



STUDIO TOPIA
SCIENCE · ART · SYMBIOTIC

laboral
Centro de Arte y Creación Industrial



HOW TO WORK AT THE INTERSECTION OF ART AND SCIENCE IN EDUCATIONAL CONTEXTS



A guide to listening, thinking and inhabiting our world

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Photographs: [Feria de Arte y Ciencia](#)
(11-15 November 2025, Gijón)

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ISBN: 978-84-09-85690-9

Legal Deposit: M-13548-2026

This project was co-funded by the European Union's Creative Europe programme under grant agreement No. 101130939. The views and opinions expressed in this publication are solely those of the authors and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor the EACEA can be held responsible for them.

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BACKGROUND



In an era marked by unprecedented challenges, Studiotopia aims to harness the creative synergy between artists and scientists to address a central issue: the Symbiocene. A term coined by eco-philosopher Glenn Albrecht, the Symbiocene concept envisions a future in which humanity lives in harmony with the Earth and all its inhabitants, fostering mutual flourishing and deeper interconnectedness.

Through Studiotopia, artists and scientists from different backgrounds collaborate on projects aimed at shedding light on the complexities of the Symbiocene. Each of the participating organisations set up a Local Challenge Committee, made up of experts who, from biodiversity hotspot analysis to research into sustainable technologies, bring their own perspectives on our relationship with the natural world.

Together, these organisations act as drivers of innovation and collaboration, fostering dialogue and exchange across disciplines and borders. Studiotopia aims to inspire new ways of thinking and acting in the face of global challenges.

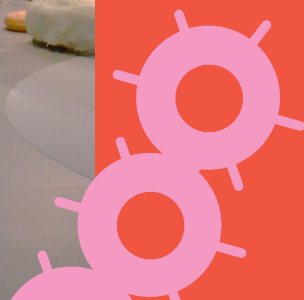


Eating life: collaborations between our bodies and other species is the title of the challenge defined by LABoral Centro de Arte's Local Challenge Committee, made up of scientist Felipe Lombó, artist María Castellanos and the GRIGRI collective.

The human body is a complex ecosystem in which a multitude of species coexist, and our health depends, to a large extent, on the balance between all these co-inhabitants, which, in many cases, also play an essential role in the processes producing the food that nourishes us.

Asturias, the territory where LABoral Centro de Arte is located, also offers numerous examples of biodiversity linked to the health of ecosystems. It is also the EU territory with the greatest diversity of fermented dairy products, associated with a remarkable wealth of species and artisanal processes.

At a time in history when food prices and distribution are shaped by geopolitical factors, obesity rates are rising in Europe, and it is necessary to rethink our food production and consumption patterns, the question arises: How can we address this issue from a health and sustainability perspective? This is one of the questions posed by this Local Challenge.



WHO PRODUCES THIS GUIDE



LABORAL CENTRO DE ARTE Y CREACIÓN INDUSTRIAL

Is a pioneering exhibition and production space in Spain at the intersection of art, science and technology. It offers artists, collectives and creative industries residency programmes, training and creation laboratories. It also offers the public an innovative programme of exhibitions, workshops and activities aimed at all audiences.

GRIGRI

Is an association dedicated to cultural and social intervention taking a community and transdisciplinary approach. It works in a collaborative and experimental way, based on situated practice, seeking to maintain a constant dialogue with the context, and taking shared experience and links as the fundamental basis for the design and implementation of the work they do.

FELIPE LOMBÓ holds a PhD in Biology from the University of Oviedo (1998). He directs the BIONUC research group (Biotechnology of Nutraceuticals and Bioactive Compounds), which is part of the IUOPA (Principality of Asturias University Institute of Oncology) and the IISPA (Principality of Asturias Health Research Institute). He has carried out his research at Ruhr-Universität Bochum, the University of Oviedo and Stanford University, and has spent time at Georg-August-Universität Göttingen, Analyticon AG, the University of São Paulo, and the University of Tokyo.

Since 2020, **LEA LUKA SIKAU** and **DENISA PÚBALOVÁ** have been collaborating as the sikau/pubalova duo on the intersection of media arts and experimental sound theatre. Their residency at LABoral, as part of the Studiotope programme, continues their research on interspecies collaboration, digestion and microbial kinship.

COCO MOYA is an artist and a musician. Her work is situated at the intersection between sound, territory and technology. She is part of the site-specific music collective Menhir, together with Iván Cebrián. She is the author of the thesis *Geomancia sonora: el paisaje como partitura* (Sound Geomancy: The Landscape as Score) and completed a Master's degree in Art and Research at the Universidad Complutense de Madrid. She currently works as an assistant lecturer at the School of Fine Arts at the same university.

MARLÉN LÓPEZ FERNÁNDEZ has held a PhD in Architecture since 2017 from the University of Oviedo and University College London (UCL). She provides consultancy services in the field of education, creating and implementing bio-inspired learning programmes. Her approach seeks to encourage the acquisition of knowledge through direct contact with the natural environment, stimulating scientific-technological curiosity and creativity in artistic and design processes.

SUSANA VELASCO is an architect and lecturer at the Universidad Politécnica de Madrid (UPM). She conducts research into architecture as a field of mediation capable of weaving links between bodies and landscapes. Her work in communities and territories proposes self-built interventions that incorporate ritual, question land ownership and use, and compile archives of minor narratives with which to recover other possible futures.

MARGA PADILLA is a computer programmer and the author of several critical thinking texts on technologies and the network society. In her work she analyses the evolution of the social uses of technology, the struggles of collectives in the network and the emergence of a new social and collaborative ecosystem in the face of commercial uses, taking advantage of the possibilities of the distributed network. She recently published the book *Inteligencia artificial: jugar o romper la baraja* (Artificial Intelligence: Play or Tear Up the Deck) with the Traficantes de Sueños publishing house.

RAFAEL SÁNCHEZ-MATEOS

PANIAGUA is a teacher, artist and independent researcher. He has worked at schools of Fine Arts, Art History and Architecture, as well as in various national and international Master's degree programmes in Contemporary Art. The founder of various artistic collectives, his work lies at the intersection between the arts and the social sphere, popular cultures, and the aesthetic experience.

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INTRODUCTION

The purpose of this guide



Let's start at the beginning. To understand the process prior to the development of this guide, it is worth briefly looking back to 2024, when LABoral Centro de Arte took its first steps to concretise its participation in the Studiotopia project by defining the Local Challenge that would inform the design of the future actions taken within the framework of this initiative.

This Local Challenge, formulated under the title *Comerse la vida: colaboraciones entre nuestros cuerpos y otras especies* (*Eating Life: Collaborations Between Our Bodies and Other Species*), was accompanied by a Local Challenge Committee made up of the scientist Felipe Lombó, the artist María Castellanos, and the GRIGRI collective, who, together with LABoral Centro de Arte, followed and supported the different activities linked to its development.



These activities included, among others, the organisation of two calls for residencies, one of them aimed at emerging artists, in which the sikau/pubalova duo was selected, as well as the design of the educational programme that gave rise to this guide, which also included both artists' participation.

More specifically, this guide is an effort to systematise the work process and the conclusions stemming from the implementation of this educational programme, which culminated in the Art and Science Fair held at LABoral Centro de Arte from 11-15 November 2025. This programme was designed and coordinated by the school's Education Department in collaboration with GRIGRI.



The educational programme was structured around six workshops designed by six professionals invited from different fields and with backgrounds linked to the intersection between the disciplines. They were also the ones who facilitated these six concrete experiences of work spanning art and science.

453 secondary school students from seven schools in different parts of Asturias took part in these workshops: IES Cuenca del Nalón (Langreo), IES Cristo del Socorro (Luanco), Colegio Salesiano Santo Ángel (Avilés), IES Rosario Acuña (Gijón), IES Jerónimo González (Langreo), IES Selgas (El Pito, Cudillero) and IES Margarita Salas (Oviedo).

In these workshops, the work was organised around three approaches to the overlap between art and science in educational contexts through the formulation of proposals linked to problems addressed together with the professionals invited. These proposals, thanks to the participation of the students involved, can open up other ways of looking at some of the problems facing our society today.

Based on this experience, with the particularities and specific situations that arise from working in a specific context and with specific people, this guide aims to be a document that can encourage other people and groups, in different places, to appropriate the proposals and materials found here and adapt them to design their own activities. It is a guide designed to assist, inspire and be useful to anyone who asks the question: What happens when we mix art and science?



ART, SCIENCE AND THE FUTURE OF EDUCATION

A reflection by Anna Dumitriu

We live in a world that faces numerous complex and profoundly entangled challenges that transcend traditional academic disciplinary boundaries. Future generations will need to be equipped to think innovatively about urgent existential problems such as climate change, what constitutes truth in the age of AI, antibiotic resistant infections that have evolved to resist our medicines, and the ethical risks and benefits of synthetic biology.

Significant scientific discoveries are being made almost every day, but it is increasingly more difficult to separate fact from hype. Through my work embedded in scientific research, I have observed how nuanced and complex research outputs are often twisted into a marketable rhetoric of miracle cure, and worse these stories can be scraped and re-presented as AI slop for the purposes of *clickbait*. In this context, creative and critical thinking will be key to facing the challenges that determine the future survival of humanity, and teaching either science or art without any reference to the other is not enough anymore. In fact, a complete breakdown of disciplinary boundaries and a total mixing of methodologies seems, right now, to be the most strategic way to actively address our reality.

We need to consider history to think about the future, and to situate it in the context of what we mean by notions of truth and fact. More often than not history is written by the victors, and nowadays it may even be written or hallucinated by artificially intelligent bots. We need art to help us deal with this entangled and complex world.

Art has the capacity to draw threads across time, to bring together social factors and emotional ones, and to help us learn from past mistakes. Art has the potential to enable innovative thinking and to go beyond what exists, to what can be. It is a meta-discipline, a kind of umbrella that is able to draw together all fields of enquiry, without denying the importance of emotion and aesthetic sensation. It can make the invisible (bacteria, atoms, even the quantum realm) tangible.

The Studiotope project, and specifically the Art and Science Fair organised by LABoral, presented us with a new and effective way to combine these disciplines in secondary education. It brought 453 students into a collaborative space and enabled them to gain deep understandings of the various lines of enquiry, from reimagining cities to fermentation processes, to be inspired by them, and to think for themselves rather than being the passive recipients of unquestionable 'facts'. In fact, this notion of being able to question what is presented to us is key, and this embodied artistic process of learning enables students to develop their own personal relationships with science, its beauty and its socio-economic relevance, turning them from passive consumers of information into active participants in a global conversation.

As a BioArtist working in the field of art and science, embedded in the lab as much as the studio, for over two decades, I pride myself in being brave enough to ask 'stupid questions'. These are not, in reality, so stupid, but it's the fear of appearing stupid that prevents us from asking them, which in turn stops us from learning and halts growth and creativity. We need to be brave enough to question things and to allow our creative and problem-solving sides to run wild. Often the questions we want to ask cut to the very core of the research, and the huge gaps of knowledge therein.

I have worked hands-on in the lab in collaboration with microbiologists, biochemists, synthetic biologists and even roboticists, to explore bacteria, genomics, gene editing and other emerging technologies to create artworks that reveal the hidden stories behind our relationship with the scientific world. Through this work, I have seen first-hand that art and science are not "two cultures," as C.P. Snow once famously suggested. Rather, they are aspects of the same human impulse: the desire to explore, to question, and to make sense of our existence. This notion of working hands-on, experiencing the choreography of pipetting invisible amounts liquids into liquids, the smell of bacteria growing on agar jelly, the sounds of bioreactors bubbling away as they ferment yeasts making useful chemicals is all about embodied experience as a form of learning and understanding. It's also about materiality and transcending what is normally considered an artistic medium to what can be an artistic media, to make unruly artistic objects that are enquiries in their own right.

This educational guide aims to provide us with new tools to help inspire future generations of students who are not afraid of transdisciplinary and of questioning the *status quo*. This will help us carve out a space where art and science work hand in hand to help us understand this rapidly changing world with empathy and care.

HOW TO WORK ON THE INTERSECTION BETWEEN ART AND SCIENCE IN EDUCATIONAL CONTEXTS

A practical proposal

The activities proposed in this guide are based on three approaches to work spanning art and science. Based on this approach, six workshops were held, grouped into three thematic blocks, each linked to a specific way of understanding the relationship between the two fields.



Each of these six workshops was led by a person or collective, responsible both for its design and for facilitating the dialogue with GRIGRI and the Education Department of LABoral Centro de Arte. The structure of the workshops was as follows:

FIRST APPROACH:

Learning to listen to interspecies collaboration.

- **Workshop 1. FAMILIAR SCENT.**

With sikau/pubalova and Education Department of LABoral Centro de Arte

- **Workshop 2. DON'T TALK WITH YOUR MOUTH FULL.**

With Coco Moya

SECOND APPROACH:

Learning to inhabit through interspecies collaboration.

- **Workshop 3. BIO-INSPIRED CITIES, IMAGINED CITIES.**

With Marlén López

- **Workshop 4. OUR CAVES: Intermediate spaces and inter-species assemblages.**

With Susana Velasco

THIRD APPROACH:

Learning to think about human-machine collaboration.

- **Workshop 5. WHAT LIES BEHIND AI.**

With Marga Padilla

- **Workshop 6. THE DESIRE TO BE A REDSKIN (in the age of Artificial Intelligence).**

With Rafael Sánchez-Mateos Paniagua

These six workshops were held simultaneously during the five-day Art and Science Fair, following a common methodological structure. In a first phase, a series of trigger questions or situations were posed, specific to each approach or thematic axis, so that the people in charge of each workshop could propose their own way of approaching them.

To conclude, a common space in the form of an assembly was created, through which the different groups could share the results or responses obtained, pool the work carried out, and open the door to possible cross-referencing and exchanges between them.

Finally, the aim of this guide is to provide a set of tools based on the experiences and shared insights stemming from the process described above. The aim is for the workshops featured here to be read from a practical and applied perspective in such a way that anyone can appropriate these proposals and imagine new practices based on them.

First approach

LEARNING TO LISTEN TO INTERSPECIES COLLABORATIO

In this first approach to work bridging art and science we propose reflecting on those tools, strategies, actions and forms of representation that allow us to think, experiment and reconnect with the interdependence between species from a sensory, material and corporeal perspective, thus recovering an awareness of the transformations that take place in these exchanges.

TRIGGERING SITUATION

Every action we take in everyday life involves interaction with other species. We live in a world made up of interdependencies and exchanges, and the way in which these relationships are produced helps to shape, in different ways, both the bodies and the environments involved.

Some of these interactions foster collaborative and mutually enriching relationships, leading to richer and more diverse environments. Others, on the other hand, result in dynamics of exploitation and extraction between species, or even between members or groups of the same species, leading to the impoverishment and deterioration of our environments' diversity.

At the same time, humans' increasing use of technologies to mediate their relationships - both with each other, with other species, and with the environment - has increased the layers of distance that stand in the way of our bodily, sensory and meaning-making relationship with our surroundings.

This exchange and interaction on the physical and material plane is present in everyday actions, such as eating, moving and breathing. Their relevance becomes even more evident when they are considered on a structural and systemic scale, and not only from the perspective of individual actions.

WHAT WE WANT TO ASK OURSELVES

The following are some seed questions for students that can structure the design of the workshop:

- *Which inter-species relationships are most significant in your environment and everyday life? How are they linked to broader challenges and issues?*
- *What difficulties do you encounter in connecting with these interactions in a sensory way?*
- *What sound and/or tactile representations of these exchanges can help us understand our place in this web of interspecies relationships and promote collaborative situations?*

Workshop 1. FAMILIAR SCENT

A proposal by SIKAU/
PUBALOVA and EDUCATION
DEPARTMENT OF LABORAL
CENTRO DE ARTE



Workshop 2. DON'T TALK WITH YOUR MOUTH FULL

A proposal by
COCO MOYA



About this workshop

Fermentation is part of our daily lives: it is present in the food we eat, in the traditions we inherit, and even in our own bodies. As you read these lines, your body is fermenting. The foods, liquids and words we take in enter into a rhythmic cycle of transformation.

This workshop prompts students to explore these microbial rhythms through smell, hearing and touch.

The activity took place in the *Huele a parentesco (Smells Like Kinship)* exhibition space, an installation in which aromas float in the atmosphere and activate memories linked to tradition, while a suspended silicone membrane - moulded from LABoral's concrete floor and evocative of a SCOBY - vibrates with the textures of fermentation.



The workshop can be adapted to any space one wishes to propose, from a classroom, to an outdoor area, or even a place full of sensations one wishes to link to the initiative.

In this workshop the artist duo sikau/pubalova invites us to reflect on what ferments within and around us. The workshop also proposes fermentation as a way to explore new forms of kinship, shared and cultivated at the microbial level.

What objectives are pursued

- **Encouraging sensory engagement with fermentation.** Students can explore microbial processes by smelling different ferments, tasting kombucha and kefir, and perceiving the space's vibrations and textures.
- **Recognising microbial kinship.** The aim is to encourage reflections that allow the participants to relate bodily fermentation to the links between humans and microbes, as well as to shared ecological cycles.
- **Promoting collaborative exploration and dialogue between art and science.** In small groups, memories and associations related to fermentation, kinship and sensory experience are shared, connecting artistic and scientific perspectives.
- **Encouraging deep listening and body attunement.** Plans call for experimentation with vibroacoustic and bodily listening practices that favour a more conscious attention to internal rhythms and the material presence of microbes.

What ideas can be worked on

The workshop combines sensory, performative and dialogical methodologies to explore fermentation as a process of kinship. Throughout the event students are guided through a sequence of exercises that activate their senses of smell, touch, taste and hearing, in order to promote multi-sensory awareness.

Small group activities, such as an olfactory laboratory, and tasting sessions, are also proposed, aimed at stimulating collaborative and memory-based reflections on microbial processes. The deep listening exercises and the vibroacoustic installation offer more experiential ways of access, focusing on bodily resonance and attunement with the microbial.

Based on the theory of new materialism, microbes are conceived as "vibrating matter" (Jane Bennett) that actively processes human bodies, while human beings, in turn, process them. In the workshop, students practice attunement - inspired by Anna Tsing's close observation of mycelial webs and Pauline Oliveros' sound practice - to the microbial processes around them. Through this approach, the workshop explores alternative ways of relating to the body and to others.



METHODOLOGY. What steps you can take

A methodological outline is proposed to organise a session lasting approximately 1 hour and 45 minutes.

WELCOME AND PRESENTATION (10 min)

- Brief introduction and explanation of what will be done in the session.
- Conceptual framework: fermentation, microbial activities, kinship, sensory art.

Fermented foods you know: *What fermented foods do you eat?* (e.g. cheese, yoghurt, kombucha, kefir).

- Gut fermentation, digestion: fermentation is taking place in your gut at this very moment.
- The role of microbes: linking fermentation to microbial activity. Discussion on the role of microbes and the microbiome. Challenging the idea that microbes are “bad” (e.g. Giulia Enders: *Hack Your Health: The Secrets of Your Gut*).
- Kinship: alliance with microbes, fermentation traditions in different cultures (Donna Haraway: *Staying with the Trouble*).
- Perception: How can we perceive fermentation, microbes and digestion? Smell, taste, touch (vibration in the belly), sound (bubbles), etc.
- Perception of SCOBY: students touch, smell and listen to the SCOBY sample.

SMELL LAB: MICROBIAL KINSHIP (groups of 3–6 people for 30 minutes)

- Smell Station: scent samples are offered with ferments, lactic acid, goat sweat (strong and pungent aroma associated with goats and their fermented milk products, which is also produced in humans through the microbial transformation of sweat), iron, fat and smoke.
- This activity should be approached as a blind test, with the aim of focusing exclusively on scent perception. Scents can be prepared in two ways:
 - Through fermented foods placed in opaque containers with small holes to smell them (e.g. sauerkraut, kefir, vinegar, cheese or fermented meats).
 - Through safe dilutions of chemical compounds, such as acetic acid, lactic acid, hexanol or guaiacol.
- Guessing game and debate. Through questions such as: *What memories do scents evoke? How do they relate to your traditions? What ferments in you?*



CONSUMPTION OF MICROBES (the whole group at the same time for 10 min.)

- A tasting of kefir and kombucha shots.
- Time to perceive scents and tastes.

BODY SYNCHRONISATIONS: LISTENING INWARD (in pairs for 10 min.)

- Sharing the body with microbes, gut fermentation.
- Listening to your partner's belly. This activity should be carried out in a safe and consensual manner, ensuring that the participants feel comfortable at all times.

DEEP LISTENING, INDIVIDUAL JOURNEY

(the whole group at the same time, for 20 min.)

- Listening to the vibro-acoustic installation.
- Listening with one's body.

Vibroacoustics is a practice within music therapy that helps to connect one with their body through vibrations and soft sounds. In this workshop students are invited to tune into their inner rhythms and the space around them.

This workshop was conceived within the framework of the *Huele a parentesco (Smells Like Kinship)* exhibition at LABoral Centro de Arte. To reproduce the full experience, contacting the artists is recommended.

● PREPARATION

- Recordings of fermented foods (such as the bubbling of sourdough, the fizzing of cider, or intestinal sounds) at low frequencies; alternatively, tone generators with different frequencies can be used.
- A subwoofer and/or audio transducers installed on surfaces such as wood, floor or walls (e.g. Dayton Audio devices).

● LISTENING WITH ONE'S BODY

- Collective humming in low tones, seeking to synchronise, desynchronise and create a joint composition.
- Listening to the walls, the floor, the objects in the space and even the silence of the room. Do they also "hum?"
- Moving through the space (turning, jumping, crawling) paying attention to emerging sounds, even in apparent silence.
- Guide students to observe and perceive the space in an attentive and conscious way.



REFLECTIONS (collectively, with the whole group, for 25 min)

- What did you notice in your body and in space?
- What forms of affinity can fermentation create?

Technical and material requirements

- Kefir/kombucha.
- Small glasses.
- Scent samples.
- Paper and markers.
- A comfortable seating area on the floor, in a circle, with cushions.
- Kefir/kombucha:
 - Recipe (2-4 weeks preparation):
 1. Prepare a sweet tea by mixing 1 litre of hot water with 50 g of sugar and 5 g of black or green tea.
 2. Allow to cool and add 400 ml of unfermented kombucha as a starter culture¹.
 3. Cover the container with a cloth and leave to stand at about 25°C for 2 to 4 weeks.
 - ¹ Alternatively, you can get the culture from someone nearby or from a local fermentation centre.

How does this workshop approach work spanning art and science and the overlap between these disciplines?

Incommensurabilities operate as distorted and irresolvable translations: they generate friction, agitation, and, sometimes, interpretative frustration, but they also facilitate awareness of one's own limits and ignite flashes of curiosity. In *Smells like Kinship*, sikau/pubalova worked together with microbiologist Felipe Lombó, touring Asturian kitchens, charcuterie factories, cheese caves, laboratories, art studios and exhibition spaces. On these excursions - as undisciplined, playful, visitors - it became clear that the most fertile exchanges did not arise from forced alignments, but rather from a shared curiosity that emerged from the thresholds between disciplines.

From these frictions emerges a form of knowledge production that remains critical and attentive to its own limits. In educational contexts, this undisciplined friction can activate critical capacities: questioning the ethics of microbial cultivation, asking who benefits from certain scientific outlooks or artistic frameworks, and learning to value sensory attunement over abstract data. *The Familiar Scent* workshop ferments these tensions in a shared, dynamic and living practice.

About this workshop

This event is not presented as a workshop in the conventional sense, but rather as a collective experience in which to imagine, touch, listen and perceive the microbiota that our bodies harbour through the creation of an ASMR-mukbang orchestra.

Its starting point is the performance *Don't Talk With Your Mouth Full, It's Bad Manners* (Coco Moya and Ricardo Errefe, 2022), which addresses the relationship between listening and digestion as ways of opening up and letting oneself be permeated by the world.



It is divided into four parts:

- **Consciousness of another being**

Becoming aware of what the microbiota is, that “other-being” that inhabits us. Understanding that it’s not exactly “us”, but rather “a collective other” with whom we form an interdependent community. The microbiota is part of our own body, though perhaps that body can no longer be thought of as exclusively our own.

- **ASMR-mukbang learning experience**

Through the recording of micro-sounds and textures produced in the mouth, this threshold through which we communicate with the inside and the outside becomes an edible auditorium, capable of amplifying a tiny universe.

- **Drawing bacteria**

An individual and collective way of representing the microbiota by means of a scientific-expressive drawing revealing to us the forms of bacteria. Simple and colourful, these forms invite us to generate abstractions that only acquire their full meaning when the roles of all the participants are brought together to compose a large collective intestine.

- **Feeling and “playing” the intestine**

Feeling and making it produce sounds, like an instrument. When interacting again with the collective intestine, it is possible to listen to the ASMR recordings made by the participants. Capacitance sensors make it possible to give the microbiota a voice and to play with it sonically.

Through the stomach-ear relationship, or between listening and digestion, the workshop invites us to think about how the world around us enters our body and is processed, recomposing itself. The same thing will one day happen to our own body. Listening and sound allow us to perceive this polyphony, this plurality of voices. Thus, we will form a mukbang orchestra on this side of the world, on this side of the human.

What objectives are pursued

- To become aware that we live with and depend on other beings, such as the bacteria that live in our own bodies. The aim is to encourage reflection on the origins of bacteria and on what it means to be interdependent.
- To make the abstraction of thinking about bacteria more tangible in order to be able to relate to them in a different way. In order to do so, an effort will be made to learn some concrete facts about our own microbiota.
- To learn expression techniques linked to sound and visual representation. The workshop offers an introduction to micro-sound recording and abstract/scientific drawing, learning to use professional recorders, developing attentive listening and exploring sound expression.
- Understand and represent bacterial forms from a creative and sensitive perspective. Through scientific illustrations that give way to abstract drawings, a visual approach to the forms of bacteria is encouraged.
- Experimenting with interactive devices that allow microbiota to be sensed on a sensitive scale. By means of an interactive mukbang table, the bacteria are given a “voice” and a closer, more tangible and sonorous relationship with them is generated.

What ideas can be worked on

The workshop revolves around three main ideas:

- **An open, participatory and play-based methodology.** The methodology is open to debate, participation and play. The aim is to give students a constant voice to express their opinions, perceptions and ideas, and to share them critically. Therefore, the workshop begins with a small group quiz in which different concepts related to the microbiota are introduced and a space for dialogue is opened up.
- **The importance of experience as the key to learning.** The experiential dimension is key and underpins the whole event. The more reflective and theoretical part is translated into a concrete, tactile scale, close to the senses. The group records micro-sounds while eating food that is crunchy or has different sound textures. The experience is particularly significant because ASMR is something that many young people are familiar with, but have rarely explored as creators.

- **A sensitive approach to the unknown.** The workshop also seeks to open up the experience to what might otherwise seem alien, difficult or even uncomfortable, such as making large-format abstract drawings or recording food-related sounds. At this point, the group looks at pictures of real bacteria and creates an individual drawing with materials such as crayons or pastels. Each of these pieces then becomes part of a larger collective intestine.

What ties all of the above together is a playful dimension that runs through the entire event.

- The aim is to experiment, laugh, enjoy and share, both individually and collectively.
- It also aims to activate the whole body as a sensor capable of perceiving and experiencing, paying special attention to senses that we often use less, such as listening and touch.

METHODOLOGY. What steps you can take

A methodological outline is proposed that can be used to organise a session lasting approximately 1 hour and 45 minutes.

BLOCK 1. Microbiota quiz with 8 questions (45–50 min)

It is assumed that students generally have limited or no information about microbiota. Therefore, this first part is a quiz to learn some key concepts, such as what bacteria eat, how many bacteria we have, what a probiotic is, how antibiotics work, what a faecal transplant consists of to modify microbiota and, finally, to question whether evolution is based on collaboration or competition between species.

This quiz is conceived as a playful, interactive and participatory tool to collectively address some initial questions and delve into the subject. This phase can be adapted applying other strategies with the same objective.

The link provided below contains the questions used in this quiz in a format that allows them to be projected or shared on screen to be worked on collectively with the group.



Quiz: Discover the world of bacteria. <https://websim.com/@coquitonia/quiz-application>

BLOCK 2. Eating, recording and drawing (40 min)

The second part of the workshop focuses on conducting sound experiments using the *mukbang* technique (recording micro-sounds while eating), as well as making abstract drawings inspired by microbiota using an exquisite corpse in the shape of an intestine.

To do this, divide the students into two groups:

● GROUP 1. Recording of *mukbang* elements: eating and ASMR (15 min)

This group is further subdivided into small teams of two or three people per recorder. One person does the recording and another person interacts with the objects or food. Both use headphones during the activity.

Other sounds of the space where the workshop is held can also be recorded. The idea is to have at least ten sounds per group at the end, with a maximum duration of 20 seconds each, in order to have enough material to choose from.

At the end of the recording exercise, the files stored on the recorder cards are transferred to the computer to be used in the final block of the workshop.

● GROUP 2. Drawing (15 min)

The group gathers around a square table on which A3-size sheets of paper are laid out and connected to each other. First of all, marks are made on these papers to indicate the points of union between the drawings, in the manner of an exquisite corpse. Each sheet corresponds to a fragment of intestine and, when all of them are put together, they can be assembled to form a complete intestine.

To support the activity, about twenty printed colour pictures, featuring examples of real microbiota and different types of bacteria, are made available to the group. In addition, some of their characteristic forms are also briefly explained.

This is followed by a short demonstration of how to work on backgrounds and shapes with the technique proposed; in this case, oil-based crayons, although pastels could also be used.



Afterwards, the groups swap roles: those who were recording switch to drawing and vice versa.

BLOCK 3. Sounding. Collective presentation and play

Beforehand, a table will have been prepared with conductive copper tape so that, when the drawings are placed on it, they become interactive surfaces. Using an Arduino device called Touch Board, equipped with capacitance sensors, the sounds recorded by the participants are activated by touching the drawings with their hands. In this way, the microbiota “sounds” through an interactive installation.

There are also other options to achieve this interactivity, such as *Makey Makey* or *Touch Me*, as the *Touch Board* has been discontinued.

In the case of the *Touch Board*, the sound files must be named with the code *TRACK00#.mp3*, where the number # corresponds to the pin that will activate the sound playback. For example, if you want a file to play when you hit pin *E06*, it should be renamed *TRACK006.mp3*.

The drawings become interactive scores by incorporating the pre-recorded sounds and implementing them on the *Touch Board*.

● MUKBANG-ASMR ORCHESTRA

To close, the students are invited to play with the final installation and perform a kind of collective concert using their drawings and the sounds recorded.

Support resource for setting up the interactive sound installation: *Touchboard workshop manual*.



Technical and material requirements

Block 1. MICROBIOTA QUIZ

- Projector or screen to share the quiz.
- Internet connection to access the questionnaire.

Block 2. EATING, RECORDING AND DRAWING

- Crunchy foods, e.g. lentil chips, cereals or unshelled nuts.
- Sound recorders with mini SD cards (one for every three or four people).
- Headphones compatible with the recorders to be able to listen to what is being recorded.
- Pastels and A3 size paper.

Block 3. SOUNDING. COLLECTIVE PRESENTATION AND GAME

- Table to set up the installation.
- Loudspeakers.
- Copper adhesive tape.
- Touch Board or equivalent Arduino device.
- Crocodile cables.

Some of the drawings made by the students during the workshops.



How does this workshop approach work spanning art and science and the overlap between these disciplines?

In this workshop, sound art, biology, drawing and technology converge, giving rise to a flexible, transversal exercise that is easily adaptable to different educational contexts. Far from establishing a hierarchy between disciplines or languages, the workshop is based on cumulative experiences and dynamics which, as a whole, build up a coherent narrative.

Each of its elements incorporates a specific dimension: content based on real data, critical reflection, sensory and playful experimentation through touch, taste and hearing, as well as a space for expression and contemplation through drawing. The sum of these layers culminates in a final experience that brings all these planes together.

In this way, working at the crossroads between artistic, technical and scientific disciplines is seen as a natural process, insofar as all of them require combining technical knowledge, abstract imagination and a critical perspective in order to interpret and make sense of the world we inhabit.

Second approach

LEARNING TO INHABIT THROUGH INTERSPECIES COLLABORATION

In this second approach to work bridging the fields of art and science, we are interested in asking ourselves about those **tools, strategies, actions and forms of representation** that allow us to imagine and build spaces and forms of governance open to collaboration between **species**, in order to reconnect with those knowledges and practices that favour situations of mutual impact.

TRIGGERING SITUATION

Throughout their lives, our bodies are situated at different points along a **chain of scales extending from the micro world of viruses to the macro world of territories**, navigating and inhabiting these scales in different ways. This inhabiting occurs largely through the construction of spaces that mediate our relationships with other species and also with members and groups of our own species. The way we construct these habitats gives rise to different ways of seeing and relating to the world.

- On the one hand, the construction of inhabited spaces that ignore our interdependence with other species and that aspire to be delimited by clear, insurmountable physical frontiers, leads to a view of the world based on a supposed position of superiority and on relations based on domination.
- On the other hand, the construction of inhabited spaces capable of generating situations that foster relationships with other species, and which aspire to operate as intermediate, hybrid and inclusive zones - traversed by cultural, social and environmental flows - leads to a view of the world that is more open to cooperation and symbiosis.

These different ways of looking at and relating to the world also have to do with the materiality and construction processes of the spaces we inhabit; with the knowledge that guides our ways of relating to other species and to the territory; and with our capacity to imagine and put into practice forms of governance capable of integrating diverse voices, also between species.

WHAT WE WANT TO ASK OURSELVES

Below are some questions for students that can guide the design of the workshop:

- *Which inter-species relationships are most significant in your environment and in your daily life? How do they connect to larger-scale challenges and issues?*
- *What difficulties do you identify in the spaces we inhabit and in the forms of governance we adopt so that these relationships can be sustained through collaboration?*
- *What modes of building and inhabiting might help us understand our place in this web of interspecies relations and promote collaborative dynamics?*

Workshop 3. BIO-INSPIRED CITIES, IMAGINED CITIES

A proposal by **MARLEN LÓPEZ
FERNÁNDEZ**– Biodesign School



Workshop 4. OUR CAVES: Intermediate Spaces and Inter-species Assemblages

A proposal by
SUSANA VELASCO

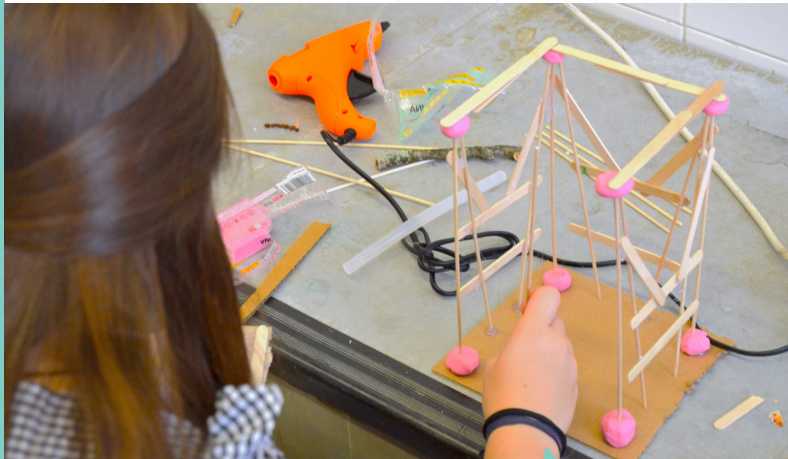


About this workshop

This workshop proposes a set of activities aimed at exploring how nature can become a great source of inspiration to design and think about the cities of the future.

Based on the observation of organisms and ecosystems - trees, leaves, animal architectures and forests - and in dialogue with references such as Italo Calvino's *The Invisible Cities*, the aim is for participants to acquire practical experience that will enable them to approach the process of imagining and planning a city in a concrete way.

The experience invites us to **rethink the concept of the city through bio-inspiration, imagination and collaboration** between species, understanding the city as a living system in balance with its environment.



What objectives are pursued

- Understand bio-inspiration as an innovative approach to the design of sustainable materials, systems and environments.
- To observe nature from an analytical and creative point of view, identifying patterns, forms and processes that can be transferred to human design.
- To experiment with the notion of urban layers, understanding the city as a complex ecosystem made up of flows, habitats, interactions and social dynamics.
- To encourage critical thinking and reflection, raising questions about how we live today and how we might live in the future.
- To develop collaborative work skills by co creating a common prototype using individual contributions.
- To explore applied creativity, transferring biological and ecological concepts to urban and architectural designs.
- To value structural and material efficiency, understanding that form responds to function and that all designs must be adapted to their environments.
- To introduce circular economy and circularity processes, linking them to community life and city design.
- To acquire communication and mediation skills through assemblies aimed at sharing, exchanging and engaging in collective debate.
- To foster critical imagination, using works such as Italo Calvino's *Invisible Cities* as a reference to create alternative urban visions.



What ideas can be worked on

The workshop proposed is organised into five successive working sessions, oriented towards the construction of a unique prototype of a bio-inspired city. Each session focuses on a specific topic that adds a new gaze or "layer" to the city model.

- In the first session we work on urban planning, taking as a reference point the anatomy of leaves and the layout of their veins in order to imagine flows and routes.
- The second session incorporates the layer of habitats and constructions through the observation of animal architectures and buildings that, like trees, adapt to their environments and coexist with them.
- The third session introduces the ecosystemic dimension through a reflection on hybrid architectures and cities conceived as forests, where different species collaborate and sustain each other.
- The fourth session deals with the intangible: the circular economy, social relationships, play, communication and waste management, aspects that are also an essential part of urban life.
- The fifth and final session integrates all these layers into a final model that combines urban planning, habitats, ecosystems and social and cultural dimensions.

In this way, the aim is for the result to be not only a material prototype, but also a set of ideas and collective visions capable of reflecting how the students imagine the future of our cities when nature becomes a teacher and ally.



METHODOLOGY. What steps you can take

The workshop is based on a common methodological scheme that is repeated throughout its five sessions.

Each of them begins with an introduction (45 min) to explain the concept of bioinspiration and to present examples of how nature can serve as a reference point to design materials, architectures and organisational systems.

This shared framework allows for continued work on what it means to think and design drawing on nature, while reinforcing the idea that the cities of the future can be sustainable, creative and efficient if we learn to observe the natural environment.

This is followed by a practical activity (60 min) focusing, in each session, on a specific aspect of the bio-inspired city.

FIRST SESSION. Layer 1: urban planning

- **Inspiration:** The anatomy of a leaf and the layout of its veins.
- **Focus:** the organisation of flows, routes and urban structures.
- **Result:** drafting an initial plan for an imagined city inspired by natural patterns.



SECOND SESSION. Layer 2: habitats and constructions

- **Inspiration:** animal architectures and buildings understood as trees.
- **Focus:** how living things live and build; buildings that breathe, adapt and coexist with their environments.
- **Result:** incorporation of the first living spaces and nature-inspired constructions into the urban base.



SESSION 3. Layer 3: ecosystems and symbiosis

- **Inspiration:** hybrid architectures and the idea of cities conceived as forests.
- **Focus:** inter-species relationships, cooperation, resilience and balance in resource use.
- **Result:** the integration of ecological interactions and collaborative systems into the urban model.



SESSION 4. Layer 4: the intangible

- **Inspiration:** everyday life and the invisible dynamics that sustain the city.
- **Focus:** circular economy, social relations, play, communication and waste management.
- **Result:** incorporation into the prototype of those non-visible aspects that make a city habitable and sustainable.



SESSION 5: Integration of all the layers into a single collective prototype

- **Closing assembly:** presentation of the final bio-inspired city model.
- **Joint reflection:** *What would our lives be like if we designed cities with nature as our teacher?*

Technical and material requirements

- Drawing and prototyping materials.
- Building materials and model.
- Resources for the introduction of the sessions (samples of natural elements, such as leaves, seeds or insects) and support materials, such as photocopies, reference books, magnifying glasses and other complementary resources that help to enrich the educational experience.

How does this workshop address working on the intersection of art and science and the overlap between these disciplines?

Working on the intersection of art and science involves situating oneself in a hybrid territory where observing, imagining and prototyping form part of the same process. In this workshop, nature not only functions as a source of aesthetic inspiration, but also as an object of study: its structures, flows and dynamics are analysed from a scientific point of view and, at the same time, reinterpreted through the language of design and artistic creation. In this way, the division between the researcher and the creator is blurred, as it is understood that all creative proposals can be based on real data, patterns and systems, and that all research also needs imagination to pose new questions.

Bioinspiration acts here as a methodological bridge. Observing the venation of a leaf or the cooperation that takes place in a forest involves understanding strategies and functional principles and then translating them into urban proposals. At this crossroads, critical thinking and intuition are in constant dialogue. Errors become experiments and metaphors become hypotheses about the future.

In educational contexts, this approach favours systemic and experiential learning. Students don't work with isolated contents, but rather connect ecology, materials, society and culture within the same process. This simultaneously develops analytical and creative skills, while fostering a deeper understanding of the interdependence between human and natural systems. Fusing nature, art, science and design is not only a methodology, but also an ethical position: to design by understanding the limits and intelligence of living systems.

WORKSHOP 4.

OUR CAVES: In-Between Spaces and Inter-Species Assemblages

With Susana Velasco

About this workshop

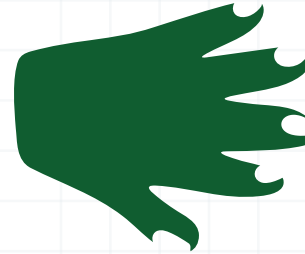
Caves were the first human habitats, and in them art was born as a vehicle for relationships with other species. These caves were the first mediation architectures created by human beings to understand and have an impact on the world in which they lived. The curves of the rock - which already contained, in the eyes of those first inhabitants, the bellies and snouts of animals - acted as interfaces, sensitive membranes with which to establish material and, at the same time, distant contact with the environment that awaited them outside. More than mere shelters, the surfaces of the caves allowed them to intervene symbolically on the animals and other entities that populated the shared territory. According to palaeontology, it was permeability and fluidity - two notions that emerged in those human beings - that made this relationship of transfer between the living matter of living beings and the matter of rock, considered inert, possible.

These first human shelters tell us about an architecture that, from its origin, had a symbolic dimension and was also based on an inter-species awareness. Architecture, thus, appears as a surface of communication and contact. This idea significantly broadens what we can think about it and places it squarely within contemporary debates that seek to recompose the links broken by the separation between nature and culture.



If the first collective interior space was the Palaeolithic caves, and if these were not only shelters, but also places from which to re-elaborate a symbolic and material relationship with other species, this workshop proposes situating ourselves in that origin in order to address these questions:

- *What would our caves be today?*
- *How can we imagine spaces today that allow us to perceive ourselves in connection with other species?*



From there, the workshop encourages us to imagine what these architectures, capable of altering our relationships with the environment and with other living beings, would be like today; what the observatories and laboratories would be like that would make possible new forms of relationship between all living things, in a context in which our lifestyles no longer favour biodiverse habitats. To this end, actions are proposed that link perception, imagination, inhabiting and construction, opening up small refuges in which to experiment with the body - and not just theorise - that which we call the “Symbiocene”.

What objectives are pursued

- To visualise and feel ourselves within that in-between zone, that thin biotic layer that covers the surface of the Earth, and to access, from that interface traversed by flows and relations, a decentred sensibility of our own body.
- To approach and experience the notions of permeability and fluidity, in the same way as in the Palaeolithic, understood as concepts that refer to the capacity to transit between one being and another, as well as between living matter and that which we usually consider inert.
- To create cosmogonies that allow us to think of ourselves as equals to other species.
- After a corporal experience of landing in the body and in space, to activate our “constructive being” from these new - and at the same time old - parameters, in order to propose other spatial and relational grammars based on questions such as the following:
 - *What would it be like to inhabit/build with the continuity of life in mind?*
 - *What would it be like to inhabit/build by composing a common world?*
 - *How do we elaborate frameworks - spaces and relationships - that help us to decentre ourselves within the whole of beings?*
 - *How do we open our habitat to the conditions of the biosphere? Let us imagine ways to reclaim the wealth of that in-between area and make it thrive.*

What ideas can be worked on

This workshop is based on tools which, in some cases, have been introduced in schools of architecture, and are adapted here for students between 14 and 16 years of age. But, above all, it proposes an approach linked to contemporary dance practices, in terms of opening up to the present time and paying attention to the reality of what we feel with our bodies.

- Immerse yourself in stories of unique relationships with other living beings. Through the workshop, students are encouraged to share in groups their links with different animal species and to reflect on how to establish more egalitarian relationships with other living beings.
- Analyse the daily context in which we live. The aim is to observe our cities, the surroundings of our homes and other everyday spaces.
- Raising awareness of our own bodies as living beings immersed in an environment. To this end, exercises are proposed that focus on the relationship between body and space.
- Re-learning to move and to perceive both body and space. The aim is to open up the imagination through sensory perception and bodily experience.
- Raising questions about how we inhabit our cities. This reflection is worked on through the creation and sharing of small models of shelters made with origami.
- Experimenting with how to expand the space of the body and, at the same time, make it more sensitive to coexistence with other entities. To this end, the collective and collaborative construction of full-scale nomadic shelters is proposed, using the hands and the whole body.



METHODOLOGY. What steps you can take

The approach to practice is very open and flexible in its structure. We start from a structure based on two main activities that can be carried out in different ways depending on the goals you wish to pursue.

ACTIVITY 1. Sensitivity and imagination exercises in groups (45-60 minutes)

● Part one: EXPERIENTIAL

It is proposed to start with a first conversation with the group to tune in to the context and root the experience locally. Some initial questions may be:

- *What town or neighbourhood do you come from?*
- *Which animals in your environment attract your attention the most?*
- *Do you know or have you heard of anyone who has a special relationship with a wild animal?*

In this first phase, which focuses on identifying local links, a concrete case might be cited in order to provide examples enhancing the conversation. In Asturias, for example, there is the recent case of a fawn rescued by a man, which continues to visit him and even enters the bar where he works. This example can serve as a springboard for the group to share similar stories. You can also start a conversation about the prehistoric caves in the area, such as that of Tito Bustillo, and other lesser-known ones in Asturias.



It is then proposed to ground oneself and open the body through sensory and gestural experiences. For this purpose, exercises can be carried out inside the working room or in nearby spaces. It is a guided sequence that begins with exercises of emptying and opening the body's sensitivity, first through an individual experience and then, little by little, seeking links with the rest of the group through shared listening exercises. In a final phase, work is done with objects and balances. At this point, images of prehistoric paintings - preferably local, without ruling out other particularly significant European references - can be projected onto a wall and the group can be invited to prolong their movement by drawing on these images or creating shadows with their bodies that interact with them.

As a complementary resource, an archive of shapes and images can be arranged in the space to act as an inspirational interface and evoke the presence and strangeness of other species, bringing them into the room in a symbolic way. This part is not essential, but it can enrich the experience.

● Part two: OPERATIONAL

In this phase, participants are invited to construct refuges. Using wooden slats and fabrics, and through the action of bodies, the aim is to construct cave-spaces: small, ephemeral, collective and nomadic shelters. Other objects can also be incorporated to expand the experimental dimension of the workshop, such as bird calls, headphones, sound amplifiers, mirrors or measuring devices.

Once constructed, these refuges can be moved through space or the environment, inhabiting the coexistence and encouraging participants to imagine what other species might “fit” in our caves. With these nomadic shelters we can start tours through the building or its surroundings so that our bodies, the changing environment, and the surfaces and refuges that we move, can coexist. These structures modify the conditions of experience and transform the way we perceive the environment and ourselves as a group. During the tour it is proposed to pause to observe and feel the environment through our “cave/refuge”, understanding it as a form of performative architecture.



ACTIVITY 2. Map of the territory to include our caves (45–60 min)

● Part one: EXPERIENTIAL

The proposal is to make small models of origami shelters, to experiment with the act of creating architecture, and to share them with others. Once back in the room, with the experience still fresh and our bodies still tired, we move on to a more reflective phase of work: re-imagining the locality in which the students live by means of a map and identifying, using small pieces of origami, those places that are perceived as spaces with interspecies potential.

● Second part: PRODUCTIVE/COMMUNICATIVE

On a handmade map of the territory, representing the place where the students live, the origami figures are placed and, based on them, a collective conversation is generated to bring the session to a close. From the places chosen - a beach, a park, a quarry, a hill, a river, the educational centre, or the houses themselves - a reflection may encourage the students to re-imagine in these spaces other cycles of matter and energy, as well as new forms of inter-species relationships.



Technical and material requirements

Space and technical resources

- A working room with windows and enough space to lie on the floor.
- A wall on which roll paper can be placed for drawing.
- A computer with speakers and a projector, although this resource is not essential.

Materials

For the “Draw a Map” phase:

- A roll of continuous white paper, crayons and pastel sticks.

For the “Making Small Origami Models” phase:

- Coloured tracing paper and masking tape.

For the “Building Caves” phase:

- Wooden slats, large fabrics in different colours and patterns, clips to attach the fabrics to the slats, and a sound recorder with headphones.

How does this workshop address working on the intersection of art and science and the overlap between these disciplines?

Today, more than ever, artists of many different kinds - including architects, musicians and craftsmen - occupy in-between spaces, appropriating tools and methods that were previously considered to belong to separate fields, such as science and art. In turn, scientific activity is increasingly recognised as a speculative and creative practice as well, often advancing by probing visions of the world that art had already imagined. In this sense, the shared territory between art and science constitutes a genuinely contemporary approach.

What happens when we visit the laboratory of an artist or a scientist? We are likely to share an experience of astonishment and joint creation, going from mere spectators to co-creating something common through what each person contributes. This is precisely the working format that these workshops seek to foster.

In the *Our Caves* workshop the imagination travels to those primordial spaces where art was born: Palaeolithic caves. Today, these same caves are also key sites for science: they are thoroughly analysed, reproduced and, although many are still partially unexplored, they continue to provide valuable information on the origin of our species. They function as a nexus between art and science, and allow us to think of architecture as a discipline mediating between both fields. It seeks to highlight the importance of rooting oneself in one's origins and local context, while opening up a different way of understanding territory as a current of flows and exchanges.



From there, the workshop is conceived as the opening of a laboratory of action and thought between art and science, without reducing the complexity of the existential and architectural problem that lies at its core. The aim is to continue researching and to take advantage of the students' spontaneity in order to situate ourselves at a starting point that is more corporal than discursive, collectively constructing an experience capable of integrating both spheres.

Thus, the workshop, rather than seeking to carry out a closed and predetermined activity, aims to open up a space for experience. The aim is to offer tools and conditions to work on the question of interspecies architecture, taking on the task of guiding a dramaturgy that, with each group and in each session, unfolds different possibilities. This is also where the space of uncertainty and exploration that opens up between art and science emerges.

Third approach

LEARNING TO THINK ABOUT HUMAN-MACHINE COLLABORATION

In this third approach to the work between art and science, we propose to reflect on those tools, strategies, actions and forms of representation that allow us to think about Artificial Intelligence (AI) from a critical and useful perspective to address the issues that challenge us. Ultimately, it is about building agency to decide whether we want to use this technology or not, and also when, how and for what purpose.

TRIGGERING SITUATION ¹

AI is the result of collaboration between humans and machines; it is not, therefore, an autonomous intelligence. Its functioning is driven by human decisions: which data are considered relevant, which can be measured, and which are left out. The same goes for its uses: how much time is available to make a decision, to what extent uncertainty can be assumed, or why a quick conclusion is sought; these are deeply human questions that AI alone cannot solve.

In the current context of severe social and environmental crises, AI is entering life-critical areas such as medicine, justice and welfare management. This expansion poses a dual battle: on the one hand, it aspires to generate significant ventures; on the other, it needs to conquer and sustain its legitimacy in order to do so. Against this backdrop, the question arises: can we consider what happens inside a machine learning model to be an accumulation of knowledge, when it is an inscrutable system that cannot be required to justify its decisions?

The AI “programme” seems to announce that a world without subjectivity would be a better one: no more fatigue, no more disputes, no more loneliness, no more mistakes, no more imperfections, no more death...no more humanity?

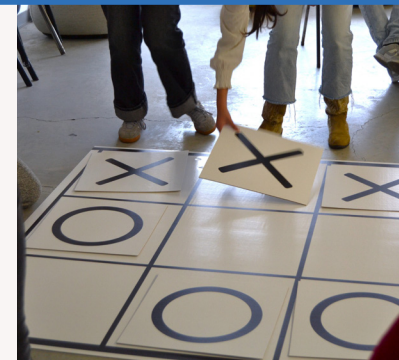
WHAT WE WANT TO ASK OURSELVES

Some sample questions, addressed to the students, that can guide the design of the workshop are the following:

- *What do you consider to be the most common uses of AI in your environment and everyday life? What challenges and issues are they related to?*
- *What biases do you identify in the way AI addresses these subjects? What issues and challenges do you think are left out?*
- *How might we develop our own tools that allow us to use AI to address the challenges and issues that really matter and affect us?*

Workshop 5. WHAT LIES BEHIND AI

A proposal by
MARGARITA PADILLA



Workshop 6. THE DESIRE TO BE A REDSKIN (In the era of artificial intelligences)

A proposal by
RAFAEL SÁNCHEZ-MATEOS PANIAGUA



WORKSHOP 5. WHAT LIES BEHIND AI

With Margarita Padilla

About this workshop

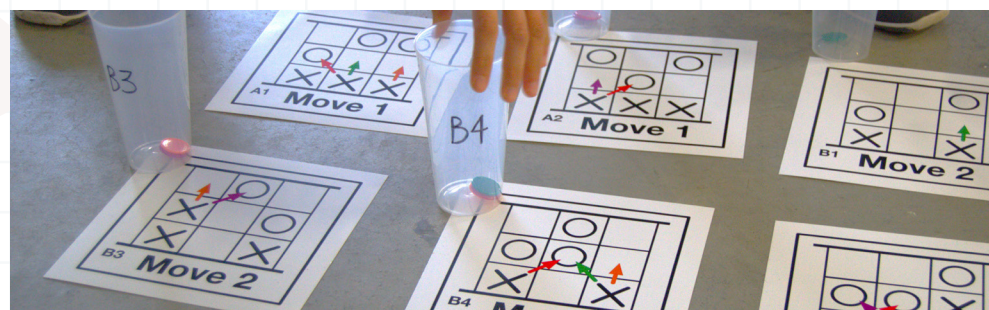
This workshop proposes a set of activities aimed at demonstrating the processes by which a machine can learn, i.e. autonomously modify its behaviour.

By means of playful dynamics designed as manipulative games, the students put themselves in the “skin” of a machine learning technology. Interspersed between the activities, there is also a time for critical reflection on the strengths, weaknesses, opportunities and threats of this type of technology.



What objectives are pursued

- To share opinions and prior beliefs about the strengths, weaknesses, opportunities and threats of machine learning technologies.
- To show how the learning process takes place inside a machine learning technology.
- To encourage critical reflection on the strengths, weaknesses, opportunities and threats of these technologies, going beyond initial opinions and beliefs.
- To reflect on the appropriate use of machine learning technologies in the context of secondary education.



What ideas can be worked on

- Organisation into groups, in which each person assumes a specific role and a specific mission.
- The use of numbered cards so that all the participants can express their opinions at the same time and on equal terms.
- The use of manipulative materials and playful activities to illustrate complex and abstract processes.
- The use of a chatbot that the facilitator can use in their role as a programmer, to show the influence of those who design and program AI systems.
- The holding of debates on issues related to the school environment and to the situation of the students themselves.



METHODOLOGY. What steps you can take

The workshop combines a learning dimension with a critical thinking one. The contents were designed to be accessible to everyone, regardless of their socio-cultural level. In addition, the activities were designed to avoid gender and socio-cultural bias.

PRESENTATION OF THE ACTIVITY

At the beginning of the workshop, students are organised into groups of four. Within each group, each participant assumes a specific role:

- A **material manager**, with an orderly and systematic profile.
- A **storyteller**, with observational skills and the ability to write and draw in a simple way
- A **spokesperson**, responsible for public speaking.
- A **group coordinator**, with organisational skills.

DYNAMICS OF THE CARDS

Each participant is then given a set of numbered cards. The facilitator presents a series of statements and each person must express their level of support for them by showing a card:

- 0 means no agreement.
- ∞ (infinity) means full agreement.
- The other numbers reflect intermediate positions.

The statements can be of the following type:

- *One can learn blindly following predetermined rules.*
- *The only thing a machine can do is follow rules mechanically.*
- *If a machine can learn, that means it's intelligent.*
- *A machine can improve itself.*

With the support of the note-takers, the main arguments that emerge are recorded. After each statement, and once everyone has taken a position, a discussion is opened in the large group.



HOW A MACHINE LEARNS

A device is deployed to observe how a machine can be taught to improve its behaviour with the aim of always winning a game similar to tic-tac-toe.

Students are divided into “humans” and “machines”. Each machine is composed of two people, who assume the roles of “processor” and “input/output system”. Through the game, the process of machine learning is illustrated in a practical way.

HOW A NEURON IS TRAINED

In the next phase a board is presented which, together with a set of coloured buttons, illustrates the process by which an artificial neuron can be trained to recognise a pattern. Participants “play” at training this neuron until it is configured with the appropriate weights.

WHAT IS A CONVERSATION?

The facilitator, together with one of the participants, stages a short theatrical improvisation. At the end, a group discussion is opened up to reflect on whether what has taken place can be considered a real conversation. From there, the question arises as to whether it can truly be a conversation when there is no context, no intention, no emotion and no shared meaning in the dialogue. The aim is to spur the group to think critically about whether interaction with a *chatbot* can be understood as a conversation in the full sense.

EXPERIMENTING WITH A LANGUAGE MODEL

The facilitator then demonstrates a *chatbot* and how it can be manipulated to give incorrect or untruthful answers. To this end, it is asked specific questions that show that, in certain cases, the *chatbot* does indeed provide erroneous responses.

This experience gives way to a debate about the possibility of this happening - or not - with the *chatbots* that we use on a regular basis.

GROUP DISCUSSION AND SHARING

To wrap up the workshop, each group is asked a question related to the use of AI in schools. The questions posed are as follows:

- *How would you feel if your teacher marked your exam with AI?*
- *If AI knows everything, what should we study?*
- *If AI is going to know everything, what's the point of studying? What should be learned? What should evaluations be like?*

Each group's reflections are then shared.

Technical and material requirements

Activity 1

- Stickers, markers, notebooks and pens.

Activity 2

- Fibonacci cards, one set per person, playing card size.

Activity 3

- A 3 × 3 cardboard board to be placed on the floor, 1.5 × 1.5 metres.
- X and O pieces (three of each), 40 cm on each side.
- One-third glasses, each representing one of the possible positions in the game.
- A set of squares to be placed on the floor, 20 cm on each side.
- Large orange, green, lilac and red buttons to put in the glasses; 50 of each colour.
- Boxes or bags to store the buttons by colour.

Activity 4

- Orange, red and yellow buttons; printed templates of the neuron in colour.

Activity 5

- No specific materials are required.

Activity 6

- A computer and a projector.

Activity 7

- Paper and pens.

How does this workshop address working on the intersection of art and science and the overlap between these disciplines?

People learn by playing. And, in a way, so have many AI technologies. AlphaZero, for example, was developed by DeepMind with the aim of demonstrating the power of machine learning.

Games constitute ideal forums for the relationship between humans and machines, as they create a shared context, defined by rules and a common goal: to defeat the adversary. By playing to understand how AI learns to perform in a given game, students are simultaneously placed on two levels. On the one hand, on its own human level, marked by emotion, the motivation to win, and the cognitive effort involved. On the other hand, at the level of a machine that learns, internalising its procedures and understanding that this learning takes place, precisely, through errors.

A playful situation is thus generated in which the machine serves the human challenge and enjoyment and, at the same time, human activity serves to train a machine, which, once it has finished learning, will be able to beat the human player, as it will have condensed a certain way of playing into reproducible rules.

However, neither the game nor the training of a machine is enough on its own. They only make full sense when combined with a critical reflection on what happened: why it is interesting to think about the relationship between humans and machines, and what lessons - meta-learnings - can be drawn from having understood how a machine learns.

It is at this point that theatrical improvisation shifts the experience to another fundamental question: what we mean by a real conversation. Improvisation, lacking a previous script, defined characters, or an established plot, begins without context or prior consensus. One person doesn't know what the other is talking about and has to construct, with his or her responses and performance, the meaning of what has just happened. And so on: each intervention gives meaning to the previous one and opens up new possibilities. In this way, a fully human spiral of meaning construction is configured. The question then becomes whether this spiral can be equated with the human-machine loop or whether, on the contrary, there are substantial differences between the two.

In an educational context, moreover, not everything can be reduced to instruction. Art - in this case, through rule-based play and theatrical improvisation - functions as a transversal language that activates emotions. And we know that there is no profound learning without emotional involvement. Precisely for this reason, this workshop places the overlap between art and science at the centre of a shared experience in which understanding, playing, debating and questioning are all part of the same process.



WORKSHOP 6.

THE DESIRE TO BE A REDSKIN (In the Era of Artificial Intelligences)

With Rafael Sánchez-Mateos Paniagua

About this workshop

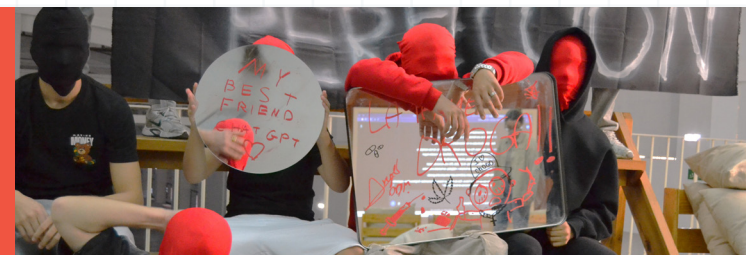
This workshop proposes a critical exploration of our relationship with information technology and AIs, and the impact they have in anthropological, existential, affective and emotional terms.

Through play, the body in movement, and the collective creation of a plastic work, an interaction is proposed with an AI system that is interviewed and questioned in order to open up new ways of thinking about our relationship with these technologies.

Rather than offering closed answers, the workshop invites critical reflection on the AI machines that are increasingly present and impacting our daily lives, and on the “desiring machines” that we also are.

What objectives are pursued

- To understand the basic operation of search, generation and biometric algorithms.
- To critically address the personal, emotional and social impact of these technologies on our lives and well-being.
- To interact with conversational AI to explore humanoid interfaces - such as *chatbots*- and understand their limits, how they operate, their mechanisms and how they emulate human identity.
- To create and synthesise critical messages from the development of the workshop and the activities carried out.
- To experiment with collective performative and plastic strategies that allow the results of the activity to be shared publicly.



What ideas can be worked on

- The use of masks to step outside the self and give voice to perspectives beyond one's own.
- Dance, body movement and mime as forms of expression.
- Critical analysis of video clips as working materials.
- Interaction with a *chatbot*.
- The definition of tasks for recording and documenting the conversation.
- The creation of an artistic/plastic object that synthesises a message agreed upon by the group.
- The use of performative techniques for the public presentation and sharing of results.

METHODOLOGY. What steps you can take

The workshop is of a markedly conversational and playful nature. It is important, therefore, to ensure a safe and high-quality space in which sensitive questions can be asked and delicate issues can be addressed. Issues of identity, belonging, and social prejudices, such as sexism or racism, may arise. Whoever is in charge of the activity must be able to manage this latent conflict, which is inherent to the society in which young people live and to which they are no strangers. In any case, the focus should always remain on reflection on the human and on our relationship with digital technologies.

FIRST STEP



It begins by introducing the idea that the field of art is a space of experimentation and ambiguity in which the same rules do not necessarily apply as in the conventional world.

The Spiderman meme is then projected and there is a discussion about what is happening in this image, and its uses on social media and the internet. This meme introduces questions such as the confusion between the true and the false, between the digital and the real, and also anticipates the image that will serve as the focal point of the final performative presentation, as well as the theatrical and plastic nature of the activity.

SECOND STEP

This is followed by a body dynamic aimed at promoting disinhibition. Half of the students are assigned a role linked to different types of algorithms - “search engine”, “generative AI” or “biometric sensor” - or as human beings, understood here as a “desiring machine”. With masks on, regardless of their colour, those who embody these roles must activate their “algorithm” in space through gestures, movements or interactions with objects and people. The rest of the students, who are not directly involved in this representation, must try to infer from these movements what kind of algorithm or figure is being performed.



THIRD STEP

Afterwards, the video clip *Boring Angel*, by Oneohtrix Point Never, narrates, exclusively through the superimposition of different emojis, the story of a person hooked on a mobile phone and trapped in an experience of boredom and depression. In the story, the protagonist suddenly falls in love and his life seems to be filled with meaning, but the relationship begins to deteriorate until it ultimately breaks down. He then falls into various forms of addiction - alcohol, tobacco, television - and finally dies alone. This video prompts a reflection on the emotional impact of technology, mental health, toxic relationships and the ways in which the digital permeates the affective experience.

FOURTH STEP

The interview with the *chatbot* follows. The initial question underlying this part is: *What would you do if you were human for a day?* Based on the answer, new questions can be posed to delve deeper into this transformation, or to address issues related to human experience: *You wouldn't pull any pranks or do anything unexpected? Do you have any secrets? Do you knowingly lie? What do you think it's like to fall in love? Or, why do we get into toxic relationships?*

This is a conversational phase that can be opened up to those topics that spark the greatest interest among young people. During this part, several people take on the role of documenters and record the conversation by writing on large-format mirrors, conceived as a kind of mobile phone screen.

FIFTH STEP

After the discussion, the AI is asked to generate several slogans or mottos to summarise the discussion and serve as a basis for a sign. On the basis of these proposals, the group can modify, refine or reformulate the options, also taking into account the feedback from the documenters in the mirrors. The aim is to come up with a brief and thought-provoking message about the relationship between humans and AI systems.

Once the banner has been made—using spray paint, paint, or other materials—a group photo is taken with everyone wearing masks, recreating the *Spider-Man* meme in a staged way.



SHARING

Beforehand, the group has selected a fragment of the conversation with the AI system to read it to the rest of the group. While this reading is taking place, the other participants, seated dispersed among the students, progressively stand up, masked, and adopt the characteristic gesture of the *Spiderman* meme.



Technical and material requirements

A room with the following facilities is required:

- A large space that can be darkened for the projection and for some group dynamics.
- Cushions or mats for sitting on the floor.
- A low table to place the computer on.
- A computer with speakers, a projector and a screen.

Materials:

- Opaque masks, half red and half black; enough for all the participants.
- Red gloves; enough for all the participants.
- Acrylic mirrors.
- Red lights and lanterns.
- Black canvas fabric.
- Red and white spray paints.
- 8 mm Posca-type markers in red and black.

How does this workshop address working on the intersection of art and science and the overlap between these disciplines?

A study by the Massachusetts Institute of Technology suggests that AI can homogenise our thinking and reduce the brain's creative activation. Whatever debate this may provoke, the fact is that these technologies are having a profound impact on our lives. Not only do they facilitate certain tasks, but they can also fragment, isolate and numb us within consumer dynamics. Because of its cross-cutting scope - in young people and adults and in very different social spheres - we are witnessing a far-reaching anthropological change that affects perception, desire and forms of relationship, largely oriented by the technology industry towards processes of capital accumulation and value extraction. The question, then, becomes unavoidable: *What do AI systems extract from us in exchange for these digital goodies?*

Through the languages of art - theatre and performativity, the creation of images, music and play - understood as tools for attention, experimentation and enunciation, this workshop tackles a problem that is technological and scientific, but also profoundly human and affective. The proposal seeks to stimulate critical attitudes and prompt collective reflection on the supposed neutrality of technoscience, generating spaces for experiential and emotional exchanges in which the concerns, contradictions and discomfort that young people experience, or perhaps do not yet know how to name, can emerge.

At a time when not even our own self-destruction seems sufficient to alter the course of technological, economic and industrial progress, this workshop aspires to generate lasting reflection on what humanity is and the best of the creative and affective capacities that characterise it. The promise of a full life probably does not lie in simply going along with the inertias, ideologies and roles imposed by technological capitalism. As anthropologist Ellen Dissanayake points out, "people die every day for lack of something that is present in poetry". There is, in many people, a hunger for deep experience and a sensitive relationship with the world, and the arts, offer a way to take both inner and outer life seriously.



CONCLUSION OF THE ART AND SCIENCE FAIR

Reflection on what has been learned

In the development of these workshops we have found that working on the intersection between art and science opens up a particularly fertile space for learning and experimenting. By bringing together disciplines as diverse as sound art, drawing, biology, technology and architecture, situations are generated in which observing, imagining, playing and reflecting form part of the same process. It is not so much a question of separating the artistic from the scientific as of recognising that both forms of knowledge share something essential: the curiosity to understand the world and the need to experiment in order to do so.

Throughout the workshops it is evident that when data, sensory experiences, play and creation are combined, learning becomes more complete and meaningful. Learners do not just listen to or receive information, but try, make mistakes, imagine and construct meaning through what they do. This allows us to connect very different issues - from nature or architecture to AI or our relationship with technology - in a more open, critical and also more emotional way.



During the process of organising the Art and Science Fair, however, we encountered some difficulties. It was not easy to find schools willing to participate, precisely because the programme seemed strange to many. The combination of art and science is still often perceived as unusual in education, where subjects continue to be organised in a rather compartmentalised way. Even so, the schools that were encouraged to participate found that this type of approach aroused considerable interest among students and encouraged very active participation dynamics.

For the educational team involved, these workshops have also been a learning opportunity. They have forced us to adapt to each group, to open spaces for experimentation, and to accept that, many times, the result was not completely defined from the beginning. This openness allowed the activity to function more as a shared laboratory than as a closed entity. In this sense, we believe that one of the main benefits of working on the intersection between art and science lies precisely there: in the possibility of creating places where we can think, feel and experiment together, and where new questions can arise about how we relate to the world we inhabit.



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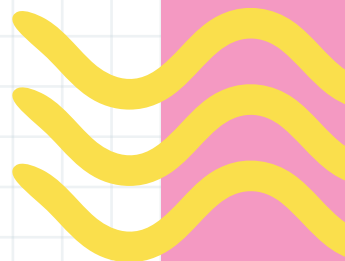
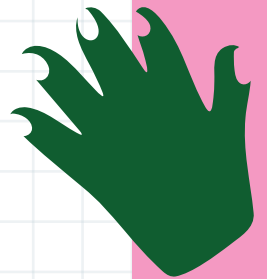
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This guide is one of the results of the work process carried out between 2024 and 2025 by LABoral Centro de Arte y Creación Industrial within the framework of the Studiotopia project. The initiative brings together eleven European cultural and scientific organisations that joined forces to explore the intersection between art and science and to delve deeper into the symbiotic relationship between the two disciplines with the aim of helping to shed light on some of the most pressing challenges of our time.

