

## **HOMO FABER**

DIGITAL FABRICATION IN LATIN AMERICA CAAD FUTURES 2015> the next city

DAVID M. SPERLING PABLO C. HERRERA Editors

SÃO CARLOS



2015



# HORNO HORNO HIBI TION DIGITAL FABRICATION IN LATIN AMERICA CAAD FUTURES 2015 > the next city

SÃO PAULO, JULY 7-31 BRAZIL



# > FOREWORD

After more than ten years spreading the word about digital fabrication applied to architecture in Brazil, it is a big honor for me to introduce this exhibition. The whole idea started when I attended the last CAAD Futures conference in 2013, held in Shanghai Jiao Tong University. The local organizers put up an exhibition titled "Digital workshop in China", which showed images of the many parametric design and digital fabrication workshops that were contributing to change the architectural practice in the country. It reminded me of all the digital fabrication laboratories that were being created in Brazil in many architecture schools; they could also be seen as a movement that was already influencing education from the bottom up.

When professors Bauke de Vries and Tom Kvan kindly invited me to chair the next CAAD Futures in São Paulo, I imediately thought about inviting Prof. David Sperling as a co-chair for the conference and as a curator for the exhibition. During his master degree thesis in the early 2000s Sperling had already experimented with rapid prototyping techniques and he was also aware of the new labs that were popping up in the country. When Sperling suggested that we could expand the exhibition to other Latin American countries, the name of Professor Pablo Herrera, an early supporter of digital technologies and fabrication techniques in architecture, came naturally to our minds. I would like to thank Professors Sperling and Herrera for their fine work designing and organizing this exhibition and, above all, for giving an underlying logic and a precise meaning to what would otherwise be just a collection of beautiful objects.

#### Gabriela Celani

Chair of CAAD Futures 2015 "The Next City"



## HOMO FABER: INFORMING MATERIALS AND MATERIALIZING > FORMS

The Exhibition "Homo Faber: Digital Fabrication in Latin America" is an event related to the CAAD Futures 16th Conference, "The Next City". The proposal to support this exhibition responds to the need to grasp more widely the Latin American digital fabrication context linked to the field of architecture.

This was a rich and challenging process of capturing an ever changing scenario. Mapping, as Janet Abrams and Peter Hall remember us, "has emerged in the information age as a means to make the complex accessible, the hidden visible, the unmappable mappable (...) mapping refers to a process – ongoing, incomplete and of indeterminate, mutable form." (*Else/where: mapping. New cartographies of networks and territories*, 2006) Our mapping highlights a recent context of starting and development of fab labs in Latin America. Beginning in university research centers, and consolidated in university platforms, this movement expands with the formation of laboratory networks and the emergence of studios and independent researchers investigating and exploring new uses for digital fabrication in architecture and in related fields.

Throughout this mapping process we contacted 50 of the 70 estimated fab labs in the region, of which 31 consistently responded to a survey aimed at recognize their works, lines of action, infrastructure and human resources, uses and applications of digital fabrication. At the end, we reach the labs presented here. As a sample of the recent yet already effervescent scenario of digital manufacturing in the region, the exhibition presents, for the first time in Latin America, the production of 25 laboratories of universities, research groups, architecture studios and independent researchers. While the first activities started 15 years ago, 2/3 of the fab labs were created in the last three years. In this scenario, the majority of the fab

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labs surveyed are bond to academic research institutions and half of them have a large variety of machines installed. These are followed by fab labs linked to universities or private studios with a medium or small variety of machines installed.

This mapping shows, for example, the predominance of applications in the production of small objects in relation to the manufacture of molds for construction or manufacturing machines, but indicate a more equal division of uses in several areas. After the predominance of design prototypes and models for teaching, uses targeted to industry, art and heritage and actions in social process (communities and impaired people) have similar results. Fab labs mapped are geared to a variety of activities involving the training of human resources, design processes and research of different uses and applications of digital manufacturing - with few cases showing a narrow specialization.

The exhibition design is inspired in the environment of an architecture studio, seeking to fluidly connect laboratories and their models, images and texts. Each lab sent a video exploring the processes of conception and fabrication of its work – they are in the exhibition and anyone can access them on the Internet, spreading these works. In reference to file-to-factory processes we have included a FILE-TO-EXHIBITION space for the interaction of a wider audience with digital fabrication, in this case a 3D printer.

The use of the term "Homo Faber" in the title of this exhibition seeks to recover associations with inherently human actions of transformation and reflective elaboration by means of "make". The interrelationships between architecture and digital technologies, initially confined to the sphere of representation and then reviewed and directed to the sphere of cognitive and design processes, present nowadays other possibilities for the manufacturing processes. Inevitably, such dynamics place epistemological questions for the field. Design and build, or think and make, the built environment both critically and synchronous to the transformations of each age is one of the greatest challenges of architecture in its history and this condition remains with digital manufacturing.

The philosopher Hannah Arendt had already distinguished in *The Human Condition* (1958) "labor" - the *animal laborans* action governed by the "how" and addressed to the satisfaction of personal needs - from "work" - the *homo faber* action directed by "why". If this action is still instrumental and directed towards an end - and therefore not disinterested as the action of the *zoon politikon* - it is an inherently human action to shape the world, which has some freedom and a public dimension, conditions for creating a common sphere.

More recently, "Homo Faber" is the title of the trilogy that the sociologist Richard Sennett has written about the material means

in production of culture and a common world. It is about man as "maker" and the skills it needs to sustain everyday in life. In *The Craftsman* (2008), the author explores the pleasure of making things with hands, linking material consciousness and ethical values. *Together: The Rituals, Pleasures, and Politics of Cooperation* (2012) explores the challenges of accomplishing something cooperatively. *Making and Dwelling*, yet to be released, will focus on open systems and urban design. Make, collaborate and produce the city are the Homo Faber trilogy for Sennett.

In the design field, "Homo Faber" is the title of a series of exhibitions and a trilogy of books - *Homo Faber: Modelling Architecture* (2007), *Homo Faber: Modelling Ideas* (2008) and *Homo Faber: Modelling, Identity and The Post digital* (2010) - organized by Mark Burry, Peter Downton, Andrea Mina and Michael Otswald. They are the result of a research keen to explore specificities and relationships between wander and critical reflection enabled by manual production models and the acceleration and the highly iterative procedures of digital media prototyping.

In the context of this exhibition on digital fabrication in Latin America, the term "Homo Faber" is a tribute to Vilém Flusser (1920-1991), Czech philosopher naturalized Brazilian, who wrote his early works living in Brazil (1941-1972). His thoughts are addressed to a world - and, significantly, to culture, media and design - mediated by technology, in some way anticipating the current scenario increasingly governed by the "apparatus-operator complex", in which man can handle concrete languages and simulate images of the world - and fabricate it - from equations. We transcribe below some of his texts:

> "The name homo faber (...) means that we belong to those kinds of anthropoids who manufacture something. (...) Thus, 'factory' is the common human characteristic (...) So, anybody who wants to know about our past should concentrate on excavating the ruins of factories. Anybody who wants to know about our present should concentrate on examine present-day factories critically. And anybody who addresses the issue of our future should raise the question of the factory of the future. (...) Factories are places in which new kinds of human beings are always being produced: first the hand-man, then the tool-man, than the machine-man, and finally the robot-man. (...) The only crucial thing is that the factory of the future will have to be the place where the homo faber becomes the homo sapiens sapiens because he has realized that manufacturing means the same thing as learning – i.e. acquiring, producing and passing on information."

The Factory (1999) / Die Fabrik (1993)

"... Take a form, any form, in fact any algorithm that can be expressed numerically. Feed this form via computer into a plotter. Stuff the form thus created as completely as possible with particles. And there you have it: worlds ready to serve." About Form and Formulae (1999) / Von Formen und Formeln (1993)

"If 'form' is the opposite of 'matter', then no design exists that could be called 'material': It is always in-forming. And if form is the 'How' of matter, and 'matter' the 'What' of form, then design is one of the methods of giving form to matter and making it appear as it does and not like something else. (...) The 'burning issue' is therefore the fact that in the past (since the time of Plato and even earlier), it was a matter of forming the material to hand to make it appear, but now what we have is a flood of forms pouring out of our theoretical perspective and our technical equipment, and this flood we fill with material so as to 'materialize' the forms. In the past, it was a matter of giving formal order to the apparent world of material, but now it is a question of making a world appear that is largely encoded in figures, a world of forms that are multiplying uncontrollably. In the past, it was a matter of formalizing a world taken for granted, but now it is a matter of realizing the forms designed to produce alternative worlds." Form and Material (1999) / Form und Material (1993)

Amid the context of apparatuses and programs, Flusser's philosophy was interested in the question of "freedom", that is a "strategy of making chance and necessity subordinate to human intention". For him, this is equivalent to the operator's strategy of playing against the apparatus. This action of play could be a possibility to open the programs that constitute the apparatus themselves, expanding the playing field.

Therefore, it is focusing on imminently experimental work that we organize this exhibition. The set of Latin American fab labs reunited here indicate the varied "homo faber" network of initiatives of digital fabrication that embrace academic investigations, architectural developments, industry applications, product design, artistic propositions and actions in social processes in the region.

By understanding the digital fabrication as a process that takes both two-way, "informing materials" and "materializing forms", we tried to articulate common aspects of the works presented based on four IN-FORMING lines: surfaces, objects, spaces and social processes. IN-FORMING SURFACES holds six fab labs and works which investigate the manufacture of skins, generative systems of surfaces, environmental performance of membranes, the construction of complex geometries through the invention of modules and equipment for mold production, reaffirming the surface as a key issue for contemporary architecture.

IN-FORMING OBJECTS is constituted by eight works (one of them as collaboration of two fab labs) which cover a significant amount of the "object" for architecture. It ranges from procedures linked to tactical media (such as hacking processes) and automation (robot design), to design and art (parametric design of domestic / public furniture and sculpture), and to representation of architecture (tactile and experimental models).

IN-FORMING SPACES has four works of labs which explore the design and fabrication, on the one hand, of small and large scale experimental spatialities and, on the other, of spatial interfaces responsive to the user.

IN-FORMING SOCIAL PROCESSES holds six works which explore the interaction of digital fabrication and participatory processes with the review of the relationship between designers and users as well as the introduction of digital fabrication in social and environmental contexts open to inventive forms of collaboration.

Finally, we agree with Flusser, for whom when the Homo Faber fabricates something he produces himself, as well as somehow informing something is to in-form ourselves.

David M. Sperling Curator and co-chair of CAAD Futures 2015 "The Next City"

Pablo C. Herrera Co-curator IN-FORMING SURFACES IN-FORMING OBJECTS IN-FORMING SPACES

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## EXPANDIBLE TESSELATIONS

IEHU - Instituto de la Espacialidad Humana Laboratorio de Morfología [IEHU - Institute of Human <u>Spaciality, Laboratory of Morphology]</u>

Facultad de Arquitectura, Diseño y Estudios Urbanos, Universidad de Buenos Aires [Faculty of Architecture, Design and Urban Studies, University of Buenos Aires]

Buenos Aires, Argentina - 2014

Patricia Muñoz and research team

Different disciplines have studied tilings and tessellations throughout the centuries. Only in the last fifty years, hinged tilings have been scarcely examined and mainly through virtual models and animations. In the research project that links Morphology and Digital Fabrication we have built physical models, in rubber sheets and in leather, using laser cutting. The hinges were created through the regulation of the length of the cutting patterns. We have been investigating the possibilities of creating new tilings using different transformation strategies. We have also experimented changing the level of symmetry of the tessellations while keeping the property of expansion. The progressive transformations produce 3D expansions, for example, on a sphere. In order to go from 2D to 3D models we have also made experiments with vacuum forming.

In 2014 we developed our first workshop with industrial design students of Morphology, at the FADU - University of Buenos Aires. The practice involved the design of a new tiling, through traditional operations of addition, substraction and selective curving of the edges of the polygons involved. These new patterns were transformed in both, uniform and progressive ways. Then, the motifs were extruded at different heights using regular or random criteria.

The physical models in 2D were cut on rubber and the 3D models were made using different available techniques. Several applications are being explored, mainly in product design and teaching experiences.















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#### HIGH PERFORMANCE FACADE SYSTEMS BASED ON THE USE OF PLANAR ELEMENTS

Frontis 3D

Bogotá, Colombia - 2014

The system controls thermal gains whilst allow for specific lighting requirements, permitting, in many cases, interior thermic and light comfort conditions without use of thermal machines or artificial lighting. The development of the system involved a definition of variable design parameters, areas of performance evaluation and optimization plus construction detailing development represented by a first project to be completed in 2014. Even if the geometrical definitions, optimization processes and production machinery are relatively simple and not particularly new to anyone in field, it is claimed that the use of such already widely available technologies at this basic level, when solving relevant problems, has still to be used in generalised ways by common designers.



#### Radiance analysis





Neutral\_Voronoi (Bogota)





### CoBLOgó - FACTORY AND OFFICE HEADQUARTER ANNEX

#### SUBdV

São Paulo, Brazil - 2014

Franklin Lee, Anne Save de Beaurecueil, Joseph Swan, Victor Sardenberg, Orion Campos, Renata Portelada, Fabricio Gomes

This factory-office annex in São Paulo Brazil employs a "high-low" fusion, where high-tech design strategies were combined with local low-tech construction methodologies, creating a "tropicalized" digital aesthetic. Parametric design, digital environmental simulation, and digital fabrication were employed to design and prepare the instructional guides for a low-tech labor force using simple local materials to construct a parametrically rotating concrete-block façade screen, as well as custom digitally-fabricated furniture and internal wall panels.

A differentiating component-based façade system was built using digital design and fabrication. In reference to the traditional Brazilian "cobogo" shading screen, this environmental "second skin" controls the filtration of indirect sunlight. Open to prevailing wind directions, the interior is cool and bathed in a diffused natural light highlighted by a phenomenological play of shadow and light. Parametric computation was used for both generating geometric configurations, as well as to construct the façade itself. Parametric scripts generated subtle gradation of rotation blocks, controlled by their distance from different "attraction points". Different sized openings and differently angled reflection planes were thus created, and tested using digital environmental simulation, to obtain the best combination of both shading and illuminance.

To assemble the concrete blocks, a parametric script created comb-like "guides" to position the blocks, which were made by laser-cutting corrugated cardboard. Theses guides were placed on a moveable wood stand and track system that were fabricated using the CNC router.

The façade also illustrates the concept of "environmental ornamentation", where ornament is no longer perceived as merely decoration, but becomes useful in producing a specific environmental performance, creating a new type of "functional aesthetic".



# Illuminance









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#### DESIGN DE PRECISÃO

**LED - Laboratório de Ensino, Pesquisa e Extensão em Projeto Digital** [LED - Laboratory for Teaching, Research and Extension in Digital Design]

Faculdade de Arquitetura e Urbanismo, Universidade Federal do Ceará [School of Architecture and Urbanism, Federal University of Ceará]

Fortaleza, Brazil - 2015

Daniel Ribeiro Cardoso, Mariana Monteiro Xavier de Lima, Roberto Cesar Cavalcante Vieira, José Aderson de Araújo Passos, Marina Pires de Castro Aguiar Vale, Artur Elisiario Carleial

Flávio Motta\* once told us about a woodcut artist, with limited resources, that transformed parts of his flatware into engraving tools. Indeed, he was talking to us about "Design de Precisão". In a semantic space, as possible in some languages like Portuguese, the word "Precisão" stands for accuracy as well as necessity. Therefore, "Design de Precisão" means designed by necessity, accurately. A creative answer to a demand, constituting a new tool, a new process, a new method, a new technology...

The Cobogó design starts in the last century. Conceived to meet the needs of equatorial regions, it was intended to reduce the incidence of sunlight allowing the flow of air inside buildings. At that time, a single shape of Cobogó could solve this architecture demand, regardless of the facade orientation. Currently, considering the development of information modeling technology and parametric tools, we set the (re) Design Cobogó more precisely taking into account the latitude -3,8° and longitude -38,5° as well as the facades oriented north, south, east and west.

Annual solar exposure simulations were run for each variation of the 4 selected cobogó typologies, each changing according to a Shape Index (S.I), ranging from 0.0 to 1.0. The S.I. determines both the radius of the circle drawn on panels 1b-2b, and how far the 4 points on panels 3b-4b are from the center point. The results show that the best typology for solar protection of the west facade (prioritized due to high temperatures in the late afternoon) is Cobogó 3, S.I.=0.7. The second best is Cobogó 1, S.I.=0.5, for the east facade. Any variation can completely block the sun for facades north and south, so wind prevalence was used to choose which of the remaining typologies would suit each orientation. Cobogó 4, S.I.=1.0, offers less resistance and goes in the south facade. Cobogó 2, S.I.=0.0, goes in the north facade, to ensure proper circulation.

\* Flávio Motta was professor of History of Art and Aesthetics at the FAU-USP.







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### THEORIES AND TECHNOLOGIES IN DESIGN COMPUTING: GENERATING DESIGNS AND FABRICATING STRUCTURES

LAPAC - Laboratório de Automação e Prototipagem para Arquitetura e Construção

[LAPAC - Laboratory of Automation and Prototyping for Architecture and Construction]

Universidade de Campinas [University of Campinas]

Campinas, Brazil - 2012 / 2015

Jarryer Andrade de Martino and Elza Miyasaka<sup>1</sup>; Wilson Barbosa Neto and Guilherme da Silva Carvalho<sup>2</sup>; Filipe Medeia Campos<sup>3</sup>; Maycon Sedrez and Rafael Meneguel<sup>4</sup>; Daniel Lenz da Costa Lima<sup>5</sup>; André L. Araujo<sup>6</sup>

The Laboratory of Automation and Prototyping for Architecture and Construction (LAPAC) aims at studying generative design systems, 3D technologies (rapid prototyping, digital fabrication and 3D digitation), computer programming and automation techniques, and their applications in architecture, from the design process to the construction of buildings.

LAPAC is presenting 6 different projects created by our researchers:

(1) Attractor: a pattern created in Grasshopper. The code was defined to generate a grid that was used as a reference to spread points and lines. These elements were used as ground to create drops. The direction of each drop was oriented by different attractor points spread on the grid.

(2) Samba Desk: a research that focused on parametric design and file-to-factory production. The design process, the production of scale models and the production in a plasma-cutting industry were documented in detail in order as a reference for future applications.

(3) Parametric sunlight responsive shelter: a project that aimed to control the solar gain of shelters and surfaces by applying diferente fractal patterns to triangulates faces according to the energy received by each face.

(4) Fractal façade: a project that explores fractals parametrically in the design process, aiming at a contemporary type of ornament, which is also the result of a search for environmental performance of the façade and the digital fabrication of complex forms.

(5) Performative façade: an exercise of design and optimization drived by General Systems Theory that aimed to control luminosity using a genetic algorithm to find the appropriate geometry.

(6) Emergence and Complexity in Spatial Structures: a project that assumes that the use of computational parametric components to build a bottom-up generative system can promote an advanced top-down approach, and aims to propose a spatial structure design method based on concepts of emergence and complexity.




















### FLEX 7D: DOUBLE-CURVED FOAM SURFACES IN A SINGLE CUT

Area Computacional [Architectural Computing Unit]

Departamento de Arquitectura, Universidad Técnica Federico Santa María [Department of Architecture, Technical University Federico Santa María]

Valparaiso, Chile - 2014

Luis Felipe González; Francisco Quitral; Fernando Auat

In current times, when all professions are challenged to innovate and cross each other's boundaries in order to find better ways to sustain our planet and our livelihood, architecture students at the Technical University Federico Santa María are encouraged in such creative intrusion expanding their vision about architectural profession. One of their goals is to learn how to use confidently and skillfully several scientific and technological innovations of our time in the field of architecture. Another is to understand how these innovations work, how they are made, and then make their own.

Helping to achieve these goals is our job at the Architectural Computing Unit. In this exhibition we present one of our students latest innovations in the field of computer numerically controlled (CNC) hot-wire cutting machines. Flex 7D has a hot cutting blade with an active synchronized bending control system which allows to produce doublecurved foam surfaces in a single cut. The fully functional prototype is meant for manufacturing geometrically complex, full-scale architectural and construction elements such as formwork, office cubicle partitions, lightweight room dividers, false ceiling, furniture, etc. Flex 7D has been completely designed and built in-house as a bachelor thesis during 2014. We encourage architects to invent things; to create reality!













## DYSGRAPHIA

gt2P - Great Things to People Santiago, Chile - 2014 / 2015

DYSGRAPHIA is a working progress project, part of our current work called "Paracrafting" who reflects about the expression of the digital world into the physical world. Dysgraphia is a language disorder that manifests itself in writing issues expressed by letters with excessive or inclined size, irregular spacing between letters, improper links between graphemes, unrecognizable letters and, ultimately, difficulty in understanding text.

Based on this condition, the project questions the contemporary production processes of objects (3D printing) in which we deposit the idea of perfection about scientific knowledge and technology. Today the prevailing opinion about 3D printers is that they are a reflection of perfection to everyone and that in the future will provide us with products manufactured everyday in our homes.

However, in reality these artifacts are sophisticated manufacturing systems that rely on a large number of mechanical, computer and human factors that create a complex and unstable equilibrium, in which the machine projects the illusion of making perfect reproductions of objects, based on virtual representations of them. The focus of the project is the intervention (hacking) in the generation of language of 3D printer machines, which are able to interpret virtually developed objects to generate a code that serves as a guide for the printing process. In this way the "programmed error" exposes the fragility of these systems, while at the same time amplifies the possibility of plastic expression of the machine.

The plastic expression of the machines comes from the way they build objects. This particular manufacturing process that consist in horizontal superposition of material is remarkable because it is a way to bring virtual object to the real world. A common assumption is that people think that the printers make reproductions of objects. However, the printed objects do not share many aspects of the original objects. This become the material of the real object, the physical properties and the manufacturing process or in other words the way that they are built. All the aspects of this production process creates a language and the manipulation of this language, done from the critical observation of it, result in three language disabilities or hacks studies (translation, reproduction and resolution), which are expressed in the resulting objects











### PARAMETRIC CYCLONE

## Desenho Paramétrico e Fabricação Digital - AUT2501

[Parametric Design and Digital Fabrication - AUT2501]

Faculdade de Arquitetura e Urbanismo, Universidade de São Paulo [School of Architecture and Urbanism, University of São Paulo]

São Paulo, Brazil - 2013

Victor Vincenzo Scopacasa, Arthur Hunold Lara

Five years ago, the postgraduate program of the Architecture School of the University of São Paulo opened its first subject involving parametric design and digital fabrication. The success enabled the offering of an elective subject in the undergraduation level. The excitement increased even more with the presence of Fab Lab São Paulo in the college. For this axis "in-forming objects" we chose the work of parametric cyclone, one of the three best works of the latest version of the discipline.

At the time, the cyclones have become more frequent in natural disasters. For the student Victor, understand the logic and the mathematics involved allowed him to add more information and values to his sculpture.

This is a work modeled digitally, manufactured by a laser cutter using acrylic and manually assembled. The sculpture is a simplified representation of a cyclone. Circular boards are overlapping each other on the vertical axis to give the rhythm of the piece.

The purpose of this project was to experiment building a form using contemporary production techniques. This was his first contact with digital fabrication choosing a simple shape to understand the digital fabrication.









#### BANCAPAR. A PARAMETRIC PUBLIC WORK OF ART WITH COLLABORATIVE DESIGN AND NON-INDUSTRIALISED MANUFACTURING

CID - Centro de Informática y Diseño [CID - Center of Computer Science and Design

Facultad de Arquitectura, Diseño y Urbanismo, Universidad Nacional del Litoral [Faculty of Architecture, Design and Urbanism, National University of the Littoral]

**Departamento de Diseño y Teoría de la Arquitectura** [Department of Design and Theory of Architecture]

Facultad de Arquitectura, Construcción y Urbanismo, Universidad del Bio-Bio [Faculty of Architecture, Construction and Urbanism - University of Bio-Bio]

Santa Fé, Argentina | Concepción, Chile - 2013

Nicolas Sáez, Mauro Chiarella, Rodrigo García Alvarado, Luis García Lara, Matias Dalla Costa, Martin Veizaga, Luciana Gronda

BANCAPAR ("Fondart Regional 2013" winning project) is a parametric bench conceived and designed as a public work of art. The project has been entirely self-managed with shared authorship (between UBB-Chile and UNL-Argentina) and stands at the entrance to the Industrial Engineering Faculty of the Universidad del Bío-Bío, in Concepción, Chile.

The use of mechanical technology with manual folding was initially driven by necessity, due to the limited technological solutions available in the given circumstances. However, this technique became a source of identity for the object, determining the definition of its final form. The spatial properties and materials used in the irregularly folded components are integrated into the "appropriable sections" generating harmonious approximations between the different tools and concepts used. The physical manufacturing process began with graphic templates, which were printed and then folded to give 106 flattened steel strips, 5cm wide by 6mm thick. The 3,000kg of steel used, the work involved in assembling the structure, the months-long folding process and the final galvanisation of each piece led to a total cost of about US\$23,000 to create this object of variable dimensions, some 10m long and 2.5m wide.

In response to the design and manufacturing processes, we have not created a finite object, but rather have adopted strategies to construct ever-modifiable geometries. In this way, certain traditional means of creation are inverted: instead of the typical artist that pursues a final form, we define a dynamic strategy that proposes families of solutions; where, in the romantic model, the designer, as solitary and sole author, displays his own personal gestural language, we propose a variety of means of collaboration; and where the final work is presented as a unique product with a determined aesthetic criterion, we propose a formula of processes that offer the possibility of diverse interpretations at any instance of its development.













"Dobrá" is a collection of outdoor furniture that explores the bending of steel sheets as a key concept to create three-dimensional objects. This essence guides formal design of every piece. The design combines the versatility of the steel properties with contemporary design and fabrication processes such as parametric modeling and computer numeric controlled (CNC) manufacturing through plasma cutting machines. File-to-factory procedures as well as mass customization concepts were heavily exploited in the project.

The three-dimensional parametric model allowed us to establish geometric relationships between each object's components to generate both tables and benches pieces. Parameters regarding the number of users, thickness of the materials, leg tilt and bolt gauge are some of the inputs that could be changed to influence the formal outcome of the furniture. Automated plasma cutting machine enabled industrialscale fabrication of the customized furniture design. This project relies on the boundaries of digital fabrication itself, drawing attention to the dialogue between the architect and the industry.













# A ROBOTIC ARM FOR TEACHING PURPOSES<sup>1</sup> | COMPACT VEHICLE<sup>2</sup>

### PRONTO 3D - Laboratório de Prototipagem e Novas Tecnologias Orientadas ao 3D

[PRONTO3D - Laboratory of Prototyping and New Technologies Oriented to 3D]

Universidade Federal de Santa Catarina [Federal University of Santa Catarina]

Florianópolis, Brazil - 2014 / 2015

Lucas Kenzo Kato<sup>1</sup> | Marcelo Cabral<sup>2</sup>

In a partnership between PRONTO3D Florianópolis and Inovation Laboratory, both in Federal University of Santa Catarina, this research enabled the design development of a super compact conceptual car. This urban electric vehicle suits 2 persons and its simple and economic construction can attend market fields among cars and motorcycles.

During design process development, the use of technologies such as CNC material subtraction enabled a sequence of models that contributed to final solution.

This multidisciplinary work aims the implementation of a robotic arm for teaching purposes, as a way to spread technology throughout high school students as well as technical and graduate ones. The experiment belongs to a major project called "Actions for the Science and Technology Museum of Federal University of Santa Catarina", in Joinville, Brazil. As a result, an articulated type of a robotic arm was designed, in low complexity (4 d.o.f.) and materialized with 3D printer technology. The project has similar functions as industrial robotic arms with a "teach" function and several types of movements. The didactical kit was organized in three modules: 1) Mechanical structure; 2) Firmware and 3) Software interface. The mechanical structure was materialized with Fused Deposition Modeling (FDM) printer, using PLA filament, during all project phases as a way of discovering different issues and details due to specific project purposes. This technology was also used in the final prototype. Regarding firmware, it was implemented with low cost hardware, Arduino Mega, SD card, cristal liquid display shield and micro servo motors. Software interface has spots to direct control the robot commands through a terminal and another one to more extensive programming codes, saved in the SD card and accomplished by the firmware.

Form materialization was present in this research since early project phases, supported by Florianópolis PRONTO Lab facilities. The developed work has helped an emergent field within great robotic area, focused in educational robotic and multidisciplinary solutions.



54-55



















São Paulo, Brazil - 2011

Affonso Orciuoli, Regiane Pupo, Ernesto Bueno, Yan Giusti and participants from Santa Catarina

For this specific workshop, we started from a book called "The craftsman" by Richard Sennett. According to the author, the idea of craftsman is present in many jobs, and not necessary is something related with the ability with the hands. Cookers, carpenters, surgeons and musicians could be a "craftsman". The idea is to reinforce the relationship between the "hand and the head", in a continuous feedback. The idea of "Hephaestus", the Greek god of artisans is represented with tools that can give form to the material: he shapes. The mainly idea is "to do things just with the pleasure to do good things".

Hannah Arendt also collaborate with this idea, when she compares the "Animal Laborans" with the "Homo faber". The first ask "how", the second ask "why". To be a good craftsman the methodology applied is improving step by step, with failure and error.

Invited to participate in a process to introduce new technologies applied into design, with a public not familiar with digital fabrication, we propose a workshop called "e-Luminarias" (e-Lamps). Around 40 participants could be introduced to digital fabrication techniques, in this case a laser cutter and a milling machine. Divided in groups, students designed and created the g-codes to the machines, and could understand all the steps to be able to "dialogue" with the machines.

We believe that "Digital Fabrication", in general terms is not the final step, but it's an important issue during the project. We imagine a solution, we fabricate and we test. We try several times, each time the solution becomes better, always going back to the CAD file, and changing, fabricating again. This feedback between design and fabrication create a "craftsman" relationship, using new technologies but that keep an ancient method to work.

Reference: Sennett, R. (2008). The craftsman. Yale University Press. New Haven.









## ARCHITECTURAL HERITAGE IN THE PALM OF HAND

GEGRADI - Grupo de Estudos para o Ensino-Aprendizagem de Gráfica Digital [GEGRADI - Research Group for Digital Graphics Teaching / Learning] Universidade Federal de Pelotas [Federal University of Pelotas - UFPel]

Pelotas, Brasil - 2014

Adriane Borda Almeida da Silva, Monica Veiga, Luisa Félix Dalla Vecchia, Janice Pires, Tássia Vasconselos, Letícia Borges, Gustavo Brod, Juarez Tabim Parode, Cristiane Nunes

The theme of representation of architectural heritage has been adopted by GEGRADI since its formalization as a research group in 2002. In this case, the production is related to the architectural heritage of the city of Pelotas, which preserves architectural relevant examples, built between the end of 18th century and early 20th century, representatives of the Portuguese-Brazilian architecture - eclectic, transition eclectic and premodern architecture. The work refers to representation experiments of the same heritage building, producing models in different resolutions and scales - entire or parts of this building - from the investigation of different technologies potentiality for various representational purposes. The transfer between virtual and physical models - made possible by digital fabrication techniques as 3D printing and laser cutting - has been carried out in two integrated directions.

On one hand, there is the investment in an adequate method of models production for the tactile experience. The method seeks to respect the capacity of form apprehension by touching integrated with audiodescription, aimed mainly at visually impaired individuals, for cultural and educational moments. Complex geometries which are difficult to understand verbally or textually are represented physically. Such method includes the production of tactile models for the comprehension of photographs. The information produced during the process of representation, specifically of geometric analysis of compositional rules, supports the production of a set of models, many times necessary to explain a single form. On the other hand, using the heritage as reference, we continue to combine the appropriation of representation technologies and the promotion of creative processes. Studies of parametric design associated to digital fabrication are being developed, making the geometry of such heritage explicit formally, generating visual compositions and educational games. Both of these directions have contributed to spread the information about the architectural heritage in the city, promoting the establishment of partnerships of this laboratory with other public institutions such as museums and secretaries of culture and tourism.



62-63







## A WALKING CITY; ARCHIGRAM UNIQUE VS REPRODUCTIBLE: TOWARDS A NEW CHALLENGE

labFabMVD - Montevideo Digital Fabrication Lab Facultad de Arquitectura, Universidad de la República

[School of Architecture, University of the Republic]

Montevideo, Uruguay - 2013 / 2014

Marcelo Payssé, Fernando García Amen, Paulo Pereyra, Luis Flores, Ángel Armagno

This work belongs to something bigger. In fact, it is an integral part of something else: the exhibition "FAB/01. Uthopia; the unbuilt" held in November 2014, during the XVIII SIGRADI Conference. For that occasion, the challenge was to create unique objects, digital fabricated architectural representations projected but never built.

Thus, various non-erected projects created by architects, engineers and designers were fabricated by laser cutting and 3D printing technologies. Also, it's ontological essence was analyzed and interpreted by renown Scholars and Lecturers of our University by publishing an homonymous book. To paraphrase Heidegger, any interpretation to produce understanding, must already have understood what is going to interpret. In other words, various possible interpretations, approaches and readings were born from the uniqueness of the object. For this new opportunity, the challenge isn't in the interpretation of material uniqueness through theory, but in the ability to materialize and reproduce a digital entity. The case study will be "A Walking City" of Archigram. The challenge of Homo Faber is, alligned with Heidegger, to interpret and materialize the unique nature of an object whose understanding is implicit, in order to interpret, or in this case, in order to understand it and show it to promote new ideas and new thinkings.








# RE-SILIENCE<sup>1</sup>, SUBMARINE LIGHTHOUSE<sup>2</sup>, RIVER SQUARE<sup>3</sup>

Taller de Concursos[Workshop of Competitions]With the support of LAB CNC.FAU/UCH

Facultad de Arquitectura y Urbanismo, Universidad de Chile [Faculty of Architecture and Urbanism, University of Chile]

Santiago, Chile - 2014 / 2015

Javiera Valenzuela<sup>1</sup>, Diego Espinosa<sup>1</sup>; Pablo Shaelchli<sup>2</sup>, Fabian Cordero<sup>2</sup>; Diego Poblete<sup>3</sup>, Francisca Barrantes<sup>3</sup>, Gonzalo Muñoz<sup>3</sup>, Paula Villagran<sup>3</sup>

The studio "Taller de Concursos" has been linked the last 2 years with the necessity to test, experimentation and speculation, from the Academy (digitalanalog architecture) with competitions both in the Chilean and international scenarios. Semester by semester students develops different strategies of space generation through the inclusion of digital design methods.

From the problematization of each competition, the students working in teams must propose different ways of approaching problems, using a methodology of research by design, intrinsically linked to dispersive thought of architecture. The student's learning path has been designed by an incremental strategy of complexity, in where they are trained in first sessions with tools of contemporary design, both focused on the similar as on software modelling 3D tools (Rhino and 3DMax). This methodology allows an exploration of fluent formal possibilities during the following stages. The course also features guests tutors who opened the range of theoretical and technical possibilities that substantiate the work of students during the semester.

During the design process, the student can experiment freely with tools and materials associated with the challenge exposed by their initial questioning process. That step has several feedbacks from the translation of physical phenomena in algorithms, tools, and digital switches that enhance the result to new limits.

The projects selected for this exhibition are part of a selection of the best studio projects for Evolo skyscraper competition 2014 (New York) and Abrilar Sustainable 2014 (Chile). In all of these projects digital and analog tools (laser-cutting and 3D printing together with classic models) are fundamental for each specific design process, recognized in both competitions with publications, honour mentions and prizes.









### UNFOLDING COLLABORATIONS

#### Aleph Zero and Juliano Monteiro Studio

### Curitiba, Brazil - 2011 / 2012

Gustavo Utrabo, Pedro Duschenes, Juliano Monteiro, Ernesto Bueno, Lucas Issey, Hugo Loss<sup>2</sup>, Mathilde Poupart<sup>2</sup>, Lucille Daunay<sup>2</sup>, Sabine Meister<sup>2</sup>; in collaboration with Thiago Mundim<sup>1</sup> and Architecture students from Pontifical Catholic University of Paraná<sup>1</sup>and from Positivo University<sup>2</sup> <sup>1</sup> Collaborator in Entre Escalas.<sup>2</sup> Collaborator in [Des]dobrar.

An important part of Aleph Zero work consists of teaching and research activities in collaboration with other professionals and academic institutions. In 2011, some projects resulted from a workshop entitled "Entre Escalas", taught at PUC-PR, were used as a basis for the development and construction of an installation by 4x4x1.50m that attended to the function as a bleacher and a children's playground in Espanha Square. The entire installation was made of more than 500 plywood pieces designed and planned with parametric design techniques and cut by CNC milling. In this structure, the parts connect together as a waffle system, but structured in a radial arrangement. The complexity of assembly required the development of a laser cut 1:25 MDF model, to define the assembly strategy. The radial arrangement allowed visual permeability in the core of the installation - a small meeting place with a spheroid shape - to which tunnels came from the outside. The installation had a positive influence on the users of the square. For a week, dozens of children experienced playing in these unusual spaces.

In 2012, the approval of a patronage project by the Department of Culture of Curitiba allowed the association with Positivo University to build and exhibit the installation [Des]dobrar. It was an installation of more than 100 m<sup>2</sup> of stainless steel reflective panels, supported by a steel structure designed with parametric design techniques and manufactured by plasma cutting and pipe folding machines. The panels in sequence formed the bounds of a modified walk path, deforming the perception of space and hiding pedestrian's own reflections. Part of the panels interacted with users, rotating when triggered by proximity sensors controlled by Arduino boards.















### TANGIBLE INTEGRATION BETWEEN BUILDING DESIGN ANDRAPID PROTOTYPING

SimmLab – Laboratório de Simulações e Modelamento em Arquitetura e Urbanismo [SimmLab - Laboratory for Simulation and Modeling in Architecture and Urbanism]

Faculdade de Arquitetura e Urbanismo Universidade Federal do Rio Grande do Sul [School of Architecture and Urbanism Federal University of Rio Grande do Sul]

Porto Alegre, Brazil - 2014

Waldo Luiz Costa Neto, Lennart Bertram Poehls, Benamy Turkienicz

The exhibition showcases the attempt to integrate building performance models and tangible interfaces into design teaching and the design process itself. A Tangible User Interface (TUI) enables the association of physical objects, virtual objects and performance models. The combination and interrelation of these first two types of objects with analytical tools would enable multiple feedbacks (environmental, structural, among others) using different simulation strategies.

A TUI prototype has been developed to speed up the awareness of students about the influence of natural light on architectural form. A platform that supports the project's physical model is automatically positioned in order to simulate the various solar positions according to time, date and geographical setting. The platform possesses two motor-controlled axes for the simulation of the solar position and one manual adjustment for the latitude. Its parts were fabricated using a laser cutter and a 3D printer. Integrated sensors installed in the horizontal plane of the physical model capture the lightning intensity and an Arduino board processes the data. Finally, using Rhinoceros 5 and Grasshopper, a graphical output is generated as feedback.

After two simulation outputs, the students were able to understand which of these two received a lower natural lightning intensity when compared to the other. During the execution of the applied methodology, students were stimulated to either alter date and time or to make changes to the physical model by cutting or adding pieces to the tested physical model in order to identify future design solutions.

The produced results and experiences have been encouraging to continue working with the use of TUIs in design teaching. Direct and indirect results have shown to be interpreted precisely by the students and future works will employ protocols to evaluate the impact of the TUI's use on the design process.











80-81





# MUSCIPULLOS

Lamo3D - Laboratório de Modelos 3D e Fabricação Digital [Lamo3D - Laboratory of 3D Models and Digital Fabrication]

NANO - Centro de Artes e novos organismos [Centre of arts and new organisms]

Faculdade de Arquitetura e Urbanismo, Universidade Federal do Rio de Janeiro (FAU-UFRJ) [School of Architecture and Urbanism, Federal University of Rio de Janeiro (FAU-UFRJ)]

Rio de Janeiro, Brazil - 2014

Andrea Baran, Aydam de Paula, Lucas Pacobahyba, Rodrigo Gurgel, Tiago Maciel

"Muscipullos" was one of the results obtained from the proposed Workshop Sensitive Shelters, where each group had to create shelter mechanisms that should respond to human interactions, called "responsive pavilions". There were five projects for five systems called "curtain", "octopus", "seashell", "chinese lanterna", and "princess earring flower". Each one of them was focused on structural movement in association with robotics, electronics and design fabrication. The 'Muscipullos' group used the principle that each petal has an axis of rotation as a conclusion between the group concept associated to "princess earring flower" with the idea of a carnivorous plant, with flycatcher system. As a result they created a 'capture system' capable to open and close with five petals each one with a diferent axis of rotation. The initiative for the Workshop was a result of a partnership between Lamo3D - Laboratory of 3D Models and Digital Fabrication - and Nano - Centre of Arts and New Organisms -, linked to the Architecture and Urbanism School and Fine Arts School of the Federal University of Rio de Janeiro, respectively. The main purpose of the workshop was to introduce the undergraduate students to a new design methodology associated with the practical experience.

This research on the interactive digital tools universe with parametric modeling in association with robotics brings the possibility to expand and explore the capacity of material, structure, surface and scale deformation of the object, giving an almost completely knowledge about the dynamic shelter.











## LOVE PROJECT

**Studio Guto Requena** 

São Paulo, Brazil - 2014

Studio Guto Requena, in collaboration with D3

The "Love Project" is a study in design, science and technology that captures the emotions of people, relating personal love stories and transforms them into objects, sculptures and art pieces. The project suggests a future in which unique products will bear personal histories in ways that encourage long life cycles, thus inherently combining deeply meaningful works with sustainable design.

The complexity involved in developing this project was made possible thanks to a multidisciplinary team collaborating in the design process. In result, the "Love Project" has many authors. It seeks to include the end user in the process of creation and therefore democratizing and demystifying the use of interactive digital technologies.

Participants themselves will investigate cutting-edge possibilities in the digital design industry and its new logic of creation, production, transportation and sales. In the first step, sensors applied to the participants read their subtle reactions while they narrate the defining love story of their own lives. As participants speak, data drawn from their altering emotions is relayed to a specially developed software via a graphic interface created in Grasshopper. This data molds every aspect of the object, which is then fabricated using a 3D printer.

After numerous tests with different sensors, three types were chosen: a sensor that reads brain activity, a heart rate sensor, and a voice sensor. All sensors were applied to participants to collect data from physical and emotional responses of their feelings during their narration. Participants are isolated during the process so that they can express their emotions as openly and intimately as possible, and so the data can be captured as accurately as possible.

Using environmental computational processing, an interface was created by D3 to interpret the data collected by the sensors, different inputs are transformed into a single language, allowing real-time visualization of the participant's emotional states as the story is told. This data is sent to Grasshopper parametric software, with which we developed a program that models three-dimensional objects.

The drawing is formed along the trail created by particles moving through forces. Each sensor provides different inputs of force in these particles, forming a singular mandala by different emotions.

The final pieces are visualized on the computer and then sent to a 3D printer that can print objects in different materials, such as ABS, Polyamide, Glass, Ceramics or Metal. Each product is unique and contains the most intimate emotions of the participants' love stories.







#### MINDWAVE

- low gamma + low beta repulsion from surface
- attraction between particles
- repulsion between particles







beats per minute (bpm) line thickness





# LIVING IN 'STRUCTURE' A PARAMETRIC POST-HISTORICAL INTERACTIVE OBJECT

**LAGEAR - Laboratório Gráfico para Experimentação Arquitetônica** [LAGEAR - Graphics Laboratory for Architectural Experience]

Universidade Federal de Minas Gerais [Federal University of Minas Gerais]

Belo Horizonte, Brazil - 2015

José dos Santos Cabral Filho, Ana Paula Baltazar, Mateus de Sousa van Stralen, Guilherme Ferreira de Arruda, Marcus Vinicius Bernardo, Luiza Diniz, Maria Cecília Rocha, Mariana Lima

Vilém Flusser proposes that we are now living in a post-historical context, which means that static images and linear progressive concepts (writing) are no longer enough to deal with the complexity of the world or of our imagination of the world. We are now challenged to deal with technical images beyond mere static representations and also to convey concepts beyond linear writing. For Flusser (2002) we now stand in "the midst of images that order concepts (in 'structure')". Our understanding of such a post-historical 'structure' in architecture leads to thinking of design as an interface that might be open not only during the conception process but also when it is lived, in use. In other words, or as Flusser (1999) proposes, a responsible design, open to those coming afterwards, a design that enables users to stop functioning according to what is set and start playing with it (Flusser, 1984). This means to work with the parametric process beyond its potential as a conception tool, exploring its potential in space, pushing parametrization from designing to using. This exhibition tries to reproduce in a small scale the investigation we are undergoing at Lagear joining parametric thinking with electronics in order to broaden people's possibilities for interaction. The interactive object proposed has no prescribed use but is open to continuous inputs from users. This object is a 'structure' in Flusser's sense, enabling people to feel themselves in a post-historical context, imagining images that order concepts.

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Nomads.usp DesignLab - Center for Interactive Living Studies Instituto de Arquitetura e Urbanismo, Universidade de São Paulo [Institute of Architecture and Urbanism, University of São Paulo]

São Carlos, Brazil - 2012

Marcelo Tramontano, Cynthia Nojimoto, Gilfranco Alves, João Paulo Soares, Anelise Ventura, Denise Mônaco, Mayara Dias, Eduardo Soares de Oliveira, Larissa Cardillo, Martina Brusius, Muriell Pereira, Paulo Carvalho, Roby Macedo, Ronaldo Paixão, Saint Clair Cerqueira, Thiego Cunha, Vinicius Weingärtner Matos, Filipe Abreu, Pedro Ivo Teixeira, Pedro Meneghel

The Slice Pavilion results from a research activity carried out as part of a major project called "Hybrid Territories" conducted by Nomads. usp – Center for Interactive Living Studies, a research group from University of Sao Paulo, and funded by Fapesp – São Paulo Research Foundation. Hybrid Territories is a public policies project whose objective is to promote dialogues among different realities and social contexts by constituting hybrid spatialities, i.e, by combining physical and virtual instances. The project seeks to explore the idea of tolerance, diversity, and coexistence, and to expand people's worldviews.

The main objectives of research activity were to create a pavilion for cultural activities exploring complex geometries based on parametric design and digital fabrication by using specific computational programmes and to engage people from different groups - public housing complex residents, students and professors from architecture schools, local industry, cultural agents, and public administration in the design process.

One of the biggest challenges in planning the activity was to develop strategies to get people to collaborate in the design process in different ways and stages, from communities, industry, universities, public administration, and cultural agents. The strategy adopted in the design process of Slice Pavilion was, firstly, to promote cultural events in order to engage different groups of residents in a collaborative process so as to investigate a wide range of aspects and opinions on public spaces for cultural activities, and secondly, to get together students, professors, professionals, and local industry in design workshops to solve technical aspects of the pavilion project. At the end of research activity, two prototypes of Slice Pavilion was assembled: one at 1:1 scale and another at 1:2 scale in order to verify its assemblage and material and structural behaviour.









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**Fab Lab SP and NOAH - Habitat Center Without Borders** Faculdade de Arquitetura e Urbanismo, Universidade de São Paulo [School of Architecture and Urbanism, University of São Paulo]

São Paulo, Brazil - 2011

Lara Leite Barbosa; Artur Vasconcelos Cordeiro; Research Group NOAH – Habitat Center Without Borders in collaboration with Research Group "Digital Manufacturing Technologies applied to the production of Contemporary Design and Architecture" (DIGI-FAB)

"APIS", the scientific name for the bee is a tribute to and a call for collaboration. Starting in 2010, university professors, students and community leaders and residents have been working together to address post-flood related issues. For this project, the university will design and build temporary and portable ablution blocks for public use. The bathroom fits inside a container that can be transported on Brazilian roads to disasters areas and installed in a location near the existing temporary shelter. It will be used during the period of sheltering after disasters, supporting the population in their daily hygiene activities. The APIS Project was ranked one of the seven (7) university

finalists to participate in the "Pillars of Sustainable Education program" in an international selection created by the Architecture for Humanity and funded by the Alcoa Foundation (http://pillarsofsustainableeducation.org/university-of-saopaulo).

It is an international program that supports community-based university design projects that explore innovative uses for sustainable materials, granting funds for construction. The research focuses on issues of sustainability since it proposes the treatment and reuse of floodwater, and also uses low toxicity sealing components made with local materials. The project explores different uses for a material widely available in the area of study: banana fibre. From the point of view of sustainability, using local resources lessens the impact on transport and facilitates the acceptance of the material by the population since it is something they are culturally familiar with.











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ACOMMON STRUCTURE FOR SERLINE WINELS - Anna

ACOLITIC INSULATION PARES ISOSCUND - Nover

INDER DE CHANGING INCHEN METALLE, ETRUCTURE WITH FABRIC VANS, ALLANAMA SIRE AND VILLEHAMMIN COVERING OF CHANGING ROMAN IN METALLIC ETRUCTURE WITH FABRIC VANS, WITH MORGLIEF OF THE METALLIC ETRUCTURE WITH FABRIC VANS, MEMANUM DOOR WITH VERSTEIN BLIND VENTLATION ALLANAUM DOOR WITH VERSTEIN BLIND VENTLATION.

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FLOOR OF CHANGING ROOMS IN ALL/MINIUM EXPANDED - Aluse

ADAUSTABLE LEVELER

METAL LADORS WITH HANDRAIL MOBILE PLATFORM FOR WHEELCHAR ACTEUR

TANKS OF GREY AND BLACK WATER - Samuly



### FAB SOCIAL AND FAB LAT KIDS: A COMMON CONCEPTUAL GROUND AMONG DESIGN, BASIC EDUCATION, DIGITAL MODELLING AND MANUFACTURING

#### Fab Social

Departamento de Informática e Telecomunicações da Prefeitura de Guarulhos [Informatics and Telecommunications Department of Guarulhos City Hall]

Guarulhos, Brazil - 2014

Alex Garcia

Product of a theoretical, empirical and collaborative research these works present a common conceptual ground among the design area, basic education, digital modelling and manufacturing technologies.

Its subject is based on the contemporaneity, in the way that introduces new means of support for learning and teaching in basic education. The computer – until that moment was used exclusively for text and image processing – is allied to modelling, digital manufacturing and network communication. In this scenario, activities with young people are promoted by several laboratories called "Fab Labs" where specific ongoing projects within Latin America such as "The Fab Lat Kids" and "Fab Social".

Fab Lat Kids is a collaborative research among latin researchers that consider the study of the digital technologies contextualized in the latin culture as a common ground. The research had taken into on line workshops held in laboratories in countries such as Mexico, Colombia, Ecuador, Peru, Costa Rica y Brazil, in order to collect data to analysis. The first phase of this project was a workshop named "Emosilla" that let the kids express their emotions using digital fabrication. The Fab Social project was supported by Fab Lab SP and take place in the "Telecidadanias" spaces in the peripheral area of Guarulhos city. The workshops were freely accessible and intended to introduce the participants with concepts of technology and design through playful activities through a simplified interface with no need of any sort of previous knowledge. In order to equip the activity centers, a mobile laboratory was prepared with the following equipment: nine computers, a portable CNC milling machine and a 3D printer. The activities aimed the interaction and sharing of ideas among the participants, providing the

opportunity to test the interfaces of their projects with other users.



102-103








## AMAZON FLOATING FAB LAB

Fab Lab Lima

FabLab MIT

nal struct

tal fabrico s - Lake Lima, Peru - 2014

The Amazon. The richest territory of the planet, both in biodiversity and multiculturalism, also is one of the most affected by global warming and social exclusion. Deforestation, extinction of species and cultures threaten the Amazon, where most of the population does not have access to education and basic public services.

How can we help? By integrating efforts for the local people (especially children) to expand their opportunities to access technological and social innovation programs.

The Floating Fab – Amazon. The project is create a digital fabrication laboratory (Fab Lab) that will navigate the Amazon River. It's a new vision about alternatives to the main challenges of today's world: climate change and social inclusion, integrating the most advanced technologies in digital manufacturing with the potential of the cultural and natural diversity of the Amazon territory (one of the most affected areas by the global warming).

It's condition of green heart makes it the ideal place where the manufacturing of the future could be incubated, exploring alternatives towards a responsible and responsive industry which is sensible and integrated to local and global developments in different fields as bio-printing, food-printing, eco-construction, bio-electronics, etc. and, it will provide local communities with access to technological tools that allow them to cope with their daily challenges with water, energy, health, food, education while at the same time, serve as a place for research and development to better understand the Amazon.



106-107





TUTOR: Ilaria La Manna | PÁRTCIPANIS, Maiana Resei | Dega Origono | German Vacquer | Erica Hatsan Felipe Arenas | Julia Grenga | Patio Ulari | Saberna Tomatrica | Jimana Califa Femanda Visian | Matane

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# MAP OF FAB LABS, RESEARCH GROUPS AND STUDIOS IN > THE EXHIBITION

IEHU.FADU/UBA, ARG Frontis3D.R+D, COL SUBdV ARCHITECTURE, BRA LED.FAU/UFC, BRA LAPAC.FEC/UNICAMP, BRA AREA COMPUTACIONAL/UFTSM, CHI gt2P, CHI DESENHO PARAMÉTRICO.FAU/USP, BRA CID.FADU/UNL+FACyU-UBB, ARG+CHI PROTOBOX, BRA PRONTO 3D.DESIGN/UFSC, BRA **RBFD,** BRA **GEGRADI.FAU/UFPEL,** BRA LabFabMVD.FARQ/UDELAR, URU TALLER DE CONCURSOS - LAB CNC.FAU/UCHILE, CHI ALEPH ZERO, BRA SimmLAB.FAU/UFRGS, BRA LAMO3D.FAU/UFRJ, BRA ESTUDIO GUTO REQUENA, BRA LAGEAR.EA/UFMG, BRA NOMADS.IAU/USP, BRA FAB LAB SP/NOAH.FAU/USP, BRA

- 23 FAB SOCIAL/FAB LAT KIDS, BRA
- 24 FAB LAB LIMA, PER





#### IEHU - INSTITUTO DE LA ESPACIALIDAD HUMANA, LABORATORIO DE MORFOLOGIA

[IEHU - Institute of Human Spaciality, Laboratory of Morphology]

#### Facultad de Arquitectura, Diseño y Estudios Urbanos, Universidad de Buenos Aires

[Faculty of Architecture, Design and Urban Studies, University of Buenos Aires]

Buenos Aires, Argentina http://morfologiadigital.blogspot.com.ar/

Coordinator: Roberto Doberti Current Staff: 23 Foundation/Beginning with Digital Fabrication: 1985/2006

The Laboratory of Morphology was created in 1985, functioning since then at the Faculty of Architecture, Design and Urbanism of the University of Buenos Aires. In 2006 it constituted the Institute of Human Spatiality, which includes the Laboratory of Morphology and the Research Center of Dwelling. Various aspects of Human Spatiality are researched in the academic scope, by the integration of thinking and doing, analysis and proposal, and by the interaction of various design disciplines and fields of thought that are adjacent to the problem of space.

Since its creation the Lab has brought together teachers and researchers from all areas of design and other disciplines. Several research projects are carried out there, many of them accredited by the Office of Science and Technology of the University of Buenos Aires, and the National Agency for Scientific and Technological Promotion. In its scope are performed the Master in Logic and Technique of Form and the Master in History and Criticism of Architecture, Design and Urbanism.



## Frontis3D R+D

Frontis3D Bogotá, Colômbia http://frontis3d.com/en/investigacion/ | www.frontis3d.co

#### Coordinator: Rodrigo Velasco Current Staff: 5 Foundation/Beginning with Digital Fabrication: 2006

Frontis3D R+D is a research led initiative. We are committed to architectural innovation, and we invest on it. Our portfolio is but a direct outcome of a permanent research activity regarding the application of Nature inspired (integrated) design principles. This research focuses on three main fields of application: new material assemblies, novel manufacturing processes, and design tools.

Frontis3D is a commercial company specialized in the design of architectural facades. Our portfolio of services includes material design, technical consultancy, product design, manufacturing, and onsite assembly of singular façade systems. We work with architectural practices, construction companies, and directly for commercial organizations that find in our architectural proposals a means to support and strengthen their corporative identity.

## SUBdV ARCHITECTURE

São Paulo, Brazil www.subdv.com

Coordinators: Franklin Lee, Anne Save de Beaurecueil Current Staff: 5 Foundation/Beginning with Digital Fabrication: 2005

SUBdV uses a mixture of high-technology and low-technology computation design and digital fabrication technologies to generate socially and environmentally responsive geometries for architecture and urban design projects. The practice works at a number of different scales from urban design, to buildings, to interiors and furniture design, finding ways to transform universal digital design and fabrication techniques so to create novel Brazilian hybrids of imported technique and local culture and expertise.

As directors of the Architectural Association Brazil Visiting Schools (brazil. aaschool.ac.uk), Franklin Lee and Anne Save de Beaurecueil have organized since 2010, ten workshops in São Paulo and Rio de Janeiro. Along with invited tutors from abroad, they have collaborated with a number of different microagencies, ranging from self-organized favela residents' associations, to carnival samba schools in Rio de Janeiro, to a former boxer champion's informal sports academy under the viaducts in São Paulo. They have required a negotiation between formal and informal entities. as well as between public and private agencies, to produce socially empowering interventions, combining computation and digital fabrication with local techniques, materials and economies.

#### LED - LABORATÓRIO DE ENSINO, PESQUISA E EXTENSÃO EM PROJETO DIGITAL

[LED - Laboratory for Teaching, Research and Extension in Digital Design]

#### **Universidade Federal do Ceará** [Federal University of Ceará]

Fortaleza, Brazil www.ledufc.org

Associated with FABLab MIT, FABLab Brasil

Coordinators: Daniel Cardoso, Mariana Lima, Roberto Vieira, Aura Celeste Current Staff: 8 Foundation/Beginning with Digital Fabrication: 2012

The purpose of the Laboratory for Teaching, Research and Extension in Digital Design is to empowering research in the Sector of Perception and Representation of the Department of Architecture and Urbanism of the Federal University of Ceará. Its objective is engendering a coordinated action with new technology and its applications to Design, Architecture and Urbanism. The Lab seeks to encourage and enhance the scientific development, supporting and guiding researches in undergraduate and graduate levels which consider the inclusion or expansion of knowledge in the area of new media (digital technology).



#### LAPAC - LABORATÓRIO DE AUTOMAÇÃO E PROTOTIPAGEM PARA ARQUITETURA E CONSTRUÇÃO

[LAPAC - Laboratory of Automation and Prototyping for Architecture and Construction]

## Universidade de Campinas

[University of Campinas] Campinas, Brazil http://lapac.fec.unicamp.br/

Coordinator: Gabriela Celani Current Staff: 11 Foundation/Beginning with Digital Fabrication: 2006

The Laboratory of Automation and Prototyping for Architecture and Construction (LAPAC) was created as part of the initiatives of a research group called Contemporary Theories and Technologies applied to Design (with support of FAPESP, CAPES and CNPq, Brazilian research agencies). This group has three main lines of research: 1.Design automation (CAD scripting and Parametric modeling); 2.Generative design (Shape grammar, Genetic algorithms and Fractals); 3.Digital fabrication (Aditive, Subtractive, and Formative processes and 3D digitation).

In Design Automation, we started working with textual scripting languages (AutoLisp and VBA) and then moved to visual programming and parametric modeling first with Generative Components and then with Rhinoceros/Grasshopper and Dot Net.

In the field of Generative Design, we have worked initially with Shape Grammars in the analysis of modern Brazilian architecture and landscape design. Presently we are participating in the Digital Alberti project, headed by Professor Mário Kruger, from Coimbra University, in which Shape Grammars are being used to understand the relation between Albertian rules and Portuguese/ Brazilian colonial architecture. We also have students working on fractals and evolutionary design for design synthesis.

In the field of Digital Fabrication, we started using of a laser cutter and a 3D printer simply to produce scale models. With the CNC router we evolved to larger formats, and finally got to full scale fabrication, using a plasma cutter from a nearby industry.

## AREA COMPUTACIONAL

[Architectural Computing Unit]

Departamento de Arquitectura, Universidad Técnica Federico St María [Department of Architecture, Technical University Federico Santa María] Valparaiso, Chile

www.arq.utfsm.cl/area-computacional/

Coordinators: Luis Felipe Gonzalez Böhme, Marcelo Bernal Verdejo Current Staff: 3 Foundation/Beginning with Digital Fabrication: 2000/2008

Architectural Computing Unit pursues the use of computer as a tool of reasoning in the performance of professional exercise. Our mission is to collaborate in the training of architects technological vision and competence in science and technology applied to architecture.

We teach subjects whose primary objective is to develop in students a structured problem-solving application in architecture using physical computing and robotics pedagogical thinking. Also we impart training and advanced workshops whose main goal is to develop knowledge and skills to apply computational methods and tools integrating advanced design and production modes.

We encourage innovation and development of practical applications in various fields of architecture. We coordinate the laboratories COMPULAB (www.arq.utfsm.cl/compulab) and Labomat (www.arq.utfsm.cl/labomat) in order to support all teaching and extension activities of the Department of Architecture of UTFSM.

#### gt2P - GREAT THINGS TO PEOPLE

Santiago, Chile www.gt2p.com

Coordinators: Guillermo Parada, Sebastián Rozas Current Staff: 7 Foundation/Beginning with Digital Fabrication: 2010

We are a studio involved in projects of architecture, art and design, established in Santiago, Chile. We are in a continuous process of research and experimentation in digital crafting, promoting new encounters between the technologies for projecting and the richness of the local expressed in traditional materials and techniques. Our work methodology has two dimensions. First, we seek to systematize knowledge and observation, whether of natural, artificial, geometric or spatial, phenomena, through generative algorithms. Here parametric design is a tool to guide the planning of projects that we carry out, enabling the integration of its stages of design, development and production.

On the other hand, we have discovered an artistic dimension that connects us with our cultural heritage, through the incorporation of traditional experience and knowledge that feed and qualify the generative algorithms or DNA that we create. Exposing the unexpectedness of manual processes and local materials is a way to value what we are in what we do.

#### 8 DESENHO PARAMÉTRICO E FABRICAÇÃO DIGITAL - AUT2501

[Parametric Design and Digital Fabrication -AUT2501]

With the support of FabLab SP (Associated with FabLab MIT)

Faculdade de Arquitetura e Urbanismo, Universidade de São Paulo [School of Architecture and Urbanism, University of São Paulo]

São Paulo, Brazil www.fau.usp.br/cursos/graduacao/design/ disciplinas/aut2501/index.html

#### Coordinator: Arthur Hunold Lara Current Staff: 1 Foundation/Beginning with Digital Fabrication: 2011

As an elective course of the School of Architecture and Urbanism, Parametric **Design and Digital Fabrication seeks** to develop and implement new design processes involving the digital fabrication. Its goal is to provide tools to enable the development of logical thinking of parametric representation and programming of algorithms. It introduces possibilities of modeling and programming, and explores the development of digital and physical models through simulation and digital fabrication. It seeks to understand the process of parametric project, which demand spatial reasoning with strong connection to the logical and mathematical operations, formal variation with insertion and modification of data, development of new design strategies and proofs by digital fabrication.

#### CID - CENTRO DE INFORMÁTICA Y DISEÑO

[CID - Center of Computer Science and Design]

#### Facultad de Arquitectura, Diseño y Urbanismo, Universidad Nacional del Litoral

[Faculty of Architecture, Design and Urbanism, National University of the Littoral]

Santa Fé, Argentina

#### DEPARTAMENTO DE DISEÑO Y TEORÍA DE LA ARQUITECTURA

[Department of Design and Theory of Architecture]

#### Facultad de Arquitectura, Construcción y Urbanismo, Universidad del Bio-Bio

[Faculty of Architecture, Construction and Urbanism - University of Bio-Bio]

#### Concepción, Chile

http://urdirlab.blogspot.com.br/ | http:// arquitectura.ubiobio.cl/

#### Director CID: Maria Elena Tosello Director of the Research Program CID: Mauro Chiarella Current Staff: 30 Foundation/Beginning with Digital Fabrication: 1995/2011

The Universidad Nacional del Litoral (Argentina) and the University of Bio-Bio (Chile) possess a decade of institutional collaboration. The Department of architecture (FACyU-UBB) and the CID-Center of computer science and design (FADU-UNL) collaborate in research and teaching of graduate (Ph.d. and master's degree) through various inter-agency funding sources. Bancapar has been funded by FONDECYT 2011 N° 3110025 (M. Chiarella) and 2013 Regional FONDART Regional 2013 (N. Sáez).

These experiences are not born from a specific institutional policy. They start from different individual projects to form a collective project of institutional collaboration. They do not constitute a coherent and linear work on digital fabrication line. They are open experiences of research and design. They prioritize freedom of research rather than institutional policies. These collaborative experiences are the meeting place between researchers, designers, managers, students and teachers of different degrees and Bachelor degrees.

## 10 PROTOBOX

Campinas, Brazil www.protobox.com.br

Coordinators: Wilson Barbosa Neto,

#### Renata La Rocca Current Staff: 2 Foundation/Beginning with Digital Fabrication: 2014

Protobox is an Architecture and Design practice located in Campinas, which explores the use of digital manufacturing technologies in Creative Industry and innovation of construction. Our mission is to demystify the use of these technologies in the field of architecture and design and bring people to design and to manufacture their ideas. Our team, with experience in both industry and important research centres in São Paulo, combines cutting-edge industrial technology with latest computer-aided design practices. Besides developing our own designs, we also work in partnership with architecture firms bridging the gap between design and manufacture of custom elements for the construction industry. Our work methodology utilizes 3D modeling programs and computer-controlled equipments capable of producing part or whole elements in 1: 1 scale components for construction.

Currently, our activities focus on the expertise of creating and manufacturing of outdoor furniture using automated plasma cutting of steel plates combined with hardwood pieces. Moreover, we have provided consulting for architecture firms in the development of custom design and manufacturing of facade components.

Finally, we offer a range of workshops for students and professionals from architecture and construction fields, disseminating knowledge and improve the practice in architecture.

## 11 PRONTO 3D - LABARATÓRIO DE PROTOTIPAGEM E NOVAS TECNOLOGIAS ORIENTADOS AO 3D

[PRONTO3D - Laboratory of Prototyping and New Technologies Oriented to 3D]

Universidade Federal de Santa Catarina [Federal University of Santa Catarina]

Florianópolis, Brazil www.redepronto3d.com

Associated with FabLab MIT

Coordinator: Regiane Trevisan Pupo Current Staff: 7 Foundation/Beginning with Digital Fabrication: 2013

Pronto 3D - Laboratory of Prototyping and New Technologies Oriented to 3D - consists of a teaching, research and extension space in the area of materialization of form through automated techniques, such as 3D printing, laser cutting and CNC machines.

Belonging to the course of Design at UFSC in Florianopolis, the Lab, its team consists of research professors, undergraduate and graduate students, participants in scientific and similar induction programs, as well as professionals involved in projects that unfold applications of research and extension. The laboratory is part of a network of rapid prototyping and digital fabrication labs, called REDE PRONTO3D which aims to structure centers strategically located in the state of Santa Catarina, currently in the city of Lages, Cricklewood and Chapecó.

REDE PRONTO3D meets Design, Architecture and Engineering courses, and all areas involving design, development and production of models, prototypes and products in full scale, assisting the different stages of the design process. 12 REDE BRASILEIRA DE FABRICAÇÃO DIGITAL

[Brazilian Network of Digital Fabrication] São Paulo, Brazil www.rbfd.com.br Associated with RhinoFab

*Coordinator:* Affonso Orciuoli *Current Staff:* 3 *Foundation/Beginning with Digital Fabrication:* 2013

Brazilian Network of Digital Fabrication (RBFD) was born from the necessity to support both commercial as training in the sectors related to the design. programming and digital manufacturing. RBFD guides the professional design and digital fabrication to use the more advanced features of technology in this sector. Among them offer training, software sales and support for all initiatives working Rhinoceros. Also affiliated with RBFD companies offer quality services that focus on individualized production of a plus for their designs. We have labor, skilled labor and can run and bring solutions to transform their designs into reality no matter the degree of difficulty.

#### 13

#### GEGRADI - GRUPO DE ESTUDOS PARA O ENSINO/APRENDIZAGEM DE GRÁFICA DIGITAL

[GEGRADI - Center for Studies in Teaching and Learning in Digital Graphics]

#### Universidade Federal de Pelotas

[Federal University of Pelotas] Pelotas, Brazil http://wp.ufpel.edu.br/aeqradi/

Coordinator: Adriane Borda Almeida da Silva Current Staff: 20 Foundation/Beginning with Digital Fabrication: 2002/2012

GEGRADI was formalized with the purpose of restructuring the graphing area in the context of UFPel, facing the possibilities of Graphic Information Technology. It is responsible for the research in digital graphics representation area established by the Master's Program in Architecture and Urbanism, PROGRAU-FAURB / UFPel. The process has always been accompanied by establishing partnerships with researchers from other fields of knowledge capable of supporting the study of Computer Graphic applied especially to architecture.

The digital graphic representation of architectural heritage has been one of the focus for development of educational, extension and research projects. Through its products, we are building up a digital collection regarding the architectural heritage of the city of Pelotas, Rio Grande do Sul.

From 2012, such methods have been expanded to produce physical models from the virtual, through digital fabrication techniques, using laser cutting and three-dimensional printing technologies. Currently, experiments are carried out to produce suitable models for tactile experience, seeking to assign accessibility to experience the historical and cultural heritage. It invests primarily in recognize parametric design concepts and technologies, aiming to improve educational processes in this field, and also perform applications in processes of analysis and representation of heritage.

## 14 labFabMVD

Facultad de Arquitectura, Universidad de la República

[School of Architecture, University of the Republic)

Montevideo, Uruguay www.farq.edu.uy/labfab

Coordinator: Marcelo Payssé Current Staff: 4 Foundation/Beginning with Digital Fabrication: 2012

The labFabMVD, is located in the School of Architecture and has computer equipment for scanning and digital manufacturing

In the lab, research and development activities are performed by teachers from DepInfo. Scanning and cutting services are provided by CEDA.

DepInfo, in behalf labFabMVD, performs the initial implementation of the necessary equipment for these purposes.



#### TALLER DE CONCURSOS

[Workshop of Competitions]

With the support of LAB CNC.FAU/UCHILE

#### Facultad de Arquitectura y Urbanismo, Universidad de Chile

[Faculty of Architecture and Urbanism, University of Chile]

Santiago, Chile www.albertofernandez.cl/UCH-studio.pdf

Coordinator: Alberto Fernandez Gonzalez Current Staff: 3 Foundation/Beginning with Digital Fabrication: 2013

Workshop of Competitions arises from the need to test experimentation and speculation of analog-digital architecture in the real world from the inclusion of competitions in the subjects that students are developing.

From problematization of each competition, students will propose different ways of approaching problems, using a methodology of project research, intrinsically linked to the dispersive thinking of architecture.

The student's learning path is designed from an incremental strategy, where the student will be trained in the first sessions with contemporary design tools focused on managing both analog and 3d modeling software (Rhino-3DMax) allowing the exploration of fluid formal possibilities during the following stages.

During the design process, students experiment freely with real models of phenomena associated with the challenge posed by the initial process of problematization. They feed back the design process by translating these phenomena on algorithms, tools and digital modifiers wich enhance the result into new limits.

Projects are manufactured with the use of laser cutters, routers and 3D printings as part of the comprehensive process of formation of the student, which means these tools not only as an end of the presentation of the project, otherwise than as part of the way to build design knowledge.



#### ALEPH ZERO

Curitiba, Brazil www.alephzero.arq.br

Coordinators: Gustavo Utrabo; Pedro Duschenes Staff: 7 Foundation/Beginning with Digital Fabrication: 2009/2010

Aleph Zero is both an architecture and design office and an experimental lab, where Philosophy. Art. Literature, and Architecture itself, take part in a constant pursuit for distinct elements that intensify the critical reflection based on the understanding of reality, the capability to generate alternatives, and the pertinence of a certain desire to a specific place/ time/culture.There is no conformation a priori, instead, there is perversion. The design is understood as a process where dissonant forces are nourished and forced to collide, settling down new oblique ways which, therefore, are attacked and questioned, becoming after each cycle more consistent, until the moment when they begin to converge towards a common direction, consonant with the initially (re) imagined concept-desire.

In the studio (derived from the previous Atelier UM+D), projects are sometimes hired or commissioned by others, sometimes initiated by members of the multidisciplinary team and sometimes grow from collaboration with industries or with educational institutions, deriving in workshops and other academic events.

Aleph Zero was initially founded by Architects Gustavo Utrabo and Pedro Duschenes, as partners and head of design; with the association of Anthropologist Hugo Loss, and Architect Ernesto Bueno, as Computational Designer; and other professionals and students.



#### SimmLab – LABORATÓRIO DE SIMULAÇÕES E MODELAMENTO EM ARQUITETURA E URBANISMO

[SimmLab - Laboratory for Simulation and Modeling in Architecture and Urbanism] Universidade Federal do Rio Grande do Sul [Federal University of Rio Grande do Sul] Porto Alegre, Brazil www.ufrgs.br/simmlab

Coordinator: Benamy Turkienicz Current Staff: 22 Foundation/Beginning with Digital Fabrication: 1994/2010

The SimmLab opened in 1994 with the scope to develop computational models for the evaluation of the impact of architectural projects and urbanization such as solar radiation, shading, urban mobility and construction area potential associated to regulatory plans, just to name a few.

Throughout the history of the laboratory topics related to the modeling of architectural and other design objects have been investigated. These models have been both static and active, with variable geometries linked to attributes of materials, building components and spatial relations connected to environmental and cultural impacts. Other research activities are concerned with the optimization of the architectural form with the support of parametric design tools. This knowledge is supporting the study of modular architecture, its structural and connection elements, and the study of the performance and behavior of the materials used in the building envelope. The Laboratory has developed various software applications, among these CityZoom (for the modeling and simulation of the environmental impact of urban rules) and the BlindArchitect, a genetic algorithm used to simulate potential floor plans solutions for residential housing. It is of a particular interest the development of knowledge related to the Tangible User Interface (TUI) paradigm.

#### 8 Lamo3D - LABORATÓRIO DE MODELOS 3D E FABRICAÇÃO DIGITAL

[Lamo3D - Laboratory of 3D Models and Digital Fabrication]

#### Faculdade de Arquitetura e Urbanismo, Universidade Federal do Rio de Janeiro (FAU-UFRJ)

[Architecture and Urbanism School, Federal University of Rio de Janeiro - FAU-UFRJ]

Rio de Janeiro, Brazil www.fau.ufrj.br/lamo3d/

Coordinator: Andrés Martin Passaro Current Staff: 5 Foundation/Beginning with Digital Fabrication: 2012

The Lab has partnerships with some researchers, especially from the postgraduate level, and receives about 1500 undergraduate students per semester. We started to introduce some workshops and lectures that were related to parametric language and design practice. Our leading works are Home-Design Reviewed (Casa Revista), a research about DIY construction and habitation in Brazil. based under the Wikihouse; Project 'Sensitive Shelters', which explores the interactions between architecture and hybrid and natural mechanisms; and Catastrophe Relief Housing, that consists of construction solutions related to digital fabrication which should fulfill certain requirements such as mobility, quickness, levity, stability, adaptability, facility of production, installation capacity; should be constructible and reusable (commitments to find solutions that should remain in place even after the catastrophe relief program is established).

#### ESTUDIO GUTO REQUENA

São Paulo, Brazil www.gutorequena.com.br

Coordinators: Guto Requena, Vitor Reais Current Staff: 3 Foundation/Beginning with Digital Fabrication: 2010

Estudio Guto Requena reflects about memory, digital culture and poetic narratives in all design scales. We shape memories through the experimental use of digital technologies. Good design should tell a good story. Our final aesthetic results from the process.

We love hybrids, interactivity and overlaying analogic with numeric. We enlarge the life cycle based in sustainable affection. Design must invite us to reflect about the time and the world we live in.Design must solve problems. Anyone can be a designer. Who is the author? Cyberculture redefined our daily lives forever.

#### 20 LAGEAR - LABORATÓRIO GRÁFICO PARA EXPERIMENTAÇÃO ARQUITETÔNICA

[Graphics Laboratory for Architectural Experience]

Universidade Federal de Minas Gerais [Federal University of Minas Gerais] Belo Horizonte. Brazil

www.arq.ufmg.br/lagear

*Coordinators:* José dos Santos Cabral Filho, Ana Paula Baltazar *Current Staff:* 19 *Foundation/Beginning with Digital Fabrication:* 1993/2012

The Graphics Laboratory for Architectural Experience (LAGEAR) of UFMG School of Architecture was the first Brazilian teaching and research laboratory in the field of architecture and new technologies of information and communication to adopt the Macintosh platform. In 2001, CAD and multimedia research converged for investigation of applications in social contexts and participatory design processes. In 2003, research was directed to the creation of low-cost immersive environments. In 2009 the investigations in the field of physical computing and tangible interfaces were deepened.From 2012 digital manufacturing were used not as a production tool of informal, irregular and complex geometries as has happened in developed countries, but as an opportunity to respond to informal, irregular and complex architectural issues present in the Brazilian context.

Currently there are three main areas of research: first, facing low cost interactive environments and connection of remote environments associated with physical computing systems and simple electronics; second, focused on immersion environments for stereoscopic design and visualization of architectural design; third, focused on parametric design process and digital fabrication.

## 21 NOMADS.USP DesignLab

Instituto de Arquitetura e Urbanismo, Universidade de São Paulo [Institute of Architecture and Urbanism, University of São Paulo]

São Carlos, Brazil www.nomads.usp.br

Coordinators: Marcelo Tramontano, Anja Pratschke Current Staff: 15 Foundation/Beginning with Digital Fabrication: 2000/2013

The lab has at its goal to explore, from the potential of digital processes currently available and using the theoretical tools offered by cybernetics, other ways of dealing with the production of design and construction elements in collaboration. It also aims to relate methods, knowledge and skills necessary for the mastery of design process skills through experiments and evaluation on technical training, to finally propose a framework of guidelines, encouraging radical changes in thinking and teaching architectural design.

Based on the existing knowledge of research in recent years and many experiments, the Nomads.usp invested in exploration of the theory of second-order cybernetics in complex management processes and design using CAD / CAM systems as platforms for advanced projective practices.

From the experiments and research developed in recent years, two fundamental questions arise for Nomads. usp: what is the feasibility of developing complex systems through feedbacks, expand the flow of project information? What is the innovation potential of these systems in the design practices?

The Design Lab, located within the Research Group Nomads.usp, appears as the convergence space that allows these exchanges, serving as a platform for the development of projective processes grounded in Conversation and Organization.

Nomads.usp has produced readings on the theme of modern habitat, connecting with different areas of knowledge, such as architecture, art, computer science, demographics, design, cultural studies, philosophy, history, mechatronics, production, psychology, social sciences, urban planning, amongst others since 2000.

## Fab Lab SP / FAUUSP

Faculdade de Arquitetura e Urbanismo, Universidade de São Paulo

[School of Architecture and Urbanism, University of São Paulo]

São Paulo, Brazil http://fablabsp.org/ Associated with FabLab MIT

Coordinator: Paulo Eduardo Fonseca de Campos Current Staff: 12 Foundation/Beginning with Digital Fabrication: 2011

The FAB LAB SP was opened in 2011 at Laboratory of Modeling and Testing (LAME) by Faculty of Architecture and Urbanism at University of São Paulo (FAUUSP). In August of 2011 a FAUUSP delegation participated in the FAB7 - The Seventh International Fab Lab Conference and Symposium on Digital Fabrication (Lima, 2011), where FAB LAB SP was recognized as new laboratory of FAB LAB - a global network led by the "Center for Bits and Atoms" of MIT Massachusetts Institute of Technology (USA). In August of 2012 the director, Prof. Neil Gershenfeld, visited us. From this meeting the foundations for the creation of the Brazil FAB LAB Association, which currently brings together several laboratories in the country, were laid.

The FAB LAB SP is itself a didactic space for experimenting and researching within the FAUUSP and the USP which is opened to other schools of USP and even to the community (Open Days, International Conferences, Workshops), through the extension activities promoted in the digital fabrication laboratory.

In 2011 was also established the Research Group "Digital Manufacturing Technologies applied to the production of Contemporary Design and Architecture" (DIGI-FAB), <digifab.fau.usp.br>, which uses the physical facilities of the digital manufacturing sector (FAB LAB SP) of the LAME and at the same time contributes to the training of its technicians and to the technological diffusion among students and researchers. Our mission include to keep a permanent activity of action and critical reflection in this area, assimilating digital manufacturing much more as knowledge than as a product.



#### 23 FAB SOCIAL

#### Faculdade de Arquitetura e Urbanismo, Universidade de São Paulo e Departamento de Informática e Telecomunicações da Prefeitura de Guarulhos

[School of Architecture and Urbanism, University of São Paulo and Telecommunications and Informatics Department of Guarulhos City Hall]

Associated with FabLab SP, FabLat

#### Coordinator: Alex Garcia Current Staff: 1 Foundation/Beginning with Digital Fabrication: 2013

The Social Fab is an itinerant project of digital inclusion that runs through the spaces of Telecidadanias (telecentres) of CEUs (Unified Education Centers) of the city of Guarulhos, São Paulo Estate. In this project are offered free computer programming workshops held with the SCRATCH software, drawing workshops computer with SKETCHCHAIR and Inkscape software, all open source. Digital fabrication activities are offered using a 3D printer, vinyl cutter and a mini milling machine. The open source operating system used is GUARUX that was developed by the technicians of **Digital Inclusion Department of Guarulhos** City Hall.

The design intent is to create digital fabrication labs using free and open technologies in Telecidadanias of Unified Education Centers. These laboratories would provide infrastructure for students of municipal schools and the community to participate in activities aimed at realization of projects. The participants are invited to build of an individual expression of knowledge using digital technologies of representation and manufacturing. The workshops address programming elements, robotics and digital fabrication in the form of small lectures and practical activities.

## 4 FabLab LIMA

Lima, Peru www.fab.pe | www.fablat.org Associated with FabLab MIT

Coordinator(s): Victor Freundt, Delia Barriga, Benito Juarez Current Staff: 12 Foundation/Beginning with Digital Fabrication: 2010

Fab Lab Lima is a project that intends to democratize the access to innovation, by developing a network of inclusive technology labs connecting the latest in digital manufacturing technologies with Latin America's potential. It integrates diverse disciplines, cultures and ages in the development of new technologies, processes and products. We work for technological democratization developing new models of inclusive laboratories, innovating processes and products of different industrial sectors, focusing particularly in the potential of Latin America, such as Multiculturalism, Eco-Diversity and Social Capital.

We developed projects by digital manufacturing, optimizing mechanical procedures and provide more time to artisan/producer to invest in creative processes directly affecting the value of the product and improving their quality of life. We develop new formats connected to diverse ecosystems, investigating the wealth of materials, complex shapes, bio-regenerative processes, solutions to energy demands, health and education of local communities. We promote social entrepreneurship through various programs and creative proposals facing social problems of insecurity, access of housing and lack of public spaces.







CID.FADU/UNL IEHU.FADU/UBA

BRAZIL

ALEPH ZERO DESENHO PARAMÉTRICO.FAU/USP ESTUDIO GUTO REQUENA FAB LAB SP/NOAH.FAU/USP FAB SOCIAL GEGRADI.FAU/UFPEL LAGEAR.EA/UFMG LAMO3D.FAU/UFRJ LAPAC.FEC/UNICAMP LED.FAU/UFC NOMADS.IAU/USP **PRONTO 3D.DESIGN/UFSC** PROTOBOX RBFD SimmLAB.FAU/UFRGS SUBdV ARCHITECTURE

#### CHILE

AREA COMPUTACIONAL/UFTSM FADyU-UBB gt2P LAB CNC.FAU/UCHILE

> **COLOMBIA** Frontis3D.R+D

**PERU** FAB LAB LIMA

**URUGUAY** LabFabMVD.FARQ/UDELAR









## ARGENTINA 2005 CID.FADU/UNL IEHU.FADU/UBA BRAZIL 2006 ALEPH ZERO FAB SOCIAL 2008 LED.FAU/UFC 2010 PROTOBOX RBFD 2011 CHILE FADyU-UBB 2012 gt2P COLOMBIA 2013 PERU FAB LAB LIMA URUGUAY

2014

DESENHO PARAMÉTRICO.FAU/USP ESTUDIO GUTO REQUENA FAB LAB SP/NOAH.FAU/USP GEGRADI.FAU/UFPEL LAGEAR.EA/UFMG LAMO3D.FAU/UFRJ LAPAC.FEC/UNICAMP NOMADS.IAU/USP **PRONTO 3D.DESIGN/UFSC** SimmLAB.FAU/UFRGS SUBdV ARCHITECTURE

AREA COMPUTACIONAL/UFTSM

LAB CNC.FAU/UCHILE

Frontis3D.R+D

LabFabMVD.FARQ/UDELAR





## **HOMOFABER:** DIGITAL FABRICATION IN LATIN AMERICA CAAD FUTURES 2015 > the next city

SÃO PAULO, BRAZIL JULY 7-31, 2015



#### CHAIR OF CAAD FUTURES 2015 THE NEXT CITY

Gabriela Celani Faculdade de Engenharia Civil, Arquitetura e Urbanismo, Universidade Estadual de Campinas [Faculty of Civil Engeneering, Architecture and Urbanism, State University of Campinas]

#### CURATOR

David M. Sperling Instituto de Arquitetura e Urbanismo, Universidade de São Paulo [Institute of Architecture and Urbanism, University of São Paulo]

#### **CO-CURATOR**

Pablo C. Herrera Universidad Peruana de Ciencias Aplicadas – UPC [Peruvian University of Applied Sciences]

DESIGN CONCEPTION Rafael Goffinet de Almeida Rafael de Oliveira Sampaio Rodrigo Scheeren David M. Sperling

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Instituto de Arquitetura e Urbanismo, Universidade de São Paulo

[Institute of Architecture and Urbanism, University of São Paulo]

Rafael Goffinet de Almeida Rafael de Oliveira Sampaio Rodrigo Scheeren David M. Sperling José Renato Dibo José Eduardo Zanardi

## ESCOLA DA CIDADE

SUPPORT TEAM Carol Tonetti Daniel Fiker Ligia Velloso Nobre

#### SUPPORT

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Instituto de Arquitetura e Urbanismo Universidade de São Paulo

[Institute of Architecture and Urbanism University of São Paulo]

Universidade Estadual de Campinas [State University of Campinas]

Centro de Tecnologia da Informação Renato Archer

[Center of Information Technology Renato Archer]

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