Enactive or symbolic representation? When the order alters the product

¿Representacion enactiva o simbólica? Cuando el orden altera el producto

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Abstract: *This paper reviews a pedagogic exercise related to the degree of Architecture being taught at the University of Chile. This exercise, which is based on the action of folding paper, integrates knowledge areas from the project learning in initial phases. To illustrate this, in the methodology section, the applied didactic strategy together with its theoretical sustenance are described and then followed by both a review of the activities of the project itself and the learning results. The exercise addresses the multidisciplinary features of our field in Architecture, since it encourages students to directly and intuitively solve physical, structural, geometric, aesthetic and functional issues in an integral manner, appealing and adding to their already acquired ability to do and think in an enactive manner. The outcome of this exercise gets deep into the relationship among a number of aspects which include the type of representation incidence in the projecting operation (iconic, symbolic and enactive representations) and its directions, i.e., from enactive to symbolic representation and vice versa. Furthermore, it also lays out the didactic strategies and teaching contributions of the study case. To conclude, the relevance of this practical approach concerning the relationship between form with these three types of representation is discussed, so students may apply their knowledge and experience acquired during their life in the first stages of their architectural training at university.*

Keywords: *architecture; symbolic; iconic; enactive representation.*

Resumen: Este artículo revisa un ejercicio pedagógico relacionado con la carrera de Arquitectura que se imparte en la Universidad de Chile. Este ejercicio, que se basa en la acción de doblar papel, integra áreas de conocimiento del aprendizaje del proyecto en fases iniciales. Para ilustrar esto, en la sección de metodología, se describe la estrategia didáctica aplicada junto con su sustento teórico, seguido por una revisión de las actividades del proyecto en sí y de los resultados del aprendizaje. El ejercicio aborda los rasgos multidisciplinares de nuestro campo de trabajo en Arquitectura, ya que incentiva a los estudiantes a resolver de manera directa e intuitiva cuestiones físicas, estructurales, geométricas, estéticas y funcionales de manera integral, apelando y sumando a su capacidad ya adquirida de hacer y "pensar" de una manera corporeizada basada en su propia experiencia. El resultado de este ejercicio profundiza en la relación entre una serie de aspectos que incluyen el tipo de incidencia de la representación en la operación proyectiva (representaciones icónicas, simbólicas y enactivas) y sus direcciones, es decir, desde la representación enactiva a la simbólica y viceversa. Además, también expone las estrategias didácticas y los aportes docentes del caso de estudio. Para concluir, se discute la relevancia de este enfoque práctico a la hora de relacionar la forma con estos tres tipos de representación (simbólica, icónica y enactiva), para que los estudiantes puedan aplicar los conocimientos y experiencias adquiridos durante su vida en las primeras etapas de su formación arquitectónica en la universidad.

Palabras clave: arquitectura; representación simbólica; icónica; enactiva.

"Where is the wisdom we have lost in knowledge?"[1]

INTRODUCTION

Historically, applied sciences and disciplines involved in formativity *have shown a strong link among them,*[2] *following the same line of the ligature among structure, function and form that seems to be inseparable or indissoluble. Hence, we may point out that this is also what unites the triad attributed to either Vitruvius in Architecture, which refers to* Firmitas *(firmness),* Utilitas *(utility),* Venustas *(beauty), or to the slightly different Albertian version that refers to* Soliditas *(stability),* Commoditas *(comfort),* Voluptas *(delight). On the other hand, Paul Valéry refers to this link as being indissoluble when he indicates that Architecture encompasses a complete magnitude,*[3] *that is, an indivisible and simple unit like the one that Leibniz calls «monad.» In fact, the architectural of Architecture is indivisible.*[4]

Problematic

*The binding relationship between the Vitruvian or Albertian triad at times weakens due to a plausible inherited Cartesian dualism that separated body (*res extensa*) from mind (*res cogitans*) or as outcome of the linearity and features that language inherits when it comes to thought as such. In any case, this dissociation hinders and conceals the important link that articulates the domains involved in architectural design up to the present time.*

Accordingly, it is given that quite often such domains are conceived as antagonistic; for instance, when it comes to the distinction between form (plastic) and structure (physical) or form (aesthetics) and function (use). Thus, this attempt to hierarchize the relationship between these domains also constitutes an old discussion with Sullivan's aphorism "form follows function" being a well-known example.

On the other hand, even within the same discipline, it is quite common to find opposition between the enactive *(or active) experience and the symbolic representation,*[5] *in the same way that when there is opposition between structural intuition and structural calculation. This is perhaps a by-product of the extreme distance that could be considered between the real experience that leans toward the* enactive*–physical, and its representation that tends toward the* symbolic*–mental, subordinating almost always the concrete experience to the symbolic experience.*

Considering a university context, this running dissociation between the multiple aspects involved in the act of projecting, together with the little attention that is given incidence as such, produce that the types of representation used in the act itself have been left out in many study plans, becoming a linear sequence of hermetic or closed units that barely obey the integrated plan as such.

In other words, dividing aspects involved in the project itself into "courses" seems to prevent the adequate articulation of such aspects and hinder their fundamental contribution to knowledge.[6] *In the same fashion Morin states that "fragmentation and compartmentalization of knowledge keeps us from grasping that which is woven together."*[7] *Therefore, although it is possible to impart knowledge coming from all domains separately, this does not guarantee simultaneous and integrated reactions as the project from a professional viewpoint may demand.*

Regardless, when it comes to the type of representation that is used in these areas or domains, the order under which these type forms are involved

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in the creation process alongside fragmentation are not considered. All the same, just by having a close look at a traditional school curriculum, one may realize that there is an evident overrated representation that leans rather toward the mental (abstract) than the corporal. In fact, from the three types of representation that are considered in this article, that is, the enactive, the iconic and the symbolic, the symbolic representation has a hierarchical monopoly over the iconic representation, with the enactive representation being considered as a representational category. Following this line, it is not unusual to come across arguments that claim that, to begin with, we must "think" (mental representation), then, obediently, "do" through drawings (iconic representation) and finally "make" through models (enactive representation). This implies that there is no thought attached to the order in which the types of representation are considered and have an effect on the architectural project development itself.

As a matter of fact, many students fail the Structural Calculation course due to their lack of understanding of the notation system in mathematics which is described for example as the notion of torque *or* moment of force. *This in spite of the fact that they have all experienced this principle at a personal physical level before reaching two years of age,*[8] *which means that without the focus on "understanding" this kind of notions, they may fully apply it since that early age.*

Generally speaking, education at a university level tends to overlook the student's previous body experience and even though this is not explicitly and openly assumed, the underlying idea that the student arrives empty or like a blank canvas and the university "delivers" knowledge, as if it were an object or fluid, still prevails. Taking into account this assumption necessarily implies subordinating the student's previous experience to knowledge that the student must in turn "receive." Here, the aim is to install, in the abstract, concepts such as torque, directly from formal languages in the line of Mathematics that bring with them high representational loads and codes without considering what the student "already knows" at a physical level.

Theoretical framework

As it is known, in the stage of formal operations described by Piaget (after 12-15 years old), trust in physical experience (enactive) is usually deliberately abandoned and deposited in symbolic and mental coding.[9] *From that moment, knowledge and reason (mental) take over to build a new cognitive comfort zone that guides our lives. According to Karl Buhler, "As an essentially verbal education gains control, the child abandons his/her graphic efforts and relies almost entirely on words. Language has first spoilt drawing and then swallowed it up completely."*[10] *Personally and socially, the drawing is relegated to an anecdotic space and, in the best of cases, it is placed in a purely romantic and* naive *environment.*

The object construction stage is even bleaker: it is removed and categorized among such practices as handicrafts. Thus, the (moral) decision to prioritize symbol systems is officially installed over the other two existing representation types (enactive and iconic). All this, despite the fact that in our mental and corporal architecture, the structures of the three types of representations, that evolution has endowed us, simultaneously coexist,[11] *and all of them are correlated, complementary and absolutely necessary structures for our life.*

Despite all of the above, learning disciplines and creative trades such as Architecture, compels to use previous experiential knowledge. In these areas,

"Learning a skill is not primarily founded on verbal teaching but rather on the transference of the skill from the muscles of the teacher directly to the muscles of the apprentice through the act of sensory perception and bodily mimesis. Indeed, (...) the foremost skill of the architect is, likewise, to turn the multi-dimensional essence of the design task into embodied and lived sensations and images; eventually the entire personality and body of the designer becomes the site of the design task, and the task is lived rather than understood."[12] *From that perspective —concludes Pallasmaa— "Architectural ideas arise 'biologically' from unconceptualized and lived existential knowledge rather than from mere analyses and intellect."*[13] *Thus, the sensorimotor abilities, and the enactive in general, are central issues in projective learning.*

However, those abilities are not given to us at birth. According to Carla Hannaford, we start by becoming sensorially aware of nature, laying down neural patterns in the brain that represent this awareness. These patterns elaborate as we take in our world through touch, sound, smell, taste and finally sight. The areas of the brain that receive sensory input from touch begin to connect, through association areas, with those areas that receive sound and sight. These contacts allow us to cross-reference our experiences, giving us our familiar base understanding of nature and our unique, subjective reality.[14]

For Hannaford, thought and awareness develop involving the whole body. The development of our consciousness is formed in a permanent interaction between the stimuli that our body receives and that we integrate into the neural structures that are structural responses to these stimuli. In this way, the physical experience we received from our beginnings shapes the way we will develop as people. That is why Pallasmaa's assertions above are not just suggestive philosophical ideas.

As Vázquez et al. summarized,

> *At the end of the 20th century the embodiment of the mind and embodied cognition (incarnation / embodied cognition) were theories strongly attended from various disciplines: in Linguistics (Lakoff, Fauconnier and others), Philosophy (Mark Johnson, Merleau-Ponty and others) and Cognitive Psychology (Rosch, Varela and others), and at present, confirmed by findings in neuroscience (Gallese, Rizzolatti and others) carried out at the University of Parma, Italy (...) In other words, with those discoveries, it is verified that [for example] the "manuaje" (doing things with the hands [and the "manuaje,"*[15] *in general]) configures, not only many of our mental imagery skills, but even a large part of the meaning of words and concepts.*[16]

These authors explain that these theoretical formulations evidence and locate the link between sensory-motor experience and physical experience (body) with mental images involved in the mental manipulation of objects and language, and, consequently, also in thought. The fortuitous discovery of the mirror neurons decisively influenced the conception we had of the construction of mental images and the nexus between sensorimotor action and mental simulation.[17]

This idea corresponds to the "embodied mind theory" that explains how humans construct the meaning of words. Contrary to what was previously believed, that meaning refers to a mental image that represents a word. It is now thought that the construction of the meaning of words is done through a mental simulation that in turn is based on previous physical experiences that we have had in relation to the word. Also, this simulation is based or embodied in the sensory and body systems. The main difference with the previous conception is that the mental image is now believed to have its basis

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both in the physical memory and in the previous physical concrete experience.[18] In this way, "when we imagine the verb to run, we activate the same brain areas as when we run for real. The same thing to imagine a sound, an image or remember an activity."[19]

Using Benjamin Bergen words "if we use our brain systems for perception and action to understand, then the processes of meaning are dynamic and constructive. It's not about activating the right symbol; it's about dynamically constructing the right mental experience of the scene."[20]

Alva Nöe exemplifies this with the vision:

> *Seeing is, in many ways, a bodily activity. Seeing involves moving the eyes and head and body. More important, movements of your eyes or your head or your body actively produce changes in sensory stimulation to your eyes. Alternatively, putting it differently, how things look depends, in subtle and fine-grained ways, on what you do. Approach an object and it looms in your visual field. Now turn away: it leaves your field of view. Now shut your eyes: it is gone (...). According to this sensorimotor, enactive, or actionist approach, seeing is not something that happens in us. It is not something that happens to us or in our brains. It is something we do.[21]*

In this way, for all the authors mentioned above, thought and consciousness do not develop only in the brain but involve the whole body, its structure and interaction with the outside. It is not that we have a body that contains our consciousness, rather we are conscious of our body knowledge.

As we can see, the theoretical formulations reviewed and encompassed in the embodied mind theory evidenced and reinstalled the nexus between sensorimotor and physical experience (enactive) physical experience, with (mental) imagery involved, not only in the mental manipulation of objects but also in language and, consequently, also in thought. Thanks to all this, "today we know with certainty that we as humans think as we corporally do,"[22] which opens new questions and multiple possibilities to investigate in the pedagogical and teaching fields of our discipline.

Assumption

With the aforementioned concept in mind, it seems neither useful nor sensible to exclude, in the field of university education, the physical experience (previous or direct) that you have when trying to address the integration of domains involved in the act of designing an architectural project. Additionally, nor does the type of representations involved (enactive, iconic and symbolic) or the order in which they interact when trying to integrate aspects of the disciplinary domains seem to be trivial. Indeed, although it is true that "learning occurs when what the student already knows and what he or she should know comes into conflict,"[23] it has also been shown that "to build a new logical instrument pre-existing logical instruments are always necessary, by extension, the construction of a new notion will always suppose substrates, previous substructures and (...) indefinite regressions."[24]

So, can we assume that when learning Architecture, rather than new learning, we are talking about extraction, systematization and use of previous experience? Can we use the fact that a student has lived for nearly two decades interacting with the physical world, with the matter (fundamental elements) and the constructed Architecture as a pedagogical input? Can we use this background in order to assemble the required new disciplinary notions? Can we build on the enactive knowledge the

cognitive knowledge? That is, to define to do/think instead of the usual think/do for creative learning? Finally, and as a generalized question of all the ones above, does the type of representation used, and its order affect the ability to integrate the three domains of the project? The answer might plausibly be "yes." The main aim of this paper is to discuss this idea based on the presented case.

OBJECTIVE

In this context, the present work reviews an experience initiated during the 2017 Arts Forum of the University of Chile,[25] and continued in the Architecture Workshop IV at the Faculty of Architecture and Urbanism. The aim of this review is to determine the incidence of the type of representations used (iconic, symbolic and enactive) and their order of participation when articulating structure, form and function in a given project design ideation exercise.

METHODOLOGY

The achievement of the aforementioned objective is predicted by reviewing the participation of the three representation types, alternating the order in which these are incorporated into a single learning or pedagogical exercise. In the first half of the exercise, we operated on representation with low coding (enactive), to then move on to representation with greater coding (iconic/ symbolic). We call this the "pathway from matter to representation." The second half of the exercise is its reversal, that is, parting from the representation with high coding, then operating on one with less coding. We call this the "pathway from representation to matter."

The development of the exercise can be described in three different stages, which address, in pairs, the components of the polynomial in question (structure/form/function). The first part tests the structure/shape relationship by devising solutions through paper folding (enactive representation). In this stage, some complementary light studies of the pre-visualization model are performed as a potential nexus with the function in the next stage.

Then, an intermediate part tries to integrate the binomial (structure/form) to the function (use/ program/scale), this, through the computational intervention on photographic images obtained from the proposal folded on paper (the photograph as an intensified iconic representation) to create a photomontage of a visually plausible "architectural space."[26]

Finally, the third stage, in reverse of the second, returns from photomontage (representation of form/ function) to matter, trying to reincorporate the physical property of the structure conceived in the photomontage in a plaster model.

Since the logic of representational media used, the total exercise (Figure 1) can be described as a development round-trip, from the enactive (fold) to the iconic intensified (photomontage) and returning to the three-dimensional enactive and iconic (physical plaster model).

DEVELOPMENT

The first part of the exercise arises from a practical problem to solve (model). The second stage collects the results of this experimentation to project through an iconic representation (the reverse order to the usual teaching of architecture). The third stage returns from the iconic representation to the material-enactive (the typical order in the teaching of architecture).

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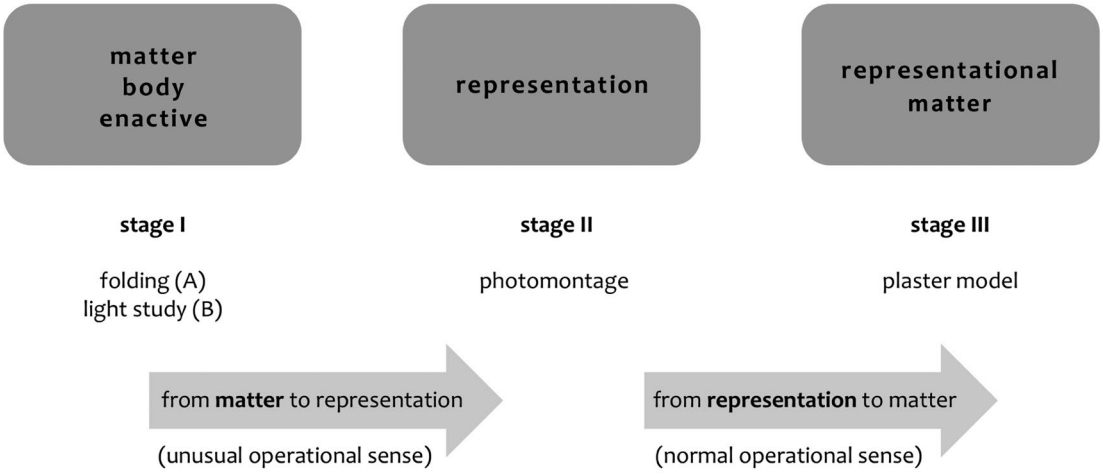

Figure 1. *Methodological synthesis of the complete exercise.*

STAGE 1:

(A) Folding and contact with paper: Structure and Form.
(B) Study of light: Form and Light.

Enactive representation

STAGE 2:

Digital photomontage from Form (visual) to Function (visual??).

Iconic/symbolic representation

STAGE 3:

Three-dimensional modelling to integrate Form/ Function and Structure.

Enactive representation (back).

Stage 1 (A)

In the first stage, four foldings were requested, each of which had to be built in two different types of paper: 80 g and 40 g paper. The first exercise was to fold both the 80-g paper and the 40-g paper, with as few folds as possible, to reach the maximum height that the length of the paper would - allow (a single sheet of paper, without cuts, only folds). The second exercise consisted of reaching the maximum possible height with each type of paper, with the greatest number of folds in the sheet. The third task was to achieve the biggest possible length, with the least amount of folds, with a maximum of two supporting points. The fourth assignment had the same challenge as the previous one, but with as many folds as possible (Figures 2, 3 and 4).

Figure 2. *Preliminary approaches.*

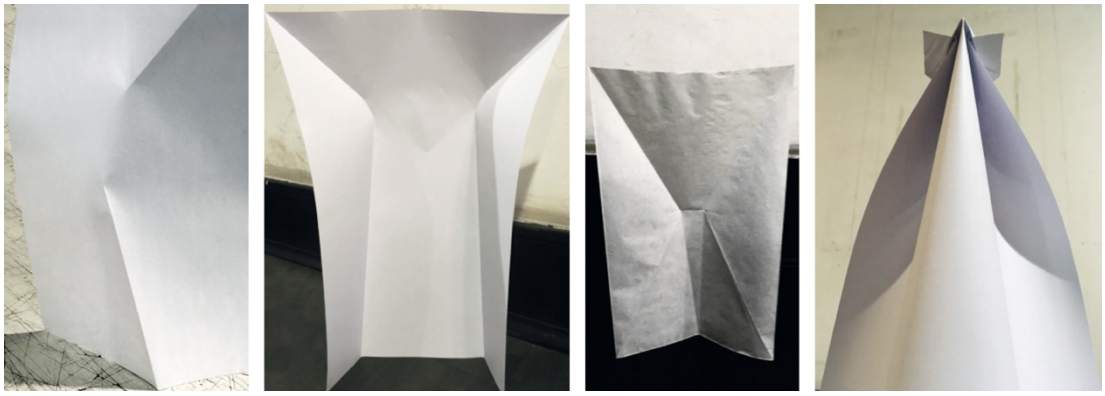

Figure 3. *Maximum heights with few/many folds.*

Stage 1 (B)

This stage was to select, from the eight resulting models, those that had greater resistance to standing and that presented the most harmonious forms. The harmony was discussed qualitatively between the teaching team and the students themselves. The criteria were: the relationship between heights or lengths reached, number of folds, form originality and aesthetics (weight balance, harmonic composition, stability uncertainty and fold originality fold). One model was selected for each student.

The selected models were subjected to a light study to reveal the folds that with homogeneous light source were not visible in the same volumetric

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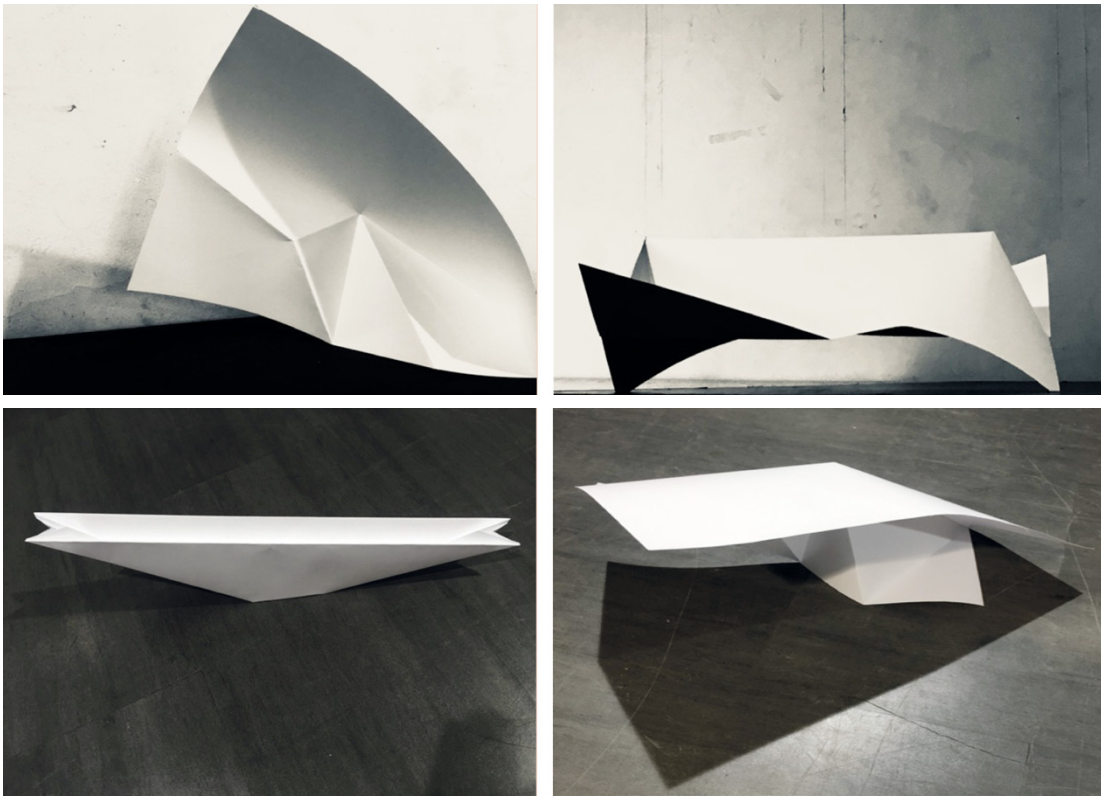

Figure 4. *Maximum lights with one or two supports.*

way as with a single light source. Backlighting that revealed the textures of the paper and different shapes produced by the shadow type was also explored (Figure 5).

Stage 2

The second phase of the exercise was to take the most interesting photography of the selected fold and create a photomontage with it, taking the fold as if it were an architectural structure, whether a building or an urban form. Qualities of the photomontage technique were also explored: repetition, composition, view point, scale, function and humour, which was previously analysed based on the knowledge of the visual artist of our team (Figure 6).

Stage 3

Once the folds were contextualized as either architectural or urban forms, they were abstracted and made into three-dimensional shapes dug in a 20 or 30 cm edge cube, no longer recreating the fold but

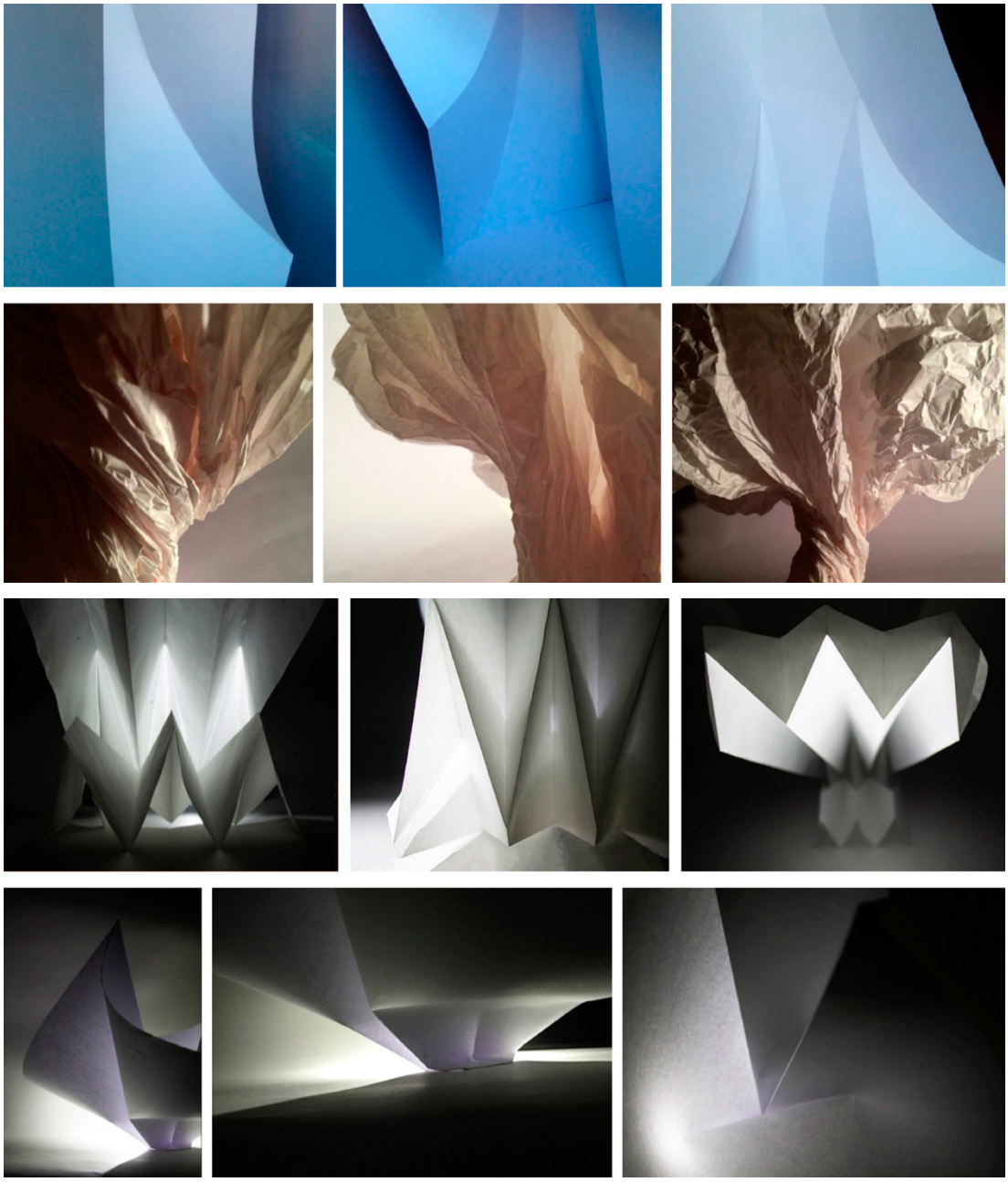

Figure 5. *Light study.*

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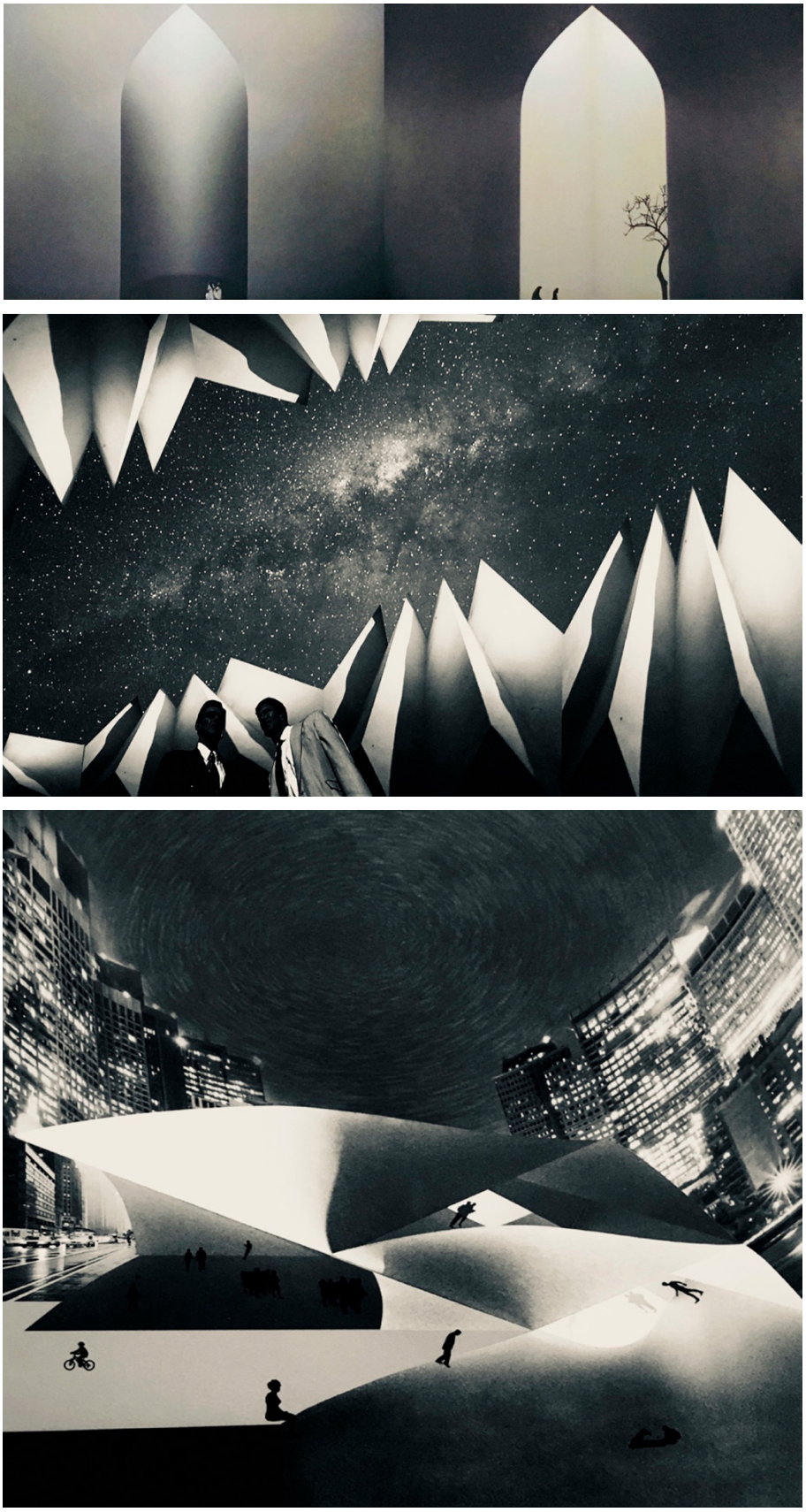

Figure 6. *Photomontage.*

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Figure 7. *Volumetric fold (plaster model).*

an architectural or urban proposal. In this way, a formal sliding of a figure of flat origin (paper) to a fully volumetric one built in materials suitable for such purposes (plaster) was achieved (Figure 7).

RESULTS AND CONCLUSIONS

To conclude, the exercise as such allowed the implementation and integration both of structural (physical) and formal (plastics) aspects mainly during stages 1A, 1B and 3. It also left room to bring into practice some aspects linked to function (use, program and ergonomics), development of the associated mental imagery, and to the speculation related to project imaginaries and their channels of communication particularly during stages 2 and 3.

The exercise also gave our group the opportunity to develop perception skills (visual/haptic) and

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graphic/visual skills throughout stages 1, 2 and 3. Participants also exerted collage and photocomposition skills (digital photomontage); balance and visual weighting skills during stages 1B and 2; and procedural manual training skills, both based on folding paper in the course of stage 1A, and on gypsum training and manufacturing, which ran from stage 3 onward. All this in compliance with the requirements specified in the study plan and its objectives.

*As for digital representation, that is hyper-representation usually referred to as hyper-coding,[27] or high representational intensity, it interrupts the continuity of the exercise and dissolves the links between one part and the other, not because it should have been ideologically continuous, but because it cancels the structural component (*firmitas*). Consequently, it eliminates all physical-real property from the problem. Hence, when the student is forced to incorporate material physical properties so as to give a physical form to the "objective image" or "visual desire" simulated in the photomontage, subordinating the same matter to that desire becomes impossible.*

*It is possible to confirm that matter does not behave naturally in this operation. Quite the opposite, it looks as if it is struggling with an arbitrary shape that is not natural for a type of matter such as plaster. This question is of great interest because it shows that the operation that involves representing something through a physical model that comes from the graphic image, brings along with it more problems than sorting out the opposite direction that is, from a symbolic representation to an enactive representation in a material model (*firmitas*).*

*Besides, during the initial stages of the exercise, the enactive operation that involves a real physical charge is made evident through a "muscle image" or a real haptic and "cenesthetic representation," that is, folding the paper and preserving it, added a visual operation (*venustas*). As for the representation, the physical paper model does not offer resistance to the real physical demands that the project itself requires.*

Taking both the aforementioned and the results into account, we may say that the path, which opened us a result of enactive-iconic direction "from matter to representation," offers less resistance and allows an increased speculation and fluidity on the project. In other words, if the type of representations that are being used coincides with the direction in which ontogenetically (Piaget and Hannaford) and phylogenetically (Donald) representations are installed in humans, the projective fluidity as such tends to be greater during the first two stages of the exercise.

On the contrary, if the path that is being used follows an iconic-enactive direction, that is, it gets started from an objective image with a high representational value, as in the third stage of the exercise, the design operation is either hindered or, at least, the results obtained are more rudimentary, requiring a larger number of attempts to solve the task that it is being requested using a plaster model. This seems to confirm what Piaget pointed out: "in order to build a new logical instrument, pre-existing logical instruments are always necessary, that is, the construction of a new notion will always suppose substrates, previous substructures."[28]

Throughout the second stage, the route from matter to representation seems to work well since it allows, by means of the model, photographic register to assign a number of functions to the model such as scaling it up, repeating it, or reversing it, among other operations. This becomes possible because the computational photomontage representation

(iconic) does not need to solve the problems appropriate to the physics of the matter.

*As for the third stage of the exercise that stretches from the iconic representation to the material, the enactive representation from the iconic representation (photomontage) does not work well, given that the project identifies its potential subordinated to the product of the previous representation system. Literally, plaster representation is a portrayal of the resulting image that springs from the digital collage. Here, the plaster model must shape and "contain" the objective image which has been digitally produced and looking after a number of real physical aspects that have not been provided in the digital image itself. This in turn, reduces or decreases the structural component given that if it is only the visual plastic aspect of the proposal (*venustas*) the one that is applied to the photographs to intervene, then only the form/function is to remain.*

When taking into account these results, it is also worth considering whether the "failures" in the performance of the students that arise during certain stages of the exercise, often associated to difficulties at a personal level such as time constraints, motivation and so on, are instead related to methodological issues such as those discussed here.

To achieve the objective in question which implies verifying incidence, type of representation with a larger or smaller degree of representationalism, representative, realism as well as the effects produced as outcome of the order in which they participate during the design exercise particularly when integrating the domains involved that consider structure, form and function, it becomes necessary to pay close attention to the results that arise from the material representation to the iconic representation processes and vice versa.

To conclude, the results that have come out of the project implementation have demonstrated that the achievements leading in the first direction seem to be more effective, since they are a by-product of the whole arsenal of enactive knowledge that students have already acquired from their own life experiences, which allow them to bring forward proposals coherent with their physical reality.

Hence, at some point in time, whether during the academic exercise or throughout the professional practice, this dissociation between physical experience and representation, together with the distinction that is produced as outcome of the biased representation of physical reality, may have consequences that need to be considered.

Notes and References

[1] *T. S. Eliot,* The Rock: A Pageant Play *(New York: Harcourt, Brace and Company, 1934), 9.*

[2] *Luigi Pareyson,* Estética: teoría de la formatividad *(1954; Milan: Editorial Bompiani, 2002), 18.*

[3] *Paul Valéry,* Piezas sobre arte, *trans. José Luis Arántegui (1924; Madrid: A. Machado Libros, 2005), 38.*

[4] *Jesús Marcos Alonso, "¿Profesiones o corporaciones? Al margen del debate gremial entre técnicos 'superiores' y técnicos 'de grado medio,'"* Construcción, Arquitectura, Urbanismo. CAU Colegio Oficial de Aparejadores y Arquitectos Técnicos de Cataluña y Baleares *2–3 (1970): 121.*

[5] *According to Bruner, there are three types of representations through which humans portray mental models and reality. These are enactive, iconic and symbolic representations. The enactive representation consists of representing or knowing through the concrete action of the body, it is highly perceptible in the first years of life. Bruner relates it to Piaget's sensory-motor phase where external action and experience merge. Alternatively, the iconic representation consists of displaying things by means of an image or figural scheme independent of direct action. The iconic representation is to know something through a drawing or an image. Finally, symbolic representation is fundamentally arbitrary (fourth property of language according to the "Course of Structural Linguistics" (De Saussure, 1916) and depends on the domain of a symbolic code).*

[6] *Based on three types of knowledge: knowing how to do (procedural), knowing how to behave, and cognitive (knowledge).*

[7] *Edgar Morin,* Seven Complex Lessons in Education for the Future, *trans. Nidra Poller (Paris: UNESCO Publishing, 2001), 38.*

[8] *According to Piaget, it is in the sensory-motor stage (approximately 0-18 months), where "all the ulterior structures are precisely constructed: the notion of object, space, time, in the form of temporal sequences, the notion of causality; that is to say, all the great notions that will later constitute thought and that are elaborated at their sensory-motor level and put into action with material activity," Jean Piaget,* Estudios de psicología genética, *trans. Antonio M. Battro, 7th ed. (Buenos Aires: Emecé Editores, 1972), 19.*

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[9] *Piaget, 19.*

[10] *Karl Buhler in Betty Edwards,* The New Drawing on the Right Side of the Brain *(1979; New York: Penguin Putnam Inc, 1999), 81.*

[11] *Merlin Wilfred Donald,* Origins of the Modern Mind: Three Stages in the Evolution of Culture and Cognition *(Cambridge: Harvard University Press, 1991), 2–3. Indeed, as Merlin Donald reminds us, quoted by Frank Wilson, "(...) the modern human mind evolved from the primate mind through a series of major adaptations, each of which led to the emergence of a new representational system. Each successive new representational system has remained intact within our current mental architecture, so that the modern human mind is a mosaic structure of cognitive vestiges from earlier stages of human emergence ... The key word here is representation. Humans did not simply evolve a large brain, an expanded memory, a lexicon, or a special speech apparatus; we evolved new systems for representing reality." Frank R. Wilson,* The Hand: How Its Use Shapes the Brain, Language and Human Culture *(New York: Pantheon Books, 1998), 41.*

[12] *Juhani Pallasmaa,* The Thinking Hand: Existential and Embodied Wisdom in Architecture *(London: John Wiley & Sons, 2009), 14.*

[13] *Pallasmaa, 14.*

[14] *Carla Hannaford,* Smart Moves: Why Learning Is Not All in Your Head, *2nd ed. (1995; Salt lake city, Utah: River Books, 2005), 30–31.*

[15] *«manuage» («manuaje», in Spanish), is a «homologous neologism to language but with hands [(manu(s) + ~age), that encloses in the verb* manuar *(from the Latin manuari, manipulate, doing something with hands), drawing, architectural model and collage, among other representations]; based on the in-tentional agitation of hands and the impact this has on matter to communicate or selfcommunicate (to "reflect"). Although, in strict definition, it is not a language, [manooge] frees the "language" of the semantic weight (anatomic and structural) that the noun «tongue» imposes ("tongue" means "lengua" in Spanish), keeping only the essential condition of the "set of signals [gestures and/or sensorimotor in-tentional actions] that suggest [or not] something...» (RAE, 2012), certainly, with the substantive differences this implies, even in the definition of the communicating or expressing something.» Mauricio Arnoldo Cárcamo and Cecilia Wolff,* CUBOOK: 1200 gramos destinados a discurrir en torno al «manoaje» *(Santiago de Chile: Universidad de Chile, 2017), 135.*

[16] *Guillermo Fernando Vázquez, Mauricio Arnoldo Cárcamo, and Eduardo Takemi, "Proposta Ditática Para Ensino de Rhinoceros: Da Formalização Manual à Digital,"* Educação Gráfica *22, no. 2 (2018): 133–34.*

[17] *Giacomo Rizzolatti et al., "Premotor Cortex and Recognition of Motor Actions,"* Cognition Brain Research *3, no. 2 (1996): 131–41.*

[18] *"(...) the simulation (mental imagery) generates in the brain echoes of previous experiences, attenuated resonances of brain patterns that were active during previous perceptual and motor experiences." Benjamin Bergen,* Louder than Words: The New Science of How the Mind Makes Meaning *(New York: Basic Books, 2012), 29.*

[19] *Cárcamo and Wolff,* CUBOOK: 1200 gramos destinados a discurrir en torno al "manoaje," *131.*

[20] *Bergen,* Louder than Words: The New Science of How the Mind Makes Meaning, *29.*

[21] *Alva Noë,* Out of Our Heads: Why You Are Not Your Brain, and Other Lessons from the Biology of Conciousness *(New York: Hill and Wang, 2009), 60.*

[22] *Mauricio Arnoldo Cárcamo and Víctor Felipe Alegría, "Dérive/Drift: Walking, Drawing and Devising on the Architectural, Urban and Territorial Projective Practices," in* Urban Futures 3, *ed. David Buck and Carla Molinari (Cheltenham: University of Gloucestershire, 2019), 18.*

[23] *DUBC, "'Tecnologías del conocimiento.' Vers. 2012. Diploma en docencia universitaria basada en competencias," 2012, http://www.tecnologiasdelconocimiento.cl/uchile.*

[24] *Piaget,* Estudios de psicología genética, *16.*

[25] *The Forum of the Arts is an activity organized by the Directorate of Creation (DICREA), of the Vice-Rectory of Research and Development (VID), of the University of Chile (UCHILE), which brings together during its development a great part of the artistic creation and research associated with creation, produced at the University of Chile.*

[26] *Although it is a two-dimensional image that is visualized on the computer screen, its production has a high symbolic coding because the algorithms produced use highly systematic symbolic coding. We could define it even in computer languages, even more formalized than natural languages in terms of their formalization. For the purpose of this text, and without pretending to enter here in this argument, we would refer to the computer graphic image as an iconic representation intensified by computerized symbol systems.*

[27] *While it is true that the development of a digital photomontage belongs to the field of the image (iconic representation), the digital component implies a high instrumental coding, product of the use of the computer, which reduces the participation of the body to the visual. In the words of Pallasmaa, it must be taken into account that, "The computer creates a distance between the maker and the object, whereas drawing by hand as well as model-making put the designer into a haptic contact with the object or space," Juhani Pallasmaa,* The Eyes of the Skin: Architecture and the Senses *(1996; London: Wiley-Academy Editions, 2005), 12.*

[28] *Piaget,* Estudios de psicología genética, *16.*

BIBLIOGRAPHY

- Bergen, Benjamin. *Louder than Words: The New Science of How the Mind Makes Meaning*. New York: Basic Books, 2012.
- Cárcamo, Mauricio Arnoldo, and Víctor Felipe Alegría. "Dérive/Drift: Walking, Drawing and Devising on the Architectural, Urban and Territorial Projective Practices." In *Urban Futures 3*, edited by David Buck and Carla Molinari, 17–26. Cheltenham: University of Gloucestershire, 2019.
- Cárcamo, Mauricio Arnoldo, and Cecilia Wolff. *CUBOOK: 1200 gramos destinados a discurrir en torno al "manoaje."* Santiago de Chile: Universidad de Chile, 2017.
- Donald, Merlin Wilfred. *Origins of the Modern Mind: Three Stages in the Evolution of Culture and Cognition*. Cambridge: Harvard University Press, 1991.
- DUBC. "'Tecnologías del conocimiento.' Vers. 2012. Diploma en docencia universitaria basada en competencias," 2012.

- Edwards, Betty. *The New Drawing on the Right Side of the Brain*. New York: Penguin Putnam Inc, 1999. First published 1979.
- Eliot, T. S. *The Rock: A Pageant Play*. New York: Harcourt, Brace and Company, 1934.
- Hannaford, Carla. *Smart Moves: Why Learning Is Not All in Your Head*. 2nd ed. Salt lake city, Utah: River Books, 2005. First published 1995.
- Marcos Alonso, Jesús. "¿Profesiones o corporaciones? Al margen del debate gremial entre técnicos 'superiores' y técnicos 'de grado medio.'" *Construcción, Arquitectura, Urbanismo. CAU Colegio Oficial de Aparejadores y Arquitectos Técnicos de Cataluña y Baleares* 2–3 (1970): 116–25.
- Morin, Edgar. *Seven Complex Lessons in Education for the Future*. Translated by Nidra Poller. 1st ed. Paris: UNESCO Publishing, 2001.
- Noë, Alva. *Out of Our Heads: Why You Are Not Your Brain, and Other Lessons from the Biology of Conciousness*. New York: Hill and Wang, 2009.
- Pallasmaa, Juhani. *The Eyes of the Skin: Architecture and the Senses*. London: Wiley-Academy Editions, 2005. First published 1996.
- Pallasmaa, Juhani. *The Thinking Hand: Existential and Embodied Wisdom in Architecture*. London: John Wiley & Sons, 2009.
- Pareyson, Luigi. *Estética: teoría de la formatividad*. Milan: Editorial Bompiani, 2002. First published 1954.
- Piaget, Jean. *Estudios de psicología genética*. Translated by Antonio M. Battro. 7th ed. Buenos Aires: Emecé Editores, 1972.
- Rizzolatti, Giacomo, L. Fadiga, V. Gallese, and L. Fogassi. "Premotor Cortex and Recognition of Motor Actions." *Cognition Brain Research* 3, no. 2 (1996): 131–41. https://doi.org/10.1016/0926-6410(95)00038-0
- Valéry, Paul. *Piezas sobre arte*. Translated by José Luis Arántegui. Madrid: A. Machado Libros, 2005. First published 1924.
- Vázquez, Fernando Guillermo, Mauricio Arnoldo Cárcamo, and Eduardo Takemi. "Proposta Ditática Para Ensino de Rhinoceros: Da Formalização Manual à Digital." *Educação Gráfica* 22, no. 2 (2018): 131–46.
- Wilson, Frank R. *The Hand: How Its Use Shapes the Brain, Language and Human Culture*. New York: Pantheon Books, 1998.

IMAGE SOURCES

1. Cecilia Wolff. **2, 3, 4.** 4th Workshop 2018, Faculty of Architecture and Urbanism, University of Chile. **5.** María Paz Yolín, Isidora Reinoso, Valentina Urrea and Salomé Muñoz. **6.** Valentina Urrea, Javiera Morales and Diego Flores. **7.** 4th Workshop 2018, Faculty of Architecture and Urbanism, University of Chile. All photographs were taken by Cecilia Wolff.

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