

THE POTENTIAL OF THE IN-BETWEEN SPACE TO STIMULATE SELF-SUFFICIENT COMMUNITIES IN OPEN-BUILDING NEIGHBORHOODS

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ABSTRACT

The Netherlands has a high demand to reduce the domestic dependency on limited natural resources in daily life of inhabitants (Government of the Netherlands, 2019). At the same time, there is a high need for more collectivity in neighborhoods, as 33% of inhabitants indicates to be lonely, while an additional 10% suffers from severe loneliness (RIVM, 2016). According to the legacy of John Habraken and the Stichting Architecten Research, applying the concept of open-building on a neighborhood scale has the potential to stimulate collective behavior and a feeling for community. Loneliness can therefore be opposed. Research and observation of Molenvliet, the first neighborhood on which the open-building concept was applied, led to the conclusion that the neighborhood consisted out of a variety of types of in-between spaces, which stimulated social interaction. However, the potential of the in-between space to stimulate self-sufficiency in terms of the dependency on natural resources, is neglected in Molenvliet. This paper therefore investigates the potential of the in-between space in open-building neighborhoods to fulfil the needs for a more collective and self-sufficient neighborhood. First, the different types of these in-between spaces are categorized, by means of a literature study in the theories of John Habraken and the Stichting Architecten Research (SAR). Secondly, the potential of each type of in-between space is researched in terms of stimulation of social interaction, by comparing the observed spaces to the literature of Jan Gehl. Subsequently, it is examined how in-between spaces in neighborhoods could contribute to self-sufficiency through a case study of the self-sufficient neighborhood of EVA Lanxmeer. Finally, this case-study led to the exploration of the potential for harvesting energy, water and food in the in-between spaces of the open-building neighborhood such as Molenvliet, by means of a research by design.

KEYWORDS: *In-between space, Energy-water-food nexus, Open-building neighborhood, Self-sufficiency*

1. INTRODUCTION

In the Netherlands, 33% of the people living in urban areas are feeling lonely, while an additional 10% suffers from severe loneliness (RIVM, 2016). At the same time, there is a high need to reduce the growing domestic dependency on limited natural resources in daily life of inhabitants (Government of the Netherlands, 2019). According to theories of John Habraken from the 60's, applying the concept of open-building on a neighborhood scale has the potential to stimulate collective behavior and a sense of community (Habraken, 1961). By means of the design of the collective spaces in a support-plan¹ and tissue-plan², collective behavior can be stimulated among inhabitants. In this approach, the inhabitants are part of the decision-making process, which enhances a sense of community. However, is it also possible to use the collective spaces in order to make an open-building neighborhood self-sufficient?

1.1 PROBLEM STATEMENT

The current dependency on limited natural resources is a great problem, as it will result in the depletion of essential elements, such as fresh water, top soil and fossil fuels, while it simultaneously is responsible for the generation of toxic quantities of elements, such as CO₂ and N₂ (Luscuere, Geldermans, Tenpierik, & Jansen, 2016)

One self-sufficient neighborhood in terms of reduction of dependency on limited natural resources, is the neighborhood of EVA Lanxmeer in Culemborg. It provides collective spaces between the private and public domain, which stimulates harvesting of energy, water and food. In open-building neighborhoods, similar types of in-between spaces offer a great potential to stimulate social interaction and collectivity among inhabitants. However, the fulfillment of the potential of these in-between spaces to reduce dependency on natural resources, such as is done in EVA Lanxmeer, is not apparent.

¹ Support plan: in the support plan the responsibility of design is divided between the support and the infill. The architect designs the support structure, which has a long life span. Each individual dweller has the responsibility for the design of the infill, which has a relative short lifespan. Because of the support, infill dwellings can be individually changed over time, without the destruction of the total building. User participation is key for this plan.

1.2 RESEARCH QUESTION

This paper explores if the in-between spaces of open-building neighborhoods can be designed in such a way that it not only stimulates collectivity, but simultaneously reduces the dependency on limited natural resources in the daily life of its inhabitants. By emphasizing the social and environmental benefits of the in-between space, this research can be used as a guide to the government, architects and urban planners to stimulate self-sufficient communities. Additionally, this research provides arguments for government, architects, urban planners and developers in order to implement the open-building approach of the legacy of John Habraken, on a neighborhood scale.

The problem statement led to the following main research question :

How can the design of the in-between space enhance self-sufficient communities in open-building neighborhoods?

The following sub-questions are defined:

1. Which types of in-between spaces can be defined in Open-building neighborhoods?
2. How to stimulate social interaction in the different types of in-between spaces?
3. Which approaches of the Energy-Water-Food nexus can contribute to the local harvesting of energy, water and food by means of in-between spaces?
4. How can the different approaches of the Energy-Water-Food nexus be applied on the typology of in-between spaces in open-building neighborhoods?

² Tissue plan: in the tissue plan the urban planner designs a composition of public accessible spaces: streets, courts, alleys, singels, boulevards etc. The urban planner makes patterns of these spaces from which variety can occur, by means of user participation. An example of a tissue plan in which this variety is apparent is the design of Molenvliet by Frans van der Werf.

2. METHODS

The first research method applied in this paper, is a literature study into several editions of the architectural magazine *Forum*, published between 1959 and 1964. In these editions, the architectural qualities of the in-between space are defined by Aldo van Eyck and Herman Hertzberger (Hertzberger et al., 1959). Secondly, a literature study about the theories of John Habraken and the Stichting Architecten Research (SAR) is conducted. In this literature a typology of in-between spaces is made, based on spatial properties and qualities (Bosma, Hoogstraten, & Vos, 2000). Regarding this typology, three case studies of open-building neighborhoods are conducted by means of analytical drawings and observations. Subsequently, it is examined which approaches towards self-sufficiency can be applied on in-between spaces, by means of a literature study in the theories of the UN (UN-Water, 2019) and a case study of the self-sufficient neighborhood of EVA Lanxmeer. For this study, self-sufficiency is defined by means of the Energy-Water-Food nexus. Finally, in order to evaluate the spatial potential of the present types of in-between spaces in these neighborhoods, a research-by-design method is applied.

3. RESULTS

The research questions answered in this chapter, consists of the following sub-sections: sub-section 3.1 emphasizes the importance of different types of in-between space and provides a typology; sub-section 3.2 gives an overview of the different ways in which the in-between spaces can stimulate social interaction; sub-section 3.3 emphasizes on existing approaches which stimulate local harvesting of energy, water and food on a neighborhood scale; sub-section 3.4 explores the potential of the in-between spaces in open-building neighborhoods to stimulate local harvesting of energy, water and food.

3.1 TYPOLOGY OF IN-BETWEEN SPACES

Which types of in-between spaces can be defined in Open-building neighborhoods?

The in-between is defined as: being in a space or time that is between one specified thing and another (Shahlaei & Mohajeri, 2015). The architects involved in the edition of the architectural magazine *Forum* 8 in 1959 defined the in-between space as the space between the private interior and the public exterior (Hertzberger et al., 1959).

According to *Forum* 8, the in-between space is the bridge between the individual and the community: *"Above all, we need to make a city which can be inhabited and adapted by humans... That is different than the functional city which is based on technology and machinery, wherein gigantic termite structures or honeycombs of housing are built. It is this architecture which is inhabitable and inhuman... In this city, we miss the in-between space. In this city, there is no transition zone between the interior and the exterior where people can meet.. Therefore, we demand the realm of the in-between space.. The neighbor is no longer an enemy if we can meet him there"* (Hertzberger et al., 1959). According to *Forum*, the in-between space has essential spatial qualities which can stimulate social interaction among inhabitants of neighborhoods. However, *Forum* did not provide a typology of in-between spaces in order to compare these spatial qualities.

To distinguish and compare different types of in-between spaces, a literature study is conducted in the Open-building theories of John Habraken³ and the Stichting Architecten research (SAR). The SAR developed two methods which made a typology of in-between spaces: the SAR65 and the SAR73 (Bosma et al., 2000). The SAR73 is a method meant to sub-divide all in-between spaces located on the site, while the SAR65 was meant to sub-divide all the spaces located on the building. The first subdivision in the SAR73 was made between the in-between spaces that were physically accessible by the public (O-spaces) and the

³ Architectural theorist John Habraken was researching an alternative to the post-war, high-rise, mass-housing projects, which were seen as a result of the functionalist movement. His research later formed the basis for the Open-building movement (Habraken, 1961) and the Stichting Architecten Research (SAR).

in-between spaces that were physically accessible only by private users or a collective of private users (P-spaces). A second sub-division was made between the spaces that had a relation with the interior spaces (α spaces) and the in-between spaces which didn't have a relation with the interior space (β spaces). With these two divisions, four types were possible by means of the SAR73 methodology: α P spaces, β P spaces, α O spaces and β O spaces (Stichting Architecten Research, 1976). On the other hand, the SAR65 method was made to subdivide all the in-between spaces located at the building. Two types are defined: the spaces that are meant for public circulation (γ spaces) and the exterior spaces that adjacent to the façade for private use (δ spaces). The subdivision about accessibility (O or P) can also be applied on the SAR65 types. After all, a balcony meant for private use can sometimes still be physically accessible by the public and a public gallery is sometimes only physically accessible by a private or collective group of people. With these two divisions, four types were possible by means of the SAR65 methodology: γ P spaces, δ P spaces, γ O spaces and δ O spaces (Stichting Architecten Research, 1975). The complete typology is visualized and explained in appendix 1.

With this typology, the presence of the different types of in-between spaces inside three open-building neighborhoods are evaluated. However, this typology did not give a coherent perspective on the relations between the in-between spaces in each specific neighborhood. Therefore, a topology³ was made for each neighborhood by consequently connecting all the in-between spaces based on the different routings from the public exterior towards the private interior (image 1,2 and 3). By making this topology⁴ it became possible to compare different case-studies of open-building neighborhoods in terms of their interrelated types of in-between spaces. The first case-study is the neighborhood of Molenvliet, designed by Frans van der Werf

in 1978. In the design, the principles of the SAR73 were applied (Frans van der Werf, 2011). All types of the SAR73 in-between spaces are present. The in-between spaces form a pattern: from the public street, small alleys (β O spaces) provide access to entrance-courtyards (α O space) which provide access to open galleries (γ spaces), which provide access to the interior private space. A second pattern is perceived in the routing by the use of alleys (β O spaces), towards a collective back-courtyard (β P space) which provides access to back gardens (α P spaces). Apart from these two patterns, balconies and loggias (δ P spaces) were made, facing the back-courts and public street (image 1). The case-study of Molenvliet is represented in appendix 2.

The second case-study, is the neighborhood of the Bijlmermeer, designed in 1965-1970. The planning was led by architect and urban planner Siegfried Nassuth, who was inspired by the functional city ideas of CIAM and Swiss architect Le Corbusier. The SAR studied, proposed and applied support systems for this neighborhood (Habraken, Boekholt, Thijssen, & Dinjens, 1974). However, these studies were only focusing on the types of spaces in the interior of the building, rather than the in-between spaces. In-between spaces in the neighborhood were eradicated from the design, due to the application of the functionalistic CIAM principles, manifested by city planner Van Eesteren. This eradication can be seen in the topology of the Bijlmermeer (image 2). The case-study of Bijlmermeer is represented in appendix 3.

The third and final case study is the open-building New-West, designed by architect Olaf Gipser in. New-West is one of the representative designs of the renewed open-building movement, manifested by Marc Koehler at the World Architecture Festival in 2019 (OpenBuilding.co, 2019a). Although this design is not a neighborhood, it consists out of a variety of in-between spaces with private accessibility (P spaces) (OpenBuilding.co, 2019b), as can be seen in

⁴ Topology is defined as the study of the way in which constituent parts are interrelated or arranged (Gorny, 2019).

the topology of New-west (image 3). The case-study of New West is represented in appendix 4.

Molenvliet and New-west have transitional accessibility between the public exterior and the private interior, because of a transition of public accessible in-between spaces (O-spaces) to private accessible in-between spaces (P-spaces). Also, these neighborhoods provide different choices of paths for inhabitants to access their private interior space. The design of the Bijlmermeer lacks in-between spaces and

therefore there is no transition between private and public space. Also, no different paths are provided towards the private interior. A transition from more public in-between spaces towards more private in-between spaces, helps to create clear boundaries of responsibility and stimulates personalization of the built-environment (Hertzberger et al., 1959). Remarkable is that in neighborhoods with these transition spaces, a higher amount of social interaction can be observed (Ulden, Heussen, Ham, & Brinkman, n.d.).

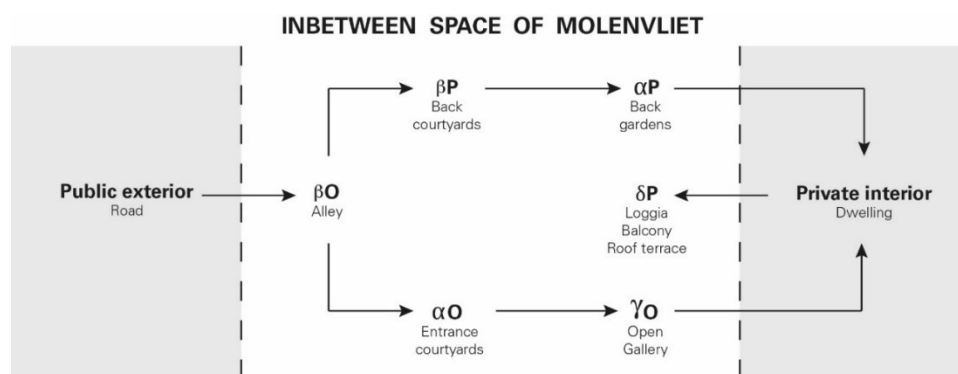


Image 1 Topology of in-between spaces Molenvliet

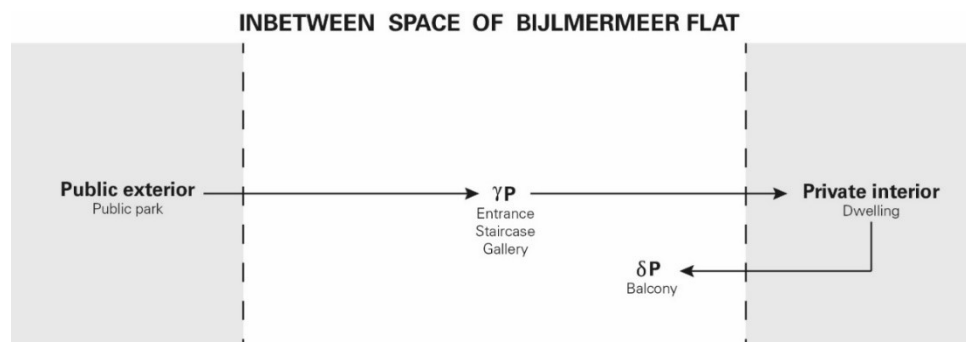


Image 2 Topology of in-between spaces Bijlmermeer high-rise.

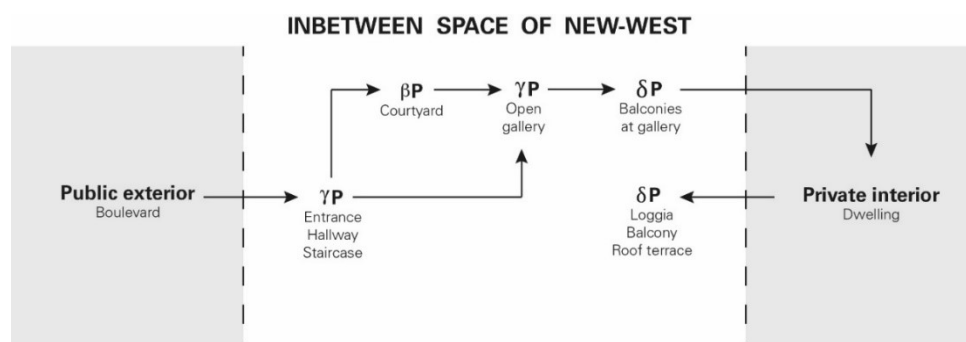


Image 3 Topology of in-between spaces at New-West

3.2 STIMULATION OF SOCIAL INTERACTION.

How to stimulate social interaction in the different types of in-between spaces?

In order to stimulate a sense of community by means of in-between spaces, it is necessary for architects and urban planners to first know if and how a type of in-between space can stimulate a sense of community. According to Jan Gehl, this sense of community is accommodated by the stimulation of social interaction. Gehl states that architects have at least five types of spatial arrangement which can promote or prevent visual and auditory contact in in-between spaces (Gehl, 2011): (1.) the degree of vertical and horizontal openings, (2.) the dimensions of the in-between space, (3.) the speed of travel that the in-between space accommodates, (4.) the differences in the height of levels and (5.) the way the orientation of the in-between spaces stimulates social contact.

For each of the three neighborhood case-studies, the different types of in-between spaces are analyzed, based on the degree of stimulation of social interaction by spatial arrangements. In Molenvliet, multiple in-between spaces are designed in order to stimulate social contact. Starting from the public street, horizontal alleys (4) are providing access to front and back-courts. These alleys are small in width (2) and are provided with small fences which rules out fast movement of bikes (3). People are forced to step down and walk slowly past the fences. The front-courts are provided with open galleries, loggia's and balconies, which can be defined as horizontal or vertical openings (1), The dimensions in a front-court is small enough, so that people greet each other when one opens the door (2). Cars are ruled out and people have to step down their bicycle to enter the court (3). The court is placed on one level, however contact can be made with the open-gallery (4). The square layout makes sure that doors are frontally orientated towards each other (5). This evaluation is done for all in-between spaces in Molenvliet (image 5). According to Frans van der Werf, architect of Molenvliet, it is important to note that the level of social interaction by means of the arrangement of

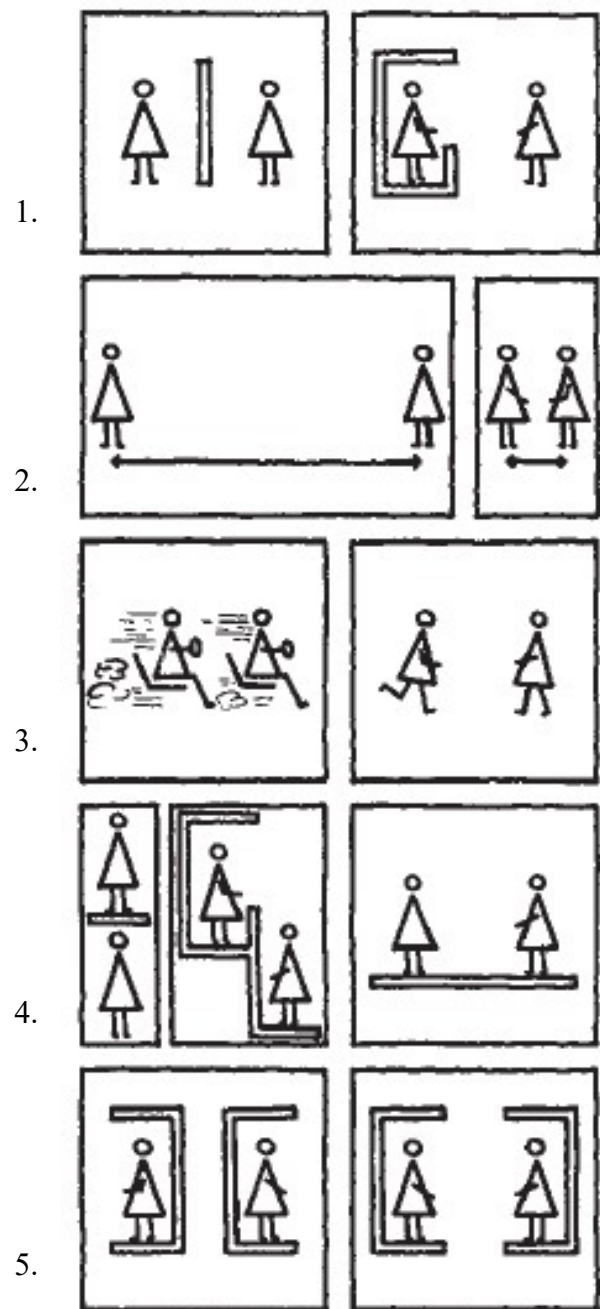


Image 4: Spatial arrangements to promote/prevent social contact

in-between spaces, is a choice of the inhabitant (FJ van der Werf, 1993). In the design of Molenvliet, the inhabitants are provided with the possibility to choose which in-between spaces had to stimulate or prevent social interaction and how this spaces would enhance or prevent this social interaction.

In the high-rise buildings of the Bijlmermeer, only two types of in-between spaces can be distinguished: γ P spaces in the form of galleries, staircases and entrance and δ P spaces in the form of balconies. These spaces are only designed for circulation. Starting from the public parks, people enter the building by means of private/closed entrances with staircases. These staircases lead to galleries. On the façade orientated towards the inner public parks, galleries with small width (2), are stretched among the total length of the building, each one above the other (4). The width is so small (2), that people are almost forced to social interact if another inhabitant approaches the gallery from the opposite site. The galleries are directly related to the interior space: neighbors can look through the large windows, which are located between the gallery and the private interior. The in-between spaces are designed for efficiency in the use of space and security for evacuations, but not or hardly for their role as facilitator of interaction (Van de Wal, Van Dorst, Leuenberger, Vonk, & van Vugt, 2015). There are more spatial arrangements that preventing social contact, rather than promoting. The few times that social interaction is promoted, the promotion is forced and there are no other options of routes/paths to enter the private interior (image 6 / appendix 3.3). In addition, there was no clear responsibility for the in-between spaces in terms of maintenance and control (Olsson & Loerakker, 2013). Because of these reasons (among others), social problems such as criminality and loneliness grew strongly, already in the first years after completion.

In the housing project New west, multiple spatial arrangements are designed in order to stimulate social contact between inhabitants. Starting from the public street, entrances, hallways and staircases provide access to the private courtyard. Inside these in-between spaces social interaction between inhabitants and people which are not living in the building, is ruled out because the entrance door is not publicly accessible (1). However, these spaces do stimulate social contact between inhabitants, because

of their width (2), accommodation of slow circulation (3) and open exposition room for art, which is visible from the same level (4). The staircases provide access to the open galleries, which are located around a courtyard. The galleries are orientated towards each other (5) and are provided with gallery-balconies, from which contact between each gallery floor is possible (4). The presence of social stimulation by means of in-between spaces in New-West is visualized in image 7.



















PREVENTING SOCIAL CONTACT	TYPE	STIMULATING SOCIAL CONTACT
	β O Alley	  
	β P Back courtyards	    
	α P Back gardens	
	α O Entrance courtyards	    
	γ O Open Gallery	 
 	δ P Loggia Balcony	

Image 5: Promotion/prevention of social contact Molenvliet







PREVENTING SOCIAL CONTACT	TYPE	STIMULATING SOCIAL CONTACT
	γ P Gallery	  
 	δ P Balcony	

Image 6: Promotion/prevention of social contact Bijlmermeer




















PREVENTING SOCIAL CONTACT	TYPE	STIMULATING SOCIAL CONTACT
 	γ P Entrance Hall	 
	β P Courtyard	    
	γ P Open gallery	  
	δ P Gallery-Balcony	   
 	δ P Loggia	

Image 7: Promotion/prevention of social contact New-West

3.3 THE ENERGY-WATER-FOOD NEXUS

Which approaches of the Energy-Water-Food nexus can contribute to the local harvesting of energy, water and food by means of in-between spaces?

The energy-water-food nexus refers to the fact that self-sufficient approaches in terms of the harvesting of water, food and energy are inextricably linked so that actions in one area commonly have impacts on the others, as well as on ecosystems (Unece, 2016). The energy-water-food nexus is central to sustainable development. Demand for all three is increasing, especially in urban areas (UN-Water, 2019). One neighborhood which incorporated the energy-water-food nexus in its design, is the neighborhood of EVA Lanxmeer in Culemborg. Analyses and observations of this neighborhoods shows that the appliances for this nexus in EVA Lanxmeer are mostly located at the collective in-between spaces. The in-between spaces are therefore not solely used for social activities and circulation, but also regards self-sufficiency in terms of harvesting water, energy and food. This subsection explains how each of the elements of the nexus are harvested in the in-between space of EVA Lanxmeer and how they are related.

Water harvesting

To reduce the dependency on the finite resource of fresh water, local self-sufficiency of reliable water supply in urban areas, is essential. Three approaches towards this problem can be distinguished in the publications of the United Nations: (1) rainwater harvesting, (2) wastewater reuse and (3) only treating water to be ready for its intended use, rather than treating all water to a safe drinking standard (UN-Water, 2019). In EVA Lanxmeer, the in-between spaces are used for all three approaches: (1) rainwater that falls on the roofs is collected in retention ponds, in which drinking water is created. This retention ponds are located in the BP spaces (Back-courtyards), which also have a green atmosphere and are used for social interaction. Rainwater that falls on the streets is guided to ground soil ditches, which are parallel to the BO spaces (Alleys). allowing the water to replenish the ground

water buffer. (3) Waste water is divided into two systems, a grey water and black water system. (2) Grey water is guided to retention ponds with helophyte filters, which are also located at the BO spaces (Park), in order to filter, clean and to be flowed into the surface water. However, the original goal was to use the filtered grey water to flush toilets, but this is prevented by Dutch building codes as regulations became stricter. The black water is flowed towards the public sewage system. in the example of EVA-Lanxmeer, several underground water-reservoirs are used for energy production. Besides the three approaches, the linkage between water and energy and between water and food need to be acknowledged. First of all, enough water needs to be harvested and contained so it can be used for the production of crops (food). Secondly, water is essential for the production of bio-energy, while underground water-reservoirs can produce energy for heating or cooling (Reinhard, Verhagen, Wolters, & Ruben, 2017).

Food harvesting

Regarding food, the main challenge is to efficiently find new top soil from which food can grow, as the amount of available top-soil is becoming depleted (Luscuere et al., 2016) There are three methods to incorporate food growth into the in-between spaces: (1) by growing food on green roofs, galleries or balconies of buildings, (2) by growing food on façades of buildings (Wilson, 2012). A third approach can be added if the density of the neighborhood allows enough solar exposure and space: (3) by growing food on the site adjacent to the building, such as front-yards or back-yards. EVA Lanxmeer contains multiple aP spaces (collective back-gardens), which are used to grow apple trees and vegetable gardens (approach 3). Additionally, a large plot of land is used for farming, however, this area can't be defined as an in-between space. Green roofs are applied, but none of them are defined as in-between spaces or used for food production. Also, no facades are used for growing food. Searching for other self-sufficient neighborhood led to the co-

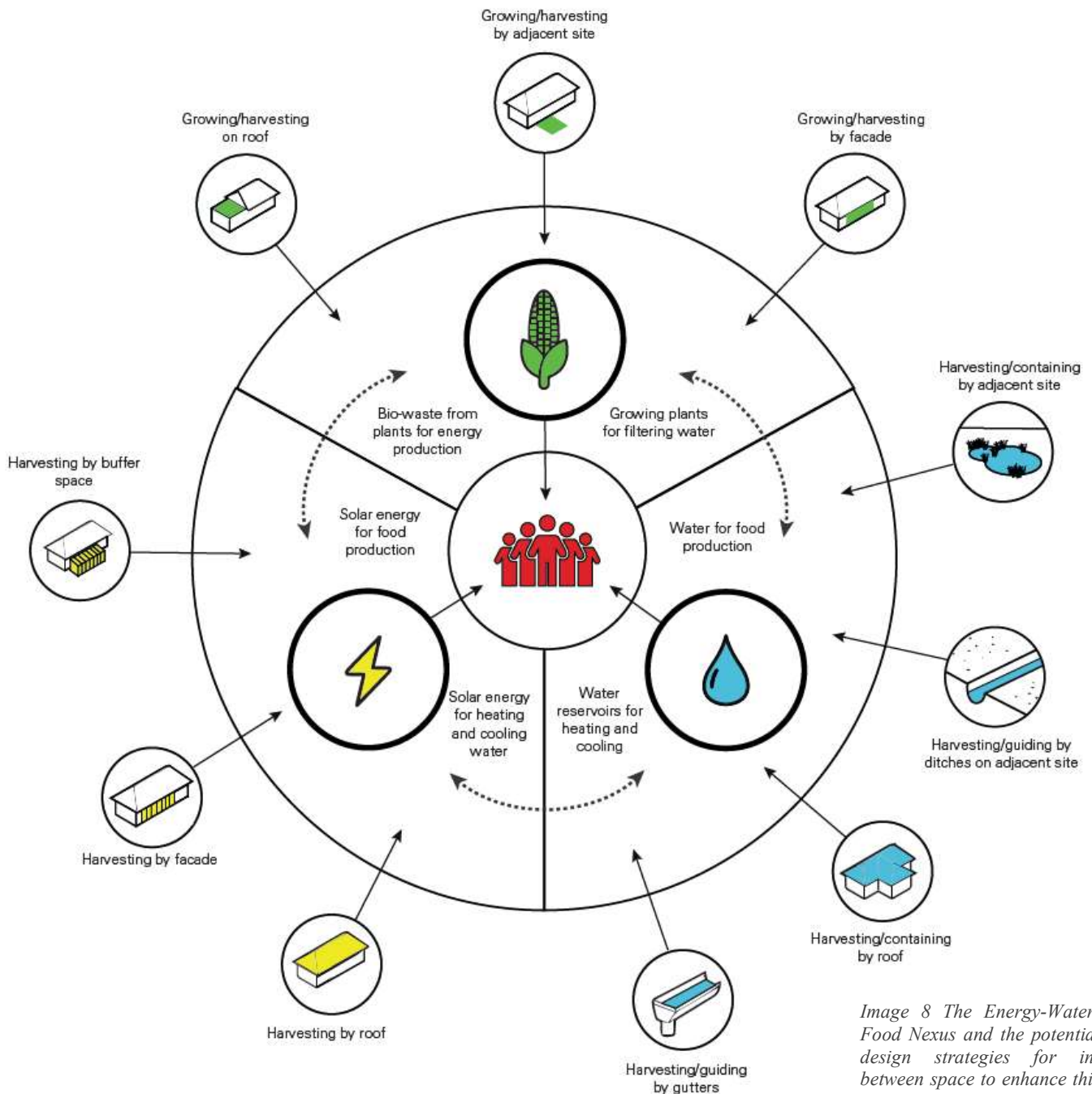


Image 8 The Energy-Water-Food Nexus and the potential design strategies for in-between space to enhance this nexus.

housing neighborhood of Hoogvliet, designed by van Bergen Kolpa architects (van Bergen Kolpa Architecten, n.d.). Here α P spaces are used to grow a variety of climbing fruits and plants on the façades and fences (approach 2) (van Bergen Kolpa Architects, 2014). In the design of New-West, a gallery-garden is designed in order to harvest food from crops (OpenBuilding.co, 2019c). This latter example can be defined as approach 1. Besides these three approaches, the linkage

between food and energy and between food and water need to be acknowledged. First of all, for food growth, energy of the sun and water supply are inextricably related. Therefore the surfaces and spaces, which are used for food production, need sufficient supply of water and exposure towards the sun. Secondly, the bio-waste from plants can be used to create energy (Reinhard et al., 2017).

Energy harvesting

The main challenge regarding energy harvesting is to reduce the dependency on fossil fuels (Luscuere et al., 2016), by means of renewable energy sources. According to Luscuere, the sun is the most logical alternative: it is abundantly available and it provides us with 5,000-10000 times our current need of energy. In terms of harvesting of solar-energy, first the separation between passive energy and active energy harvesting needs to be acknowledged. In terms of the in-between space, there are three approaches which can be applied: (1) the use of roof area for harvesting energy, in a passive or active way (2) the use of façade area for harvesting energy, in a passive or active way. (3) the use of buffer spaces for harvesting energy in a passive way. In EVA Lanxmeer, most houses are provided with solar panels on their roofs, which provide the houses with warm water and electricity (1). However, these roofs cannot be seen as in-between spaces, as there is no accessibility or social interaction possible. All houses main facades are facing south in order to harvest energy in the form of passive heating (2). Most of these facades are combined with yP spaces, δP spaces, aP spaces or aO spaces. (terraces, balconies, loggias, galleries, courtyards) which stimulate social interaction. In addition, all houses are extremely well insulated and some of the houses provide buffer spaces, such as adjacent collective greenhouses, in order to use the sun for energy in the form of passive air heating (3). These greenhouse spaces are defined as aP spaces. Besides these three approaches, the linkage between food and energy and between food and water need to be acknowledged. First of all, active energy of the sun can be harvested and used to pump water from the underground water reservoirs and to heat or cool this water, in order to heat or cool the dwelling. In addition, passive energy in buffer spaces can be used in the form of greenhouses, in order to more effectively use this energy for food production.

All approaches and strategies to enhance in-between space, so that these spaces will

contribute to the nexus, are visualized in the diagram of image 8. For each open-building neighborhood, this diagram can be used as a tool to evaluate to which extent the present in-between spaces are used for the local harvesting of food, water and energy.

3.4 SELF-SUFFICIENT IN-BETWEEN SPACES IN OPEN-BUILDING NEIGHBORHOODS

How can the different approaches of the Energy-Water-Food nexus be applied on the typology of in-between spaces in open-building neighborhoods?

In order to learn how the different approaches of the energy-water-food nexus can be applied on the in-between spaces of an open-building neighborhood, a research-by-design method is applied on the neighborhood of Molenvliet and New-West. First, the diagram of image 8 is used in order to research which present types of in-between spaces were matching the spatial requirements for each strategy). If the spatial requirements were matched, a conceptual design intervention for the harvesting of the specific element of the nexus is made (appendix 5). For each type of in-between space the possibilities for the harvesting of water, food and energy are explored.

4. CONCLUSION

How can the design of the in-between space enhance self-sufficient communities in open-building neighborhoods?

First, the research in this paper showed how a typology of in-between spaces in open-building neighborhoods is made (appendix 1). It can be concluded that each type of in-between spaces in open-building neighborhoods has a different potential for promoting social interaction, due to the degree of privacy in and around the space and the relation with the adjacent interior spaces. It can be concluded that a transition from more public in-between spaces towards more private in-between spaces, such as the patterns in Molenvliet, helps to create clear boundaries of responsibility and stimulates personalization of the built-

environment (Hertzberger et al., 1959). In the neighborhood with this transition spaces, a higher social interaction was observed (Ulden et al., n.d.). Moreover, it can be concluded that the lack of an adequate sequence of in-between spaces will lead to a lack of social interaction between inhabitants of a neighborhood, as can be seen in the design of the Kleiburgflat in Bijlmermeer.

Regarding social interaction, it can be concluded that in the existing open-building neighborhoods, the βP spaces (back courtyards) have the most potential to stimulate social interaction in a private sphere, while the αO spaces (entrance courtyards) have the most potential in a public sphere (image 5, 6 and 7). It is important to note that unwanted social control can occur in these. γP and γO spaces (private and public spaces for circulation) are often designed for efficiency in the use of space and security for evacuations, but not or hardly for their role as facilitator of interaction. This is the case in the design of the Kleiburgflat in Bijlmermeer (appendix 3). On the contrary, in the design of Molenvliet and New-west γP and γO spaces are used to enhance social interaction between inhabitants, by opening the circulation spaces towards a collective or public space.

From the case-study of EVA-Lanxmeer can be concluded that architects have the possibility to implement specific tools regarding in-between spaces, so that communities are able to harvest their own energy, water and food. However, this research shows that self-sufficiency is not only a spatial challenge, but also a collective challenge in terms of organization and management. Spatial arrangements in in-between spaces to promote social interaction between inhabitants, is therefore essential. If architects want to promote self-sufficient communities, the social potential and the potential for harvesting energy water and food cannot be seen as loose challenges, but rather as challenges which are inextricably linked. Social values have to be related to the energy-water-food nexus and vice versa. The neighborhood of EVA-Lanxmeer is a representational project

wherein social values are connected to the harvesting of energy water and food. This decentralized harvesting by means of the in-between spaces, takes shape through local cooperatives, which simultaneously promote the social coherence of the neighborhood.

Finally, by exploring the potential to harvest energy water and food by means of the in-between spaces in a neighborhood, it can be concluded that each type of space has its own strategies which can be implemented (Appendix 5). Therefore, each design intervention has to have its specific role in the larger ecosystem of the neighborhood in order to beneficially contribute to the energy-water-food nexus. Thus, each spatial design intervention needs to be linked to specific harvesting strategies (for example rainwater harvesting) and needs to strengthen the harvesting of other strategies (for example: growing food by plants) located at the in-between space.

Discussion

The purpose of this research was to provide architects with the arguments to implement types of in-between space in their designs, in order to stimulate a feeling for community and self-sufficiency for inhabitants. This research can by no means be seen as a strict regulation, but rather as a guideline. It must not be forgotten that the key objective of the open-building philosophy is public participation and freedom of choice for the user (Habraken, 1961). For architects it is therefore most important that the potential for self-sufficiency in combination with social stimulation in in-between spaces, is at least discussed with clients. The responsibility of the architect is therefore limited: the architect has the task to provide the in-between spaces with the spatial properties to answer the need for collective action towards environmental and social problems. By means of a tissue or support plan, in-between spaces have the potential to form the basis from which the inhabitants can decide to which extent they are self-sufficient or socially connected. Follow-up research needs be conducted to learn how this can be realized in practice.

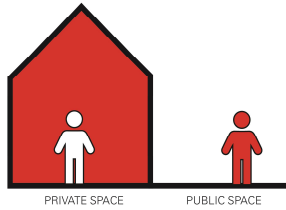
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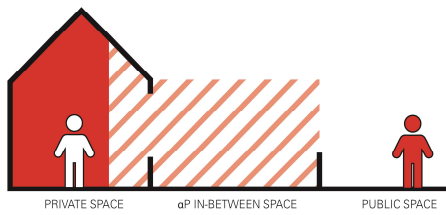
APPENDIX 1

Typology of in-between spaces

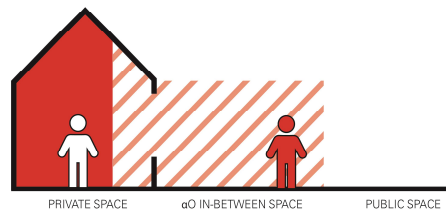
NO IN-BETWEEN SPACE



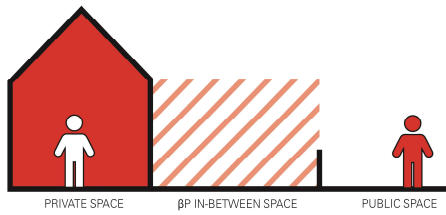
αP IN-BETWEEN SPACE



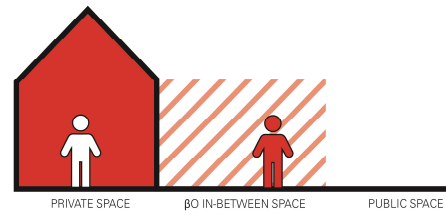
αO IN-BETWEEN SPACE



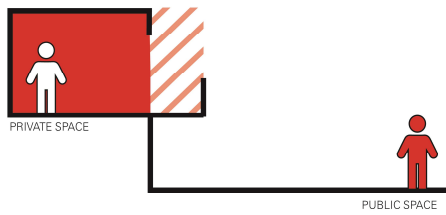
βP IN-BETWEEN SPACE



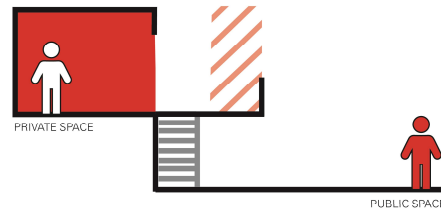
βO IN-BETWEEN SPACE



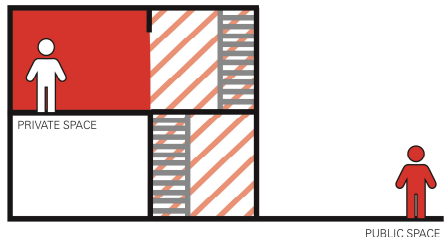
δP IN-BETWEEN SPACE



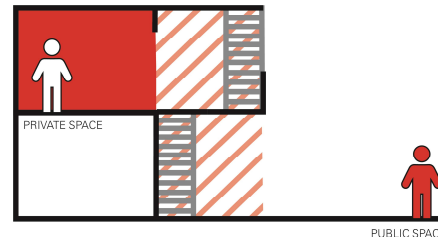
δO IN-BETWEEN SPACE



γP IN-BETWEEN SPACE



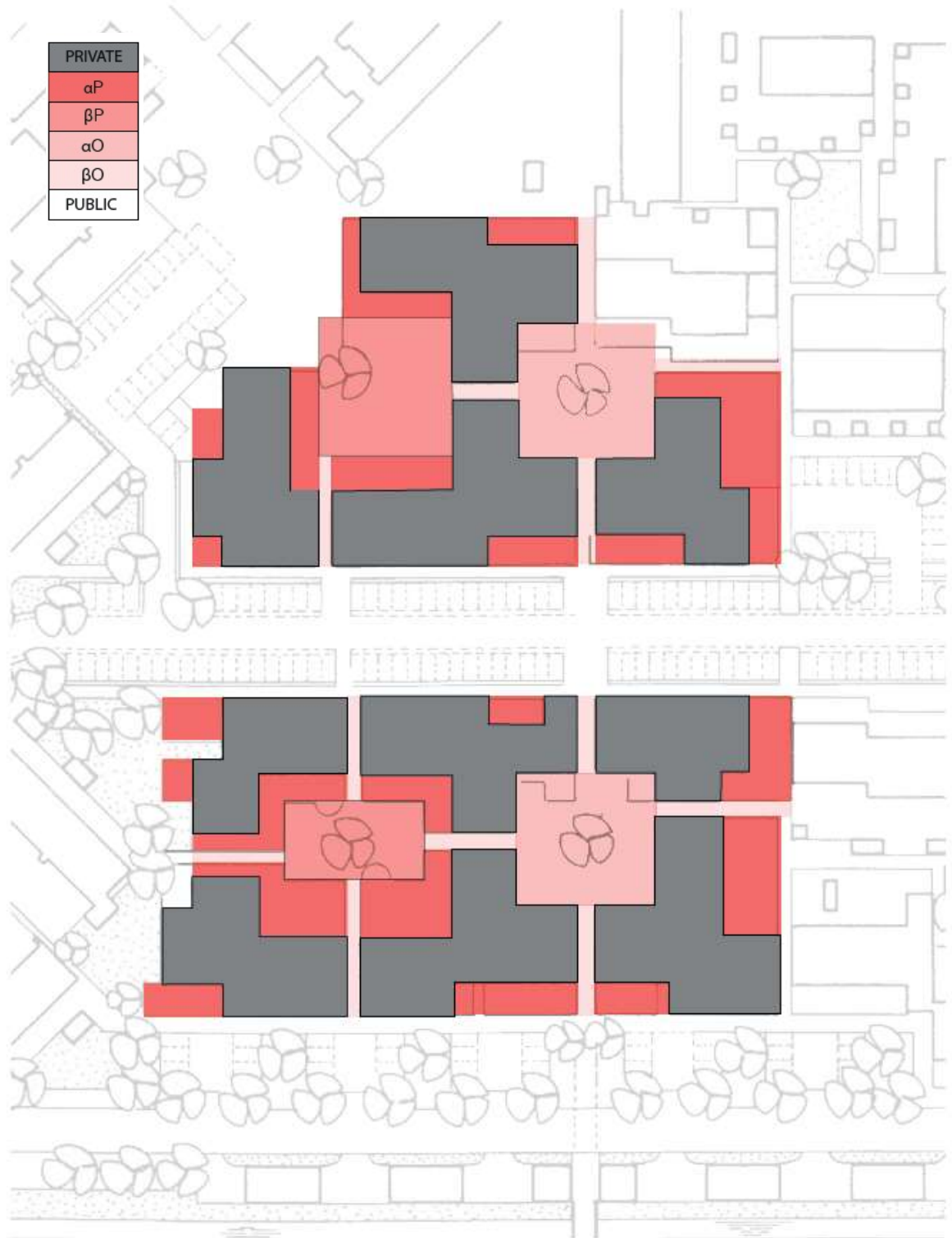
γO IN-BETWEEN SPACE



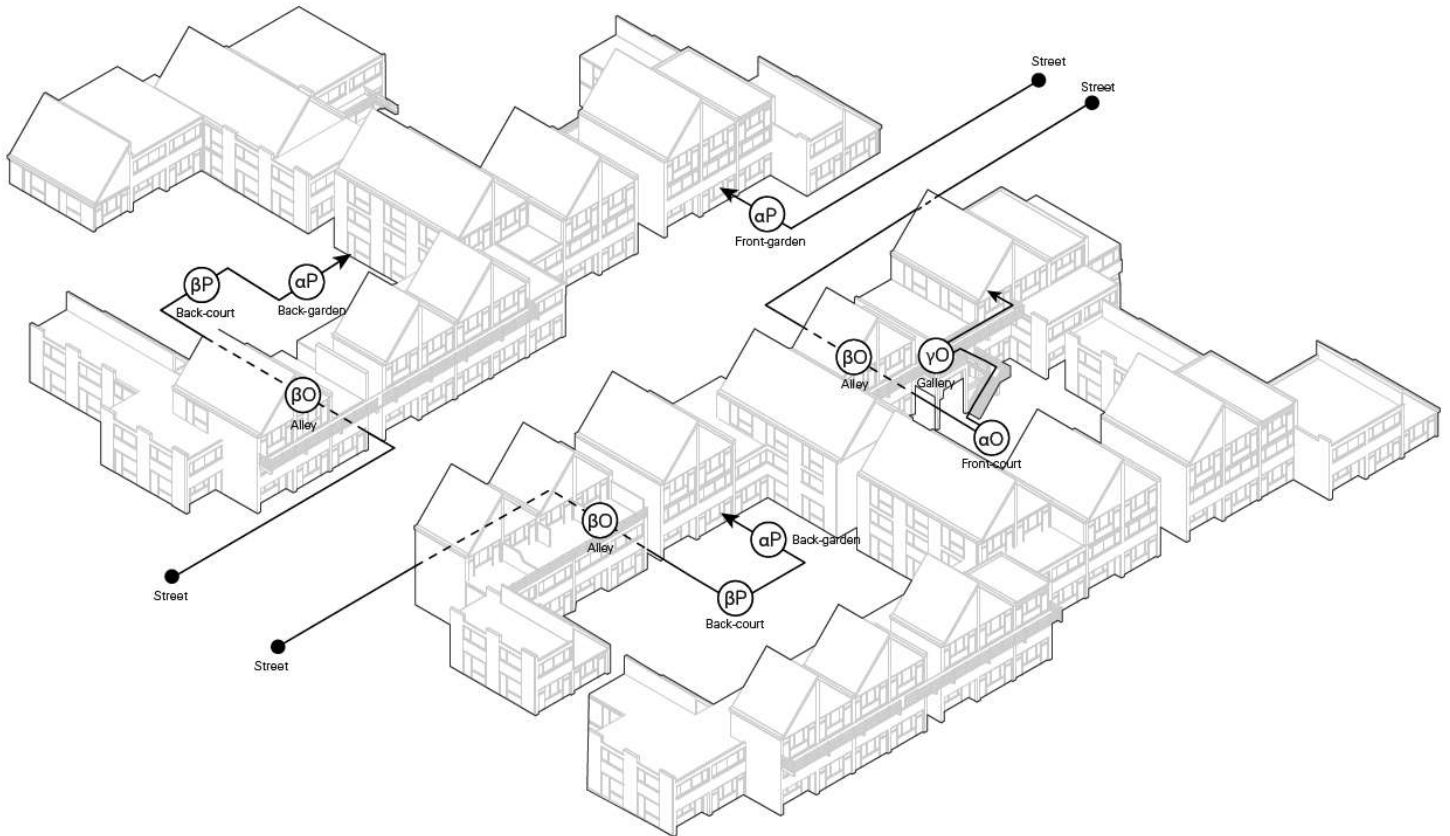
APPENDIX 2



















Molenvliet

2.1 Ground floor analysis Molenvliet



2.2 Routing analysis Molenvliet

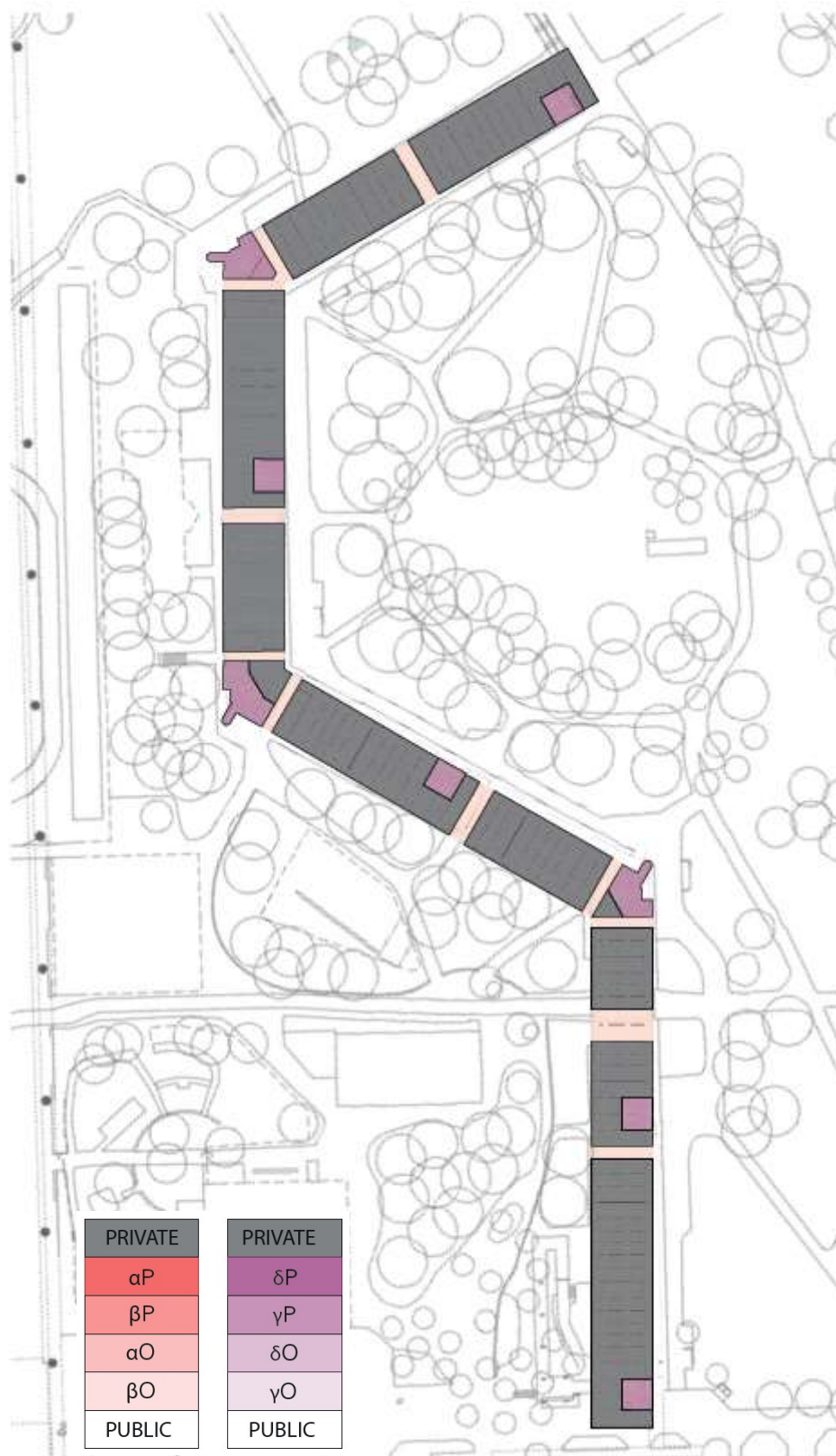


PREVENTING SOCIAL CONTACT	TYPE	STIMULATING SOCIAL CONTACT
	βO Alley	  
	βP Back courtyards	    
	αP Back gardens	
	αO Entrance courtyards	    
	γO Open Gallery	 
 	δP Loggia Balcony	

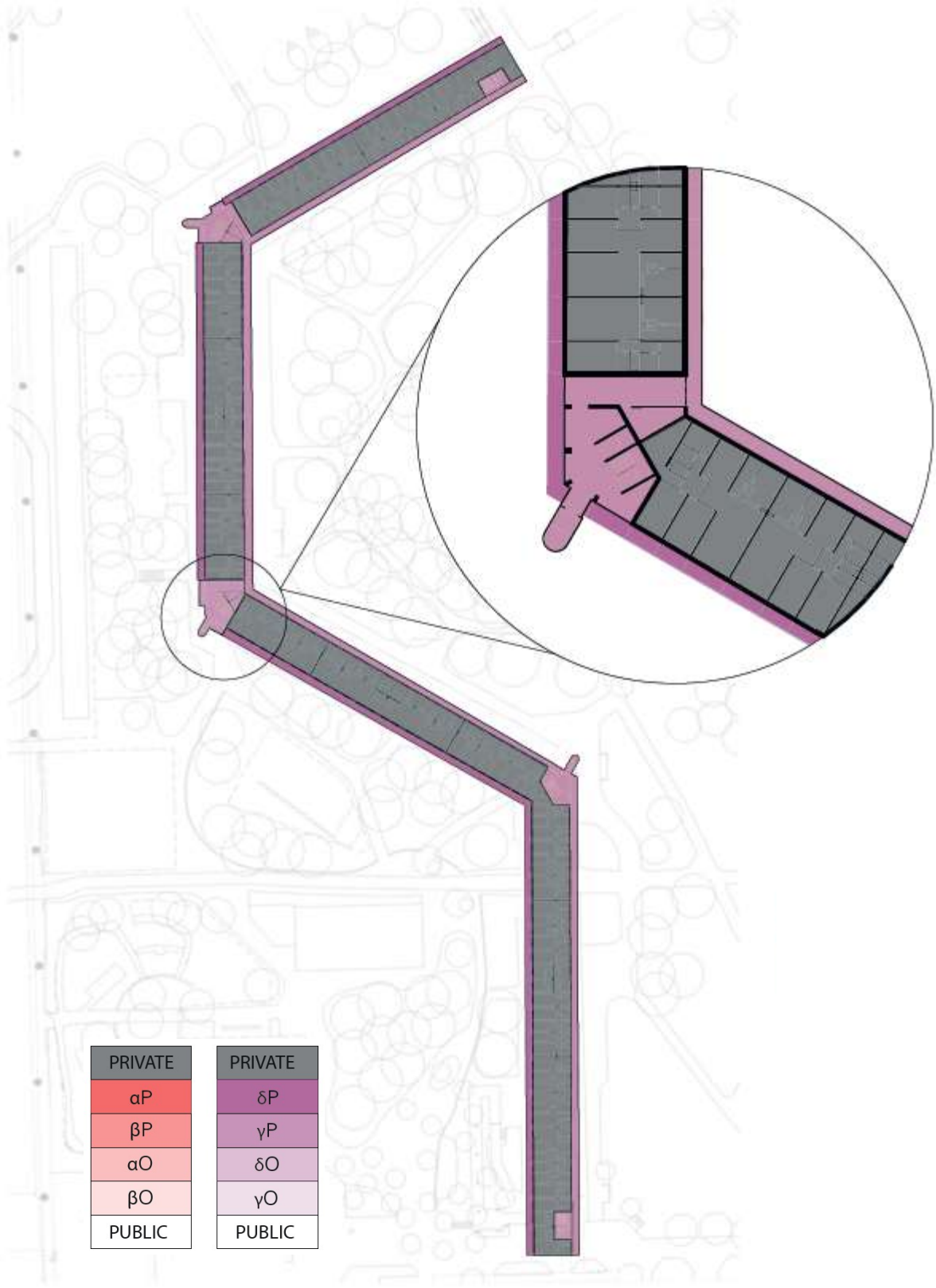
APPENDIX 3

Bijlmermeer Kleiburg

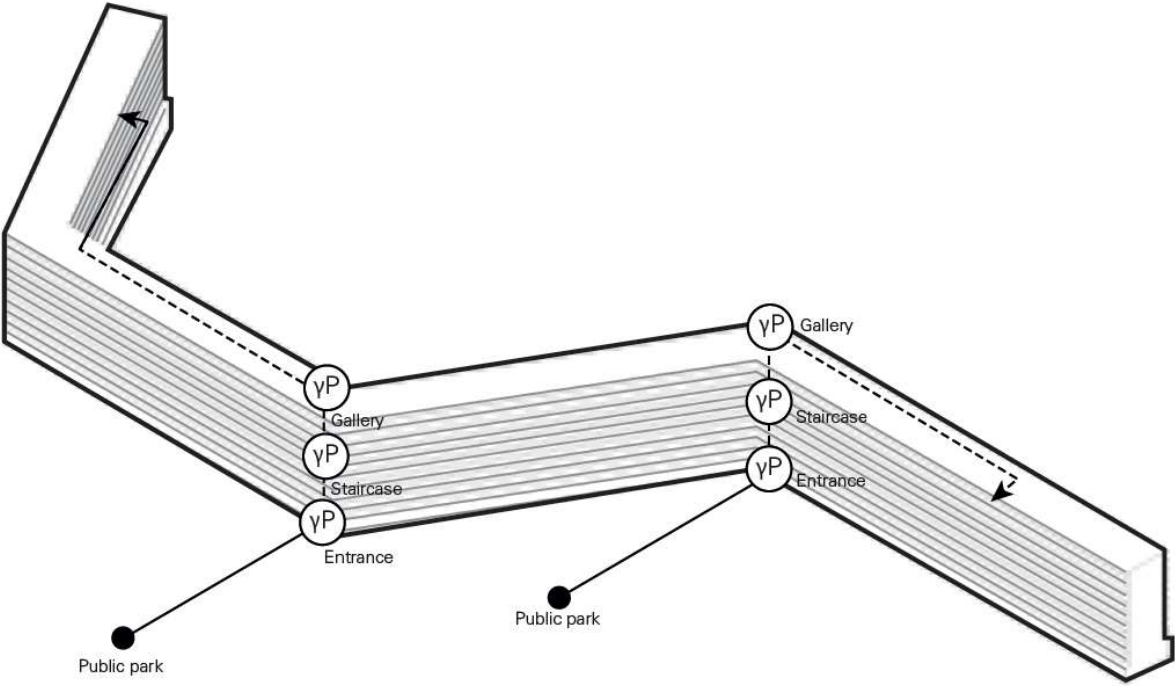
3.1 Ground floor analysis









3.2 3th floor analysis

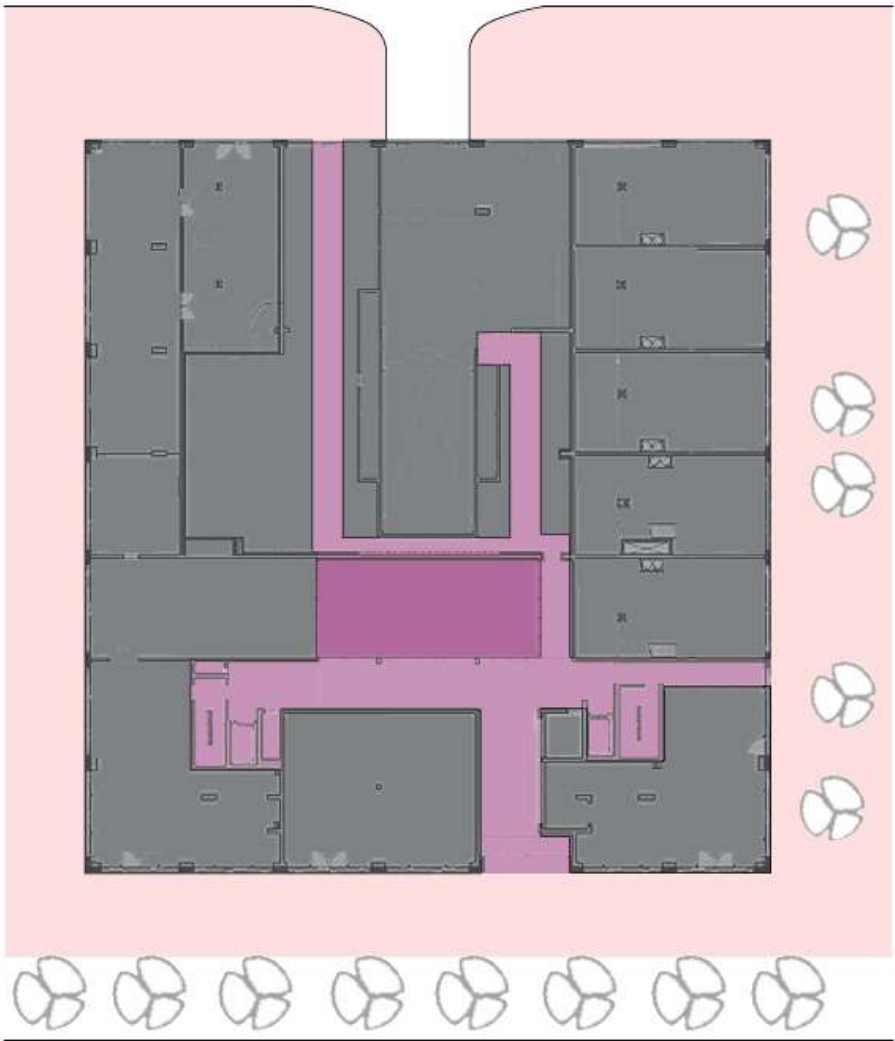


3.3 Routing analyse Kleiburg, Bijlmermeer



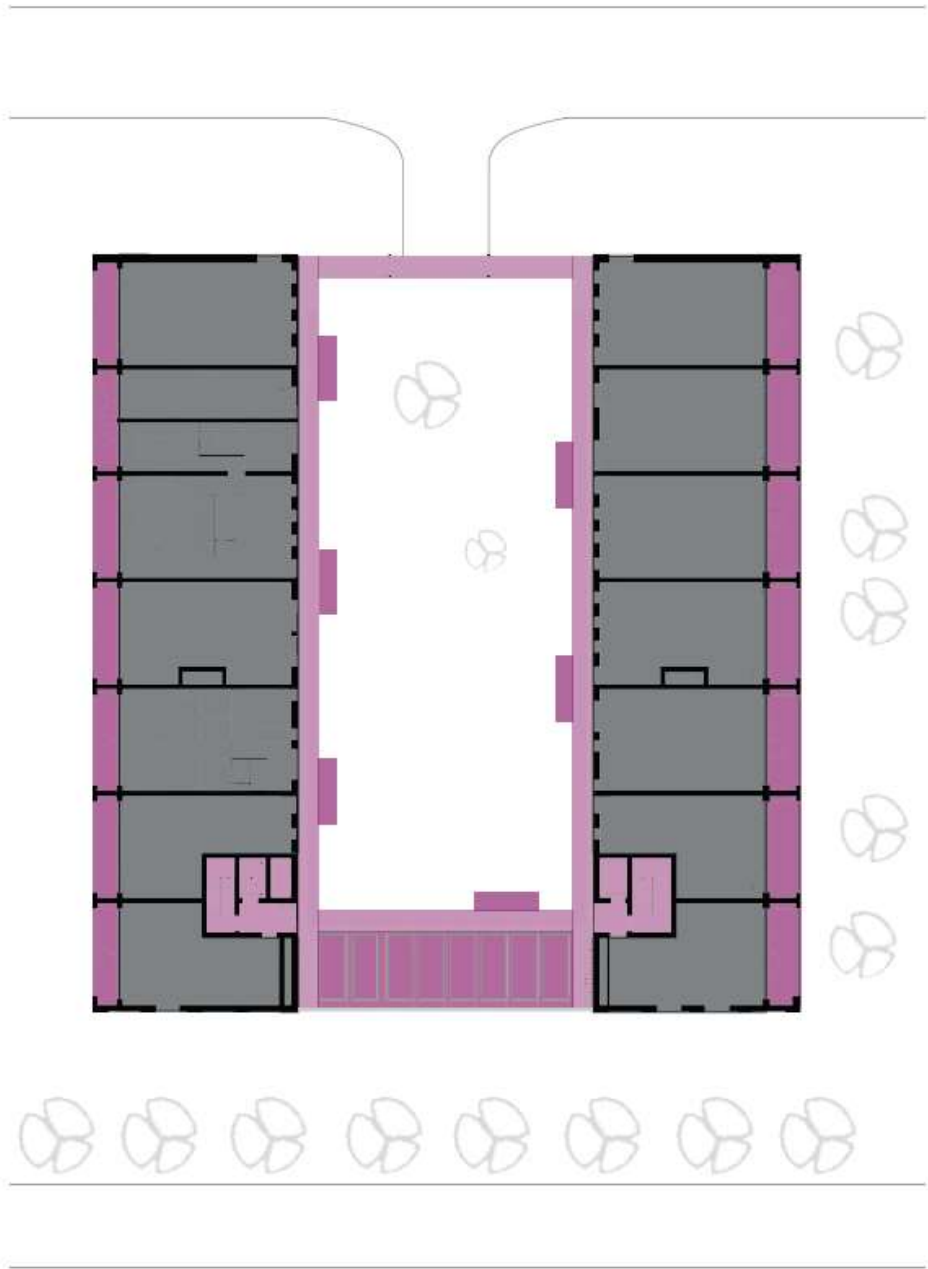
PREVENTING SOCIAL CONTACT	TYPE	STIMULATING SOCIAL CONTACT
<div>  </div>	<div> γP Gallery </div>	<div>    </div>
<div>   </div>	<div> δP Balcony </div>	

APPENDIX 4
New-West analysis
4.1 Ground floor analysis



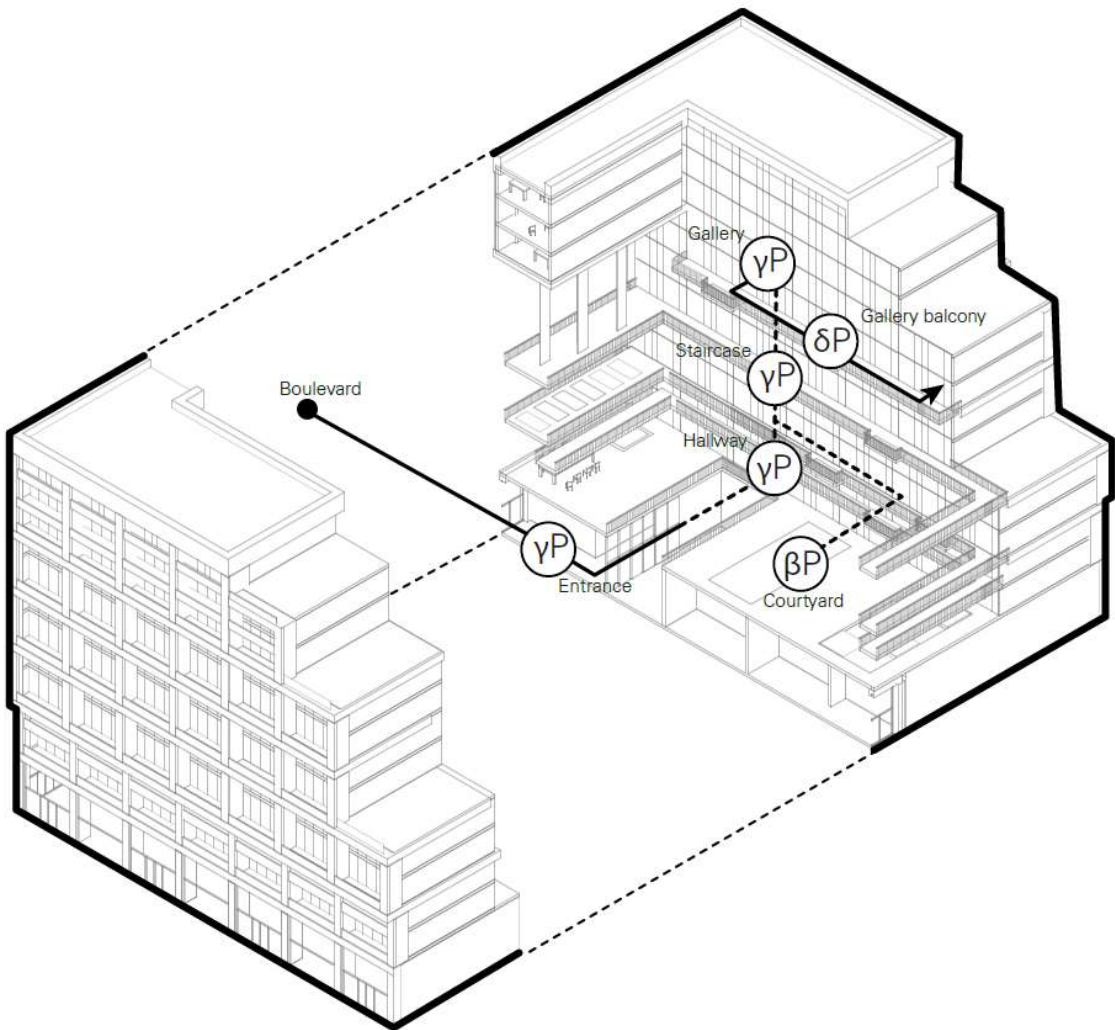
PRIVATE	PRIVATE
α P	δ P
β P	γ P
α O	δ O
β O	γ O
PUBLIC	PUBLIC




















4.2 3th floor analysis



PRIVATE	PRIVATE
α P	δ P
β P	γ P
α O	δ O
β O	γ O
PUBLIC	PUBLIC

4.3 Routing analysis



PREVENTING SOCIAL CONTACT	TYPE	STIMULATING SOCIAL CONTACT
 	γP Entrance Hall	 
	βP Courtyard	    
	γP Open gallery	  
	δP Gallery- Balcony	   
 	δP Loggia	

APPENDIX 5

Molenvliet, research by design
Energy-water-food Nexus diagram

