# Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences

# Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examencommissie-BK@tudelft.nl), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

| **Personal information** | |
|---|---|
| Name | Arne Boenders |
| Student number | 4591690 |

| **Studio** | | |
|---|---|---|
| Name / Theme | Adapting 20th Century Heritage - Vacant Police Buildings | |
| Main mentor | Lidy Meijers | Design mentor |
| Second mentor | Frank Koopman | Building technology mentor |
| Third mentor | Hielkje Zijlstra | Research mentor |
| Argumentation of choice of the studio | Most of the societal and ecological issues arose in the built environment, but it is also there where I believe most possibilities for change and improvement are. The open-ended technological cycles are taking place in an existing built environment and in order to control and alter these cycles, transformation of existing buildings and infrastructures is needed. In this way, trying to create a better relationship between the built and the natural environment. That is why I have chosen the studio of Adapting 20th Heritage, as it focusses on the re-design of the existing built environment and can in that way have a large impact on the way how we live together with nature. | |

| **Graduation project** | |
|---|---|
| Title of the graduation project | Re-design of police station Eenheidsbureau in The Hague into an Ecological community centre: *finding a new way of living together* |
| **Goal** | |
| Location: | The Hague, Burgemeester Patijnlaan 35 |
| The posed problem, | See text below |
| research questions and | See text below |
| design assignment in which these result. | See text below |
| | |

*Problem statement*

The history of the natural environment and the built environment goes far back and are closely related with each other. The natural environment has already existed for around 3.7 billion years, while the built environment exists for around 12 thousand years. For a long time, these two entities were in some sort of balance. But something happened, a disconnection between nature and humans emerged, the relationship between them had changed.

The main reason for this change in the relationship is the change of cycles. The natural environment consists of ecological cycles, which form a balanced, connected, and interdependent system of closed cycles. With the industrial revolution, a new cycle emerged in the built environment; the technological cycle. This cycle had one main difference to its ecological predecessor, it was not a cycle, as it had waste at the end which could not be used anymore by the ecological cycles. In this way, a different relationship between the natural environment and the built environment was created, as the former would be exploited for recourses used by the latter and disposed in the form of waste not useful for the natural environment again (Van Dijk, Tenpierik & Van den Dobbelsteen, 2014). These technological cycles are causing climate change, loss of biodiversity, shortage of resources, and abundance of waste; ultimately leading to an inhabitable planet for a great part of living species including humans.

In current articles, policy documents, but also in academic debates about sustainability strategies, the main focus lies on the reduction and minimization of the negative environmental impact (Van Dijk, Tenpierik & Van den Dobbelsteen, 2014). With this research, I hope to contribute to the shift of this focus towards creating a positive impact on the environment. The way how the built environment currently functions needs to be transformed in order to create this positive environmental impact.

A method for guiding this transformation can be urban metabolism. This term was first used by Wolman in his book *The metabolism of cities* (1965). The definition of urban metabolism is the sum total of the technical and socio-economic processes that occur in cities, resulting in growth, production of energy, and elimination of waste. Also the study of quantification of the inputs, outputs, and storage of energy, water, nutrients, materials, and wastes for an urban region (Kennedy, Pincetl, & Bunje, 2011). It presents the built environment as an ecosystem with flows and processes. The concept of metabolism is used to analyse the interactions and flows of materials and energy in an urban region (Broto, Allen & Rapoport, 2012).

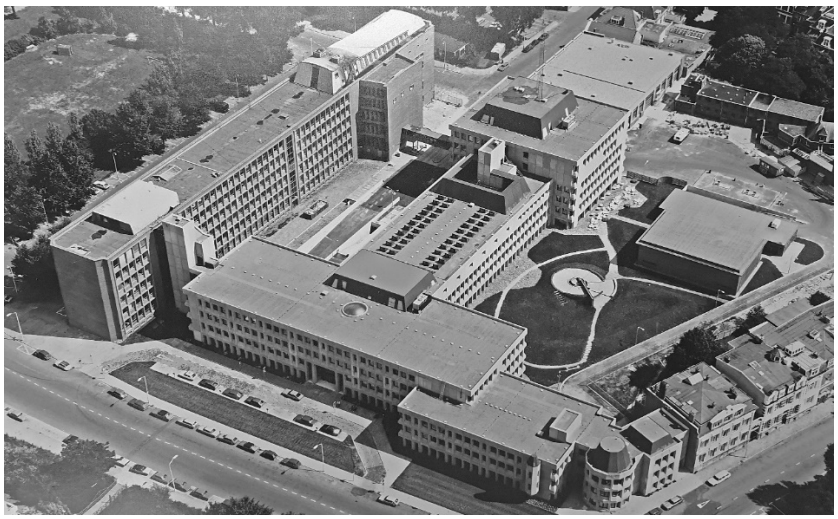
Based on urban metabolism, interventions can be designed to create symbiotic relationships. In this way transforming the built environment in a way so it has a positive impact on its environment.

The heritage department has developed a value assessment tool with which a transformation framework can be created (Kuipers & De Jonge, 2017). These values are however a social construct created by humans and are mostly subjective based on the different perceptions of the stakeholders. I believe that another tool is additionally needed to help guide an architect with the transformation of a building. This research will by no means ignore or reject the heritage value method of guiding the transformation, but rather seeks an extra tool that does not only focus on the human needs and values of the building but a tool that tries to include the needs and wishes of nonhuman actors. This framework will be tested and applied on a case study in The Hague and focus on the neighborhood and architectural scale to keep the research focussed and possible within the time period. In this way designing a transformation that not only positively contributes to humans but also to its environment, in an effort to try and find a way of living together.

*Design assigment*

The urban metabolism transformation tool will be researched and developed during the Vacant Heritage graduation studio, which focuses on vacant police buildings. The goal of this studio is to create a re-design strategy for these vacant police buildings, which can be used as input on the discussion about the future of these buildings.

For this studio ten different police buildings were given by the police, located in Groningen, Rotterdam, Eindhoven, The Hague, Haarlem, Warnsveld, and Middelburg. Most of these buildings will become vacant in the future as the police will no longer use them. The Eenheidsbureau in The Hague (see image below) was chosen as case study, mainly because of its large scale and character. When visiting the building it felt like a fortress, a safe place in which you are protected, but also like a complete village inside of a building. The large scale can be used to imitate the urban scale inside of a building and apply urban metabolism on a building scale.



Part of this studio is the Spatial Building Typology analysis, which compares the spatial aspects of the police buildings on four different scales. Later in the process the design interventions of the different buildings are compared to research if there is a relation between the spatial typology of a building and the interventions used.

*Research question & Subquestions*

The goal of both the research and the design is to find new ways of living together with a transformation of a building that has a positive impact on both humans and their surroundings. Therefore the following questions are formulated:

*How can an architect transform the Eenheidsbureau to create a symbiotic urban metabolism in the neighborhood?*

- How can an urban metabolism transformation framework be created?
- How did the urban metabolic relationship between the natural environment and the built environment develop over time?
- What are the current urban metabolic flows on different scales of the Eenheidsbureau in The Hague in relation to the spatial impact?

*Design questions*

- How can these current urban metabolic flows spatially be transformed to create closed cycles and mutually beneficial relationships, while taking the heritage values into account?
- What program benefits from other program inside a building and in its surroundings to create symbiotic relationships?
- How can the heritage value framework and the urban metabolism transformation framework be combined in order to guide the design?

## Process

### Method description

*Literature research*

Different literature sources about ecological design, systems theories, and urban metabolism will be compared. These literature sources are further defined in the Theoretical framework. Based on the existing frameworks of these topics a new framework will be made.

Outcome: An urban metabolism framework to analyse the metabolic flows and cycles on different scales.

Reflection: The creation of a new framework out of existing literature is in a way a subjective, as certain elements from existing frameworks are chosen, while others are left out. These choices will be supported with literature to create a logical tracable process, but will contain a form of subjectivity.

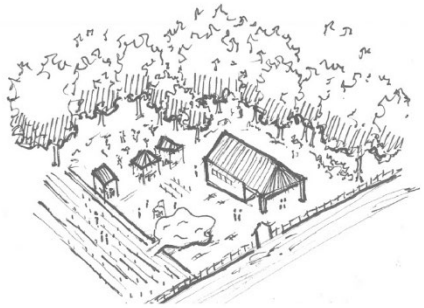
*Case studies*

Three different case studies are analysed that are examples of symbiotic urban metabolism. The case studies are chosen in different times in order to research how the relationship between humans and nature changed over time and if the methods that were used to create symbiosis have developed (see images below):

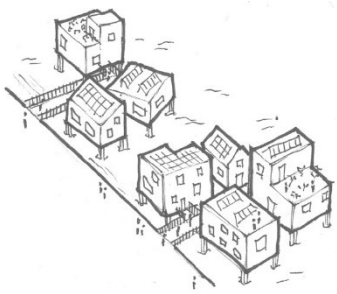
- Past: Edo period 1600-1850 in Japan with research of Azby Brown (2012)
- Present: Schoonschip - 2020 - Amsterdam
- Future: ReGen Village - Oosterwold

The analysis will be performed with the developed urban metabolism framework.

Outcome: Input to improve the urban metabolism framework and design guidelines to create symbiotic urban metabolism.



Edo period 1600-1850 in Japan - *own drawing*



Schoonschip Amsterdam - own drawing

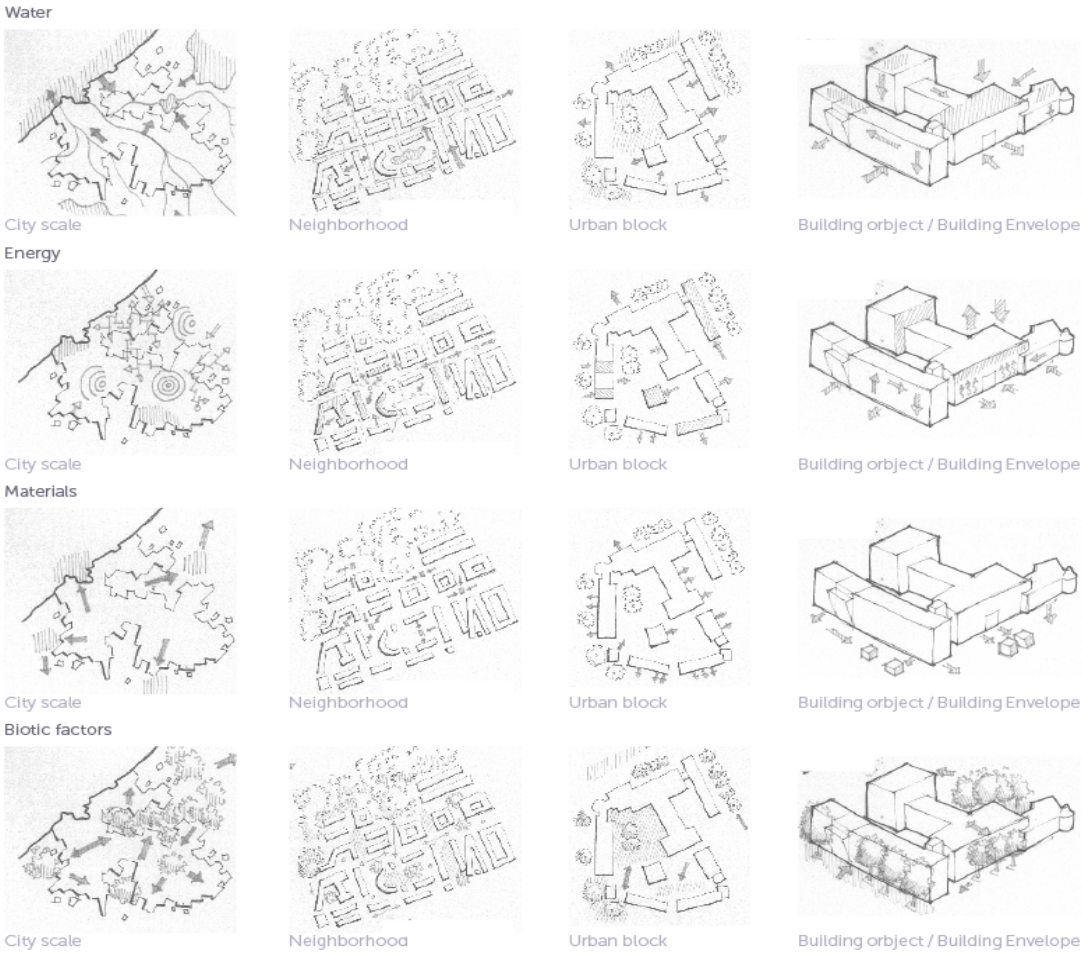
ReGen Village Oosterwold - own drawing

*Urban metabolism analysis Archipelbuurt*

The urban metabolism framework developed in the previous step will be applied to the Eenheidsbureau and the Archipelbuurt. Previous metabolic research of The Hague will be combined with GIS data (Geographic Information System) to analyse and map the different existing metabolic flows of the neighborhood Archipelbuurt. The flows will be analysed on different scales, but the emphasis will be on the building scale and its immediate surroundings. The analysis will be categorized into water, energy, materials, and food (for a first sketch example see diagrams on the next page).

Outcome: A framework of urban metabolic cycles that are currently present around the Eenheidsbureau.

Reflection: The urban metabolism analysis will be selectively performed in order to not get overloaded with data. The primary focus of this research lays on the possible interventions on the building scale and the data will be accordingly selected. In order to have a reproducable analysis, open source data (QGIS) and public available sources are used for the urban metabolism analysis. The depth and scope of this analysis will greatly depend on the availability of data and is therefor at this point still a bit uncertain.



*Value assessment*

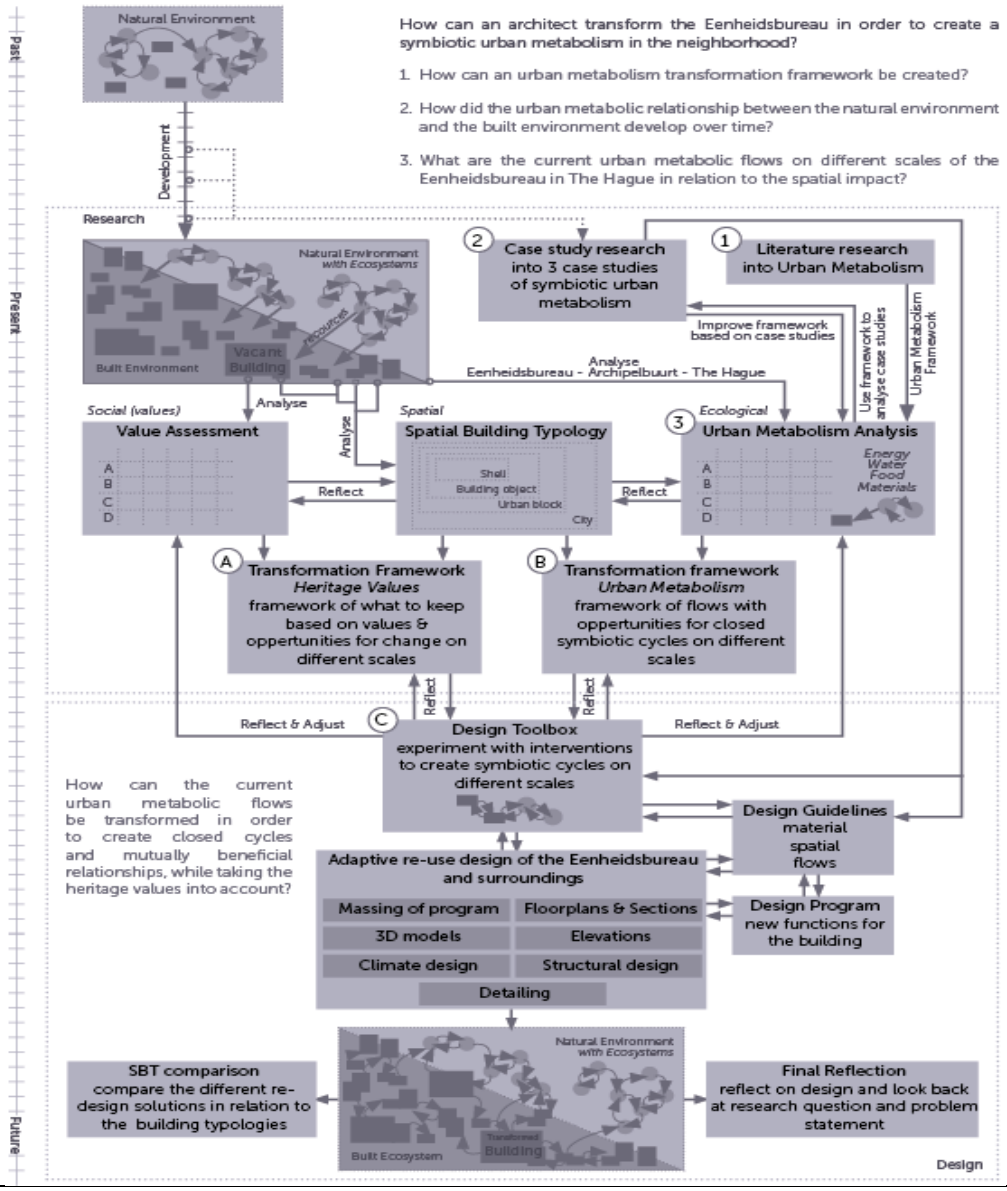
The existing building will be mapped and assessed based on the heritage values framework.

Outcome: A framework of what should stay and why and at the same time a framework of what can be changed.

*Spatial building typology analysis*

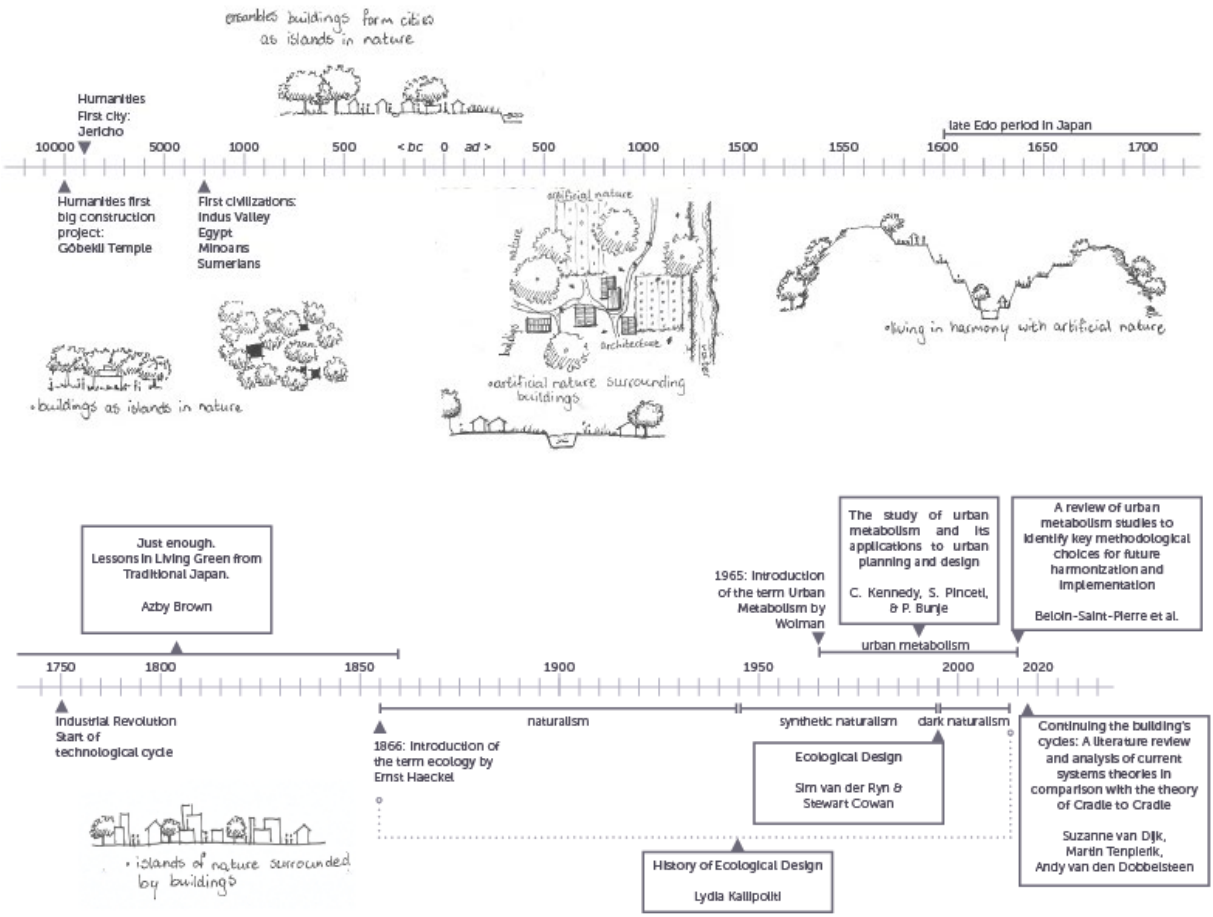
The eight case study police buildings will be analysed and compared on 4 scale levels with each several spatial aspects.

Outcome: A comparison and conclusion of different building typologies and their influence on the re-design solutions.



## Literature and general practical preference

Important literature sources are selected and positioned on a timeline to show the relation between the literature and the development of the relationship between the natural and built environment (see image below). These literature sources were chosen as they present a clear overview of certain academic debates by reviewing the previous articles on a specific topic.




For the development of ecological design, an article by Lydia Kallipoliti (2018) will be used as she created a framework on the history of ecological design. It reflects on the different theories in this field and positions them in her framework, concluding that ecological design developed towards systems theories.

*Systems theories*

These so-called systems theories are further researched by Van Dijk, Tenpierik, & Van den Dobbelsteen (2014) in an article where they compare cradle-to-cradle with six different systems theories; laws of ecology, looped economy, regenerative design, industrial ecology, biomimicry, and blue economy.

*Urban metabolism*

Urban metabolism is further set apart in two articles written by Beloin-Saint-Pierre et al. (2016) and Kennedy, Pincetl, & Bunje (2011) which both review over 50 urban metabolism studies. The articles come to different outcomes, which is why these two studies were chosen to compare the different interpretations of urban metabolism.

*Heritage value assessment*

The heritage value assessment framework is a combination of the shearing layers by Brand and the Rieglian values Kuipers & De Jonge, 2017) and will be used to create a transformation framework with possibilities for change while respecting the heritage values.

*Spatial building typology framework*

Another framework developed by the heritage department is the spatial typology framework which exists of four scales with each several spatial aspects. This framework will be used to analyse and compare these spatial aspects of the different police stations to define several building typologies.

*Bibliographical references*


Beloin-Saint-Pierre, D., Rugani, B., Lasvaux, S., Mailhac, A., Popovici, E., Sibiude, G., ... Schiopu, N. (2017). A review of urban metabolism studies to identify key methodological choices for future harmonization and implementation. *Journal of Cleaner Production*, *163,* S223–S240. https://doi.org/10.1016/j.jclepro.2016.09.014

Broto, V. C., Allen, A. E. & Rapoport, E. R. (2012). Interdisciplinary Perspectives on Urban Metabolism. *Journal of Industrial Ecology, 16,* 851-861. 10.1111/j.1530-9290.2012.00556.x.

Brown, A. (2012). *Just enough: Lessons in living green from traditional Japan.* Tokyo: Tuttle Pub.

CBD. (2010). *Article 2 of Convention on Biological Diversity*. https://www.cbd.int/ecosystem/description.shtml

Johnson, D. L., Ambrose, S. H., Bassett, T. J., Bowen, M. L., Crummey, D. E., Isaacson, J. S., ... Winter-Nelson, A. E. (1997). Meanings of Environmental Terms. *Journal of Environmental Quality, 26* (3), 581-589. https://doi.org/10.2134/jeq1997.00472425002600030002x

Kallipoliti, L. (2018). History of Ecological Design. *Oxford Research Encyclopedia of Environmental Science*. Retrieved 3 Oct. 2021, from https://oxfordre.com/environmentalscience/view/10.1093/acrefore/9780199389414.001.0001/acrefore-9780199389414-e-144.

Kennedy, C., Pincetl, S. & Bunje, P. (2011).The study of urban metabolism and its applications to urban planning and design, *Environmental Pollution*, *159* (8–9), 1965-1973. https://doi.org/10.1016/j.envpol.2010.10.022.

Kornberg, H. (2021, August 19). *Metabolism*. Encyclopedia Britannica. https://www.britannica.com/science/metabolism

Kuipers, M. C., & De Jonge, W. (2017). *Designing from heritage: Strategies for conservation and conversion*. Delft: TU Delft-Heritage & Architecture.

Pimm, S. L. & Smith, R. L. (2019). *Ecology. Encyclopedia Britannica.* https://www.britannica.com/science/ecology

Portella A.A. (2014). Built Environment. In: Michalos A.C. (eds) *Encyclopedia of Quality of Life and Well-Being Research*. Springer, Dordrecht. https://doi.org/10.1007/978-94-007-0753-5_240

The Editors of Encyclopaedia Britannica (2020, 14 February ). *Symbiosis*. Encyclopedia Britannica. https://www.britannica.com/science/symbiosis

Van Dijk, S. Tenpierik, M. & Van den Dobbelsteen, A. (2014). Continuing the building's cycles: A literature review and analysis of current systems theories in comparison with the theory of Cradle to Cradle. *Resources, Conservation and Recycling*, *volume 82*, 21-34. https://doi.org/10.1016/j.resconrec.2013.10.007

Van Hees, R. P. J., Naldini, S., & Roos, J. (2014). *Durable past-sustainable future*. Delft: TU Delft - Herit-age & Architecture.

Wolman, A. (1965). The Metabolism of Cities. *Scientific American, 213*, 179-190. http://dx.doi.org/10.1038/scientificamerican0965-178

## Reflection

1. What is the relation between your graduation (project) topic, the studio topic (if applicable), your master track (A,U,BT,LA,MBE), and your master programme (MSc AUBS)?
2. What is the relevance of your graduation work in the larger social, professional and scientific framework.

*Graduation topic, studio topic, master track & master programme*

The graduation topic is about trying to balance the relationship between the built environment and the natural environment with the re-design of a vacant police building, as part of the Heritage studio, which focusses on the re-design of vacant 20th century heritage. This architectural heritage re-design studio is one of the possible graduation studios of the Architecture master track which is part of the master Architecture, Urbanism and Building Sciences.

*Societal, professional & scientific context*

The societal challenges that are addressed with this research are related to the disconnection and unbalance between humans and nature and the therefrom arising problems, like climate change, decrease of biodiversity, shortage of resources, and abundance of waste; all ultimately leading to an inhabitable planet for humans and many other species. This research and the design aim to shift the focus of the current sustainability strategies from minimizing the negative environmental impact towards creating a positive impact on the environment.

The relevance of this research for the profession as an architect is related to the additional urban metabolism transformation tool which will be developed during the course of this research. It will add to the heritage value transformation framework in order to guide an architect during the design of a transformation of a building. This extra framework will attempt to help an architect to, next to the human values, also take nonhuman values and the environment into account while transforming a building in an effort to find ways of living together.

Next to this a book will be made of the Spatial Building Typology research. This is part of a new series of books which started last year. This years volume will focus on the spatial building typology of police stations, where last years edition focussed on department stores. This book series will add to the field of knowledge by carefully defining Spatial Building Typologies based on spatial aspects analysed on four scales.