

REPORT LSAAP(L)

2016-2017

*Laboratory of Somatic Applied to Architecture and
Landscape*

*San Pablo CEU University. Escuela Politécnica Superior (High Polytechnic
School)*



LSAAP(L) September 2016

Director:

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*Nowadays, teacher in training on the Feldenkrais method of Somatic
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Introduction:

LSAAP(L) is the first Laboratory of this characteristics developed in Spain. Format and contents are thought by M^a Auxiliadora Gálvez to conform a pedagogical and research project whose description is registered at the G.R of the Intellectual Property at the "Comunidad de Madrid". LSAAP(L) is hosted at the E.P.S Faculty of Architecture, San Pablo C.E.U University in Madrid, Spain.

The Laboratory works with somatic experience as a way to develop pedagogy of architecture and landscaping based on self-experience in space and environment. We could say that the work is related to Embodied Cognition in architecture and landscape.

LSAAP(L) deals with the study of the "alive" (the study of our own organism in relation with the environment) within a process that aims to extrapolate this knowledge to other systems. This study is conducted mainly through the Feldenkrais Method of Somatic Education, but also is supported by other ways of sensory-motor learning and a collection of thematic theoretical lectures. The theory involved has to do with human anatomy, the nervous system, biomechanics of the skeleton and other structural body systems, the environment, geology and landscape, evolution (focused in motor development), architectures and architects with somatic roots, and processes like imagination, morphogenesis or learning modalities.

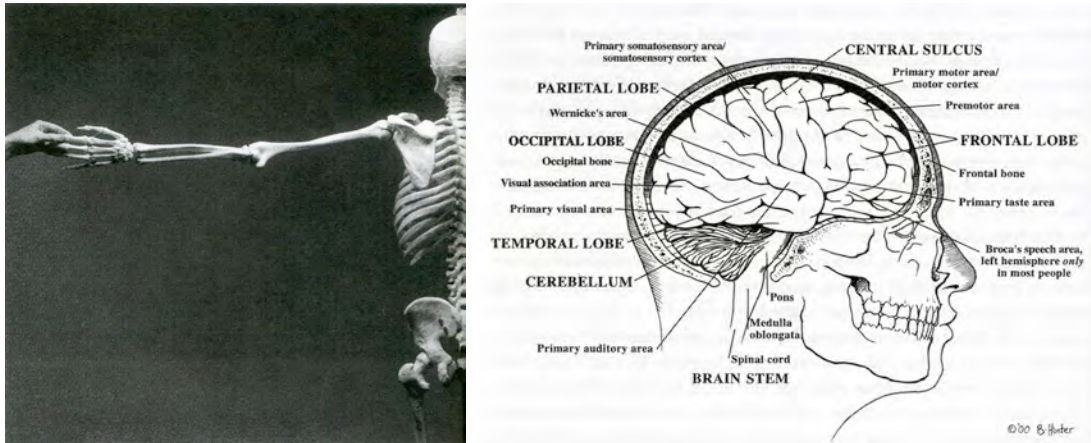
The own experience, through the relations in between nervous system, musculo-skeletal system and environment, is the one opening issues to study. This approach leads to new pedagogical lines in architecture and landscape in terms of "Spatial thinking", "Social or ecological concerns" and "Structural thinking".

The aspects that are trained or studied through somatic applied to the pedagogy of the architectural and landscape practices are the following:

- Interaction with the environment; perception of our actions and ourselves are not isolated from the experience of the surroundings. There are bidirectional affections. They conform a system.
- Cybernetics (automatic capacity of living organisms to adapt, communicate, and self-regulate)/ Neuroplasticity (capacity of our nervous system to learn)/ Systems theory (interrelated components and with multiple ways of interaction).
- Visualization and transference of structural patterns. Lines of force and distribution. Dynamic reality. (SPIFFER- Concepts by Larry Goldfarb).
- Changes in the environment or in our sensors provoke different response capacities. Perceptive awareness is educated and tuned. (Weber Fechner Law).
- Imagination is a tool for perception and knowledge and vice versa.

The lessons of somatic education introduce from experience the subjects of study. Through them, the work with proprioception* is developed (under the thesis of the laboratory, this lead to an improvement in learning in terms of spatial thinking) and also the work with the body representations of our nervous system. We refer to

"Body image"* and "Body schema"*, both being the ones receiving nowadays more consensus about how the nervous system work talking about the sensory-motor system. This, under the thesis of the laboratory, intervenes in learning in terms of "structural thinking".



***Proprioception:** Perception governed by proprioceptors, as awareness of the position of one's body. Intervene in the development of the body schema and in the relation of it with the space, supporting motor action. *Etymology: PROPRIO + (RE) CEPTION 1905-10*

***Body Schema:** Sensorimotor representations of the body that guide actions. Operates in a nonconscious way, is prepersonal, functions holistically, and is not something apart from its environment. (Shaun Gallagher, 2005).

***Body Image:** Is the conscious image or representation, owned, but abstract and disintegrated, and appears to be something differentiated from its environment. Body image groups all the other representations about the body that are not used for action, whether they are perceptual, conceptual or emotional. (Gallager, 2005).

Others authors (Schwoebel&Coslett, 2005; Sirigu. Grafman. Bressler,&Sunderland, 1991) mention that the Body Image is split up into two distinct body representations: the visuo-spatial body map (body structural description) and the body semantics. (See: Frederique de Vignemont "Body Schema and Body Image- Pros and cons", 2009)

Calendar:

The Laboratory in its first year, is developed in between September the 21st (2016) and April the 26th (2017).

Program:

In its first year, the experiences of the Laboratory are developed following three main axes:

- Theory**:
We go deep into processes of architecture and landscape of somatic profile, but also into different theoretical questions related to the organic systems involved. The main part of the Laboratory is based on experience but the theoretical lessons help to go ahead in learning and research. Theory issues are decided following research goals of the approaches of the Laboratory.
- Somatic awareness:
This work is developed mainly through ATM sessions "Awareness through movement" (© Feldenkrais).
- Atmospheric and environmental awareness:
Within this axis, ATMs in the open air are used but also experiences of "Body and Earth" (© Andrea Olsen y Caryn McHose) and other experiences created directly within the Laboratory.

** Study subjects within the theoretical lessons:

- Introduction to nervous system.
- Introduction to skeleton anatomy and its biomechanics
- Introduction to the structural systems of living organisms and comparison with other structures.
- Introduction to ontogenetic and phylogenetic development.
- Introduction to history of somatic in architecture and landscape.
- Introduction to morphogenesis of the living systems.
- Introduction to the relationships in between neuroscience and architecture.
- Introduction to embodied cognitive theories of space and imagination.
- Introduction to basic aspects of ecology.

Through the experience of the Laboratory the participant acquire knowledge about the "Theoretical lessons" and at the same time improves his/her capacities for "Spatial thinking" (through the proprioceptive work) and "Structural thinking" (through the "Body image" work).

Collaborators and guests:

Alba Aja, Isabel Daganzo, Esther García, Pedro Goucha, Chus Jiménez, Mariano Molina, Ana Mombiedro, M^a Concepción Pérez, Jaime Polanco, Kasia Salamon, Inmaculada Torrero... .. Thanks to each of them!!... Also thanks to Marilupe Campero, who gave us important advices and also to the rest of the team and companions of the Feldenkrais Training in Madrid 3. Special thanks to the Polytechnic School E.P.S San Pablo C.E.U University Faculty of Architecture and Faculty of Medicine, without their support this experience wouldn't exist...

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1st Part (September the 21st- November the 30th)

(1)>>SEPTEMBER THE 21st, WEDNESDAY 12:30> Presentation

(2) SEPTEMBER THE 28th, WEDNESDAY 18:30-20:30> ATMs 1

Introduction to spatial tests.

ATM1 (Leonardo da Vinci)

Introduction to anatomy of the skeleton and planes. Lines

ATM2 (Rotating while sat down)- The nervous system patterns of action

Theory: Introduction to perception and movement patterns of the nervous system.



"Hangar", Anna Halprin (circa 1957)

(3) OCTOBER THE 5th, WEDNESDAY 18:30-20:30>

TEST 1- Structural patterns reading and understanding

(with professors Mariano Molina and M^a Concepción Pérez, architects experts in structure calculation and design)

Theory: Introduction to Palpatory Anatomy and Biomechanic of the Skeleton. (Guest: Esther García, physiotherapist)



Image from the exhibition "L'altro sguardo", Triennale de Milán, 2016.

OCTOBER THE 12th, WEDNESDAY> HOLIDAY

(4) OCTOBER THE 19th, WEDNESDAY 18:30-20:30> ATMs 2

ATM3 (Guest: Alba Aja, physical education teacher and therapist) Assistants:
Isabel Daganzo and Inmaculada Torrero.

The structure of the pelvis. Movement transmission.

ATM4

Acoustic space of jumping. Biomechanic learning and experience.



Image: Charlotte Rudolf. Gret Palucca, 1924.

"... Basis of jumping, acoustic space, vibration and... something else... we will continue learning from our biological structure: through our nervous system, our skeleton and the environment... where begins this vibration and till where arrive? Does it have any spatial or atmospheric form? Is it inside or out of yourself?"



This drawing is part of the material produced during the workshop Touchandgoreality celebrated in Buenos Aires in 2012. The workshop was directed by Daniela Muttis, Edgardo Mercado and M^a Auxiliadora Gálvez.

"... How is a space that you know visually, from the acoustic point of view? At different rhythms and different places of emission, would it change its acoustic image its ambiance?... how is the perception of your own organization in parallel to the medium that surrounds you?... do you know the biomechanics of jumping? And all this, can be drawn using your imagination and perceptive awareness in order to be used and learn?..."

(5) OCTOBER THE 26th, WEDNESDAY 18:30-20:30> ATMs 3

ATM5: Systems of reference and spatial navigation (Clocks)



Making of, Global Tools Bulletin №1, 9999
1974, Archive Ugo La Pietra

Making of. Global Tools Boletín, 1. Ugo La Pietra, 1974.

"... Have you ever explored the relation of your anatomy with the cardinal points and places? With the axes, directions and basic geometries according to which we orientate ourselves?..."

(6) >>NOVEMBER THE 2nd, WEDNESDAY 12:30-14:30> First session in the landscape. EXPERIMENTS IN THE ENVIRONMENT and BODY AND EARTH.

Plumb line; Snapshots; Principles of Ecology.



Gilles Clement en "Environ(ne)ment. Approaches for Tomorrow.
G. Clement & Philippe Rahm" CCA

"... The landscape where we have been working today was gestated geologically talking in the Miocene... geological epoch that began 23,3 millions of years and ended 5,2 millions of years ago when some apes where about to take the step in evolution to the first hominids... homo sapiens appeared just between 200.000 and 100.000 years ago... Reddish, pink and grey argillaceous materials, and ochres lutites, were today the terrain under our feet... Are you more conscious now about the point in which you are in the ecosystem? In evolution? In the landscape panorama of times and rhythms?... a landscape in continuous change and movement like you... within overlapping rhythms... like you..."



"Ritual Group Drawing" 1969- "Experiments in the Environment" by Anna Halprin and Lawrence Halprin.

(...In relation with breathing, ourselves and the environment...)
["... A substance full, dense, rich in qualities and attributes, where things would be cut islets made out of this substance, moviles yes, but on condition that all the relations of its substance and the exterior substance accompany and register movement..."]
Michel Tournier, "Les météores"

NOVEMBER THE 9th, WEDNESDAY> HOLIDAY

(7) NOVEMBER THE 16th, WEDNESDAY 18:30-20:30> ATMs 4 + Spiffer

ATM6- Eyes and lines

Theory: Dynamic patterns of forces and movement. SPIFFER



Image by Izabela Wieczorek. Venecia, 2016

"There is always some measure of adventure in the meeting of ("the self") and universe, and this adventure is, in its measure, imagination."
Art as Experience. John Dewey



Imagen: Fluxus, 1 (1964-65) Fluxus Edition, New York

"... Following diverse lines in space, and our virtual movement transforming us into observers through imagination..."

(8) NOVEMBER THE 23rd, WEDNESDAY 18:30-20:30 > ATMs 5

ATM7- Dominant hand /
ATM 8- Water. Flowing movement.
Theory: Morphogenesis of water.



"Constrain for the open palm", Global Tools. Milan, 1975

"In 1833, with Darwin near the midpoint of his epic five-year voyage on the Beagle, Charles Bell completed and published the Fourth Bridgewater Treatise: "THE HAND, Its mechanism and Vital Endowments, as Evincing Design" [...] Bell's hand now, because its singular message- that no serious account of the human life can ignore the central importance of the human

hand- remain as trenchant as when it was first published."
The Hand. How its use shapes the brain, language, and human culture.-
Frank R. Wilson



"This is an image of water. When you look at it, as you are probably doing now, you are looking at screen, and there is no necessary relationship between the two. Yet the screen floats the image of water or facilitates it, and you see before you a water without wetness. As with all images, you imagine what you are looking at and doing so grasp it."

"What do you know about water? Only that it is everywhere ¿Qué es lo que sabes del agua? ¿solo que está en todos lados de manera diferente?"

"STILL WATER (THE RIVER THAMES, For example)" 1999. Roni Horn

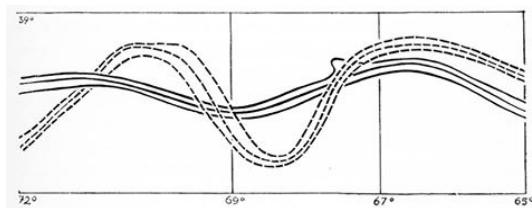


Image by Theodor Schwenck, "Sensitive Chaos: The Creation of Flowing Forms in Water and Air", 1989.

[*"In the Atlantic Ocean, the warm Gulf Stream, describes, in the middle of the cold waters, big meanders that scroll along time..."*]
Theodor Schwenck, "El Caos Sensible, 1989.

"How does participate movement in the processes of morphogenesis?"

(9) NOVEMBER THE 30th, WEDNESDAY 18:30-20:30> "Walking as an aesthetic practice I"

Guest: Chus Jiménez, podologist, physiotherapist and Feldenkrais teacher.
"Weight, sensitivity and action in displacement"



Robert Smithson in Spiral Jetty, 1970. Photo by Gianfranco Gorgoni.

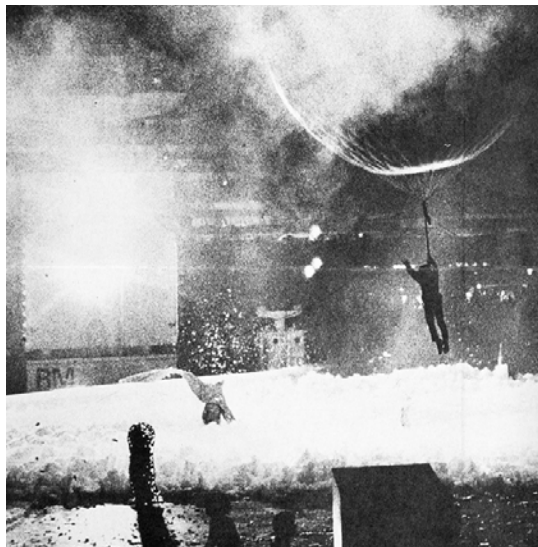
2nd Part (February the 1st- April the 26th)



Image: manipulation of "Pearblossom Highway", 1986.
David Hockney. Poster of the second phase of the LSAAP(L).

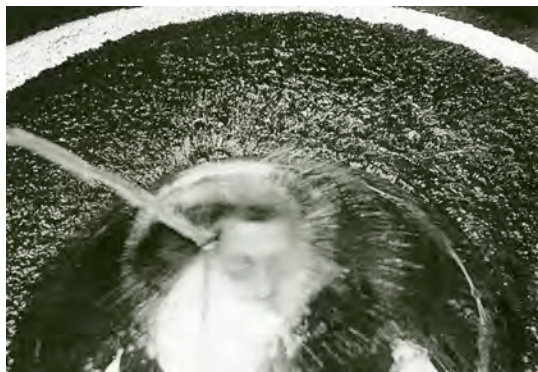
(1) FEBRUARY THE 1st, WEDNESDAY 18:30- 20:30> ATMs intro 2

ATM (0)- Bringing the arm behind in arch...
Theory: Immersions- Ugo la Pietra



Gutai Art Festival. EXPO'70.- Festival Plaza, 1970.

"...immersions and a walk around the black and white strip of our vision..."



Disequilibrante system. "Nell' acqua", Ugo La Pietra, 1970.

"We can only hope that future planners, rather than flattening until the limit of the total destruction of human imagination, would leave at least a window that would allow him to accept these unbalancing forces that are, perhaps due to backlash, able to restore that mental balance that the technocratic and consumerist civilisation deprives him of more and more."
Gillo Dorfles, in *Il sistema disequilibrante*, Milán 1970.

(2) FEBRUARY THE 8th, WEDNESDAY 18:30- 20:30> ATMs 6

ATM8

Anatomic drawing- Flexors and extensors coordination/ Structural test:
explanation.



Image by Heinrich Heidersberger. Kleid aus licht series (light cloth) 1949.



This is one of the images included in the Structural Test 1 done by M^a Concepción Pérez and Marinao Molina for the Laboratory. They are professors in structural design teaching at E.P.S Faculty of Architecture University San Pablo C.E.U.

Alexander Calder.- Mobile au plomb, 1931

Do you know how you can improve your learning in terms of "reading and design of structural patterns"? In the Laboratory we develop a pedagogical study with an experimental group and several groups of control...



Le Grand Cirque Calder, 1927

"...To understand balance and organization of forces starting from your own experience, makes easy to extrapolate this learning to other structural systems... in the session we connected with the funambulists of the Calder's Circus and its mobile structures looking at the balance systems."

(3)>> FEBRUARY THE 15th, WEDNESDAY 12:30- 14:30> "Walking as an aesthetic practice II. The body and its changing perception." Munition Dump landscape in Montegancedo

Guest: Chus Jiménez, podologist, physiotherapist and Feldenkrais teacher.



Casabella, n. 397, 1975

"...The changing perception following our orientation and position... windows to the environment...sensory-motor interdependence, to receive and to activate simultaneously... and collective imagery... in primitive movements previous to walking..."



Lawrence Halprin, Sea Ranch Landscape

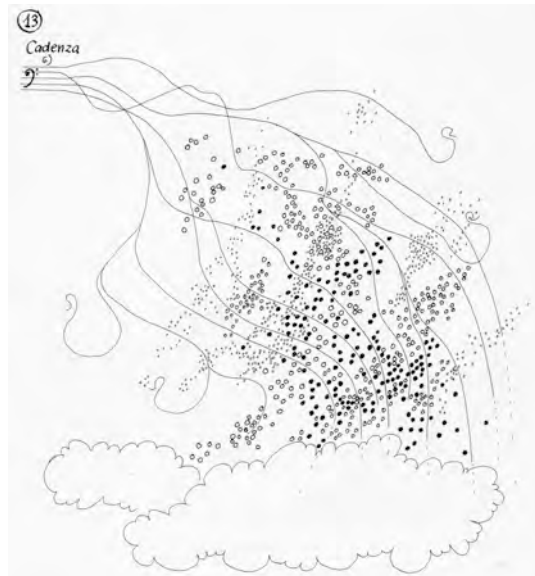
"... It is said that size and form of a body representation is isomorphic when it coincides with objective reality and, curiously, this will seldom be the case..."

"... Vestibular apparatus, vision and somatosensory system (tact and proprioception) can be educated." Chus Jiménez

(4) FEBRUARY THE 22nd, WEDNESDAY 18:30- 20:30> ATMs 7

ATM9- A plane dividing the body...

Theory: Architecture and Neuroscience> Ana Mombiedro, architect, PhD candidate.



"The End" For solo cello. Bent Lorentzen, 1969.

"...How is your self-image built? Body-schema; Body-image... Mirror neurons and motor imagery..."

"...Have you ever feel your half and section? Your self-image in relation with the medium?..."

(5) MARCH THE 1st, WEDNESDAY 18:30-20:30> ATMs 8 Imagination

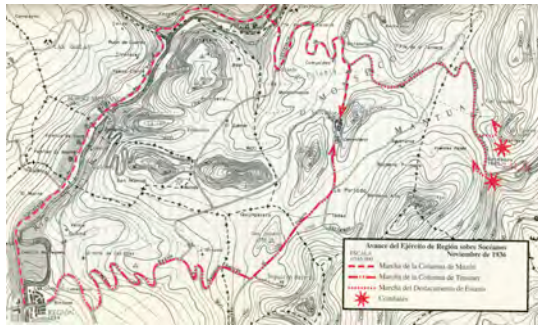
ATM10

Alice in wonderland

Theory: Patterns of dynamic imagination, opposites and telepoetry... (Martha Graham, Isamu Noguchi, Buckminster Fuller...)



Alice in wonderland. John Tenniel, 1864-65



"Region" map. "Herrumbrosas lanzas", Juan Benet, 1983.

"You have in front of you the map of "Region", invented by Juan Benet and its "Socéanos" battle... you are in territories of the imagination. Can you visualize this landscape and its movements with a bird's-eye view? As if you were a giant?... and the opposite, can you imagine this territory thinking that you were tiny... tiny?..."

(6) MARCH THE 8th, WEDNESDAY 18:30-20:30> "Hydraulic volume, pneumatic volume. BODY AND LANDSCAPE STRUCTURES" Session I.

Guest: Jaime Polanco, physiotherapist and Feldenkrais teacher.



Fragment of "Musique en couleurs", 1931. Boris Bilinsky.

"... What do you see in this image? Water volumes? Currents and air volumes? Vortices?... are you interested in studying the dynamics of the alive and its atmospheres?..."

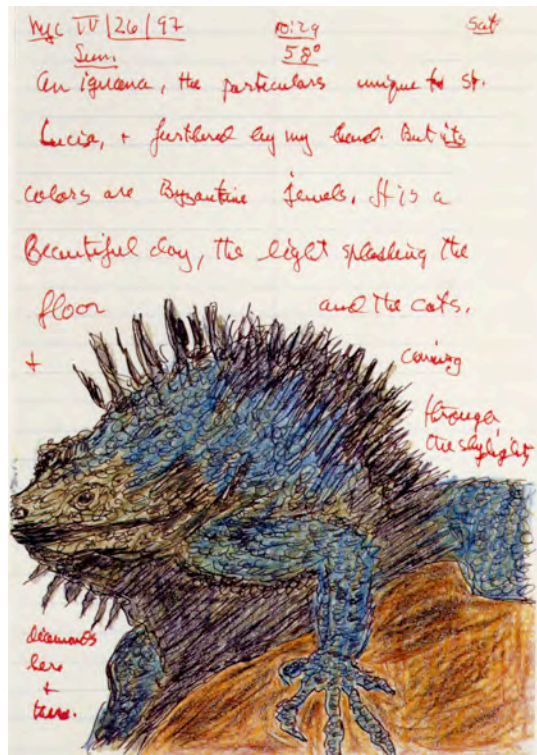


"CLOUDS"- Weightless. Luis Callejas LCLA Office.

"... Did you test how the process of breathing and its neumatic structure, through the awareness of these two volumes (neumatic-hidraulic) is self re-adjusted to the posture of the body in accordance to gravity?..."

(7) MARCH THE 15th, WEDNESDAY 18:30-20:30 > ATMSs 9

Ontogenetic and phylogenetic development. Experiences about psychology.
ATM11
Guest: Alba Aja de Maruri, physical education teacher and therapist.



Drawing by Merce Cunningham. "Other Animals. Drawings and journals", 2002 (Dib. 1986-1999)

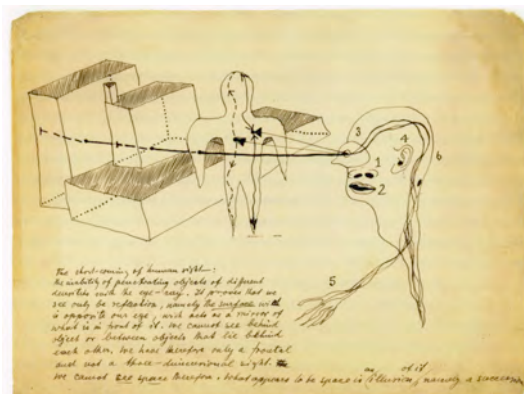
"A trip back in time and in evolution of the species through the sensory-motor development"

(8) MARCH THE 22nd, WEDNESDAY > HOLIDAY

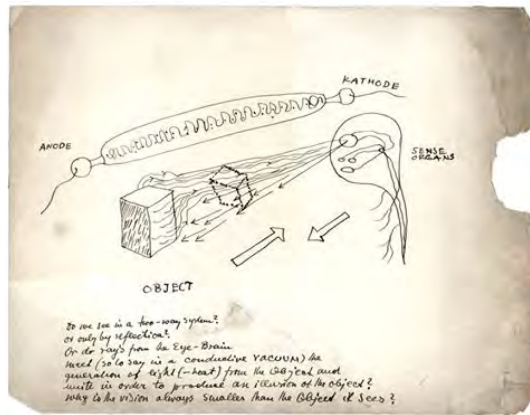
(9) MARCH THE 29th, WEDNESDAY 18:30-20:30 > Connecting the movement of your eyes with your sense of space.

Guest: Pedro Goucha Gomes, coreographer, dancer and somatic movement practitioner.

Theory: M^a Auxiliadora Gálvez (Georges Bataille and Japan)



"Vision Machine. Study of perception". Frederick Kiesler, New York, 1938/1942



"Vision Machine. Study of perception". Frederick Kiesler, New York, 1938/1942

"We were able to experiment the coordination in between eyes movement and our hands and how this relation once fixed, produce a dynamic perception of the peripheric environment... Had you ever done such a beautiful drawing "on" the atmosphere surrounding you? But we also experimented with our visual field and with our senses as extensions of our limbs reaching the territory and conquering social space in different ways. Do you know the drawing "extended senses" by Frederick Kiesler?... and the effects of the movement of your eyes on your whole organization?... we continue advancing on our work with proprioception and our "Body image"..."

(10)>> APRIL THE 5th, WEDNESDAY 12:30-14:30> "Hydraulic volume, pneumatic volume. BODY AND LANDSCAPE STRUCTURES" Session II. The session will be developed in the landscape of the abandoned Muniton Dumps.

Guest: Jaime Polanco, physiotherapist and Feldenkrais teacher.



Bill Dan, esculptor. July, 2014

"Can you transfer your own experience of equilibrium to other systems?..."



"Driftwood City," Sea Ranch, CA. Experiments in Environment Workshop, July 4, 1966. Lawrence Halprin.

(11) APRIL THE 12th, WEDNESDAY> HOLIDAY

(12) APRIL THE 19th, WEDNESDAY 18:30- 20:30> ATMSs 10

PLAYFUL

ATM12- Baby Roll and other plays of exploration of movement in space.



CICCI COCCÒ, Bruno Munari (1974-1981)

"How do we learn through play? In between 1974 and 1981 the pictures of "CICCI COCCÒ", the book by Bruno Munari, are taken. The text begins like this:

"[...] In childhood we live in the estate which in the Far East is called Zen: our knowledge of the reality around us happens instinctively through what adults call play. All our senses are open to receive data: looking, touching, tasting, hot, cold, weight and lightness, hard, soft, rough and smooth, colours shapes, distances, light and dark, sounds and silence... it is all new, everything is still to be learnt and play helps the memory. Afterwards we become adults and part of society. One by one our senses close up, we hardly learn anything new, we only use reason and the word and the questions we ask are: how much does it cost? What use is it? What will I get out of it? [...]"



CICCI COCCÒ, Bruno Munari (1974-1981)

*"It isn't a whale, It isn't a shark,
It's a six-legged monster hid in the dark"*

*"Human life and the beginnings of the intelligent behavior that we can see in the infant are not only measured by their physical manifestations as bodily processes, they ARE those processes, and are constituted by them."
(Shaun Gallagher: How the body shapes the brain, 2005)*



CICCI COCCÒ, Bruno Munari (1974-1981)

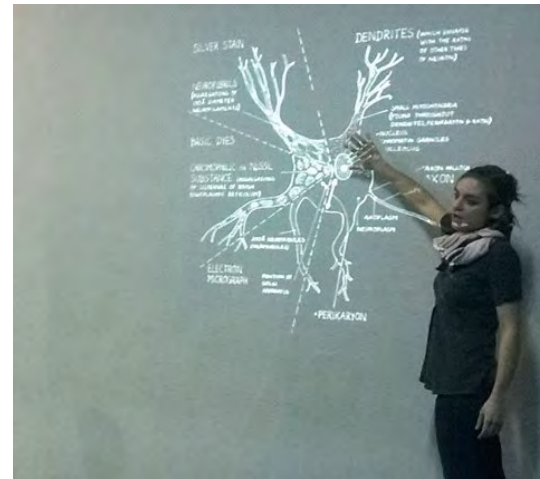
(12) APRIL THE 26th, WEDNESDAY 18:30-20:30> Final session in the landscape or outdoor spaces of the campus.

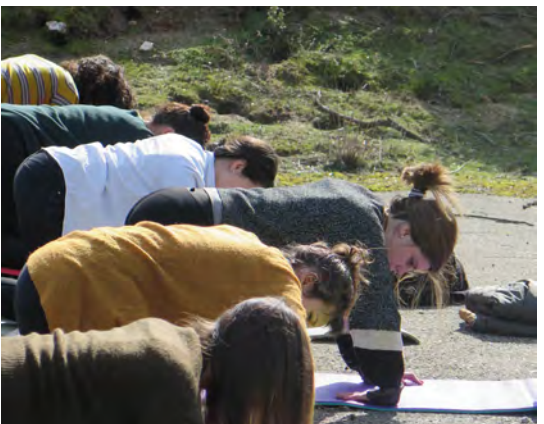
“Tandem” with knee flexion; Final spatial tests; Final structures test.



"La Face Cachée du Léman. Mythes, Légendes et Sornettes", 2008.

Photo-report of some of the sessions >>>







“[...] If architectural design is based on the soma and aims to enhance somatic experience, it should be critically attentive to the soma’s multiplicity of senses [...] if the soma is the crucial medium through which architecture is experienced and created, then developing its discriminatory powers could enrich architecture’s critical and creative arsenal as critical perception is always part of the creative process”

Richard Shusterman, *Thinking through the Body. Essays in Somaesthetics*, 2012



Manipulation of the poster by Hijikata Tatsumi
"Dance Experience"... 60's

Movement, perceptive awareness and imagination as a way to learn and experience: LSAAP(L)

***“Motofuji says that they entitled the group “650 Experience Society”, because there were 650 seats in the hall where they were going to perform, so that each person would have an experience for a total 650 experiences”
B. Baird***

Facebook- <https://www.facebook.com/Plataforma-de-Som%C3%A1tica- Aplicada-a-la-Arquitectura-y-el-Paisaje-117632268706318/>

ANNEX:

Here we would like to show the first empirical appreciations of the experience of the Laboratory. This is an on-going process just beginning so for most of the aspects we begin to learn now how to do it better and with more solid and complete documents. But for now, these tests are useful to begin to see tendencies in learning, and it seems to be a promising beginning!

(Updated: 29-August-2017)

Test: Spatial thinking> These tests are done only to the architecture students involved in the Laboratory of Somatic. We test perception of their body dimensions and also in relation to space, also their relative position (proprioception). We do it mainly through ATM lessons focused on these aspects. Participants take notes about their experience. A similar test is done at the end of the year and we compare the results.

The experience shows that either the accuracy of the experience and its perception, or the performance in itself is improved. But we need to improve the way we measure it so for next year we plan to do it through video recordings and photos in order to have a more objective appreciation.

Test: Structural thinking> We have monitored basic structures knowledge in different systems. It is done to three groups:

- Students of architecture involved at the Laboratory (mainly 4º, 5º and Diploma Thesis level)
- Students from the Feldenkrais Training Madrid 3 (they are in between second and third year)
- Diverse profiles with no education either in architecture, or in somatic disciplines.

Architecture students: They do one test at the beginning of the course (September) and another one (both of similar levels) at the end of the year (end of April).

Somatic Feldenkrais students: They also do both tests, one in October and the second one at May.

Diverse profiles with no somatic or architectural education: They do only the first test in order to see the validity of the way of testing.

These were the results: In the first test, the architectural students had an average of 6,29/10 and the Feldenkrais students of 6,25/10. They were responding quite equal. On the other hand, participants from the third group (no somatic education, no architectural studies) had lower marks: 5,69/10.

In the second test, participants from the Feldenkrais Institute, obtain a very similar mark: 12,80/20, but the architectural students obtain 14,80/20, improving their results in more than one point.

Even if this first study is only the beginning of the monitoring of this kind of learning, it seems that the embodied experience of structural patterns allows a valid intuition in the reading and understanding of structural systems, even if the concrete study of architectural structures has not been produced. We find this very interesting for an architectural school. The combination of the conventional way of teaching with organic learning seems promising, looking for a better integration of knowledge, and more based in self-discoveries.

Hereafter we attach the initial and final structural tests in order to give the idea about our work on this aspect.



Analiza el equilibrio del móvil de Calder de la figura adjunta y explica si son verdaderas o falsas las siguientes afirmaciones:

[Analyze the equilibrium in this Calder sculpture and explain if the following affirmations are true or false:]

1.- El peso de la bola blanca es igual a la suma de los pesos de las bolas rojas y negras.

[The weight of the white ball is equal to the addition of the weights of the red and black balls.]

2.- El esfuerzo axial que soportan las tres barras inclinadas del tetraedro es el mismo.

[The axial force that support the three slanting bars of the tetrahedron at the basis is the same.]



En la figura adjunta, explica si son verdaderas o falsas las siguientes afirmaciones:

[Looking at the image explain if the following affirmations are true or false.]

3.- Si el acróbata que se sitúa arriba se apoyara sobre los hombros del acróbata que apoya los pies en la viga, el ejercicio sería más sencillo. [If the acrobat on top would lean on the shoulders of the acrobat with his feet on the beam, the exercise would be easier]

4.- Si el acróbata tumbado se colocara boca arriba, el sistema perdería el equilibrio. [If the horizontal laying down acrobat would face up the system would lose its equilibrium]

5.- Los brazos del acróbata que apoya los pies en el suelo no soportan el peso del acróbata que está en posición vertical. [The arms of the acrobat with his feet on the beam don't support the weight of the acrobat in vertical position]



6.- Explica la relación que puede existir entre el comportamiento estructural de la cubierta del estadio municipal de Braga (Souto de Moura) y los niños jugando a la soga-tira.
[Explain the relation in between the structural way of working of the roof in the stadium of Braga, by Soto de Maura, and the kids playing.]

7.- ¿Cómo variaría el comportamiento de la estructura si los elementos de hormigón fueran verticales en lugar de inclinados?
[How would this structure change its way of working if the concrete elements would be vertical instead of tilted?]



8.- ¿Qué efecto producen los tripulantes colgados? Explícalo con un diagrama de fuerzas.
[Which effect do create the hanging sailors? Explain it with a forces diagram.]



Analiza la posición del elemento vertical en torno al que se organiza la pasarela:
[Analyze the position of the vertical element around which the walkway is organized]

9.- ¿qué ocurriría si el elemento vertical estuviera inclinado hacia la derecha?
[What if the vertical element would be tilted to the right?]

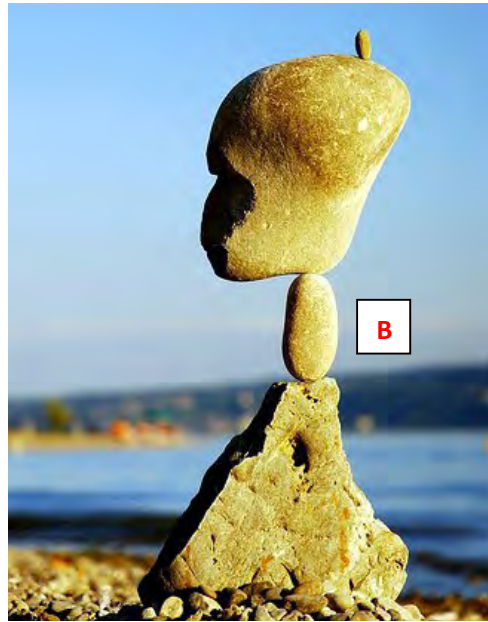
10.-¿qué ocurriría si el elemento vertical estuviera ubicado a la izquierda de la pasarela en lugar de a la derecha?
[What if the vertical element would be placed to the left of the walkway instead of to the right?]

TEST final [Final Test]

¿Verdadero o falso? (V ó F) [True or false? (T or F)]

A.- El equilibrio de la figura, suponiendo que no hay adhesivos entre las piedras...

[Consider the equilibrium of the system below if there is not any kind of glue between the stones...]



1.- Es inestable, la foto está trucada porque es imposible el apoyo sobre la piedra B.

[It is unstable, the picture is a fake because stone B cannot support any stone over it.]

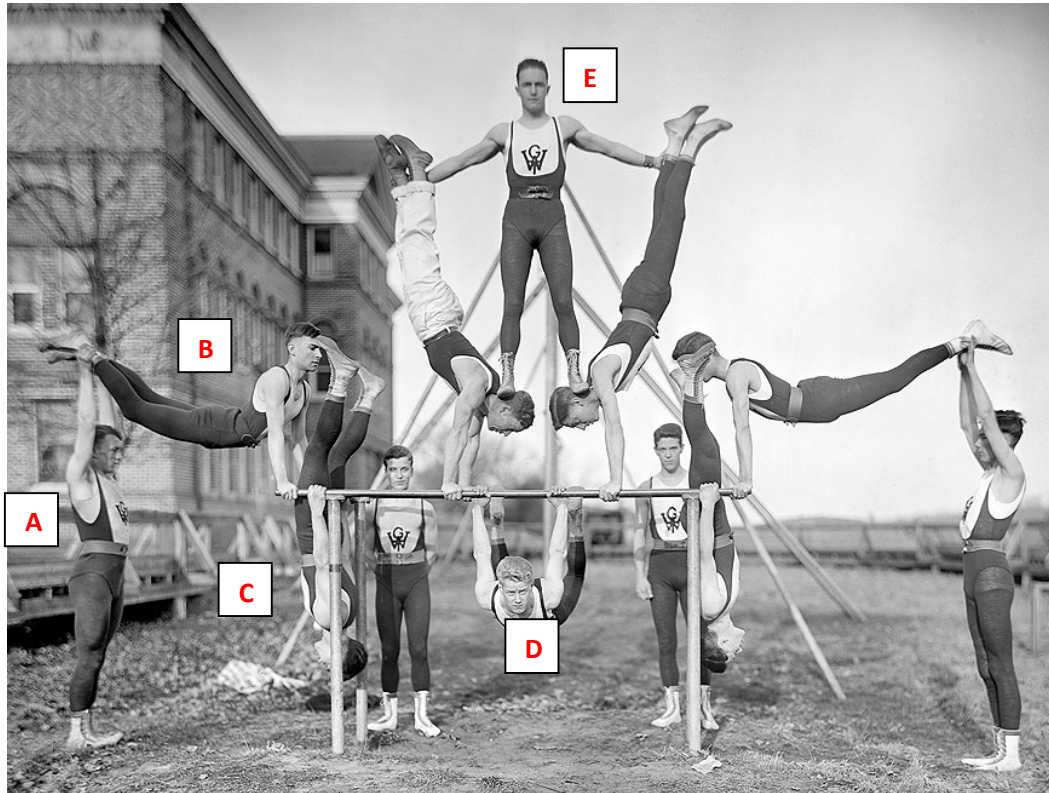
2.- El efecto de la piedra minúscula que está coronando la escultura es despreciable.

[The effect of the little stone at the top of the sculpture can be neglected in the global equilibrium]

3.- Sería posible el equilibrio dando la vuelta a la piedra de base triangular.

[It would be possible to find a balanced position for the system if we put the triangular stone in the base upside down]

B.- La figura representa a un grupo de gimnastas sobre dos barras paralelas apoyadas en el suelo:
[The figure represents a group of gymnasts on the parallel bars]



4.- Los brazos del gimnasta A trabajan aproximadamente lo mismo que los brazos del gimnasta B
[Gymnast A arms work roughly the same as gymnast B arms]

5.- Los brazos del gimnasta B trabajan aproximadamente lo mismo que los brazos del gimnasta C
[Gymnast B arms work roughly the same as gymnast C arms]

6.- Los brazos del gimnasta C trabajan aproximadamente lo mismo que los brazos del gimnasta D
[Gymnast C arms work roughly the same as gymnast D arms]

7.- Los brazos del gimnasta E no intervienen en el equilibrio del sistema.
[Gymnast E arms are no involved in the system equilibrium]

C.- Comparemos la forma de trabajar de estos dos puentes:



[Let's compare the way these bridges work]

8.- Si cortamos uno de los cables exteriores en el puente de la izquierda (los que forman los triángulos superiores) la estructura podría no perder su funcionalidad.

[If we cut one of the outer cables of the bridge on the left (the ones that build the external triangle) the bridge would not completely collapse.]

9.- Si cortamos uno de los cables exteriores en el puente de la derecha (los que forman la curva superior) la estructura podría no perder su funcionalidad.

[If we cut one of the outer cables of the bridge on the right (the ones that build the external curve) the bridge would not completely collapse.]

10.- En la estructura de la izquierda todos los cables tienden a estirarse.

[In the bridge on the left every cable gets longer]

11.- En la estructura de la derecha los cables verticales tienden a estirarse y los cables curvos a acortarse.

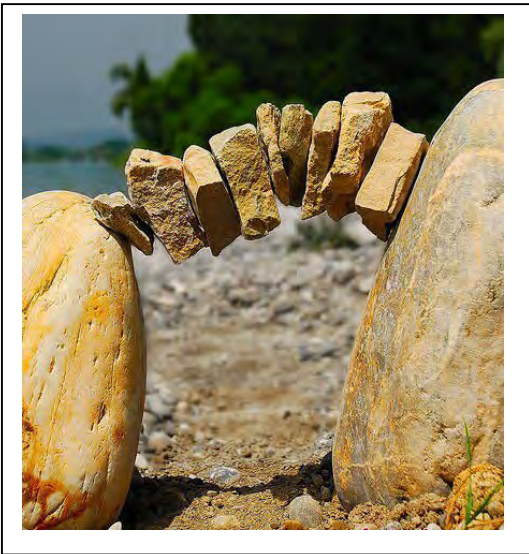
[In the bridge on the right the vertical cables get longer and the curved one gets shorter]

12.- El trabajo de las pilas de hormigón en ambos puentes es análogo.

[The concrete towers (or pylons) in both bridges work in the same way.]

D.- Comparemos la forma de trabajar de las siguientes figuras:

[Let's compare the way of working of these two systems:]



13.- La figura de la izquierda no es posible, es un montaje.

[The image on the left is not possible, it is a fake]

14.- La figura de la izquierda se puede construir colocando una piedra sobre la otra hasta completar el dintel. [The structure on the left can be build placing one stone over the other from the left to the right]

15.- En la figura de la derecha los cables se podrían cortar en cualquier momento, son sólo un sistema de seguridad extra. [The cables of the picture in the right can be cut at any time because they are only there for extra safety]

16.- En la figura de la derecha los cables se pueden cortar cuando se complete el arco metálico.

[The cables of the picture in the right can be cut when the steel arch is finished]

E.- En la escultura de Calder de la figura: [\[In he Calder mobile of the figure below:\]](#)



17.- En el equilibrio entre la bola blanca grande y la bola negra, se puede decir que el peso de la bola blanca grande es la razón única por la que baja más que la negra.

[\[The big white ball goes down only because its weight is higher than the one of the black ball\]](#)

18.- La bola azul más la bola roja pesan igual que la blanca pequeña.

[\[The blue ball weight plus the red ball weight equals the small dwhite ball weight\]](#)

19.- La bola azul, más la roja, más la blanca pequeña, pesan igual que la blanca grande más la negra. [\[The blue ball weight, plus the red ball weight, plus the small white ball weight, equals the big white ball weight plus the black ball weight\]](#)

20.- La varilla vertical que conecta el sistema con el suelo, tiende a alargarse.

[\[The vertical rod that connects the system with the floor gets longer\]](#)