



**KA-AU KNOWLEDGE ALLIANCE
FOR ADVANCED URBANISM**
VOLUME 11
IAAC_GLOBAL SUMMER SCHOOL '17
BARCELONA NODE



Co-funded by the
Erasmus+ Programme
of the European Union

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au-**

Knowledge
Alliance
for Advanced
Urbanism

DELIVERABLE 2.5 SUMMER SCHOOL WORKSHOP REPORT

IAAC_SUMMER SCHOOL WORKSHOP SPACE DYNAMICS BARCELONA NODE

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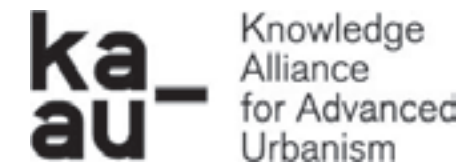
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FOREWORD // KNOWLEDGE ALLIANCE FOR ADVANCED URBANISM

THE PROJECT

The increasing availability of data creates new opportunities not only for the monitoring and management of cities but also for changing the way we describe, understand and design them, challenging many fundamental assumptions of urban design and planning professions. In order to promote the innovative education and training that emerging technologies require, higher educational institutions together with industrial partners have created the Knowledge Alliance for Advanced Urbanism (KA-AU).

KA-AU develops courses, symposia and an educational and training platform, offering participants an innovative education on planning and design.

The group understands “Advanced Urbanism” as the sensitive integration of ICTs in cities, taking into consideration cultural heritage, environmental and social issues. “Advanced Urbanism” is about designing and planning processes, instead of just concrete artefacts, linking citizens, businesses and governments in sustainable urban culture. “Advanced Urbanism” requires changing traditional design and planning practices towards a more open, collaborative and interdisciplinary approach.

KA-AU is co-funded by the Erasmus+ Programme of the European Union.

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ABOUT THE WORKSHOP AND THE ORGANISERS

IAAC Summer School was a full-time two-week course in Barcelona that provided 37 students from different nationalities with both practical and theoretical knowledge on smart furniture development.

Its structure consisted in learning modules on Urban Strategies and Technology (Concept), Generative Design and Data (Coding) and Fabrication and Robotics (Prototyping), carried out by expert tutors in Computational Design, Coding, Parametric Design, Digital Fabrication, Interactive and Media, but also Contemporary Urban Phenomena and Urban Planning.

In addition, lectures by renowned professionals and academics relevant to the topics (Tomas Diez - Fab City

Global Initiative, Phyl Aires - CITA Copenhagen Flora Robotica, Luis Falcon - inAtlas, Africa Sabè - Santa&Cole, Areti Markopoulou - IAAC) were given during the course.

As final output students developed 1:1 models of smart urban furniture exploring how to combine digital inputs and physical behaviours, defining a new generation of public spaces.

The proposed urban elements were able to perform different activities and to this aim technologies such as sensors, gateways and cameras for tracing activities and flows were integrated. The elements developed defined scenarios of new urban services, physical interactions and future inhabitation of the Public Space.

Students worked in collaboration with experts from the industry, including KAAU partners Santa & Cole, which brought its expertise on urban elements' design and InAtlas, an expert in urban analytics.

KAAU partners and KAAU Project Officer (Silvia Benedetti - EACEA, Areti Markopoulou - IAAC, Chiara Farinea - IAAC, Manuel Gausa - Unige, Nicola Canessa - Unige, Elodie Nourrigat - ENSAM and Champ Libre, Jacques Brion - ENSAM, Africa Sabè - Santa&Cole, Andrea Caridi - Darts, Agnès Jullian - Technilum, Maritè Guevara - Mcrit, Oliver Broadbent - USP, Silvia Bianchini - inAtlas, Ramon Prat - UrbanNext) have been invited to be the final projects jury, giving their opinion and advice to students.

GLOBAL SUMMER SCHOOL is a project of IAAC
involving more cities all over the world.
Barcelona Node Summer school was leaded and hosted at



in partnership with



with the support of:



with the active collaboration of

(ka-au partners)





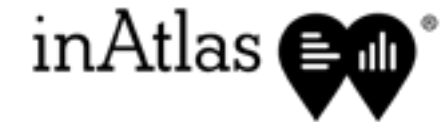
IAAC(Institute for Advanced Architecture of Catalonia) is an international centre for research, education, investigation; one of its objectives is to develop multidisciplinary programmes that explore international urban and territorial phenomena.

The Self-sufficiency Agenda, central to all research lines developed in IAAC, establishes the responsibility for confronting the process of global urbanisation from multiscale operations through prototypes that promote environmental, economic and social sustainability.



Santa & Cole is a small, independent, and global company interested in a two-speed city: the slow, pedestrian city and the high-speed, technological Smart City. For the slow city they offer well-designed, ergonomic urban furniture, with a collective identity and meaning.

They present useful, durable pieces that are locally manufactured and environmentally conscious. For the high-speed city, they embrace LED technology, editing efficient, durable elements to save energy and minimize light pollution.



inAtlas is a Big Data and Location Analytics company that offers strategic business solutions. It has created a proprietary technology that increases the speed of geospatial data processing. In 2014 it launched inAtlasPlaces, the first Geospatial SelfService Web App that helps entrepreneurs and small businesses to choose the right location for their new businesses.

In 2013, inAtlas was recognised as an Innovative New Tech Company by the Government of Spain, Minister of Economy and Competitiveness.

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IAAC - GLOBAL SUMMER SCHOOL'17//
SPACE DYNAMICS - BARCELONA NODEGLOBAL SUMMER SCHOOL

The Global Summer School (GSS) is a platform defined by ambitious, multi-scalar investigation on the implications of emergent techniques in our planned environments.

Each year, international teams located in key cities (in 2017: Barcelona, Beirut, Beijing, Tehran, Moscow, Monterrey, Muscat) around the globe explore a common agenda with projects that are deeply embedded in diverse local conditions.

Participants are involved in an international laboratory to test their design hypothesis, understanding how design conclusions derived locally can be tested and evolved globally in different ci

ties where other teams reside. This intensive two-week course put in contact each participant to ongoing research agendas in robotics, simulation, physical computing, parametric design, digital fabrication, and other relevant emerging design methodologies.

Specific emphasis is placed on understanding the multiscalar implications of design conclusions, thus creating critical advanced research on the application of new technologies in design.

This report presents the results of the work developed within Global Summer School-node of Barcelona.

MAIN TOPICS

Over the last decades a new generation of cities and urban planning paradigms have emerged.

Technology has risen as a driving force defining new urban developments and government's decisions.

The City has started to implement technology at different scales, providing more accurate models describing its functions, organization and relationships. Within this context, Public Spaces are being redefined in their consistency.

The public space is the soul of the City. It is the area of overlap and inter-connection: the place where the

character of a society is materialized and where all infrastructure networks that connect city's functional nodes, come together. If the public space we inhabit today follows principles/protocols of the Industrial revolution, the Information society is boosting the emergence of other protocols for the design and performance of Public Space elements.

GSS17 agenda focuses on the applications and implications of new technologies in the dynamic field of public space.

Specifically GSS17 focused on the advancements of technologies of in-

formation, interaction and fabrication in the redefinition of public space, as catalyst for achieving resilience and high quality of life.

New modes of interaction among social, environmental and economic agents can be fostered through the redefinition of the Public Space.

How do we design and inhabit it? How does it perform? What does it produce?

As part of the GSS17 program, students defined strategies for the applications of Advanced Urban Technologies as essentials means for the change.

Testing the combination of software and hardware students explored real-time data capture, energy generation, storage and reuse, material adaptability, real-time management of time-uses and citizen-space interaction.







BARCELONA BRIEF

The architectural culture of Barcelona is rooted in the historical identity of a city shaped by a tradition of innovation.

From Cerdà's Eixample to Léon Jaussely's plans and the Macià plan, Barcelona is a leading place in the formulation of modern theories of town planning, including pioneering projects such as the recently imple-

mented "Superblock" plan on mobility redistribution proposed by the urbanist and ecologist Salvador Rueda.

In our digitally connected and overpopulated cities, public Space needs a renewed capacity to power the essence of the public sphere. Issues such as lack of security and accessibility or excessive contamination just

to name a few, are reducing the historical function of public spaces and challenge people to find alternative physical or digital spaces with similar effects.

Technology is emerging as a powerful generator of a new digital public sphere, that can produce a substantial impact on the physical shape of the city.

The rise of new tools and planning strategies brings designers and urbanists to face new challenges for future cities.



COURSE DEVELOPMENT.

During this course, students explored how to combine digital inputs and physical behaviours, defining a new generation of public spaces.

Initially, students were implementing technology not only to trigger interactions among citizens but also to map social behaviours, environmental conditions and energy flows.

Once analysed various layers of urban complexity, the final goal of the course was the digital design and fabrication of a series of 1:1 urban elements to be placed in the Pilot Project of Poble Nou Superblock. Superblock (part of SuperrillaPlan for Barcelona), aims at closing to the traffic a part of the city roads,

creating pedestrian areas and public space. The proposed urban elements were able to perform different activities, integrating technologies such as sensors, gateways and/or cameras for tracing activities and flows.

The system defined scenarios of new urban services, physical interactions and future inhabitation of the Public Space.

Students were exposed in a unique environment of Applied Research by working in collaboration with experts from the industry, including Santa & Cole, as well as InAtlas both partners of ka-au network.

**Which is the new urban configuration that emerges in the Public Space?
How do urban elements interact with the citizens and how do they perform?**



GSS17 _ BARCELONA

STRUCTURE

IAAC Global Summer School was structured in three main learning modules, led by expert tutors, that in a full-time two-week course, provided students with both practical and theoretical knowledge.

In addition, lectures by renowned professionals and academics relevant to the topics were given during the course.

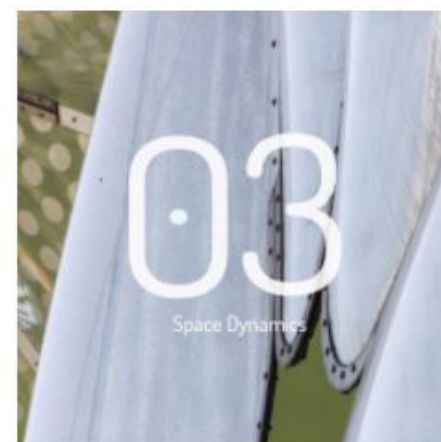
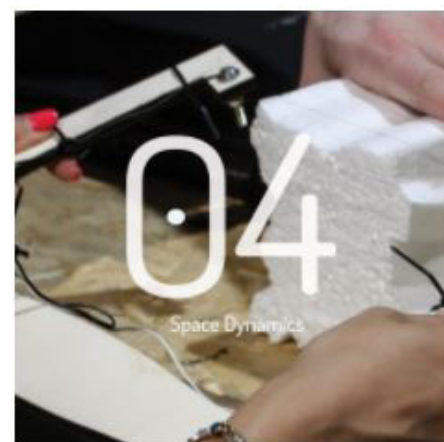
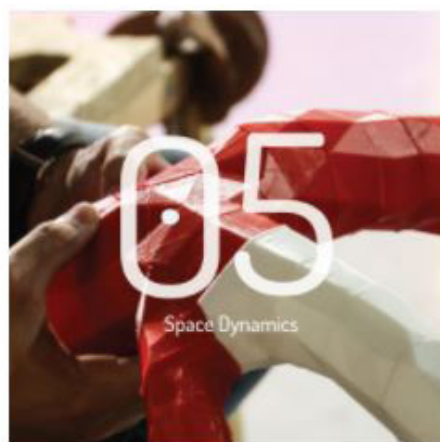
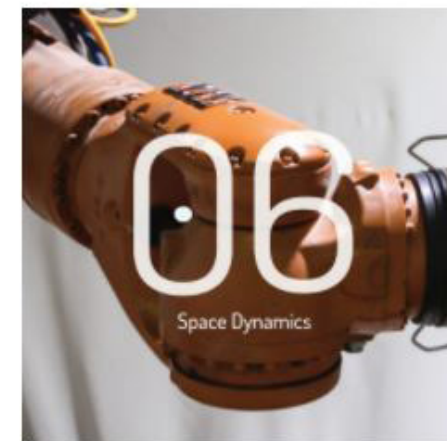
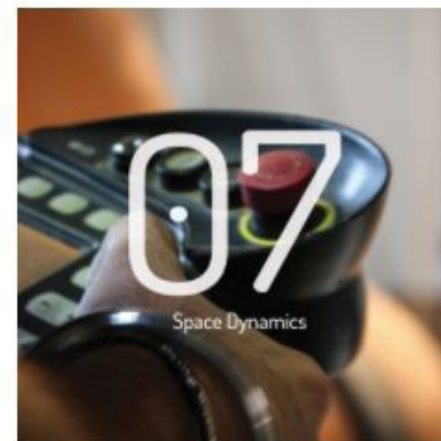
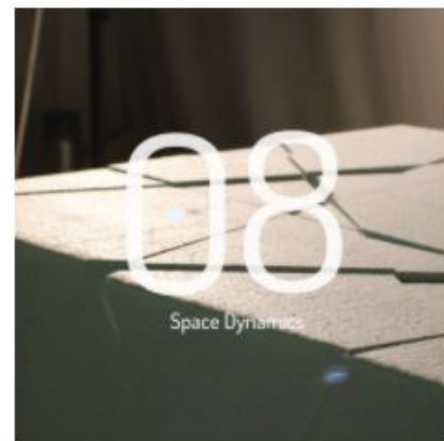
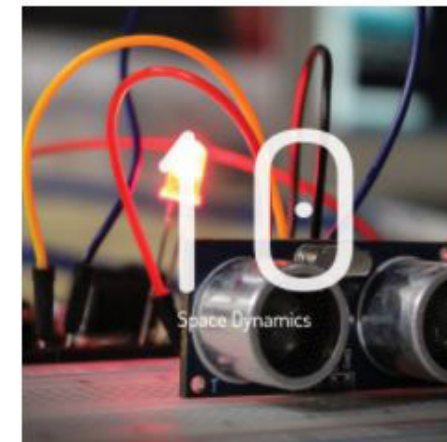
These were broadcasted in the different node-cities, all globally connected.

The course was structured in three-course modules aiming towards the common objective of the fabrication of 1:1 urban furniture, transferring and digitally interrelating multiple sets of data collected from the city.



CALENDAR

		DAY 1 MONDAY 3RD	DAY 2 TUESDAY 4TH	DAY 3 WEDN. 5TH	DAY 4 THUR. 6TH	DAY 5 FRIDAY 7TH	DAY 6 SAT. 8TH	
MORNING	10.00/13.30	CS	CS/US	CS	CS/US	CS	WORKING SESSION	
BREAK	13.30/15.30							
GLOBAL LECTURE	15.00/16.00	—		—		—		
AFTERNOON	16.00/19.00	PC/DF	PC/DF	VISIT	PC/DF	PC/DF	WORKING SESSION	
LOCAL LECTURE	19.00/20.00		—		—			
		DAY 7 MONDAY 10TH	DAY 8 TUESDAY 11TH	DAY 9 WEDN. 12TH	DAY 10 THUR. 13TH	DAY 11 FRIDAY 14TH	DAY 12 SAT. 15TH	DAY 13 SUN. 16TH
MORNING	10.00/13.30	CS	CS/US	CS	CS/US	CS	FINAL PHASE	GLOBAL EVALUATION
BREAK	13.30/15.30							
GLOBAL LECTURE	15.00/16.00	—		—		—		
AFTERNOON	16.00/19.00	PC/DF	PC/DF	VISIT	PC/DF	FINAL PHASE	FINAL PHASE	GLOBAL EVALUATION
LOCAL LECTURE	19.00/20.00		—		—			



MODULE 01: CONCEPT_ URBAN STRATEGY AND TECHNOLOGIES (US)

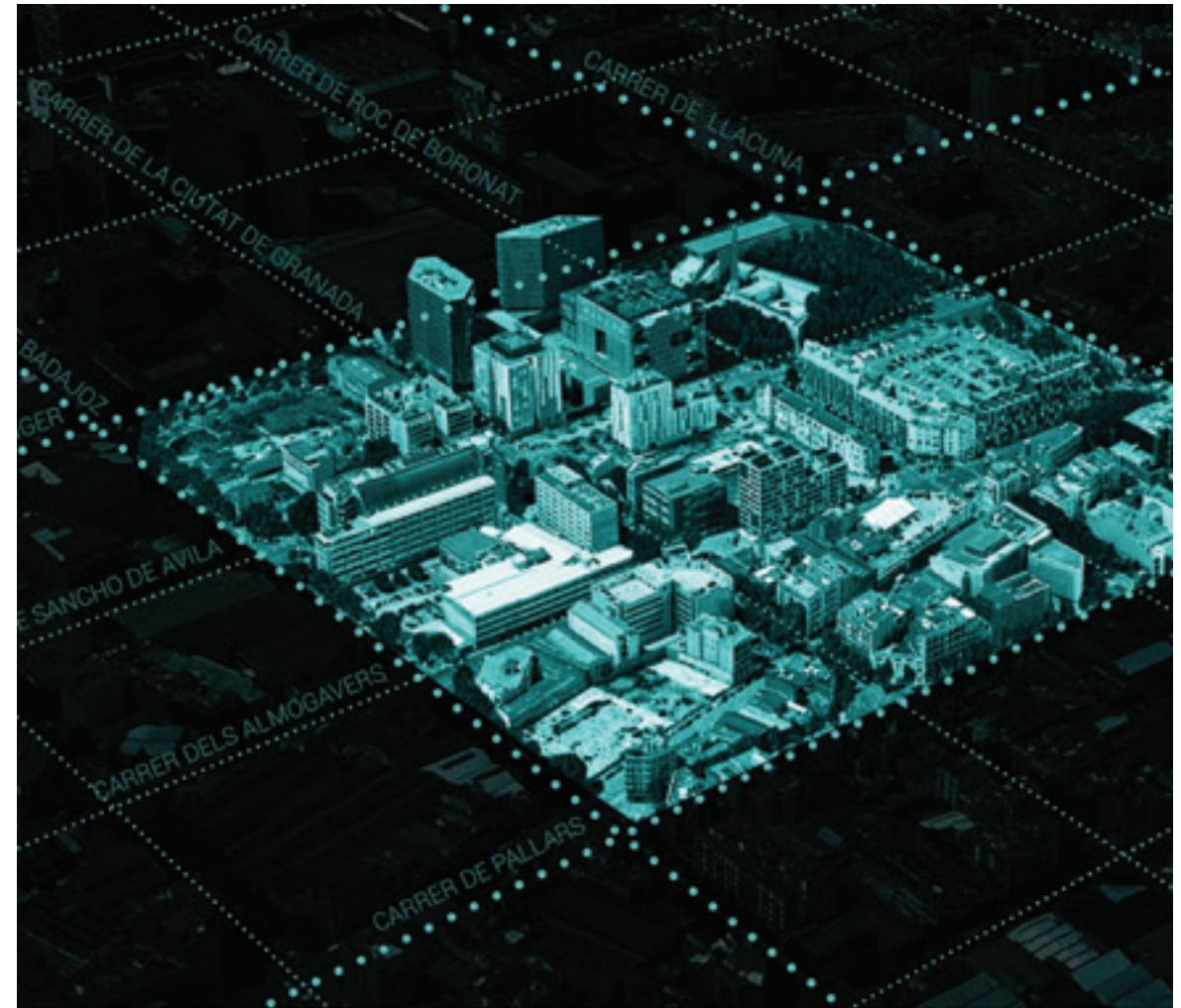
The module in Urban Strategy and Technologies was giving to the students a theoretical base, but also a series of active bits of knowledge on the topic of City System, Advanced Urbanism and the current panorama around these. In the framework of the rapid and exponential growth of technology and urbanisation, this module aims to transfer to the students a new knowledge on innovative technologies and solutions that can help cities to become more efficient and more consistent with today's exponential technological evolution. The tutors created a calendar of classes focusing on a schedule developed for visualising a clear picture of the current state of the art in Urban Contemporary Phenomenon. The course was led by Chiara Farinea and Mathilde Marengo, both part of the Advanced Architecture Group of IAAC and involved into ka-au Agenda.



Chiara is an Italian architect, Phd in Urban Planning (IUAV-Venice), with a Master in Advanced Architecture obtained at IAAC (Barcelona). She is currently Head of European Projects and faculty at IAAC. Moreover, she is founding partner at Gr.IN Lab art group, exhibiting installations in 2015 at Venice Arsenale and Turin for the Italia-China Art Biennale.



Mathilde is an Australian – French – Italian PhD Architect whose research focusses on the Contemporary Urban Phenomenon. She is currently the Academic Coordinator and Faculty at the Institute for Advanced Architecture of Catalonia, as well as PhD Supervisor within the InnoChain EU research project.



Students elaboration

MODULE 01: CONCEPT_ URBAN STRATEGY AND TECHNOLOGIES (US)

Within the Urban Strategy and Technologies module, a course led by Santa&Cole industrial company was developed . Following the guidelines of ka-au project, the collaboration between academic and industrial partners was fundamental for changing traditional design and planning practices towards more open and collaborative practices.

Santa&Cole is an urban element design and production company with the aim of producing a stable catalogue of good Indoor and outdoor products including Urban Lighting and Urban Elements.

Specifically, this module aimed to transfer to the students the whole idea of a comprehensive working-strategy going from needs to solutions in a really short and intensive time.

The students experimented situations of difficulties that people with incapacities can meet in public space, in order to better understand their difficulties. The following step was defining a project strategy to design urban furniture, respondent to people needs and more sustainable also with regards to the production process.

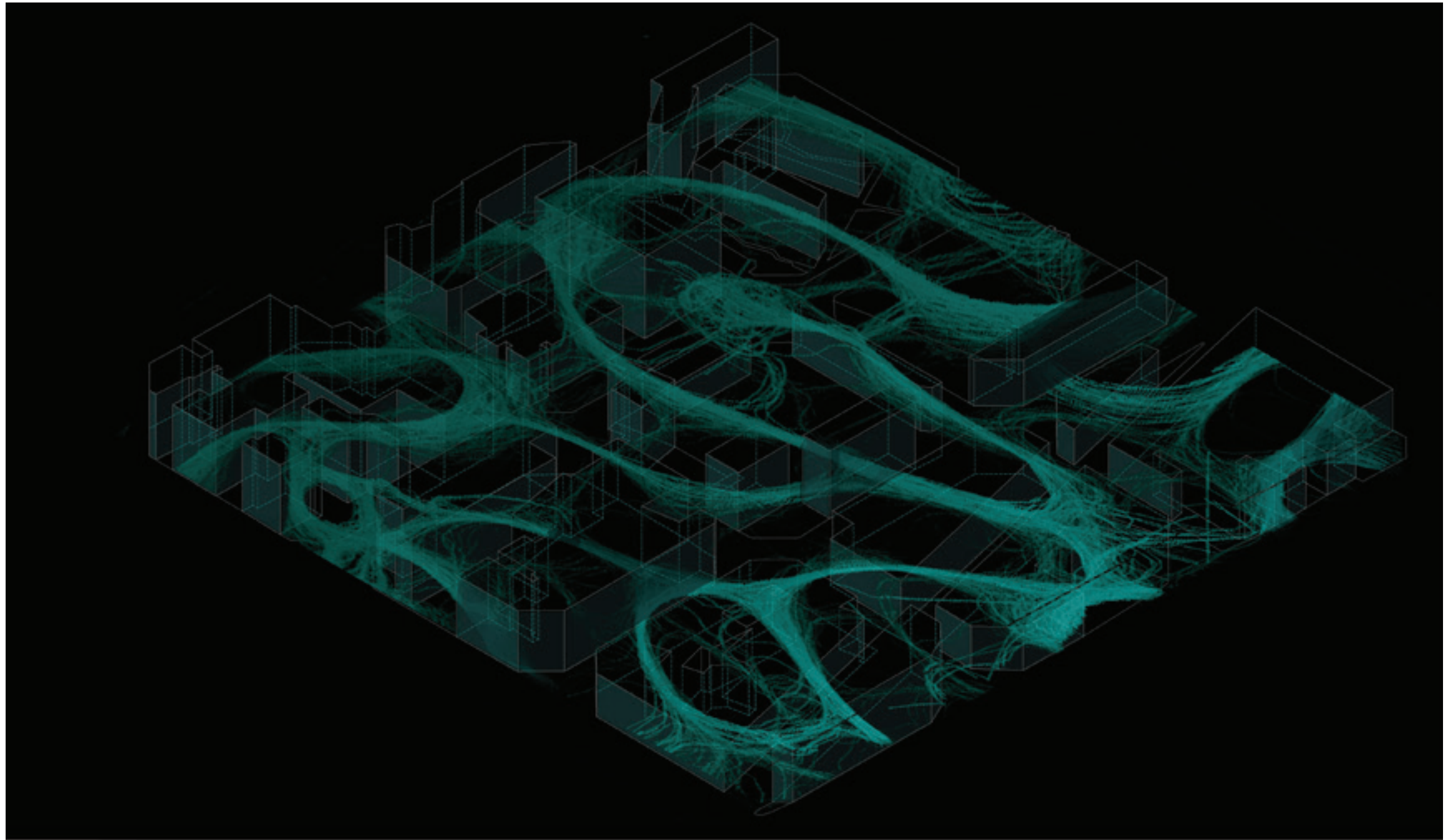


Àfrica is an architect; she obtained a master in architectural lighting design, focusing on light and lighting.

She is part of Santa & Cole projects department working on all phases of product design and development.



Students experimental training



MODULE 02: CODING GENERATIVE DESIGN AND DATA COMPUTATIONAL STRATEGIES (CS)

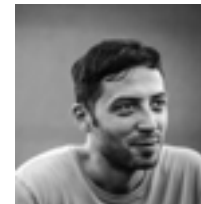
Algorithms, in computer science, are habitually defined as fixed and often finite procedures of step-by-step instructions.

Structures of logics interfacing with data sourced from any computable phenomena, from the physical space of our built environment to the networked space of digital culture, are reshaping not only design strategies but the entire perception of Architecture.

The module in Data Computational Strategies and Generative Design focused on emergent strategies based on algorithmic design, introducing also Augmented Reality and Virtual Reality (AR/VR) applications.

The AR/VR was an introductory course that enabled participants, with or without any previous experience, to develop virtual and augmented reality applications. Starting from the very basic concepts of interfaces and covering some aspects of a basic AR/VR application development, the participants obtained skills and expertise necessary to develop their own AR/VR apps.

The module was led by Aldo Sollazzo Global Summer School Director, and Rodrigo Aguirre, expert in Computational Design both from IAAC. Starsky Lara, from Noumena, has taught coding and development of AR/VR interfaces.



Aldo is an architect and researcher. He has got a Master in Architecture in 2007, Master in Advanced Architecture at IAAC in 2012, Fab Academy diploma in 2014 in the Fab Lab Barcelona. Aldo is expert in computational design and digital fabrication, founder of Noumena and Reshape, as well as Head of IAAC Visiting Programs.



Rodrigo is a Nicaraguan architect specialised in the fields of parametric tooling, digital fabrication and manufacturing. He has got the Master in Advanced Architecture at IAAC. Currently he is faculty at the Institute, and he is collaborating in projects regarding form finding and computational methods related to generative design.



Starsky is computation designer & product development Engineer, with experience in manufacturing, computer science and IoT. He has got the Master of Advanced Architecture at IaaC and the Master in Product Engineering and Manufacturing Processes at UPC. Currently, he is developing VR-Edge platform, where designers and journalists can build a new internet experiences.

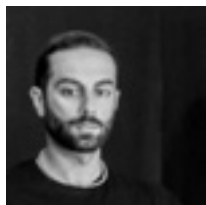


PROTOTYPING (FABRICATION AND ROBOTICS) PHYSICAL COMPUTING (PC)

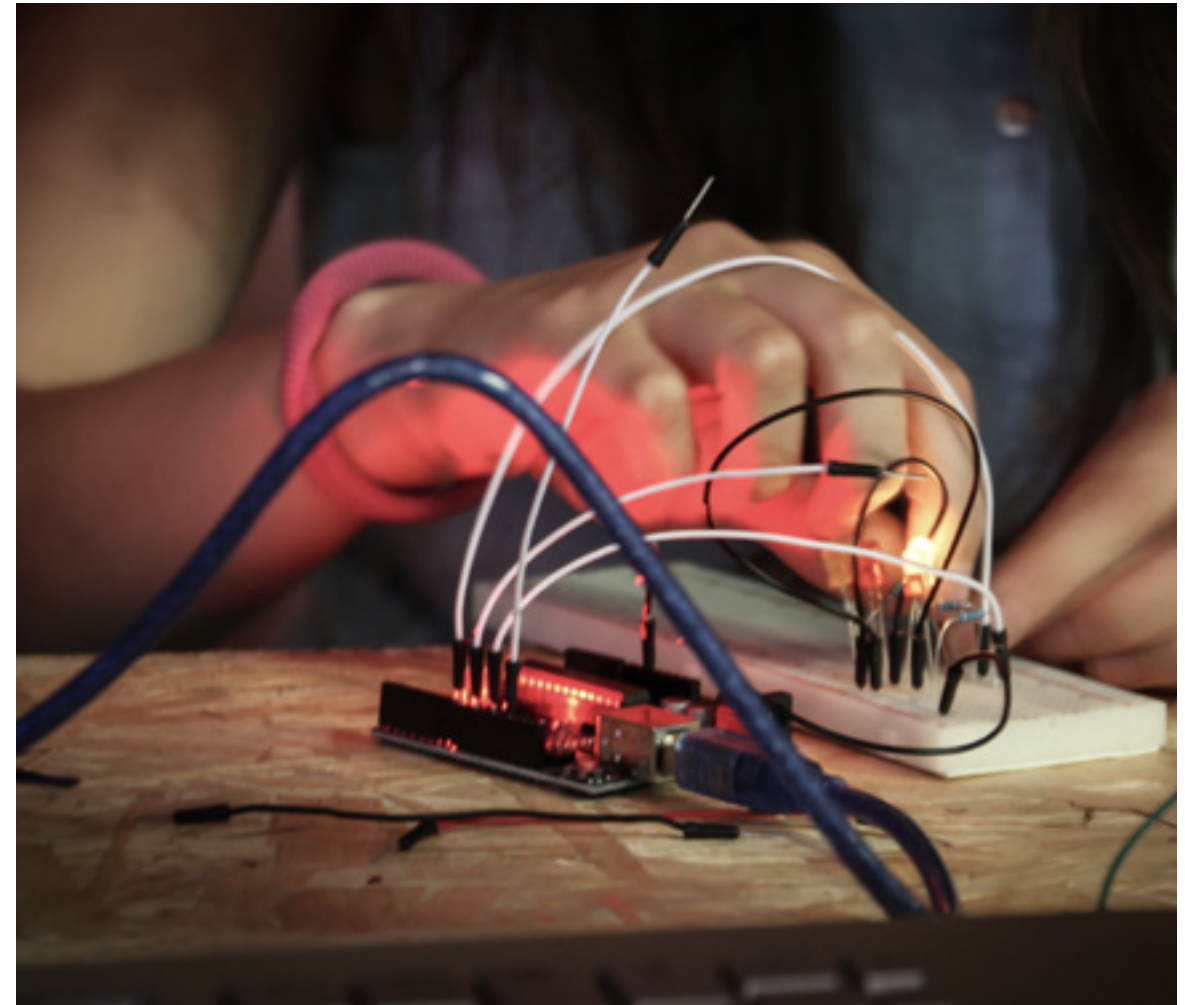
Physical computing means building interactive physical systems through the use of software and hardware able to sense and respond to the analogical world. In a broader sense, it is a creative framework for understanding human beings' relationship with the digital world, using sensors and microcontrollers to elaborate analog input through a software system to control electro-mechanical devices such as motors, servos, lighting or other hardware. This course gave students an essential introduction to the world of open source programming languages and physical computing. Students learned about basic coding/scripting tools that complement IaaC's digital tools and fabrication framework, integrating primary interfaces, visualising methods, data sensing, and actuation to conduct more advanced research and architectural proposals with embedded technology. The module of Physical Computing was led by Angel Muñoz, expert in Programming, and Cristian Rizzuti, interactive media artist, both part of IAAC's team.



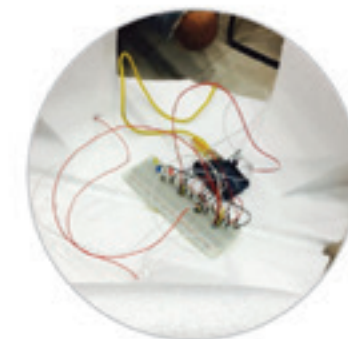
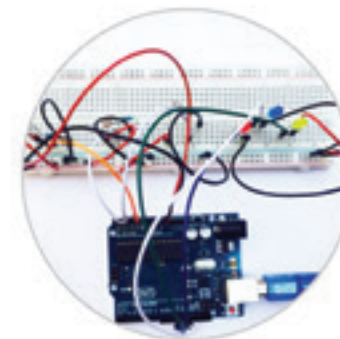
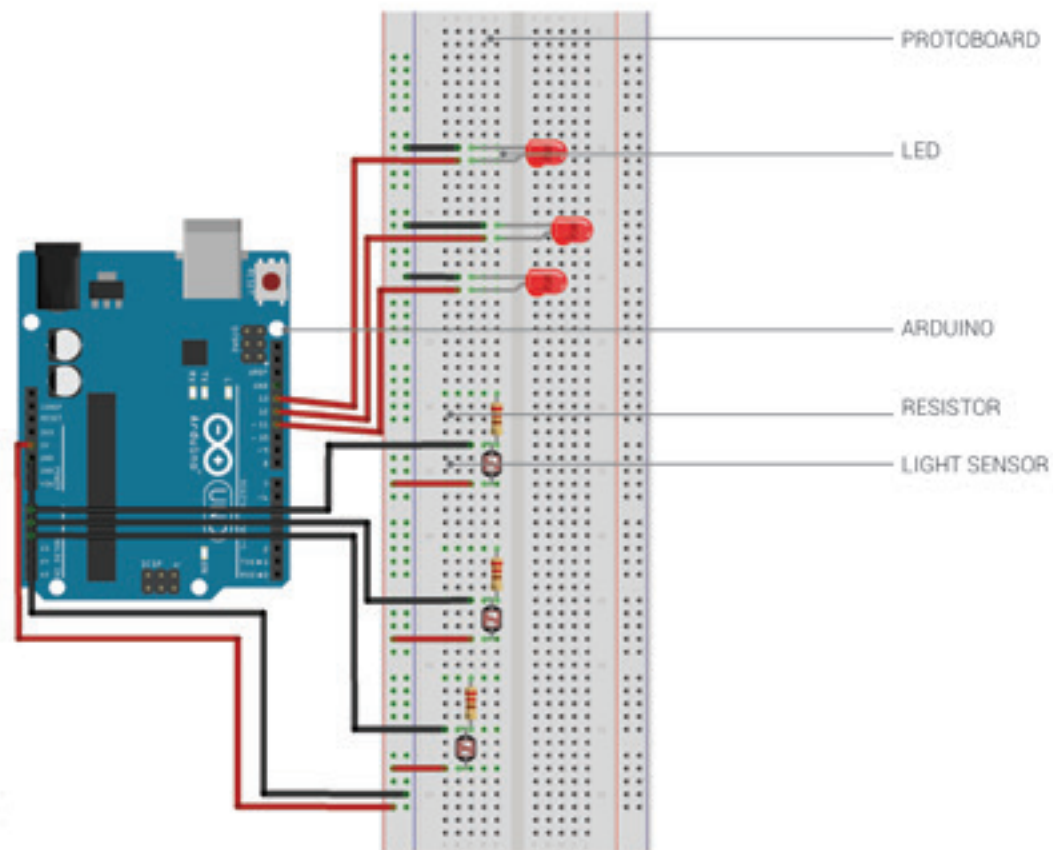
Angel is a Programmer from La Rioja in Spain. He worked in the interactivity and multimedia departments for several well know brands, developing an interest in open hardware. He studied Electronic Product Design obtaining a Higher Vocational Training Qualification. Angel is part of the IAAC Academic team as Physical Computing Expert.



Cristian is an interactive media artist Graduated in Visual and Multimedia Art. He has achieved a M-IA Master course at IUAV University of Venice focusing on interactive immersive environments. Cristian has focused his personal investigation on the role of human perception and the definition of synesthetic spaces and emotional sounds connected to the body.



Students work session (PC class 01)



ARDUINO PROGRAMMED SYSTEM - PROCESS PICTURES

```

#include <Arduino.h>

// Define pins
const int LED1_PIN = 10;
const int LED2_PIN = 11;
const int LED3_PIN = 12;
const int LDR_PIN = A0;

// Define variables
int led1_status = 0;
int led2_status = 0;
int led3_status = 0;
int ldr_status = 0;

// Setup function
void setup() {
  pinMode(LED1_PIN, OUTPUT);
  pinMode(LED2_PIN, OUTPUT);
  pinMode(LED3_PIN, OUTPUT);
  pinMode(LDR_PIN, INPUT);
  Serial.begin(9600);
}

// Loop function
void loop() {
  // Read LDR sensor
  ldr_status = analogRead(LDR_PIN);

  // Print LDR status
  Serial.print("LDR: ");
  Serial.println(ldr_status);

  // Control LEDs based on LDR status
  if (ldr_status < 100) {
    digitalWrite(LED1_PIN, HIGH);
    digitalWrite(LED2_PIN, HIGH);
    digitalWrite(LED3_PIN, HIGH);
  } else {
    digitalWrite(LED1_PIN, LOW);
    digitalWrite(LED2_PIN, LOW);
    digitalWrite(LED3_PIN, LOW);
  }

  // Delay
  delay(1000);
}

```

ARDUINO SCRIPT

```

// Processing sketch
import processing.serial.*;

// Define pins
final char HEADER = 'H';
final char A_TAG = 'A';
final char R_TAG = 'R';
final int LED1_PIN = 10;
final int LED2_PIN = 11;
final int LED3_PIN = 12;

// Define variables
Serial myPort; // Create object from Serial class
int led1_status = 0;
int led2_status = 0;
int led3_status = 0;
int ldr_status = 0;

// Setup function
void setup() {
  size(300, 300);
  myPort = new Serial(this, "COM3", 9600);
}

// Loop function
void loop() {
  // Read LDR sensor
  ldr_status = analogRead(A0);

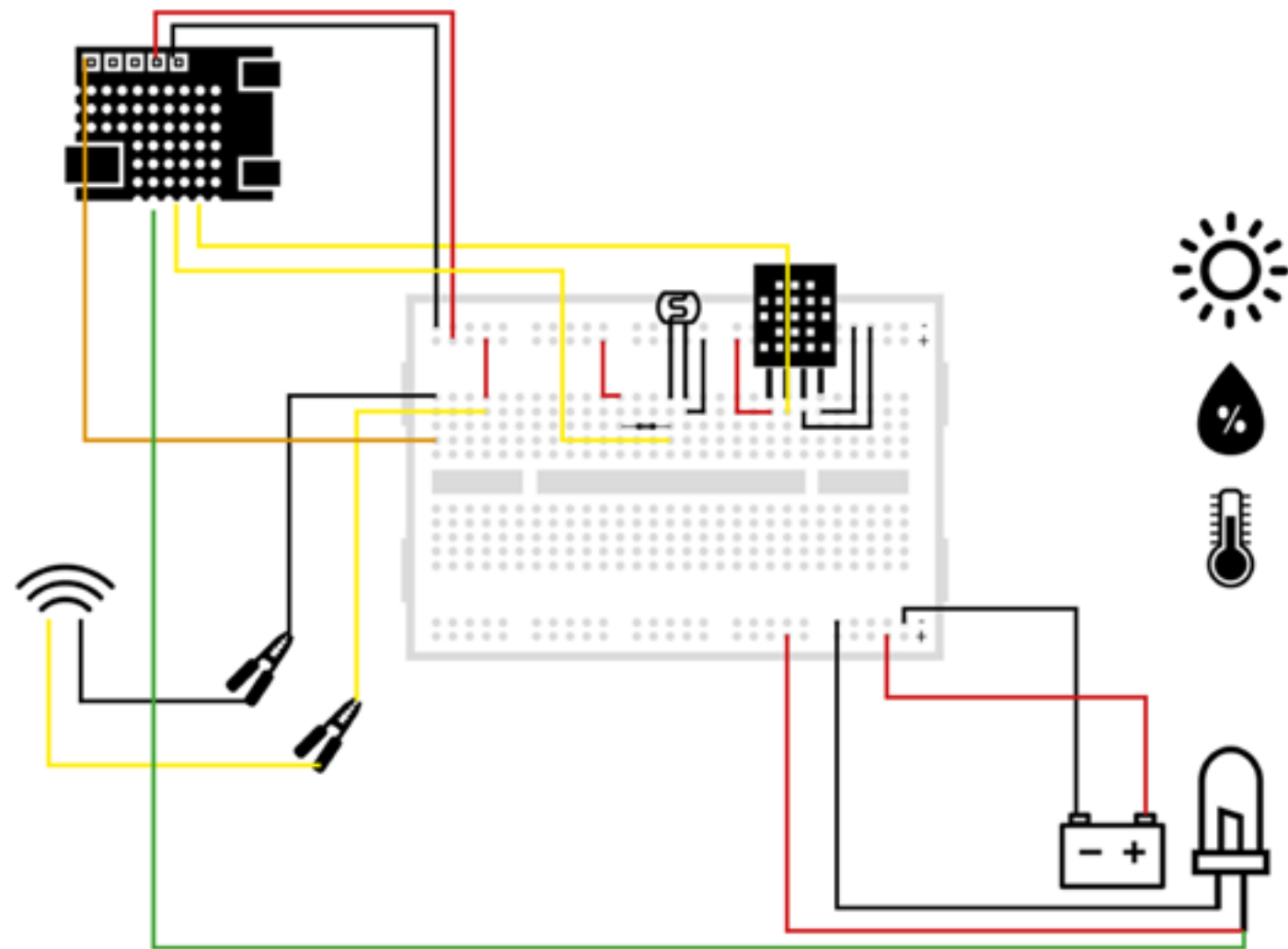
  // Print LDR status
  String ldr_status_str = String(ldr_status);
  myPort.write(HEADER);
  myPort.write(A_TAG);
  myPort.write(ldr_status_str);
  myPort.write(R_TAG);

  // Control LEDs based on LDR status
  if (ldr_status < 100) {
    digitalWrite(LED1_PIN, HIGH);
    digitalWrite(LED2_PIN, HIGH);
    digitalWrite(LED3_PIN, HIGH);
  } else {
    digitalWrite(LED1_PIN, LOW);
    digitalWrite(LED2_PIN, LOW);
    digitalWrite(LED3_PIN, LOW);
  }

  // Delay
  delay(1000);
}

```

PROCESSING SCRIPT



PROTOTYPING (FABRICATION AND ROBOTICS) DIGITAL FABRICATION (DF)

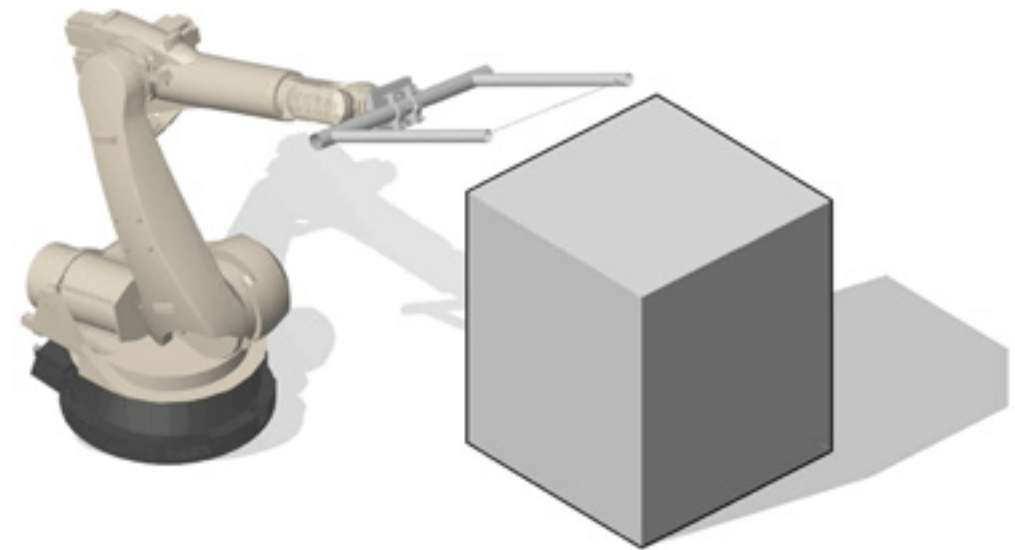
Digital Fabrication was an introductory module, on new production techniques developed through the relation between computer data and machine oriented materialisation. It was part of the course of prototyping and robotics.

The relation between design and digital fabrication CAD / CAM processes in architecture is not new anymore. It started during the last two decades of the XXth century, affecting the way architecture is produced, and changing the way machines are constructed and conceived for the production of architecture. The course focused performances based design with efficient fabrication methods, specifically using, in this case, the 6axis robotic arm.

The digital fabrication course encouraged students to re-search on the production of non-standard components and on the use of tools for optimising the relation between form and function, promoting the exploration of design/production processes.



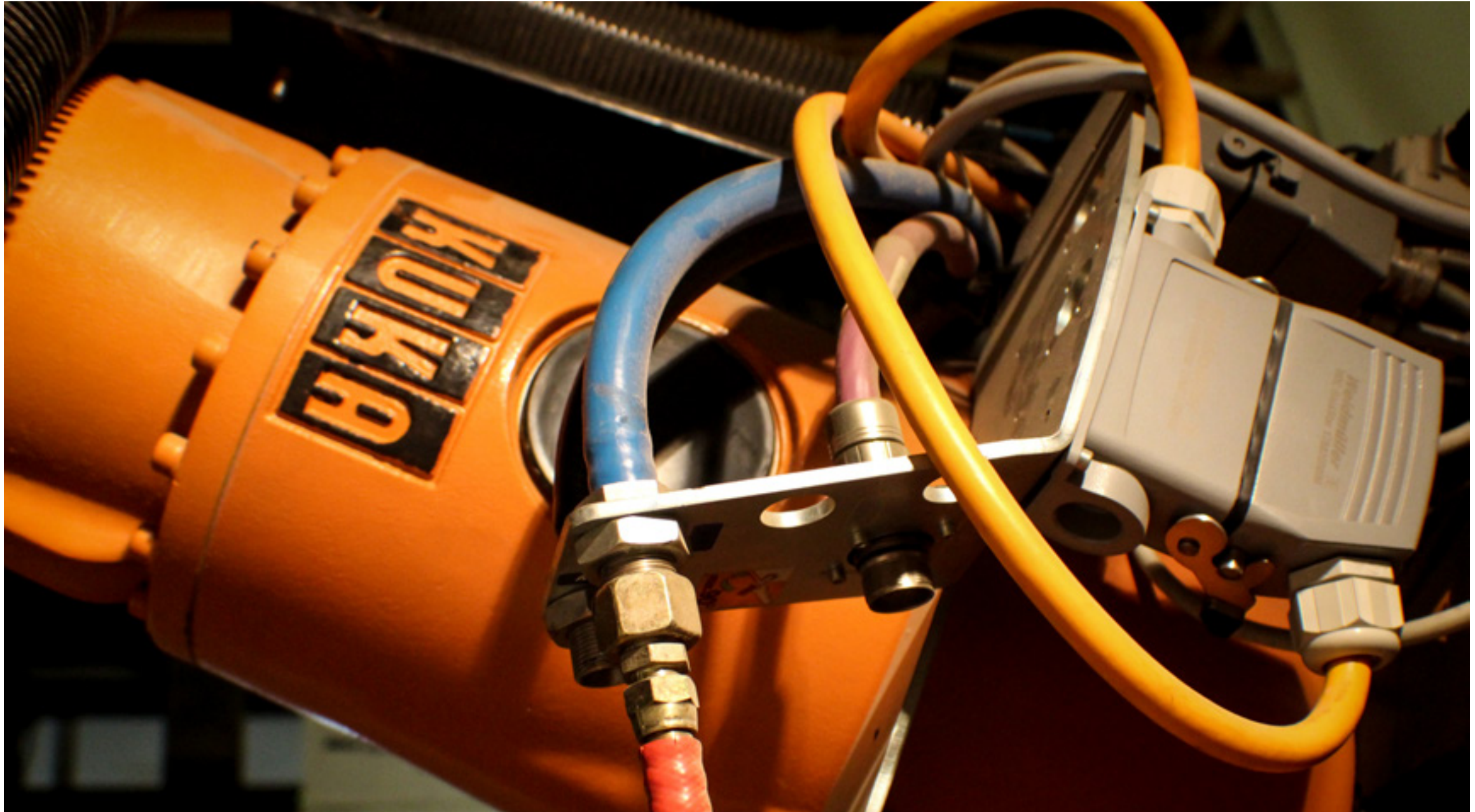
Kunal is an Indian architect and a Digital and Robotic fabrication researcher. He is currently active in the academic field with workshops in India, Spain, Iran and France. Focusing on machines making architecture, he joined IAAC in 2016.



| Students elaboration

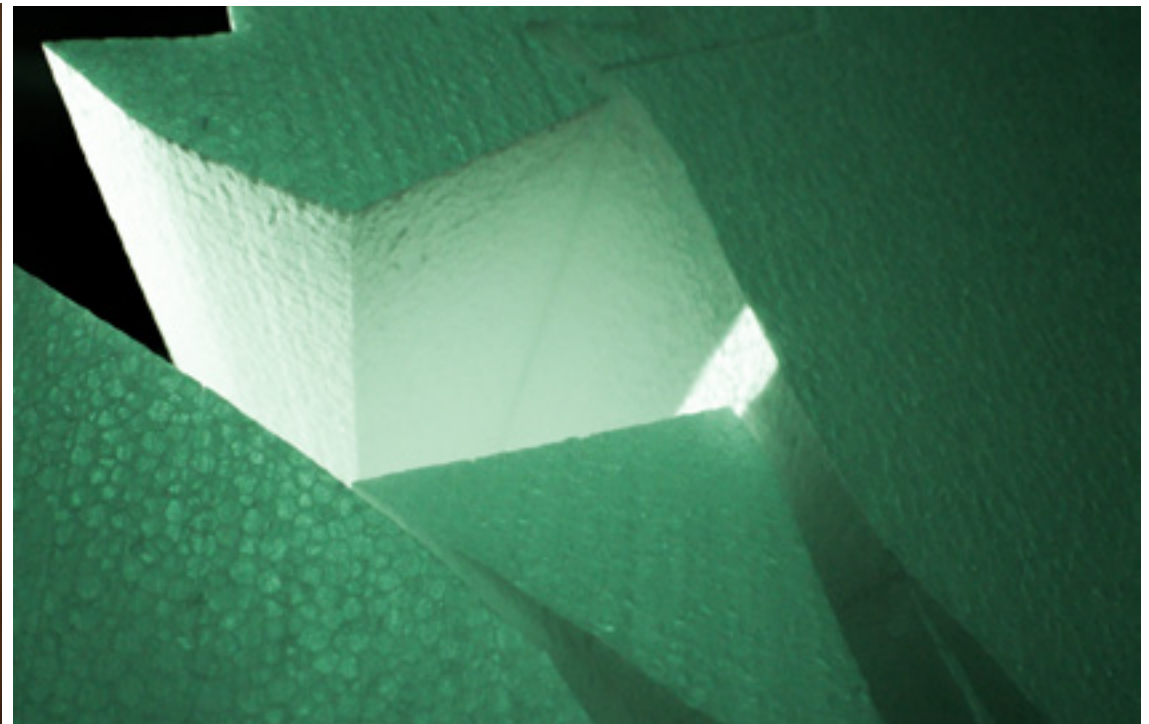
module **03**_b





| Prototyping Activities Machine





LECTURES & GLOBAL LECTURES

During IAAC Global Summer School lectures by renowned professionals and academics relevant to the topics were given.

Locally IAAC hosted lectures, that were open also to the public, by: Tomas Diez from FabCity on the topic of Fab City Global Initiative, Luis Falcon from inAtlas, that talked about Big Data and Cities Management, Africa Sabè from Santa&Cole and Areti Markopoulou from IAAC Advanced Architecture on City and Technology.

There was also the opportunity to involve students in a lecture of Phyl Aires - from CITA Copenhagen Flora Robotica in the framework of Innochain programme.

He focused on the topic of Challenging Customary Expectations of Architecture. Moreover, Global on-line lecturers were Long Nguyen-Beirut, Zubin Khabazi-Tehran, Daniela Frogheri-Monterrey, Andrew W.Haas-Beijing, Eduard Haiman and Vadim Smacktin from Moscow.



Phil Ayres is an architect, researcher and educator. Phil's research explores the potentials that lie at the intersection between digital and material practice. His current focus is on adaptive systems that combine technical and organic systems, together developing supporting digital design environments.

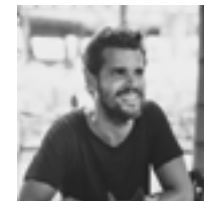


Africa is an architect; she obtained a master in architectural lighting design, focusing on light and lighting.

She is part of Santa & Cole projects department working on all phases of product design and development.



Luis has a Master in Strategic Planning and Architecture, and in Urban Planning. He is Co-Founder and CEO of inAtlas. He is also Director of Urban Consultancy and Strategic Planning at Intelligent Coast and Member of the Sectorial Commission of Knowledge and Strategy of the Tourism Table of the Generalitat of Catalonia.



Tomas is an Urbanist specialized in digital fabrication and its implications in the future of cities. He is the director of Fab Lab Barcelona at laaC, the FabAcademy global coordinator, and the EU project manager of the Fab Foundation. His research interests focus on the use of new technologies in cities.



Areti is an architect, educator and urban technologist working on the intersection between architecture and digital technologies. She is the Academic Director at IAAC, co-editor of Urban Next and co-founder of StudioP52. Her research explores new architectural models allowing built and public space to dynamically adapt to behavioural and environmental changes over time.



4

OUTPUTS

Students, in groups, worked during this 2-weeks intensive workshop exploring how to combine digital inputs and physical behaviours, defining a new generation of public spaces.

Initially, students implemented technology not only to trigger interactions among citizens, but also to map social behaviours, environmental conditions and energy flows. Then, they proposed different approaches to the topic.

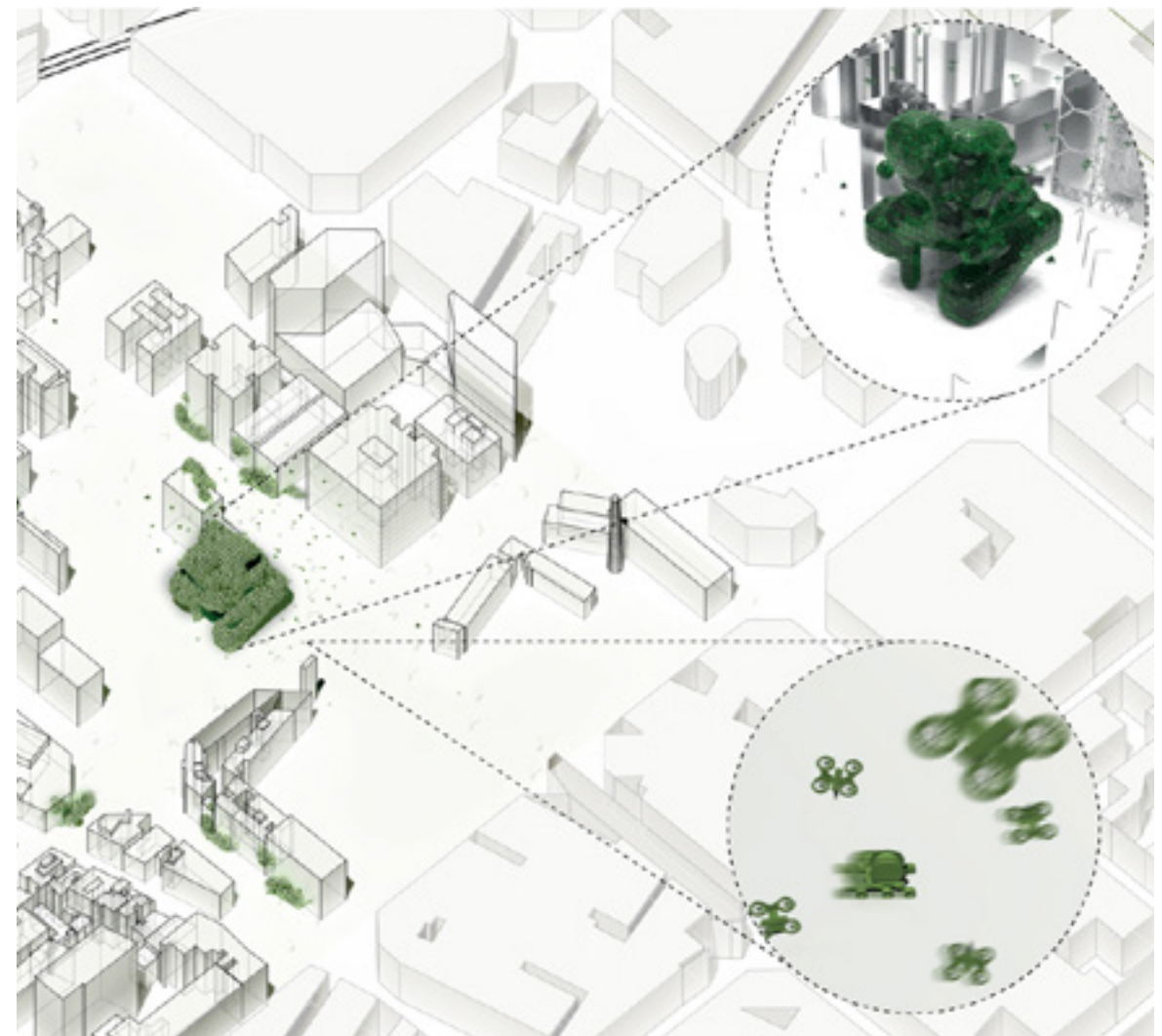
They proposed a series of urban elements able to perform different activities integrating technologies such as sensors, gateways and cameras for tracing activities and flows.

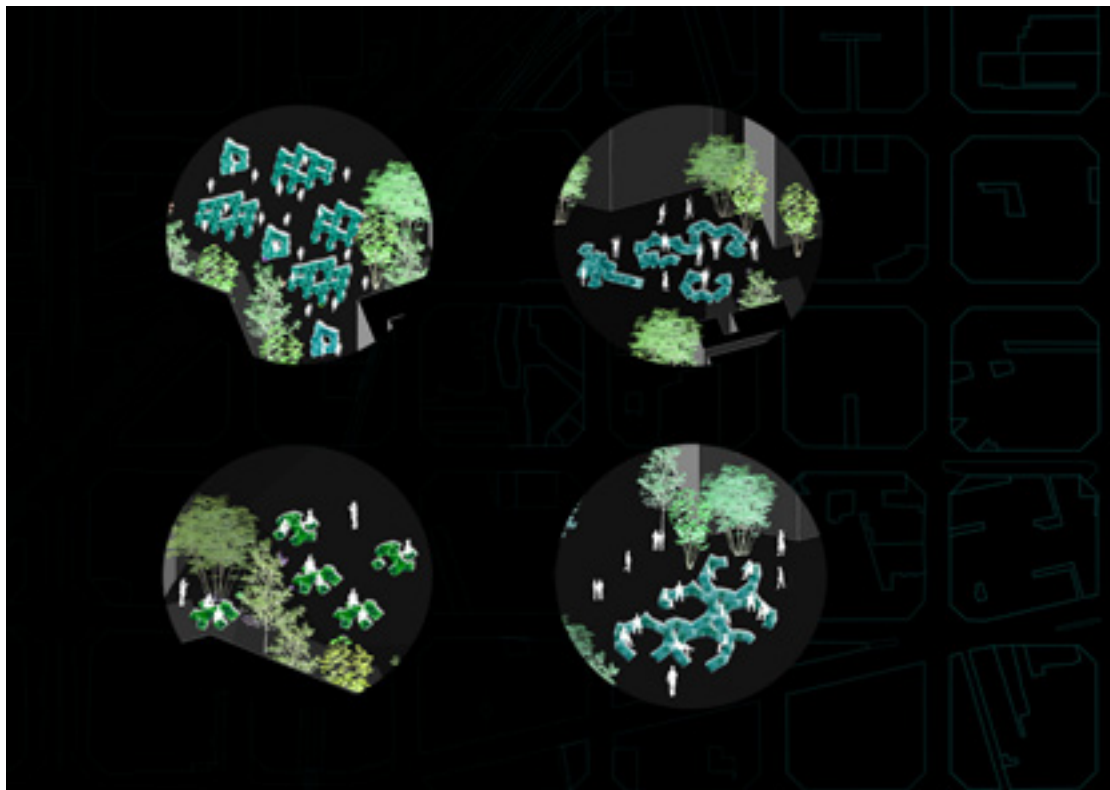
The urban elements system defined scenarios of new urban services, physical interactions and future inhabitation of the Public Space.

Students were exposed to a unique environment of Applied Research, resulting from the collaboration between IAAC- Research Centre and experts from the industry, including Santa & Cole and InAtlas.

Students' final presentation was structured in 6 steps to cover all topics discussed over the course.

Following the same structure of the whole programme, they presented their projects in a final Global Presentation in front of their local jury into a Global Streaming one, in front of their 100 colleagues (and boards) coming from all over the world.





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CONCLUSIONS
AND RECOMMENDATIONS

The workshop was an intense experience which allowed students to get familiar with many topics, around the common idea of developing a critical approach towards a data-driven design process.

Important attention was given to familiarise students with the necessary instruments needed to convert data into information, using computation as a common ground.

Proposing such a complex program was an ambitious task, which couldn't have been possible without the appropriate involvement of the students participating in the course.

The learning by doing/hands-on approach was fundamental to enable students to deeply understand the concepts presented in the course.

Students were really satisfied about this programme. With the results of the USP analysis on the courses we saw that this Summer School was helping students learn about technology, methods for using it and how it impacts on the way we think about and practice architecture.

Every respondent said this course had impacted the way they would carry out their projects, either in practice or research.

“Weeks after it has ended, I find myself keeping investigating on topics covered during the course.”

“It will definitely change the way I design.”

(Student of Iaac Summer School, Barcelona, July 2017)





Final presentation - Jury comments on the projects of the students



Final presentation - Barcelona Node Group



Final presentation - Barcelona Node Group

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