



# HYPERBODY

## 2012



# HYPERBODY FORWARD TO BASICS

The world is changing. So is architecture, the art of building. Architecture will never be the same, since the world is evolving its communication and manufacturing methods are changing drastically and with increasing speed. My theory and practice of architecture is based on the principles of swarm behavior. It comes down to the provocative assumption that all building components must be designed to be active actors. I have come to the conclusion that buildings and their constituting components no longer can be seen as passive objects. This assumption revolutionizes the way we organize the design process, the way we organize the manufacturing process, and the way we interact with the built structures. The new kind of building is based on the invasion of digital technologies into the building industry. Such as parametric design, generative components, file to factory production process of mass customization, embedded intelligent agents. Step by step we are balancing the familiar top down control with emergent bottom up behaviour. We rethink the basic building blocks and we build bottom up bidirectional relationships between all constituting building components. I will dive into the effects the paradigm shift from mass production to mass customization may have for the designers mind. When the designer is open for this new reality, architecture will no longer be the same. Within 50 years this new reality will be the common language of international architects. If my assumption proves to be false after all efforts I have done in the last 20 years to develop the practice of industrial customization in the realized works of the architectural office ONL [Oosterhuis\_Lénárd] in Rotterdam, and to develop during the last decade the theory of swarm behaviour in various educational and research projects with my research group Hyperbody at the Faculty of Architecture of the TU Delft, I will be the first to acknowledge that. But if it proves to be right then you as a student of Hyperbody will consume the pleasure of having been an early mover to design and construct buildings according to the new rules of industrial customization, and you will feel satisfied having explored the fascinating consequences of swarm behaviour for the profession of architecture when the theory was still fresh and new.

Everyone is emotionally struck by the sight of a swarm of birds flocking in the air. Much has been said about the simple rules that the birds are executing when flocking. The birds are constantly aware of their neighbours, avoiding collisions, keeping mutually agreed distance, adapting to the neighbour's direction, always striving at a central position in the flock. Their flocking behaviour has been modeled in simple computer graphics by Craig Reynolds [red3d.com] back in 1986. He made a computer model of animal motion, scripting the rules for virtual creatures he named boids, based on three dimensional computational geometry. Why is it that I am so interested in boids and swarms? Why did I introduce the term swarm architecture back in 2001 during the first Game Set and Match Conference that Hyperbody organized at the TU Delft? My objective has been clear from the beginning: I wished then and still wish now to identify all possible building components as interacting actors building up bidirectional relationships with each other. The idea of behaviour has always intrigued me since it defines the foundations for an architecture that is not static but animated in real time. Animated not as described by Greg Lynn in his book *Animated Form* [1998], who de facto claimed his "license to kill" the animation, but animated in its purest sense, that is keeping the structure informed, much like the living flock of birds. I concluded that there is no meaning in freezing the motion. I realized that it was necessary to use actual ICT technology to sustain the information flow throughout the full life-cycle of a built structure.

As the world keeps turning we will need to redefine the foundations of architecture from time to time. Now more than 20 years have passed since the introduction of the PC, since the emergence of the global Internet, since embedding miniaturized information technology in our consumer

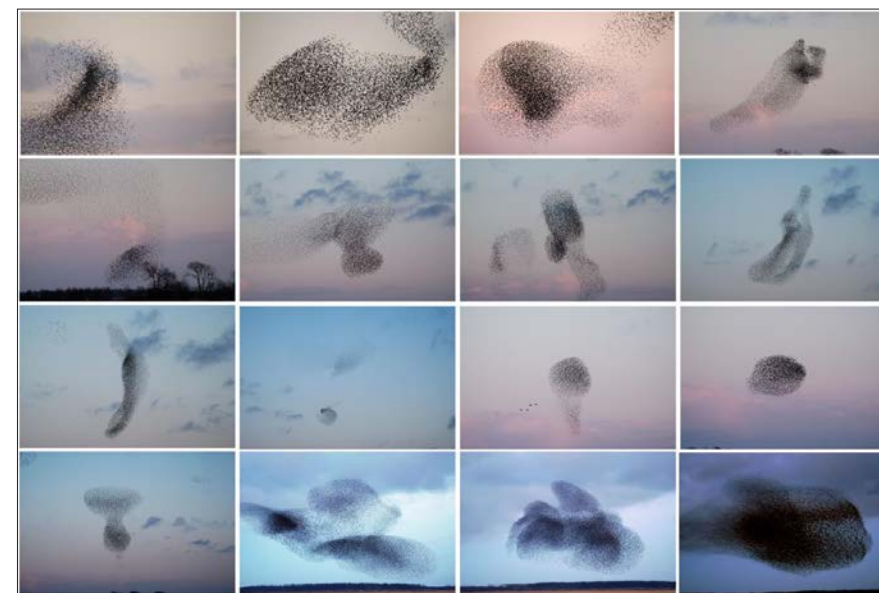


products. Today we have become familiar with remote control, wireless internet, with intelligent agents active on the internet, with intelligent agents embedded in consumer products like printers, cars and computers, but we have not seen much change in the very building blocks of the built environment. Neither have we seen much change in the way we design and build our environment. We have indeed developed computer programs to simulate otherwise traditional building materials like concrete, steel, glass, composites in a Building Information Model [BIM]. The simulated building components are tagged, the tags containing information on their qualitative and quantitative properties. Most architects do not use computer technology in the way they design, even on respected universities the students are told not to use the computer to design. This proves once again how slow the building industry and their seconds on the educational institutes are catching up with new technologies. But is not my aim to complain, on the contrary, I want to show a possible way forward, forward to the basics of the profession of architecture. To take that step forwards I imagine the built structure to be represented by a point cloud of acting reference points, reference points that move all the time like the birds in the swarm. The points of the point cloud are continuously informed to behave, the points receive streaming information. The points process the streaming information. The points produce new streaming information. Indeed like the birds in the swarm. Suppose the information defining its spatial coordinates which is received is not changing, then the position of the point in the point cloud remains stable, it does not change its position. Now suppose some data are changing, then the point will act accordingly and change its position, or change any of the other properties the point has been tagged with. The crux of the new kind of building is that all reference points will be informed both during the design process and during its subsequent life-cycle. Even if we are commissioned to design for a static environment, we must set up the Building Information Model [BIM] in such a way that all constituting components potentially can receive, process and send streaming information. The Building Information Model will understand its new meaning as Building In Motion.

Now what is the specific condition of the artist formerly known as the architect? There are hundreds of specific tasks to be fulfilled, and one person, or one team of experts including the signature architect may adopt a number of these well specified tasks. Analyzing my own practice I suggest the following tasks to be adopted by the signature architect. The new kind of architect launches the concept in a few simple lines of script, to be quantified in a few essential parametric values, via the graphic interface of the script directly linked to relevant external data feeding the quantitative aspects of the concept. During the fulfilment of the tasks the new kind of architect requires an active participation of other experts. The active participation includes the financial expertise of the client as to supply the designer with relevant data in due time, as early as possible in the design process. And including the active participation of CNC equipped manufacturers as well, who are responsible for verifiable tender budgets, based on precise data from the swarm of experts. Data must be verifiable, while all experts will be held responsible not only for their qualitative and quantitative data, but for the financial logic of their expert input as well. Everything that is related to geometry must be the responsibility of the new kind of architect. And then I indeed mean literally everything, including the geometry of the structure and the geometry of all components of the climate installation. When there is a debate on the shape, any shape, it must be the form giving expert who is responsible. The engineering partners must calculate the quantity, performance and effectiveness of the flow inside the given shapes, be it spaces, structural components or air ducts. The geometry of things belongs to the realm of the spatial form designer, calculation to structure designer and climate designer. This is the most straightforward definition I can think of. Shape and concept is the domain of the artist formerly known as the architect, performance and calculation is the domain of the artist formerly known as the architect engineer. At the same time it must be underscored again that geometry and computation must be bilaterally connected as from scratch in all possible aspects, bringing both the shaper and the calculator in the position of a creative designer. One can design with shapes, one can design with numbers, both are equally important. This straightforward definition of the work covers every possible act in the

design process, and this definition certainly will cater for a better integration of the disciplines. Hyperbody education means forward to basics since we do not want to look back. We do not look in the back mirror to see the what is behind us, we simply look around and appreciate what we see. Now in 2011 it is the perfect time for an accelerated innovation in the architecture and construction business. It is a time of rethinking the basis of our society, after the internet bubble and the mortgage crisis shaking the foundations of society. It is the proper time to implement streaming nonstandard customized strategies in all businesses related to the building industry, from designers to manufacturers, and speaking for myself, the perfect time to develop Hyperbody's protoBIM / protoNET / protoSPACE innovations based on the principles of swarm behaviour to inspire the expert artist formerly known as the architect to design and engineer the new kind of dynamic building. Forward to basics does not mean to step back to what we knew already 20 years ago, that would be back to basics. Forward to basics means redefining our core business, redefining architecture, redefining the building industry, redefining the behaviour of built structures. Redefining the very essence of our profession.

Kas Oosterhuis  
Professor Hyperbody,  
Faculty of Architecture TU Delft  
[www.hyperbody.nl]  
Principal ONL [Oosterhuis\_Lénárd]  
[www.oosterhuis.nl]



Excerpts from the book "Towards A New Kind of Building" by Kas Oosterhuis [NAi Publishers 2011], Chairholder Hyperbody. TANKOB is for sale at the BK bookshop.





# MASTER TRACK

Hyperbody's MSc track in Non-Standard and Interactive Architecture (NS&IA) aims to implement innovative architecture with state-of-the-art material and information logistics. In this context, Non-standard Architecture (NA) is defined as an architecture that departs from modernist, repetitive, mass-production principles in order to address complexity, variation, and mass-customization. Furthermore, interactivity in architecture is addressed at the level where building components and buildings become dynamic, acting and re-acting in response to environmental and user-specific needs.

Students without prior computing and software knowledge join Hyperbody design studios and workshops that introduce students at MSc 1&2 level to the basics of NS&IA, while at MSc 3&4 level they advance their expertise in parametric and scripting-based design for NS&IA, in order to join after graduation internationally known offices such as ONL, Forster & Partners, UN Studio, OMA, etc. Worldwide renowned guest lecturers and tutors including Hyperbody Alumni are invited to participate in the program for both theoretically inspiring lectures and practical workshops to be hosted in our design lab protoSPACE. Furthermore, Rapid Fabrication and Prototyping sessions are held in protoSPACE in order to enable students to build scaled models and 1:1 components of their projects.

Students from all semesters (Minor and MSc 1-4) participate in generously provided vertical-studio activities, allowing for exchange of knowledge and experience between beginners and advanced student groups. Additionally, special shared activities are organized within collaborative inter faculties educational projects such as "Interactive Environments" (Minor) organized together with ID-StudioLab at IO and Man Machine Interaction Group at EEMCS.

Henriette Bier  
Assistant Professor  
Hyperbody TU Delft

# HYPERBODY GUESTS

Alisa Andrasek, Antonino Saggio, Axel Kilian, Ayssar Arida, Bert Bongers, Charl Botha, Christian Derix, Daan Roosegaarde, Dan Overholt, Gijs Joosen, Jerome Decock, Jordi Truco, Jorik Blaas, LABau, Marcos Novak, Mario Carpo, Matias Del Campo, Neil Leach, ONL, Philippe Rahm, Ruairi Glynn, Tetsuo Tomiyama, Ulrike Karlsson, Chris Speed, Fabian Scheurer, Fabio Gramazio, Philippe Morel, Peter Macapia, Bernhard Sommer, Wes McGee, Dave Pigram, Gregory Epps, Daniel Piker, Manuel Kretzer.





# MSC 1&2

1:1 Interaction & Fabrication Prototypes

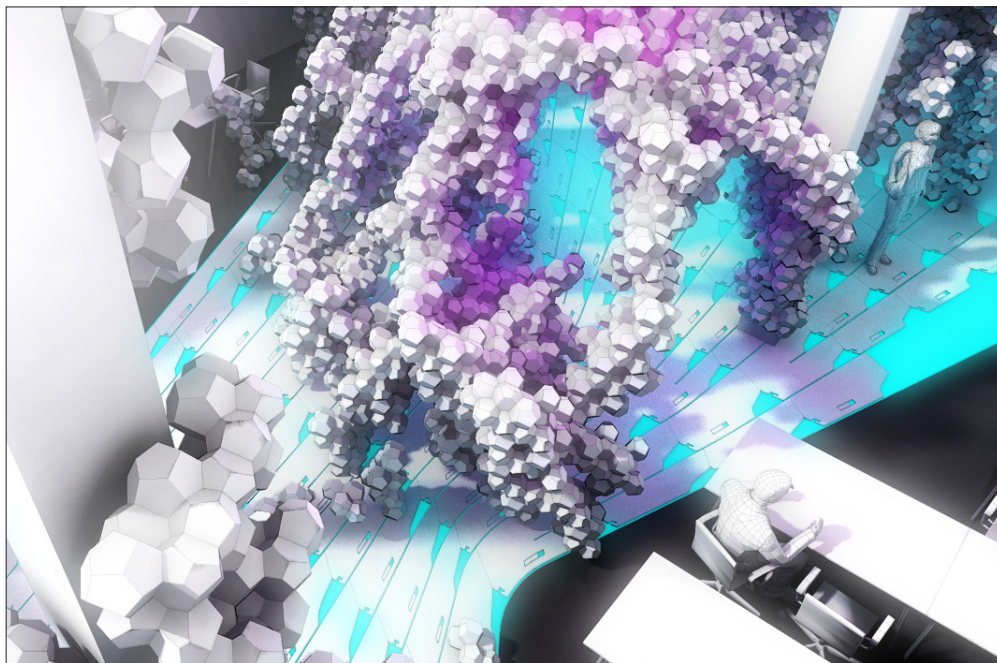


ProtoSpace 4.0 MSC2 Design Studio 2010 | Architect: Kas Oosterhuis | Coordinator: Chris Kievit | Tutor: Christian Friedrich, Gija Joosen, Owen Slootweg, Bas Wijnveld, Mark David Hosale, Marco Verde, Charlotte Lelieveld | Students: Shi Yang, Viss Naoum, Jonas Sin, JunJie Yan, Roxana Palfi, Urvi Sheth, Krzysztof Gornicki, Soran Park, Stella Lam, Mingyu Seol, Melina Mezari, Kwok-Tung Chun, Agata Kycia, Aurélie Hsiao, Gustavo Nascimento, Erwin Osch, Marco Cimenti, Harikrishnan Sasidharan





TouchSpace. Minor Interactive Environments, Hyperbody & ID-StudioLab, Fall Semester 2011 | Instructors: Ir. Chris Kievid, ir. Aadjan van der Helm, Dr. Walter Aprile



protoCology. MSc2 & BSc6 Design Studio | Instructors: Ir. H.C. Friedrich, Ir. Chris Kievid | Students: Rene-Paul van Leeuwen, Michel Stienstra, Sander Apperlo, Gerben Knol, Igor Leffertstra, Marjolien Overtom, Jasper Schaap, Jaimy Siebel, Wilson Wong, Frank Bunschot, Bao An Nguyen Phuoc

# MSC 1&2

## 1:1 Interaction & Fabrication Prototypes

Hyperbody's MSc1 and MSc2 studios inspire its students to rethink conventional design processes in order to creatively challenge the interplay between contemporary culture and technology, and their relation to architecture. The studios operate at the scale of an architectural insert situated within urban context. The shared studio framework challenges the students to develop an architectural process that can keep up with the actual needs and desires of people in a rapidly changing world. Such a process can only be validated by participants in the project - users, stakeholders, experts and designers - actual people who judge the state of the design process against their actual needs.

This semester, Hyperbody MSc1 and MSc2 embark on a collaborative project dealing with the design, fabrication, erection and operation of an architectural intervention situated in Delft, between the Faculty of Architecture and the Delft Science Centre (De Vries van Heyst plantsoen).

Study goal of these semesters is introduction to the architectural application of emerging technologies as design instrumentarium. Open-mindedness, team performance, associative capability, a sense for form, flexibility and a pro-active attitude are seen as important and acquirable skills for the successful completion of these courses.

### MSc1 | 1:1 Interaction

The focus of the MSc1 course is set on the notion of architectural adaptation and transformation, achieved through complex interactions among building components and people. In the MSc1 courses you will explore the notion of user participation in the architectural process, challenge the relation between digital media and architecture, and investigate means for creation of dynamic architecture, absorbing information, processing it and acting in response.

### MSc2 | 1:1 Fabrication

Hyperbody MSc2 is an advanced introduction to Non-Standard parametric design, digital fabrication, durability and collaboration. In this semester, students encounter the methodological implications of emerging design and fabrication technologies in the setting of a hands-on realisation of a design project at scale 1:1.

Architecture in our culture is fed by global resources

and processes that transform building materials, energy, collaborators and information. This globalized production site is by no means spatially immediate. It is connected by networks of digital communication: any kind of digitized information can be accessed everywhere, immediately. In a situation where all digital information is at immediate reach; what matters for immediate adaptation of our material environment are transformations from the digital to the material realm and back. Only these transformations bind digital information to location.

Non-Standard Architecture is based on adaptive, informed digital-material transformational processes, which allow each building component to be individually made to measure. The complexity of non-standard building geometries can be handled efficiently and precisely due to digital design instruments, digital fabrication and tagging of building components. Tags are basis for numerical control of the building model, in parametric design, fabrication, assembly and interactive operation.

Tags can ensure an immediate linkage between a produced piece and its digital origin, providing informational context. With tags, all parts of a digital plan can be allocated in the physical environment. Digital model and physical environment can be matched one to one. The potential of such immediate allocation exceeds linear construction processes. It enables designers to track the life-cycle of each building component individually, and can help to establish a sustained population of building components. A population that can grow, mutate and evolve.

# DS 1

## Design Studio 1

*Course Code* ARIAUE010

*Course Title* Hyperbody Non-Standard Architecture

*Course Coordinator* Ir. T.J. Jaskiewicz

*Course Tutors* Ir. T.J. Jaskiewicz, Ir. C. Kievid, Prof. Ir. K. Oosterhuis

*Credit Points* 12 ECTS

Projects on which students work in the DS1 are shared with the DS2 course. In this setup, DS1 students work as expert designers focusing on the issues related to user participation and design of complex, architectural interactions. DS2 students join the project in the 2nd quarter, develop and apply design expertise on digital fabrication and parametric modelling to the collaboratively developed projects.

The project site offers ample opportunities for DS1 students to study interaction patterns among its regular as well as the spontaneous users while at the same time it allows for encouraging new interaction

scenarios, enhancement of active participation and transformation of current spatial configuration. DS1 and DS2 students are grouped together in expert units called “atoms”. Each atom identifies, researches and consequently answers to a different architectural, societal or cultural challenge. In this, every atom develops a unique, task-driven expertise. Throughout the duration of the course atoms cluster together forming projects - specific architectural interventions, to be tested, prototyped as full-scale components and deployed on location. In this setup students work in a manner similar to this found in architectural professional practice, and learn how to solve complex problems that they are bound to encounter as future architects.

# AS 1

## Architectural Studies 1

*Course Code* ARIAue020

*Course Title* Architectural Studies 1, an introduction into modeling and fabrication

*Course Coordinator* J.D. Feringa

*Course Tutors* J.D. Feringa

*Credit Points* 3 ECTS

The Architectural Studies 1 (MSc1) course introduces students to a computational approach of architectural design. A series of workshops prompts students towards an understanding of computational design strategies, methodologies and tools. These workshops bring student up to speed in terms of modeling, programming and fabrication skills, which are needed to successfully complete the Design Studio. Workshops consist of architectural design exercises that can be completed within 2,5 days. This hands-on, intensive approach allows students to build skill and confidence in short periods of time. Specific design problems that have filtered through from the Design Studio Projects are zoomed in upon; a way of inserting domain expertise of the workshop tutors into the studio projects.

# MS 1

## Media Studies 1

*Course Code* ARIAue070

*Course Title* Media Studies 1: New Media

*Course Coordinator* X. Xia, MFA & MA

*Course Tutors* : X. Xia, MFA & MA

*Credit Points* 3 ECTS

This course takes an interdisciplinary perspective in examining media as carriers of multimodal information and it provides the basis for the exploration of the theory and praxis of Non-Standard and Interactive Architecture. This course offers two interdisciplinary tracks:

### *Intermedialities in Media and Art*

Intermedialities are crossovers and interrelations between the arts and the media, but also within and between various media. In this session, students are asked to absorb knowledge and seek for inspiration from artists, art critics, computer scientists, psychologists, web epistemologist, social and behavioural scientists. We will investigate not only the effects of technology, social and institutional forces on media content and functions, but also the embodiment of human factors and cultural factors. Addressed topics range from Multimedia and Hypermedia to social media, from contemporary culture to cognitive psychology.

### *Theories and practice of Non-standard and Interactive Architecture*

Topics such as Evolution & Adaptation, Systemic Complexity, Swarm Behaviour, Interactivity, Information architecture, and Process/Time, are going to be addressed by internationally renowned invited guests.

C-Strip infoMATTERS MSc1 Design Studio 2010 | Tutors: Dr. Nimish Bilorla, Ir. Han Feng | Students: Patrick Bedarf, Dimitrie Stefanescu



010 HYPERBODY



Computational Chair Design Project | Jelle Feringa, EZCT  
Architecture & Design research

HYPERBODY 011





# DS 2

## Design Studio 2

*Course Code* AR0850

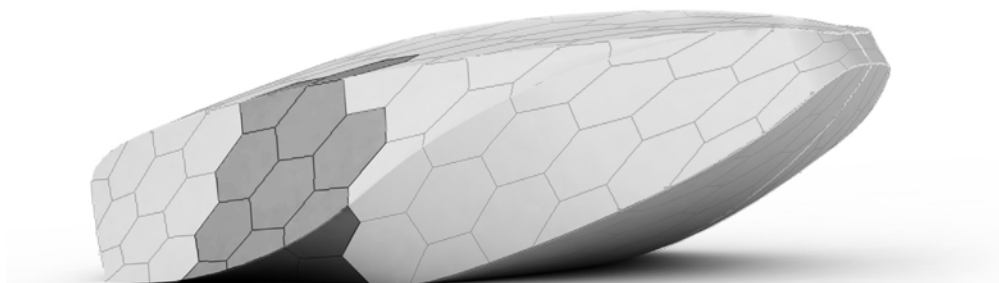
*Course Title* 1:1 Interactive Prototypes

*Course Coordinator* Ir. H.C. Friedrich

*Course Tutors* Ir. H.C. Friedrich, Ir. C. Kievid, Prof.  
Ir. K. Oosterhuis

*Credit Points* 12 ECTS

Projects on which students work in DS2 are shared with the DS1 course. In this setup DS2 students work as expert designers focusing on 1:1 fabrication and material realisation of a design. You will learn how to utilize parametric design, CNC fabrication, robotic building and BIM operation to the advantage of your design. In cooperation with experts from practice, you will get a hands-on experience of design and making as a sustained continuum.



# AS 2

## Architectural Studies 2

*Course Code* AR0855

*Course Title* Architectural Studies 2

*Course Coordinator* Ir. H.C. Friedrich

*Course Tutors* Ir. H.C. Friedrich, Ir. C. Kievid, Prof.  
Ir. K. Oosterhuis

*Credit Points* 6 ECTS

This seminar has to be chosen together with Hyperbody MSc2 Design Studio AR0850 "1:1 Interactive Prototypes".

This accompanying seminar is set up as a series of workshops in which design and technological dimensions of the MSc2 studio project will be subject to co-evolutionary development. With each workshop, the design project will be exposed to incentives emerging from state-of-the art technological developments, an exposure formulated as bi-directional validation and development of both design project and its technical dimension. The seminar challenges to explore what can be the best technical means, and how to apply means have to be applied, for the project to flourish as demanded by design intention.

### Course structure

The seminar is set up as a series of workshops given by academic and professional experts in the subject matter.

## History / Theory Thesis

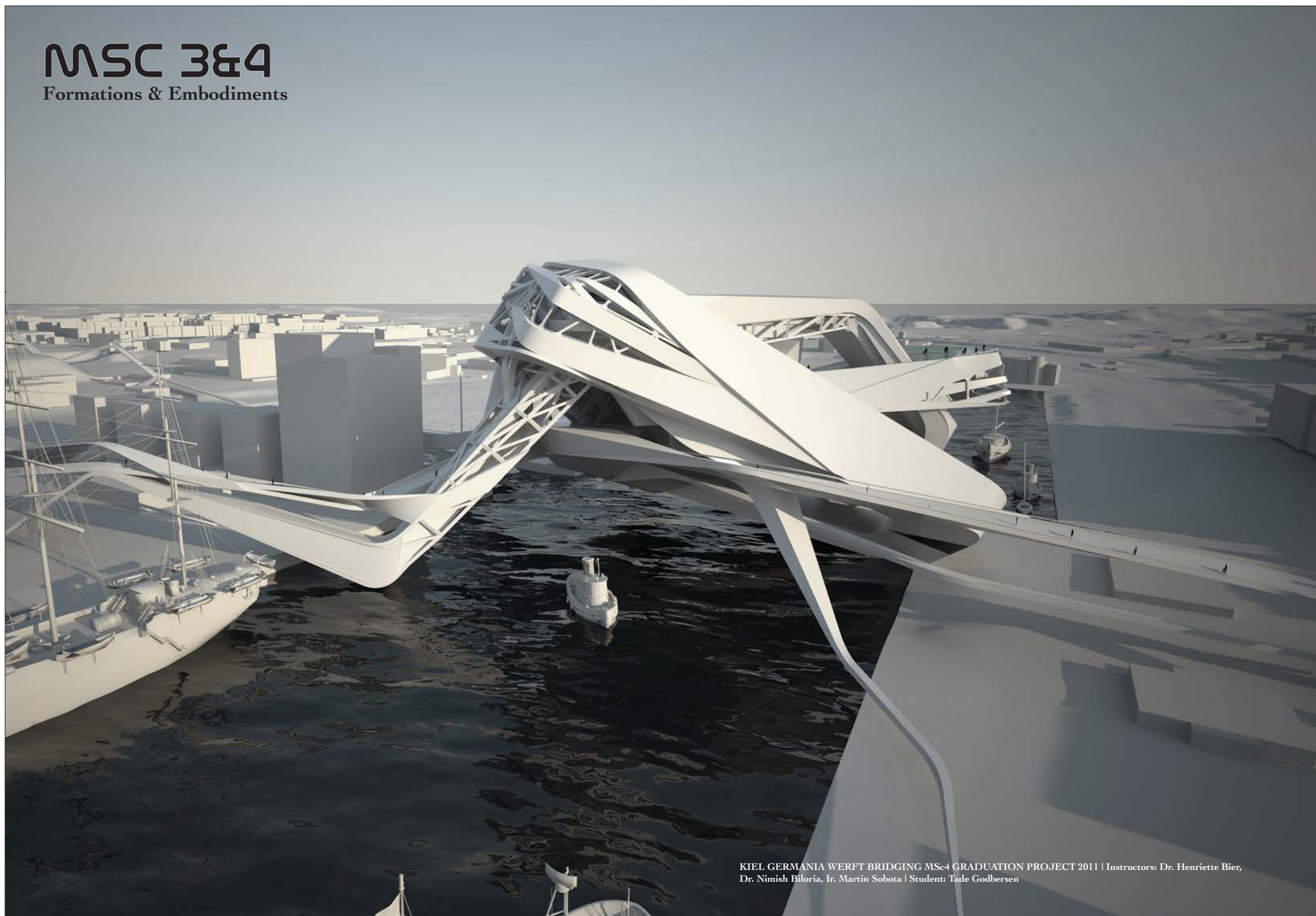
Starting 2011-12 MSc2 students may choose between doing a thesis in theory or history. In this context, Hyperbody students are encouraged to do their thesis in theory ( AR2DSD820, 6 ECTS) with Deborah Hauptmann (DSD). {6 ECTS are missing in MSc2}



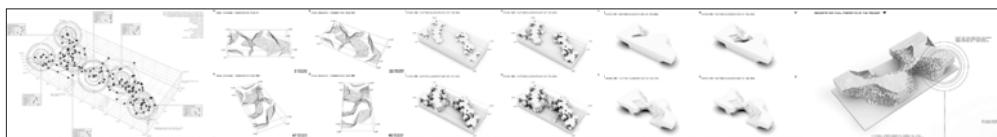
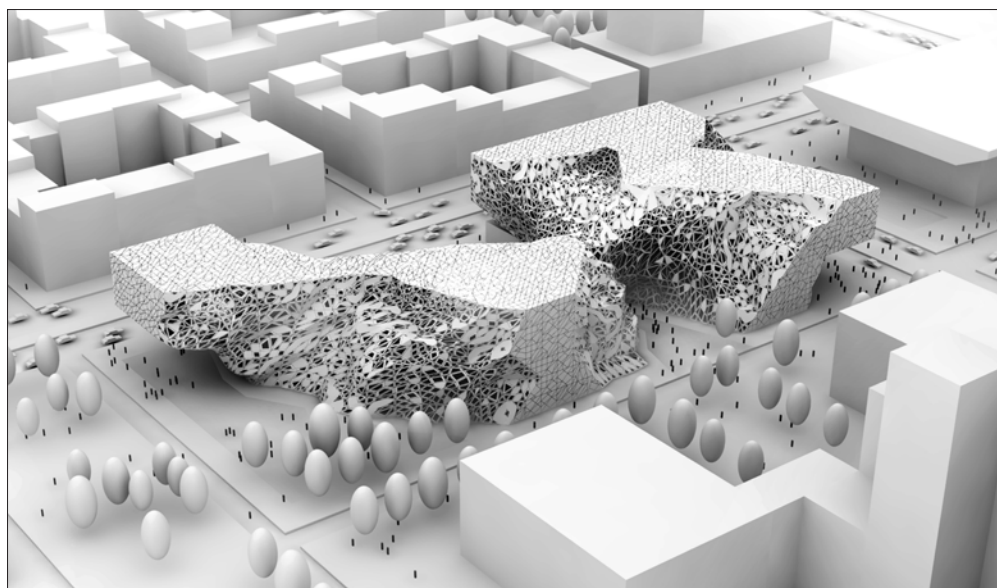


# MSC 3&4

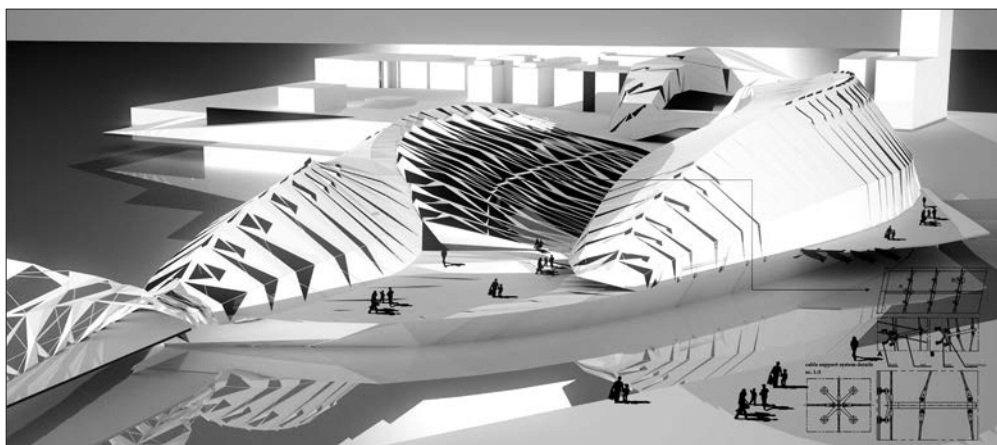
Formations & Embodiments



KIEL GERMANIA WERFT BRIDGING MSc4 GRADUATION PROJECT 2011 | Instructors: Dr. Henriette Bier,  
Dr. Nimish Biloria, In. Martin Sobota | Student: Tade Godbersen



NOMINATED FOR ARCHIPRIX | Warsaw Cultural Center Graduation Project MSc 4 2010 | Tutors: Dr. Nimish Bioria, Dr. Henriette Bier | Student: Krzysztof Gorniki



NOMINATED FOR ARCHIPRIX | REDESIGNING THE EDGE Oslo Aquarium MSc4 GRADUATION PROJECT 2011 | Instructors: Dr. Henriette Bier, Dr. Nimish Bioria | Student: Roxana Palfi

## DS 3&4

### Design Studio 3 & 4

*Course Code* AR3AUE30 & AR4AU200

*Course Title* Hyperbody Graduation Studio: Advanced Non-Standard & Interactive Architecture – Formations & Embodiments

*Course Coordinator MSc 3* Dr. N.M. Bioria

*Course Tutors MSc 3* Dr. N.M. Bioria, Dr. H.H. Bier, Ir. H. Feng, Ir. T.J. Jaskiewicz, Ir. H.C. Friedrich, J.D. Feringa, Dr. J.C. Hubers, Prof. Ir. K. Oosterhuis

*Course Coordinator MSc 4* Dr. H.H. Bier

*Course Tutors MSc 3* Dr. H.H. Bier, Dr. N.M. Bioria

*Credit Points* 15&20 ECTS

Hyperbody's Graduation studios involve a research driven design approach, which primarily focuses on articulating the complex relationship between social, environmental, spatial, technological and user based information with physical matter. Focusing on the development of large architectural scale urban inserts, the MSc 3 studio investigates the aforementioned information sets in an associative/ parametric manner with the help of computational and analogue apparatus. In order to cater to the inherent dynamism embedded within the contemporary, the studio shall investigate simulation driven design as a vital design strategy to attain optimal social, environmental and structural performance of the designed architectural forms. Strategies for ensuring optimal environmental conditions as well as for ensuring optimal programmatic positioning and enhancing user interaction will thus be seen as important goals to achieve via the interdependence of multiple bottom-up simulation sets.

The term apparatus itself shall be investigated from a systems view point to derive notational procedures which, in-turn will give rise to creative mapping techniques and produce measuring rule sets serving as algorithms within the computational domain. The urban context, via such an understanding of an apparatus or in other words a computational abstract machine, will result in the generation of a dynamic information embedded genetic blue print of the site under consideration. This Blueprint consisting both qualitative and quantitative data, will subsequently be analyzed and experimented with for its potentiality to embody and generate spatial formations with the use of evolutionary computational tools and techniques. Issues concerning material logics, environmental performance and structural optimization will serve as integral fitness goals for experimenting with such computational methods. The relation between such potential genesis of form and its continual performance in time via auto-regulation of its spatial make-up shall thus become a

critical area of investigation in the MSc 3 studio. The term "Formation" shall thus be understood as a self-organizing systemic population of spatial, structural, program and user based agents in time, which result in the generation of an emergent architectural condition.

A specific site exhibiting critical urban context within The Netherlands shall be chosen for the graduation studio. The students, operating within this challenging context shall conduct an in-depth analysis of intrinsic as well as extrinsic parameters. The studio shall operate on a dual level (group – till P1 as well as individual – post P1) in order to cover a wide range of biotic, computational as well as systemic concepts: networks, porosity, growth, evolution, mutation, emergence etc. A meaningful sharing of such conceptual research amongst all members of the studio shall further enhance the capabilities per student to develop a strong grounding as regards the extrapolation and application of knowledge onto bottom-up architectural explorations. The MSc3 studio shall also provide integrated computation and interaction design workshops and lectures in order to stimulate the students as well as to obtain a global viewpoint as regards cutting edge research and design initiatives.

The MSc 3 studio shall thus via a variety of exploratory strategies and research experiments pave the way for graduation projects in the MSc4 phase. To summarize, the graduation studio thus creates a solid foundation in computational design, engineering and above all paves a critical thinking process not only necessary for pursuing the MSc4 graduation design project at Hyperbody but also to become a design professional in the contemporary information driven era.

MSc 4 deals, therefore, with the selection of a specific 'formation' from MSc 3 and its implementation into architecture. This process requires in addition to bottom-up approaches (explored extensively in MSc 3) top-down methodologies for the specific implementation of 'formations' into 'architectural embodiments'. Bottom-up and top-down methodologies will be discussed in the MSc 3/4 studio with respect to their deterministic and non-deterministic, as well as procedural and object-oriented intrinsic nature and their impact on design. In this context, bottom-up methodologies refer to process-oriented approaches implying deterministic use of environmental, functional, and structural data for architectural design, while top-down methodologies refer to non-deterministic choices regarding use of formal language, for instance, that are object-oriented and imply a positioning and framing of the architectural work within the contemporary architectural discourse.



# TS 3

## Technical Studies 3

*Course Code* AR3Aue22

*Course Title* Technical Studies 3: Interlaced Design Strategies

*Course Coordinator* Dr. N.B. Bioria, Ir. J.D. Feringa  
*Course Tutors* Ir. J.D. Feringa, internationally renowned invited guests such as S. Oesterle, M. Rippman, A. Søndergaard  
*Credit Points* 6 ECTS

The Technical Studies 3 course introduces students to advanced design and manufacturing methodologies. It does so in the form of a series of workshops, lectures, seminars and excursions that initiate students to advanced concepts such as CNC manufacturing, simulation based design methodologies, evolutionary computing and architectural geometry. Students are introduced to contemporary architectural design challenges; the unfolding of geometry, how simulation analyses can be incorporated in design processes, the coupled problem of manufacturing and geometry. Therefore the workshops confront students to problems of contemporary architectural theory in the most hands-on, practical manner. The material taught in the Studies is crucial to the development of the Design Studio projects.

# L&M 3

## Literature & Media 3

*Course Code* AR3Aue21

*Course Title* Media Studies: Interactive Environments

*Course Coordinator* Dr. H.H. Bier

*Course Tutors* Dr. H.H.Bier, Dr. N.B. Bioria, Ir. H. Feng, Ir. T.J.Jaskiewicz, Ir. H.C.Friedrich, Ir. J.D.Feringa, Dr. J.C.Hubers, Prof. Ir. K.Oosterhuis  
*Credit Points* 6 ECTS

Drawing from specialized topics that lay at the intersection and overlap between architecture, art and computer technology, this course is designed as an inquiry into the field of digital media, as it relates to the development of non-standard and interactive architecture.

Emphasis of the research is not limited to techniques, but is connected to the impact of these concepts on culture, art, architecture, and the speciation of new ideas. Readings such as Kolarevic's Architecture in the digital age: Design and manufacturing (UK, 2005), Bier and Knight's Digitally-driven Architecture, and Friedberg's The Virtual Window: From Alberti to Microsoft (USA, 2006) constitute the basis on the investigation.

# WS&L 3

## Workshops & Lectures 3

*Course Code* AR3Aue14

*Course Title* Hyperbody Workshops & Lecture: The Digital Paradigm

*Course Coordinator* Dr. N.B. Bioria

*Course Tutors* Dr. N.B. Bioria, Ir. H. Feng, Ir. T.J.Jaskiewicz, Ir. H.C.Friedrich, Dr. H.H.Bier, Ir. J.D.Feringa, Dr. J.C.Hubers, Prof. Ir. K.Oosterhuis  
*Credit Points* 3 ECTS

This course addresses recent developments in architecture, building, and information technology in hands-on workshops lead by architects, researchers, and engineers working in internationally relevant research institutes and factories, which employ computer-based design and fabrication methods. Addressed topics range from non-standard architecture dealing with parametric geometries and file-to-factory processes, to interactive architecture using sensor-actuator technologies.

Invited guests are internationally known architects and researchers giving insight into recent developments in architectural practices, engineering offices, and research institutes enabling students to not only get to know state-of-the-art computer-based design and implementation techniques but also learn in hands-on workshops, how to apply those to architecture.

# R&D 3

## Research & Design 3

*Course Code* AR3Aue13

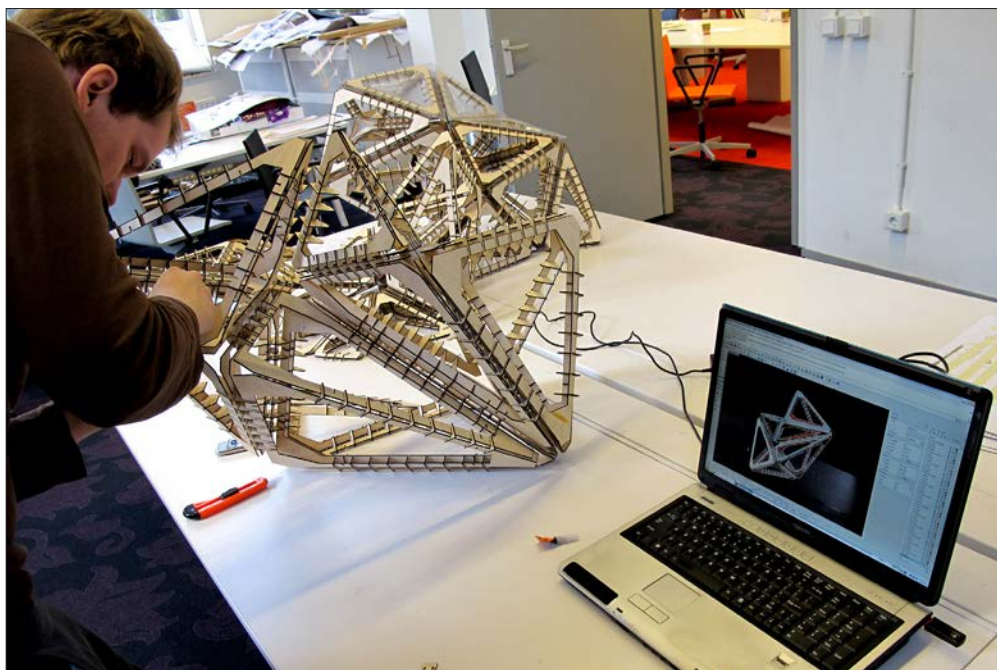
*Course Title* Research & Design Methods

*Course Coordinator* Dr. Ir. J. C. Hubers

*Course Tutors* Dr. Ir. J. C. Hubers

*Credit Points* 3 ECTS

The goal of the Research & Design Method module is to learn scientific research and design methods. A method is a process, and a good way to learn a process is by doing it, while being corrected by a tutor. The result should be a scientific conference paper with two parts. Part 1 is about the state-of-the-art in the research field the students choose in groups. Part 2 shows the way the students applied the research in their design studio in MSc3. Students can choose subjects that fit in the goals of Hyperbody: non-standard and / or inter - active architecture. We are at a design driven technical university and so especially design aspects of non-standard and interactive design should be studied, how design and technology are interlaced and interwoven in a complex whole of complementary argumentations. The content of the research is found by searching answers to research questions that the students have to formulate.





# HYPERBODY ALUMNI

Misja van Veen > UN Studio  
Tim Mc Ginley > Foster + Partners  
Adriane Fischer > OMA  
Yaël Brosilovski > Zaha Hadid Architects, now established own studio in Hong Kong  
Caroline Barat > Morphosis, established own company in LA  
Giorgio Martocchia > Massimiliano Fuksas  
Andrei Ivanescu > Coop Himmelb(l)au  
Giulio Piacentino > McNeel Rhinoceros  
Adi Fajar Utama > UN Studio  
Krzysztof Gornicki > Foster + Partners  
Aurelie Hsiao > UN Studio  
Tade Godbersen > Graft

Max Cohen de Lara established his own studio in Amsterdam  
Dieter Vandoren established his own studio in Rotterdam  
Andre Houdart established own company in Antwerpen  
Ergian Alberganti and Laura Aquili established own company in Milan  
Andrei Badescu established own company in Romania  
Dimitar Karanikolov established own company in London  
Rafaël and Paulina Seemann established own company in Poland  
Gustavo Nascimento & Roxana Palfi established their own company in the Netherlands

# AFFILIATIONS

Hyperbody, as a cutting edge ICT driven research and design department, has over the years developed intricate academia and praxis based connections with some of the world's leading professionals, institutes as well as industrial practices. Some of our prominent connections include Marcos Novak (University of California, Santa Barbara, USA), EZCT (France), Servo (USA), ONL (Netherlands), Ayssar Arida (Q-DAR Developement, architecture research, London), Antonino Saggio (University of La Sapienza, Rome), Neil Leach (Architect and theorist currently teaching at the University of Southern California), Chris Speed (Edinburgh College of Art), LABau (Belgium), Alisa Andrasek (Biothing, USA) etc.

Hyperbody has been instrumental in conducting a variety of workshops and lectures together with our international connections specifically focused on contemporary research and design approaches ranging from the product scale to the urban scale. These workshops thus provide researchers and students alike, the cutting edge knowledge and awareness pertaining to global initiatives in the field of computational design, analysis, new media, fabrication processes and socio-cultural dynamics. Equipped with this global outlook, our students find place worldwide in some of the most esteemed architectural design practices, thus maintaining Hyperbody's position as a critical research and education department.

# RESOURCES & COLLABORATIONS

## protoSPACE

The protoSPACE laboratory is an initiative of Prof. Ir. Kas Oosterhuis, is developed by Hyperbody at the Delft University of Technology as a revolutionary real-time collaborative design environment. As a research facility dedicated to the development of nonstandard, virtual, and interactive architecture, protoSPACE facilitates the continuum between these domains via collaborative research design systems, the development of embodied interactive architectural components, file-to-factory design work flows, and non-standard geometries in architectural form. From scaled prototyping to 1-to-1 manufacturing of non-standard and interactive architecture, protoSPACE is a platform for the development of innovative solutions for architectural design and production.

## Science Centre Delft

Hyperbody and the Science Centre Delft have initiated close cooperation. Science Centre Delft is the institution that acts as an interface between the Delft University of Technology and the general public. Its mission is to open up and share cutting-edge science and research of TU Delft with people of all ages and all social backgrounds. In this framework Hyperbody researchers and students work directly at Science Centre Delft. Its section functions as a lab where prototypes of interactive and non-standard architectures can be fabricated, assembled and tested, while at the same time they become immediately exposed to the curious public. Each semester the installations are updated by replacing some elements in the ecology of their interacting components. Visitors to Delft Science Center can meet researchers and students at work, help them with user-testing of developed prototypes and acquire understanding of this new kind of architectural environments.

## Festo

Festo is Europe's leading supplier of pneumatic and automation components and systems. Festo promotes ideas and initiatives that go beyond the core business of automation and didactics, and may well give rise to promising areas of application in the future. Festo has been our research partner on the development of interactive architectures since 2003. The collaboration has resulted in the development of the Muscle projects, our first prototypes of interactive Architecture [iA], in which we tried to emphasize the real-time actuated spatial response that a building or architectural space might provide. For the Hannover Messe 2009, the world's leading showcase for industrial technology, Hyperbody and Festo presented, an architectural-scale installation work, the InteractiveWall, with multi-sensory, real-time behaviours inspired by natural phenomena and triggered by internal and external stimuli.

## ONL

In collaboration with ONL, Hyperbody developed iLITE, an installation commissioned by Philips, and part of the Transitions II – Light on the Move traveling exhibition, which highlights the architectural application of Philips' lighting systems.

## DRI

Hyperbody as part of the recently established Delft Robotics Institute (DRI), which brings together 14 chairs from 6 TUD faculties, is applying and advancing robotics in architecture at two levels: Integration of robotic devices into buildings and employment of robotics in the production process of buildings.





# CONTACT

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