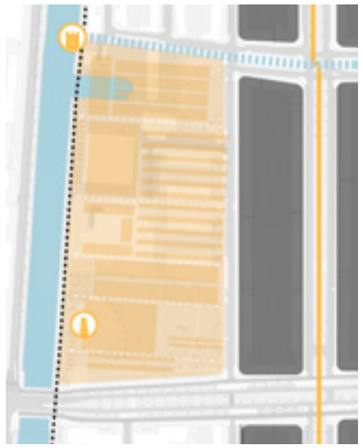
3.3 LANDSCAPE ANALYSIS
DESIGN STARTING POINTS ON A NEIGHBOURHOOD SCALE

Zooming in from oud Hoograven to the former van Arkel terrain, the spatial makeup of the neighbourhood becomes clearer. Two main axes: the canal and the Julianaweg, surround the historic industrial zone along the canal, which is diverse in form and function due to the gradual replacement of water-bound industries with public functions, offices and housing blocks. 4 urban typologies have been selected within the former van Arkel terrain. These are made up of the neighbourhood park environment, the working environment, and the wide and narrow living streets.

While the neighbourhood is well mixed in functions, its functions are rather monofunctional and do not interact well with one another. Analysis of this scale leads to the conclusion that the local history is poorly legible in the space, the pedestrian connections are awkward and discontinuous, and the greenery can be more layered, better connected and more in line with the waterfront. This historical industrial waterfront therefore has a lot of untapped potential with regards to history, connectivity and ecology.

Image 3.7; The former van Arkel terrain.
The map shows the typology zones, as well as the current functions of the various buildings and public spaces. The building at the top left is marked as it is the same building found in the historical photographs, earlier in this chapter. The van Arkel terrain has been selected due to its singular history, diverse functions and ample amount of interesting public and privatised open spaces along the canal. This presents ample design opportunity. The large road in the south is the t'Gooylaan, an important connector and a generally busy one-lane road. With the exception of the need to reach the working environment with vehicles during the daytime, the rest of the road systems in the neighbourhood are living streets only, they do not serve a connecting role for other parts of Utrecht.

IMPROVING HISTORICAL LEGIBILITY

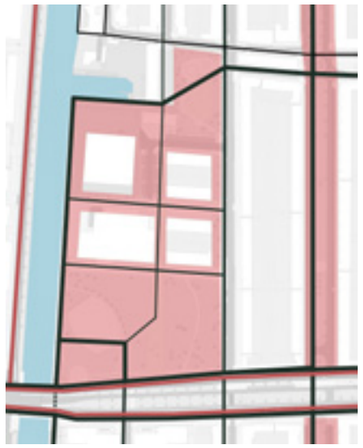


1:5000

Image 3.8

This map gives an overview of the most important historical layers of the site. These should be made more legible in the redesign.

IMPROVING SLOW CONNECTIVITY



1:5000

Image 3.9

This map presents a schematic overview of important connections to be made in the redesign. The red zones are imagined as a continuous public space.

IMPROVING ECOLOGICAL VALUE

1:5000

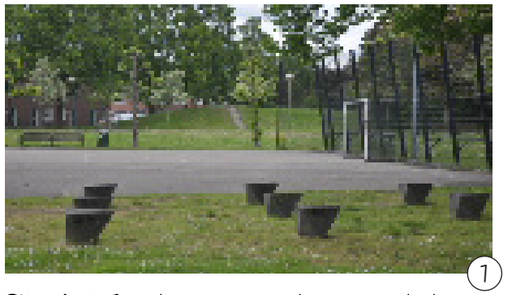
Image 3.10

This map presents an overview of existing green zones, imagined connections and green roofs. The existing habitats can be improved upon by means of more diverse and layered planting.

3.4.1 TYPOLOGY ANALYSIS
THE VAN ARKELPARK

The van Arkelpark is a relatively small park of roughly 1.3 acres, currently characterised by a large field in which the main feature is a sports court. Partly due to the location next to the water, this field is surrounded by a fence structure. Other features include a large central axis which currently leads nowhere in particular, as well as a hill marking the east side of the park. Strengths of the park are the variety of old and large trees, the multifunctionality of the eastern hill (seating, play, etc), the visible location and the potential link to the public function of the sports hall at the northwest border of the park. Issues include the absent connection of the park design to the water, and the dominance of grass and trees over other types of planting. The sports court also leaves little room for proper use of the green areas as they are diminished to subordinate, awkward spaces. With a dense local urban expansion on the way along the Merwede canal, the demand for qualitative public green space will only increase in this location.

The park is currently mainly consisting of lawn, and could do with a lot more public programme in general. Due to the nature of the park, these activities should include sports, play and leisure activities, but also attract users for social gatherings. The canal should be more included in the park design as well. The sports halls' potential to activate the more should be utilised. The hill is already an attractive feature of the park but could be elaborated upon further. The current sports court has been observed ti be well-used, affording sports, skating and play due to its hard, smooth surface area. The park design should include both green and a qualitative paved spaces and present these as different but equally important destinations, instead of merely using lawns as filler spaces without any clear agency.

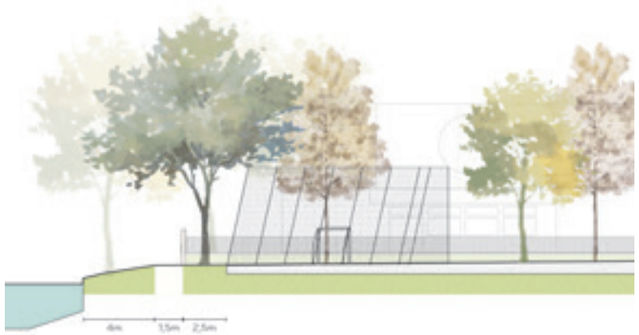


Site photo 1: *solitary seating elements with the sports court and the hill in the background (image by author)*

Site photo 2: *The two levels at the sports hall create an interesting effect along the water edge, but the paths lead nowhere and the spaces have no clear function (image by author)*

Site photo 3: *The park contains large, longitudal sightlines. all of them lack points of reference, making the park feel both neglected and unfinished (image by author)*

Section A-A': *The space behind the sports hall is used as a small parking lot. While the spaces beside the water read as routes, they are stopped deads in their tracks at the end of the terrain. (image by author)*



Section B-B': *the cage distances users from the water's edge. While the paved surface itself is used quite regularly for sports, it has little relation to the water edge, which offers few methods of interaction. (image by author)*

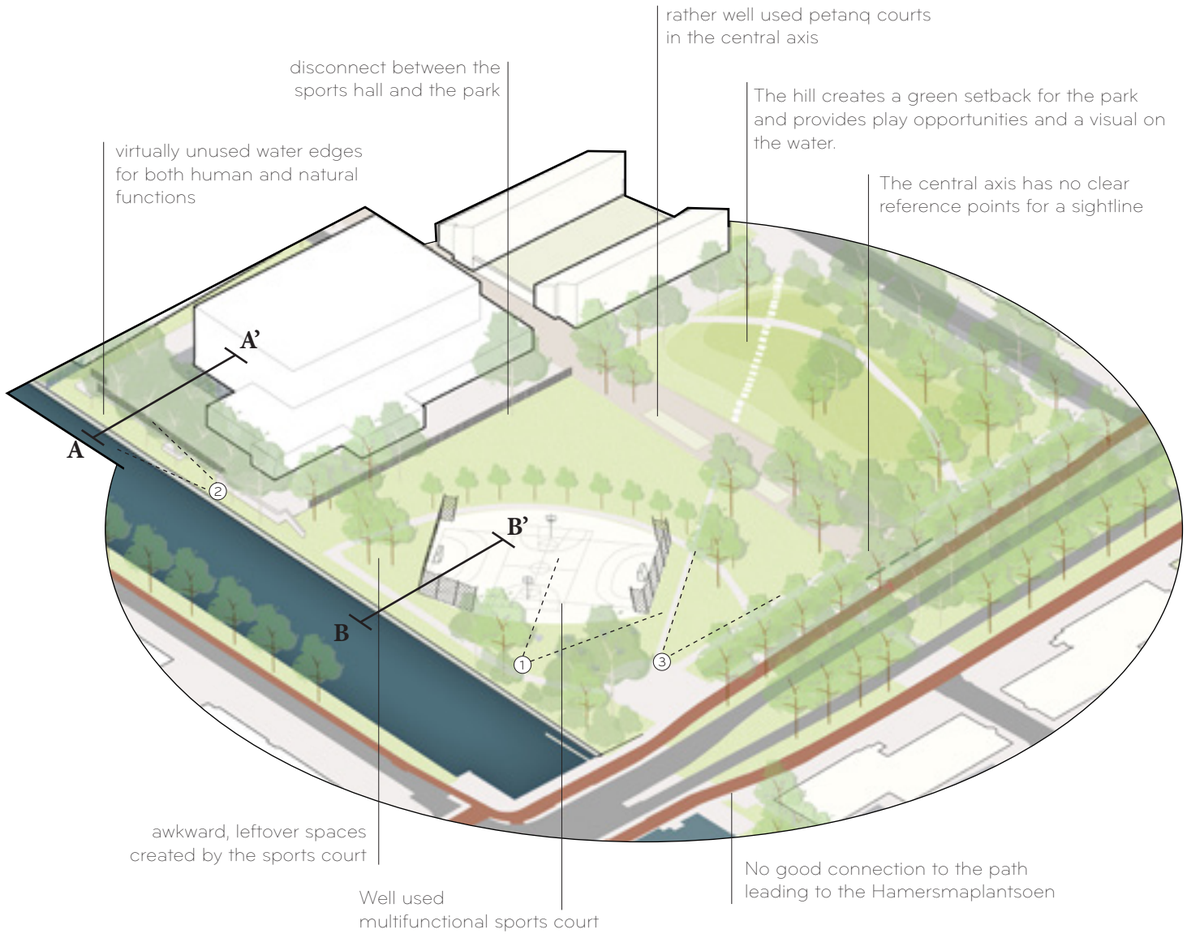


Image: 3.11 The van Arkelpark in axonometric view photo and section locations are shown in this visual (image by author)

3.4.2 TYPOLOGY ANALYSIS
THE WORKING ENVRIONMENT

The working environment is characterised by its large private area along the water. It primarily consists of the municipal harbour, the Romal company and the local scouts. Both working functions are on land owned by the municipality, and therefore under threat of relocation under the pressure of housing demands.

The municipal harbour serves many purposes. The harbour facilitates barging services, maintenance on water works, the collection of waste by boat and vehicle, storage of municipal vehicles and other municipal property as well as the temporary storage of confiscated boats. The boats of the municipal harbour also supply inner city businesses. The boat responsible is known as the "beer boat". In general, however, the municipal harbour is currently in use as something in between a shunting yard and a garbage dump, and its setup as of now allows for little other functionality. When considering the possibility of opening the waterfront to the public in the evenings and weekends, care has to be put into how these rather rough urban functions can coexist with a qualitative urban space.

The Romal building is surrounded by a paved area of over 2000m2. While the terrain needs to be accessible to vehicles, it does not require such extensive amounts of paving. The waterfront connection is not used by Romal. The terrain is currently blocked of by a fence on both sides along the water. The terrain is effectively only used during the daytime.

The area also houses the local scouting, who are active only during the night and during weekends. They would like to have access to a more open, natural space than the playground, as well as to the water. They are willing and able to move their building in order to improve their situation.

The focus of this typology is finding a way to combine public space and working space in a way that the work is not hindered. Ideally, functions even enhance one another, for instance by utilising the character and liveliness of the work area to enhance the public functions.

1

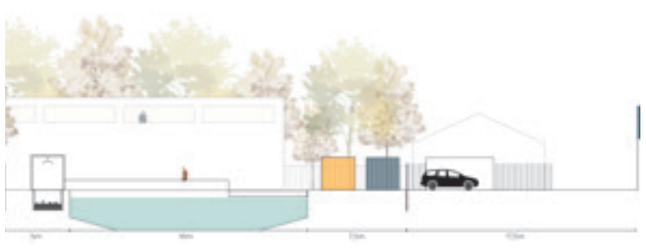
Site photo 1: *Due to the the municipal harbor serving many different logistic functions, the waterfront is messy, full and inaccessible. (image by author)*

2

Site photo 2: *The Romal terrain is a rather bleak, paved space. Romal does not make use of the water for transport, is supplied by means of trucks. (image by author)*

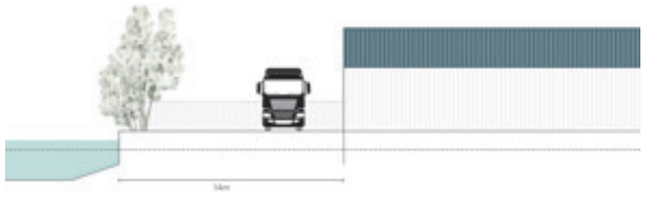
3

Site photo 3: *View on the scouting building and the romal office part of the building. The scouting has boarded off their building for fear of vanadalism. (image by author)*



C C'

Section C-C': *The municipal harbor conists of a narrow strip of land around the water. The northern (c) side of the water is outfitted with sunken containers for resources. The*



D D'

Section D-D': *The Romal loading bay: trucks line up close to the entrance of the building, instead of entering it in a full turn. This leaves a lot of design space as it is not needed to make the full width of the loading bay car-accessible. (image by author)*

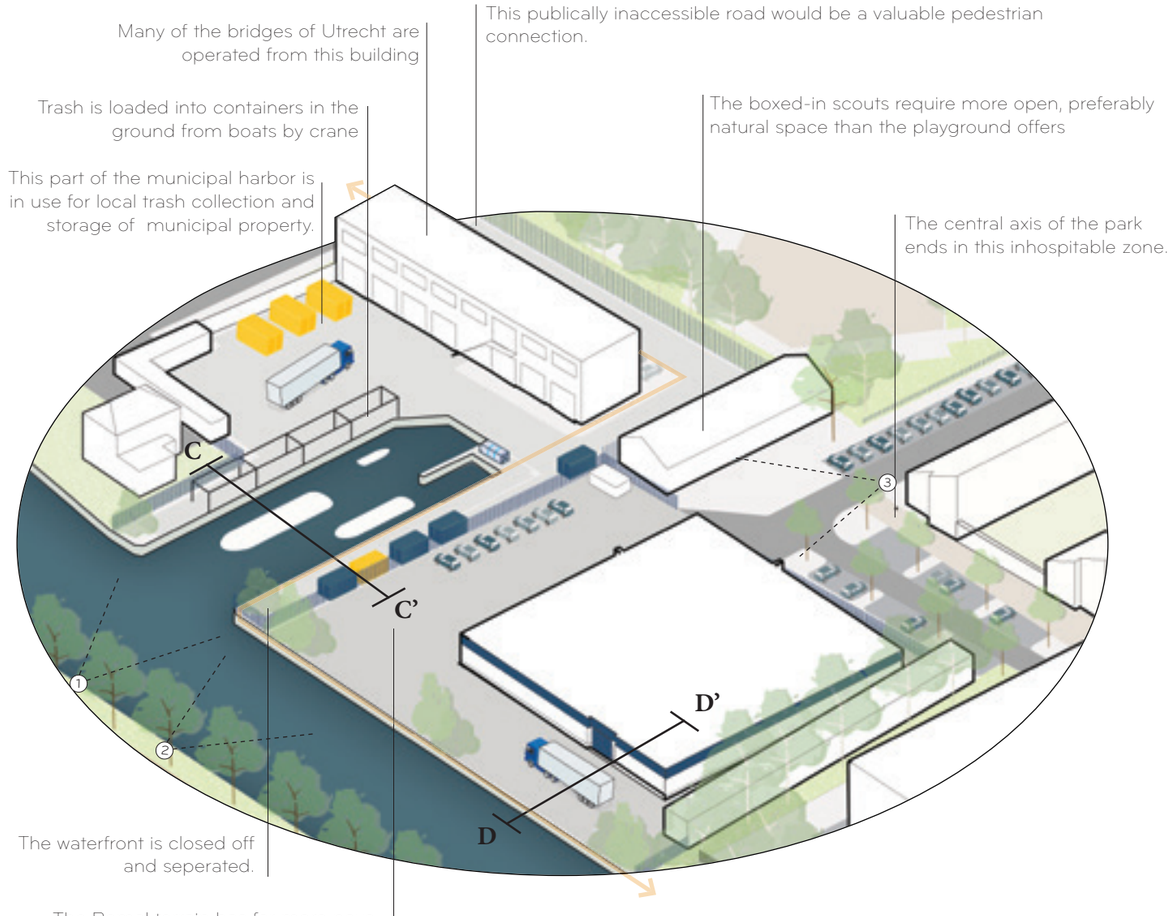


Image 3.12: The Working environment in axonometric view.photo and section locations are shown in this visual. (image by author)

3.4.3 TYPOLOGY ANALYSIS
NARROW STREET

TYPOLOGY 3

The verlengde Hoogravenseweg is a typical example of a residential street that is nearly completely in service to motorised mobility. Due to the street serving mainly as a living street, there is a potential for additional activities in lee traffic moments. The current state of this elongated street of over 1.4 km solidifies the road as a continuum and leaves little room for interpretation. On the east side of the street the buildings continue in a similar way for most of the street. The west side of the street is open, showcasing the variety of the former industrial strip of Hoograven. A connection between the programme of the street and the public spaces on the west side could be explored.

The design will examine the potential of combining access of cars with more local life-related activities such as play and relaxation. This typology is thus dependent on the traffic rhythm and requires activities that peak in when there is little traffic and few of the cars are present on the parking space.

Image 3.13: View from the centre of the verlengde hoogravenseweg The street profile is simple, but car-dominated. The street is generally bordered by greenery or public functions on the west side (left in the photo) of the street. *(google streetview, 2018)*

Image 3.14: view on the street from the sport hall and the rental homes. The west side of the street opens up to the various spaces in the former industrial strip of the canal. The housing block of the verlengde Hoogravenseweg will thus be the backdrop of the glimpses through the industrial zone the design seeks to create as a reminder of the brick factory legacy. This particular space is a square-like space between the rental homes next to the sports hall. It could incorporate the streetscape as a part of this whole in a redesign, connecting the street to the programme. *(image by author)*

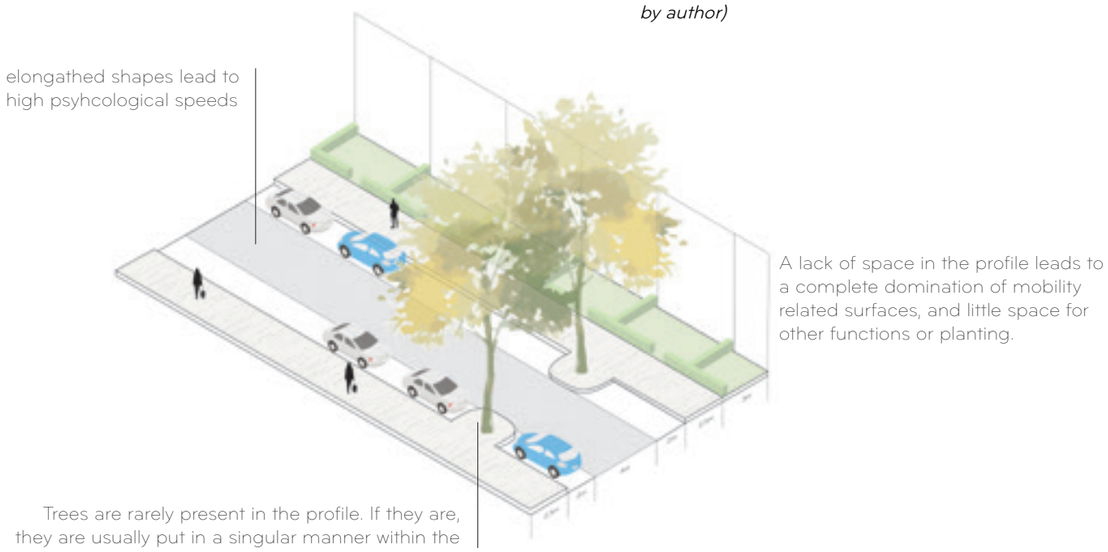


Image 3.14: The Verlengde Hoogravenseweg in axonometric view (image by author)

3.4.4 TYPOLOGY ANALYSIS
WIDE STREET

TYPOLOGY 4

The Julianaweg is another elongated street of about 1.4 km in length. the streetscape is relatively wide, with one-directional streets on each side of a central green strip. The green strip consists mainly of lawn, and the position in between the roads and cars makes for an unattractive, vulnerable space. While the road looks like an important connector, its elongated shape and wide profile come from its history as part of the NHW during which the road contained an inundation ditch and a covered road. Rather, the main artery to and from the city centre is the W.A. Vultostraat, which lies one block to the east. As such, these roads are only needed for destination traffic. Cars in the city are contested in general. For the purpose of using various functions in the same spaces however, this thesis will try to incorporate car-centric infrastructure into other residential functionalities during lee moments of traffic. Other site-specific design starting points are to decrease the psychological speed limit of the space and to use the wide profile to create an ecological corridor and places for neighbourhood activities throughout the day. However, the design should also maintain valuable trees and shrubs, as well as communicate its NHW-related history.

Image 3.15: View from the central axis
several centrally placed green structures in the axis further limit the usability of the green space. Cars parked within the curb of the field limit the experience further. (image by author)

Image 3.16: View from the central axis
The old trees and the lawn do give a lot of quality, but space is hardly ever used due to its location. A "slow peter" sign is indicative of the many young children that live in this neighbourhood, and the high speeds people tend to use in such elongated spaces. (image by author)

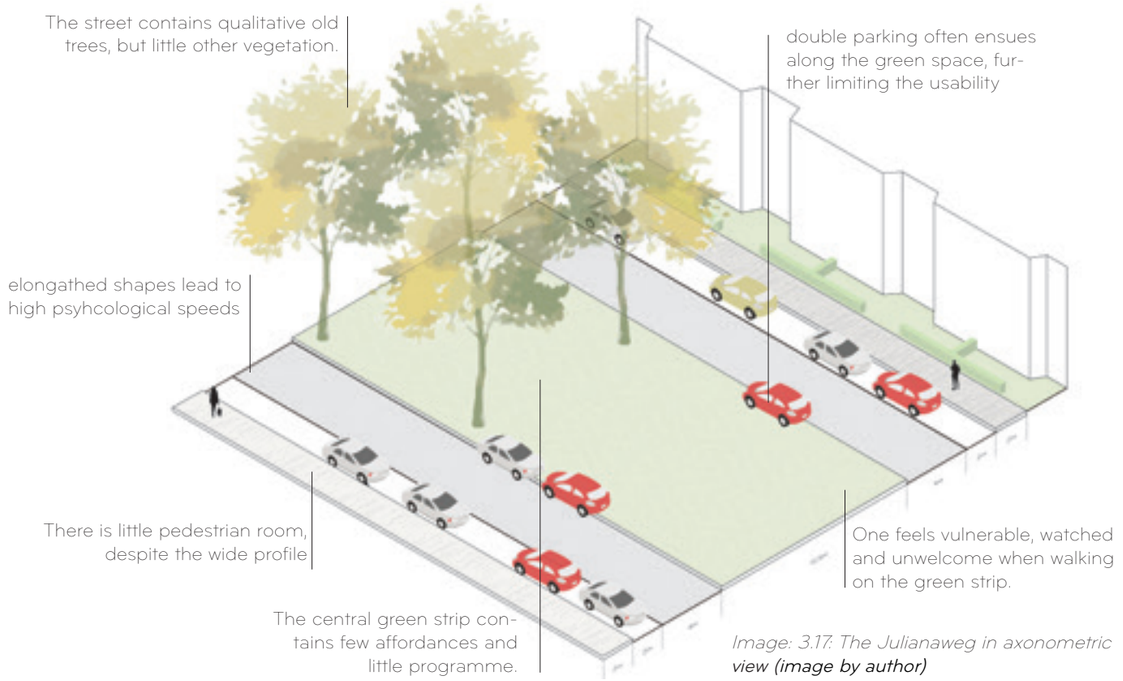


Image: 3.17: The Julianaweg in axonometric view (image by author)

TEMPORAL ANALYSIS

"Landscape is time materializing: landscapes, like time, never stand still"

(Bender, 2002, p103).

4

4.1 TEMPORAL ANALYSIS
THE TIME DIARY RESEARCH AND RELATED SCHEMES

TIME USE DIARY STUDIES
Every 5 years, the Dutch government conducts a time diary-based research to create insight in how its citizens spend their time. The 2016 study, which is the most recent dataset at this time, has been used for this thesis (SCP, 2016). The study contains detailed information of over 2200 respondents of varying age, gender, living environments, income, etc. Each respondent has filled in a time diary for a full week, as well as an accompanying questionnaire. In these diaries respondents report their activities in a week in ten-minute time slots. These activities have been coded and gathered in a data sheet. Using SPSS and Excel, the data can be used to generate insight in the amount of people participating in a certain activity during a certain time of the day.

STEPS TOWARDS APPLICABILITY
In order to produce the relevant rhythms for oud-Hoograven, some alterations have been made that are de-scribed in the appendix. This chapter will focus solely on the results of the research. The rhythms in this thesis are presented by means of two types of interrelated graphs. **the activity pattern graphs** (image 4.1) and **the peak-use graphs** (image 4.2).

ACTIVITY PATTERN GRAPHS
Activity pattern graphs shows the total amount of people participating in a certain activity at a certain moment for both weekdays and weekend days. It runs from 00:00 until 24:00 and has been divided in 5 temporal sections: morning, afternoon, evening, night and midnight. The example graph shows a single rhythm: that of fitness (image 4.1). Combining all activities from the research provides a complete model of the time expenditure of the people Hoograven (image 4.3). The complete overview of all these rhythms, their makeup and their related codes as well as their related activity pattern graphs can be found in the appendix.

PEAK-USE GRAPHS
From the activity patterns, peak moments of the day are derived. In the example (image 4.2), fitness peaks during the morning in the weekend, and at night during the weekdays. This can be represented in a peak-use graph, which shows the peak use moments of the day of a single activity during the weekdays and weekends. This simplification is done to aid legibility and eventually the applicability of the individual rhythms.

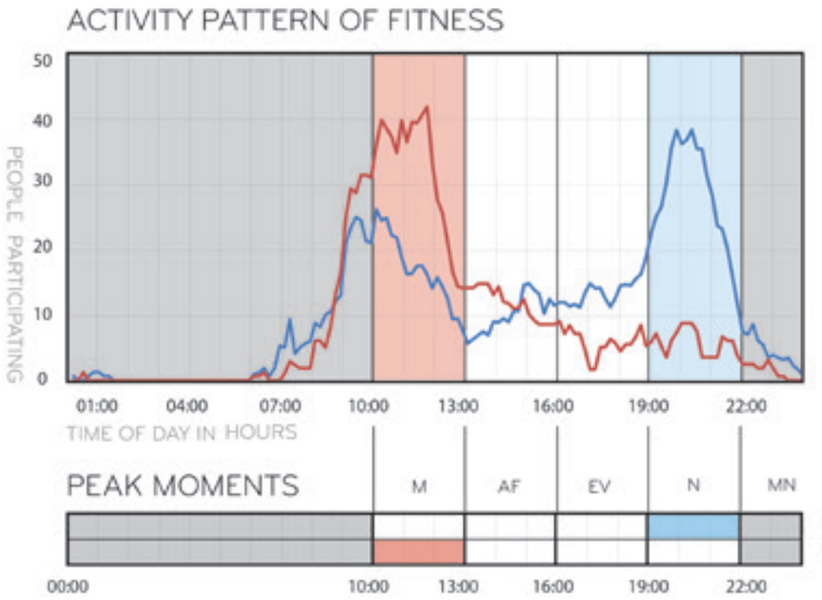


Image 4.1
The activity pattern graph of fitness.
(adapted from SCP, 2016)

Image 4.2
The peak use graph of fitness.
(adapted from SCP, 2016)

4.2 TEMPORAL ANALYSIS
TEMPORAL DESIGN STRATEGIES

TOTAL USE OF PUBLIC SPACES
By isolating the activities that are likely to take place in the public space, an activity pattern graph of the public activities of the people of hoograven can be generated (image 4.3), which plots the time of day against the amount of people active in public spaces at a given time. This gives insight in how public space is used in general throughout the day and its analysis provides the first conclusions of the time-diary research, which are visualised in image 4.4. These conclusions are as follows:

1. There is a significant difference between the combined required space for each activity and the actual use of public space.

2. Human use of public spaces is unevenly distributed over the different times of day overall.

3. There is a significant increase in demand of public spaces during the weekend.

DESIGN STRATEGIES
All the conclusions describe variances which produce some form of temporal vacancy through an uneven use of public space. In order to deal with these realities, three design strategies have been defined:

1. STACKING PRESENT ACTIVITIES IN THE PUBLIC SPACE

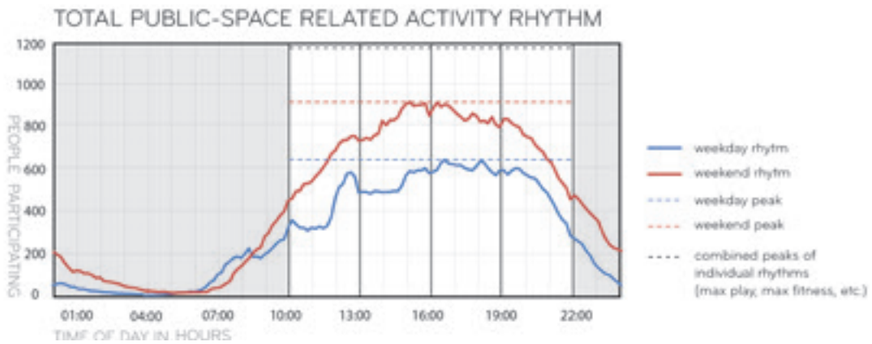
Combining temporally compatible activities in a single space allows for a better use throughout the day, closing the gap between required space and used space.

2. INTRODUCING NON-HUMAN RHYTHMS

As human activity as a whole differs significantly, non-human functions are likely the solution to finding temporary uses fot the least active moments of the day.

3. INTRODUCING TEMPORARY PUBLIC SPACE

The extra space required in the weekends could be found in spaces that are not public during the week due to school or work activities. Space could temporarily be made public.



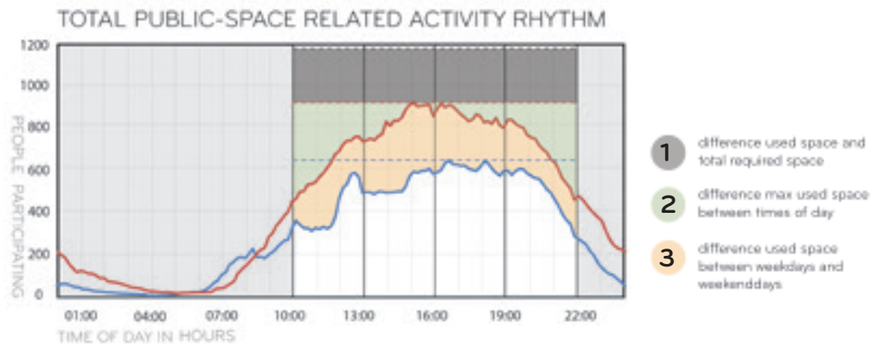


image 4.3 the daily use of public space during weekdays and weekends. *The blue and red dotted lines indicate the peak moments of use during the day. The black line is calculated by adding the peak moment of each individual activity group related to the public space. It represents the amount of people that public spaces need to be designed for, if each activity would require its own, separate space. This relates to the initial concept of temporal vacancy: as being the difference between the used space and the provided space (adapted from SCP, 2016).*

mage 4.4: Time-space ineffi-ciencies. *The three conclusions are shown here as parts of the rhythm graph of public space in general. In the theoretical spa-tio-temporal optimum that is a world without temporal vacancies, the graph would consists of a single straight line (adapted from SCP, 2016).*

4.3 TEMPORAL ANALYSIS
IDENTIFYING RELEVANT URBAN RHYTHMS

TIME DIARY RHYTHMS
An overview can be presented of several relevant individual rhythms from the time-diary research (image 4.5). These rhythms are shown in peak-use graphs. The following rhythms are the relevant outcomes of the time-diary research. They are divided into three categories.

ACTIVE USE OF PUBLIC SPACE
These are the most relevant rhythms when it comes to informing the design of multifunctional public spaces, as these rhythms are generally very temporally variant (containing high peaks and lows), often quite different during the week and during the weekend, and generally containing clear design requirements (i.e., playgrounds, sports fields, calisthenics and skateparks)

SEMI-PUBLIC ACTIVITIES
These activities, such as shopping and going out, can take place within the public realm (i.e., markets and bars, respectively), but also take place behind closed door of homes, venues, establishments and associations. These activities can partly activate spaces during their peak times (e.g., in the case of shopping) or be taken into the public realm entirely.

INFLUENTIAL RHYTHMS
influential rhythms are rhythms that do not take place in the public space but are among the most massive and influential of the rhythms researched and provide insight into the complete rhythm. The work and school rhythm for example, confirms the potential for work and school grounds to function more publicly during weekends, when the demand of public space is higher.

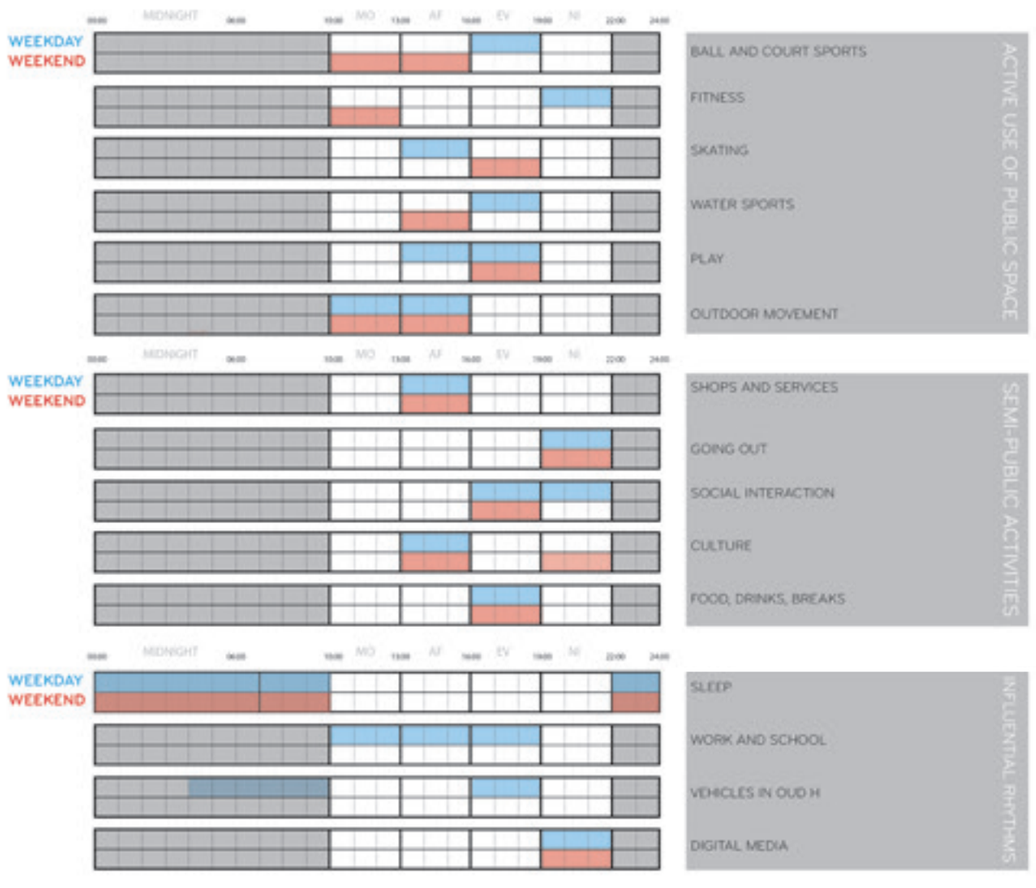


image 4.5: *Three catagories of relevant rhythms from the time-diary research.* (adapted from SCP, 2016)

RHYTHMS BY INTERVIEWS
While the time diary research is a report on the use of the time of the average inhabitant, the neighbourhood of oud-Hoograven has been selected for its diversity in function and character beyond merely a living environment. Therefore, local stakeholders have been contacted in order to gain more insight into their use of space throughout the day, their spatial needs, their willingness to share their space and their wishes for additional space at specific times. The outcomes of these rhythms cannot be presented in as a complete time-use graph, but active and available hours can be visualised in a peak-use scheme (image 4.6). Two of these local rhythms correspond to the design strategy: "introducing temporary public space", as they contain significant surface areas that are currently unused during the night and during weekends. These spaces are all found in typology II: the working environment.

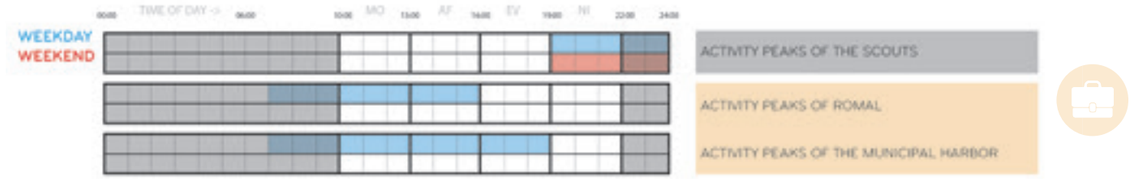


Image 4.6: *local rhythms gathered by means of interviews.* (adapted from SCP, 2016)

PARKING RHYTHMS
Many of the inhabitants of the neighbourhood of oud Hoograven own cars. Besides the rhythm of car movement which has been described in the time diary rhythms, parked cars require space in the neighbourhood as well. The use of parking spots over time has been described by the CROW (2018) for the purpose of assessing whether a parking spot can function for multiple destinations at once. This data has been formatted in a peak-use graph as well (image 4.7).

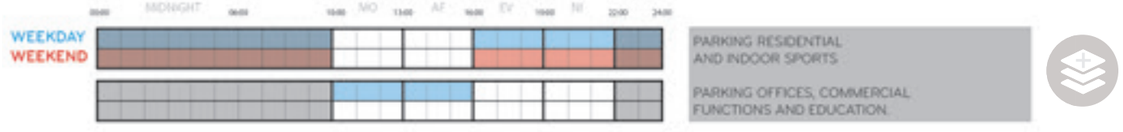


Image 4.7: T*he parking use data of the CROW, reformatted in a peak use graph. The low moments of the weekdays amount to roughly 50% use of the parking spots (adapted from CROW, 2018)*

RHYTHMS OF URBAN ECOLOGIES
It has been established that by relying on human activities alone, it will not be possible to make use of public spaces evenly during the day. As such, non-human uses must be considered as well. An interview with an ecologist working for the municipality of Utrecht has established that already, due to the daytime nature of human activities, a significant part of the urban fauna is consisting of nightlife. Furthermore, even an actively used space during the day can function as an ecological corridor during the night-time, if the calm period is predictable and recurring every day. While this is no replacement for ample substantial green structures during the daytime, there may be ways to incorporate more ecological time space dynamically. To represent these rhythms, simplified peak-use schemes are added (image 4.8).

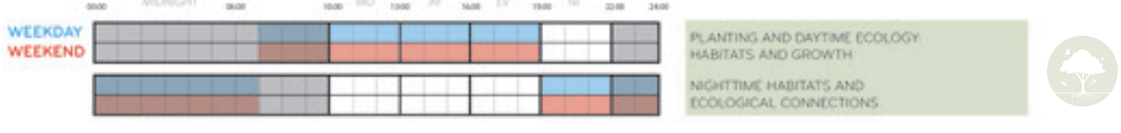


Image 4.8: *An indication of activity peaks of daytime ecology and nighttime ecology by means of average dutch dawn and dusk times.* (adapted from SCP, 2016)

4.4 TEMPORAL ANALYSIS
AN OVERVIEW OF THE RELEVANT RHYTHMS

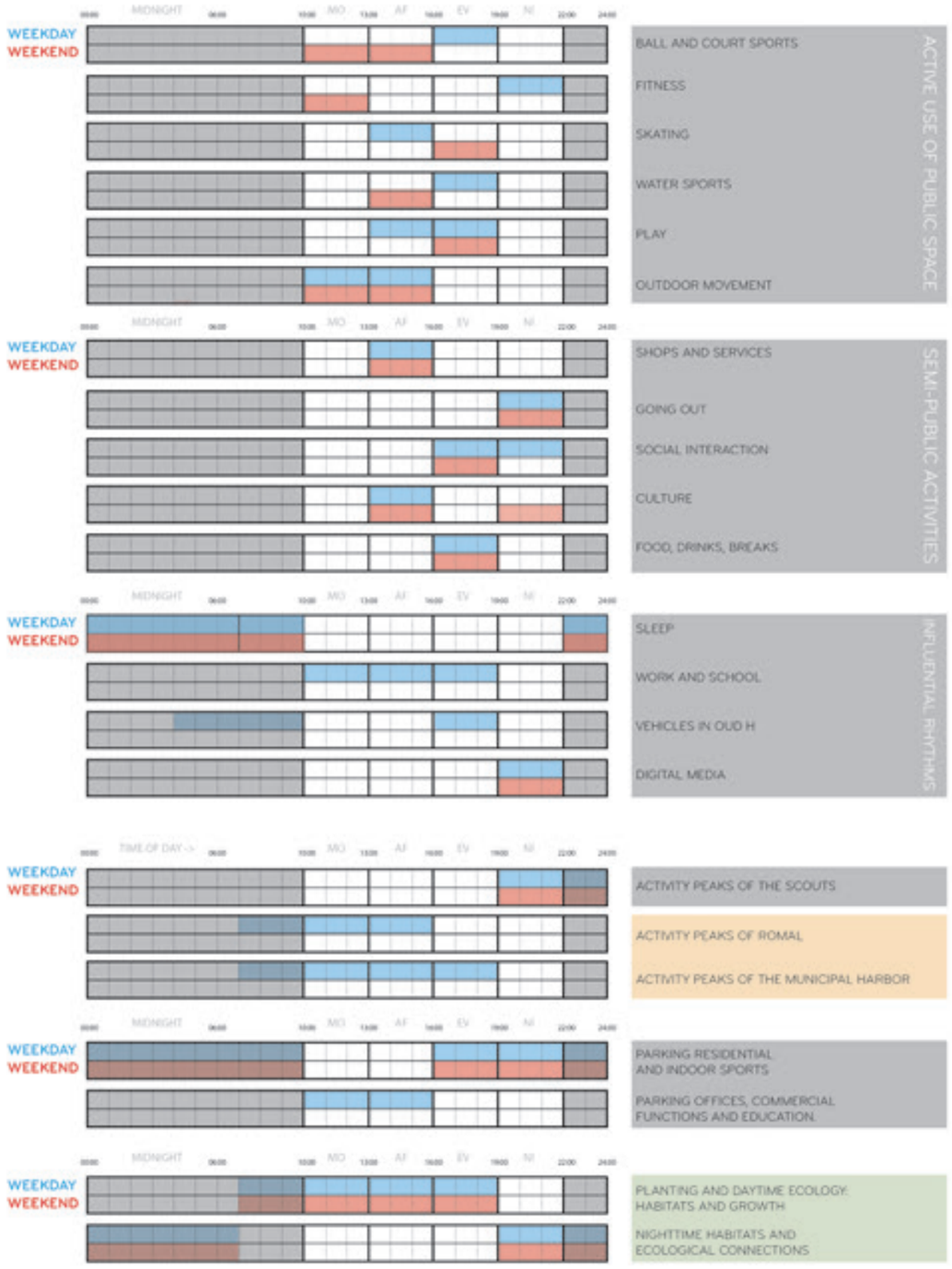


Image 4.9: *A complete overview of all the peak-use schemes of the described rhythms, that allows for the checking of temporal compatibility. THe colours correspond with the strategies derived in paragraph 4.2.* (adapted from SCP, 2016)

4.5 RHYTHM RESEARCH
DESIGNING POLYCHRONIC PROGRAMMES

AN INTEGRATED METHOD

The use of the peak-use schemes allows for a combination of these different methods of data collection to be compared (image 4.9). Each individual rhythm is related to one of the three strategies. The black rhythms are human activities that already take place in public spaces. The green rhythms represent non-human functions in time. The yellow rhythms represent the rhythms of private spaces that could be made public during specific moments of the day. The overview informs on the temporal compatibility of multifunctional programmes. Ideally, the peak use schemes would be combined in such a way that each moment of the day has an equal amount of use. However, an even coverage of activity is near impossible to achieve without an overlap of peak use moments. Using these rhythms, a dilemma is raised between a 'no conflict' and 'full coverage' type of solution.

A no conflict programme (image 4.10) strives to achieve a good coverage of the daytime by means of the peak use schemes but will not allow any overlap of peak moments. In the example provided here, fitness and play are combined in a space While peak-use schemes are reductive in nature, the activity pattern scheme of this combination confirms the evened out and increased space-time use when compared to the individual rhythms it is comprised of.

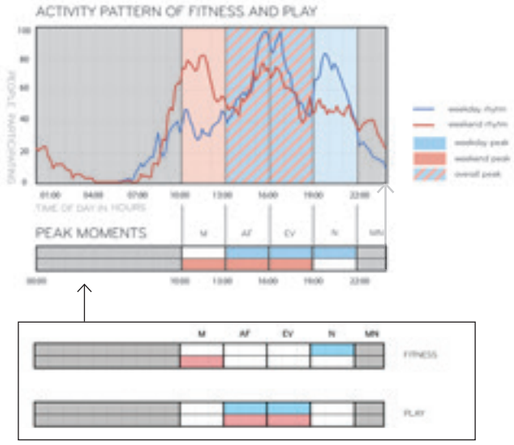


Image 4.10: *A 'no conflict' way of comprising a polychronic programme. Combining fitness and play leads to a more evened out daily rhythm.*

After a no-conflict combination has been found, an additional step may be taken to try to fill in the remaining lee moments of the day. Due to the nature of the rhythms, this will often result in an overlap of peaks of the peak-use schemes. In the example, culture has been added to the previously established mix of fitness and play (image 4.11). This results in peak overlaps, during the afternoon and night-time. As the heights of the different rhythm peaks differ, this may or may not improve upon the evenness of use throughout the day. In this example, adding culture does indeed lead to a more equal use of space throughout the day, when compared with the previous combination.

RELATIVE BASELINE USE

Comparing the lowest number of users with the highest number of users during a day could be interesting with regards to the concept of efficiency. During weekdays for example: the relative baseline use of play and fitness were 15% and 8% of the peak use respectively, whereas the relative baseline use of their combined rhythm is about 35%. Temporal vacancy is therefore reduced, even in the lee moments of the day. In the rhythm where culture is included, this number went up to 35% of its peak use.

PRODUCING POLYCHRONIC PROGRAMMES

Using the rhythm overview in conjunction with the spatial analysis, several polychronic programmes are formed for each typology.

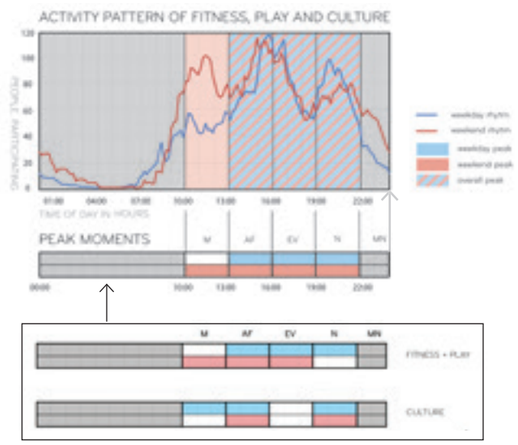


Image 4.11: *a 'full coverage' type of comprising a polychronic programme. Adding the rhythm of culture to the previous programme leads to a bettter overall use here, but that is not always the case when overlapping peaks.*

4.6 POLYCHRONIC PROGRAMMES
THE PARK ENVIRONMENT

Several polychronic programmes for the park have been imagined, relating to different types of spaces. Collectively, they would result in a polychronic park design (image 4.16)

1. A re-imaged version of the sports court. A smoothly paved square-type space, likely in communication with the sports hall including ball sports, extreme sports and going out (image 4.12).

2. A redesign of the hill that is more inviting for uses that involve the height difference the hill provides, likely involving play and social interaction (image 4.13).

3. A dedicated fitness and play area, which may combine well with ecological rhythms (image 4.14).

4. An open green space for cultural events and social gathering and sports (image 4.15).

TYPOLOGY 1

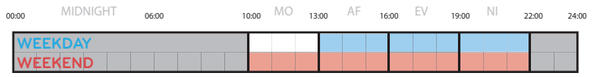


Image 4.12: Sports square programme. *made up of the rhythms of ball and court sports, extreme sports and going out.*

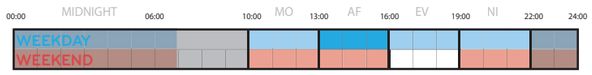


Image 4.13: Hill Programme *made up of the rhythms of fitness, play, and general outdoor activities*

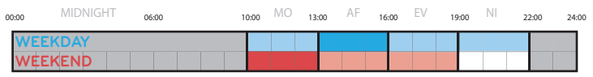


Image 4.14: play and sports programme: *made up of the rhythms of play, outdoor movement and nighttime ecology*

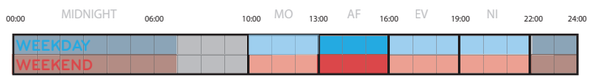


Image 4.15 Open green space programme: *made up of the rhythms of social interaction, culture, outdoor movement and nighttime ecology.*

TYPOLOGY 2
THE WORKING ENVIRONMENT

The working environment is dictated by the local rhythms of the companies, which provide the base for the polychronic programme. The challenge is to combine public activities with privatised spaces. If the rhythm exchange is to be mutually beneficial, other economic functions seem to be the best choice for this location. That would benefit the original owners of the space in the form of shared costs and/or rent, while also having someone responsible for the area after hours. Due to the location by the water, the closeness to the park, the narrrative of the beer boat and the local rhythms, a bar/cafe type of use is imagined for the space along the water.

For the scouts, a new ecological green/blue connection could be established that could be partially used by the scouts during the evenings.

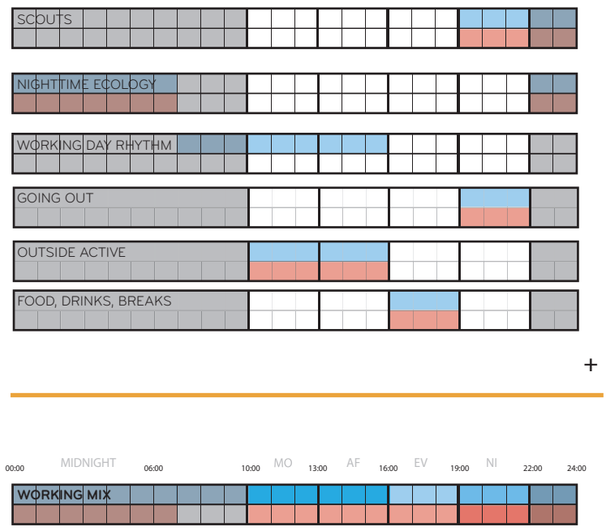


Image 4.17 Polychronic programme of the working space. *This programme is made up of the rhythms of the local businesses, the scouts, active outdoor activities, going out, nighttime ecology,and and food drinks and breaks.*

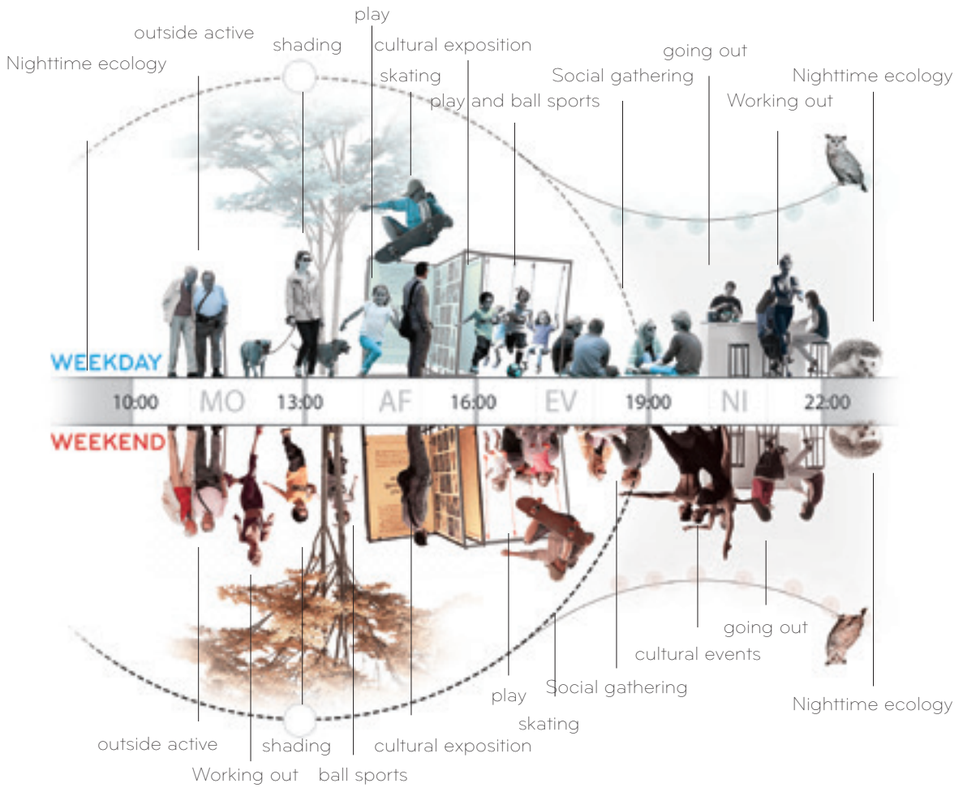


Image 4.16: *A visualisation of the combined park rhythms from- morning untill nighttime.*

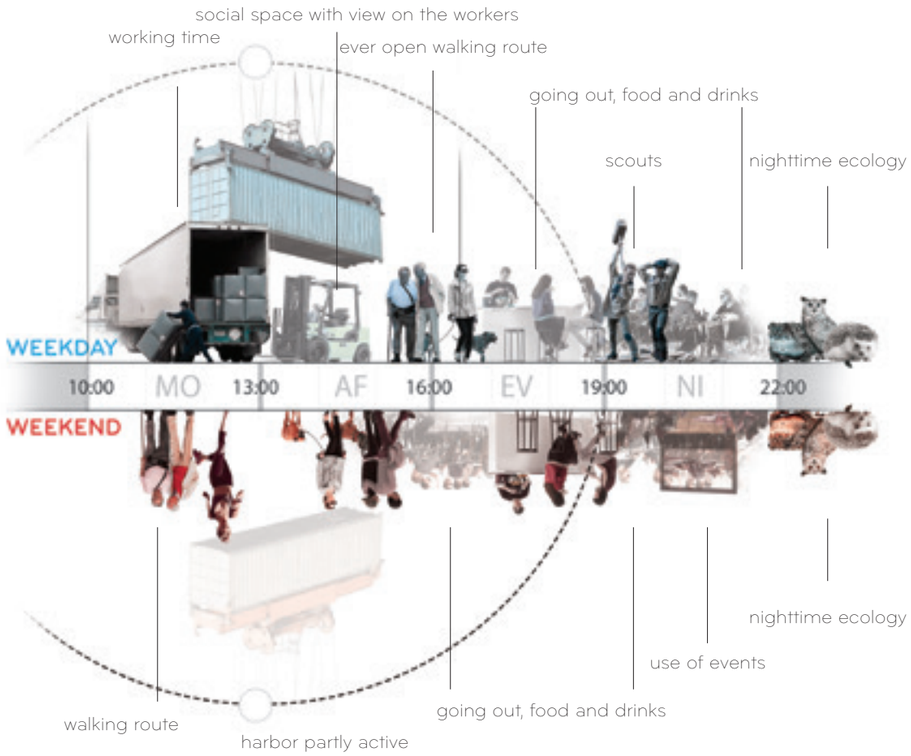


Image 4.18: *A visualisation of the combined working environment rhythms from- morning untill nighttime.*

TYPOLOGY 3

NARROW STREET

The narrow street is under heavy influence from the car rhythms, as there is little space for anything else due to the width required for driving, parking and pedestrian movement. As such, two rhythms are dominating the street: the car use peaks, and the intensity of parked cars within the street. In order to alternate between functions in time, the most potential lies in the mornings and afternoons: after most cars have gone and about half of the parking spots lie empty. temporally, this leads to functions such as play, sports, commercial parking, outside activities, skating and daytime ecology (image 4.19). These combinations make up the temporal programmes to be tested in this typology. These are very much about how to switch between the currently very dominant traffic function and its temporally compatible activities, while keeping both functional.

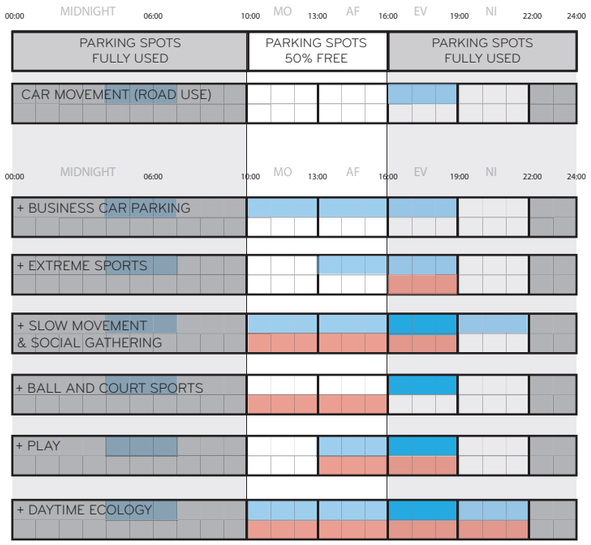


Image 4.19: Narrow road programme: *Wether the streets can be used for other functions is dictated by the rhythm traffic and the parking intensity of the street. In general, this leaves spacetime in the morning and afternoon. In this case, several potential alternative functions for the road surface can be explored in the design.*

TYPOLOGY 4

WIDE STREET

The wide street will also have to deal with traffic, but is far more flexible in its design due to the larger amount of space. The infrastructural spaces can be additive to the larger spaces, instead of consisting completely out of them.
The street should contain an ecological connection, but also usable spaces for local inhabitants. Many activities can be combined in this setting as well, but activities such as culture and going out will not be viable in this living environment. rather, activities will focus on promoting social interaction, play and active movement. If we image the users of a street to mainly be its direct inhabitants, there is a lot of space available in this profile compared to the amount of likely users of the space. Instead of avoiding spatial conflicts, these spaces explore the potential of facilitating social interaction by stacking similar rhythms. This leads to spaces with a specific optimal time of day in mind, while still containing a polychronic programme in the street overall (image 4.21-4.26).

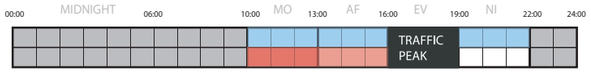


Image 4.21: Morning-oriented space. *Rhythms: fitness, walking (slow movement), coffee (food, drinks, breaks)*

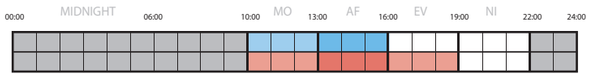


Image 4.22: Midday oriented spaces. *Rhythms: afternoon walks, (slow movement), play and skating*

Image 4.23: Evening oriented spaces. *play, social interaction, food and drinks.*

Image 4.24 nighttime (overall). *sleep, nighttime ecology, evening walks (slow movement)*

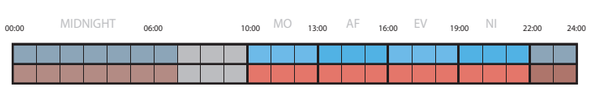


Image 4.25: Total street rhytm. *a combination of the individual space rhythms.*

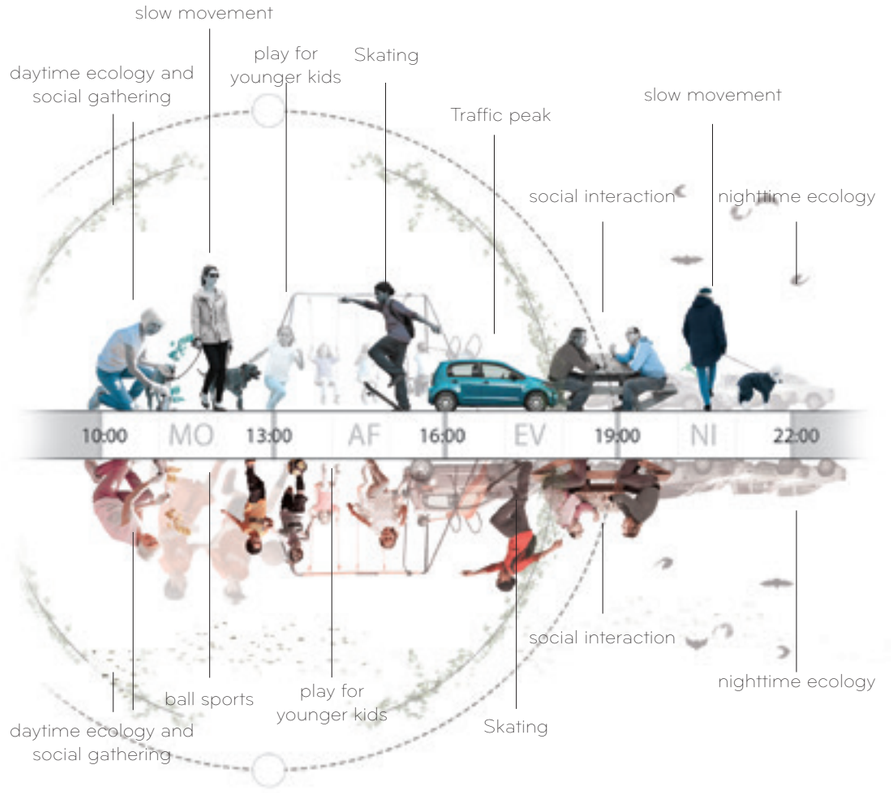


Image 4.20: *A visualisation of the combined narrow street rhythms from- morning untill nighttime.*

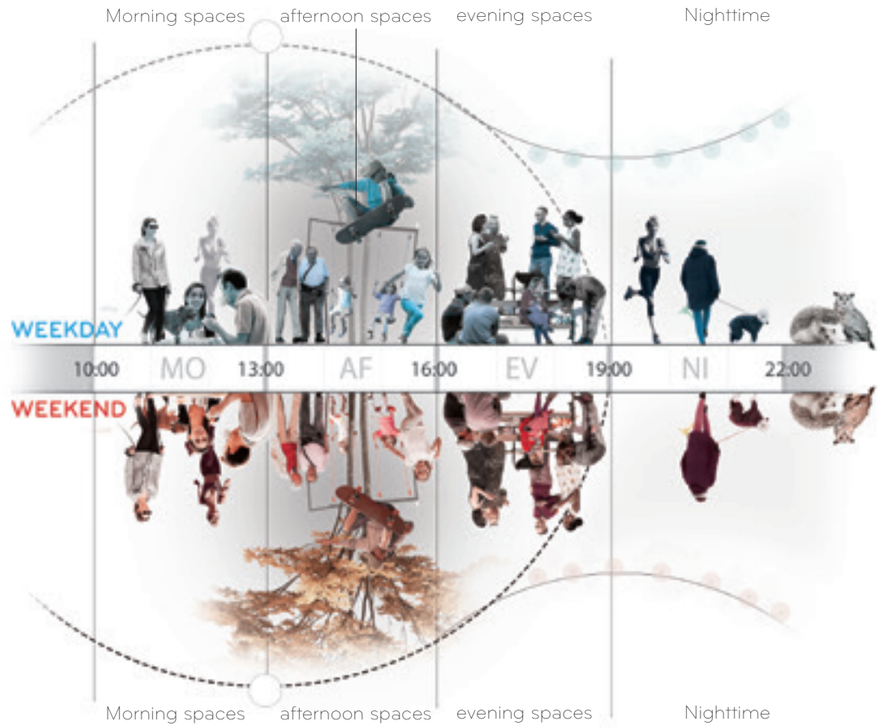


Image 4.27: *A visualisation of the combined wide street environment rhythms from- morning untill nighttime.*

ANALYTICAL FRAMEWORK

"While activity timing is as important as activity spacing,
it is less often consciously manipulated"

(Lynch 1981, p452).

5

5.1 QUALITATIVE ASSESMENT RUBRIC
MEASURING EFFICIENCY AND FLEXIBILITY

One of the main points noted in the knowledge gap is the absence of practical examples and theory of regards to poychronic design. As such, this thesis proposed assesing the efficiency and flexibility of the designs, and put forward certain requirements for these markers.

Within this thesis, spatio-temporal efficiency is understood as *the (anticipated) use of a space compared to its potential use during a given recurring time period.* Efficiency entails both human and non-human functions and activities and should consider the quality of the individual spatial functions as well. Flexibility in this thesis is understood as *the ease with which a space can be freely interpreted and used by any given person at any given time.*

A proposition has been made to assess efficiency and and flexibility in a qualitative way by means of an assesment rubric containing 6 markers. This overview has been developed by the author, informed by the thought process found in the theoretical framwork (page 14). It is a first attempt at making an analytical framework for polychronic designs, and may be improved upon in later research. The rubric is used to assess the performance of complete typologies in this thesis. The assesment will be done for both the original situation as the design. This will shed light on the performance when compared to the current situation, which is in many cases quite typical for these urban typologies which are common in Dutch cities.

Image 5.1: The assessment rubric
The rubric presents a way of assessment that is as transparant and replicable as possible. It contains 6 assesment markers: spacetime use, compatibility, ecosystem services, degrees of freedom, equity and publicness and adaptability.

	SPACETIME USE	COMPATIBILITY	ECOSYSTEM-SERVICES	DEGREES OF FREEDOM	EQUITY AND PUBLICNESS	ADAPTABILITY
	This marker describes whether a space is capable of functioning well during different moments of the day. It is related to the notion of urban vacancy directly and responds to a temporal division of 5 moments of the day, namely: morning, afternoon, evening, night and midnight.	While functions may be compatible in a temporal sense, their spatial requirements could differ greatly, taking away from the quality of the individual functions. This marker is related to the notion of affordances and considers the potential loss of the *benefits* of spatial specialisation.	Passive use is ecosystem service-related. It describes the continuous effect a certain space has on the urban environment with regards to ecology, air quality, climate adaptivity and microclimate. When a space produces a lot of beneficial effects, even when unused, the space scores high on this marker. Paved, lifeless spaces are more likely to score low on this marker.	Degrees of freedom relates to the amount of possible uses a space can be interpreted as having. Spaces like conventional classrooms, playgrounds and highways have very specific affordances and expectations. They allow for little use besides the intended use. Spaces that are more open-ended such as parks, beaches or squares for example, score high on this marker.	This is related to who can decide what a space is used as. If anyone can choose to use a space in any way it was intended, the space scores well on this marker. If the space can only be used, adapted or managed by owners, locals or people with a certain knowledge or power status, the space scores poorly on equity.	Adaptability in this case relates to the speed and ease at which intended uses can be alternated. For instance: if the alternative use of a space first requires a complete overhaul of the space, the space scores poorly on this marker. If little to no action is required, the space scores well.
+	The space is active for three or more of the five moments of the day	Spatial requirements of functions are very similar, and hardly intrude upon one another. They may even postively influence one another.	The space is passively functional: it is capable of water infiltration and stormwater management and positively influences the urban microclimate when not in use. It provides in habitats and/or connections for urban ecology.	A large amount of possible functions is possible within the space, due to the absence or overload of normative expectations. The design is thus open-ended but does provide ample affordances to interpret. It cultivates the interpretation of the user.	anyone is welcome in the space, and can make use of the different functions of the space as they see fit.	The different functions of the space can be immediately used and require little to no adaptation of the space.
+/-	The space is likely to be active during two of the five moments of the day	The combination of functions requires some sacrifices when compared to specialised spaces, but each function is still legible and useful.	With regards to urban microclimate, stormwater management and ecology, the space has a positive influence on some, but not all of the topics.	The design is either open-ended but lacking in possible affordances (i.e: an empty square or field) or a combination of very prescriptive functions that result in a multi-interpretable space.	While the space is technically public, not everyone is always able or empowered to make use of the space or to interpret its function freely.	Switching between functions requires some time and effort, for instance by moving or rearranging objects within a space.
-	The space is only likely to be active during one of the five moments of the day	The functions are detrimental to one another, the quality and usability of each individual function drops significantly through the spatial requirements of the others.	the space is mostly paved and lifeless. It negatively influences stormwater management and urban microclimate. It has a low value for urban ecological habitats or connections.	A minimal amount of uses is commmunicated very dominantly and prescriptively. Any interpretation of the space other than the primary, intended use is clearly unintended and subordinate in case of conflict.	Power and ownership is communicated in this space. It is clear not everyone is welcome in this space and spatial appropriation of a single user group is legible, even during moments of the day this group is not around.	Switching between functions is time consuming, costly and elaborate. It requires physical effort, large investments or access to certain technologies.

TYPOLOGY DESIGNS

" A jack of all trades is a master of none,
but still always better than a master of one"

- English proverb

6

6.1 SPATIAL DESIGN
THE PARK ENVIRONMENT

IN the design, the park has been rearranged to contain the four function mixes proposed in the polychronic programme. In the overall design, a continuous route along the water edge is proposed. Along the water, the park interacts with the canal in several different ways. There is an underpass that runs below the water level and provides an ecological connection to the Hamersmaplantsoen at night, a harbor which can be used as a swimming bay during busy summer afternoons, ecological slopes that allow for easy acces by canoo and kayak, and a deck with play and seating elements that allow sunlight air and water to pass to an ecological connection underneath.

The sports hall has been reimagined as being partly underground, making a visual connection possible between the new sports square and the inside of the building. Lawns are used to form several unique spaces while more structural green has become more abundant. The axis has been reused, but the sightline starts and ends within the park itself. The shape language of the design is mostly historically based: either on current features or the industrial background of the area.

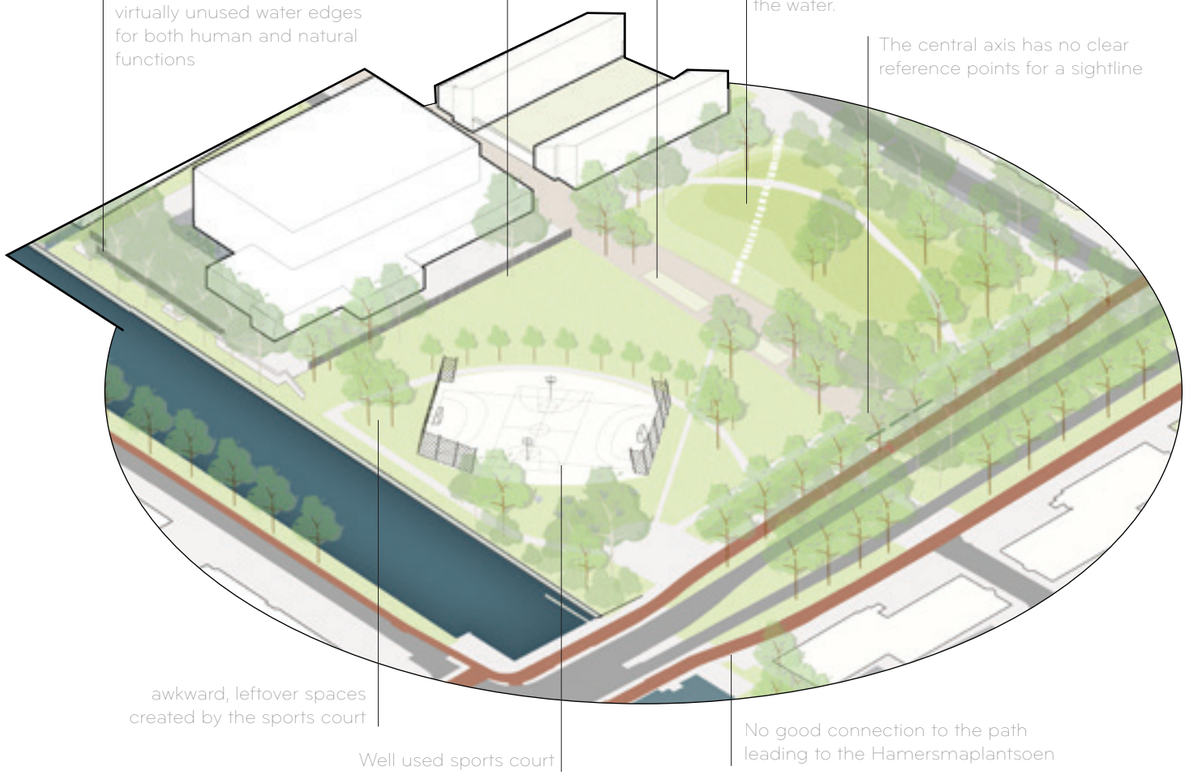


Image 6.1: *The van Arkelpark in axonometric view.*

Image 6.2: General design of the van arkelpark
charater, connectivity, programme and detail

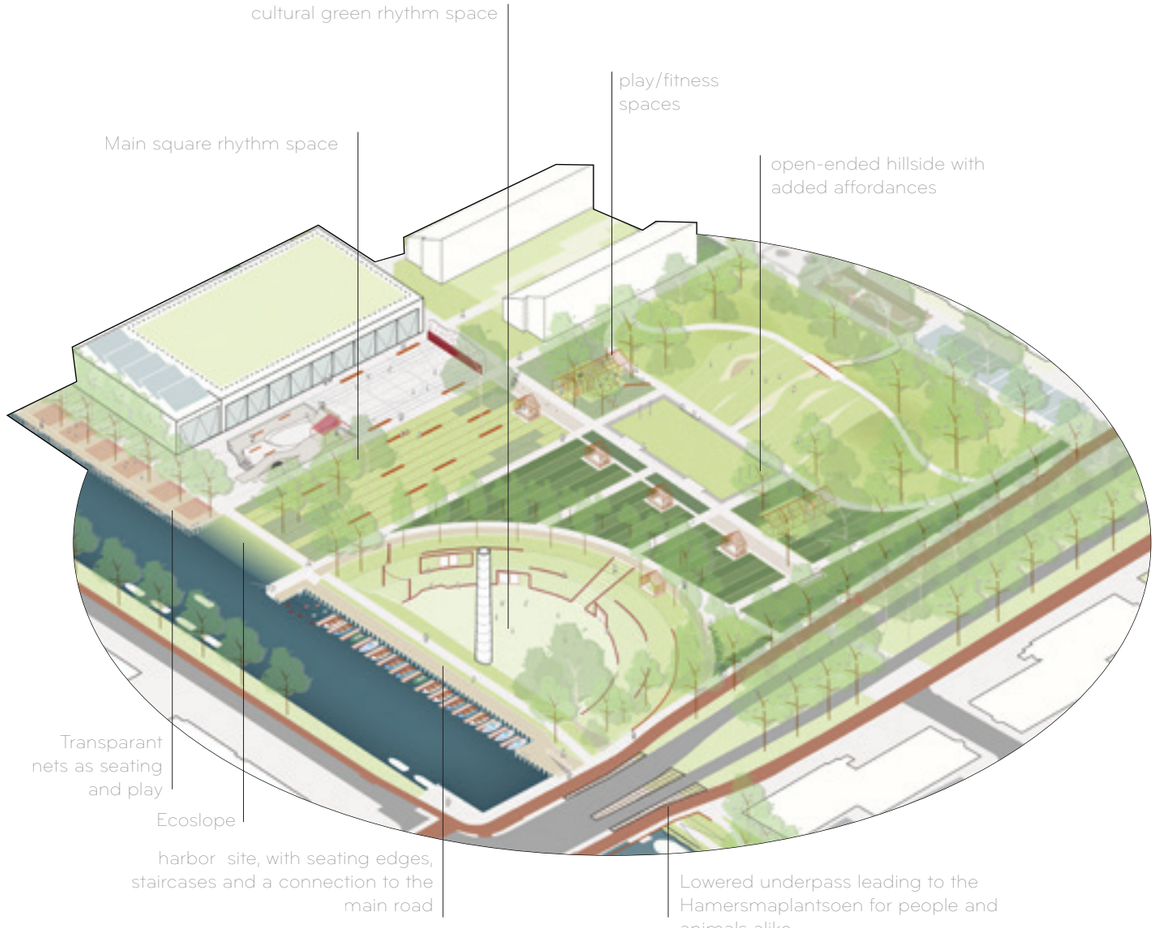


Image 6.3: *The redesign of the van arkelpark in axonometric view.*

6.1 SITE DESIGNS
THE MAIN SQUARE

In the design of the square (image 6.5 & 6.6), the shape language of the design is informed by the sports hall and the industrial history. The design allows for ball sports, play, skateboarding, bouldering and social events during the daytime and night-time, as per the devised programme (image 6.4). The functions of skating, ball sports and play make up the staple of daily public activities on this square, due to their high temporal and spatial compatibility. The square is further activated by the new sports hall, which is envisioned as being lowered into the ground to allow free vision into the hall from the square. This solves the problem of the many blind walls common to these types of buildings as well as provide a means of eye-level activation and lighting of the square. These functions are all overlaid in the grid motif that is recurring all throughout the design as a nod to the brick-drying fields that once defined this industrial landscape. Additionally, different subtle line works on the square relate to different possible uses, much like inside the sports hall itself. The field of the square contains the same grid, made up of rails on which benches are attached. The arrangement of these benches is entirely up to the users of the space, creating a more open-ended space. In this way, each space is designed to suit multiple activities that generally happen at different times of the day.

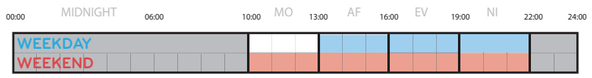


Image 6.4 Sports square programme. *made up of the rhythms of ball and court sports, extreme sports and going out.*

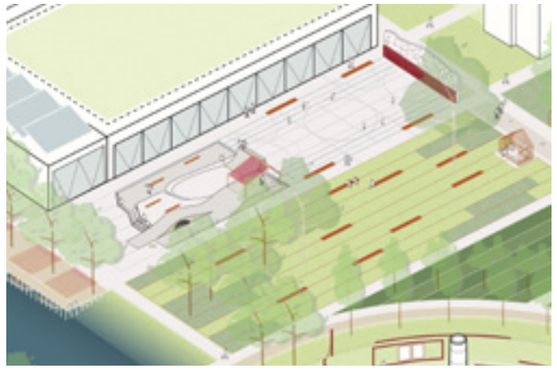


Image 6.5: The main square design in axonometric view.
The entrance to the sports hall is at the area near the decks. The skate element besides it doubles as sa eating element with view over the water, a social space, a stage and a goal for the sports court. The court contains many types of line-work, some relating traditional sports activites, some more open-ended. A water square is an addittion that can be made within this space for hot days when open, paved squares like these are not considered comfortable. The wall can be put to use for bouldering by lowering the mats. On the other side, falls are broken by a sandbox, which can be used by younger children as a play element as well.

Image 6.6:
The square seen from the main axis during weekends.

THE AMPHITHEATER

The amphitheatre (image 6.8 & 6.9) functions as the central element of the park. It reuses the existing tree structures placed around the original sports area as a point of leaving for the concentric circular shapes. This leads to a more natural and inviting entrance of the park from the west side and orients the entirety of the park towards the water. The area is host to the temporal programme of the 'open green space' (image 6.7) The lower part is usable for most grass-based ball sports, due to its raised edges and natural seating gallery. The potential of the shape is explored further by using a variety of furniture, doubling as play elements and exhibition spaces on different levels along the circles. These exhibitions are the staple pulling factor culturally but can be easily taken down when the space is in full use as a theatre. The field is accessible to night-time fauna by using gradients instead of continuous hard edges. These departures from the classic theatre aesthetic challenge the agency of the theatre in favour of a more open-ended, flexible character. In the centre of the field stands a monument referring to a stone factory tower that once stood roughly at this location. This structure also serves as a sundial by subtle markings in the ring's furniture as a nod to the exploration of time of day as a design inspiration. The theatre lends itself to performance and spectacle, and infrastructure to provide lighting and sound are present in the tower. In winter, the field can be flooded in order to create an ice-skating rink.

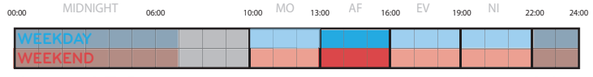


Image 6.7 Open green space programme: *made up of the rhythms of social interaction, culture, outdoor movement and nighttime ecology.*

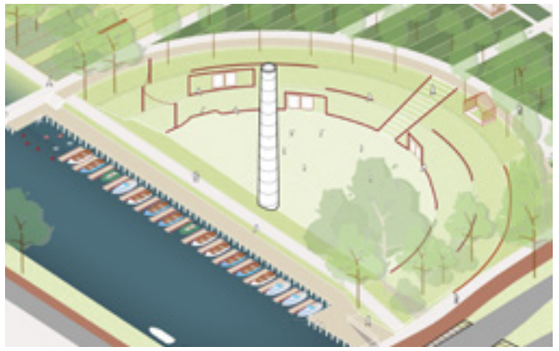


Image 6.8: The amfitheater design in axonometric view
on the water edge of the theatre, there is a harbour with seating edges and stairs looking out over the water. The harbour is made up of floating decks between the boats. and a pulley system, which causes any unused space to be automatically added to the northern swimming zone. During hot days, this means a larger zone is available for swimming, when the boats are used most. The waterfront path becomes an underpass underneath the road, allowing for a direct pedestrian connection to the southern waterfront spaces.

Image 6.9: The amphitheater as seen from the dock.
The industrial feel of the space is maintained by means of raw materials such as rough bricks, concrete and wood. The tower is executed in a non-historicizing manner by means of steel.

6.1 SITE DESIGNS
MULTUPURPOSE PLAY SPACES

TYPOLOGY 1

Within the main axis, the gravel fields for the game of 'petanque' have been reused but the raised edges are lowered in order to fully integrate these fields as a part of the route. Both ends of the axis now end in a moment: a fountain on one side, and a continuous route on the other, leading to the working space and the playground (image 6.3). Along the path, layered planting strips aim to both maximise the use of sunlight and refer to the stone-drying fields. The structures along the path (image 6.11) refer to the elongated structures once abundant in this area. The smaller structures are seating elements that contain sections overgrown with vines, which can be lowered or raised to offer a pleasant seating experience under different conditions. The longer structures are designed to allow for play, calisthenics (fitness), elderly exercise (outdoor movement) and ecological functions, as indicated as a desirable temporal programme (image 6.10). Calisthenics and play both have very clearly defined affordances but are similar in that they use such structural elements to function. The structure is therefore overloaded with invitations for these different and competing kinds of use, inviting more potential users that possibly exclude one another. In order to achieve this, the functions must be completely mixed instead of compartmentalised, and the colour scheme is kept clear of overly child-like and sportive colours, opting instead for a more neutral, industrial feel.

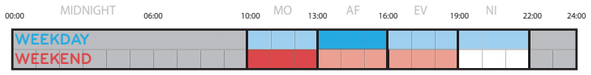


Image 6.10: play and sports programme: *made up of the rhythms of play, outdoor movement and nighttime ecology*

Image 6.11: The play and sports element along the axis
The shape of the element refers to the elongated buildings used for drying bricks that once dotted this space. The space is loaded with invitations of use that would not be possible to all happen at once but by alternating between these the element maintains a steadier use throughout the day.

Image 6.12: A panoramic view of the main axis, play elements and hill.

HILL AND FIELD SPACE

The existing hill, which is well used throughout the seasons, is expanded upon. The height difference is an opportunity in an otherwise flat landscape. Instead of filling the hillside with climb-related play elements, the grid motif of the rest of the park continues in the third dimension here, creating different heights and slopes. The different circumstances create several means of use which are left open to interpretation. While likely to attract play, clear play elements are left out in order to remain inviting to other users, for instance as a resting area or a lookout point (image 6.14). The polychronic programme (image 6.13) includes several types of use indicative of potential uses for the height differences. The trouble with open-ended, interpretive space is that the eventual use is unclear, which makes its rhythm of use more difficult to predict. The hill, its flowing pathways and English garden style are referring to the estates often founded by the owners of the industries on the lots along the canal. Looking out from the hill best shows the recurring grid-motive that is recurring the in the park. The field underneath the hill is the most sheltered and surrounded open space of the park, allowing for a more enclosed site for small social gatherings and play. Its seating edges also make the lower space usable for sports.

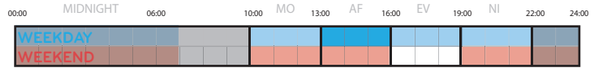


Image 6.13: Hill Programme *made up of the rhythms of fitness, play, and general outdoor activities*

Image 6.14: The hill and the field.
The waves of the hill are all different, allowing for different experiences for sleighing, play and seating. playful ways of ascending the hill are linked to the play elements, whereas the waves are kept intentionally free from any communication of common spatial functions.

6.1 SITE DESIGNS
THE PARK ENVIRONMENT ASSESMENT

The park is a fully public space and is therefore the least constrained of all the typologies, as those must deal with work activities or car mobility-related functions. Here, public activities can be freely used to design polychronic spaces. Due to this freedom, there are many combinations to be made. As such, four different polychronic programmes were proposed as temporal design solutions. These have been made spatial in this phase.

ASSESMENT OF THE PARK SPACE

The current park design is already public, open space. While it is relatively singular in its spatial features, it scores quite well on markers of flexibility. Using the rubric to assess the new park design leads to the output shown in image 6.15. The new design brings in many possible activities while fulfilling the passive use requirements. In general, this increases the efficiency at the cost of flexibility. The drop in flexibility is arguable, but it is rooted in two reasons. The first is that linking the sports hall to the park creates a possible notion of ownership that was not there before, limiting the publicness of the space. The second is the amphitheatre's cultural function, which inherently requires more complex adaptations (lighting, audio, exposition pieces) which not every user is free to make use of. It will therefore require curation of the materials and the programme of the space.

THE 'WHEN' OF FLEXIBILITY AND EFFICIENCY

Still, evening uses in the public space are rare and the cultural function of the theatre does not make it harder to utilise the space freely during the daytime. Being able to activate the night-time chronotope of the park may weigh up to the loss of flexibility at this time, due the lack of spatial competition at this time. In this sense, flexibility can be said to be more required in high pressure chronotopes, often found in the afternoon and evening, than it is during less populated moments such as the morning and the night-time. By making use of the concept of the chronotope, we can thus describe a space to be both contested and vacant. A polychronic design should thus focus on flexible alternation between some activities, while allowing more formal alternations between others.

PRESCRIPTIVE DESIGN

The design process gradually made clear that there are two extremes with regards to overlaying functions with regards to affordance and agency.

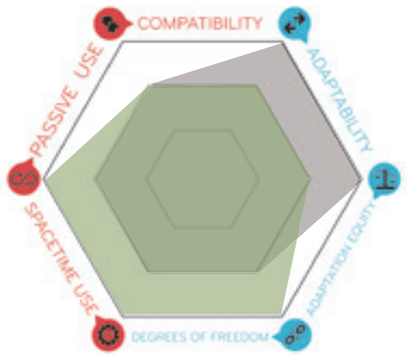


Image 6.15: The design assesment of the park terrain.
The grey area is an assesment of the current situation, while the green area represents the design outcome.

One extreme is making each intended function very clearly legible. In a multifunctional setting, this creates a very busy space which invites one to different but well-understood activities by means of their formalised and normalised design language. Particularly the play elements of the design work according to this principle as they overload a user with legible functions for play and sports. The benefit of this method of overlaying functions is that it is easier to predict the use of the space, as their functions tie more directly to researched rhythms. This increases the expected efficiency of the space at the cost of its flexibility. After all, the more formal and prescriptive functions become, the less they become freely interpretable.

OPEN-ENDED DESIGN

The second extreme is to opt for an open-ended design strategy, in which the affordances of functions are less pronounced in order to allow for more unpredictable uses. The hill is the best example of such a space, as it is not sure how those hill elements will be used in practice. While they were inspired by a playground, the play elements were deliberately removed in order to allow for a freer interpretation of the space, making it more approachable for other age groups as well. This increases the flexibility of the space but makes it harder to predict the use throughout the day.

PRESCRIPTIVENESS AS A DESIGN CHOICE

Both strategies are viable, as long as the affordances of the intended activities are somewhat balanced. The amount of prescriptiveness and legibility of intended activities can vary, and a large discrepancy between the prescriptiveness of the functions will cause the more legible of the two to be more dominant (image 6.17). Sticking to either extreme is not advisable, and prescriptiveness and open-endedness should be regarded as a scale to choose a position on, depending on the intended activity and the overall aims of the design (image 6.16).

GENERAL RESPONSIVENESS

The rhythm research focusses on very specific, recurring, daily time-space relationships. This is the main driver behind the activity mixes of the various site designs. However, these are not the only types of space-time relations that can inform a polychronic design. Spaces could be responsive to certain events, such as weather. The park waterfront along the amphitheatre, for example, relies on hot weather as a pace-maker for both boat use as swimming. Such if-then relations can be powerful tools in polychronic, multifunctional design. However, they are not discussed in detail in the rest of this thesis.

TAKE-AWAYS TYPOLOGY I

The park shows a relationship between flexibility and efficiency, as some of the design choices arguably sacrifice flexibility for an increase in efficiency.

Efficiency seems to provide a solution for underused space, whereas flexibility seems more valuable in more contested spaces.

Prescriptive design is better at producing efficient spaces at the cost of flexibility, whereas open-ended design allows for more flexibility at the cost of efficiency.

The use of daily rhythmic information is not a catch-all with regards to polychronic design. Responsive designs based on certain conditions, or designs handling differences in seasonal use should be considered as well in order to make a more holistic polychronic design.

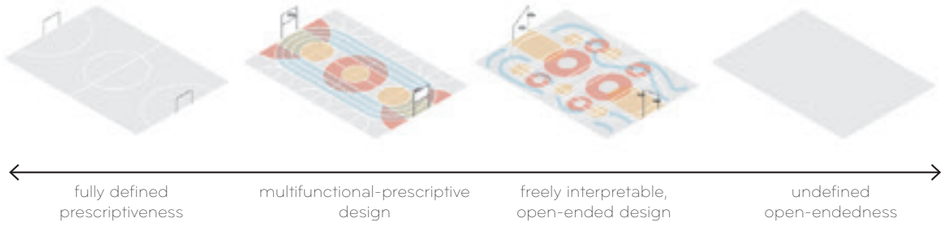
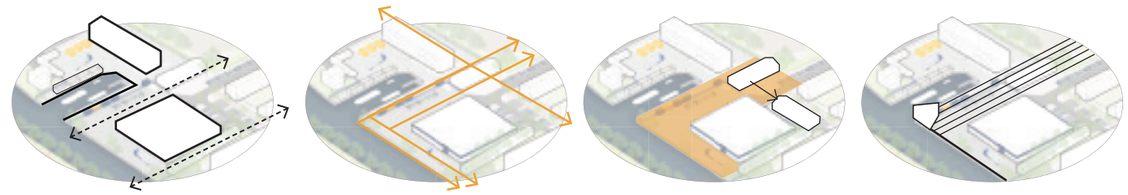


Image 6.16: prescriptiveness in design as a scale
By overlaying functions, some ambiguity is created with regards to the function of a space. This can either be minimised by making use of clear prescriptive signals, or celebrated as a feature, inspiring a more informal use.

Image 6.17: balanced affordances
Two functions can either be balanced or unbalancedn with regards to their legibility or presence within a space. The more clearly a function is legible, the more it is likley used and the more authority it is likley to have over another, in case of conflict. This has to be taken into account in the design.

6.2 SITE DESIGNS
THE WORK TERRAIN

The temporal design strategy for this space is based upon the rhythms of local stakeholders. The design therefore keeps the workspaces and loading bays operational while treating them as public spaces for their newly found uses in the evenings and weekends. Part of the municipal harbour and the Romal terrain is reimagined as a large, wet green lane. These contain lowered green beds. These function as a rain garden, are outfitted with play elements and can be used as event space by overlaying them with wooden stage elements. The beer boat, tied to the "Engelenburght" building, activates the harbour side while the café addition to the Romal building activates the canal waterfront. This waterfront contains three levels: terrace/ parking elements, a continuous ecological slope to the water edge, and a deck route along the water. The scouts no longer block the continuous route from the park to the rest of the neighbourhood, and their new location allows them to make use of the park, the playground and their own green space.



1. maintaining characteristic spatial structures

2. Improving connectivity and routing

3. defining spaces for the allotted rhythms

4. Adding historic design motife

Image 6.19: General design of the working terrain
charater, connectivity, programme and detail

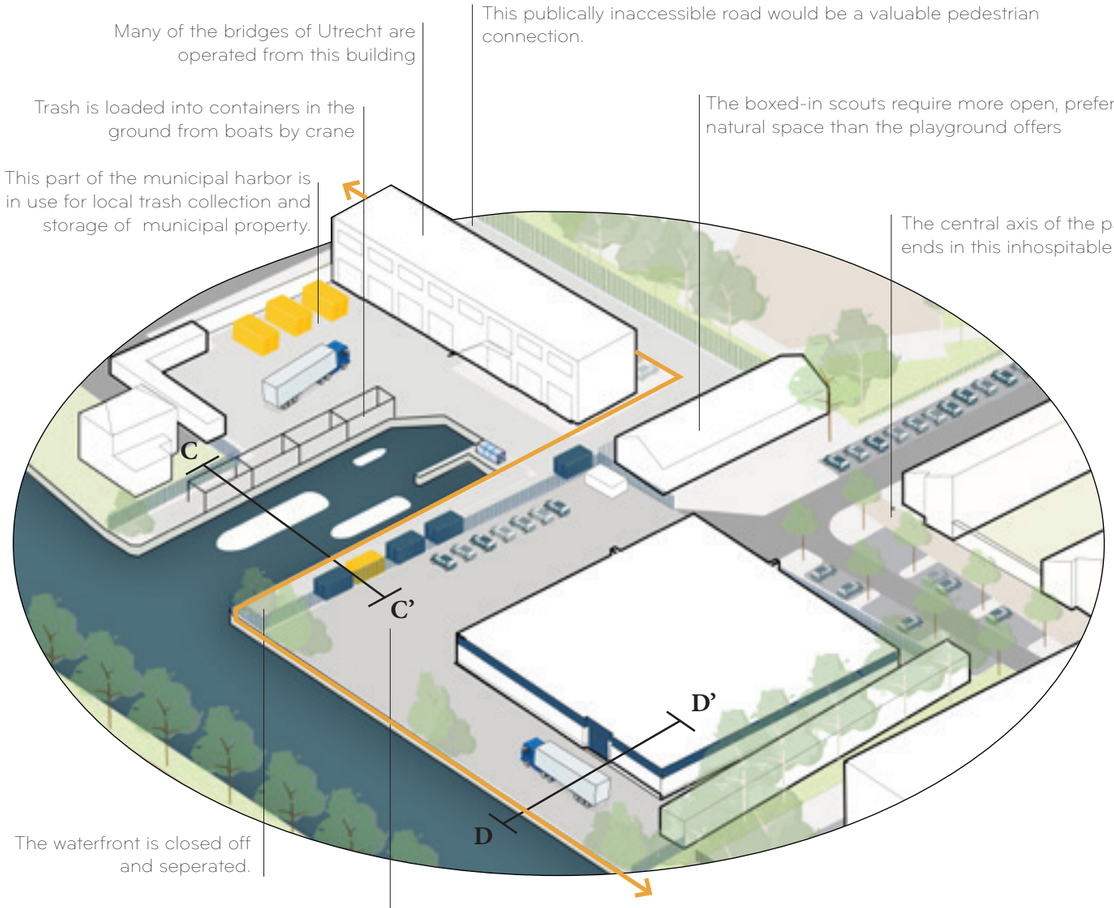


Image 6.18: The Working environment in axonometric view.
photo and section locations are shown in this visual

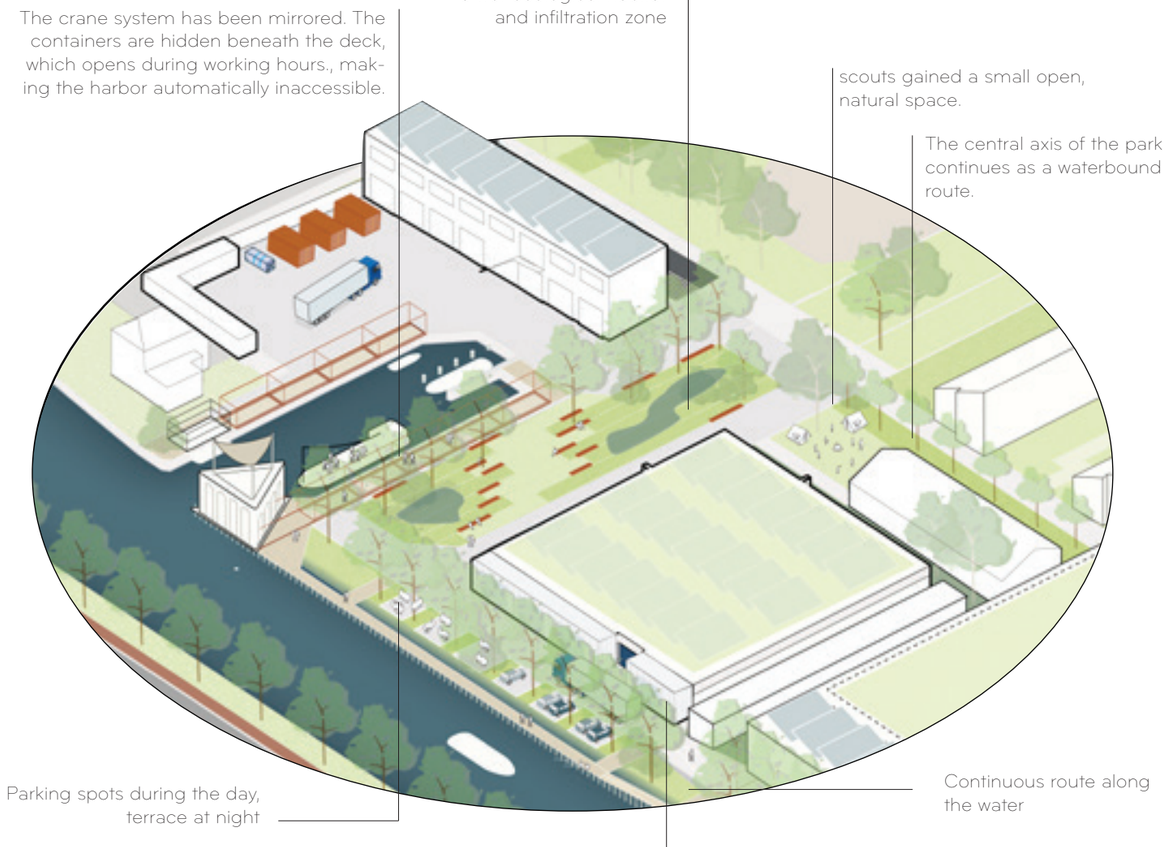


Image 6.20: The van Arkelpark in axonometric view
photo and section locations are shown in this visual

TYPOLOGY 2

At the peak of the harbour design (image 6.22 & 6.23) stands an iconic little building, a contemporary rendition of the old "Engelenburght". While not the whole deck is available during the daytime, people, mostly retired, can sit and watch the comings and goings of the harbour and the canal. Ships and vehicles alike come and deposit collected resources in their respective containers, which are all lowered beneath the main level. The crane system is moving around tirelessly on its supportive structure, moving contents in and out and occasionally loading full containers on trucks. At around 17:00, when the last boats have returned from their daily tasks, the deck slabs, forming the main barrier between the harbour and the publicly accessible Romal terrain, close. As the smells cannot penetrate this seal, the harbour becomes like any marina. Some brave children go for a quick dive between the buoys, and the deck is visited by evening strollers and waterside wanderers underneath what has now become an intriguing pergola structure, Its lights dancing on the water when the sun goes down. The bear boat, now rented by an entrepreneur in the evenings, sells local beers of the inner-city breweries which the boat has restocked on during the day. At times, especially during the weekends, the bear boat and Romal's facade bar co-organise movie nights, floating markets or live music. At night, when the people have left, the green axis transforms from wet hiding place into an ecological connection between the canal and the neighbourhood.

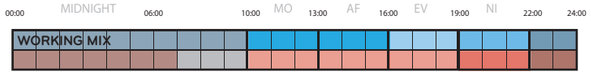


Image 4.17 Polychronic programme of the working space.
This programme is made up of the rhythms of the local businesses, the scouts, active outdoor activities, going out, nighttime ecology,and and food drinks and breaks.

Image 6.21: The original working terrain in axonometric view.

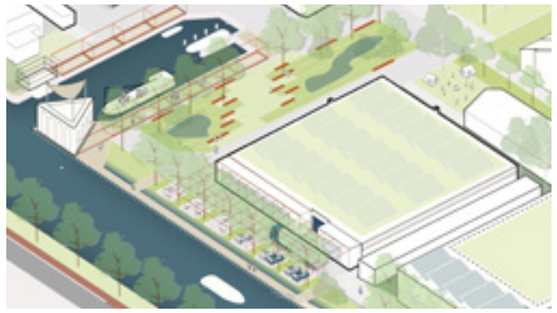
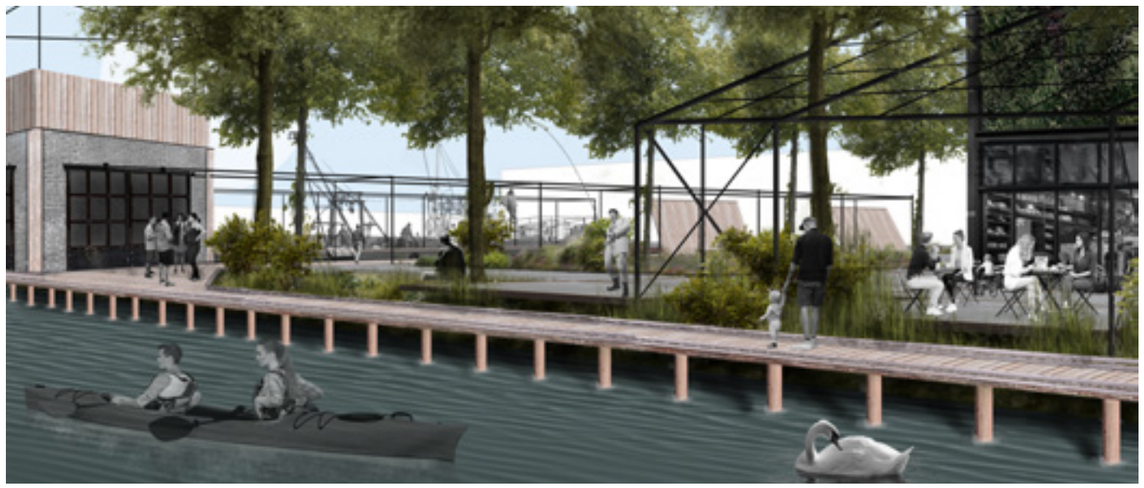


Image 6.22: The working terrain design

Image 6.23: The working terrain as seen from the water



TEMPORARY HARBOUR DECK

Lowering the waste collection into the floor, like the other side of the harbour, allows it to be temporally closed off during non-working times. In the design, this is imagined as a deck that can be raised to access the waste containers (image 6.22).

ACCESSIBILITY

The area containing the businesses has been kept accessible to trucks to enter and turn freely, using a turning radius of 8m. However, as only two business make use of the access road, the number of times a truck will run into another is small. As such, the road is only wide enough to accommodate a single truck at a time. In the rare case trucks do need to pass one another, they require a single time expenditure to wait for one another, instead of a permanent spatial one. This frees up a lot of space for public green (image 6.24). The turning circles are hidden within the more rigid shape language of the design as to not enforce the idea of a high-speed road during times the pavement is not in use by vehicles (image 6.20).

TEMPORARY FACADE CAFE

By using these widths and the 8m turning radius, space is freed up in front of the Romal terrain as well. This space is used to create a new facade in front of the building of no more than 3m wide (image 6.25). This is just enough to allow for single sitting booths and a bar that is accessible from the outside. During the warmer seasons, the space in front of this facade cafe can be utilised as a terrace as well. These spaces also function as the parking spaces of the Romal employees during the day.

WATERFRONT EXTENTIONS

Like other spaces along the water, the design of the working area extends 4m past the previous waterfront edge. This is possible as the canal is wider than required with regards to navigable space. The canal, which is roughly 24m wide, arguably only requires 16m of navigable width. This is because the canal's bottlenecks are 8m wide, meaning that the largest possible ships passing one another would require 16m of free space. This frees up about 4m on each side of the canal for waterfront functions such as boat storage or ecological waterfront zones. The designs along the water thankfully make use of this extra space (image 6.25) but aim to not decrease the flow capacity of the canal.

Image 6.24: Section C-C' before and after the design step.

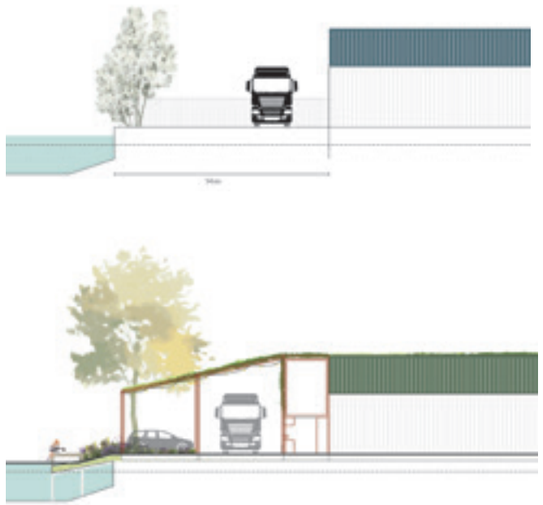


Image 6.25: Section D-D' before and after the design step.

ASSESMENT: A LEAP IN EFFICIENCY

Compared to a ranking of the original situation, the design scores better overall on the assessment rubric. The strategy of combining functions in time by means of shifting ownership scores noticeably better on efficiency than on flexibility. By making the space owned in each moment of the day, free and spontaneous use is curbed. Still, compared to the complete inflexibility of a locked-off terrain, more activities have been made possible to alternate between, causing an increase of the flexibility markers nonetheless. The space is, after all, still partially public. The catering industries proposed in the design simply carry the responsibility for those moments of the day. Overall, this strategy makes it possible to utilise these spaces for other means, causing a significant increase in the markers of the assessment. The exception to the high score on efficiency is compatibility, which drops slightly compared to the monofunctional, completely dedicated spaces.

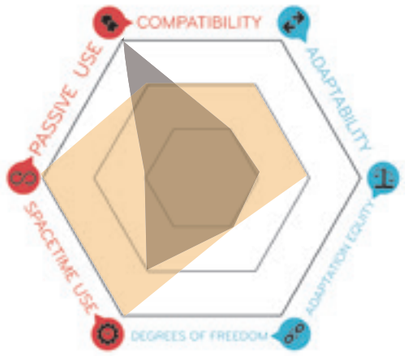


Image 6.26: The design assesment of the working terrain.
The grey area is an assesment of the current situation, while the yellow area represents the design outcome.

DESIGNING TEMPORALLY PUBLIC SPACES

Businesses and their owners are unique. The strategy of additional exploitation of the space proposed in this design is for its likelihood of succeeding in creating semi-public spaces, but it is not inherently required. The proposed combination of functions is therefore not the end-all conclusion to combining work and leisure activities in space. The possibilities depend for an important part on the types of businesses and spaces this is attempted with. In this case for instance, there was quite a lot of underused, paved space that could be used in a different way for the Romal terrain. However, the municipal harbour makes use of its space in such a way that publicness was not an option everywhere, due to the already present intensity of uses as well as the continuous, albeit partial, use of the space by municipal vehicles during the evenings and weekends. For designing a successful polychronic working space, it is essential to fully understand what the limits and requirements are for each existing and envisioned activity are. It is also important that these rhythms are recurring and dependable, especially in the case of different exploiters of the space. After this information is gathered, each function is overlaid with others as much as possible, so that a maximum of additional space can be used for urban ecosystems. This concept may be used not just to better utilise existing business or school spaces in the city, but also help build more polychronic mixed-use neighbourhoods in new city developments.

ADJACENT COMPATIBLITY

While the function of the municipal harbour is generally far from qualitative in terms of recreation, it can be utilised as a scene. The Engelenburght building is intended to look out over the harbour while being separated from it. It takes the hustle and bustle of the harbour and uses it as a way of activating the adjacent space. Compatibility between functions is thus also applicable between adjacent functions, not only those functions that directly overlap.

NARRATIVE COMPATIBILITY

One of the problems of stacking as many functions as possible is that it may deteriorate a certain sense of place. In the design of the park, this is solved by means of similar thematic elements, shapes, colours, materials etc. It tries to correct its functional differentiation by means of a strong visual and narrative unity based in history. In the working environment, the narrative of the beer boat is used to connect the function of the working environment to the activity of going out in a narrative sense.

RHYTHMIC DESIGN AIMS

This typology relies most on rhythms gathered from local stakeholders. This is viable data to use due to the small number of stakeholders in this area. In this case, not only the rhythms were documented, but their vision of the area and their ambitions within it was also requested. In the case of the scouts did that lead to an addittional design requirement: free green space. As the scouts only operate during evening hours, this means this spatial requirement can be assigned a temporal component as well. The big benefit of local information is therefore that time diaries can only inform the way people currently operate. Rhythms, activities and habits are under the influence of certain spatial or temporal constraints. Identifying what those constraints and their implications are gives more potential input as to what could be done to change rhythms, rather than just utilise them. This ties directly to the ideas of time-geography and is a big argument for gathering information directly from users and inhabitants, rather than merely using a temporal model.

TAKE-AWAYS TYPOLOGY II

The design scores better on nearly all markers compared with the original situation. The design mainly scores very well on efficiency, whereas flexibility is curbed by the emphasis on ownership.

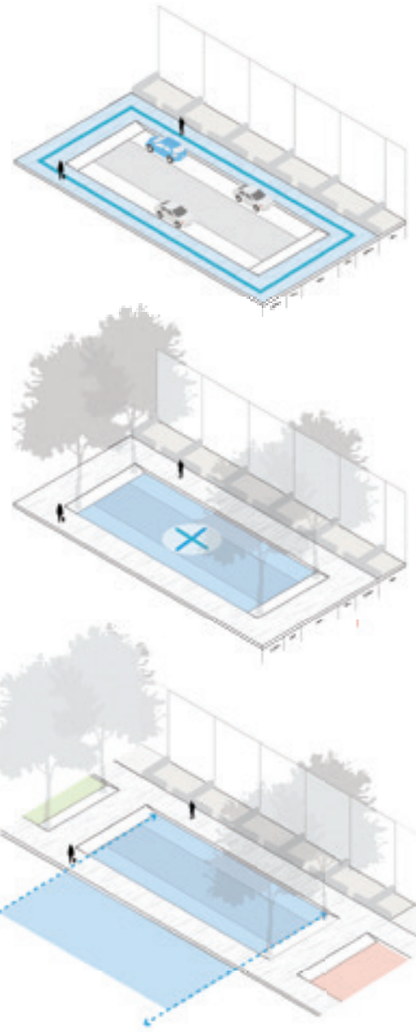
For designing a succesful polychronic space, it is essential to fully understand what the limits and requirements are for each existing and envisioned activity are.

compatibility can be understood as the interaction between functions directly overlapping one another, but also as the interaction between adjecent or even narratively connected functions. In order to maintain a sense of place in these very multifunctional spaces, a coherent narrative or style is

6.3 SITE DESIGNS
NARROW STREET

The spatial analysis concluded that the design needs to challenge the agency of the road function of the street within its narrow profile. To deconstruct this agency in a visual way, the design initially makes the sidewalk the dominant pavement: the car now has to cross the pedestrian connections, which are made more abundant. This generates several lowered road sections, breaking the continuity of the road while maintaining the general profile. Within each lowered section, the road and parking functions are to be shared with additional activities. the sides of the speed bumps are used as a space to place trees more abundantly, further defining the spaces as separate entities. Due to the street being lined with housing only on the west side, the east side opens towards the public spaces of the park, the playground and the working area. The character of the road spaces could relate to their bordering areas, to further the notion of the street being part of the living environment (image 6.27 & 6.28).

With regards to possible temporal combinations, the temporal programme proposes several possibilities. Day-round parking, extreme sports, slow movement & social gathering, ball and court sports, play and ecology are proposed as being interesting avenues of exploration. This proposed programme have been made spatial in the design phase. The outcome is a showcase of how functionalities can be embedded within a still functional road system. While certainly not exhaustive, these designs (image 6.29) serve to show how such a combination could be made and help in assessing what the costs and benefits of such a method would be.



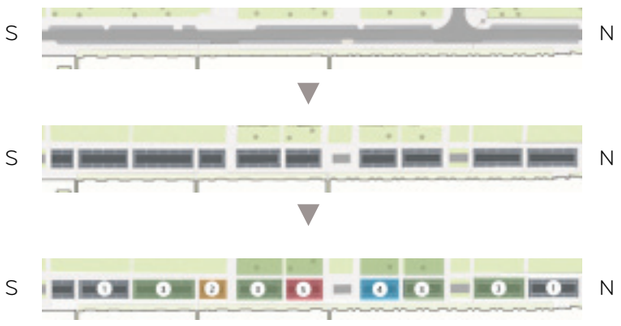
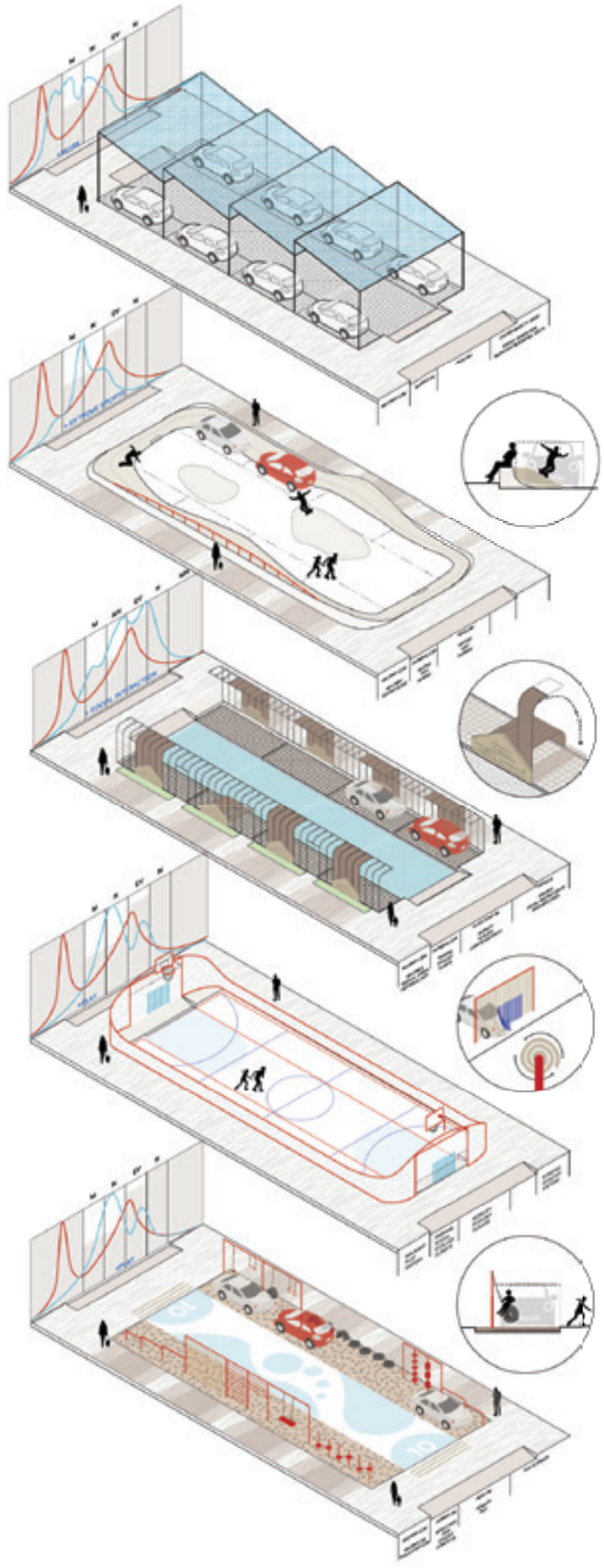


Image 6.27 *The design steps based on the spatial analysis as axonometric principles.*

Image 6.28 *The design steps based on the spatial analysis in plan view.*

Image 6.29 *Five designs in axonometric view. The rhythms are shown as simplified time-use graphs in the background of each design. The red line represents the road-use. the grey bars represent parking use, and the blue lines represent the new rhythms.*



1. CAR HUBS
While the functions are selected to be as temporally compatible with mobility as possible, the designs should inspire discussion on the place of cars in the public space. Expecting this conflict to eventually lead some car-owners to reconsider their need for car-ownership, car sharing hubs are placed at the beginning and end of the street, to offer a direct alternative to car ownership, and in time, the possibility to make the street car free altogether.

2. SKATEPARK(ING)
Skating and skateboarding tends to happen a lot outside of the confines of prescribed skateparks already, hence the discipline "street skating". This is especially true for younger children. Given the present structural conditions of the lowered road, speed bump and need for pavement, designing for skating requires but a few modifications. The walkways are set to 2m here, in order to facilitate the more extreme curvature as well as seating edges and rails, leaving equal space for parking one's car.

3. SOCIAL PARK(ING)
This proposal combines a pergola structure with a mix of vines (Clematis, Parthenocissus, Wisteria, Hedera and Lonicera for instance) together with an adaptive seating system with minimal moving parts. Furthermore, the idea of transparent streets made from materials such as metal grating and reinforced glass is explored. Placing plants underneath creates a type of urban herbarium which can soak up sunlight, heat, water and air contaminants at all times while the road structural functionality is preserved. The grating allows access to insects and pollinators.

4. SPORTS STREET
While "ball games" tend to peak at night, this can be attributed to the pace-making of sports clubs which are often supervised by adults after work. When seen as part of the realm of play, especially in this size category, the combination is viable. Here, a net of heavy hanging ropes (like those found at the car wash) keeps the ball inside the cage while still allowing cars to pass without a scratch if need be (an ambulance, for example) After a game is over, the ropes can be wound up on the upper beam using a turning handle on the goalpost.

5. PLAY STREET
The street as a place for play is not a new concept, but ever since the introduction of the car it has been declining. This design makes use of the widespread availability of relatively two-dimensional play objects in order to mark the edge of the parking spaces. In the case of moving elements, soft materials such as rubber are used in order to protect the vehicles from harm. The surface then, is made up of wood chips, preferably from native trees felled in and around the neighbourhood. This material is already in use as a ground cover for both playgrounds as parking spaces. Furthermore, the material allows for permeability, less daytime heating and a habitat for insects and fungi.

ASSESMENT

The original street design scores poorly on all markers. Compatibility is scored low due to the fact that, other than work spaces, streets are already not considered to be monofunctional. They facilitate social interaction and play, for example. Currently, the mobility function is detrimental to those activities. In this specialised, monofunctional space different activities are possible, but it is technically unauthorized behaviour which may or may not be tolerated by other road users, who will always have a higher claim to the space. With regards to flexibility, mobility is very clearly the main use of the space (degrees of freedom) and this lends power to car users (equity). In order to alter the street function, say for a neighbourhood party, whole blockades are usually planned and arranged (adaptability).

The design improves slightly on all markers. compatibility in the design suffers a lot, especially since only two functions are mixed here, but both are still legible and usable. The passive use is slightly increased by means of greenery, additional trees, water collection and energy production. spacetime use is increased but the individual spaces are not fully activated as done in the previous two typologies. With regards to flexibility, the increase is marginal as well: the road function is deconstructed as much as possible within such a narrow profile, allowing for other functions to take place. However, in order to compete with the still very present road these lack nuance. This slightly levels the playing field between pedestrian users and vehicles, but when the car eventually arrives, it will still take precedent over other users. This also means certain activities can only be done during certain hours, although this problem is reduced precisely by the temporal selection of these specific functions. In general, therefore, the design increases both efficiency and flexibility. Reaching better scores would either require giving up the road function altogether or having more space to recontextualise the road by means of its surroundings. How this can be done is explored in the final typology.

All in all, the road function contains so many spatial needs and requirements over the complete surface area, that a thin profile such as this only allows alternative functions when these are very clearly legible, intended uses. In other typologies, using spaces more efficiently also means being able to redefine some space for non-human uses.

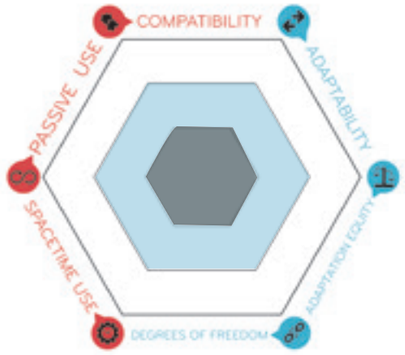


Image 6.30 The design assesment of the working terrain.
The grey area is an assesment of the current situation, while the blue area represents the design outcome.

This proves far harder in such profiles, as all space is already in use for human functions. The only way to circumvent this is to go into the

MUTUAL EXCLUSIVITY

When considering multifunctional parking spaces, there is a clear difference between spot-specific functionality (as seen in the playground and pergola designs) and the need for completely cleared space (as seen in the sports and skatepark designs). The chances of a space clearing completely diminish substantially when more parking spots are included and this damages both the efficiency and the flexibility of the space. Therefore, spot-specific functionalities are far more viable. For the spaces that need to be completely cleared, such issues may be solved by creating a dialogue in the neighbourhood on which spaces should be available at which moments of the week/year, etc. This could create a link between the seasonal and the daily rhythms within public spaces, but it would require a lot of coordination. In other words, the spatial requirements of these activities are not completely incompatible with parking, but they are mutually exclusive. A certain activity (e.g., soccer) thus cannot take place if only one person uses the space for the alternative function (parking).

REGARDING AFFORDANCE BALANCE

As described in the assessment of the park typology, the balance between the affordances and legibility of intended activities is of great influence on the experience of the design. The road with sidewalks is a classic sight in the Netherlands, loaded with meaning caused by upbringing, social rules and laws. The affordance of the road, then, is very dominant and needs to be challenged accordingly. This generally led to multifunctional prescriptive design solutions, rather than open-ended designs. Still, some variety in that regard can be observed. For example: the social park(ing) and play areas are still communicating the idea of roads quite clearly, albeit less clear with regards to parking. The sports and skate spaces, however, seem to be more legible than the road function itself. While some balance is required to at least make both functions legible, this (un)balance can also be used to convey a certain hierarchy between functions.

EXPRESSING THE CONTESTATION OF SPACE

Mainly due to the character of the mobility function, the intended uses are almost completely mutually exclusive. These designs require flexibility from their users as they are more likely to generate conflicts. This is part of the point however, as these designs are a visible and tangible manifestation of an already existing spatial conflict between mobility and liveability. It physically challenges the idea that the car-centric street is an unavoidable reality by proposing the alternative while still allowing the other. This is also why the alternative of shared mobility is of importance in the design. If successful, conflict avoidance may lead people to cycle and walk more often, which reduces the business of the roads. The storage park of the problem: the heaps of largely unused cars, is initially increased as the midday functions rely on the cars leaving the area. By proposing an alternative for car users by means of the shared car system at the beginning and end of each road, this problem could be partially solved as well. Multifunctional space does not just challenge users to be more flexible with regards to one another, it also embodies a discussion that should be visible. This would, in turn, inspire a more flexible mindset about what a street can and should be.

TAKE-AWAYS TYPOLOGY III

Including cars in narrow profiles severely limits opportunities for qualitative polychronic designs, but the method still improves markers of efficiency and flexibility equally across the board

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Functions and activities can be technically spatially and temporally compatible, but still be mutually exclusive. Rhythms are not absolute in nature: people partake in activities all over the day, albeit in different capacities. Mutual exclusivity can thus be detrimental to the efficiency and flexibility of a space.

The balance between affordances of intended activities is again highlighted as an important influence. Very dominant, legible, prescriptive functions require either an equally pronounced alternative function, or need to be made less dominant within a space to better fit the alternative.

Polychronic design can be used as a tool to visualise existing but unseen spatial conflict in general. In this case, it can be used to transition towards a less car-centric living environment.

6.4 SITE DESIGNS

WIDE STREET

The spatial analysis concluded that the space should incorporate car-centric infrastructure into other residential functionalities as much as possible. The psychological speed limit of the space should be adressed and the wide profile should be used to create an ecological corridor and places for neighbourhood activities throughout the day. The design should also maintain valuable trees and shrubs and communicate its NHW-related history.

Temporally, this typology aims to use rhythmic information in a different way. The street is mostly meant for its local inhabitants. Due to the large amount of available space in this profile compared to the small amount of users, this design explores stacking activities of similar rhythms in order to encourage interaction between different inhabitants of the street. In this context the street as a whole should still be functional during the whole day, but it may contain spaces that are optimised for a certain moment of the day. The temporal design thus consists of activity mixes aimed specifically at the morning, afternoon, evening and night.

The design itself bases itself of these analysis. The traffic system is rearranged to form a one-way road with perpendicular parking spots on one side. The design seperates main pedestrian movement from faster traffic users while also making it possible to encorporate the street and parking spaces for people staying in, rather than moving through, the space. By moving the road from one side of the road to another, this arrangement creates spaces that differ in traffic intensity and lighting conditions during the day. The activity mixes from the temporal analaysis are then coupled to the most favourable conditions for each moment of the day. The road lends its design language of 45 degree corners and formal elements from the history of the NHW. The design maintain existing green structures and create a network of thicker vegetation throughout the street. As another historical nod, the central axis of the street always contains some form of water-related element such as a wadi, rain garden, a surface drain or a fountain element.

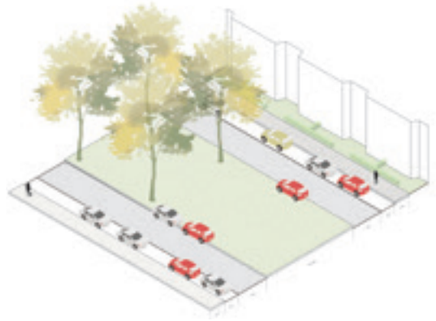


image 6.31: The current situation

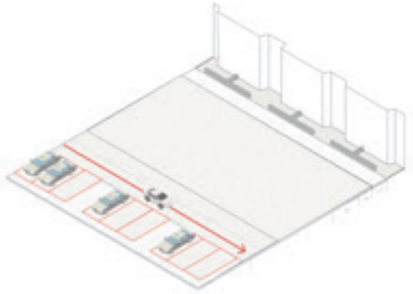


Image 6.32: One-way, one-sided traffic

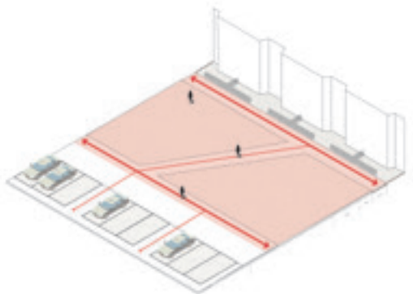


Image 6.33: large all-pedestrian spaces

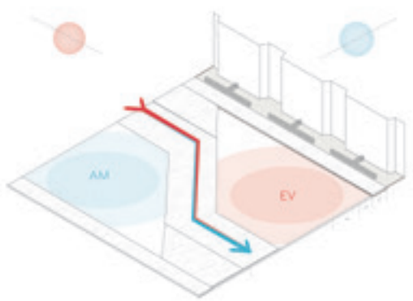


Image 6.34: spaces linked to characteristics of the time of day

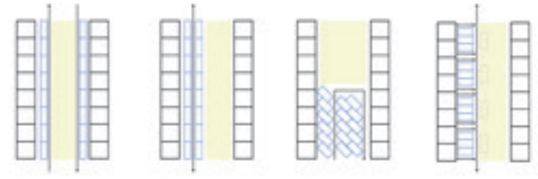


Image 6.35: deciding upon a parking system:
Several methods of roadside parking have been explored. The first method is currently in use, and makes the green space inaccessible. The second method is more promising, but always seperates the road system from the other space, making for a difficult annexation of the paved area for other functions. The third method would create a large unbalance in spatial quality at the entrances of the street. The final solution has been selected due to the possibility of committing part of the pavement to public functions as well as a higher potential for multi-purpose parking spots.

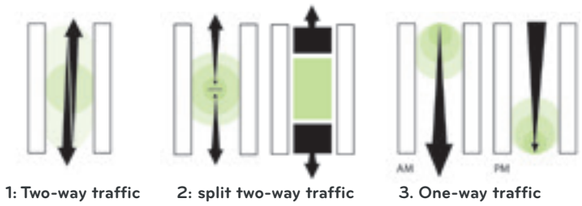


Image 6.36: deciding upon traffic orientation:
The orientation of the traffic decides when and how cars drive through a certain area. Two-way traffic is best for a traffic connection, it has wider roads and allows for cut-through traffic. For a calm living environment, splitting up the traffic is a way to generate a calm central area, but it still requires wide roads and clashes with the history of the julianaweg as a continuous waterway axis. One-way traffic requires less wide roads and disencourages cut-through traffic. One way traffic is also a predictor of activity at a certain point in the street at a certain time. Cars in use all pass the exit of the street in the morning, and the entrance of the street in the evening. This can be used to designate functions fit for morning or evening rhythms, at the least busy location with regards to traffic.

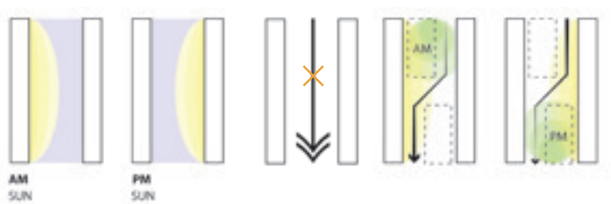
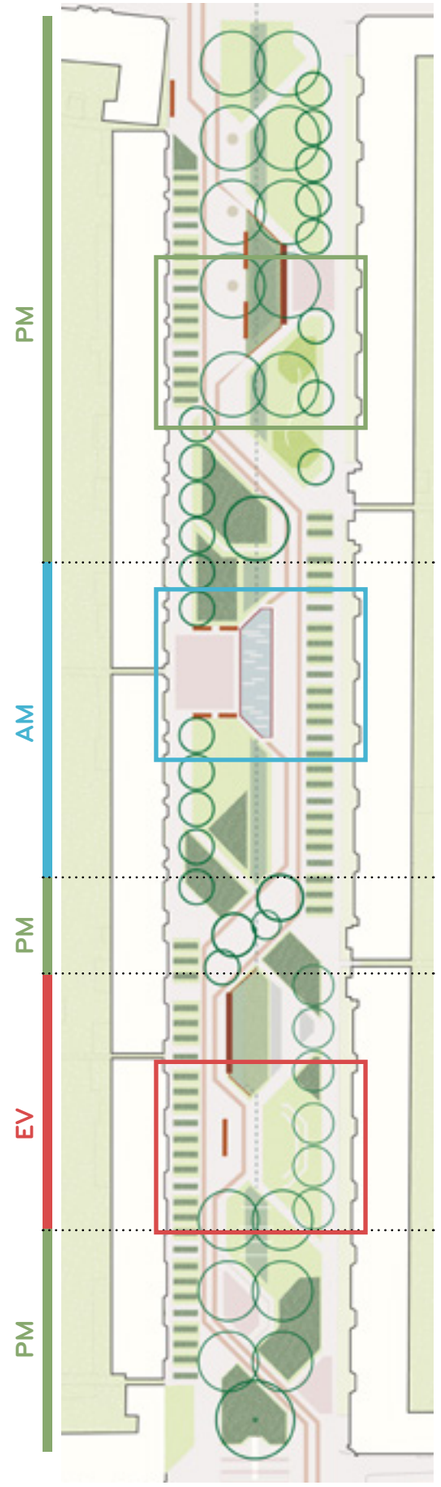
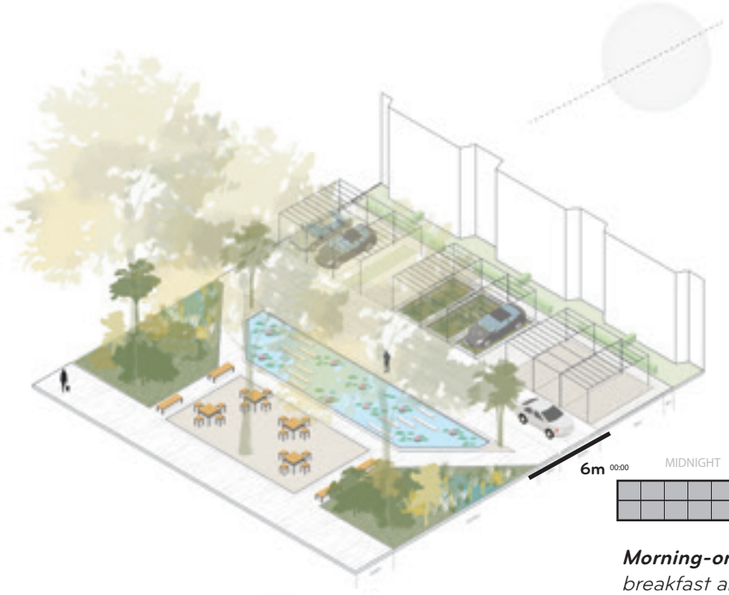


Image 6.37: a temporally based design strategy
Due to the east-west orientation of the street, sunlight reaches both sides of the street at different moments. Coupling this with the temporally-linked calm sites of the street allows for activities to be calm and sunlit during the mornings and evenings. Turning corners also helps with psychological speed limits. In the afternoons, shading routes and spaces is the main objective.

Image 6.38: The overall street design and the locations of axonometric views (1:1000)





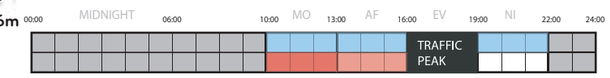
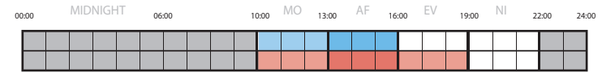


Image 6.40: the morning-oriented space
The morning oriented space allows light to access the public spaces. This space is meant to be calm and soothing, containing a lot of surrounding greenery and a formal water element. The square is meant for sunny breakfasts and ootentially for shaded lunches. The parking elements double as fitness tools.

Morning-oriented space: *Morning sun, fitness, walking, breakfast and morning coffee.*

Image 6.41: a midday-oriented space
The midday oriented spaces use the existing tree locations for a shaded cover during the midday. This axonometric section of the road shows its play spaces and skatable surfaces. It is also an example of how the road space can be deconstructed by overtaking it by a square-like space. The parking elements are as green as possible, to minimise daytime heating.



Midday oriented spaces: *Midday shade, lunch, lafternoon walks, play and skating*

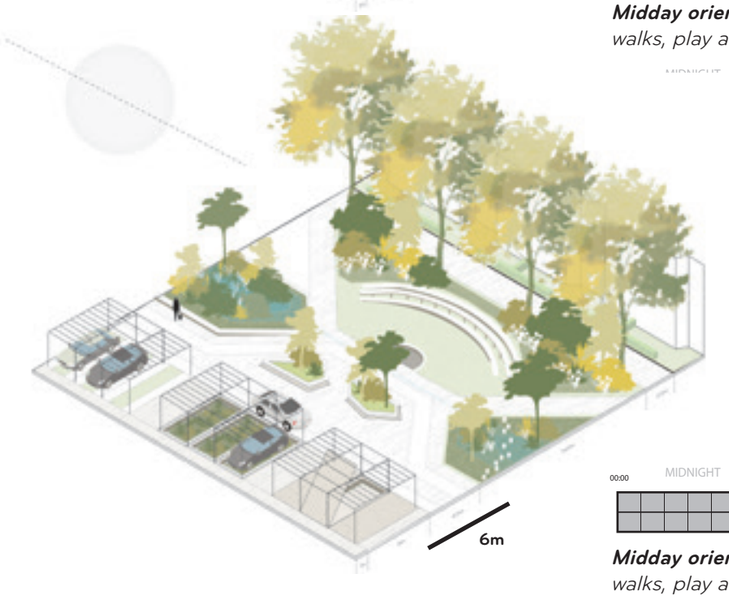


Image 6.42: a midday-oriented space
The evening space us most busy with traffic during the morning. It makes use of the evening sun, heating up the space during the last light hours of the day. The continuous bench can be employed as a picknick table, play element or theater-like space. The pit in the centre can function as a fire-pit, a barbeque space, or , when covered, as a tiny stage area. Again, the road is symbolically deconstructed to lend more authority to a idea of a square.

Midday oriented spaces: *Midday shade, lunch, lafternoon walks, play and skating*

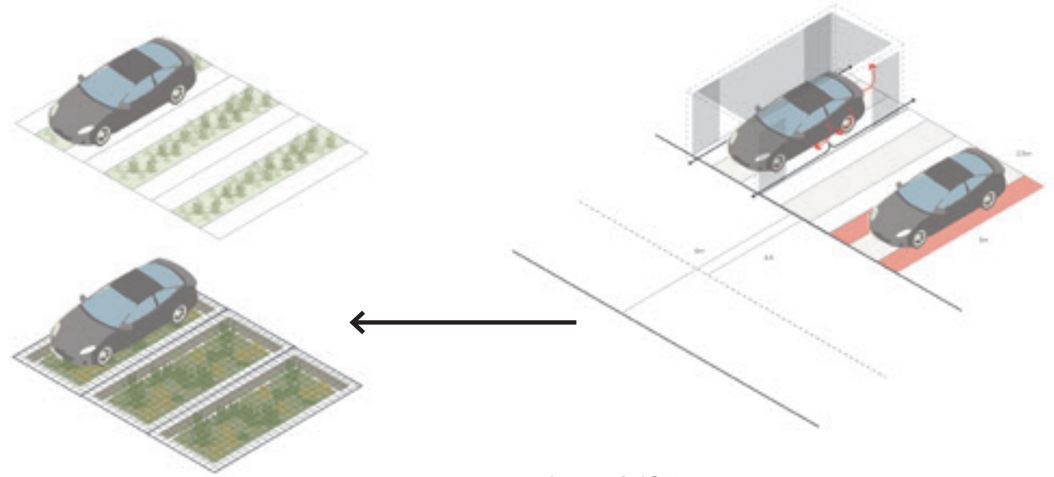


Image 6.42: **Parking space requirements**

PERPENDICULAR PARKING AND COMPATIBILITY

Like in the narrow road, which had parallel parking spots, secondary functions can be added in this typology as well to explore perpendicular variants. This design exploration essentially captures and mirrors the design process on the other scales. It starts with assessing the requirements of the parking function (image 6.42). These include the required width of the spot and of the pavement for entering and leaving the spot, the ability to open and close doors and exit the vehicle, the weight of the car and the position of the tires. This dictates the constraints within which other functions must operate. Then, looking at the rhythm of residential parking spots, certain temporally compatible activities can be found. In this case: daytime ecology, fitness, play and court sports. These activities can then be facilitated within the confines of the parking constraints (image 6.43). Finally, even combinations of these design interventions could be made. However, for each addition, the compatibility should be reassessed.

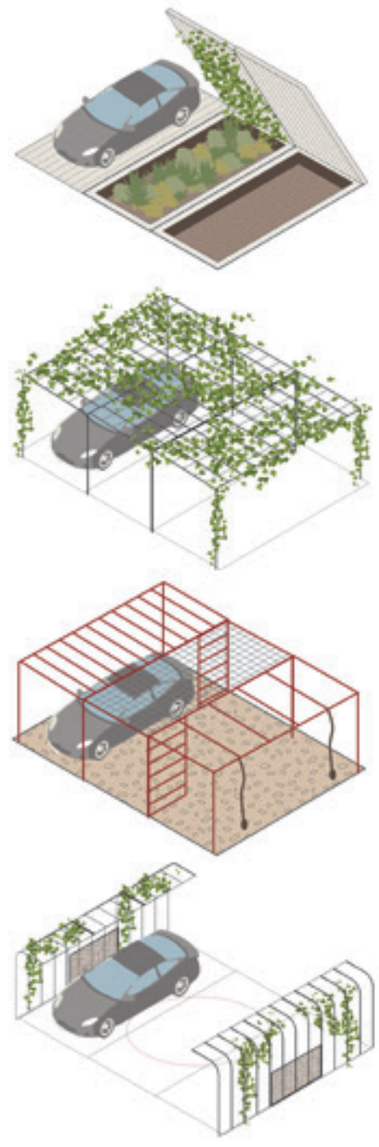


Image 6.43: **Optimising the parking spaces**
These explorations contain ways of incorporating greenery or various human-focussed functions. From top to bottom they contain:
1. levelled green strips
2. rastered rain garden
3. opening green bed/storage compartment
4. trellisses
5. play/gym props
6. small soccer court

ASSESMENT

The original street scored slightly better than the narrow street typology, due the large amount of space used for the central lawn. This lead to a higher amount of ecosystem services as well as some degrees of freedom in using the space. Still, the adaptability is low as both the road and the field are seperate monofunctional, hard to adapt entities. The compatibility is also low, as the lawn space suffers heavily in its functionality due to the road.

The design would score very well on spacetime use as a whole, but individually the optimised spaces mostly adhere to around two moments of the day. On the whole the design provides the ecosystem services listed in the rubric by means of the green and blue structures. While the design does better than the narrow street design in most regards, mobility and parking still largely influence the possibilities of the design, thus still leading to average compatibility. The freedom to interpret the space has gone up quite a bit. This is due to the various possible uses of the public spaces but mainly due to the road occoccassionally being compeletely dissolved into a public space, creating quite an informal, interpretable situation. Adaptability goes up but is still constrained by the mobility and parking functions. Equity also goes up, due to the leveling of the playing field between the movement function and the living function of the street. However, the design is far more complex and dense than it was. The street is designed to be a local public space, giving it an almost semi-private character. Due to this loss of a public sense, equity is placed on the average tier as well.

TEMPORAL OPTIMALISATION

By designing the street based upon the temporal variance in traffic and sunlight, a solution has been presented which is based upon a form of spatio-temporal optimalisation. This solution seems to lie very close to spaces described as the very issue in the original problem statement. In a way, it actively sets out to design near-monochronic spaces: spaces that only function optimally at a certain moment of the day. After all: in the designs proposed by this thesis, polychronic design thinking has been mainly utilised to practice a form of functional generalisation, of stacking functions, rather than specialisation. Is it possible then, to design efficient and flexible streets by doing the exact opposite?

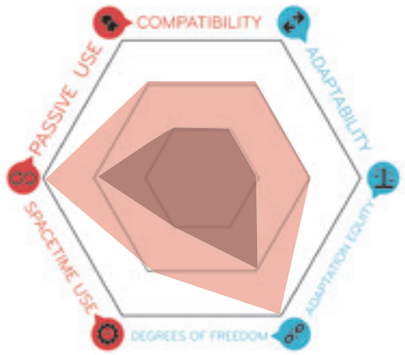


Image: The design assesment of the working terrain.
The grey area is an assesment of the current situation, while the red area represents the design outcome.

This interpretation depends hevaily on wether the street is considered as a whole, rather than as individual spaces. The original street contained a lot of free (albeit inaccessible and unusable) space. All of this space was largely homogenous in nature. It presents the other end of the extreme of generalist, open-ended spaces: a homogenous, empty, and largely uninhabited lawn of roughly 1,4 km long lacking any workable affordances towards precise functions or towards a sense of place. In order for the street to be efficient and flexible, it first needs to provide different spatial characteristics and affordances for people to utilise.

TEMPORAL DIFFERENTIATION

It is also important to note that this process does not cancel out the use of the time-oriented space during their 'inoptimal' times. It merely suggests that calm and sunlight are favorable in most situations and times in this particular climate. It involves a value claim, which can be contested. During a heat wave, for instance, the preferred situation may be shade, at which time the morning and evening spaces could be used invertedly fro, what is suggested here. Following this idea, the direction of the traffic could even be flipped during the hottest summer months, to facilitate this flip of chronotopes even further.

As such, creating spaces with different affordances is immensely important to both flexibility and efficiency. This can be seen in virtually every typology: the spatial characteristics dictate what can happen in a space, and variety of these characteristics is required in order to provide space for every activity wihtin the public realm. This means creating big and small spaces, open and dense spaces, paved and unpaved surfaces, flat and three-dimensional structures, etc. Diversity is key. Designing polychronically thus involves defining spaces with unique spatial properties and then informing suitable combinations of functions by means of rhythmic information.

INTENDED CONFLICT

The temporal specialisation in this design is intended to have social repercussions. As spatial charachteristics lure people towards a certain space at a certain time neighbourly interaction could be increased. This particular street is in a rather unique situation, considering the street has roughly the same floor surface as all houses facing the street combined. The space is far too large to be efficiently utilised by just the inhabitants of the street. Using much of this space for greenery and water, partly in order to limit the total amount of actively usable space for inhabitants, is an important part of the optimalisation of the street. Having less space available for human use means social interaction is more likely. Knowledge on rhythms can thus not only be used to smoothe out use over time in highly contested spaces, it can also be used to **focus** social interaction between different types of users in less contested spaces.

LEGIBILITY

Due to the focus on local users, afforfances do not need to be obvious to everyone, as long as they are understood by their users. For this reason, interventions such as the vastly different road aesthetic and some of the stranger parking solutions are possible where they would not have been in a more public context.

ADAPTABILITY THROUGH CO-OWNERSHIP

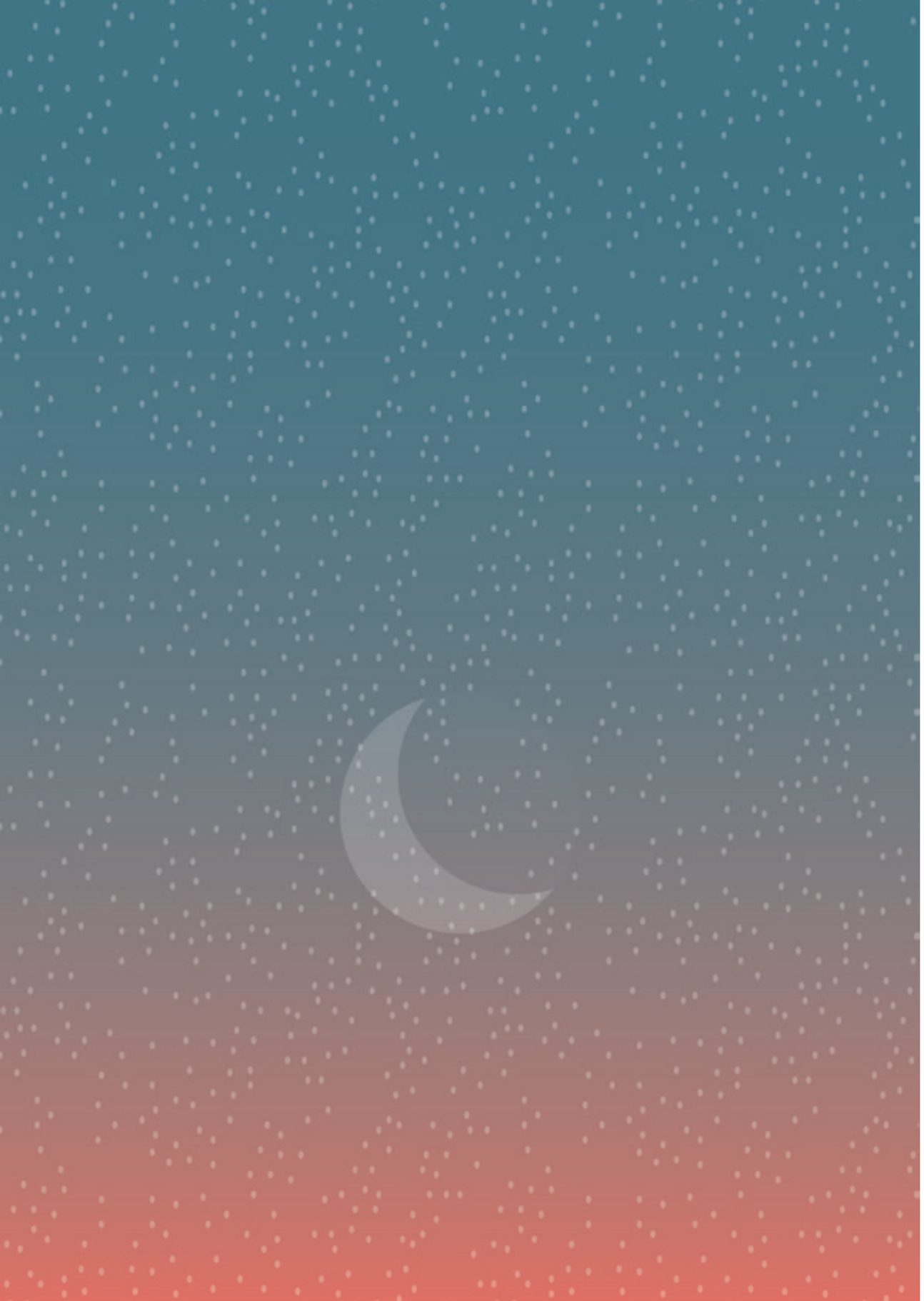
The primary users of the spaces are the inhabitants of the street, who are in a position to utilise the space as an extended garden. (Co)owned items such as beach umbrellas, chairs, slacklines, goals and trampolines may find their way into these spaces far more easily than they would in public parks. Adaptability is therefore higher for direct inhabitants than for others. As such, co-ownership and co-design are likely to be vital to the succes of these spaces, and more personal and local rhythms should be examined before actually implementing polyrhythmic design solutions in such spaces.

TAKE-AWAYS TYPOLOGY IV

Temporal optimalisation seems counterintuitive to designing polychronic environments, as it leads to monochronically optimised spaces. However, what is considered optimal may vary for different users and different times. All in all, variety and function stacking leads to multifunctional spaces that offer different characteristics during different times.

Rhythmic information can be used to avoid human interaction or encourage it. This too, depends on what is to be achieved by the design. Very contested spaces may benefit most from avoiding conflict, while scarcely visited public spaces may become social hubs by means of temporal concentration.

The "publicness" of the typology influences how clear certain functions need to be. Some affordances do not have to be immediately understood by every user, as long as it is understood by its users. Local users are more capable of appropriating the space if the right conditions are present. Rhythmic information also become less predictable for smaller groups of people. Due to these reasons, more locally-oriented spaces can therefore be left less defined, opting for a more open-ended aesthetic than the other typologies could.



DISCUSSION

7

7.1 DISCUSSION

During the thesis process, some choices were made with regards to the methodology of the research and the design that need to be discussed before the value of the outcome can be better understood.

APPLICABILITY OF THE TYPOLOGIES

Since the used time diary data is specific for the urban population of oud-Hoograven, the temporal data is not directly applicable to other situations. Still, the neighbourhood contains people of all ages in no abnormal rates, so the data is still relatively valid for similar situations. The design solutions themselves are therefore usable as inspiration for other designs in similar contexts, but local investigation into rhythms and spatial needs would be preferable. The eventual designs have been heavily influenced by the genius loci through historical references. While the eventual form of many of the designs can therefore the not be *directly* applied to any similar typology, many of the strategies and activity mixes can. Most importantly, the methodology of the design process is reusable in other situations.

INFLUENCE OF THE COVID-19 PANDEMIC

The constantly shifting rules and regulations related to the covid-19 pandemic have had a large impact on rhythms and daily behaviour. This was the reason local observations and interviews were deemed insufficient to be able to give a complete picture of 'normal' rhythms, and time diary information was selected. The data used is from 2016. While these daily rhythms historically do not change in extreme ways, the pandemic and the associated regulations have proven such a disruptive force to normal daily rhythms that a permanent shift is entirely possible with regards to how and where people spend their time. Working from home is encouraged while social interaction is discouraged through the means of, effectively, time policies. As such the applicability of the outcomes relies on a 'normal' behaviour that may never fully return. Regardless, the thesis mainly shows the workings and potential of polychronic design, even if the rhythmic realities change. The fact that rhythms and uses of space change over time is further proof of the importance of flexibility and multifunctionality.

APPLICABILITY OF THE TIME DIARY RESEARCH

The time diary research used was undertaken by the social and cultural plan bureau and is not directly intended as a means for spatial planning and urban design. Rather, it is meant to provide insight into social aspects and the way they change over time. **()** Conclusions drawn by the SCB itself relate to aspects such as the amount of chores men do in the household as opposed to women, or how many hours people work and travel as compared to earlier years **()**. The codes listed in the questionnaire were not geared towards spatial aspects. Certain activities had to be assumed to take place either at home, in public spaces or somewhere else. The codes used in the research are therefore very specific for certain social activities such as types of self-care, several types of chores and work hours, for example. It is often lacking information that would be spatially interesting, such as the mode of travel, the type of play or the locations of certain activities for example. So, while the information of the time diary research is complete, it lacks some of the detail required to make informed choices. In the design for example, rhythms of broadly defined activities such as "social interaction" are used. This can inform a designer of a certain social need during a certain moment of the day, but it lacks a good understanding of what this social interaction is made up of. While this ambiguity may lead to a less constrained interpretation from the part of the designer, it would be better to be more informed on the specifics of such codes. If rhythmic information is to become more valuable as a design input, the national time-diary research could become more detailed on distinctions related to the use of public spaces. Specifically tailored spatio-temporal databases for spatial planning and design would be an even more valuable resource. GIS-based location tracking data coupled with detailed time diary queries focussed on public and social activities would be especially valuable in this regard. Such a method of data collection may also allow research into local behavioural changes in case of spatial interventions have been made. A case could also be made for favouring methods for gathering more local rhythmic information, but observation and interviewing is a very time costly method. Having a standardised dataset would be sufficient for more basic implementations of temporal multifunctionality.

PEAK-USE AS A SIMPLIFICATION OF TIME-USE

in order to make the time-diary research more applicable, the time-use graphs were simplified into peak-use schemes. The peak use was determined by means of the highest average values of the activities in the temporal divisions. As is the nature of any simplification, the peak-use scheme does not convey all the information that the time-use graph contains. for each polychronic programme, a peak use scheme has been provided. By means of the temporal data, these programmes could be comunicated as time-use graphs as well (as demonstrated in the images in paragraph 4.5) For the purpose of this research, that level of detail has not been found required.

THE VALIDITY OF AVERAGES

The graphs deduced from the time-diaries inform of an *average* weekday and an *average* weekend-day. It is built up of information gathered all throughout the year, under varying weather conditions and compiled of Mondays to Thursdays and Saturdays & Sundays, respectively. It provides a baseline for expected behaviour in time that is expected to be reliable for large groups of people for an average day. However, certainly not every day is the same. Behaviours and rhythms differ due to the time of year, the day of the week, holidays, the weather and many other reasons. While these can be anticipated upon to some extent, the complexity of reality dictates that every day is different. As such, any activity may suddenly see a surge or peak beyond what is recorded in the outcomes of the rhythm research, which raises some questions as to the validity of the data as a predictor of behaviour. While daily rhythms are often overlooked, it is still important to take other temporal factors like weather, seasonality, holidays, or sheer randomness into account when designing public space. For an even more in depth understanding of human behaviour in time, time-diary data from different seasons could be compared. The problem is that the more complex the spatiotemporal information becomes, the harder it is to translate it into designs. Already the interplay of weekdays and weekend days created complex deliberations in the design as some functions that were compatible during weekdays were overlapping during the weekend. The consideration of every possible temporal variance might bring to light more temporal incompatibilities under scpecific circumstances. It is not so much the seasonal changes themselves that pose a challenge, as these are of a more permanent nature than the highly dynamic rhythms of daily life and may allow for more semi-permanent design solutions. It is rather the potential influence different circumstances have on these dynamic rhythms that may cause further temporal incompatibilities, that should be investigated further.

All of this can be taken as another general argument for flexibility and heterogeneousness, which is a recurring aspect in the designs already. Variety between affordances allows for different uses under different circumstances. Still, anticipating on other types of spatiotemporal relations than what has been considered in this research may have a lot of elegant design solutions to offer.

ANTHROPOCENTRISM

The data from the time diary research is inherently anthropocentric. This has pushed the design process towards a human-focussed design as well. While ecosystems, habitats and ecological connections have been an important factor of the designs of the thesis, there is a huge potential in a better understanding the rhythms of flora and fauna. It was outside of the scope of this research for now, but what has been determined is that spatial functions always have a temporal component as well. Better understanding the needs of ecosystems in time may make ecological functions easier to implement in contested spaces dynamically. Like with human activities, understanding habitat requirements such as lighting levels and disturbance zones as temporal components might make them easier to combine with other functions. This would allow specific animals and plants to be included as equal stakeholders. In this way, the prioritisation between ecological and anthropogenic functions in a polychronic design process is not based on the availability of information of each stakeholder, as arguably has been the case in this thesis. Natural spaces are arguably already polychronic by definition, due to the tendancy of natural processes to optimise their resources. Especially in dynamic, anhtropogenic spaces, a deeper understanding of specific needs and rhythms of plants and animals may lead to more ecologically inclined time-space as well as a more effective use of space overall.

AGE AS A PRIMARY INFORMER

Initially, the research was set up to give an indication of free time and how it was spent for different age groups. While this provided some insight: for instance, that the elderly are far more active during the morning than any other user group, and the midday belongs mostly to children, it proved hard to directly translate this data into design logic. Any conclusion drawn from it would be overly

simplistic at best, as people's actions are led by far more than their age. It would have required design interventions to be directly linked to specific ages, which would have required assumptions and presuppositions that could not be supported by research. Therefore, the age groups were instead used to inform a coherent model of the Hoograven population, but the activities were the outcomes in and of themselves.

ADAPTIVE SPACES

While some examples of this method of combining activities in a space are present (the theatre lighting, the moving benches on the sports field and the retractable deck of the working environment, for example), they are less present in the design solutions. This is because high-tech options and effort to switch between functions have a negative effect on the flexibility markers of equity and adaptability respectively. Such solutions are also assumed to be more costly, less durable and less likely to be implemented than low-tech design solutions.

CUTTING EFFORTS, IMPROVING OUTCOMES

The research process towards the gathering of the rhythmic data has been a complex and time costly endeavour. Expecting landscape architects and urbanists to include this analysis as a standard step in a design process is therefore not realistic. Many of the outcomes with regards to rhythms however, (such as the rhythms of traffic, work times and going out, for example,) are rather straighforward and within reasonable expectation. As such, designers can already accomplish a great deal by considering potential addittional uses and by making educated guesses on likely rhythmic properties of these activities.

Another option is to produce a more standardised overview of urban rhythms. In the thesis, extra care has been given to make the data as valid as possible for the local conditions of oud-Hoograven. However, the overall rhythms may not differ that significantly unless a very specific user group is abnormally over- or underrepresented. As such, a more general outcome of rhythms could be produced for the different levels of urbanity or even specific urban typologies and densities. This may lead to a more general understanding of urban rhythms and their temporal compatibilities. Moreover, with a minimal amount of programming, this part of the temporal research can even be fully automated. A tool could be produced that would use neighbourhood characteristics such as urbanity and demographics as input, generating a peak-use overview on the same level of detail automatically. Such a tool could be built upon to incorporate some of the points raised in this discussion, such as non-human rhythms and more design-focussed rhythmic distinctions.

As such, while the approach taken in the thesis for every design would be impractically slow, the data processing could potentially be automated and improved upon. This would only leave the designer or planner with the most local queries that involve interviews with local stakeholders and businesses. As these conversations are likely already part of the reserarch process, the temporal aspect could be easily included in these discussions. From the point where the rhythms are represented in a peak-use overview, it becomes mainly an interplay between the planning problem of defining a polychronic programme and the design problems those generate. If polychronic design can simplified to the design problem of combining certain pre-defined functions in this way, it becomes a far more viable method for common practice.

So, while thinking about space as being subject to changing rhythms and users may already lead to an increase of polychronic design solutions without the requirement of data-driven rhythmic information, the process of representing general urban rhythms could be facilitated quite easily. A governmental institution promoting compact city development could take up such a project, for instance.

7.2 CONCLUSION

The central question of this research: "How can polychronic design solutions contribute to more efficient and flexible urban environments?" has been subdivided into 3 research questions and a design question. This section serves as the collected answers to these questions and on the central question. It also provides additional reflection.

research question I

what are the relevant urban rhythms for designing polychronic public spaces in the urban context of oud-Hoograven?

Several relevant rhythms for designing polychronic public spaces have been found. The most relevant and appplicable of these rhythms are rhythms that concerned active uses of space that can be tied to specific spatial affordances. These rhythms include ball and court sports, fitness, skating, water sports, play, parking rhythms and general outdoor movement. Other important rhythms are rhythms that indirectly or partially make use of public spaces, including shops and services, going out, social interaction, culture and food drinks and breaks. While not necesarily taking place in public spaces, these rhythms have the potential to take place in a more public setting and therefore pose a viable source of potential programme. Activities that do not directly take place in the public space of the neighbourhood, but are very influential to rhytms nonetheless the rhythms of sleep, work and school, travel, and digital media. Finally, ecological rhythms and local stakeholder rhythms are found to be relevant to the eventual design. All rhythms were eventually gathered in a peak-use overview (image 7.3). Abiotic rhythms, such as the diurnal rhythm of daytime and nighttime, are not listed in the overview but are considered relevant as well. The time-use graphs of the individual rhythms and their make-up in terms of individual activity codes can be found in the appendix. Most activities are inactive during the night and somewhat active during the day, peaking mostly around midday. The largest peaks and fluxes in rhythms however are found at various moments throughout the day, meaning there is indeed a potential in combining them for a more evened out use throughout the day. Most weekend rhythms are simply more active versions of their weektime rhythms (image 7.4), but for certain rhythms, namely sports-related rhythms, the weekend differs dramatically from the week rhythm (image 7.5).

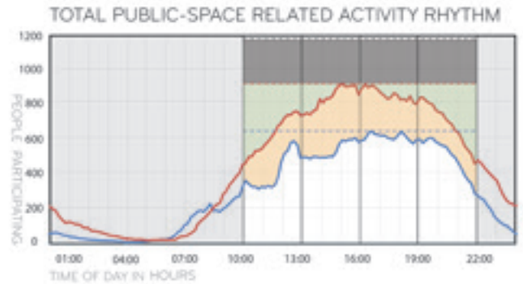


Image 7.1: *Total use of public space during the week (blue) and weekend (red).*

STACKING PRESENT ACTIVITIES IN THE PUBLIC SPACE

INTRODUCING NON-HUMAN RHYTHMS

INTRODUCING TEMPORARY PUBLIC SPACE

Image 7.2: *Polychronic design strategies*

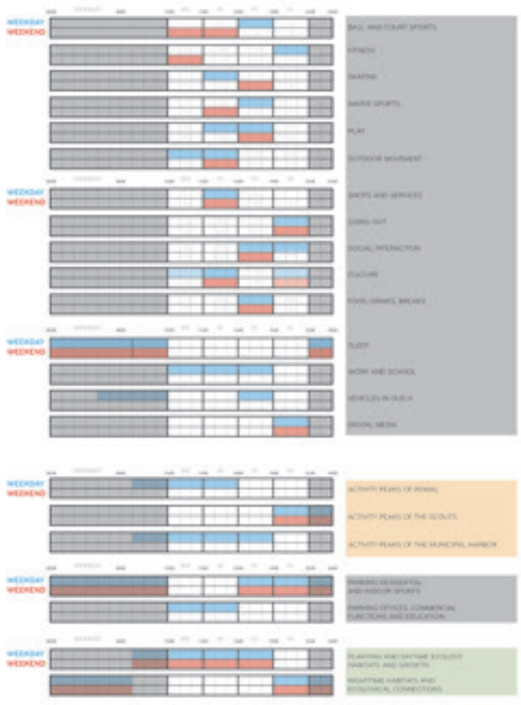


Image 7.3: *Overview of the peak-use moments of relevant rhythms.*

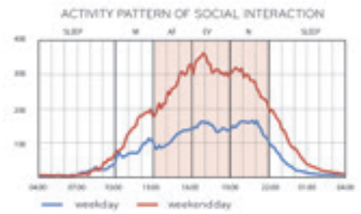


Image 7.4: *The rhythm of social interaction is an example of a very spread-out rhythm of which the weekend rhythm is an overall increase of use.*

Image 7.4: *The fitness rhythm is an example of a highly time-specific rhythm as well as of a rhythm that changes dramatically during the weekend.*

Some rhythms, such as fitness (image 7.5), have a far more intensive peaks as compared to other rhythms, such as social interaction (image 7.4), which are more evenly distributed over the course of the day. These 'sharper' activity rhythms with very clear peaks are more prone to temporal vacancy but also easier to succesfully combine as they are very specific.

In this data collection phase, one of the stakeholders informed of certain temporal needs, besides merely imforming of their temporal modus operandi. Specifically, the scouts requested a natural open space which they could use during the evenings for activities and setting up and tents. While this research included mainly the *current* activity patterns, there is a potential in expressing the temporal characteristics of the wants and needs from stakeholders and inhabitants during a query or participatory process, especially when this is expected to result in a helpful change of activity patterns.

The time-diary research also provides insight in several ways the total human use of public space throughout a day varies**.** First, there is a significant disconnect between the space required if each human activity were to have its own dedicated, monofunctional space, and the actual need for public space at any given time. The second conclusion drawn is that human use of public spaces is unevenly distributed over the different times of day overall. The afternoon and evening are far busier than the morning, late evening and night. Finally, there is a significant increase in use of public space during the weekend. All of these lead to temporal vacancy and an uneven use of public space, causing temporal vacancy to occur.

research question II

How can these rhythms be employed in designing polychronic programmes for oud-Hoograven?

POLYCHRONIC STRATEGIES

Three polychronic design strategies were found to us the rhythmic information to counteract the overall variances in the use of public space. The first strategy **"stacking present activities in the public space"** is the stacking of temporally compatible human functions to better the match the total amount of public space to the actual need of it. The fact that temporal compatibility is taken as the input for the programme is the important distinction between this specific polychronic design method and the design of multifunctional space in general. This strategy relates most directly to the problem of temporal vacancy, as it aims to reduce the vacant space throughout the day. To address the problem of peak activity during the afternoons and evenings without getting into the realm of behavioural change, the second strategy: **"utilising non-human rhythms"** is used. This can take multiple forms and does not have to limit itself to ecological functions. Rather, the concept is that spaces that are not in use for human consumption could be put to, sometimes temporary, use for other functions. These functions may include energy production, positive influences on the microclimate or temporary ecological connections and habitats. The final strategy proposed, **"introducing temporary public space",** relates to the weekend peak. The strategy is to make currently private spaces alternate between a public and private function according to need. This is especially suitable for work and school related spaces. This again underlines the potential of mixed-use neighbourhoods. While a strong argument is already present for mixed-use neighbourhoods, this usually refers to including shops, schools and offices. Here, a case is made for containing more industrial types of working environments, as these are more likely to contain open space for parking lots, loading bays or harbour docks. Such spaces can be designed to function polychronically, possibly providing temporary recreational space during the weekend.

PRODUCING POLYCHRONIC PROGRAMMES

By means of the simplification from time-use graphs to peak-use schemes, all these strategies could be integrated into a single simplified overview of rhythms. This overview was then be used to assess the temporal compatibility of different activities and functions. Using both the temporal and the spatial analysis as input, polychronic programmes were devised for each typology. These programmes contain several functions that are temporally compatible as well as desirable in the context of the space they are intended for.
Designing polychronic programmmes for individual typologies can be done by means of a peak-use overview of the relevant rhythms. This overview should contain human, non human and local stakeholder rhythms in order to allow for a polychronic use of space. The individual programmes, developed mostly based on their temporal information, can then be tried and testec spatially. From there, a more fluid, iterative design process begins in which the spatial compatibility of the polychronic programmme is tested and the programme can be adjusted accordingly.

As this overview of the peak use moments of rhythms is merely informative, it does not force designers to use it to smooth out functions over the day. In the case of the wide street for instance, the programme instead focussed on generating as much overlap of use as possible in order to incite social interaction between the residents of the street. This indicates that rhythms can be used to optimise spaces by generating as llittle conflict as possible between as many different users, but also to incite meetings, friction and interaction. The value of temporal design thinking is thus not restricted to highly contested spaces, it may be valuable for other aims as well, such as enhancing local social cohesion.

research question III

How can the efficiency and flexibility of polychronic design solutions be assessed?

The efficiency and flexibility have been assessed by means of a qualitative assessment rubric involving three markers for both terms. Efficiency was assesed based on the space-time use, ecosystem services and the compatibility of functions. The flexibility was assesed based on the degrees of freedom, equity and adaptability of the space.

Design question

How do the polychronic programmes translate into polychronic design solutions for the selected urban typologies in the neighbourhood of oud Hoograven, and how do these contribute to more efficient and flexible urban environments?

FROM PROGRAMME TO DESIGN

The polychronic programmes, containing several distinct activities and functions, need to be translated into a functional design. After all, the functions and activities that combine well temporally are not always easily combined spatially. It starts with the question what the function or activity needs in order to be viable, and when it needs it. This is compared to the spatial needs of each individual function in the programme, and appropriate methods of alternating between functions are selected based on this information. Some functions can alternate passively. Solutions like the covered green beds above parking spaces of the wide street typology are an example of that. The benefit of passive functions is that they automatically function without further human interventions when the other functions are not in use. This is especially beneficial to the efficiency-related markers of ecosystem services and time-space use.
In many other cases, temporal design solutions contain multiple potential activities, requiring interpretation of the affordances and potential conflict between users. In these cases, decisions on the communication of the affordances of the space, its agencies, need to be made. To reiterate: affordances dictate how a space can be physically used, while agency relates to what it communicates to (specific) users. Overly expressing functions can lead to very prescriptive designs (e.g., a sports hall), while allowing activities to take place without overly guiding people towards that function creates more open-ended spaces (e.g., an open lawn in a park). In this example, both spaces afford the activity 'ball and court sports' but their agencies

differ significantly. Especially when combining spatial functions, the agencies of a space must be considered. This is because all functions need to be legible to the intended users. An overrepresentation of one agency leads to an unbalanced situation, in which the less represented alternative might be less legible or be perceived as unintended or uninviting. Unless this is the intention of the design, multi-interpretable spaces seem to generally benefit from a certain balance between its agencies. In order to maintain this balance, either the more dominant agency can be toned down to match the less expressive ones, or the more modest agencies can be made more expressive. Where in the scale from prescriptive to open-ended this balance is found is a design choice, which is dependent on the local situation, the types of activities combined and the aim of the design. When designing functions to freely alternate, it is also important to consider whether certain activities match in terms of scale. In the narrow street designs for instance, certain spaces would be completely unusable if only a single car would be left parked on that part of the street. As that chance is quite high, it severely hinders the efficiency and flexibility scores of those design solutions. Combining activities of similar scales lowers the chance of this problem occurring. The play elements in the playground-street design are still usable in any of the free parking spots, even if part of the playground is inaccessible. This is not exclusive to the road: in the park, having a soccer game in the amphitheatre makes it impossible to effectively use it for cultural events. In this case the scale of both activities is comparable, creating less vacant space in the process than in the other example. In essence, every activity excludes a potential other activity to some extent. Having similar scales of use limits those issues of mutual exclusivity.

IMPACT ON EFFICIENCY AND FLEXIBILITY

In general, the polychronic design interventions explored in the thesis have led to far more efficient and flexible environments overall, as per the scoring system of the assessment rubric. A direct opposition or trade-off between the markers of efficiency and flexibility was expected, but not directly perceived between the original and polychronic designs. Between the different polychronic design interventions however, a relation between efficiency and flexibility was hinted at. Design choices made in favour of efficiency sometimes had negative repercussions on the flexibility markers and vice-versa. The working environment is a good example of that. In order to ensure the successful use of the space throughout the day, other economic functions are proposed that are less flexible than other more public functions would have been. In that sense, there does seem to exist a certain dualistic relationship. This is mostly related to how different functions are combined than the process of polychronic design itself. In general, prescriptive designs seem to be better at producing efficient spaces at the cost of flexibility, whereas open-ended, less prescriptive designs allow for more flexibility at the cost of efficiency. Although different ways of polychronic design result in slightly different outcomes, it can be concluded that polychronic design solutions increased the efficiency and flexibility of the urban spaces significantly. The explorative setup of the research was not aimed at investigating the relationship between outcomes of open-endedness and prescriptive design methods but rather to investigate the potential of stacking temporally compatible functions in general. More comparative research between the characteristics of different methods of stacking functions spatio-temporally could be an interesting next step. With regards to the indicated trade-off between flexibility and efficiency, another interesting and temporally related find was that the need for more flexibility or more efficiency could vary for different chronotopes. Efficiency seems to mainly be an aim for underused chronotopes, whereas flexibility is better suited in more contested chronotopes.

IN CONCLUSION

The answer to the central research question of this thesis is comprised of the answers of and reflections on the research and design questions. The central research question was:

"How can polychronic design solutions contribute to more efficient and flexible urban environments?"

OVERALL IMPACT OF POLYCHRONIC DESIGN

Polychronic design can contribute to efficiency and flexibility by designing polychronic programmes that include a multitude of activities and spatial functions that are both temporally and spatially compatible. In general, polychronic programming causes an increase of efficiency and flexibility as compared to the monochronic versions of the spaces considered in this thesis. If the rhythms of a space, its inhabitants and its processes are known, it is thus possible to design spaces that are more efficiently used throughout the day, without a direct implied sacrifice to the flexibility of the space. By stacking functions in space, introducing non-human rhythms in the lee moments of human use and by making temporary use of work and school spaces during peak moments, existing rhythms can be better facilitated. Rhythmic information can also be utilised in the opposite way, by stacking functions temporally and thereby enhancing interactions as well as potential spatial conflicts in a space. The scores on the efficiency and flexibility markers of a design depend mainly on the ways in which functions and activities are combined and the characteristics of the activities themselves. Highly contested chronotopes likely benefit more from flexibility-oriented interventions while largely vacant chronotopes should prioritise efficiency-related interventions. Spaces with a more prescriptive overall agency scored relatively higher on efficiency at the cost of flexibility, whereas open ended designs were more flexible at the cost of efficiency. Both efficiency and flexibility are benefited by a balance between the different agencies and the scales of their related activities.

7.3 RELEVANCE

SCIENTIFIC RELEVANCE

The research mainly proves it is possible to use temporal information to imagine spaces that are used by different people for different uses throughout the day. In order to do this, the research explores certain methods of combining functions in a space. This leads to all kinds of various new questions in different scientific realms this question dabbles in. Questions that could be raised in this regard include: To what extent are people able and willing to understand and respect conflicting agencies in multiplicit spaces? Is spatial appropriation something that lingers in a way that would repel other users, even when those users are not around physically or symbolically? To what extent are local rhythms influenced by specific spatial interventions? How will people respond to the potential unavailability of a certain spatial use by competition from another? To what extent does a physical manifestiation of spatial conflict instigate open debate? How much space would this type of design ultimately potentially save? What are the limits and potentials of open-ended and prescriptive multifunctional designs? If a space is supposed to welcome everyone, will anyone feel welcome at all? Design theory wise, the research shows the potential of basing design choices involving multifunctionality on temporal information. It is by no means exhaustive in its design solutions or proposed strategies. Polychronic design involves many creative steps in the process of combining potential uses. There are as many solutions as there are spaces and designers in the world, and polychronic design could benefit from a lot more pratical examples from which a better understanding could arise about the process in general. An important step in increasing the value of polychronic design research would be the improvement of the specificty of the temporal data towards activities related to the public realm. On a whole, the research has takern steps to bridging the application gap between knowledge on urban activity patterns and the practical applications thereof in urban landscape design (van Schaik, 2011), which was the aim of the research.

SOCIETAL RELEVANCE

Polychronic design can seem daunting, but the potential is undeniable. Understanding and using activity patterns in design can aid in enabling interaction or in minimising spatial conflict. It has the potential to instigate more vibrant public life throughout the day while freeing up space for flora and fauna. It may help visualise unseen spatial potential to instigate public discussion. It can help rethink institutionalised forms of common spatial functions and lead to creative, unexplored combinations. Using a temporal approach to design in such a methodical way is impractically slow and complicated for professional designers. This step in the process might be better suited for city planners, due to their access to access to local and expert knowledge and their responsibility for the urban programme. The designer then, would only shoulder the responsibility of combining the different functions in the most optimal way. Furthermore, the methodology that is used in this research is not solely applicable to polychronic design, but to any multifunctional design process. Even without data-driven input, significant temporal optimalisation could be achieved by a more active consideration of the 'when'. Understanding, even intuitively, temporal aspects of spatial needs, wants and processes, allows designers to see potentials otherwise unexplored.

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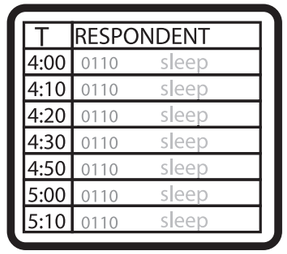
APPENDIX A
TIME USE DIARY RESEARCH: DATA MANAGEMENT STEPS

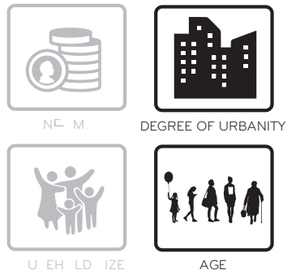
Every 5 years, the Dutch government conducts a time diary-based research to create insight in how its citizens spend their time. The 2016 study, which is the most recent dataset at this time, has been used for this thesis. The study contains detailed information of over 2200 respondents of varying age, gender, living environments, income, etc. Each respondent has filled in a time diary for a full week, as well as an accompanying questionnaire. In these diaries respondents report their activities in a day in ten-minute time slots. These activities have been coded and gathered in a data sheet. Using SPSS and Excel, the data can be used to generate various time-use graphs, creating insight in the amount of people participating in a certain activity during a certain time of the day.



T	RESPONDENT	
4:00	0110	sleep
4:10	0110	sleep
4:20	0110	sleep
4:30	0110	sleep
4:50	0110	sleep
5:00	0110	sleep
5:10	0110	sleep

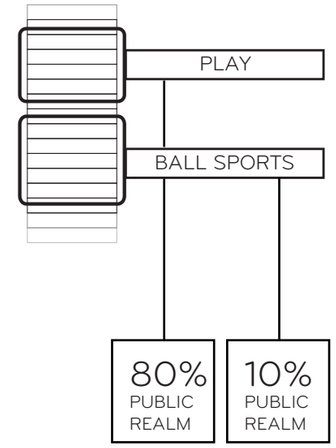
ACCOUNTING FOR SIGNIFICANT INDICATORS

The most influential variables gathered significant R-values, which were, in descending order; age, income, urbanity, and household size (SCP, 2018). Age has been accounted for by splitting the responses in respective age groups, then applying a weight factor to account for the actual demographics of Hoograven. Data on income is not readily available and has thus not been accounted for. The same goes for household size, of which only a mean is available. Urbanity has been considered. In order to represent the environment of Hoograven, only "urban" and "very urban" dwellers' responses were used.



CATAGORIZATION OF ACTIVITIES FOR DESIGN INSIGHTS

In order to gain insights that could be applied within an urban design, activities were coded in larger categories. The most important characteristics in deciding these categories were whether the activities were considered "free time", and to what extent they demanded something from the public space. Individual, detailed activities such as "making crosswords" were grouped together with other activities with a similar impact on public space. The exact grouping of individual codes related to the time-use research system of the SCP can be found in appendix B, C and D.



WEIGHING CATAGORIES

Some activities were expected to only partly contribute to a demand of space in the public realm. Ball sports, which occur mostly at sports clubs, is an example of such an activity. These activities have had a weighing factor added to them as well. A list of weighing factors for significant rhythms can be found in appendix E.

WEEKDAYS AND WEEKENDS

In order to get an overall view of weekdays and weekend days, the information of weekdays and weekend days was compiled to form an average. The Friday was not included. This creates a clearer distinction between weekdays and weekends, as the Friday generally contains characteristics of both. This compilation has led to a larger amount of input per average day. 4400 individual weekdays and 2200 individual weekend days were thus considered.

INITIAL PROCESS: PLOTTING AVERAGE DAYS PER AGE GROUP
Initially, the age groups were plotted separately, in order to generate an insight into who uses the space at what time. However, linking programme solely to the dominant age groups would require a great deal of assumptions to generate a viable spatio-temporal design programme. Nevertheless, this exercise has generated some insight in who is likely to use public spaces at which times, and some conclusions on design implications is shared within the research conclusions.

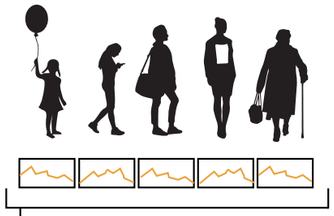
ACCOUNTING FOR THE ENTIRE POPULATION
Compiling the age groups leads to a clearer image of the types of use over time, as this is more informative to the design than which age groups participate in such activities. The weight of the data of different age groups has been weighted with regards to the demographics of the site, based upon governmental demographic data (Gemeente Utrecht, 2020). Compiling these age-based datasets generates a time-use model of the total population of oud-Hoograven, generating two general graphs: an average weekday and an average weekend day.

PLOTTING INDIVIDUAL CATAGORIES
These average weekdays and weekend days generate large and complex graphs, providing little insight. A more legible format is produced by plotting each category as a graph individually.

ISOLATING RELEVANT CATAGORIES
While all categories provide insight into the rhythms and schedules of the neighbourhood, not all activities, digital media for example, require public spaces. Isolating categories that do or could make use of these spaces provides insight into the actual spatio-temporal programme.

DEALING WITH TEMPORAL COMPLEXITY BY SUBDIVISION
The graphs of most individual activities show a constantly and gradually changing participants. select peaks are rare, indicating that besides dinner times, sleep times and the morning commute, most activities are spread out during the day. They gradually increase towards a peak after which it gradually decreases again. In order to increase legibility for the bigger picture, four 3-hour long temporal divisions were made. These included morning (10:00-13:00), afternoon (13:00-16:00), evening (16:00-19:00), and night (19:00-22:00). The rest of the time is regarded as midnight (22:00-10:00). These five divisions were selected in order to always have 80% of the population awake during both weekdays and weekends, to minimise influence by sleep patterns.

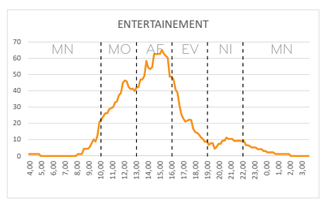
IDENTIFYING TEMPORALLY COMPATIBLE CATAGORIES
An important aim of the time-diary research was to identify temporally compatible categories: that is, activities that are done at different times, so that they may alternate more liberally at different moments of the day and week. For each category, during both weekdays and weekends, a peak moment was derived to be one or more (if very similar values) of the five temporal divisions. This has allowed insight into compatibility: activities with similar peak moments, similar rhythms, are best not to be combined.

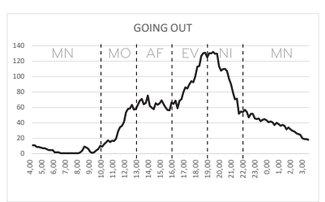


combining the individual rhythms of the age groups gives a complete overview of expected activities during the day.

An overview of the activities of the population of hoograven in the public space during a typical weekday. While precise, conclusions are difficult to draw from this overview.

an individual catagory plotted out over the day. It shows the amount of people expected to be participating in the activity at any given point during the day. The dotted lines indicate the five time divisions: morning, afternoon, evening, night and midnight.





an example of two temporally highly compatable functions: both functions peak at different times, making them good candidates for spatial overlap.

APPENDIX B
ACTIVITY CODES: CARE AND COMMITMENTS

Most activities incorporated in the time diary research codes were not directly useful for design purposes. As such, some new groups have been made. The most important of these groups are the activities that could or do take place in public spaces and venues. Still, mapping how we spend out time in general has helped understand activity patterns within the thesis. A subdivision has been made between care and commitments, free time that is not likely to be spent in public spaces, and free time that is likely spent in public spaces. Shopping has been placed under commitments due to the current absence of shops within oud hoograven.

SLEEP
sleep - unspecified	110
sleep - remaining	190

WORK AND SCHOOL
work - unspecified	1000
work - main	1100
work - general	1110
work - secondary	1112
work - courses	1130
work - chores	1190
work - related	1200
work - unspecified	1290
study - unspecified	2000
study - at location, unspecified	2100
study- attending classes	2110
study - homework unspecified	2120
study - homework at school	2122
study - homework elsewhere	2123
study - university	2190
study - unspecified study/course	2200
study - free time	2210
study - lecture	2220
study - leisure	2290

COMMITMENTS ELSEWHERE
voluntary work, help, meetings, religion	4000
voluntary work for organisation	4100
voluntary work - unspecified	4110
voluntary work - youth work	4111
voluntary work - school work	4112
voluntary work - care	4113
voluntary work - sports	4114
voluntary work - hobby association	4115
voluntary work - culture/music	4116
rvoluntary work - religion	4117
voluntary work - union	4118
voluntary work - political	4119
voluntary work - law	4120
voluntary work - housing organisation	4121
voluntary work - neighbourhood	4122
voluntary work - nature/environment	4123
voluntary work - human rights	4124
voluntary work - other	4129
help - other household	4210
help - paid work other household	4220
help - children	4230
help - children other household	4240
help - adults other household	4250
help - other household other	4290
participatory events	4300
meetings	4310
religious activities general	4320
philisophical activities	4321
prayer, reading scripture	4322
religious activities other	4323
(religious) ceremonies	4324
religious other	4329
participatory other	4390

HOME COMMITMENTS
unspecified	300
washing/dressing	310
shower/bath	311
brushing teeth	312
shaving	313
make up/ hair	314
clothes	315
washing other	319
medical care	320
personal care	330
personal care other	390
working at home	1111
looking for work	1220
huiswerk maken thuis	2121
family and household care	3000
preparing food babies	3110
washing dishes	3130
conserving food	3140
cleaning, household tasks	3200
cleaning the home	3210
vaccuum cleaning	3211
floors, bathrooms, toilets	3212
window cleaning	3213
furniture cleaning	3214
tidying up	3215
cleaning the bed	3216
cleaning inside	3219
cleaning outside	3220
heating/water	3230
household tasks general	3240
household tasks other	3290
making/fabricating clothes	3300
dry cleaning	3310
ironing	3320
clothes maintaninance other	3390
gardening and animals general	3400
gardening / plants	3410
animal care	3420
pet care	3430
gardening and animals other	3490
odd jobs	3500
building/renovating	3510
maintenance of buildings	3520
maintenance of buildings - goods	3530
maintenance of buildings - movement	3540
maintenance vehicles -car	3541
maintenance vehicles -motor	3542
maintenance vehicles - other	3549
maintenance - other	3590
household organisation	3710
administration	3711
taxes	3712
grocery shopping list	3713
grocery shopping - storage	3714
teleshopping, online banking	3716
household care other	3719
care children general	3800
care children and watch	3810
care children - sustainance	3811
care children - washing dressing	3812
care children - out of bed into bed	3813
care children - other	3819
care children - help homework	3820
care children - play, talk, reading	3830
care children	3890
care adult with needs - physical	3910
care adult with needs - other	3920
care adult with needs	3990
rest	5310
time diary	9950
committed time - other	9990

GROCERIES
daily groceries	3611
groceries other	3619

SHOPS AND SERVICES: OTHER
shops and services unsp.	3600
shopping	3610
shopping - general	3612
shopping - home decor	3613
shopping - car	3614
commercial services unsp.	3620
legal and financial services	3621
governmental services	3622
commercial services	3623
personal services	3630
health related services	3631
appearance related services	3632
sauna/wellness	3633
personal services and police	3639
shops and services - other	3690

APPENDIX C
ACTIVITY CODES: FREE TIME OUTSIDE PUBLIC SPACES

DIGITAL MEDIA

phone unsp.	5140
mobile games	5144
use of pc/internet	5242
use of pc unsp.	7200
programming, maintenance	7210
gathering information by pc	7220
online news	7221
streaming services - video	7222
streaming services - audio	7223
information search pc	7224
pc/internet offline	7250
text processing	7251
film/dvd	7252
music	7253
editing photos and films	7254
pc offline	7259
use of pc other	7290
games unsp.	7300
individual games, unsp.	7310
computer games offline	7331
computer games online	7332
games, other	7390
mass media, unsp.	8000
media - television	8210
media - sport	8211
online news	8212
online updates	8213
films, series	8214
talkshows	8215
quizzes, games, kids shows	8216
music shows	8217
art shows	8218
TV other	8219
video/dvd	8220
radio	8300
music online	8310
recorded music	8320

SOCIAL MEDIA

call - land line	5141
call - cell phone	5142
communication via internet	5143
phone other	5149
communication via pc	7230
E-mail	7231
chat, msn	7232
chats	7239

HOBBIES AND ANALOGUE MEDIA

making clothes, knitting, embroidery	3330
library	5240
borrowing books	5241
library other	5249
hobbies and computing, other	7000
art and hobbies, other	7100
art unspecified	7110
painting	7111
sculpting	7112
photography	7113
film, video	7114
stage arts unsp.	7115
playing instruments	7116
singing	7117
cabaret, arts, plays	7118
art other	7119
collecting	7120
correspondance	7130
other unsp.	7190
puzzels	7311
crosswords	7312
bridge	7321
cards	7322
chess, checkers	7323
bord games other	7324
biljart, snookers	7325
darts	7326
reading unsp.	8100
reading periodicals	8110
reading newspapers	8111
reading opinion magazines	8112
reading magazines	8113
reading door to door magazines	8114
reading commercials	8115
periodicals other	8119
books general	8120
books literature	8121
books romantic/exciting	8122
books youth/comics	8123
books informative/non finction	8124
boeen relaxing	8129
lezen other	8190
free time other	9980

FACILITY-BOUND SPORTS

ice skating	6135
winter sports	6136
	6139
tennis	6143
golf	6144
water sports unsp.	**6160**
pool swimming, aquajogging	6161
sailing	6162
surfing, kitesurfing	6163

APPENDIX D
ACTIVITY CODES: IN PUBLIC SPACE

SOCIAL INTERACTION

meal at other people	212
snack at other people	222
drinks at other people	232
social and enterntainment, unsp.	5000
social, unsp	5100
social at home	5110
getting visitors, unsp	5120
getting visitors at home	5121
going on visitation	5122
gatherings and parties at home	5131
gatherings and parties at other people	5132
social other, unsp	5190

GOING OUT

meal at hotel/restaurant/cafe	214
snack at hotel/restaurant/cafe	224
drinks at hotel/restaurant/cafe	234
gatherings and parties, unsp	5130
gatherings and parties, elsewhere	5133
gatherings and parties, other	5139
going out (clubbing etc.)	5191

BALL SPORTS

balsports unsp.	6140
soccer	6141
hockey	6142
balsports other	6149

SKATEPARK SPORTS

cycling, mountainbiking, skating unsp.	6130
skeelering	6133
skateboarding	6134

FITNESS/WORKOUT

sports and body movement, unsp.	6000
active, unspecified	6100
jogging, running	6120
fitness, gymnastics, home trainers	6150

PLAY

individual play	7319
group play	7320
adult co-play/supervision	3840

ACTIVE OUTDOORS

walking the dog	3440
active walking	6110
recreative cycling	6131
cycling, mountainbiking	6132
other active	6190
actve, productive, unspecified	6200
fishing/hunting	6210
searching, picking in nature	6220
active productive activities other	6290
sports related activities	6310

OUTDOOR WATER ACTIVITIES

beaches and pools	5262
kanooing, rowing	6164
swimming, watersports, other	6169

MOVEMENT

cartouring	5266
movement - unspecified	9000
movement - workrelated	9100
movement - studies	9200
movement - shopping	9360
movement - household	9380
movement - voluntairy work	9400
movement - socially	9500
movement - free time	9600
movement - other	9800

CULTURE

cinema	5210
theater, concert, play,cabaret, opera, ballet, dance event	5220
art and museums	5230
historical sight	5263
city trip	5264

ENTERTAINMENT

entertainment general	5200
watchjing sports - gen	5250
watchjing sports - paid	5251
watchjing sports - amature	5252
watchjing sports - other	5259
outing unspecified	5260
theme parks, zoos	5261
fair	5265
outsings other	5269
entertainment other	5290

FOOD, DRINKS, BREAKS

meal - unspecified	210
meal - home	211
meal - work/school	213
meal - other	219
snack - unspecified	220
snack - home	221
snack - work	223
snack - other	229
drink - unspecified	230
drink - home	231
drink - work	233
drink - other	239
food and drinks	290
breaks at work	1120
lunch break	1210
break school	2130
making the table	3111
cooking a meal	3112
heating a meal	3113
prepare food and drinks	3119
baking	3120
prepare meal	3190

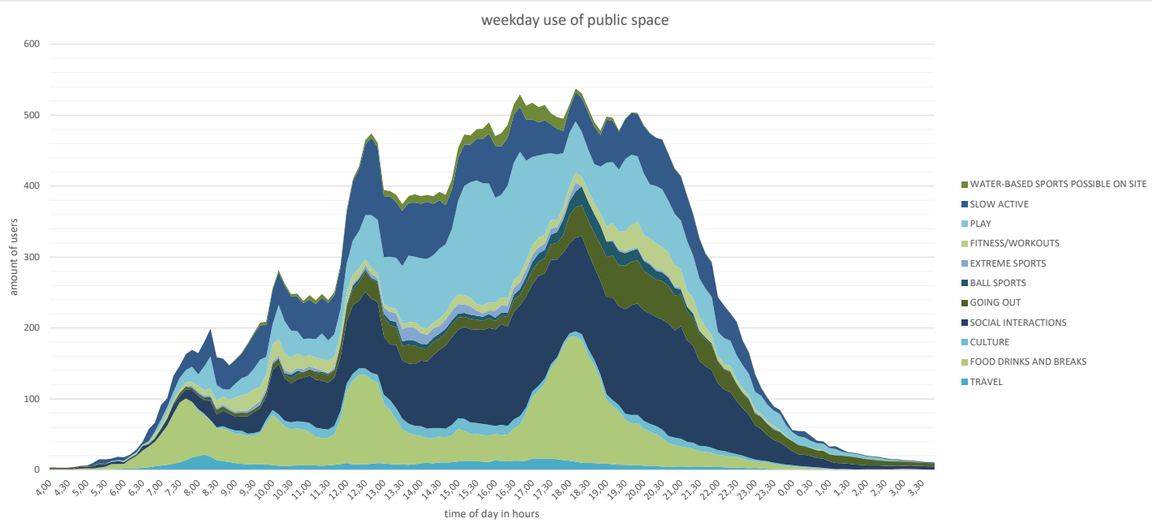
APPENDIX E
WEIGHING FACTORS: % OF WHICH IN PUBLIC SPACE

Of the activities expected to possibly take place in public spaces, it is not realistic to assume all of the activity takes place in public, let alone in hoograven. weighing factors have therefore been introduced for several rhythms.

MOVEMENT	2%	45% of all time is spent in cars, of which 5% is assumed to be in the neighbourhood. 20% of 36,5% of is added to slow active outdoors due to slow traffic
CULTURE	50%	The assumption is the neighbourhood could provide 50% of the cultural need.
ENTERTAINMENT	0%	entertainment, with regards to its activity codes, is done outside of public space
SOCIAL INTERACTION	50%	assumed is that half of the interactions could take place in public spaces
GOING OUT	50%	assumed is that the area could provide in half the nightlife, especially in the night and early midnight stages.
BALL SPORTS	25%	As most ball sports are still done in associations and facilities, only 25% of ball sports are assumed to be done in the public spaces
SKATEPARK SPORTS	200%	Due to the absence of good places to skate in the vicinity, skate amenities are assumed to attract people from the surroundings.
FITNESS/WORKOUT	50%	Fitness is increasingly done outside, half is assumed in this case.
PLAY	80%	play is assumed to be outside for about 80%, as media, social visits and gaming is already incorporated in the social, digital media and social media groups.
ACTIVE OUTDOORS	80%	due tot the inclusion of the nature activities, not all of this activity will take place in the living environment
OUTDOOR WATER ACTIVITIES	100%	balance between the pull factor of the canal, and the admittance of water sports likely taking place at other spaces, such as the beach and the pool.
FOOD, DRINKS, BREAKS	10%	Only partly in the public space, mainly (smoking) breaks, walks, and outside lunches

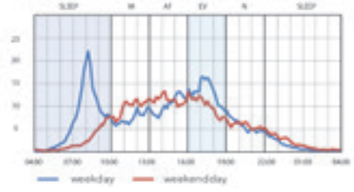
APPENDIX F
ILLEGIBILITY OF COMPLETE ACTIVITY HISTOGRAMS

For both the week and the weekenddays, a complete histogram can be produced informing the average use of space in a single day. However, this method of representation is very unhelpful in producing conclusions with regards to the use of public space during a day. Simpler methods have therefore been used in the thesis.

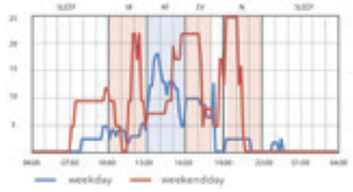


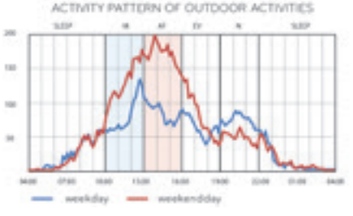
APPENDIX G
RELEVANT INDIVIDUAL RHYTHMS AND THEIR PEAKS

INFLUENTIAL RHYTHMS



ACTIVE USE OF PUBLIC SPACE





SEMI-PUBLIC ACTIVITIES