Movement and Cognition at the Laboratory of Somatics for Architecture and Landscape

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Synopsis: The present research is focused in the pedagogical experience of the "Laboratory of Somatics for Architecture and Landscape" [LSAAP(L)], developed at the Faculty of Architecture San Pablo C.E.U University. We will use this Laboratory as case study in movement and cognition. LSAAP(L) works with somatic experience and movement- Feldenkrais Method mainly- as a way to develop learning in architecture and landscape issues.

The Laboratory poses three questions:

A- *Would it be possible to develop "structural thinking" through somatics and movement?* By "structural thinking" we refer to how students of architecture learn structures and structures calculation. The approach is that if you are able to experience through your own movement, dynamic structural patterns within your own structures- mainly the skeleton- should be easier to integrate structural knowledge as it is conventionally taught in academic environments. This was tested during the 2016-17 academic year with students of Architecture participating at the Laboratory and two more groups of control. The result was that Architectural students involved at LSAAP(L) were able to increase in 1,1 points their marks in the structural tests proposed, meanwhile the rest of the groups remained the same.

B- *What if through movement, students could improve "spatial thinking" skills?* Through "sensory-motor" learning and "motor imagery" the idea is to work with proprioception in order to improve their skills in reading and designing spaces and ergonomics. The experience points out that either the accuracy of the experience and its perception, or the performance is improved.

C- *What if some theoretical ideas could be integrated through the embodied experience of them?* Are conceptual aspects better remembered if they are accompanied by an experience? Let us give an example with the imagination theories by Gaston Bachelard or Gilbert Simondon. These theories are similar to some concepts within ATM lessons of the Feldenkrais Method of Somatic Education dealing with imagination. Using both formats together- conventional teaching through a lecture and real action through experience- we test nowadays if learning is actually improved… and it seems that actually… it is…

As conclusion we can say that even if the study is a work in progress it seems that sensory-motor experiences, can improve or enlarge the possibilities for learning in Architectural and Landscape Studies.

***** ***paper*** *****

The “Laboratory of Somatics for Architecture and Landscape” [LSAAP(L)], was founded in September 2016 as an experimental area of pedagogical research located at the Faculty of Architecture of the San Pablo CEU University in Madrid, Spain. The antecedents of this approach can be found in the Doctoral Dissertation- within the architectural discipline- “Active matter: dance as an experimental field for architecture of phenomenological roots” [1] developed by the author in 2012. The outcome of these research showed how along the history of Modern, Postmodern and Contemporary Dance, including the roots of them in the second half of the XIX Century, the concepts of space and perception involved in dance and architecture were running in parallel concerning design methodologies, conceptions and creative tools: from gesture and action- attitude- to atmosphere or nature, jumping into haptic perception, fantasy and imagination or acoustic space where time was the one organizing the experiences. In this way, experiencing through the body with dance, a huge collection of conceptual approaches in architecture could be followed, understood and applied. These ideas brought the attention to how “much” embodied could be learning architecture, or in a more general sense if could it be interesting when you come to study spatial disciplines, to do it in an embodied way. And this guided us to contemporary discussions about embodied cognition and situated cognition. How to introduce embodied and situated cognition in architectural disciplines such as structural learning and calculation? or how to do it dealing with aesthetic, philosophical, conceptual architectonical theories? Or would it be possible talking about spatial thinking to achieve appropriate dimensional control and ergonomics? How could we use movement and action in the environment in the development of learning and cognition in the architectural and landscape field?

In order to answer to these questions, first let us remind briefly what embodied and situated cognition means. In short we can argue that in embodied cognition do not isolate the brain as the only actor but it is acting together with the body, directly or with the motor areas of the brain. In addition, when we come to see that also the social and environmental structures are acting in cognition- cognition is embedded in them- and that some scholars even argue that the “contour

lines" of cognition run beyond the "contour lines" of individuals- extending their structures into the environment- we can talk about situated cognition. [2]

In pedagogy, and specially in pedagogy of architecture we can mention here- as important antecedents of LSAAP(L) under a conceptual point of view- John Dewey's research about experience and education[3] , or Donald A. Schön studies of thinking in action in professions like architecture and urban planning[4]. Under the point of view of both, situation and interaction are inseparable from each other and it is through that dialogue that learning and thinking in action is produced. Self-experience is also fundamental, as each organism will develop the learning structures in a different way even within the same frame. Learning would be based on embodied self-experience. A consequence of this situated learning and cognition is also that a more transversal interconnection in between different fields is operated, because learning is not isolated in lessons disconnected from situations but based on those situations that require the intertwining of different skills and expertises in different aspects. Interconnected and extrapolated from one system to another, these skills are integrated and transformed through action and direct experience in valuable knowledge ready to be used, not only in that already known system but also in others with similar structures or basic underlying schemas.

In the field of architecture we find also some antecedents, we will mention here just two of them. First the approach to experiencing, learning and innovating exemplified by Buckminster Fuller with his ideas about what he called "teleology". B. Fuller would argue that just in paying attention to reality, to the experience in the environment- we shouldn't forget that he was sailor and airplane pilot- we would not be only reading how things are but also the creativity about how they can be. And through that experiential- somatic- reading we could learn from the situation extrapolating that knowledge to other systems. He would apply for example his dynamic knowledge of ecosystems and in general navigation, to structural systems and distribution of forces. Invention would be better called re-combination and re-reading of diverse aspects of already existing structures in the universe. For B. Fuller "teleology means the intuitive conversion […] of special-case subjective (dynamic) experience into generalized principles and their subsequent objective employment in special case undertakings." [5]

A second example is the so-called anti-school of architecture Global Tools [6], it was developed in between 1973 and 1975 by a group of radical Italian architects, in between others Andrea Branzi, Remo Buti, Ricardo Dalissi, Ugo La Pietra or Ettore Sottsass, but they had also a collection of international collaborators forming a network including faculty members like B. Fuller already mentioned. It was an experiment for alternative education in architecture claiming for "life as a permanent global education" […] "the teaching and exchange of experiences around themes like the working of iron and wood, ceramics, tailoring, music, gymnastics, singing and dance, gastronomy, photography and film, can constitute an approach to the ideal point at which education coincides with life itself." [7] the different areas within Global Tools were "communication", "body", "construction", "survival" and "theory" and the work within these issues was developed in workshops through action and direct experience. Embodiment was enhanced through "all the psycho-motor and aesthetic activities connected with the body and its most immediate stimuli: dance, music, cosmetic, tattoos, gymnastics, dress design, hair design, ornaments, jewelry, somatic communications, mimicry, proxemics, rituals, ergonomics, behaviour." The question in this experiment is that they were not always interconnected in their findings, as sometimes the different areas were not communicating in between them, and in addition, there were not monitoring of the way of learning within the "anti-school" or in comparison with other conventional schools. However, the experience of Global Tools was opening a transversal embodied and situated pedagogy really interesting for us nowadays. This last points are really important for our experience at LSAAP(L) as we can see in the following words.

Reached this point now we can answer the more general questions posed at the beginning of this paper going into detail through three principal lines of inquiry:

A- *Would it be possible to develop "structural thinking" needed in architecture through somatics and movement?*

B- *What if through movement, students could improve "spatial thinking" skills?*

C- *What if some theoretical ideas could be integrated through the embodied experience of them?*

In this way, the general approach of LSAAP(L) is manifold in these three lines. But also, its interest is really to follow and measure how learning- including somatic experiences guiding to a more explicit embodied and situated learning- add or not, something valuable to the existing pedagogical program in Architecture. Let us start with the first aspect related to “structural thinking” and on the way, we will be extracting the general structure of the LSAAP(L) in terms of movement and cognition.

One body of work fundamental to our approach to “structural thinking” is the one developed by Mark Johnson[8]. He points out two main types of imaginative bodily-based structures that are central to embodied cognition: “image schemata” and “metaphorical projections”. “Image schemata” are dynamic, preconceptual schemas that rise from our experience in the world. They are at the basis of meaning and play an important role in cognition. They are different from mental pictures (concrete rich images) and from abstract propositional representations. They are clear in their basis but can fit in different situations and systems. Some examples are the image schemata of “balance”, “path” or “in and out” that following a body basis are extended to meaning and structures of thought through our understanding. These image schemata interconnected with “metaphorical projections” allow the possibility of extending the basis of one experience to another. To say it with an example, we have the image schemata of “equilibrium” and that can be applied to the understanding of mathematical or physical formulations or to a person, meaning he or she is a equilibrated person or to a project or structural pattern… so the underlying image schemata of “balance” fits in different perceptive situations but give to them some underlying structure, and it is through metaphorical projections that we can change the domain, but maintain the underlying structure for reading or transform it. Image schemata are connected also with action, and they evolve and establish dialogue with our cognitive and perceptive fields creating interactive cycles[9].

It is in these terms that we try to proceed at LSAAP(L). Thinking that in architectural studies, one field of domain is devoted to structural analysis and design the idea is to work with bodily experience on this. The tool that we thought to use is a collection of sensory-motor experiences. They could have been developed through dance phrases but for this, we came to know the Feldenkrais Method[10] and its structured lessons of Awareness Through Movement (ATM), which we found really appropriated. They are interesting on this task because they combine a

process of movement in the environment, together with a directed attention or awareness to the own structure of the skeleton and the distribution of forces of the sequence of movement along it. In addition, they are structured by patterns of action, a very interesting question when one try to analyze different systems and structural behaviours[11]. Hence, the thesis of LSAAP(L) is that through this experience students could interrelate, in a more easy way, structural patterns proposed by professors in the structures field- and in general structural patterns that they may find or imagine- with their own experience, creating a learning platform by their own, "learning to learn" through the direction of their attention to the structure and system that is with them and that they can explore through careful observation. To test this, a weekly class of two hours was established with voluntary students, most of them from the final courses of the studies of Architecture (5th year and Diploma Thesis). From a total of 30 participants more or less involved along the year, 21 develop full attendance in the first semester and 15 in the second semester. In order to monitor the learning and in collaboration with the professors of structural analysis of the university, a collection of tests of structural knowledge were created (see some examples in the collection of figures at the end of this article). During the first year we made two tests, one at the beginning of the course- September- and one at the end- May- and in parallel to the architectural students participating at the Laboratory, we made the same tests to two more groups: the first one formed by the participants in the Feldenkrais training of the Feldenkrais Institute Madrid 3. So to say people from different backgrounds- dancers, philosophers, medical doctors, physical therapist, physical educators…- and from different parts of the world. They never had studied structures. The second group was a mixed group of people with no training in structures and no training in Feldenkrais or any other somatic education. The results of the first test showed that students of architecture of last years, and Feldenkrais practitioners were having almost the same marks-6,29/10 and 6,25/10 respectively- meanwhile the third group obtained lower results (5,69/10). After the whole course working with the students through ATM lessons, in May, we develop the second test with a similar level of difficulty, and the results showed us that architectural students had improved their marks in 1,11 points, obtaining this time 14,80/20 (7,40/10) and the Feldenkrais practitioners remained more or less the same (12,80/20= 6,40/10). Must be said that the character of these two first tests was intuitive in the sense that every question, was showing an image and the participants should say in most of the

cases “true” or “false” and why, or choose in between several options already given. So, thinking about this, we decided the following course (2017-18) to test the existing knowledge in structures but not only through intuition but using calculation or drawing. So we developed another two different tests to explore this in the first semester. This time the participating groups would be participants at LSAAP(L)- different people from last year and a total of 8- a second group of students of architecture not participating at LSAAP(L)- a total of 7- and the third group integrated by the same Feldenkrais practitioners from the Feldenkrais Institute in Madrid. The first test- done in September- was this time not only true or false, but the participants needed to do some simple calculations and some answers where numeric. No options were given but they had to develop by themselves the answers. The level of difficulty was increased and most of the questions were having drawings and diagrams for their explanations, so more abstract inputs than images. The result of this new test was a little bit surprising as the marks for the two first groups of students of architecture were not good, just 4,5/10; but surprisingly the group of people from the group of the Feldenkrais Institute participating- 8 in total as some of the group declined to do it when they saw that some calculation was needed- obtained again a similar mark 6,25/10. In December we developed a similar test in difficulty but this time including more drawing, the participants should transform into diagrams of forces the observed situations. There were no calculations but an understanding through diagrams of forces of the different situations. The students of architecture this time improved their marks 5,18/9 and were better than their colleagues, students of architecture out of the laboratory (3,60/9). But the interesting thing is that the Feldenkrais practitioners this time obtained their worst mark (3,75/9). Following this, is interesting to see how the understanding of a structural situation can involve different layers of abstract ways of thinking and how some of them are more developed intuitively through embodied training and some of them no, or maybe some of them come only later.
At the end of the course- end of May- we reviewed again with a test of similar level where both skills (calculations and graphic interpretations) are developed in order to compare the process of learning after one year of ATM lessons at LSAAP(L). The result was that the students involved within LSAAP improved their marks in 2,00 points comparing with the September initial test.

Observing these tendencies and with the data that we already have concerning structural thinking, it seems interesting to consider to enhance embodied learning as a way first to integrate in a more transversal way the knowledge acquired in conventional academic education; second to improve learning skills, as our relation with the world is embodied; and third to give some alternative possibilities of learning for different kind of students- an example of this last point is represented by one of the students of LSAAP(L) who was not specially skilful in structures during her years of study but in LSAAP(L) was one of the best in the tests through the "embodiment" learning process.

But let us continue now with the aspects related to "spatial thinking". We define "spatial thinking" as the capacity to read in its appropriate measure and proportion a specific space; but also to be able to work with scale, measures and proportions properly in new designs. The first issue, the appropriate reading can be measure quite easily, the second require a longer period of observation and probably the setting of a broader protocol to do it on order to have some objectivity. At the moment at LSAAP(L) we measure the first. We do it through the monitoring of the descriptions of an existing space, also using video recording and the comparison in between the beginning and the end of the course. We measure perceived distances and dimensions of space, but also positions of the own body limbs and parts of the participants in relation to space. In other words, we measure proprioception following not the more restrictive definitions of it [12], but the definition used by Gibsonian psychologists. For them, in the words of Shaun Gallagher, proprioception "means a certain aspect that belongs to any modality of perception (vision, touch, hearing, and so on) that delivers a corresponding sense of body position relative to the environment, or a corresponding sense of self […] thus proprioception in this wider sense depends on integrating different modalities of sensory information concerning one's own body as a moving agent in the environment, with the intracorporeal information provided by an internally generated sense of posture and movement."[13] To test this aspect we use three kinds of essays. The first is included in some ATM lessons where for example you have to take as reference different parts of your body, visualize some imaginary lines in space connecting them and then to locate in the space the intersection point, pointing it out with your hand for example. We record this test in video and we compare the accuracy of this location in space. The second

kind of test is related to standard ways of measuring proprioception and static balance like the Unterberger test, or the Barany test. We equally record these trials in video and we compare them. Lastly, we use a collection of tests in which the students walk around a given space but at some point they are asked to suddenly stop and close their eyes, the task that we ask them at that point is, maintaining the eyes closed, to visualize the space and to measure in their imagination the distance to one reference that we give them (a wall, or a window, a pillar, etc.) in “bodies” (their own body) or “feet” (their own feet), or “hands” (their own hands) or in meters or any other unit. Then, they open the eyes, they check first visually and finally we measure it with a measuring tape. We register these data and we compare them at the end. The results show that during the course participants improved in the 60% of the tests. Moreover, some people doing only the tests but not coming to the regular classes at LSAAP(L) make the tests in the same way, with no variations in the results.

Finally, we come to mention how is working the integration of theoretical ideas through the embodied experience of them.

The classes at the Laboratory of Somatics, are structured following different organizations but most of the times, they have a first part dealing with a lecture about some theoretical subject- sometimes quite short, around twenty minutes and sometimes longer about one hour- and then in the second part, we develop an ATM lesson or a sensory-motor experience which allows to relate the theoretical inputs of the lecture with our somatic experience. In this sense we have given the same lecture to two different groups. The first, students of regular classes of architecture in their forth year. The second, the students participating at LSAAP(L) coming from forth, fifth and Diploma Thesis stages. In the first group only the lecture was delivered, in the second, in addition, we developed an ATM lesson in order to experience bodily some of the theoretical concepts. Asked one week later through a test, we measured how many different concepts in between the ones explained in the lesson they remembered. The results show us that the students of architecture participating in the laboratory were remembering 3,3/7 and students not participating at the laboratory were remembering 2,08/7. None of the two groups knew that these questions were going to be posed so none of them studied for the unexpected test. Of course students at the laboratory are in average a little bit older, so more experienced

but anyway it seems interesting and fruitful, as the results show, to support theoretical learning in a somatic way.

The conclusions of this pedagogical experience are positive. Not only because of the tests measurements but because the attitude of the students and how they get involved in this way of learning. The possibility to implement at the university what is being developed in psychology, neuroscience studies or philosophy [14] in terms of embodied cognition is really challenging and opens an interesting perspective for development. This can be a pedagogical revolution able to bring students to learn in a more organic way and in a more transversal panorama where they can interrelate knowledge. We really think that to intertwine embodied experiences with conventional academic classes is a way to attend better to the whole array of human capabilities.

The program of LSAAP(L) for next year (2018-19) will include “embodied” sessions about alive systems and how we can learn from them, ecology, spatial navigation and cognitive maps, biomechanics and body structures, cultural studies on the role of imagination, study of projects dealing specifically with somatic issues, or perceptive systems and neuroscience… all of them applied to architecture and landscape.

***** ***acknowledgements*** *****

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Credits:

2016-17 Academic year:

Direction: Mª Auxiliadora Gálvez (PhD in architecture and teacher under training of the Feldenkrais Method)

Collaborator Teachers: Mariano Molina and Mª Concepción Pérez (Architectural Structures)

Guests and Advisors: Alba Aja, Esther García, Pedro Goucha, Chus Jiménez, Ana Mombiedro, Jaime Polanco and Kasia Salamon.

Collaborators: Isabel Daganzo and Inmaculada Torrero.

Collaborating Institutions: Faculties of Medicine and Architecture EPS San Pablo CEU University; Feldenkrais Institute Spain.

Participants: Mainly students of the EPS Faculty of Architecture, most of them of Diploma Thesis level (in the group also a few of 4º and 5º year and some graduates), in total in between 20 and 30 (25 as average).

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2017-18 Academic year:

Direction: Mª Auxiliadora Gálvez (PhD in architecture and teacher under training of the Feldenkrais Method)

Collaborator Teachers: Mariano Molina and Mª Concepción Pérez (Architectural Structures)

Guests and Advisors: Alba Aja, Laura de Azcárate, Isabel Daganzo, Chus Jiménez, Malcolm Manning, Ana Mombiedro, Jaime Polanco and Kasia Salamon.

Collaborators: Juan Hernández Basterra, Margarita Pueyo, Julia Ruíz-Cabello and Rocío Santo-Tomás.

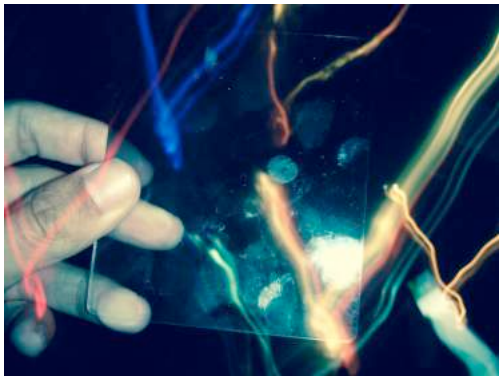
Collaborating Institutions: Faculties of Medicine and Architecture EPS San Pablo CEU University; Feldenkrais Institute Spain.

Participants: Mainly students of the EPS Faculty of Architecture, most of them of Diploma Thesis level (in the group also a few of 4º and 5º year and some graduates)- (9 participants as average).

Know more at www.psaap.com

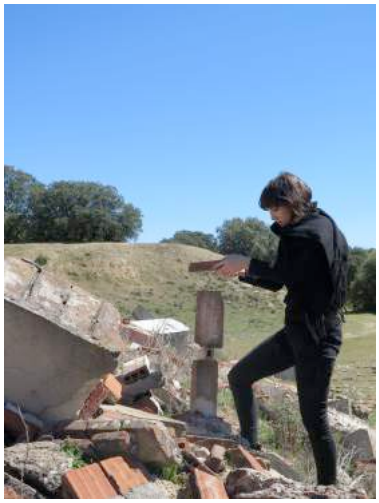
***** ***images of LSAAP(L) sessions*** *****













***** ***samples of "structural thinking" questions*** *****

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Laboratorio de Somática Aplicada curso 2016/7

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 axil 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.]

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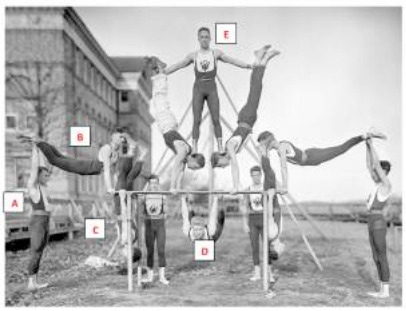
Escuela Politécnica Superior
Laboratorio de Somática Aplicada curso 2016/7

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]

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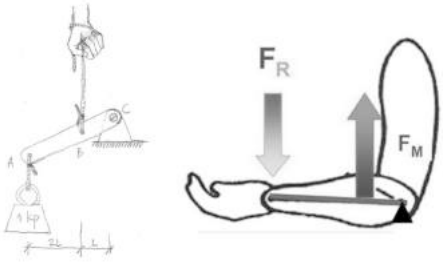
Escuela Politécnica Superior
Plataforma de Somática Aplicada curso 2017/8



3. En la figura izquierda, ¿cuál es la fuerza mínima con la que debemos tirar de la cuerda con extremo en el punto B para mantener el peso en su posición o comenzar a elevarlo?/ In the left figure, which is the minimum force that we should use pulling on the rope at point B to maintain the weight in its position or to start lifting it?

4. Por cada centímetro que elevamos el punto B, ¿cuánto se eleva el punto A?/ Every time we lift 1 cm point B, how much is point A lifted?

5. ¿Hacia dónde deberíamos desplazar el punto B dentro de la barra AC para tener que realizar un esfuerzo menor?/ Where should we move point B along the bar AC to be able to reduce the effort?

6. Si desplazamos B de la forma prevista en la pregunta anterior, ¿aumentaría o disminuiría el ratio entre lo que se eleva el punto A y lo que se eleva el punto B?/ If we move B as planned in the question above, the ratio in between how much A and B are lifted would be bigger or smaller?

7. Relaciona las preguntas anteriores con la capacidad del bíceps humano para levantar peso y la movilidad que se requiere en la articulación del codo./ Relate the already done questions with the capacity of the human biceps to lift weight and the movility required at the elbow join.

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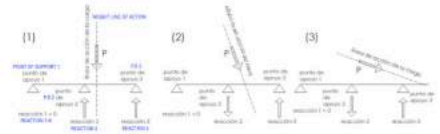
Escuela Politécnica Superior
Laboratorio de Somática Aplicada test E2 curso 2017/18

A.- Analiza la posición de la figura (acróbatas del Circo del Sol) / Analyze the figure of the acrobats:



A.1.- ¿Es importante la inclinación de la chica? / Is it important the inclination (angle) of the girl on top?

A.2.- ¿Qué ocurriría si el brazo izquierdo del hombre no estuviera apoyado? / What would happen if the left arm of the man (below) wouldn't be based on the floor?

A.3.- ¿Qué esquema de fuerzas podría representar la acrobacia de la fotografía? / Which diagram of forces could represent the acrobacy of this picture?

A.4.- Plantea otro u otros esquemas de fuerzas posibles. / Draw another one (or more than one) diagram of forces about this configuration.

Página 1 de 4

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[9] One important antecedent of M. Jonhson on the role of image schematas in the perceptual cycle is the work of Ulrich Neisser. Neisser U. Cognition and reality. Principles and implications of cognitive psychology. New York: W.H Freeman and Company, 1976.

[10] As may be known, the Feldenkrais Method is a sensory-motor somatic education developed by scientific Moshe Feldenkrais along the 40's and till his death in 1984.

[11] "I was born cross-eyed. I could see only large patterns, houses, tress and outlines of people- and all coloring was blurred. I could see two dark areas on human faces, but I could not see a human eye or a teardrop or a human hair. Not until I was four years old, in 1899, was it discovered that my cross-eyedness was caused by my being abnormaly farsighted. Lenses fully corrected my vision. Despite my new ability to apprehend details, my chilhood's spontaneous dependence only upon big patterns has persisted. The most poetical experiences of my life have been those moments of conceptual comprenhension of a few of the extraordinary generalized principles and their complex interactions that are apparently employed in the governance of universal evolution." Fuller B. I seem to be a verb. New York: Bantam Books, 1970.

[12] Neuroscientist "thinks of somatic proprioception as an entirely subpersonal, non-conscious function". "Psychologists and philosophers sometime treat somatic proprioception as a form of consciousness". See these quotes in: Gallagher S. How the body shapes the mind. New York: Oxford University Press, 2005. (p.7) In this sense Gallagher distinguishes "proprioceptive information" and "proprioceptive awareness".

[13] Ibid., (p.7)

[14] Apart of the aforementioned authors, some others authors of reference could be:

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