AR3U105 GRADUATION ORIENTATION
Deliverables

ASSIGNMENT:

The assignment has 2 parts as indicated in the deliverable form, namely: Part A, dedicated to the argumentation for the selection of the graduation studio and 1st mentor (wk. 3.1-3.2); Part B dedicated to the elaboration of the preliminary draft of the thesis plan (wk. 3.8).

DEADLINE FOR SUBMISSIONS:

09/09/2022 17:30: Studio preference (1st and 2nd choice)

16/09/2022 17:30: 1st mentor preference (1st and 2nd choice)

28/10/2022 17:30: Preliminary thesis plan (prior to P1)

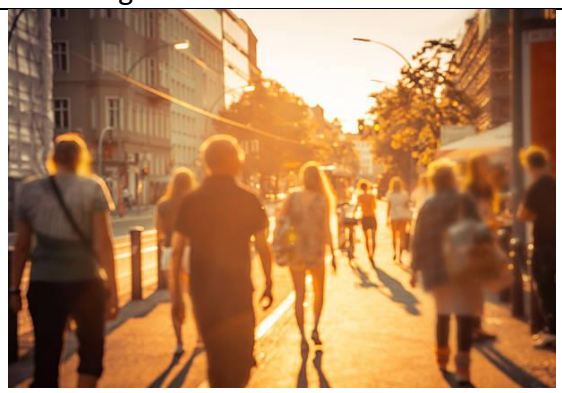
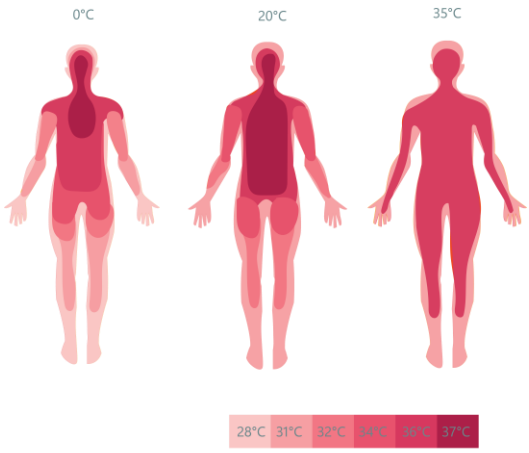
WAY OF SUBMISSION:

Brightspace > AR3U105 > Assignments > dedicated folders

Please, for the Studio and 1st mentors preference upload in the folder of your first choice studio.

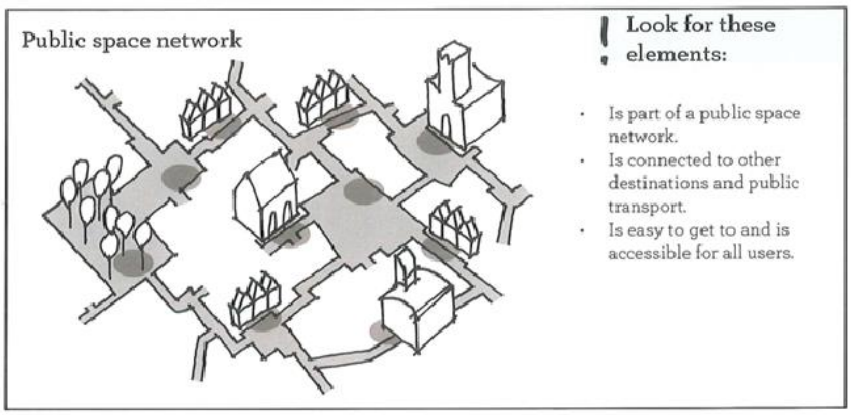
AR3U105 Graduation Orientation form	
Student Name	Marieke van Esch
Student Number	4545508
First part: Urbanism: Design of the Urban Fabric + MEP DEADLINE:16/09 17:30	
1st choice 1st mentor	Dr. Ir. S.C. der Spek
2nd choice 1st mentor	Dr. Ir. Marjolein van Esch

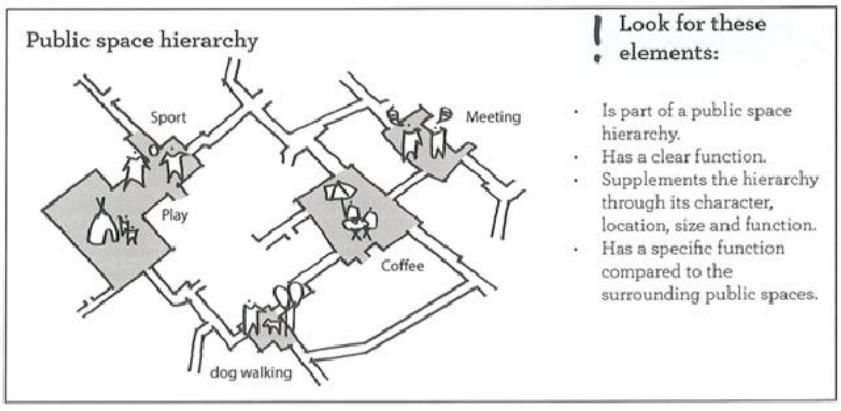
First part: Geomatics DEADLINE:16/09 17:30	
1st choice 1st mentor	Ir. E. Verbree
2nd choice 1st mentor	Dr. Ir. S.C. der Spek
3rd mentor	Dr. S. Koopmans (Wageningen University)

AR3U105 Graduation Orientation form DEADLINE:28/10 17:30	
Student Name	Marieke van Esch
Student Number	4545508
Preliminary graduation project title	Can we all stand the heat? Mitigating heat stress for pedestrian accessible public space networks for a healthy future in the case study of Rotterdam the Netherlands
Key words (4-7)	Heat Stress, Healthy cities, Public space networks, pedestrian friendly, heat mitigation
Key images (min. 3)	 Figure 1. Retrieved from https://www.wcrf.org/do-we-really-need-to-walk-10000-steps-a-day/  Figure 2. Regular body temperatures with surrounding temperatures. Severe heatstress encountered with 35 degrees or higher. Adjusted from https://www.belimo.com/us/en_US/cesim-am/comfort

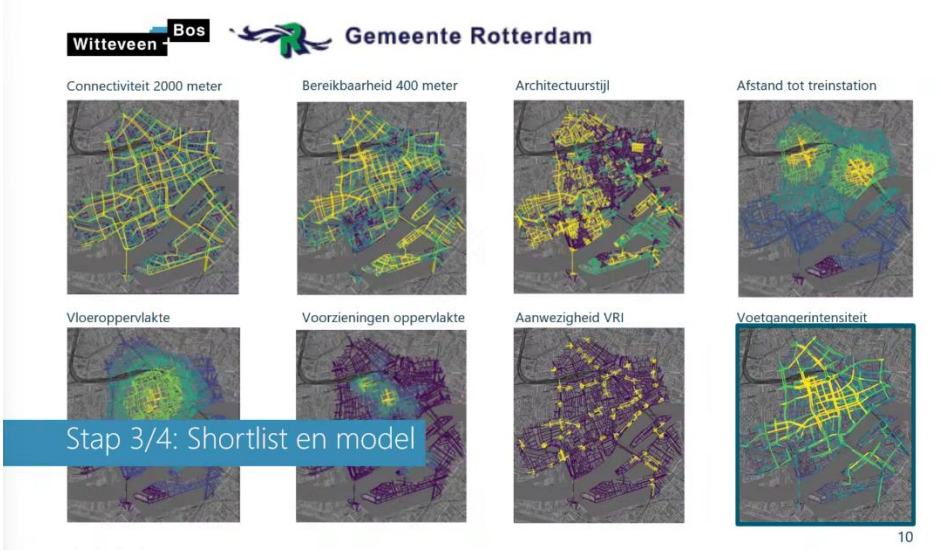
PET	Thermal perception	Grade of physiological stress
4°C	Very cold	Extreme cold stress
8°C	Cold	Strong cold stress
13°C	Cool	Moderate cold stress
18°C	Slightly cool	Slight cold stress
23°C	Comfortable	No thermal stress
29°C	Slightly warm	Slight heat stress
35°C	Warm	Moderate heat stress
41°C	Hot	Strong heat stress
	Very hot	Extreme heat stress

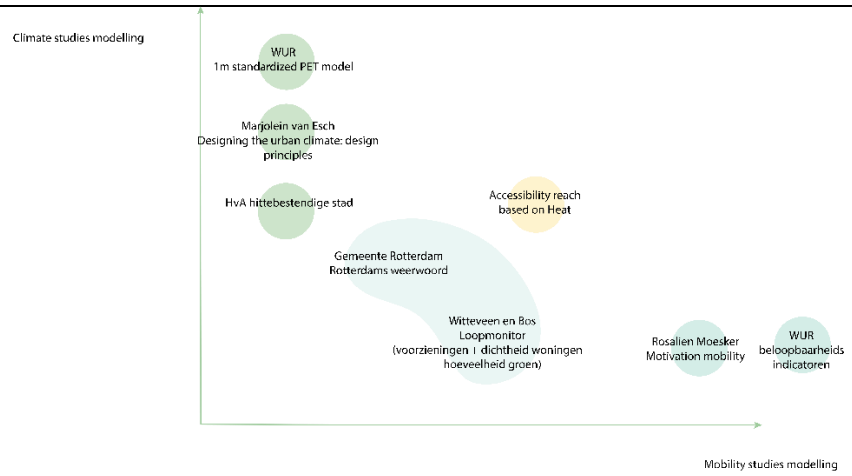
Table 1. Ranges of physiological equivalent temperature for different grades of thermal perception by humans beings and physiological stress: internal heat production 80W, 0.9 clo (image retrieved from Koopmans, Heusinkveld, Steeneveld, 2018 page 1 quoted from Matzarkis and Mayer, 1996)



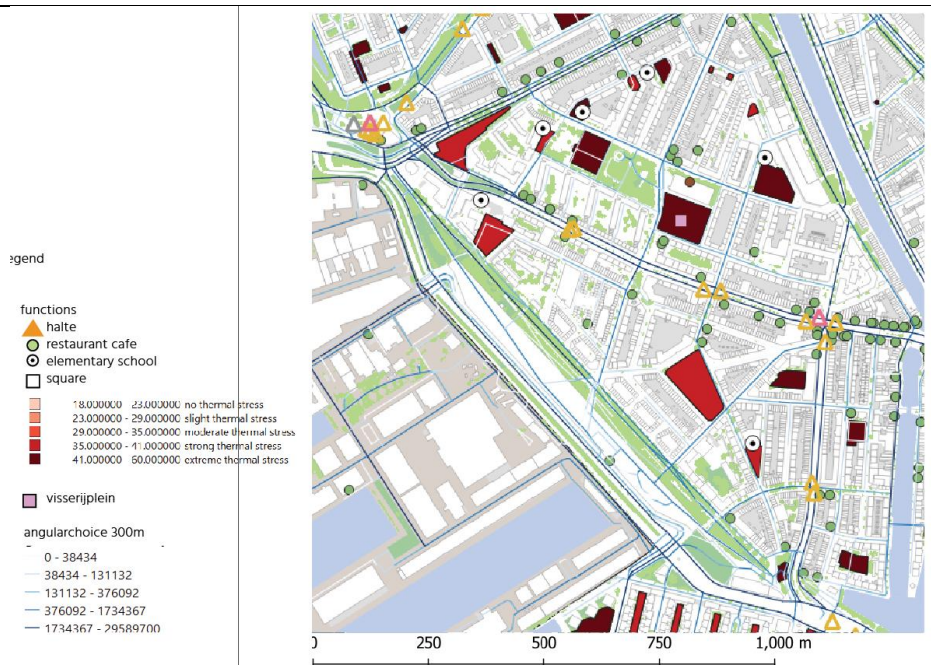


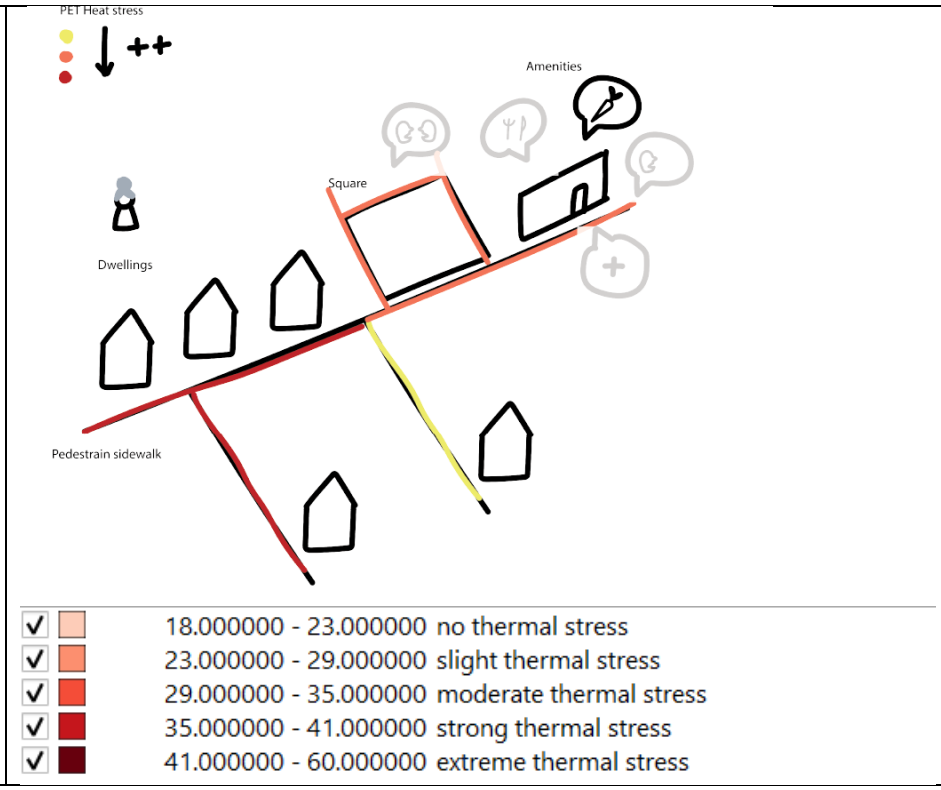
Public space hierarchy network structure

Key literature (max 5)	1. Koopmans, S., Heusinkveld, B.G., Steeneveld, G.J. (2020) A standardized Physical Equivalent Temperature urban heat map at 1-m spatial resolution to facilitate climate stress tests in the Netherlands. DOI: 10.1016/j.buildenv.2020.106984 2. Rotterdams Weerwoord (nd) Kaarten Programmakader Weerwoord 2030. Retrieved from https://experience.arcgis.com/experience/d57b8ff3d2fe4a7a8df7bbb6b3481afa/page/Wijkkaarten/?views=Fiets-%26-OV-routes 3. Marjolein van Esch (2015) Designing the Microclimate. A framework for a design-decision support tool for the dissemination of knowledge on the urban microclimate to the urban design process Retrieved from https://journals.open.tudelft.nl/abe/article/view/pijpers with DOI: 10.7480/ABE.2015.6.905} 4. Witteveen en Bos (nd) Loopmonitor. Retrieved from https://digitalsolutions.witteveenbos.com/ruimtelijke-ontwikkeling-wonen-en-mobiliteit/mobiliteit/loopmonitor  5. Gromule, Vaira & Yatskiv, Irina & Pēpulis, Juris. (2017). Safety and Security of Passenger Terminal: the Case Study of Riga International Coach Terminal. Procedia Engineering. 178. 147-154. 10.1016/j.proeng.2017.01.080 *proposed in* Rosalie Moesker (2022) A Restorative Last Mile Towards The Erasmus Medical Center, Rotterdam: Improving the quality of last mile reachability and arrival, by assessing societies' opinions on urban stress and restoratives, and digitally researching scenarios by the use of personas. Retrieved from http://resolver.tudelft.nl/uuid:aa0b6083-97d1-4b39-b101-5039449672b1

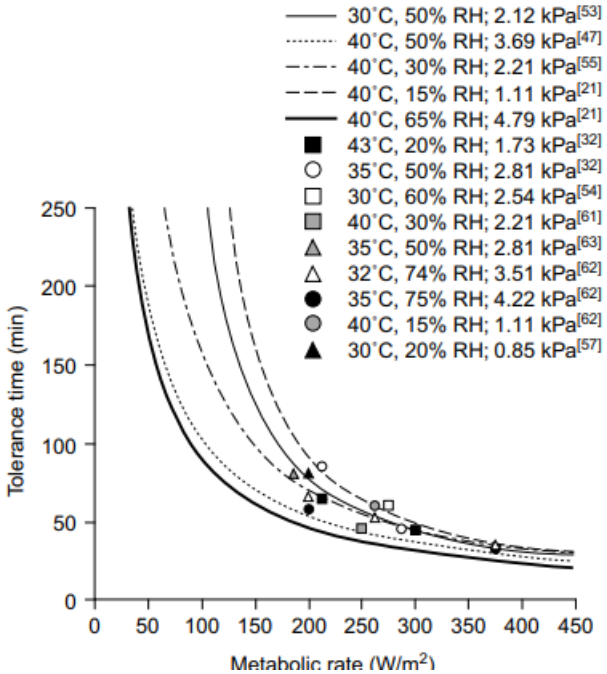
	
Selected Graduation trajectory (argumentation) Design/Planning/ Technology	The combination of Design of the Urban Fabrics studio and Metropolitan Ecologies of Places studio, the focus is on the design and technology aspect in the Urbanism part. Therefore the planning trajectory is not the main focal point of this research. However, to create an operable design the strategy phasing will be elaborated in the last design chapter. The report consists of five parts: 1. Theory 2. Analysis 3. Synthesis modelling 4. Design 5. Reflection See appendix for planning scheme
Main motivation for the project / Problematization	The last years indicate the change of climate variability. In Spain people experience the effects of heat already in the beginning of the Spring (Guardian, 2023). Due to the carbon emissions consumption of the past decades the heat will remain dormant in the atmosphere. The government over there warns people to take precautions amid drought and heat 7C-11C above average for this time of the year. They point out behavioural thermoregulation strategies to deal with the heat (Millyard, Layden, Pyne, Edwards, Bloxham, 2020). If the emissions continue like they did in the past decades these heat events are likely to happen more often in the future, and not only in the southern part of Europe only. Instead of only taking action on the health of the inhabitants by taking precautions, the built environment takes a role as well for the storage of heat in cities. In order to take action in the built environment due to climate change a new way of spatializing our building environment is necessary. My education career focuses on speculative design. By creating scenarios and testing

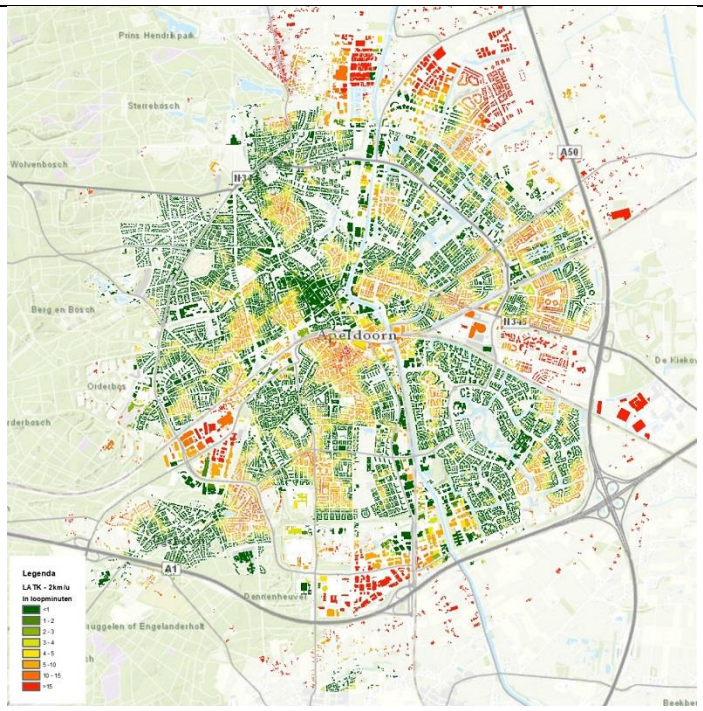
	them, an elaborated design is made. In the terms of climate modelling the complexity of meteorological and geographical aspects are used. The social aspect of the use of public space is therefore the main driver for creating change in the built environment.
Location(s) of your graduation project (for research and intended interventions) (add visual references, including maps)	Location of research is Bospolder Tussendijken in Rotterdam since it has a dense urban environment and fast traffic still has an impact on the form of the public space Intended outcomes:  Design principles: Cooling mechanisms based on: Evaporation, shade, albedo and convection. Restorative design based on urban accupunture inverventions in the network: OASIS - School yards: Openness, Adaptation, Sensitisation, Innovation and Social ties: Design and transformation of local urban areas adapted to climate change, working jointly with users [based on the method of Rosalien Moesker thesis and Paris heat mitigation report] https://uia-initiative.eu/en/uia-cities/paris-call3 Square: playground square: the schools available in the network could provide restorative public space nodes in the network. Otherwise the streets need to be reconfigured to have more places to rest: think of seatings in the shade

	
Aim of study	Main: Create a healthy environment for inhabitants to walk to their basic needs and social needs Geomatics: Spatial temporal urban heat stress modelling on the pedestrian infrastructure in Rotterdam Urbanism: Design an healthy environment with measured design interventions
Main preliminary research question(s)	How to mitigate heat stress on pedestrian routes to create an accessible public space network with the highest increase of temperature KNMI climate scenario of 2050 in order to improve the health of its inhabitants, in the case study of Rotterdam the Netherlands? Subquestions: 1. What is needed for climate modelling human health effects? 2. What is the public space network hierarchy in bospolder tussendijken for its inhabitants? 3. What does the heat network look like? And what kind of accessibility reaches are there due to heat? 4. Intervention: What are the mitigating effects available? For the nodes and streets 5. Validation and assessing the methods used

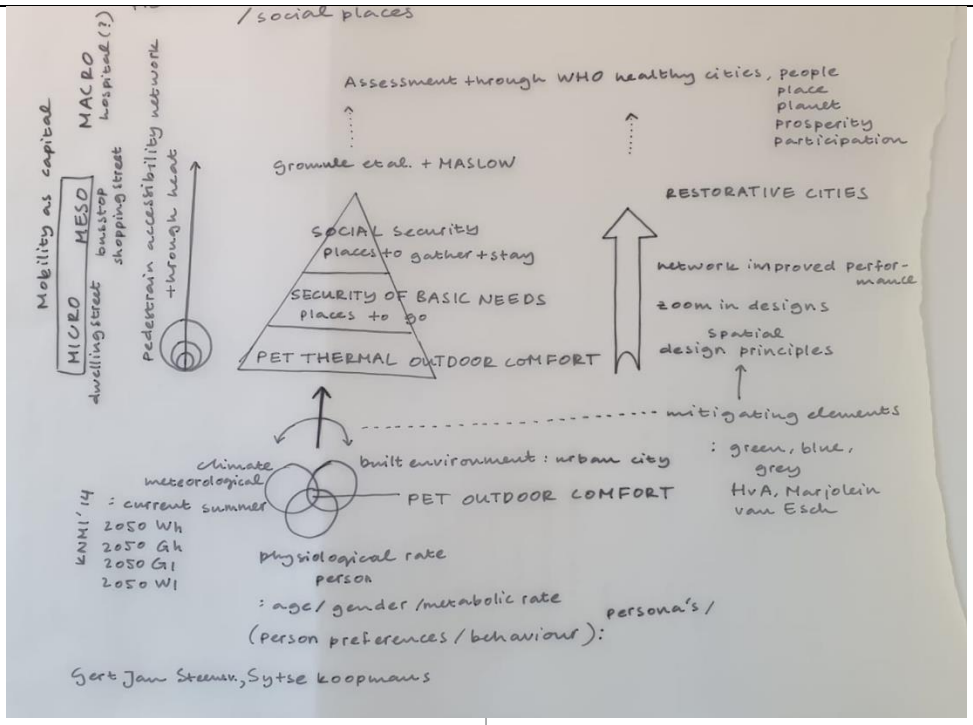
Intended concrete outcomes (add visual references, including reference projects)	 18.000000 - 23.000000 no thermal stress 23.000000 - 29.000000 slight thermal stress 29.000000 - 35.000000 moderate thermal stress 35.000000 - 41.000000 strong thermal stress 41.000000 - 60.000000 extreme thermal stress


PET Heat stress
accessible within 300m
inaccessible within 300m
Amenities
Square
Dwellings
Pedestrain sidewalk

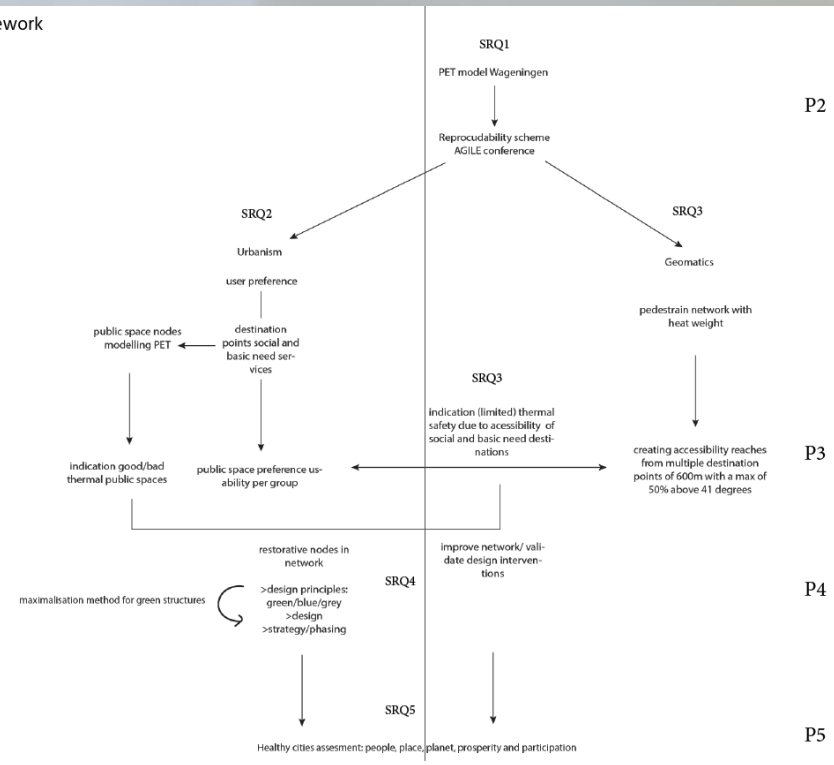

30˚C, 50% RH; 2.12 kPa[53]
40˚C, 50% RH; 3.69 kPa[47]
40˚C, 30% RH; 2.21 kPa[55]
40˚C, 15% RH; 1.11 kPa[21]
40˚C, 65% RH; 4.79 kPa[21]
43˚C, 20% RH; 1.73 kPa[32]
35˚C, 50% RH; 2.81 kPa[32]
30˚C, 60% RH; 2.54 kPa[54]
40˚C, 30% RH; 2.21 kPa[61]
35˚C, 50% RH; 2.81 kPa[63]
32˚C, 74% RH; 3.51 kPa[62]
35˚C, 75% RH; 4.22 kPa[62]
40˚C, 15% RH; 1.11 kPa[62]
30˚C, 20% RH; 0.85 kPa[57]
Tolerance time (min)
250
200
150
100
50
0
0 50 100 150 200 250 300 350 400 450
Metabolic rate (W/m2)

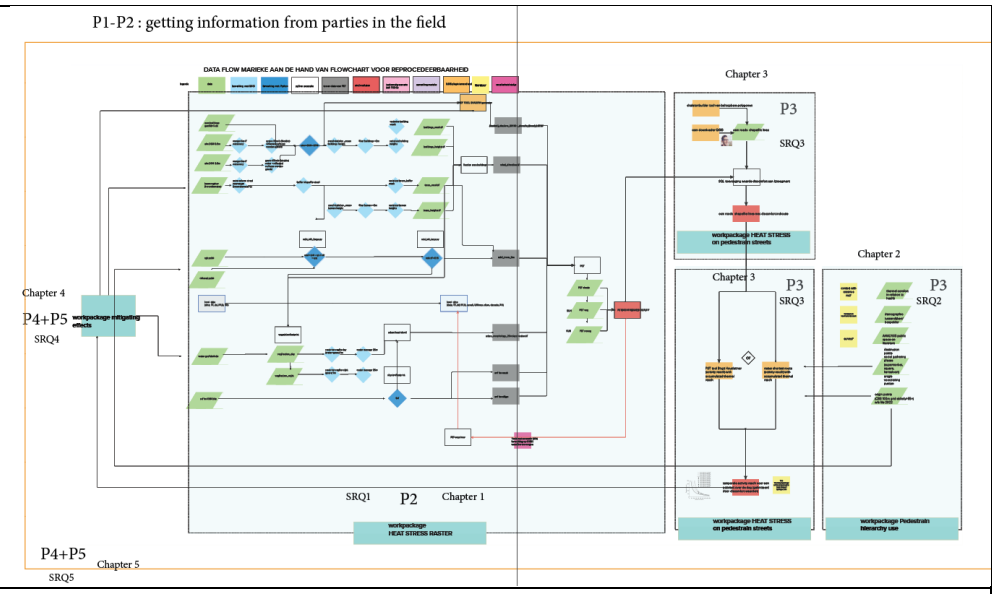
	 Tauw example access to cool areas. Instead of this to public amenities for different groups and see inaccessible areas. https://www.tauw.nl/nieuws/handelingsperspectief-hittestress-op-zoek-naar-koele-plekken-in-de-stad.html
Methodology	How to mitigate heat stress on pedestrian routes to create an accessible public space network with the highest increase of temperature KNMI climate scenario of 2050 in order to improve the health of its inhabitants, in the case study of Rotterdam the Netherlands? Subquestions order: 1. What is needed for climate modelling human health effects? - A method to adress biometrical stress, meteorological trends and geographical components for increase of heat. Name all components - PET model conducted by Wageningen University Koopmans, S., Heusinkveld, B.G., Steeneveld, G.J. (2020) for the Netherlands. Condition for modelling climate effects terms for other disciplines it is important to adjust to terms of reprocudability (Nüst, D., Ostermann, F., Sileryte, R., Hofer, B., Granell, C., Teperek, M., Graser, A., Broman, K., Hettne, K., Clare, C., Belliard, F., and Wang, Y., 2020) ➢ GEOMATICS/URBANISM basis: product parametrisation of python files for all users, text file, open data, clear licence, citations 2. What is the public space network hierarchy in bospolder tussendijken for its inhabitants?

	- Analysis usability and movement patterns by users - Analysis demographic bospolder tussendijken ➢ Urbanism: Selected areas with bad stay location quality or potential nodes in the network for restorative behaviour ➢ Urbanism: important locations and different groups 3. What does the heat network look like? And what kind of accessibility reaches are there due to heat? - Use street network - Argumentation raster/vector representation necessary for representation heat on road segments ➢ GEOMATICS: Representation heat on network - Name destination points of interest for target groups health profile. Create network radials around destination point - Define maximum added weight value reach of PET temperature within the argued 10 min reach (approximately 600 m) with heat weighted factors on road segments. ➢ GEOMATICS: Indication problem areas not accessible for pedestrians 4. Intervention: What are the mitigating effects available? For the nodes and streets ➢ Urbanism: What are the design principles ➢ Urbanism zoom in locations ➢ Urbanism evaluate/validate design interventions in network ➢ Urbanism: strategy phasing 5. Validation and interventions assessed


/social places
Assessment through WHO healthy cities, people place planet prosperity participation
Gromme et al. + MASLOW
RESTORATIVE CITIES
SOCIAL security places to gather + stay
SECURITY OF BASIC NEEDS places to go
PET THERMAL OUTDOOR COMFORT
network improved performance
zoom in designs
spatial design principles
mitigating elements
: green, blue, grey
HvA, Marjolein van Esch
Mobility as capital
MACRO hospital (?)
MESO busstop shopping street
MICRO dwelling street
pedestrain accessibility network + through heat
climate meteorological
: current summer
KNMI '14
2050 Wh
2050 Gh
2050 Gl
2050 Wl
built environment : urban city
PET OUTDOOR COMFORT
physiological rate person
: age / gender / metabolic rate
(person preferences / behaviour):
persona's /
Gert Jan Steeman, Sytse koopmans

l framework


SRQ1
PET model Wageningen
Reprocudability scheme AGILE conference
P2
SRQ2
Urbanism
user preference
destination points social and basic need services
public space nodes modelling PET
SRQ3
Geomatics
pedestrain network with heat weight
SRQ3
indication (limited) thermal safety due to acessibility of social and basic need destinations
indication good/bad thermal public spaces
public space preference usability per group
creating accessibility reaches from multiple destination points of 600m with a max of 50% above 41 degrees
P3
restorative nodes in network
improve network/ validate design interventions
maximalisation method for green structures
SRQ4
>design principles: green/blue/grey
>design
>strategy/phasing
P4
SRQ5
Healthy cities assesment: people, place, planet, prosperity and participation
P5

	
Scientific relevance of your graduation project	The scientific relevance is creating a reprocudable climate model climate modelling and showcasing an example of synergising pedestrian modelling and climate scenario for estimating the health of the city
Societal relevance of your graduation project	Societal relevance is attention for health conditions in future climate scenarios
Reflection on all Urbanism MSc3&4 studios: briefly describe the project focus when performed under studio	The relation between this graduation project and the related master track combination is the evidence-based design approach. With real-time climate data a good estimation of temperature behaviour in the city can be conducted. In this way a better approximation can be made for the experience of the pedestrian in the network. In this way this helps in scenario-planning for urbanism. Research and design are interchanged with literature review and designing by drawing. Also research is conducted by modelling the environment on heat and destinations to create a better understanding of the environment and its usability. Assessing the value the work of these thesis will be conducted through closing the loop of design by evaluating the design interventions in the model again. There is a possibility to hand out a questionnaire to people to see if they would be satisfied with the outlook of the design interventions. For the assessment of academic, scope and societal value as well as ethical aspects. It is relevant to position the work between other work that has been done before. Also the applicability of this case study must be critised for other regions in the Netherlands and difference with other countries. The academic relevance can be compared with the reprocudability paper guidelines of AGILE conference (Nüst, D et al., 2020). This implies as well the societal relevance for other disciplines to conduct their own research.

	The aim of this research is that the first part of PET model repocudability that this is transferability for other disciplines such as: urban planners, health experts and investors. The other products conducted through this research is a combination between modelling which is applicable for Geomatics students and the societal relevance in the perspective of Urbanism. Estimated learn objectives in the graduation process is to be connected to different stakeholders in the field of climate modelling and pedestrian movement modelling on academic level, policy level as well as experience level of the users themselves. It is a good manner to work interdisciplinair to these relevant future questions. Another reflective objective of the author of this paper is to assess the interventions on the healthy cities objective of the WHO (2020).
Ethical considerations	This design tries to serve an inclusive approach for human well-being and environmental aspects. However it solely promotes the walkability aspect of streets it is possible that people will be shortened on the use of further travel moads which are still relevant in the displacement methods of today.
Additional remarks	Study advisor and mentors are aware that this student deals with family issues

Bibliography

Guardian (2023) Spain braced for record April temperature of 39C as extreme heat causes misery. Retrieved from https://www.theguardian.com/world/2023/apr/27/spain-braced-for-record-april-temperature-of-39c-as-heatwave-causes-misery

Millyard, A., Layden, J.D., Pyne, D. B., Edwards, A. M., Bloxham, S. R. (2020) Impairments to Thermoregulation in the Elderly During Heat Exposure Events. Gerontol Geriatr Med. 2020 Jan-Dec; 6: 2333721420932432. Published online 2020 Jun 15. doi: 10.1177/2333721420932432

Nüst, D., Ostermann, F., Sileryte, R., Hofer, B., Granell, C., Teperek, M., Graser, A., Broman, K., Hettne, K., Clare, C., Belliard, F., and Wang, Y. (2020) AGILE Reproducible Paper Guidelines. Retrieved from https://osf.io/numa5

Tauw (nd) retrieved from https://www.tauw.nl/nieuws/handelingsperspectief-hittestress-op-zoek-naar-koele-plekken-in-de-stad.html

WHO healthy cities assessment https://www.uwe.ac.uk/research/centres-and-groups/who/healthy-cities