Ap(ConZ(T)) => DZ (T)

"All processes produce products and all products are produced by processes"
Gordon Pask, referencing Niels Bohr's principles of complimentary.

ARCHITECTURAL & MEDIA STUDIES

Catherine McBride

Report & Critical Reflection

INTRODUCTION

The MSC1 2016 studio project requires the design of a new student housing project serving TU DELFT on a pre-assigned site location. Students are encouraged to question how the concepts within Next Generation Building, Robotic Building and S.M.A.R.T Environments can further the student housing typology in a way beneficial for the future.

This process included compulsory attendance at the GSM3: Game, set and match Symposium during Novermber 2011. The symposium featured three days of guest speakers speaking on their research and it's applications, providing further precedents for the studio.

The following paper discusses the select speakers and how their ideas, works and processes have conceptually shaped the workflow of the studio project alongside design progress, studio workshops and external research.

Michael Hensel writes that "Performance-oriented design is characterised by four domains of 'active agency': the human subject, the spatial and material organisation complex and the environment." (Hensel, 2011) He continues on to say that "while these four domains are seen to be interdependent and interacting with one another, it is nevertheless necessary to examine each in its own right." (Hensel, 2011)

Similiarly to Hensel's seperation of domains, the design workflow has been seperated into distinct scales and focused on individually within the larger design context.

1.

FORM GENERATION

Frits Van Dongen (GSM)

Site Strategy

The use of site based information and optimisation strategies in forming a project with an ideal interface within it's context.

2.

CIRCULARITY & STANDARDISATION

Menno Rubens, CEPEZED (GSM)

Individual Dwelling

Negotiating the dichtomoy of Standardisation and Customisation within the design process to balance user-centric adaptation with maintaining circularity.

3.

ADAPTABLE THRESHOLDS

Chris Kievid (GSM)

Gordon Pask

Wall Typology

Discussing how sensors and actuation could facilitate a flexible wall typology and what role that would play within the scheme.

4.

STIGMERGY & DYNAMIC OPTIMISATION

Paolo Alborghetti

Matthijs La Roi

User Interaction

Exploring the possibilities of a system that can learn from the behaviours of it's occupants in order to further omptimise over time.

5.

USER MODERATION

Usman Haque (GSM)

Gordon Pask

Extent of Constraints

Discussing Gordon Pask's view on second order cybernetics as a reference for drawing the line between control over the design by the Architect against the occupant.

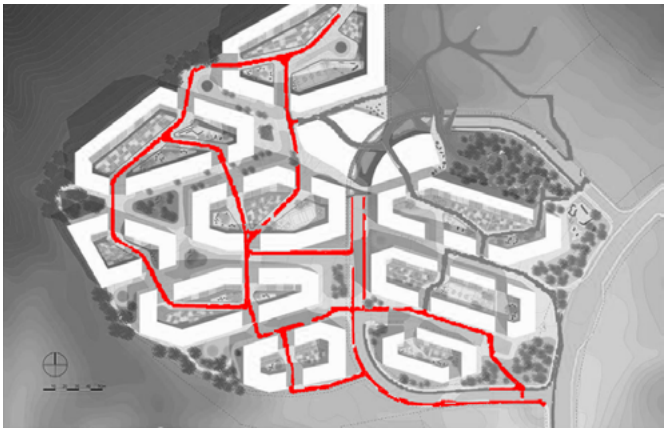
1

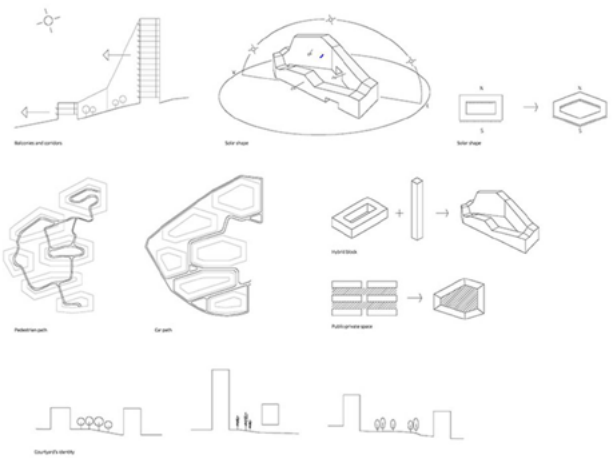
FORM GENERATION

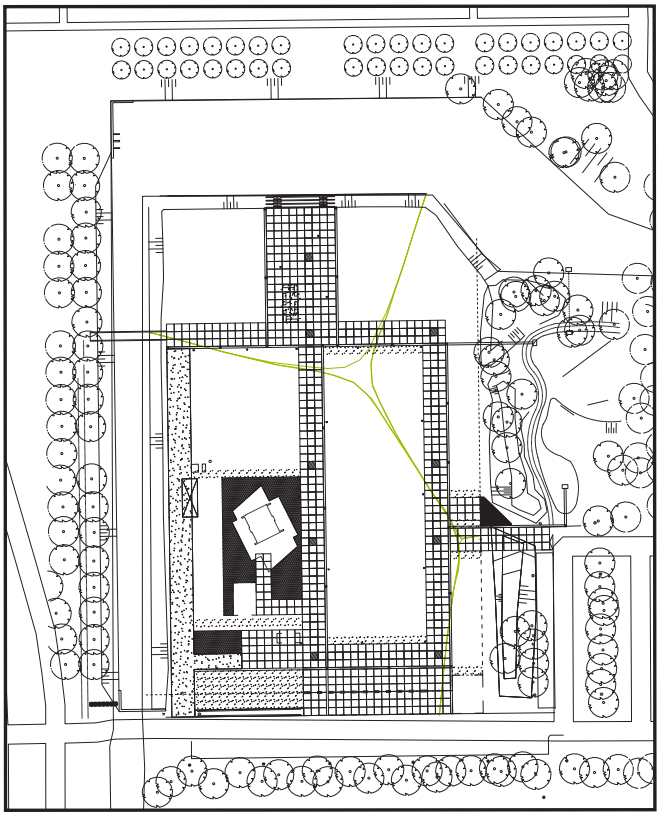
Site massing and orientation underpin a project's capacity to exploit site resources. Standardised site massing solutions fail to align with the geometries congruent with optimally receiving these resources. Optimisation technologies allow site data can be stored through digital means and analysed against prospective forms simultaneously. The studio project's interface with the site became the focus of preliminary form-finding explorations.

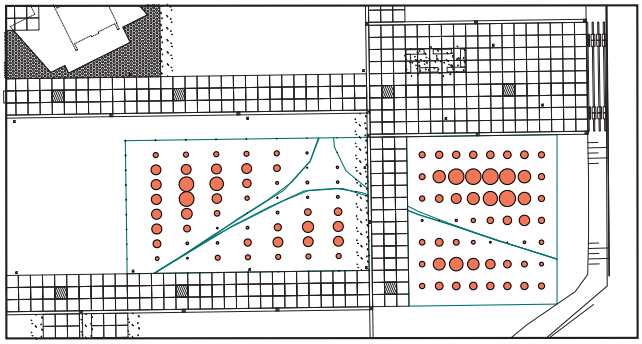
Project by Frits Van Dongen demonstrate non-standard massing underpinned by a design process that critically analyses site conditions and opportunities against design objectives. The atypical massing strategy in 'The Whale' residential complex in Amsterdam allow the residences to have greater access to daylight, solar radiation, ventilation and views. Block A5 in Seoul extends this process to encapsulate social agendas alongside climate objectives. Socially the form generation needed to promote resident connectivity and sense of ownership over communal public spaces. The resulting projects deviate from precedent typologies however feature greater performance.

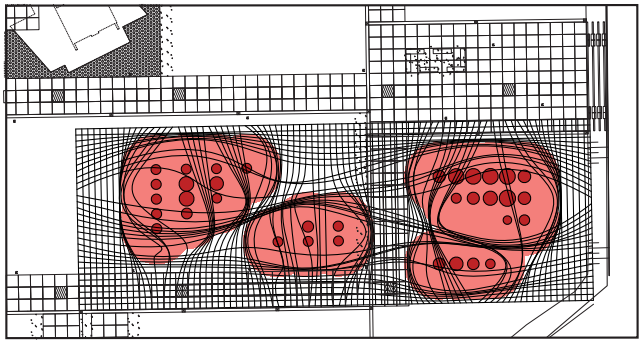
In a similar strategy to Van Dongen, site bound objectives were identified and incorporated into form generation strategies. Pathfinding as a way to divide massing addressed the project's need to maintain the existing streetscapes on site and extend them into the project circulation. After initial distribution of massing, preliminary investigations into ideal orientation and elevation between modules were conducted using climate optimisation through Galapagos.

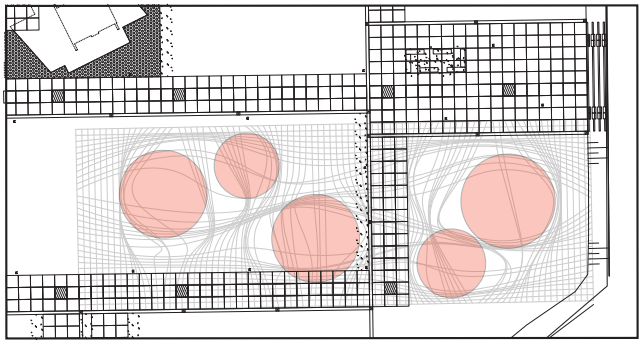












Left 1: Block 5 atypical massing strategy (van Dongen-Koschuch, 2016)
Left 2: Documentation of massing ojectives underpinning the form generation of Block 5 (van Dongen-Koschuch, 2016)

Right 1: Path optimisation mapping ideal circulation through site based on future entry points
Right 2: Distributing form on site to allow circulation to easily cut through
Right 3: Using grid seperation process to map form density and ideal circulation paths between masses.
Right 4: First iteration of the resulting masses to be used on site. Within these zones, the distribution of smaller modules are placed along the perimeter in a way that optimises solar radition and daylight access.

2

CIRCULARITY & STANDARDISATION

Human's occupation is currently required to exist in a liquid state, with furniture, daily structure and patterns of occupation needing to conform to the rigid boundaries of the static architecture that contain it. Technological and socio-political trends continue to impact work and living habits and as they develop at an escalating rate. As a result, how a house is occupied is repeatedly evolving.

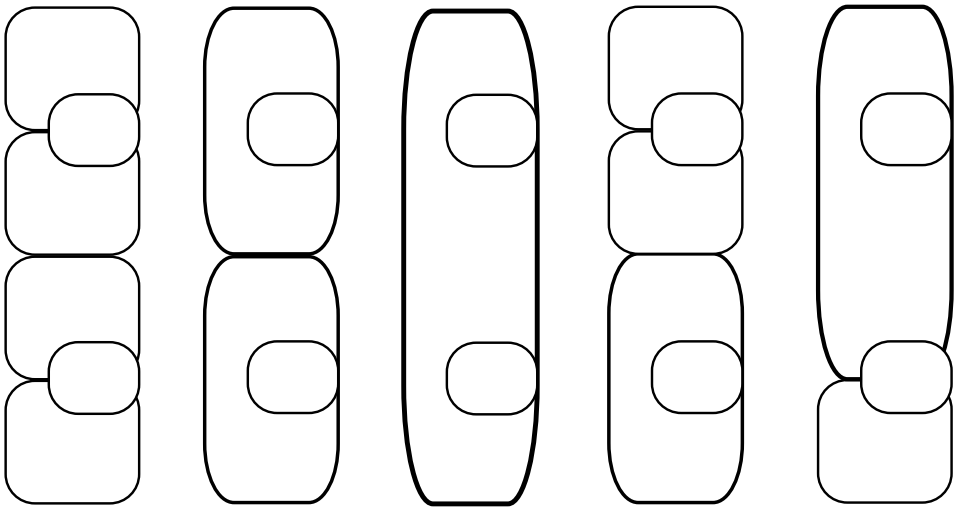
The current socio-political context has introduced a new diverse range of work patterns and dismantled long term consistency within daily routines. Maintaining stagnant living patterns to support the demands of current static architecture norms is no longer the optimal solution. Given the increasing diversity in homeowner demands and shorter durations of long term residency these new conditions would benefit from an Architecture that can adapt to each passing user. While customisation to each individual user is important, to support shorter durations of homeownership it is important to consider an architecture that can be valuable beyond its initial occupancy.

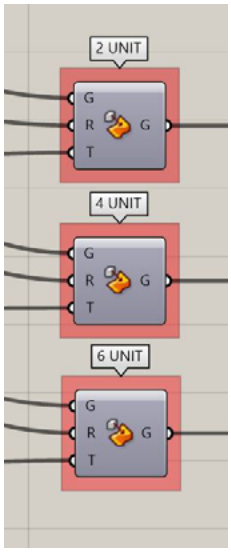
GSM speaker Menno Ruben's firm CEPEZED achieves an Architecture that is adaptable over time through the manual reconfiguration of static building components. His work challenges a market that provides architectural solutions without consideration beyond their initial 10-15 year occupancies. Customisation is realised by highly standardised building components which, while static and unadaptable on their own, can be reconfigured to create a new organisation.

Built applications of this concept include Ruben's bonded warehouse building which provides a housing solution capable of facilitating a variety of demographics through each units re-configurability. This strategy allows each unit to individually be capable or serving multiple users which is a development from simply varying the supply within the collection of units. This allows the architecture to address the issue of changing demographics over time which is an important objective as seen throughout the design studio research.

The studio project is designed with a single standardised unit typology whose internal divisions can be reconfigured to satisfy a variety of demographic demands. Divisions can be manipulated to transform a single family size apartment into two studio units, four dual occupancy student rooms or a mixed combination. Utilities remain anchored to servicing points in a way that allows each configuration access to services as required.

Computationally this strategy was dealt with using Box morph tool through grasshopper. An array of reference units was stored within grasshopper. Where





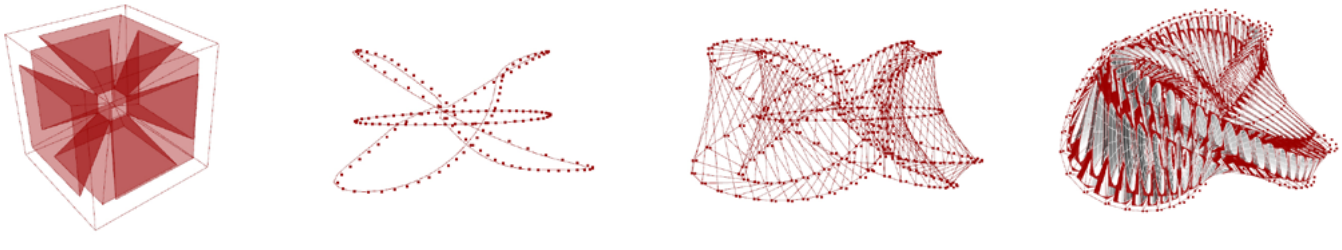
site optimisation results in a unit location, it's size is evaluated and the appropriate 2,4 or 6 capacity unit is placed within that space.

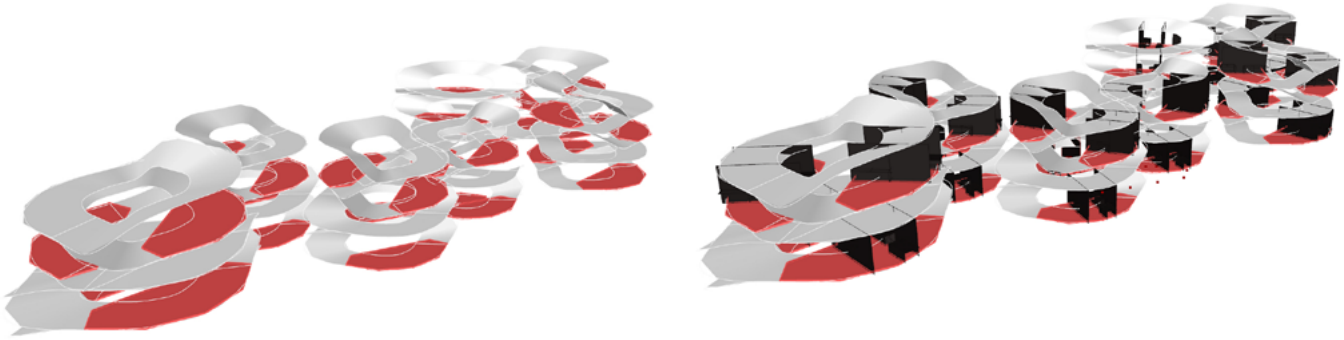
While this does provide a level of customisation, it is available only at the scale of the tenure duration. Designing for circularity demands juggling varying demographics however to tackle issues of density, the project must also juggle a variety of spatial programs. Occupants require access to varying spatial progress on a daily scale which requires building components that can be reconfigured by the user on a smaller scale. ¬

Top Left: Example of 4 smaller units organised into different configurations
Top Right: After locations for units have been massed optimallyl for climate, the resulting masses can be classified on size to be suitable for 2, 4 or 6 unit variations.

Below 1: Object to be distributed via Box Morph
Below 2-3: Forming final Box Morph locations
Below 4: Final Box Morph result as example.

Bottom 1: Studio project 'box locations'
Bottom 2: Result of inputting units into place via box morph.





3

ADAPTABLE THRESHOLDS

A volume that can provide varying programs to support an occupant's daily schedule demands a building technology who's capabilities surpass what traditional static construction can offer. Real time user operated manipulations of the spatial boundaries can be facilitated through flexible and operable building elements.

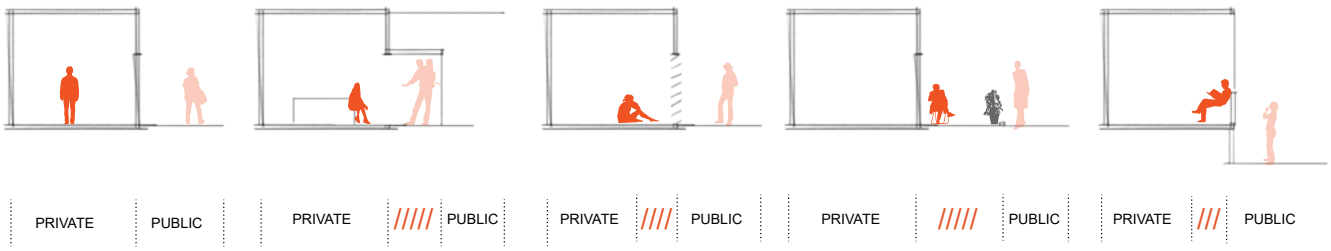
In justifying the importance of the InteractiveWall project Chris Kievid references Gordon Pask who opines "given that human interaction in the system is dynamic, so too should the structural part be dynamic in order to continually regulate its human occupants through their changes." (Kievid & Hosale, 2010)

The studio project aims to utilise adaptable boundaries within each static module, allowing occupants to access a variety of spatial conditions without creating extra monoprogrammatic rooms in order to meet density demands.

GSM Speaker Chris Kievid's work includes a collaborative role within the InteractiveWall project. The project demonstrates the potential for standard static architectural elements such as walls to become dynamic elements. Interaction with human position can instigate light changes, sound changes as well as changes to the wall's physical geometries in relation to the human. The system is triggered by human movement captured through motions sensors and relayed into data fed through a custom Arduino system. A boundary condition that can modify the light, acoustic and spatial properties of its space is better equipped to negotiate the demands of a varying program.

Workshop 1 assessment explored using attractor points to generate a gradient of properties adjustments amongt like-geometries. Primarily this was achieved by tracking each geometries proximity to a relocatable point. Condition of the threshold depending upon the location of the point. This logic could be adapted to acount for thermal data at each geometry by use of thermal sensors and light sensors instead of selection of points allowing the facade to respond to climate instead of distance. This logic is intended to be used to construct an exterior shell.

This logic is built upon and combined with grid spreading strategies to create a proposal for the social threshold on the interior of the unit. Cords represented by GH lines run along 2 axis respectively. Where points occur at intersections, constructed 'nodes' link the cords to create the grid points. Using grid spreading, the selected points are shifted along the line, resulting in openings.

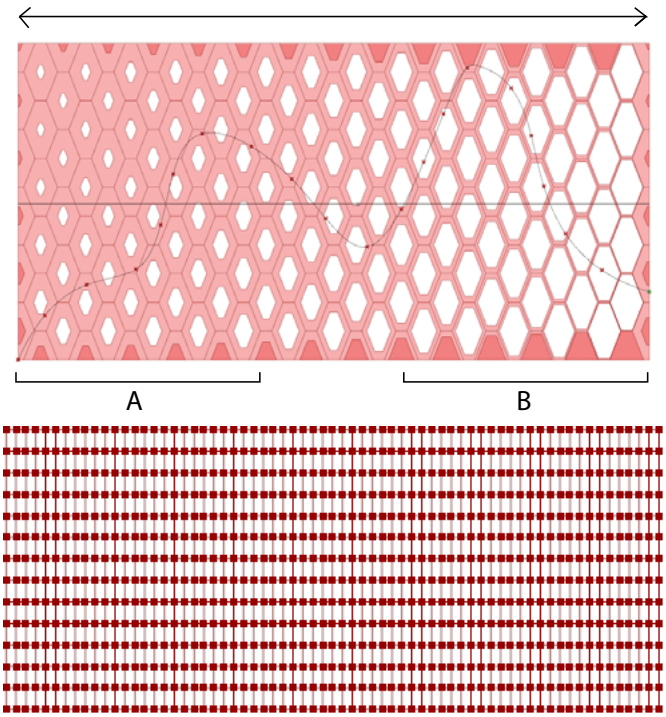


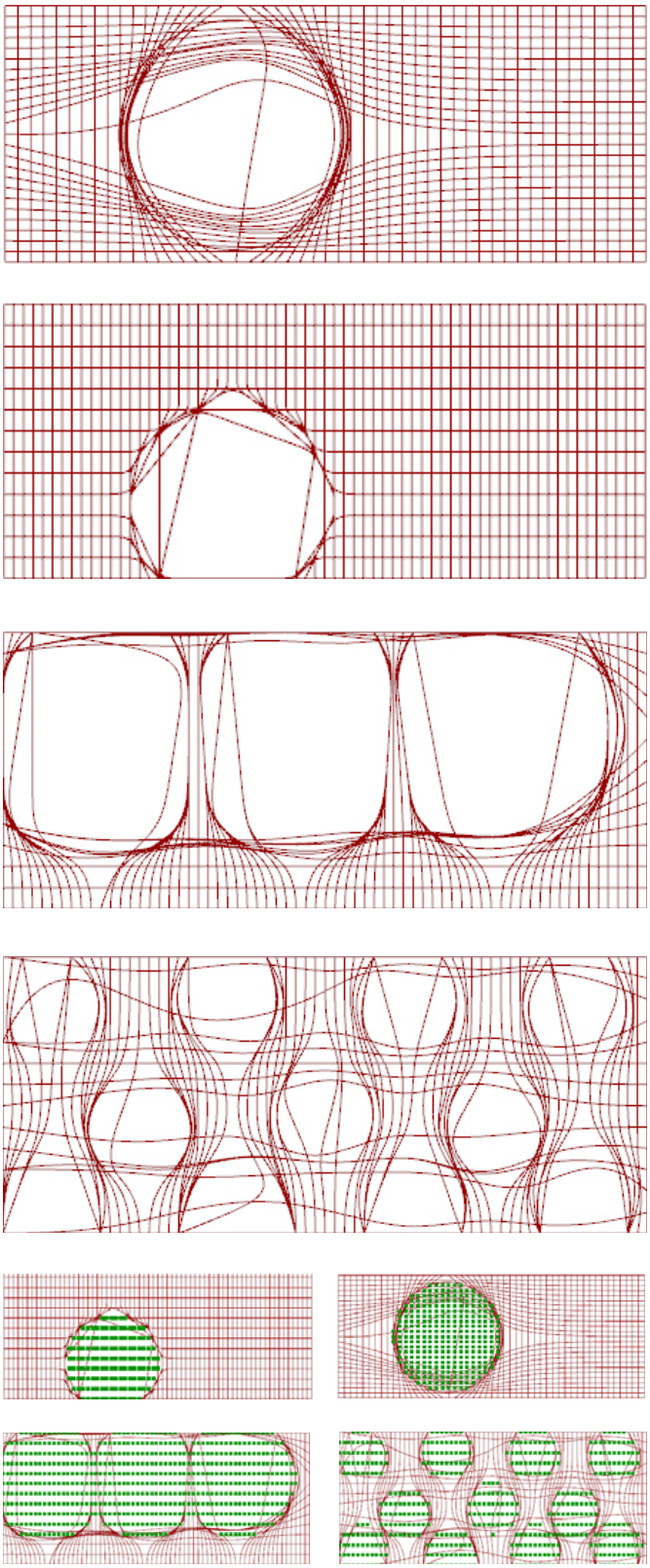
Achieving this physically requires running tensile cords through the nodes at each line. Actuated physical 'nodes' will compute true/false condition based on their selection. True nodes will clamp firmly to it's respective cords, False will allow the cords to cycle through. Each cord, can be pulled x distnace through the nodes by a pulley system. Nodes selected will clamp to the cord pulling the perpendicular cord along the axis while unselected nodes will remain in place againt the overal wall.

Top: Example of different threshold conditions as objectives to be achieved.

Below 1: Submission requirement for Workshop 1 demonstrating a gradient of threshold conditions from A to B.
Below 2: Base condition of social threshold proposal. T

Right 1: Window example
Right 2: Door example
Right 3: Half height wall/ bench with coloumns
Right 4: Screen example
Right 5-8: 'True' points required to create above geometries





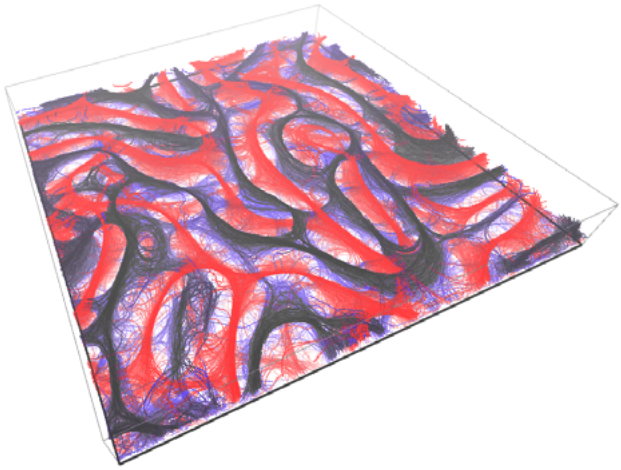
4

STIGMERGY & DYNAMIC OPTIMISATION

The studio project aims to provide an architectural solution that can balance distinctive demographics simultaneously. Each individual user will interact with their unit's environment uniquely as well as participate with the collective environment in a different way. The ability for the system to learn and adapt to the individual user preferences could be aided by Stigmergy, the underlying process in the construction of ant colonies. While constructing colonies, ants communicate with each other along time by depositing lingering pheromones along their trails. This method of communication allows ants to improve each subsequent action based on the trail resulting in an optimal solution over time. Where multiple collections of agents exist, Chemotaxic stigmergic processes allows the different collections to collaborate. Chemotaxisin Stigmergy involves adjusting behaviour in response to signals received from an entire environment as opposed to simply the individuals past movements.

These underlying strategies will be used to allow the system to indirectly communicate with the occupants to learn from their actions and more effectively provide customised comfortable settings for them. User manipulation of the system are mapped against their environmental conditions and 'trails' of data are stored. By constructing a history of behaviour the system can begin to perceive certain environmental conditions as either satisfactory or requiring action, triggering a Boolean condition to activate the dwelling to adapt in the precedented way. This strategy could be applied in the outer façade's climatic response and the inner façade's social response.

Paolo Alborghetti's project the "Red Queen Hypothesis" explores Chemotaxic Stigmergy and its application in balancing the needs of two collections of agents. Active agents in Alborghetti's project are able to set extents, perceive the environment, and move in an optimal way towards their attractors while minimalizing interaction with clashing agents. The result is a geometry where the resources (space) have been optimally divided between the two agents. This logic is also seen in Hyperbody Alumni Matthijs La Roi's research project on Path construction based on pheromone networks. Stigmergic paths are processed and converted into habitable paths, suitable as circulation and a valuable precedent for the studio precedent.



The studio project is required to provide suitable access, circulation and social setting for autonomous and collectively geared occupants and the circulation strategy needs to negotiate this clash accordingly. Using chemotaxic stigmergy to generate circulatory forms between the modules could provide an occupant their ideal level of autonomy regardless of location on the site.

Left 1: La Roi's example of converting stigmergic paths to usable geometries as a precedent for linking units. (La Roi, 2012)
Left 2: La Roi's pheremone research demonstrating a system where approaching agents can percieve their proximity and adjust future behaviour to create 'bridges' and 'tunnels' to avoid collision. (La Roi, 2012)

Right 1: Alborghetti's experiment with two agents equally inhabitting form without colliding. (Alborghetti, 2014)
Right 2: Quick experiments combing path optimisation with contradicting lines that repulse each other. Lines intersecting only where necessary
Right3: Adding a z vector the process to allow the paths to grow vertically.

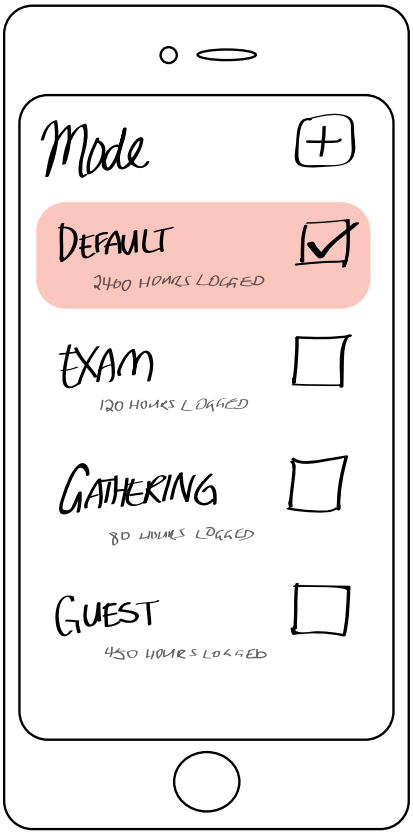
5

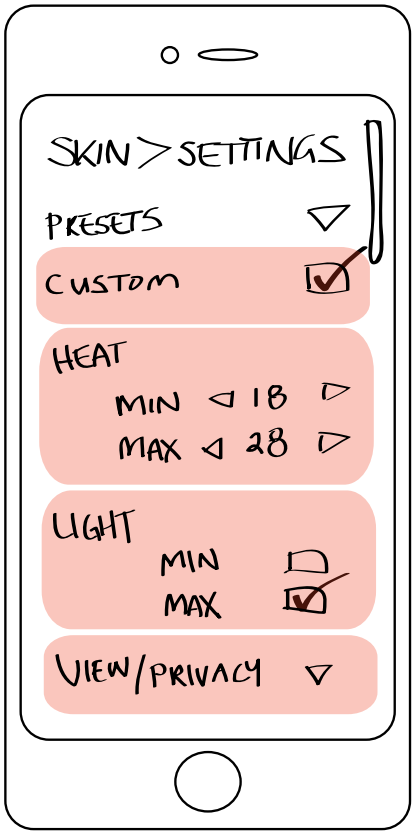
USER MODERATION

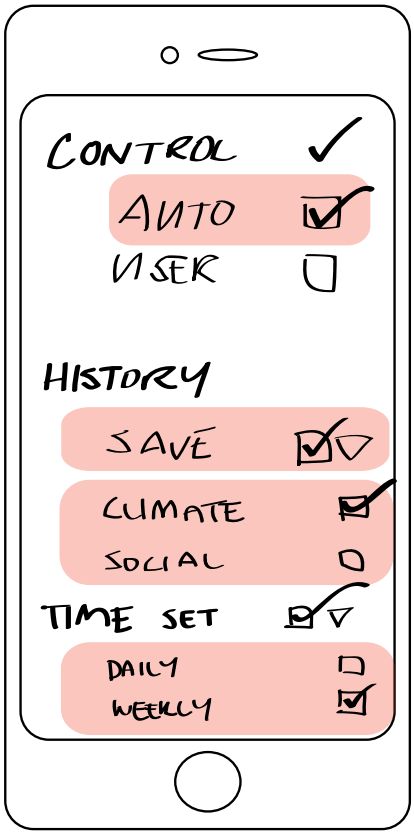
In referencing Niehl Bohr's complimentary principle, Gordon Pask states "All processes produce products and all products are produced by processes." Architect's role within parametric design is considered to be designing the process itself, therefore influencing the design through forming the overall system. Parametric systems as designed by Architect's could be loosely defined as a cybernetic system. When the influence of the architect is acknowledged the overall system could be referred to as second order cybernetic system. Here the architect is treated as part of a secondary contained system due to their inability to act independently of their own underlying values and beliefs. As the studio project hopes to create housing suitable for all socio-cultural backgrounds due to Delft's large international student intake, it is important for the system to be able to be moderated objectively towards each individual user.

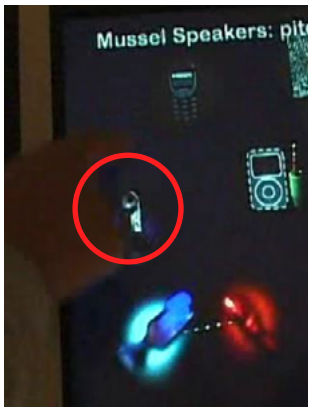
GSM Speaker Usman Haque challenges the concept of interactive systems with algorithms designed solely by one Architect. His project, the 'Reconfigurable House', critiques this idea by transferring full agency to the occupant. The house, which hosts various responsive systems, makes the underlying software accessible for visitors to view and reconfigure, allowing them to changes which behaviours will triggers which reactions. Haque's project uses Arduino and sensor systems making it an adaptable precedent for the studio project. Re-configurability exists in a digital interface where users could access the software intuitively without disturbing the hardware. Its core thematic value is that "the system not only reacts to visitors, but, at a higher level, also changes the way that its reaction is computed." (d+r, 2008)

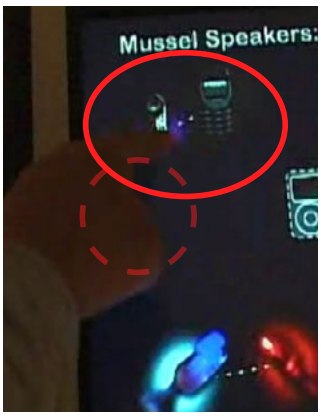
It is intended that the studio project will feature a system with adaptable operability by the immediate user. Ideally through an intuitive digital interface, the occupant can moderate how they want their own thresholds to respond. This includes a user's ability to determine the degree to which the system can act on their behalf including the extent of history considered relevant, what environmental conditions to consider or ignore etc. Furthermore, it is intended that the user can create a variety of profiles for different living conditions within their unit. For example a student could create an 'exam profile' which encompasses a store history significantly different from 'mid-semester break.'











Top 1-3: Examples of user iterface that could be employed within the system

Bottom 1-4: Demonstration of users modifying software within Haque's Reconfigurable house project. (d+r, 2008)

CITATIONS

The paper makes references to the workshops conducted within the Hyperbody MSC1 2016 studio, the speakers within the GSM3 Symposium as well as ongoing dialogue with Studio Co-ordinators.

Alborghetti, P. (2014, February 5). The Red Queen Hypothesis : Chemotaxic stigmergic systems and Embodied Embedded Cognition-based strategies in architectural design. Retrieved October 2016, from Radical Reactions: http://radical-reaction-ad.blogspot.nl/2014/02/the-red-queen-hypothesis-chemotaxic.html

d+r, h. (Director). (2008). Reconfigurable House 2.0 [Motion Picture].

Hensel, M. U. (2011). Performance-oriented Architecture and the Spatial and Material Organisation Complex. FORMakademisk, p. 1.

Kievid, C., & Hosale, M. (2010). Modulating Territories, Penetrating Boundaries. Footprint, pp. 55-67.

La Roi, M. (2012, July 10). Pheremone Networks. Retrieved December 20216, from Matthijs La Roi: http://www.matthijslaroi.nl/portfolio/pheromone_networks/

Ruben, M. (2016, November). (D. Jing, C. McBride, & E. Dekker, Interviewers)

van Dongen-Koschuch. (n.d.). 'Design Masterpiece' Housing, block A5, Seoul Gangnam District. Retrieved December 2016, from van Dongen-Koschuch: http://vd-k.eu/design-masterpiece-housing-block-a5-seoul-gangnam-district/