

**matter**

Marine de Carbonnières

**and creative  
process**

**Marine de Carbonnières (Mdc)**

Enoncé Théorique de Master

EPFL, ENAC, Architecture

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# preamble

Between my bachelor and master studies, like many of my fellow architecture students, I had to do an internship to acquire some professional experience. I found a junior architect position in Toronto in a firm whose work mainly comprises large condominium towers in order to keep the finances going and includes the occasional educational or public building in which to find more liberated design possibilities. At the same time, I had discovered a small pottery studio near my house and signed up for a yearlong class. After working on a computer for eight hours every day, I would find great relief in this leisurely occupation, creating something with my own hands and seeing the physical result of a few weeks worth of work.

At the office, I was put on a competition with a few other more experienced architects. The program of the project was very complex and, whilst working on 3D models, at one point our team became very frustrated. It had been some time already that we had been struggling and we were still unable to figure out an efficient form and plan combination to satisfy our ambition for the project. My fingers were itching with an idea which I had been trying to visualize on the modelling software. To sooth my impatience, I decided to go to the model making room and create a paper model. As simple as this act might seem, it was a relief to finally exteriorize an idea and see its physical shape. To my surprise, the small model was then used by our team as a base for the design, unlocking a process which had been on standby.



The exteriorizing of an idea through a physical and haptic process gave me a sense of the richness of this way of creating. Departing from a very personal experience, this thesis proposes to explore the possibilities of a design process which starts from materials. Many architects work with collages, pictorial references, sketches or 3D modelling as a base, and I would like, in turn, to examine a process of creation which begins with matter and question the consequences of this working method.

# introduction

*"Occupying oneself with the inherent laws of concrete things such as mountains, rock, and water in connection with a building assignment offers a chance of apprehending and expressing some of the primal and as it were "culturally innocent" attributes of these elements, and developing an architecture that sets out from and returns to real things."<sup>1</sup>*

Peter Zumthor  
*Thinking Architecture*

Physical matter surrounds us by constituting the spaces in which we live. We perceive it mainly with vision and touch but hearing and smelling are also senses that are solicited, although often unconsciously. Usually solely seen as an instrument in the building process, materials are a component for architects to use in their conceptions, to experiment with form, and ultimately to question and compose a built environment. It is thanks to materials that ideas become a reality. The interaction of users with the space around them is highly dependent on the materials that consists its making and the choice taker of these materials is under the responsibility of shaping the user's perception.

In an age of digital architecture, our body becomes more and more disconnected from the spaces we imagine during the creative process. CAD Software, Rhino, Revit are digital drawing tools which offer an incredible amount of possibilities through the jump of scales in infinitely zoom-able drawings. Drawing on the computer can seem overwhelming for this very reason and it is important to set constants from which the project will evolve.

Rather than the common creative process that might depart from a visual idea evolving into a project, this *énoncé* proposes to explore a creative process that departs from matter to then derive a project. Considering a material as a constant, rather than a variable, creates a quantifiable framework from which the creation can evolve into a reality. In starting the design from a material, this 'matter method' implicates that certain constraints will be set before the creation of the project. The working method studied in this essay

<sup>1</sup> Peter Zumthor, *Thinking Architecture* 3rd Edition, (Basel: Birkhäuser Architecture, 2010), 32.

does not reject software and the use of computers but merely sees them as tools which can facilitate certain phases of the architectural project.

The first part of the *énoncé* defines an interpretation for the word matter and explicits its importance in creative processess. The design practices of three architects, whose work revolves around material exploration, will then be analysed to pull out lessons and limitations from their methodologies. In a second part, this theoretical interpretation of the design starting with the matter will be physically explored. A personal interest for ceramic art and hands on experience with pottery craft has led me to choose clay and its ceramic form as the material to be explored in this *énoncé*. Ceramic and its links with architecture will be presented. We will then see how a brick can be used to experiment a new creative process departing from ceramic matter. A catalogue of the result of these experiments will be exhibited in order to to summarize the scope of the *énoncé*.

The analysis and testing of a creative process departing from material will undoubtedly have consequences on the architectural project and these conclusions will be a departure point for the 'projet de master' in the following semester.

# matter and manner



**fig.1** *Renacer*, Graham Metson,  
Clorado, 1969.

## Definition and importance of 'matter' in architecture

The word matter means the substance of which a physical object is composed and consequently a constituent which occupies space and has mass. Materials are the matter from which something is or can be made. In this *énoncé* the word matter will be used generally to describe all the materials available in architecture.

It is not surprising that our relationship towards matter provokes in us a subconscious spatial understanding. Indeed, the word 'material' takes its origin from the Latin word 'mater' meaning 'mother' but also 'Materia', meaning 'timber, substance' and finally 'subject of discourse'<sup>2</sup>. The origins of the word material insinuate the profound connection we feel to mother nature. Through our senses we automatically connect to matter and retain different feelings from different spaces. The architect Ivry Serres writes "Matter, as a complex and changing substance, can help us manipulate the properties, the emotions and the energies found in architecture, with the goal of obtaining harmony."<sup>3</sup> For example, if a room is made of concrete or entirely clad in wood, our perceptions will be of feeling cold or feeling warm.

<sup>2</sup> Lexico Dictionaries. "Matter:  
Definition of Matter by Lexico."

<sup>3</sup> Ivry Serres, *L'œuvre des matières*,  
(Tusson, Edition Cosa Mentale,  
2017) 39.

*« La matière, dans sa substance  
complexe et changeante, peut nous  
aider à manipuler les propriétés,  
les émotions et les énergies  
de l'architecture, dans le but  
d'atteindre l'harmonie. »*

Translated by M.de C.

In a traditional Japanese house, the idea of harmony is immediately recognizable to our senses. Upon entering one of these houses, the fresh smell of Igusa emanating from the tatami floor make us want to remove our shoes and step on the soft mat. The dimensions of the mats carried through the whole conception of the rooms and the translucent sliding panels subconsciously participate in our understanding of the openness and lightness of the space. But the poetics of a material only exist when life takes place within or around this material. This is what Peter Zumthor implies when he says that as architects we need to “generate a meaningful situation for them, since materials in themselves are not poetic.”<sup>4</sup> It is then essential, to generate meaning in materials, to understand the dialogue that takes place between the users of a space and the materials with which it is composed.

The interpretation of a space is based on a phenomenological experience and it is this first encounter that can be altered through materials. As Valerio Olgiati defends in his book *Non-Referential Architecture*, most of the buildings created nowadays are devoid of any symbolic cues which could serve to its reading and he emphasises this when saying “[...] architecture engenders, above all else, a basic physical and sensual experience prior to also initiating intellectual interpretation.”<sup>5</sup> Olgiati explains that the society of today functions without a fundamental comprehension of cultural and historical relationships to architecture but that it is impossible for architecture not to have meaning.<sup>6</sup> This meaning is found in our sensual experience of the space and therefore it is through its construction and physical composition

that architecture can be understood. Materials also reveal the passing of time through use and sculpting from natural degradation. They are witnesses of cultures and help us understand our progression as a society. Once the people, ideas and symbols of a place have disappeared, it is the materials which persist in time, not untouched but withstanding. If non-referential architecture is the current state of the profession, then materials are even more important in the composition of our built environment.

<sup>4</sup> Peter Zumthor, *Thinking Architecture* 3rd Edition, (Basel: Birkhäuser Architecture, 2010), 10.

<sup>5</sup> Valerio Olgiati, Markus Breitschmid, *Non-Referential Architecture*, (Basel: Simonett & Baer, 2018), 15.

<sup>6</sup> Ibid., 22

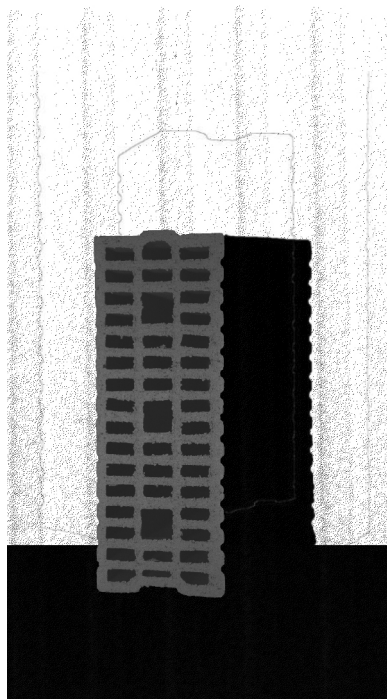


fig.2 drawing from brick outlines  
and texture, MdC, 2019

## Creative processes

Taking the idea that architecture is first and foremost a haptic experience of a place means that its conception must be fundamentally connected to matter. Nevertheless, most design processes do not depart from materials.

In a classic scheme, the project moves from the conceptual design, to schematic design, design development, construction documents, construction bidding and finally construction administration. Materials are a variable which often enters the project at the end of the schematic design phase and are treated as a 'finish'. There are a variety of components which the project can take inspiration from (ex: the context, the program, a signature form, a concept, a reference image, a collage...). This primary idea must be concretized in some form whether it'd a drawing, a render, or a model and presented to the client. The materials in which it will be constructed are a variable, selected in function of aesthetical, technical and economical parameters. The initial idea for the project can often be drastically modified if a certain material does not meet technical and monetary constraints, altering the initial vision of the architect.

A dramatic example of this is the office building La Grande Arche, in Paris, an ambitious project the realisation of which could not respect the initial intention of the architect because of thier discrepancy with construction reality. Johan Otto von Spreckelsen won the design contest for the planning of "Tête-Défense" with his hypercube proposal in 1983. The Danish architect, more of an idealist than a builder, tried to oversee every construction detail and element of the project, but the reality of the built work and tensions with his engineer collaborators led him to quit in 1986, three years before the end of the project, refusing to sign his work. Spreckelsen had chosen materials of

high quality but inappropriate for the scale of the work. Carrara marble was to cover 3.5 hectares of facade but was deemed too expensive. The grey marble, which Spreckelsen picked as an alternative, absorbed water and fell off the facade because of its high porosity. Ten years after its construction the north and south marble facades were completely replaced with granite. The ambitious vision of the architect had clashed with the physical reality of the project and consequently led to the distortion of his initial intentions.<sup>7</sup>

Working on a condominium tower during my internship, I experienced a disconnect from reality when modelling the building which we had not decided a material for. The proposals I was creating were detached from a physical reality and the result was a series of random iterations unrelated to the dimensions of a specific material. It was immediately easier to design a wholesome facade once the office opted for brick panelling as the main component. Instead of being a theoretical exercise devoid of any real constraints, it became an articulation of building techniques using bricks and understanding the spatial language of this material. The architect's power is to work with restrictions and propose, sometimes devious, solutions to a series of limits. The latter can therefore be transformed into a source of creativity especially in the conception phase.

In a project, the finality or usage of the building, the context, the program and the budget are defined before conception starts. Material and shape of the building are the variants which are modelled to respond to these initial parameters. This *énoncé* seeks to understand what happens when matter is introduced as an input at the beginning of the conception of the project. The vision of a project will undoubtedly be altered if a specific

material is already chosen. The role of the architect becomes then, instead of finding a material which suits the architecture, imagining an architecture that reveals the inherent properties of the material. Architecture becomes much more dimension-able once the physical components of its construction are chosen. And it reaches an integrity when the created space dialogues harmoniously with the materials from which it is made.

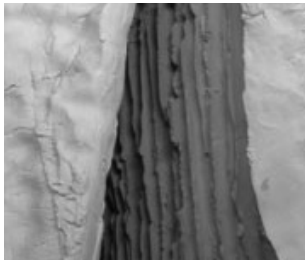
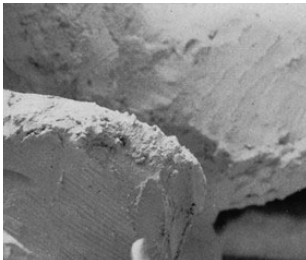
We've seen that the choice of construction material at an early stage can be crucial. Working with models at the conception stage of a project is also a common way to introduce matter early into a design process. Interacting with matter through the force of our hand gives way to a proximity to our senses and apprehending a possible space. Physical modelling is ultimately a tool to visualize the consequences of certain architectonic decisions. The atmosphere of a space is better anticipated through modelling. Creating with one's hands should be a tool to better create with one's mind.

By choosing a material as source of creativity for inventing shapes rather than as an economical or technical reduction of a conceptual idea, the vision of the architect and its realisation become one fluid process. Matter has an influence on the creative process from conception to construction and clashes between an idea and its physical reality can be avoided when matter is brought early into the conception phase to influence the vision of the final proposal.

<sup>7</sup> Laurence Cosse, *La Grande Arche*. (Paris : Edition Gallimard, 2016). 255.

## Manner of using matter: case studies

The following architects have different approaches towards the use of materials in their design process. These approaches involve a series of stages which can be analysed in order to explore the influence of matter over the architectural project. I have chosen each architect not only for their notoriety but also because each one has a different method of using materials in the conceptual phase of the project. This paper will analyse the work of André Bloc, whose work explores the jump of scale from sculpture to architecture, of Peter Zumthor and the creation of atmosphere by modelling space and using locally found materials, and finally of Anne Holtrop who experiments with a material to derive formal lessons and a gesture inherent to the properties of that material.



(left to right)

**fig.3** Sculpture Habitat II, André Bloc, Aujour'dhui, 1967

**fig.4** Bruder Claus model, Peter Zumthor, 2007

**fig.5** Batara model, Anne Holtrop

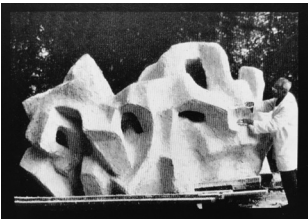
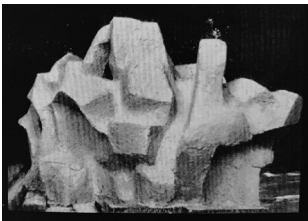


## André Bloc

André Bloc is considered a sculptor alongside his education as an engineer and his vocation as an architect. His research of space passes through small scale modelling of form and a transformation into architecture. The interest in his architectural works lies mostly in this jump of scale from sculpture to built space.

The first '*Sculpture habitacle*' appeared in 1962. Claude Parent, one of Bloc's close friends and partner, defines the artwork as "a usable interior space but not habitable in the sense that its author's intention was not to integrate the functions of a daily livable space."<sup>8</sup> These spaces are interesting because they represent sculptural experiments for André Bloc and do not seek to become architecture per se. Their scale gives them architectonic qualities, but Bloc does not intend on declaring them architectural works. In fact, Bloc speaks about his inhabitable sculptures as an occasion to "challenge the merits of certain creations where plasticity is freed from considerations of pure logic."<sup>9</sup> . André Bloc deliberately frees himself from 'pragmatic' constraints, like the function or the use, when he makes building sized sculptures that are not intended to be lived in. In this case, the material can become the constant in the spatial conception because Bloc purposefully removes the components that are usually at the origin of a concept.

Claude Parent writes about Bloc's methodical three phase process. The first phase involves modeling at a small scale. The second stage is a larger 1 to 5 scale test, enabling a better sequencing of form and resolving the transition between exterior and interior spaces. The third and final stage reaches architectural dimensions and is subject to important modifications done on



**fig.6** Sculpture Habitacle II, primary sculpture, André Bloc, 1964.

**fig.7** Sculpture Habitacle II, model 1 to 5, André Bloc, 1964.

**fig.8** William Klein, filming of Qui êtes-vous Polly Magoo in the Sculpture Habitacle II, 1968.

<sup>8</sup> Claude Parent, *Sculpture Habitacle*, ed. Bloc: *Le Monolithe Fracturé*. (Orléans: Éditions HMX, 1996.), 36.

« L'habitacle se définit comme un espace utilisable intérieurement, mais non habitable, dans la mesure où il n'est pas dans les intentions d'origines de l'auteur d'y intégrer les fonctions habituelles de la vie quotidienne. »

<sup>9</sup> André Bloc, ed. Bloc: *Le Monolithe Fracturé*. (Orléans: Éditions HMX, 1996.), 50.

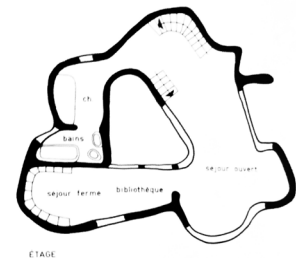


fig.9 Sculpture Habitacle and respective plan, André Bloc, 1962-1966.

site and introduces, as Claude Parent says, the "discipline of the material and the incidence of technique"<sup>10</sup>. Bloc's creation thus departs from purely esthetic choices but necessitates a constant questioning of constructability along the entire progression of the project.

The fact that Bloc needs to create the gradually increasing scaled models demonstrates an attention to the capacity of material and adapting the sculpture to the form permitted by the material. In the *Habitacle II*, the formal qualities of the small-scale model must be adjusted because of the use of bricks in the final work. Bloc appropriates himself with the bricks and uses them in a manner unusual to their modular nature. Bloc pushes the capacity of the brick module and at this point the creation becomes architecture while also pertaining to its original intention as a lyrical expression of form.

This methodology of working with large scale models, simplifies the task of transcribing the space into plans. Insofar as the 1 to 1 habitable sculpture will be constructed from the gestures and intentions tested in the model. Bloc's process is different than the typical architect who would start by planning out spaces and drawing them. The drawings of the *Maison à Carboneras* built in 1964 and the *Sculptures Habitacles I* (1962-1969) testify to this. A plaster model is created and then plans are drawn from it and traditional living spaces are inserted in the unusual volumes. The series of habitable sculptures are a demonstration of Bloc's will to create an architecture born from sculpture.

Another exploration of form through modeling are his housing projects made from modular elements. Bloc seeks to combine and juxtapose these standard elements to create a composition where these modules are read as part of a whole and not individually, as their nature might suggest. An article about this is published in his magazine *Aujourd'hui* in 1963. His combination of elements of different sizes but that can all be prefabricated remind us of the later Habitat 67 by Moshe Safdie. Bloc allows himself to play around with the modular parts and liberates the formal possibilities of prefabrication. The constant which are the prefabricated elements are given a more interesting and still efficient use when Bloc creates these variations of interpretations and combinations.

André Bloc is a sculptor of space and his work is closely linked to material in the fact that he creates physical models from which to derive an architecture rather than working from plans. Taking in modifications from the jump of scales, the ultimate object is finely tuned to his intention and to the material's capabilities. The projects which he creates are open to interpretation and deliberately reside at the limit between sculpture and architecture, recalling Bloc's lifelong endeavor of reconnecting the arts to the building discipline.



fig.10 *Maison à Carboneras*, Building, Plan, André Bloc, 1964.

<sup>10</sup> Claude Parent, *Sculpture Habitacle*, ed. Bloc: *Le Monolithe Fracturé*. (Orléans: Éditions HMX, 1996.), 38.

## Peter Zumthor

Among the many renowned Swiss architects there is one that is often associated to the perfected use of materials. Peter Zumthor's working process is intimately linked to the exploitation of material specificity. The atmospheres created in his buildings are achieved through a process of spatial and material studies.

I went to Venice for the first time in 2018 to see the Architecture Biennale and it was there that I first physically encountered the work of Peter Zumthor. Indeed, I had heard a lot about this mythical architect at university in the various studio courses that I took, but never had the chance to visit one of his buildings. I found the models superb and having recently graduated from an architecture school where model building is not as much of a focus as digital renderings, I was really enthralled. The first thing that came to my mind when entering the room was, why are all these models placed on such high platforms? As I approached them it became evident that it was to facilitate the onlooker's immersion into the model. It was impressive how easily understandable the atmosphere of each project was, and I walked around for some time taking pictures of them. Apparently, it was the first time these models were exposed. Thinking back on this experience I believe the models were especially striking from the originality of the use of materials. Modelled clay, coloured wax, burnt wood chips, Styrofoam, dust, metal, these were some of the many materials which produced the atmosphere emanating from each piece and made the essence of the projects come to life as you approached them.



(left to right)

**fig.11** Bruder Klaus Feild Chapel  
clay model 1 to 10, Peter Zumthor,  
Venise Biennale, 2018.

**fig.12** Log structure, Brother Klaus  
Field Chapel, Peter Zumthor,  
Mechernich, Germany, 2007.

**fig.13** Bruder Klaus Field Chapel,  
Peter Zumthor, Mechernich,  
Germany, 2007.

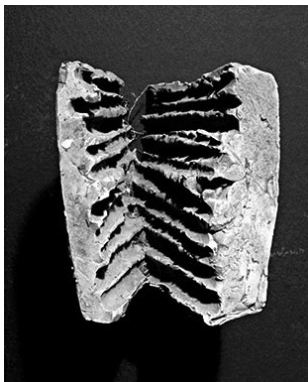


fig.14 & 15 Concrete cast from logs construction technique prototype, Bruder Klaus Field Chapel, Peter Zumthor, 2007

When speaking about his models, Peter Zumthor relates his creative process to the way artists work saying "I'm not implementing the ideas of others. My client wants a building; I will try to find a good form for it and share this work with them. The process of finding the right form is full of insecurities, of despair, pleasure and joy, and it needs free space to move and think. Our models — structural, sculptural, atmospheric, always different — aim to discover and show the physical presence of building and place. They help us to understand, to think and to dream. We make them to hold the promise of the object we are looking for." <sup>11</sup>

Letting the creative spirit move freely about a project allows a dialogue to take place between the constraints of a material and looking for a desired atmosphere. The models are not only a way to convince the client of their investment but most importantly to grasp the atmospheric qualities of the piece to be. At the Venice Biennale there were a few models which testify to this experimental way of discovering atmosphere. The models of the Bruder Klaus Field Chapel reveal this search through a material driven process. The 1:10 sculpted clay model stood in the middle of the exhibition and, approaching it, you could see traces of a scalpel pushed into the material to spread the malleable dough over the round wood-stick frame. Another detail model shows a test for the effect desired on the interior of the church. Clay is spread over wood sticks which are then taken out to reveal the concave textured pattern on the formed walls.

The technique used in building the model is very close to that of the building construction itself. Initially built out of pine logs, the structure was then

covered in reinforced concrete. The logs were then burnt in a three-week long fire, thus revealing the wood formed walls and a similar pattern as the small-scale model. Architectonic qualities in the model are re-enacted in the final building and prove the efficiency of working directly with matter. This process of material tests made it easier to gauge beforehand the effect of two materials, wood and concrete, against each other. Through 3D modelling or rendering, the haptic qualities would have never been so immersive as with a large working model, where the creative conclusion is still open to interpretation. In an interview about the Therme Vals Zumthor says "Architecture has a body. This body is physical it is present. What interests me is concrete architecture. Virtual architecture on paper or on a screen, it doesn't interest me. Or as an idea perhaps, I find it incredible to have spaces that have presences or atmospheres that are surrounded with specific materials where the shell of the building is like an instrument." <sup>12</sup>

Indeed, Peter Zumthor's thought process is close to that of the musicians. The composer creates from a variety of sounds and the associations between these creates a harmonious whole. Zumthor composes with materials to create a wholesome atmosphere and trigger emotion. He says, "Architecture is not about form, it is about many other things," and adds "The light and the use, and the structure, and the shadow, the smell and so on. I think form is the easiest to control, it can be done at the end." <sup>13</sup> There is a distinction between using the language of a material to create atmosphere and exploring atmosphere by physically building it without a particular material.

<sup>11</sup> Philip Stevens, "Peter Zumthor Puts a 'workshop' of Models on Display at Venice Biennale."

<sup>12</sup> Richard Copans, "Peter Zumthor - The Thermae of Stone - Val's."

<sup>13</sup> Amy Frearson, "Peter Zumthor at the Royal Gold Medal Lecture 2013."



**fig.16 & 17** Material variations in  
Therme Vals, Peter Zumthor, photo  
by MdC, 2019

In his monography *The Therme Vals* project is accompanied by pictures of working models. These pictures show a variety of spatial sequences from which Zumthor is able to achieve an atmosphere composed from more than form. In this respect his method becomes more than only a play of physical matter, and it must pass through a modelling phase to become a reality. The final form is not as important as the atmosphere created and appearing in it.

It is also a process of understanding the milieu in which a building will be placed that guides Zumthor's material choice and exploration. The stone used in *The Therme Vals* was excavated 2km above the construction site and it can only serve the nestling of the project into its context than to have it constructed out of local minerals. Much like the hot spring flowing in Vals, the baths connect to the geology of the place and immerse as a rock from the mountain inserting itself into an undefinable timeframe. The 60 000 slabs of Valser Quartzite<sup>14</sup> used in the thermal baths encounter various states of existence. Some slabs are exposed to exterior elements and the seasonal change, others are submerged in waters ranging from 14 to 42 degrees.<sup>15</sup> A repeated quality in Zumthor's work, the use of a single material and the revelation of the various characters of that material shows the delicate attention which he has in regard to how the atmosphere of his building comes together. His creations are integrated and demonstrate a profound comprehension of context through specific material choices.

Peter Zumthor is in search of an atmosphere and the blatant dignity and calm found in his work is created through a process of modelling the

space which he imagines. The final building is a masterpiece of sensorial and bodily events and what gives these exceptional haptic qualities is the choice of matter that anchors the architecture to the site, and the three-dimensional research through hand-made modelling with real construction materials.



**fig.18** Material variations in  
Therme Vals, Peter Zumthor, photo  
by MdC, 2019

<sup>14</sup> SwitzerlandMobility, "*Therme Vals - Wanderland.*"

<sup>15</sup> Russell, "*Therme Vals.*"





**fig.19 & 20** Sand casted Concrete and plaster models, Batara, photo by Bas Princen, 2012

## Anne Holtrop

The practice run by Anne Holtrop is another example of a design method using a material at the beginning of the architectural conception. His work can be compared to a sculptural process of material play. His experimental approach towards architecture takes place through appropriation of materials as the architect's gesture. The work of Anne Holtrop differs from that of Peter Zumthor in that it seeks to reveal how a material performs. Holtrop's method begins with a material and its inherent qualities to discover the possible atmosphere it can generate. In this way, the architecture derived from an initial material experiment or gesture stays closer to his primary intuitions. Through models, experiments and photography, he gains a deep understanding of the limits of a material to make it speak a language specific to its properties.

"I am interested in a possible architecture. In my work I start with form or material that often originates outside architecture. In the conviction that things can always be re-examined and reinterpreted, they can also be seen as architecture. In the same way as someone can see a butterfly or a lake in the ink blots of a Rorschach test. I want to look freely – more or less without a plan – at material gestures and found forms and let them perform as architecture. In this way, architecture emerges by imagining the next step that follows the steps already taken. I want the work to remain interpretable exactly the way it originated."<sup>16</sup>

In the introduction of Holtrop's monography, Giovanna Borasi writes about this architect's work as spaces where the sensorial stimulation is so high that our attention is drawn away from the functional use of the building.



**fig.21** Sand casted Concrete and plaster models, Batara, photo by Bas Princen, 2012

<sup>16</sup> Anne Holtrop, "Studio Anne Holtrop."

She writes "the plan, the form of the building, the materials and the way they are utilized support by themselves the *raison d'être* of the building and become its content."<sup>17</sup> Overlooking the function of a building, Holtrop is more interested in the spaces which he will be able to pull out from a material. Experimentation and model building are his way of finding expressivity in a chosen material.

The Batara pavilion in Wageningen built from 2012-2013 exemplifies a process of material research before the creation of the final pavilion. The initial project was a collaboration between Anne Holtrop and the photographer Bas Princen. Before creating a full-scale pavilion, smaller concrete and plaster tests were made and exhibited along with pictures of this working model. The photos of the model capture the atmosphere produced by the organic forms and enable us to imagine the project at a larger scale. For this pavilion, huge arches were dug out in sand or earth and the natural mould was then filled with dark tinted concrete or plaster. The large empty frame-like forms were then excavated and flipped around to be placed as a passage through which the promeneur can walk into and under.

The question of scale becomes an essential part in this project and one that must be addressed when using a design method based on a material. There is a jump between the results a material gives at a 1 to 50 scale and when it is used 1 to 1. Like in photography, the grain or resolution of the material is dependent on the overall size of the frame or the final work. The Batara pavilion and its model are examples of this change of material resolution. Observing the pictures exhibited with the model we notice how large the textures of the

concrete arches seem to be in relation to their form. The photos taken by Bas Princen frame fragments of the atmospheric qualities of the model, distancing us from the direct encounter we could have with the model and placing us inside the space. The fact that this pavilion also has no function keeps the imaginary around these formal experiments open to what they could become. Much like André Bloc, the constraint of function is removed to work more freely and put materials first in the experimental process.

In their work, Princen and Holtrop point to examples of architecture where the material is the same as the natural environment in which it is placed. A specificity regarding place is achieved and the building becomes an accepted part of the natural landscape. The Batara Pavilion is inspired by a visit to the ancient city of Petra in Jordan, which is an example of mono-material architecture. Holtrop's projects usually revolve around the use of one material and this permits us to focus on the qualities of the material and the making process rather than the function. Batara was a stepping stone in the creative postulate of the studio and Holtrop explains in an interview: "I began to see a lot more possibility in Batara; a strong wish to work directly with material and the way I can form it," [...] "Making Batara was about influencing the process rather than realizing a fully designed form."<sup>18</sup> The formal qualities extrapolated in Batara are a result of the way matter is manipulated, of a gesture shaping an interaction with an environment (the sand box). The architect says "For a sculptor, perhaps it's normal, but for an architect to get into such a close relationship with the material — that's what I'm looking for".<sup>19</sup>



**fig.22** Framed photography on Sand casted Concrete and plaster models, Batara, photo by Bas Princen, 2012.

<sup>17</sup> Giovanna Borasi, *Studio Anne Holtrop*, (Köln, Walther König, 2016), 6.

<sup>18</sup> Shumi Bose. "Architect Anne Holtrop Finds a New Lease on Life in the Desert."

<sup>19</sup> Ibid.



**fig.23** Bataravilla, Wageningen, Netherlands, photo by Bas Princen, 2013.

Holtrop allows himself to rely on intuition as a first gesture. Roland Barthes' description of Cy Twombly's work, is for Holtrop, an important departure point in assimilating the idea of material gesture. "In his writings on the work of Cy Twombly, Roland Barthes defines the term gesture as the surplus of an action: "The action is transitive, it seeks only to provoke an object, as a result," whereas the gesture is "the indeterminate and inexhaustible total of reasons, pulsion, indolence which surround the action with an 'atmosphere'"<sup>20</sup>. The act carried upon the object, for example the act of scratching the canvas, is more important than the product, the painting, in Cy Twombly's case. The essence of the work then relies on the character of an action onto a material. The production of an effect is created while not intending on a particular result. This process allows Holtrop to create work at the intersection between sculpture and architecture, thus utilizing a fundamental aspect of art which is its interpretability. Holtrop writes about his work in an article called "Openness" explaining that there is no hierarchical relationship between the different type of explorations that he does<sup>21</sup>. He cites Umberto Eco and what he calls 'Opera Aperata'. Umberto Eco describes many types of art works where openness is fundamental, from music, literature to poetry and architecture. This openness is the artist's deliberate decision to leave the work's arrangement to the public or to chance. Umberto Eco writes "Every reception of a work of art is both an interpretation and a performance of it, because in every reception the work takes on a fresh perspective for itself"<sup>22</sup>. Inspired by this, Holtrop deliberately judges his material and conceptual

experiments as an open source of inspiration where ideas can cross and influence each other. This possibility of reuse of ideas and openness of mind is how Holtrop juggles between the medium of photography, models, temporary spaces and built work. His creative process derives an interpretation from matter and expands the language with which a material can talk to the user.



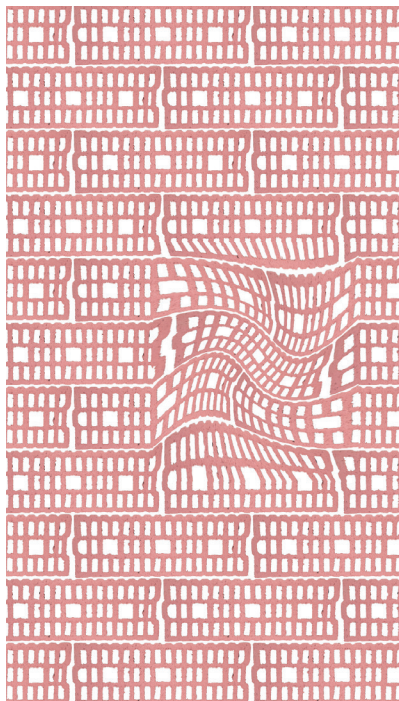
**fig.24** Casting Bataravilla in sand, Anne Holtrop, 2013

<sup>20</sup> Roland Barthes, *Cy Twombly ou « Non multa sed multum »* (Paris: Seuil, 1979), 2.

<sup>21</sup> Anne Holtrop, "Openness". in *Displayed Spaces: New Means of Architecture Presentation through Exhibitions*. (Leipzig: Spector Books, 2015 ), 50.

<sup>22</sup> Umberto Eco, *The Poetics of the Open Work, The Open Work*, translated by Anna Cancogni. (Cambridge, Massachusetts: Harvard University Press, 1989), 4.





## Creative principles

What are the constraints of the material toolbox of an architect? Principles are pulled out from the preceding case studies to answer this question and set a frame within which the material possibilities of a building can evolve. Certain themes are common to these three architects and by studying their work it is possible to derive conclusions about their underlying thought processes. The following principles are conditions which allow the architect to work with matter as a base. The methodology then developed in the last part of this *énoncé* will seek to appropriate itself with these four principles.

### Principle I : *mono-material*

A recurring theme in the work of André Bloc, Peter Zumthor and Anne Holtrop is the use of the same material everywhere in the final construction. In the Bruder Klaus Chapel and in Batara, the use of form casting involves more than one material, but the ultimate production consists of only one. The unique textures are born from the interaction between wood and concrete, or sand and concrete, but the final built work is one material where only the traces of the other remain. As Valerio Olgiati writes in his book about non-referential architecture: "Buildings benefit if they are constructed of one single material. To construct a building with a single material presents the formal intention unequivocally. This assertion is based on three considerations: first, a building that is made from only one material is ideational in any sense; second, in a

building that is based on an idea, it is the architect's task to decide on the material with which the building is built; and third, the single material defines the formal qualities of the building.”<sup>23</sup> An interpretation of this principle could be that the qualities or possibilities of a material are better utilized when a variety of spaces are created from this one type of material.

If a material is used at the start of a conceptual process and experimented with to be used in the final project, then it is bound to be used in a way that takes into account its inherent properties and dimensions. Such as when Holtrop creates a concrete sculpture for Batara and uses the same technique in the pavilion. The experiments in this *énoncé* will investigate the scope of mono-materiality through a case study of ceramics.

### Principle II : *scale*

Scale must be understood as dimensions and resolution of material. André Bloc uses scaled models to assure that his sculptural intentions will be the same from the object to the built result. Anne Holtrop uses scale to extrapolate the qualities of a material. His challenge lies in projecting the use of a material on a small scale to a large one where the material will not have the same resolution. For example, the Batara pavilion does not have the same tactile qualities during the exhibition and once the casting method is used for a pavilion. It is through the lens of the photographer Bas Princen that the spatial qualities can be extrapolated from the small-scale model. Batara was an exploration of casting technique which evolved from a model to a pavilion

and now the studio is making a full five-story building in Bahrain. Since the elements are casts of the landscape, no drawing precedes it. Holtrop describes in an interview that “It is the act of making that is the form”<sup>24</sup>. This has a resonance with André Bloc who works from scaled models and Zumthor who believes form is the easiest and last part of a project, favouring over it the haptic qualities, the possible construction technique and the material of a building.

With scaled models it is possible to gage how the material will react to certain gestures or uses. The physical tests allow the hand to have an easy, direct and immediately visible impact on the projection of the space. Physical testing is very efficient, compared to 3D modelling and rendering, in making us feel how the material expresses itself. In renderings a material texture is often placed over a volume, and it is a play with parameters which allows a perfected scaling of the flat image to represent something accurately. To simulate the bulks in the material one could also play with the “bump” ratio and arrive to a closer version of the desired effect. Today renderings are producing convincing representations of spaces, but they are often perfected views of a place and rely on much fine tuning and modifications of parameters to come close to reality. Notwithstanding the haptic qualities, renderings exclude a lot of potentially exploitable components in materials which simply might not be represented in imagery. A three-dimensional object cannot be as well perceived as when it is in the hands of the beholder. In the end, to represent something on the computer excludes the possible mis-happenings

<sup>23</sup> Valerio Olgiati, Markus Breitschmid, *Non-Referential Architecture*, (Basel: Simonett & Baer, 2018), 96

<sup>24</sup> Andrew Heid. 2018. “*Nothing Can Be Too Crazy for Architect Anne Holtrop* | Cultured Magazine.”

otherwise present when testing matter physically. This leads to the next principle which is interpretability.

### Principle III : *interpretation / intuition*

Anne Holtrop cites Umberto Eco and speaks about the importance of “openness” in a work<sup>25</sup>. The cross between different forms of expression, whether it be sculpture, drawing, photography or architecture can participate in creating this fluidity of interpretation between works. When doing conceptual tests through material the desired product is not necessarily determined by this search although the material opens the possibility for interpretation. The interpretability of a work introduces the possibility of using matter in a devious way. When Bloc uses the brick to create his ‘Sculpture habitacle’, he is defying the modularity of it and proposing an alternative identity for the brick. Holtrop’s interpretation of the cast model or the use of the Rauschenberg ink blots as inspiration for plans defies the use of this type of art work and takes out inspiration from it. Peter Zumthor creates sketches of ambiances that are then determined formally by the material which it is constituted from.

Our imagination and intellect are what allow us to interpret what our senses feel. For a work to stimulate the onlooker it needs to be deliberately given a chance to be interpreted. The photography of the Batara pavilion are an opportunity for the onlooker to imagine what a space made of concrete cast in sand could be. Fredrich Teja Bach in an article from Archisculpture

says “The capacity that enables us to see the small as large and to conceive the large as small stems from human perception and imagination. This ability is activated when the automatic estimation of distance is disrupted, or when such a disruption is artificially produced in the interpretation of the seen and the real (or ideal) distance. This occurs, for example, through the absence of presentational scale, through perspective puzzles, and through sculptures that are also intended as or can at least be conceived as architectural models. In this manner, sculpture is effective as a “shifter” of spatiality; as a visible form whose meaning shifts with its context.”<sup>26</sup>. Therefore, the architect must find ways in which a creation can become and stay in an interpretable realm. The manipulation of matter on a small scale is a method for the architect to shift spatiality and explore the physical potential of a desired scheme.

### Principle IV : *local provenance*

The provenance of a material should be considered from the beginning of the process. This sets a frame within which the conception of the building can evolve. The time spent understanding a context allows architects to find which materials would be appropriate for it and to learn the existing language of local materials. Taking the provenance of a material into account helps to create a project which blends into the landscape and existing context. For example, when Zumthor chooses the Valser Quartzite for the Termes Vals he immediately starts to connect the built work to an existing identity.

<sup>25</sup> Anne Holtrop, “Openness”. in *Displayed Spaces: New Means of Architecture Presentation through Exhibitions*. (Leipzig: Spector Books, 2015), 50.

<sup>26</sup> Markus Brüderlin and Friedrich Teja Bach. *ArchiSculpture: Dialogues between Architecture and Sculpture from the Eighteenth Century to the Present Day* (Riehen/ Basel: Fondation Beyeler, 2004), 35.

In addition, from an ecological point of view, when a material is locally sourced its transportation emissions and costs are reduced. This not only promotes local building industries but also produces a building which is made from the materials identifiable to a land and which has the potential to complement the existing built fabric instead of confusing it. Achieving a continuity of means throughout the building process assures a completeness for the creative process and the built form.

In the advent of global warming, and the ever-massive destruction of natural landscapes, it is our responsibility to have an ecologically driven mindset when designing. We need to address the carbon emissions of buildings and construction, currently responsible for 40% of carbon emissions globally. How we build and what we build out of are unavoidable questions. Ideally, the complete life cycle of a construction material should be assessed when chosen for a construction.

These four creative principles, mono-material, scale, intuition/intention, and local provenance are guidelines which will be applied in the third part of this study, Material Gesture as Creative Process. By applying the lessons discovered from André Bloc, Peter Zumthor and Anne Holtrop's practices, a personal material driven process can be applied to ceramics. Studying the works of experienced architects serves a reasoned thought process based on references. The following part dives into the relationship between ceramics and architecture to gain a historical and physical understanding of this matter.

# ceramics as matter



**fig.25** Ceramic construction elements. Extract from Alexandre Brongniart and Denis Riocreux, *Description méthodique du Musée céramique de la manufacture de Sèvres, 1845.* (modified)

## Ceramic and Architecture

Ceramic is defined as a material made from clay and permanently hardened by heat. The first found functional pottery vessels are dated back to 18 000 BC and preceded from far the premises of sedentary architecture dated to 9000 BC. It might not seem obvious that architecture and the art of ceramics are linked but some theories in the 19th century explained how the art of building “could derive from gestures initially applied to the shaping of vases” <sup>27</sup>.

Alexandre Brongniart (1770-1847), son of an architect and who was director of the Manufacture de Sèvres for 47 years and member of the Académie Royale des Sciences, wrote the *Traité des arts céramiques ou des poteries* in the same manner as an architectural treatise. Not only does his *traité* compile a thorough and historical account of ceramic arts and the skills of potters in ancient times, but it also contains a theory about ceramic objects used as basic habitats. Brongniart mentions funerary jars used in South

<sup>27</sup> Estelle Thibault, *A Ceramic Origin for Architecture? 19th century hypothesis, myths and accounts in Architectures Céramiques-De la Structure à l'Ornement.* (Genève: HEAD, 2019), 10.

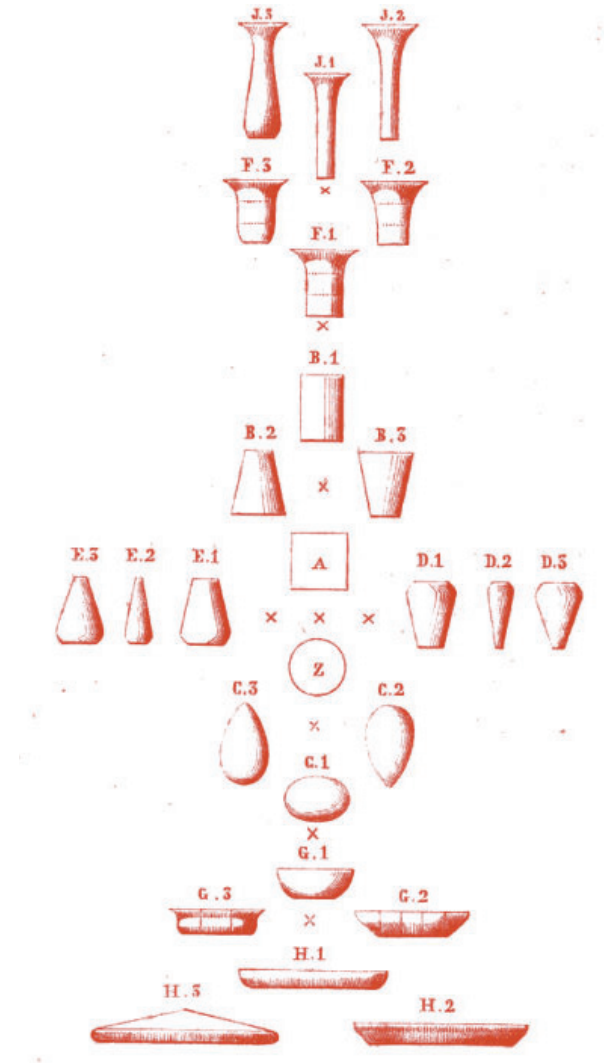


fig.26 Classification of vase forms.  
Extract from *Etudes Céramiques: Recherches Des Principes Du Beau Dans l'architecture*, Jules Zeigler, 1850.

America which were large enough to contain bodies and reminds us of the myth of Diogenes who resided not in a barrel but in a terracotta pithos, a large vessel used to contain wine.

Brongniart's Treatise on the Ceramic Arts is followed by *Etudes céramiques: recherche des principes du beau dans l'architecture, l'art céramique et la forme en général*, published in 1850 by Jules C. Ziegler who deliberately puts forward the common origins of architecture and ceramics. Ziegler considers the influence of ceramics on architecture in formal and aesthetic terms. He writes about the architects of ancient Greece who would have been educated by contact with ceramic workshops in Athens. Ceramic art (from the Greek word Ceramos meaning clay) would be named after the district of Athens<sup>28</sup> where these workshops were located. The making and perfection of vases would have been testing grounds for aesthetic principles then transferred to monuments. Laws about symmetry, proportion, stability and balance could be exercised in Ceramic art before being applied to architecture. Ziegler insists that Ceramic art and architecture are united by the same sense of beauty and purposes of ornamentation and utility as well as the same quest of shape ingenuity.<sup>29</sup>

Another important figure supporting these theories is the architect Gottfried Semper. He stipulated that Ceramic art had an important role to play in construction. Semper greatly admired the colourful terracotta pieces from monuments in Italy and Greece. When exiled in France from 1849 to 1850, he frequented the Sèvres museum and manufactory and read the works of

<sup>28</sup> J.C. Ziegler, *Etudes Céramiques: Recherches Des Principes Du Beau Dans l'architecture ; l'art Céramique et La Forme En Général ; Théorie de La Coloration Des Reliefs*. (Boulogne: Paulin Mathias, 1850), 14.

<sup>29</sup> Ibid., 16.

« L'art céramique est l'art des formes inventionnelles ; l'analogie du principe unit encore cet art à l'architecture. C'est en s'exerçant à l'étude des formes céramiques qu'on arrive à produire des formes nouvelles, et que par conséquent l'on peut trouver les rudiments, les bases d'une architecture nationale et nouvelle »





**fig.27** Vase by Jules Zeigler, *Etudes Céramiques*, Atlas, 1850, 13

Brongniart and Ziegler. In 1960-63, Semper writes one of his key work, *Style in the Technical and Tectonic Arts*. At the centre of this analysis, Semper defends that architecture originates from four ancient craft trades, each related to a specific material and having a defined role to play in construction. The four crafts are ceramic art, masonry, carpentry, and textile trade. Since ceramic art necessitates the action of fire, it is linked to the creation of the hearth, where family and social gathering take place. Semper sought to give equal importance to all four craft trades and refuted the dominance of masonry and carpentry in architecture. Contrary to his contemporaries who believed that a structure generated by the architect preceded ornamentation, he defended the role of ceramics as original to the creation of a structural system. His theory was that the design of Doric columns was derived not from a primitive wooden framework but from the cylindrical shape of vases made from a potter's wheel.

The relationship between Ceramic Art and Architecture is revealed by their similar creative processes. There is a parallel between the physical artwork of an artisan and a construction project. The sculptor or ceramist and the architect create from matter and express an intention. They aspire to give meaning to a material by making it a tangible representation of an idea. The attitude of the ceramist and the architect are similar in that they use matter to shape their vision. In both trades, space is created from its containment by a material and accompanied by a haptic experience of matter. Through form, the ceramist and the architect have a certain freedom to innovate, to find beauty and create a sensorial experience for the user. They must respond to

function and design accordingly while also pertaining to material constraints. A most interesting comparison is made by Zeigler who defends that the art of ceramics and architecture borrow common principles and proportions. He says these principles are worked by a potter over a hundred times a day but an architect, due to the nature of his work, has fewer opportunities to see these put in practice. This explains why the architects of ancient Greece were looking for experience in the work of ceramists. This idea of perfecting the object through trial and repetition is somewhat appropriated by the architect with models and prototypes.

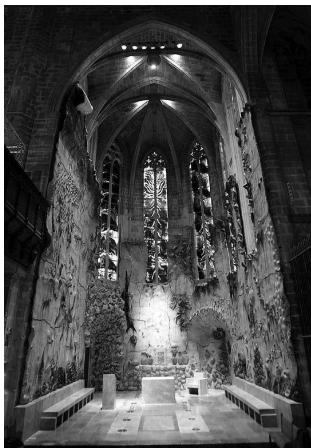
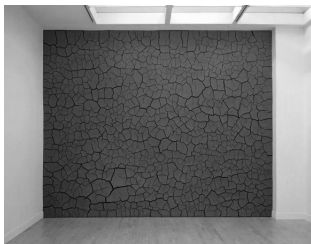
The sculptor Alberto Giacometti once said that the best thing about his sculptures was that one can touch them. The physical experience of matter is common to ceramics and architecture, whether it is an object or a room. A potter knows the types of clays which he/she works with and will have to adjust the firing temperature, the form and the glazing according to this clay to obtain the desired result. It is this finely tuned knowledge that the architect should have about building materials for his/her creation to correspond with his/her ambitions.

Although clay is not very popular in today's architectural education, there are a few contemporary examples of successful architects who have sparked off interest for it and who profit from its inherent qualities. The Russian architect Alexander Brodsky is also considered a sculptor because of his regular use of unfired clay. His interest for the material lies in its capacity to represent memory and reuse, qualities he embodies in his architectural work.



**fig.28** Untitled, Unfired clay, 840 × 760 mm, Alexander Brodsky, 2014.

**fig.29** Earth floor in gallery, The mediated motion, Kunsthaus Bregenz, Bregenz, Austria, 2001, photo by Markus Tretter.



**fig.30** Clay wall, Andy Goldsworthy, 2019

**fig.31** Ceramic mural for the Cathedral of Palma in Majorca, Miquel Barcelo, 2000.

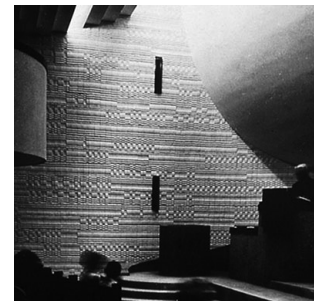
He says "The memory aspect is definitely a big part of its appeal. This is why I never wanted to fire the clay pieces I made, because when you put it in a kiln you kill it, you remove the ability to rehydrate it and make it into something new."<sup>30</sup> Brodsky created reliefs of facades, models of buildings, and even an entire imaginary city out of unfired clay. He purposefully lets the cracking and degradation of the clay apparent, reminding us that buildings too have to age.

Martin Rauch is another architect who speaks about clay as a material that shows the passing of time through erosion. His profession revolves around the use of clay or rammed earth. He explains that "for us, as home dwellers, it is hard to psychologically accept the concept of erosion, that something dwindles", adding "erosion continues all the time; it is a natural cycle of materials, and when we adapt to its mechanisms, then this force need not be destructive".<sup>31</sup>

These two architects demonstrate that clay can be a vehicle to sentiments when its fundamental qualities are brought out and recognized. Exemplified in their work is the beauty of a material that takes in its environment and whose physical change is a wholesome part of a design.

Inversely, there are innumerable contemporary clay artists who step into architectural ambitions. Andy Goldsworthy is a British artist who profits from the idea of erosion and produced installations of raw clay walls where the earth is deliberately left to dry and crack. Left to the effects of time, the earth wall is a direct portrayal of a material's shifting states of being. Another important figure is the Spanish artist Miquel Barcelo who in 2000 created a 300

square meters ceramic mural for the Cathedral of Palma in Majorca. In 2006 his performance piece Paso Doble also involved architecture. Accompanied by Josef Nadj, the two are seen battling a wall and ground of clay. For four minutes they decorate and violently sculpt the still soft clay, entering a trance where they finally become part of the wall. Barcelo's ceramic creations appropriate the scale of architecture to step out of the realm of sculpture. Nino Caruso is another example of a sculptor whose work focused on the architectural scale through ceramic elements. Taking the idea of tiles, Caruso created a variety of reproducible ceramic modules by slip casting clay into blocks of polystyrene (a previously unexplored technique in ceramics). He put these modules to test when commissioned to create the interior surface of the Evangelical Church in Savona in 1968. He focused on creating spaces to be experienced by the viewer through the relationship between ceramics and architecture. By working at the intersection of art and architecture, these artists propose new interpretations and possibilities appropriable in the built profession.



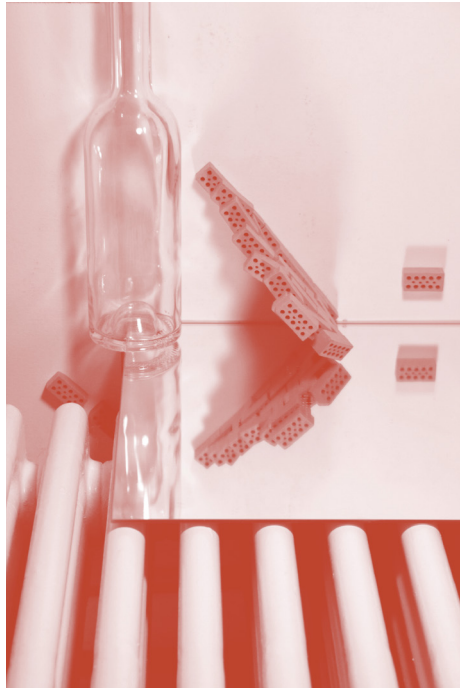
**fig.32** Paso Doble, Miquel Barcelo and Josef Nadj, 2006.

**fig.33** Continuous Bas Relief, Evangelical Church in Savona, Nino Caruso, 1968.

<sup>30</sup> Divisare. 2016. "Alexander Brodsky · Reliefs."

<sup>31</sup> Kateřina Zvelebilová, NETservis. "Rammed Earth – the Amazing Clay Architecture of Martin Rauch."





**fig.34** *Ceramic composition, glass & brick*, personal photography, 2019

## Working with ceramics

When a material is at the basis of a creative process it is essential to understand what its physical properties are. As well as words have to be chosen carefully and put together in a particular way to express an idea, the characteristics of a material are an important part of the language used by the architect to express his vision in the final project. When a material is fully grasped, the dimensions and details of a built work start to derive from the features of this material.

As the architects of ancient Greece would wander into the ceramic workshops of Athens, I have sought out a few pottery studios to see the different techniques and rituals surrounding this ancient art. The following part gathers the knowledge gained during ceramic workshops in Canada with a Turkish potter, in Japan with a potter from Kyoto and in Switzerland with a Lausanne artist. This variety has given me the opportunity to try different techniques and start to gauge the underlying possibilities of making with clay. It would take years to become a specialist of a material but collaborating with these artisans and taking the step of experimenting with it has opened a world of imagination to me.

Ceramics is a very general term and commonly applies to non-metallic and inorganic matter. There are two types of ceramics, crystalline and non-crystalline (glass). The principal elements that compose ceramics are quartz, feldspar, clay, and kaolin. Feldspar is the main component transformed into glass or a glass like substance. Ceramics are considered refractory, a term applied to materials which form at, and therefore resist, very high temperatures.

The main properties of ceramics are the following:

- High melting points, very heat resistant
- Hardness and strength
- Considerable durability (hard-wearing so long lasting)
- Low electrical and thermal conductivity (good insulators)
- Chemical inertness (very low reaction to other chemicals)

These technicalities make it usable in a variety of domains applicable in two general groupings: traditional and advanced ceramics. Traditional ceramics comprise the typical general use materials. Classic examples of these are bricks, pottery, glass, porcelain, tiles. Advanced ceramics are the materials which have been engineered for highly specific uses such as hard-cutting tools, electrical computer components, medical prosthetics, combustion engines, rocket parts, gas-turbine jet engines, etc.

The type of ceramic which I will focus on are the ones made from clay, which is a subcategory of ceramics. Ceramics made from clay are earthenware (fired at low temperatures), stoneware (vitreous or semi-vitreous), porcelain (containing a high amount of kaolin) and bone china. These have a limited amount of processing methods. There exists countless techniques to form clay but the most common ones are: shaping by hand, slip casting, tape casting, moulding, and pressing.

There are a few important steps in creating ceramics. In general terms, the first one is preparing the clay, then creating the form, following is drying

and finally firing. At this stage the clay can be called ceramics because it has undergone the action of fire. Depending on the makers desire, the object can then be glazed and fired again for the coating to melt and solidify as a glass-like finish. Aesthetic and technical choices are implemented throughout all the stages from the malleable, flexible state to hard and non-recyclable.

As part of the preparation, ceramic artists will wedge the clay before throwing it to avoid the presence of air bubbles. There are three most commonly used wedging techniques, spiral wedging, ram's head wedging and kneading. If there is a small amount of clay it will be knead and with large quantities, it is easier to use the spiral wedging technique. The thickness of the material which will be fired is important and, in most cases, should not surpass 3cm. If the thickness is too important, the possible presence of air bubbles or water trapped in the clay could lead it to crack or explode in the kiln.

Patience is key in the arts of ceramics and, just like the architect needs time and hindsight to find solutions for his design, the potter must sometimes wait upon the clay to shape it. As the material dries, its bending and malleability changes, becoming more leather-like as water evaporates. The rigidity or sharpness of the form is determined by the amount of humidity present in the clay when it is shaped, and the potter will sometimes have to let the clay dry before being able to handle it.

The process of ceramic firing is mostly the same with works of different scales. The clay needs to be dry before it is fired for the first time. The particles



**fig.35** Ceramic vase, Shoji Hamada, Mashiko, Japan, photo by MdC, 2019.

of water need to be evaporated to avoid the risk of expansion and the explosion of the piece. Depending on its composition, every type of ceramic has an average temperature at which it should be fired. For example, porcelain will have a higher firing temperature (1,200 and 1,400 °C) than earthenware (1,000 to 1,150 °C) because porcelain has a more important amount of feldspar. Once the piece has been fired it is impossible for it to be recycled and reused as pure clay. It can be ground and used in drainage systems, as a rock base for driveways, in tennis court earth floor, or even combined into a paste to become tableware.

From the discovery of the wheel to deciding to write an *énoncé* on matter, I have had unique encounters with the ceramic arts by living and traveling to different cities.

The year-long pottery workshop held in Toronto and run by Hatice, a Turkish artisan, was an introduction for me to making with clay on the wheel. Working under Hatice's vigilant eye for 3 hours straight, once a week, I found it extremely enriching to focus on a material and understand how it reacts to physical action.

When traveling to Japan, in August 2019, I took courses in two very different pottery studios. The first one was in the small town called Mashiko in Tochigi Prefecture. The town was home to Shoji Hamada, a potter who brought fame to the area. His dedicated museum preserved his home and I had the opportunity to see his impressive earth-built kiln. The second workshop was with a Kyoto potter called Shigeru. Shigeru took me through all the stages

of making and I found two moments of the lesson struck me as the most important ones. Shigeru told me about the provenance of the clay he used and the history around the excavated sediments from the neighbouring lake Biwa. The best clays were at an archaeological site called Irienaiko on the east side of the lake. Kyoto emperors from the 8th century would have it brought into the city for their artisans. An important trade route developed thanks to this locally found material and elevated ceramic craft in the region. The second important moment of the lesson with Shigeru was about the shaping of the tea bowls. The shape depends on the season in which the tea bowl will be used and how much heat should, in consequence, be retained in the future bowl. For the summer season, the bowl's walls are flattened outwards so that the tea will cool down faster. For winter, a bowl with straighter uplifted walls will be made to better contain the heat. For the mid-seasons, a form in between the latter two is advisable. Thanks to Shigeru, I realised that ceramic craft made sense economically and sentimentally to people because it had an inherent quality of local produce and that the choice of the form coinciding with seasonal change had a resonance with architecture which must be tailored to its users and adapt to its environment.

Throughout the last semester, I have been working with the contemporary ceramic artist, Geneviève Schneeberger in Lausanne. Her approach towards ceramics is sculptural and she takes great care in assembling textures and materials. She has a very finely tuned knowledge of the clay and can therefore experiment with the combination of different types



**fig.36** Shigeru's drawing explain the provenance of the clay, Kyoto, Japan, photo by MdC. 2019.

**fig.37** Shigeru demonstrating the making of a winter bowl, Kyoto, Japan, photo by MdC. 2019.



**fig.38** Bowl making in Mashiko,  
Japan. 2019

of earth, testing out how they react with each other and combining diverse methods. The apprenticeship with her has been an exploration of techniques and understanding how to grasp the inherent qualities of a material.

Arising from a personal interest around ceramic art, I found great richness in learning from these artisans. The technical knowledge gained from working in these different studios would not have been as profoundly beneficial had it not been accompanied by the personality of these teachers.

The next chapter departs from my knowledge and experience and is driven by the will to understand how 'things are made'. The multiple stages of learning about ceramics were necessary to develop a sensible material gesture.

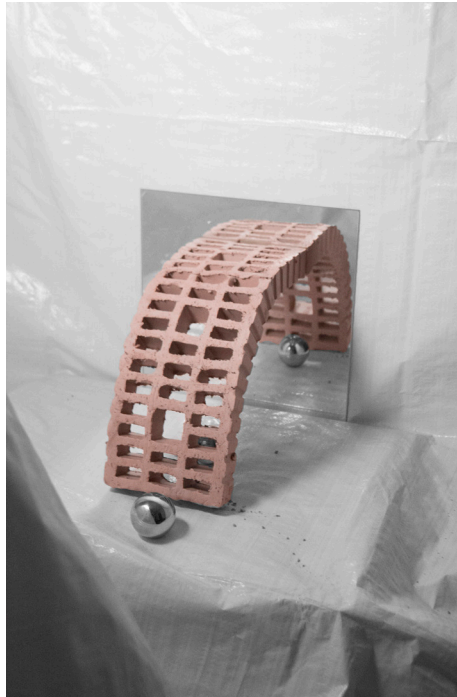
# material gesture as creative process

## Premise

After pulling out creative principles from the work of architects that use materials at the base of their architectural profession, and understanding ceramics, this part of the *énoncé* proposes to explore a material gesture with clay.

As mentioned earlier, Anne Holtrop uses the expression material gesture when speaking about his approach to matter and it is this definition that will guide the work in this last chapter. Roland Barthes writes about the artist Cy Twombly defining the term gesture as the surplus of an action and surrounding the action with atmosphere.<sup>32</sup> The actions taken are therefore a means to “provoke” an object and in this case, to obtain a result from matter. This part of the *énoncé* is inspired by this definition and Cy Twombly’s work wherein the gesture is more important than the final product.

<sup>32</sup> Roland Barthes, *Cy Twombly ou « Non multa sed multum »* (Paris: Seuil, 1979), 2.



**fig.39** *Brick Arch*, photo by MdC, 2019.

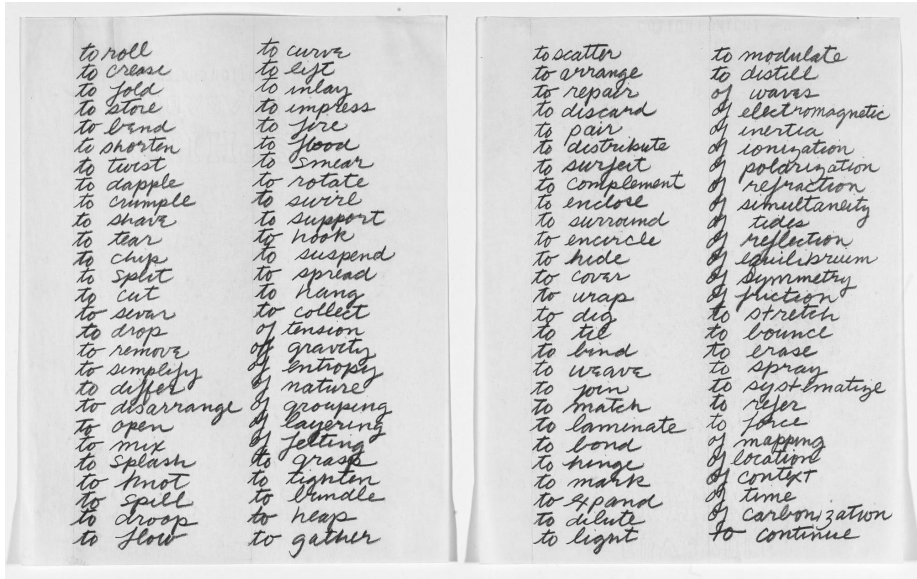


fig.40 "Verb List", Pencil on two  
sheets of paper, Richard Sierra,  
1967-68.

In his book *The Savage Mind*, Claude Levi-Strauss defines the word 'bricoleur' as being someone who works with their hands and "uses devious means compared to those of a craftsman".<sup>33</sup> No matter the task, the bricoleur must tackle the problem at hand with whatever is directly at his disposal and nothing else. This definition has been applied before to the making process in architecture. The idea of *bricolage* is usually seen as something negative, something that is not completely coherent, that is clumsily assembled. However, it seems that it could have a potential for architecture because it allows intuition to crystallize an idea through a hand gesture in matter. To consider the architect more of a *bricoleur* than a craftsman is to allow mythical thought and dexterity to seep into the creative process.

The idea of the *bricoleur* should be carried out through all phases of the architectural project, from the first design intuitions to the final construction phase. It is a simple enough idea for the architect to look at a site and assess the means which are available to him/her, but it is a challenge of greater complexity to create innovation out of it. *Bricolage* has in this meaning an implication of mismatch and temporary state. This seemingly disordered condition is one that I find fitting to allow unusual, inventive and sensitive ideas to push a project. Departing from the available means and allowing mis-happenings to participate in a then reasoned project gives way to an enriched proposal.

The matter, in this case clay, is put through a series of defined actions to derive a material gesture. The production from this experiment becomes

<sup>33</sup> Claude Levi-Strauss, *The Savage Mind* Translated by George Weidenfeld and Nicolson Ltd. (Paris: Librairie Plon, 1962), 16.

a tool part of the creative process. Thus developing, like André Bloc, Peter Zumthor, and Anne Holtrop, a personal approach based on matter. The tool is not seen as a finality but a springboard from which to launch an architectural project highly specific to a material. This experiment will also respond to the principles defined in the first part of the *énoncé* which are: local provenance, mono-material, scale, interpretation / intuition.

A fundamentally architectural and ceramic made tool, the brick will serve here as the base for the material gesture. I have chosen to experiment with unfired bricks made in the Tuileries Fribourg & Lausanne SA factory. The local provenance of the material is assured because the clay for these bricks is excavated 100 m away from the factory located in Crissier. A single type of module of the brick is used and undergoes a series of actions to distort it. The products will then be photographed and classified in a catalogue. Using the brick in devious ways correlates with Strauss' definition of bricolage in order to create a tool open to interpretation.

In the following sections, the origin of the used brick will be explained and then the catalogue of actions and effects will be displayed along with comments and observations. The visit of the brick factory is at the core of the first part and departs from the simple will of understanding how a brick is made. The catalogue is initially inspired by Richard Sierra's "Verb List".<sup>34</sup> Sierra writes a series of words that entail a modification of matter. These words allow him to methodologically choose the force with which the material will change. The actions chosen are not an externalization of emotion, which

could be sought out in an artistic practice, but they are a series of simple verbs which can shape materials. The catalogue is projected to be the child of this verb list but contrary to Richard Sierra who catalogues a series of ways to manipulate form, I chose to create a list cataloguing many consequences. These consequences depend on the way the brick is cut and the tool which is used to produce the action. Specific verbs are picked out and it is their result on matter which are listed. The last part of the *énoncé* lists the observations and conclusions derived from this catalogue.

<sup>34</sup> Richard Sierra. "Verb List", pencil on two sheets of paper, 1967-1968.



## Brick Factory Visit: Tuileries Fribourg & Lausanne SA

Entering this highly mechanized space where matter intertwines with machinery, pathways for workers and the loud sounds of crushed earth, one realizes how perfected the industrialization of brick making has become. Thanks to a very entrancing organization, the process generates a variety of products, sizes of which vary from hand held to heavy, made for machine, objects. The intricacy of this system is fascinating, and the timing of every phase is as important to the company as it is to the quality of the material.

Mr. Aita has been working at the Tuileries Fribourg & Lausanne SA for a few years and took me around the factory, giving me a detailed description of all the steps which the clay goes through before reaching the desired form. The crushing, grinding and pressing of the clay gave a new rhythm to the image I had of brick making.

A foraging site 1km away is part of the brick factory. The earth is brought to the factory by truck and dumped into large bins to be gradually crushed into smaller sand like particles (from 20 cm rock sized blocks to 1 mm fine grains). It then passes through an extrusion mould and is cut into its final dimensions. After a primary drying, the bricks are stacked and sent through a conveyor belt in a 100m long kiln. They are fired at 1020 °C for 300 minutes. The cooked bricks are thereafter ready to be used in a building and are sent off to their financier. This territorial system creates a locally made product from the depth of the Swiss earth.



**fig.41** Brick Factory, Tuileries  
Fribourg & Lausanne SA, photo by  
MdC, 2019



**fig.42** Steaming recycled paper to be mixed with clay, T. F. & L. SA., photo by MdC, 2019

**fig.43** Pile of clay, T. F. & L. SA., photo by MdC, 2019

**fig.45** Dumped bricks, T. F. & L. SA., photo by MdC, 2019



Mr. Aita generously gave me five bricks which I had to heave up to my apartment. After the fifth brick it seemed difficult to imagine myself building a wall out of them. Each brick weighed 14 kg and measures after being fired (from which it loses approximately 2mm and 5kg of water), 40cm long by 14.5cm wide and 23.8 cm deep.

As highly controlled and perfected is the manner of making the brick, there are anomalies and singular moments that slip into the process. Certain bricks will have cracked or will bend during the firing process, making them unusable. There exists a quality control section by eye by a worker who, from time to time, throws a few cracked bricks on a separate conveyor belt to be dumped in the 'unwanted' pile outside of the factory. Sometimes tests are done on the uncooked brick and these malleable forms can still be recycled hence they are brought back to the starting point and ground again.

Considering these mis-happenings in the industrial process, the following part comprises material deviances that alter the scale, function, form and possible interpretation of the standard brick. These tests are an opportunity to formally alter the bricks by performing actions upon the perfectly moulded objects and bring them back to the scale of the hand. The rationalization of this process is a play between intuition and a deep understanding of how clay reacts. Literally using an industrialized object was the departure point from which the devious interpretation of matter took place, not to feign a form of craftsmanship but to explore the potentials of deconstructing a highly standardized object.



**fig.46** earth and unfired bricks, T. F. & L. SA., photo by MdC, 2019



**fig.47** Earth bin, T. F. & L. SA., photo by MdC, 2019



**fig. 48** clay stock, T. F. & L. SA., photo by MdC, 2019



**fig.49** drying bricks to be fired, T. F. & L. SA. , photo by MdC, 2019



**fig.50 & 51** drying bricks to be fired, T. F. & L. SA. , photo by MdC, 2019



## Material Gesture

### Process

Departing from the visit to the factory, this ultimate part takes on the hypothesis that the architect's action upon matter has an impact on the way that material will be used. It seems obvious that if a material has a certain form it will be used in a certain way. What happens when a material is given a form, such as clay which is given the shape of a brick, but its use is surpassed by interpreting a new form from it? By questioning the usual use of bricks as stacked entities, a material language is created opening a new space of interpretation.

In order to create the catalogue certain constants had to be set. Limiting the number of tools and actions done on the brick allowed for a sort of primitive modification of clay which surprisingly gave complex reactions. The only tools used were my hands and a surface, which in most cases was the floor. The four actions done on the brick were to tighten, to twist, to bend, and to drop. For every action the gesture was enacted eight separate times, four times using only my hands and four times using both my hands and a surface. There are around 8 iterations per action.

Each action was chosen because of certain characteristics present in the brick. The action "to tighten" was used because of the holes in the brick. The desire to close these was the initial reason why it was picked. The action "to twist" is so contrary to the form of the brick that it would inevitably create interesting consequences. "To bend" is also contradictory to the usual cubic form of the brick and introduces the idea of curvature into the regular unit. The



**fig.60** *Brick on a Cloud*, photo by  
MdC, 2019



**fig.70** Action *To drop obj. 29*, photo  
by MdC, 2019

action “to drop” came simply from the bricks in the factory that are dropped back into the system to be recycled or thrown out. This action is also a clin d’oeil to Ai Weiwei who dropped, a much more valuable, Han Dynasty Urn to spark controversy.

The large brick is broken down to be used in smaller slices so that it can be easily manipulated at the scale of the hand. There are three different cutting directions and the action is usually done once and lasts around 10 seconds. When enacting a gesture, I was careful not to bring the object to its breaking point and it was an intention to be able to read the object as a whole. This is to be able to identify the original form of the object and imagine the action applied to it. In the catalogue, each object is photographed from three points of view (two angled views and a front view) to grasp its qualities as a three-dimensional form. Unable to tell the scale of the object from the photograph, the imagination can start to interpret it freely. The catalogue is printed on a large poster to have an overview of the experiment and take out similarities between objects under and across the four actions.



**fig.80** *Dropping a Han-Dynasty Urn*,  
Ai Weiwei. 1995.



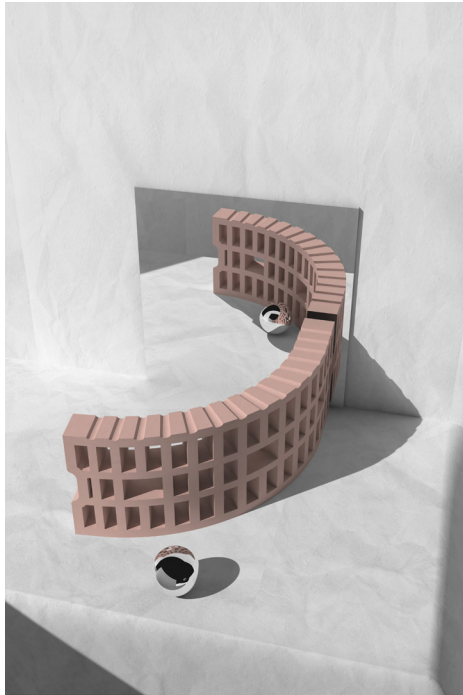
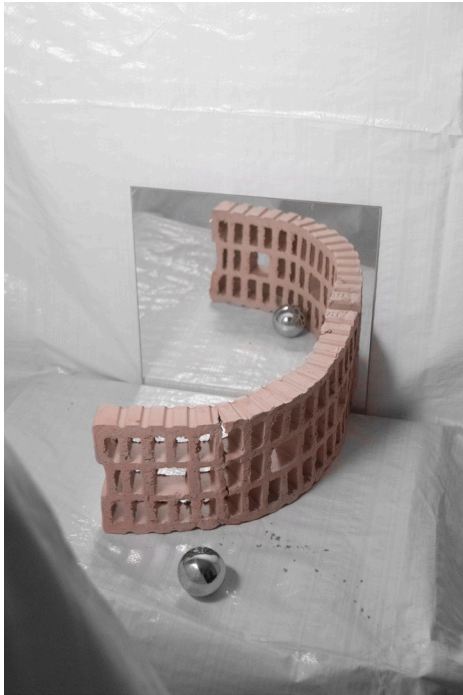


fig.91 & 92 no.1 Spot the difference:  
reality and render, by MdC, 2019

### Interpretation

After visiting the industrialized process of brick making and experimenting with one of these modules, it is noteworthy to realize the disconnection of the hand with the once man-made block. The Tuileries Fribourg & Lausanne SA has four robot arms which precisely move bricks from one stage of the process to the next, eliminating most of the human contact with the material. Technology has reduced the amount of hands on labour necessary in production and humans are mostly present to watch over the machines and decide which item will be produced. This idea that human participation is more important in the conception or organisational phase poses the question of introducing the human gesture in a mechanized environment. The iterations of the bricks created in this *énoncé* were a way to re-introduce the human hand in this process. The pieces are a mixture of machine made and human modified objects where traces of both creators are present.

Mario Carpo speaks about the shift from crafted to standardized and mass-produced objects. He writes in "The Second Digital Turn" that "Computer-based design and fabrication eliminate the need to standardize and mass-produce physical objects, and in many cases, this has already created a new culture of distributed making that some call digital craftsmanship." And later adds, "Because once again, as architects have learned in the daily practice of computer-based design and fabrication, digital post-modernity is upending the game, creating a new environment and new practices that are much closer to our premodern, artisanal past than to our modern, industrial present."<sup>35</sup>

<sup>35</sup> Mario Carpo, *The Second Digital Turn* (Cambridge, Massachusetts: The MIT Press, 2017), 150.



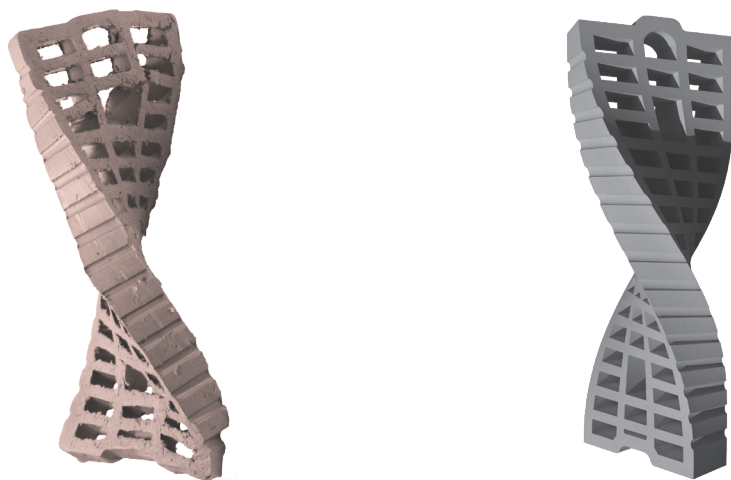


fig.93 no.2 Spot the difference:obj.15,  
reality and render, by MdC, 2019

This new culture around craft, which accepts the digitalization of handmade objects, pushes forward the advantages of such a process to finally maximize the time allocated to the creative part of an endeavour.

Ceramics is a craft that is close to the hand but also producible at a large scale. The experiments with an industrial brick could be a starting point for introducing humanized gestures in the production process. Since computer-based design and fabrication are inevitable components in our architectural profession, it becomes a question of when to use these tools and how to have the digital world coincide with our physical reality.

As a short experiment, the brick module was modelled on the computer and then subject to the same gesture as the physical brick. Without a program that takes in the properties of the material, there are evident losses in the modeled tests. The unforeseen qualities in the physical experiments are not easily reproducible on the computer. It would probably be superfluous, and a greater hassle to introduce them in the programmed distortions. Instead of reproducing the objects exactly as they were created by the hand, could a human gesture inform the gesture of a machine?

Having experimented with the material and becoming acquainted with its haptic properties it would be interesting to bring this human touch back into the factory. Is there are way for the unforeseen, present in physical modelling, to appear during the mechanized process?

The flipbook illustrates a hypothetical situation where the unpredictable has been programmed in a robot. Based on the catalogue from the *énoncé*,

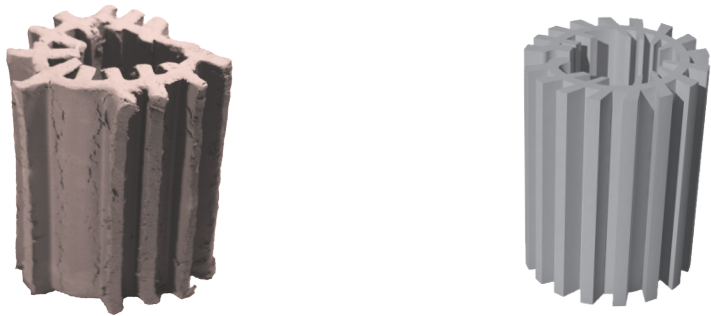


fig.94 no.3 Spot the difference: obj.21,  
reality and render, by MdC, 2019

the reader is invited to flip through the words and items as if he/she were entering words into a brick form changing machine. The words on the left of the strip represent the user's input and on the right is the object produced by the machine. The unpredictable is automated as the robot arm imitates pre-defined human gestures. Associating words with form, the machine creates a series of altered bricks that could be used as models digitalized to enrich the object library of a software. The robot could become a plug-in to the traditional brick factory and a way to introduce devious means into a highly digitalized system.

The flipbook becomes a tool for the architect, serving as both a hypothetical visualisation of programmed distortion and a manual with a collection of bricks.



# conclusion

Studying the parallel between ceramic art and architecture and analysing the methodologies of chosen architects, while also conducting a personal experiment of a "material gesture" with bricks, has been a way to explore the influence of a creative process based on matter for a final work and to propose creative principles for the architect. This *énoncé* serves also to propose that using devious means like working with matter early in the conception phase broadens the inspiration of the architect and increases the chance of a wholesome result. There are an infinite number of possible outcomes for a creative process which departs from materials, as there is with any other process. But in a world where technology and virtuality are taking over the shaping of our lives, it is crucial to be aware that matter is at the base of our interaction with the environment and everyday reality. Architects have a responsibility towards our wellbeing when they design the places we live in and we should encourage the professionals who seek to reconcile the digital world with the physical one by considering the importance of matter.

The case studies on André Bloc, Peter Zumthor and Anne Holtrop reveal the many methodologies in which material plays a core part of the architectural endeavour. In architecture, the materials are, without wordplay, set in stone after the construction and there is no way of knowing if the choice of another material would have produced a different effect on people. Architects rely on their own perception, intuitive or based on experience, when choosing a material for their construction. When Holtrop freely experiments with matter, it is with the intent to widen its performances and possibilities. Increasing the size of sculptures allows André Bloc to express his spatial intentions at



**fig.95** *The Sculpted City I* from obj. 8, 10, 30 in catalogue., photomontage by MdC, 2019



**fig. 96** *The Sculpted Skate park from obj. 24 in catalogue, photomontage by MdC, 2019*

different scales. Peter Zumthor comes up with the idea of an atmosphere and makes it a reality thanks to materials. These three architects reach a desired architectural effect by investigating with materials throughout their design process, from preliminary models to pavilions to finally built works.

The four creative principles set out from these case studies – mono-material, scale, intuition/intention, and local provenance – are aspects which prevail in most architectural projects but their relationship to matter is specific. Matter is the instrument with which the spaces will be perceived, and the architect must find the most harmonious combination between the shape of the space and the materials. Choosing the right material, demands knowledge of the “language spoken” by this material and its environment. Understanding the provenance of a material makes the architect conscious of what creates the essence of a place as well as of the availability of this material. We study a context to not only find which materials would be well integrated into it but also to listen to the “voice” of existing local materials and learn from them.

Similarities between the work of an architect and a potter allows an interesting exchange between the two professions, whose origins are closer than we would think. Just as the potter can make hundreds of iterations, perfecting the composition and proportions of his work pieces, architects can work with multiple scaled models, prototypes or pavilions to put their idea to test before building. Despite being one of the most ancient tools used by humanity, clay has been supplanted by modern materials and has fallen into disuse. But with ecological concerns growing, and as people might become more and more in need of escaping an overwhelming “connected” way of



**fig. 97** *The Sculpted City from obj. 2 in catalogue*, photomontage by MdC, 2019

life, clay seems to be gaining a renewal of interest in multiple fields as an artistic material or construction component and its potentials are yet to be fully uncovered.

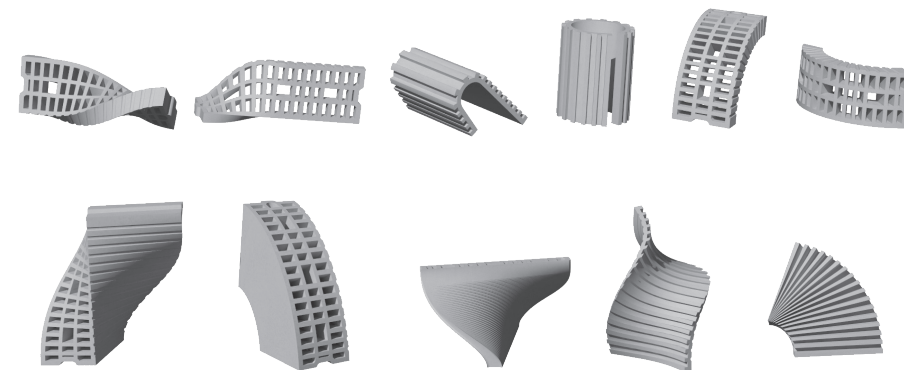
The cunning use of materials and questioning of how something could be used in a built form has been at the core of architecture for ever and the proposed 'matter method' in this *énoncé* should be considered as an incitement to engender an efficient creative process. Focusing on ceramics and specifically on bricks has given me the possibility to test out a gesture as architectural process on a specific matter of local provenance and to become acquainted with its possible performances. By modifying a standardized brick, a new material language is revealed. From these experiments, a project can arise or not, but the flip-book deliberately stays in the realm of an interpretable proposal. Even if a machine can imitate a human gesture, the emotion and subconscious thoughts that lie behind the form shaped by a human hand cannot be reproduced.

Starting from matter and returning to matter along the creative process, from conception to building, can allow the architect to create meaningful uses of local materials. When matter is approached as a constant rather than a variable, the creative process is indubitably altered but its outcomes are a tangible enactment of ideas realized harmoniously through the internalization of the language of a material. The character of an action on matter participates in the intuitive reasoning of the architect for the built project. Thus, to create an architecture inscribed in time and in the minds of people, matter should be given its rightful importance in the creative process.





**fig.98** Collection of physical and digital bricks, photo by MdC, 2019





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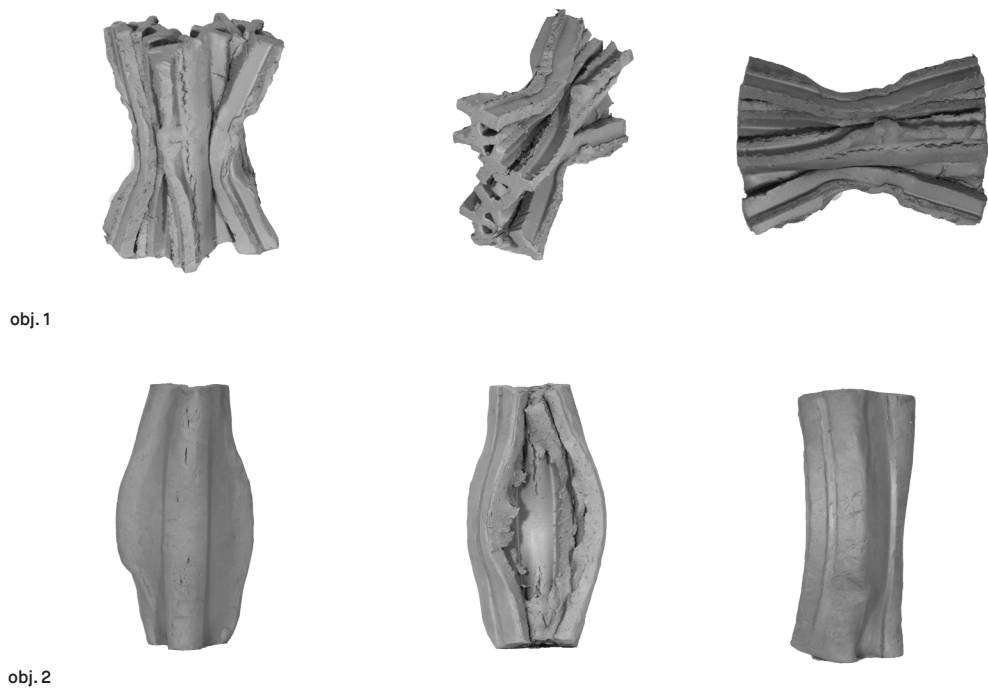


# TOOL

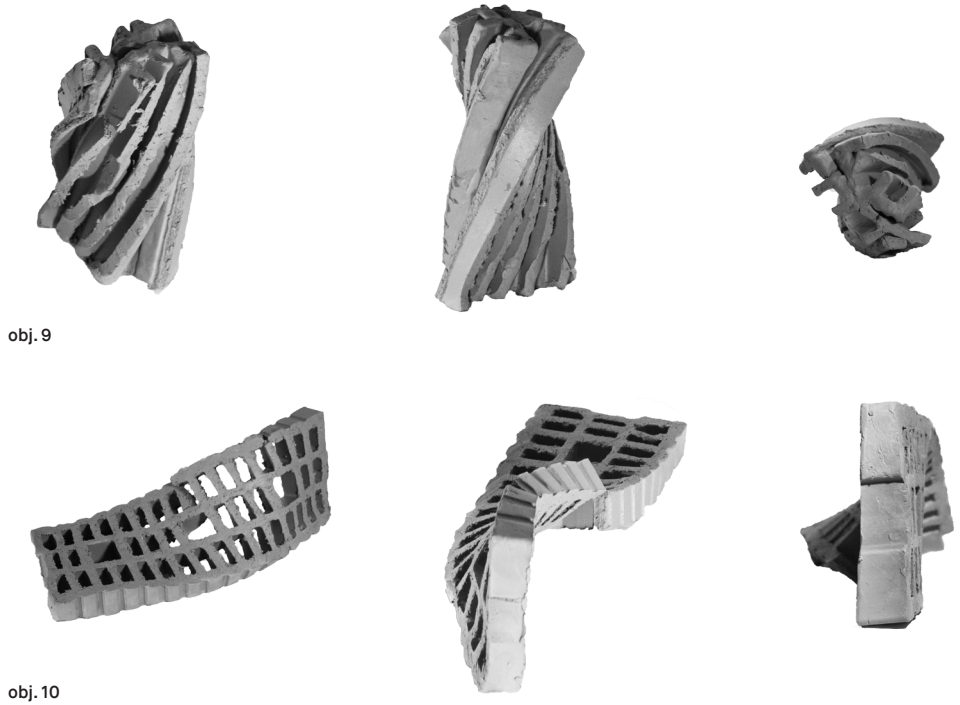
# GESTURE

## TO TIGHTEN

### HANDS



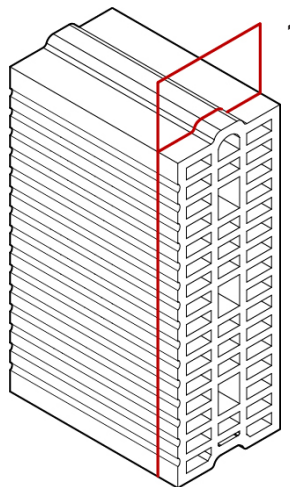
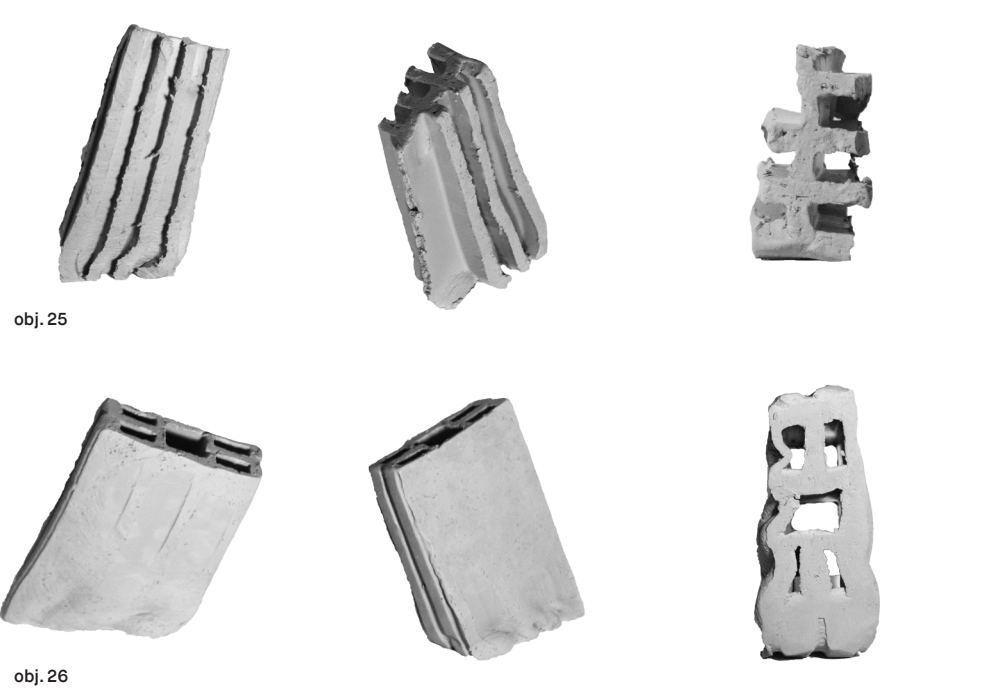
## TO TWIST



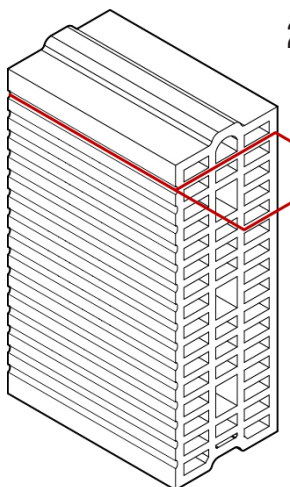
## TO BEND



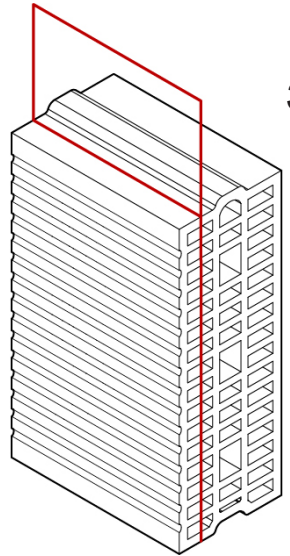
## TO DROP



1



2



3

**obj. 1** The brick was cut on its long edge direction (dir. 1). The plaque was then squeezed in the middle, creating an agglomeration of the material.

**obj. 2** Dir. 1 is used and the brick is squeezed at the top and bottom.

**obj. 3** Sliced in dir. 1, the piece broke in two and was tightened in the middle.

**obj. 4** Sliced in dir. 1, the piece broke in two and the smaller piece was pushed on both sides.

**obj. 5** Cut in dir. 2, the piece was pushed in the middle on the floor.

**obj. 6** Cut in dir. 2, and then pushed at the top while on the floor.

**obj. 7** Dir. 1 cut was used and pushed from the top towards the floor.

**obj. 8** The object comes from a cut in dir. 3. It was pushed with two hands towards the ground.

**obj. 9** Cut in dir. 3, the piece split in two and was collated to be twisted, creating two intertwining parts.

**obj. 10** Dir. 1 cut and twist in both hands.

**obj. 11** The object came from a cut in dir. 1. It split into three flaps while being twisted.

**obj. 12** Cut in dir. 1, the piece broke in two and was twisted.

**obj. 13** The brick was sliced in dir. 2 and twisted at the top while on the floor.

**obj. 14** The brick was sliced in dir. 1 and twisted on the floor.

**obj. 15** Sliced in dir. 1 and twisted on the floor by holding one end and twisting the other.

**obj. 16** Cut in direction 3 and twisted on the floor holding the bottom part and twisting the top.

**obj. 17** Cut in direction 3 and split in two, bent again in hands.

**obj. 18** Sliced in dir. 2, tried to bend but the reach of hands left piece sticking out.

**obj. 19** sliced in dir. 2, bending breaks in this direction.

**obj. 20** The brick was cut in dir. 2. Pressing against the floor the bend was controlled. Thumb marks.

**obj. 21** Object is from a cut in dir. 2 and then is bent to create a cylinder.

**obj. 22** cut in dir. 3, the bending breaks the piece and they stack up on each other.

**obj. 23** Sliced in dir. 3, the piece also breaks into two parts against the ground.

**obj. 24** The brick is sliced in dir. 1, placed on the ground and bent, uncontrolled break.

**obj. 25** Sliced in dir. 2, dropped from over the head.

**obj. 26** Object from slice dir. 1, dropped from mid-body height.

**obj. 27** Dir. 1 cut and dropped twice from head height.

**obj. 28** Cut in dir. 3 and dropped from head-height.

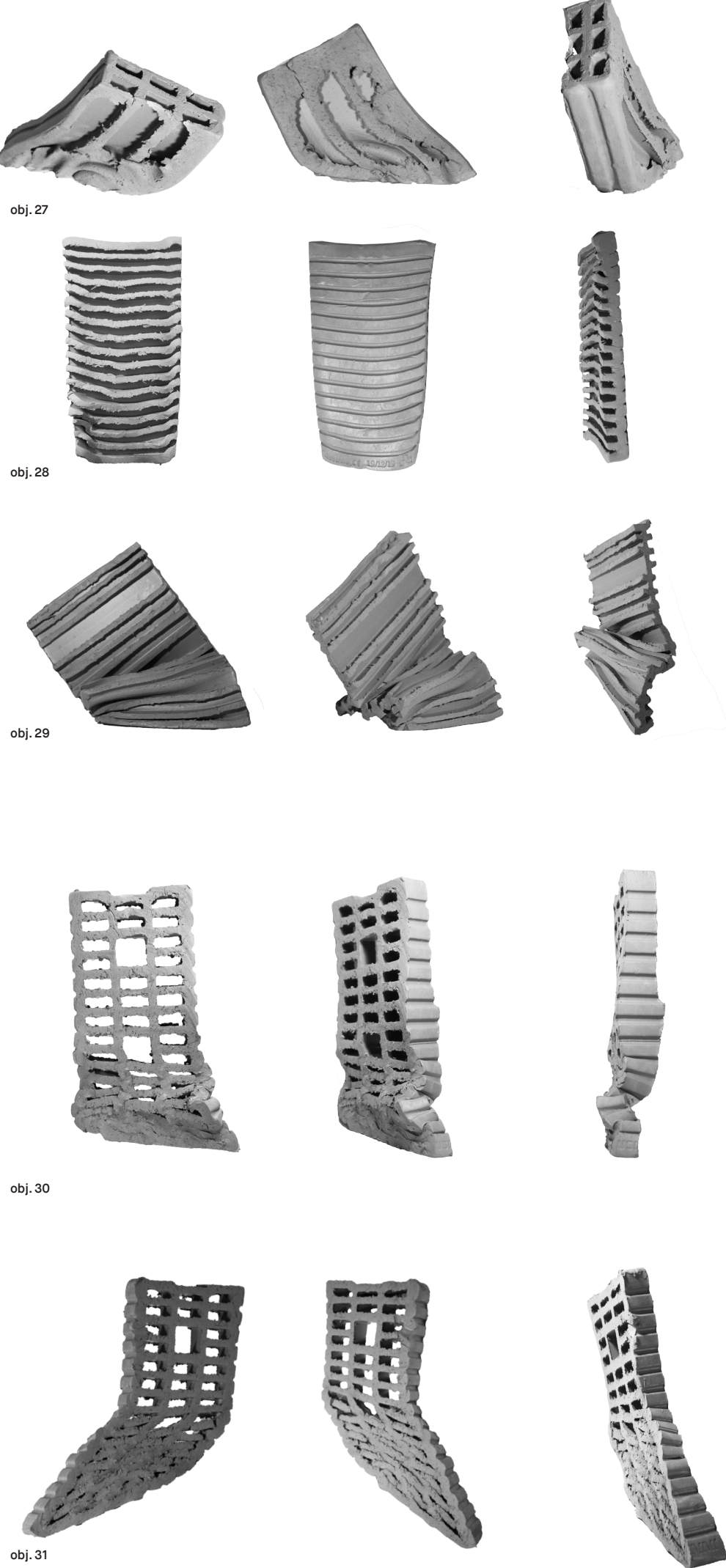
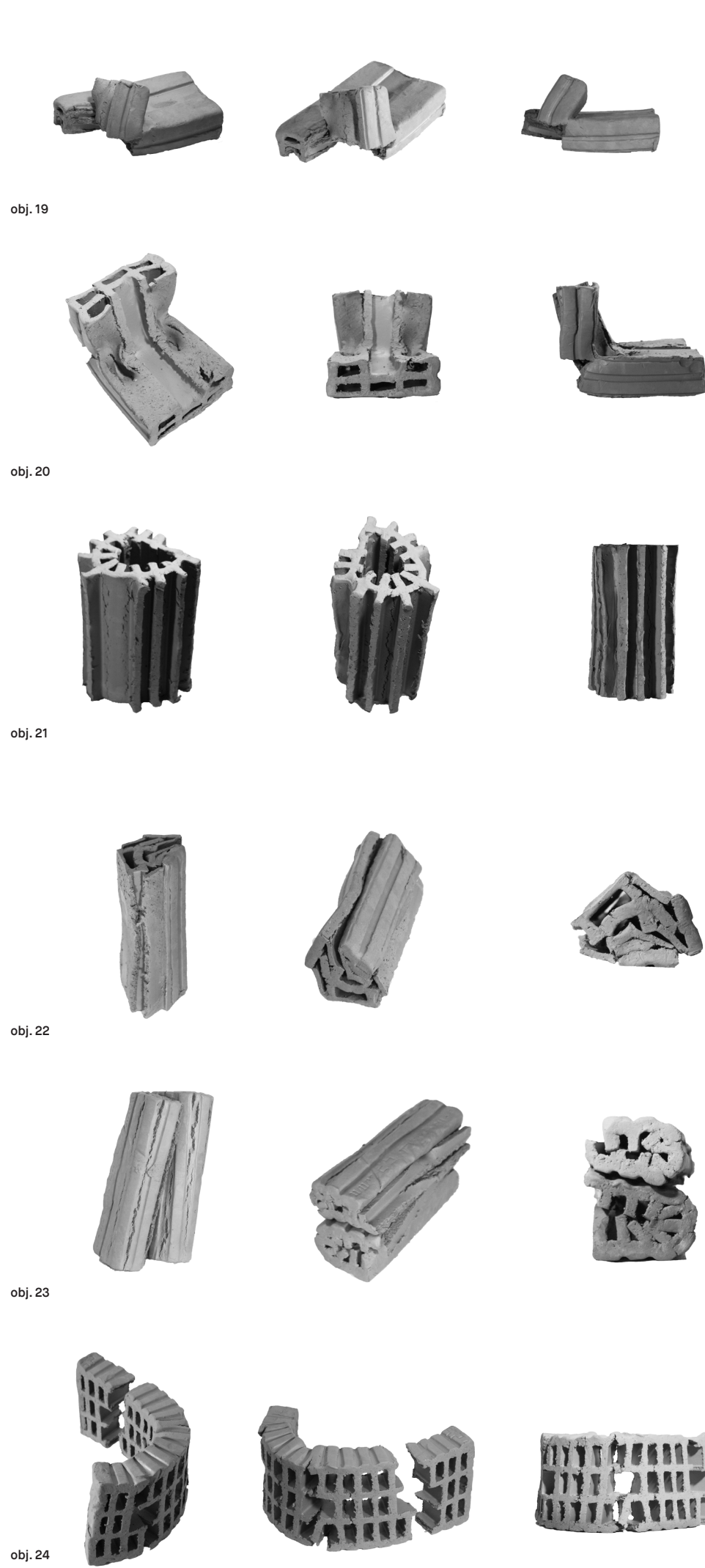
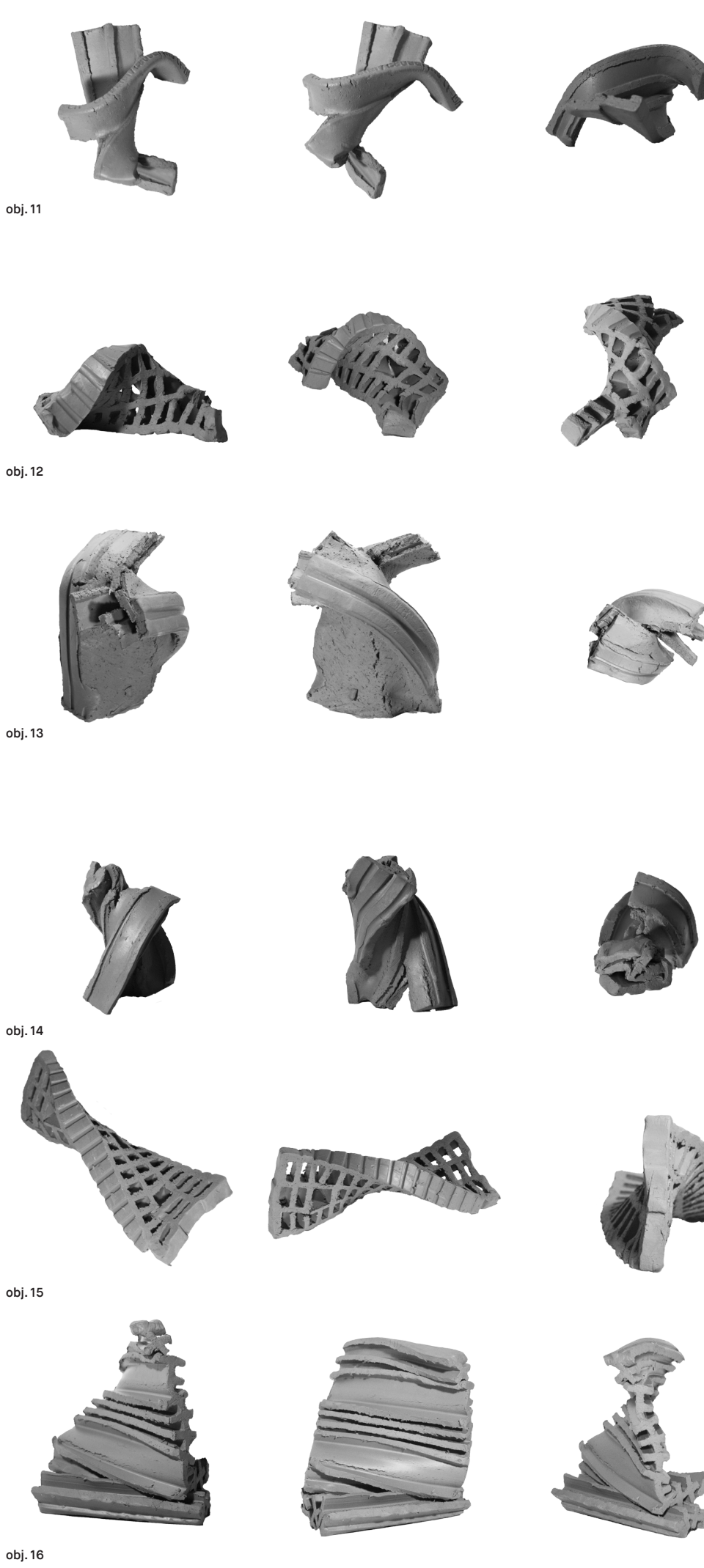
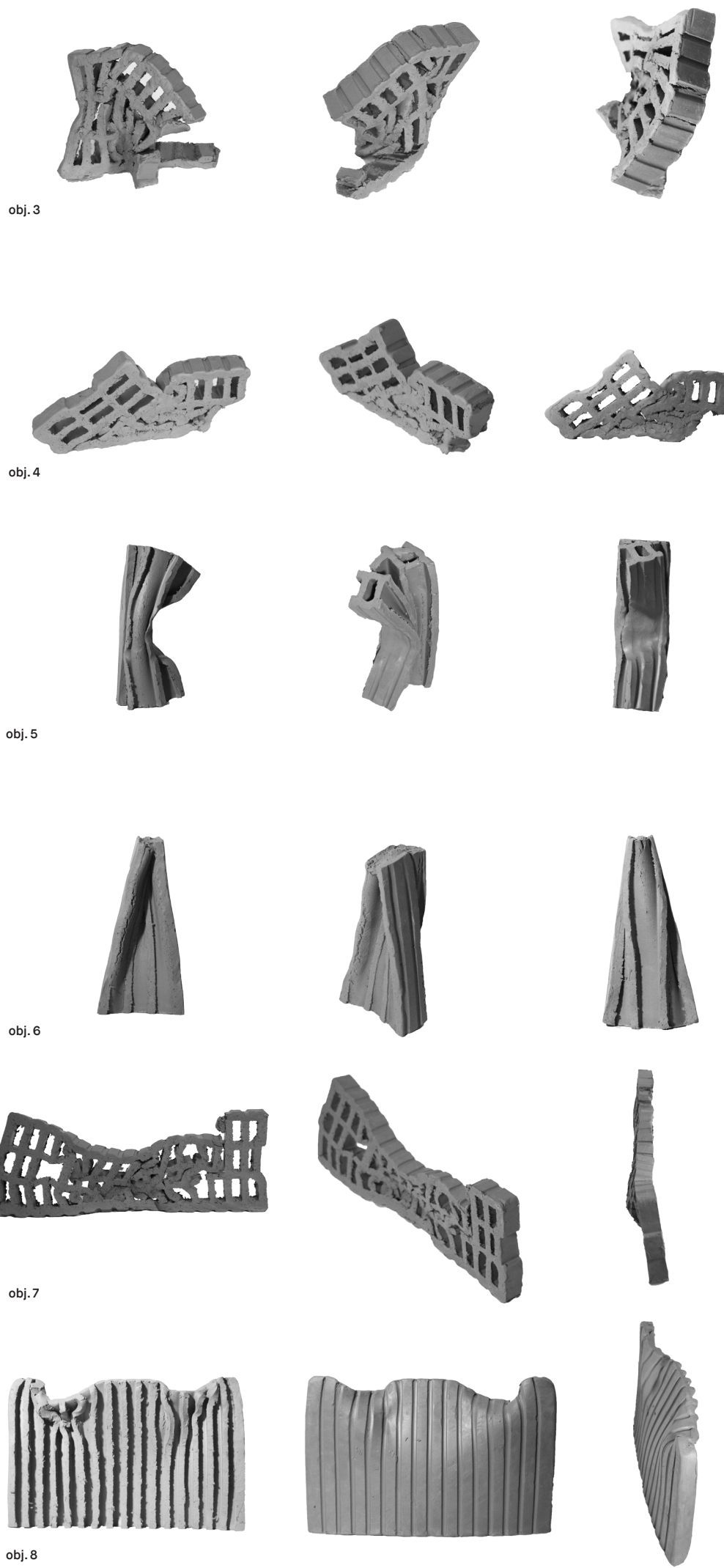
**obj. 29** Cut in dir. 3 and dropped from head-height.

**obj. 30** Sliced in dir. 1 and dropped on the side from head-height.

**obj. 31** Sliced in dir. 1 and dropped from over head height.

If you have really read this then please choose your brick and contact me to claim your prize.

### SURFACE





**brick  
- flip**

**Marine de Carbonnières**

The flip-book illustrates a hypothetical situation where the unpredictable has been programmed in a robot. Based on the catalogue from the *énoncé*, the reader is invited to flip through the words and items as if he/she were entering words into a brick form changing machine. The words on the left of the strip represent the user's input and on the right is the object produced by the machine. The unpredictable is automated as the robot arm imitates pre-defined human gestures. Associating words with form, the machine creates a series of altered bricks that could be used as models digitalized to enrich the object library of a software. The robot could become a plug-in to the traditional brick factory and a way to introduce devious means into a highly digitalized system.



```
import (user input)
```

```
{  
    twist;  
    noodle ;  
}
```

```
return = action (to push), tool (hands)  
produce = obj 1.
```



```
import (user input)
```

```
{
```

```
    cross;
```

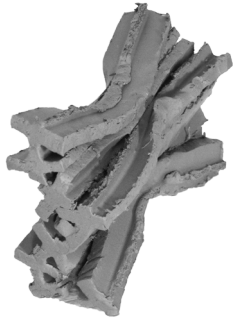
```
    line ;
```

```
    crush ;
```

```
}
```

```
return = action (to push), tool (hands)
```

```
produce = obj 1.
```



```
import (user input)
```

```
{  
    wave;  
    curve;  
}
```

```
return = action (to push), tool (hands)  
produce = obj 2.
```



```
import (user input)
```

```
{
```

```
    open;
```

```
    eye ;
```

```
    smooth ;
```

```
}
```

```
return = action (to push), tool (hands)
```

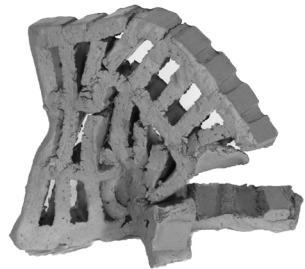
```
produce = obj 2.
```



```
import (user input)
```

```
{  
    fall;  
    unstable ;  
}
```

```
return = action (to push), tool (hands)  
produce = obj 3.
```



```
import (user input)
```

```
{
```

```
  open;
```

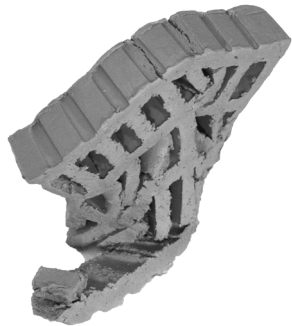
```
  eye ;
```

```
  smooth ;
```

```
}
```

```
return = action (to push), tool (hands)
```

```
produce = obj 3.
```

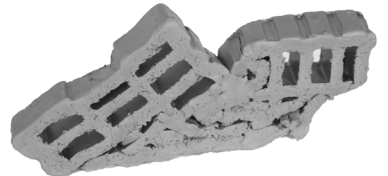




```
import (user input)
```

```
{  
    flat ;  
    squished ;  
}
```

```
return = action (to push), tool (hands)  
produce = obj 4.
```



```
import (user input)
```

```
{
```

```
    laying ;
```

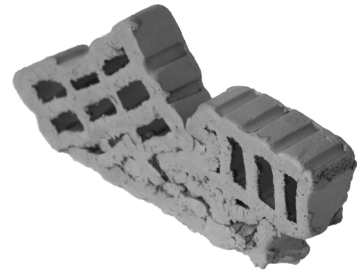
```
    angle ;
```

```
    boat ;
```

```
}
```

```
return = action (to push), tool (hands)
```

```
produce = obj 4.
```



```
import (user input)
```

```
{
```

```
    warp ;
```

```
    bow tie ;
```

```
    punch ;
```

```
}
```

```
return = action (to push), tool (hands, surface)
```

```
produce = obj 5.
```



```
import (user input)
```

```
{
```

```
    pipe ;
```

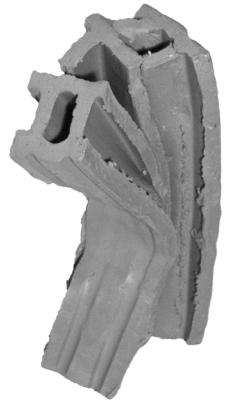
```
    vase ;
```

```
    avoid ;
```

```
}
```

```
return = action (to push), tool (hands,surface)
```

```
produce = obj 5.
```



```
import (user input)
```

```
{  
    ruins ;  
    falling ;  
}
```

```
return = action (to push), tool (hands, surface)  
produce = obj 6.
```



```
import (user input)
```

```
{
```

```
  wobbly ;
```

```
  failing ;
```

```
  tremble ;
```

```
}
```

```
return = action (to push), tool (hands, surface)
```

```
produce = obj 6.
```

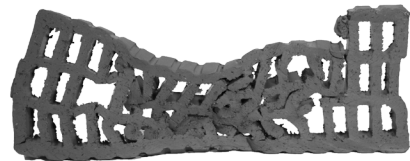




```
import (user input)
```

```
{  
    ruins ;  
    falling ;  
}
```

```
return = action (to push), tool (hands, surface)  
produce = obj 7.
```



```
import (user input)
```

```
{
```

```
  wobbly ;
```

```
  failing ;
```

```
  tremble ;
```

```
}
```

```
return = action (to push), tool (hands,surface)
```

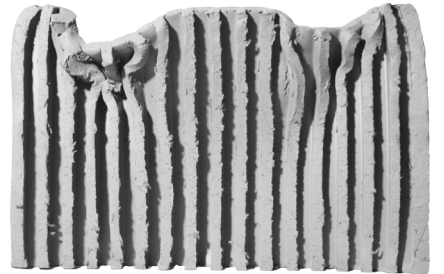
```
produce = obj 7.
```



```
import (user input)
```

```
{  
  ruins ;  
  falling ;  
}
```

```
return = action (to push), tool (hands, surface)  
produce = obj 8.
```



```
import (user input)
```

```
{
```

```
  wobbly ;
```

```
  failing ;
```

```
  tremble ;
```

```
}
```

```
return = action (to push), tool (hands, surface)
```

```
produce = obj 8.
```



```
import (user input)
```

```
{  
    twister;  
    striped;  
}
```

```
return = action (to twist), tool (hands)  
produce = obj 9.
```



```
import (user input)
```

```
{
```

```
    embrace ;
```

```
    join ;
```

```
    wrap ;
```

```
}
```

```
return = action (to twist), tool (hands)
```

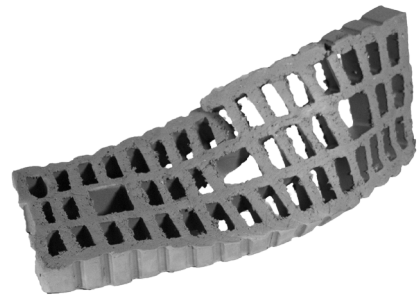
```
produce = obj 9.
```



```
import (user input)
```

```
{  
    ondulate ;  
    wrap ;  
}
```

```
return = action (to twist), tool (hands)  
produce = obj 10.
```





```
import (user input)
```

```
{  
    avoid;  
    break;  
}
```

```
return = action (to twist), tool (hands)  
produce = obj 10.
```



```
import (user input)
```

```
{  
    twister;  
    swivel;  
}
```

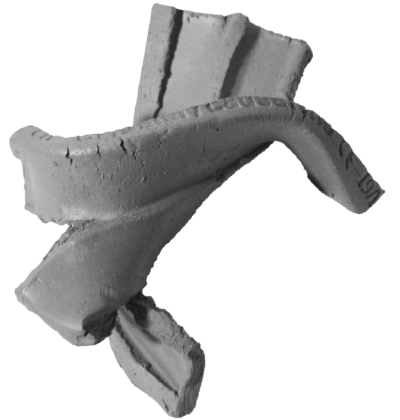
```
return = action (to twist), tool (hands)  
produce = obj 11.
```



```
import (user input)
```

```
{  
    trio ;  
    split ;  
}
```

```
return = action (to twist), tool (hands)  
produce = obj 11.
```



```
import (user input)
```

```
{  
  creeping ;  
  pattern ;  
}
```

```
return = action (to twist), tool (hands)  
produce = obj 12.
```



```
import (user input)
```

```
{  
    spin ;  
    decompose ;  
}
```

```
return = action (to twist), tool (hands)  
produce = obj 12.
```



```
import (user input)
```

```
{
```

```
  hug;
```

```
  dance;
```

```
  hide;
```

```
}
```

```
return = action (to twist), tool (hands,surface)
```

```
produce = obj 13.
```



```
import (user input)
```

```
{  
    turn ;  
    avoid ;  
}
```

```
return = action (to twist), tool (hands,surface)  
produce = obj 13.
```

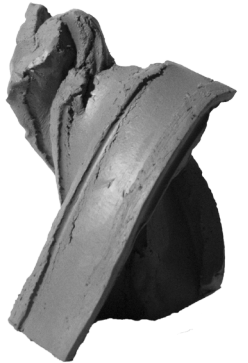




```
import (user input)
```

```
{  
    hold;  
    fall;  
}
```

```
return = action (to twist), tool (hands,surface)  
produce = obj 14.
```



```
import (user input)
```

```
{  
    turn ;  
    structure ;  
}
```

```
return = action (to twist), tool (hands,surface)  
produce = obj 14.
```



```
import (user input)
```

```
{
```

```
    roll ;
```

```
    rotation ;
```

```
    hide ;
```

```
}
```

```
return = action (to twist), tool (hands,surface)
```

```
produce = obj 15.
```



```
import (user input)
```

```
{
```

```
    pivot ;
```

```
    bow tie ;
```

```
    fold ;
```

```
}
```

```
return = action (to twist), tool (hands,surface)
```

```
produce = obj 15.
```



```
import (user input)
```

```
{  
    pyramid;  
    steps ;  
}
```

```
return = action (to twist), tool (hands,surface)  
produce = obj 16.
```



```
import (user input)
```

```
{  
    escalate ;  
    lazy ;  
}
```

```
return = action (to twist), tool (hands,surface)  
produce = obj 16.
```



```
import (user input)
```

```
{
```

```
    lines;
```

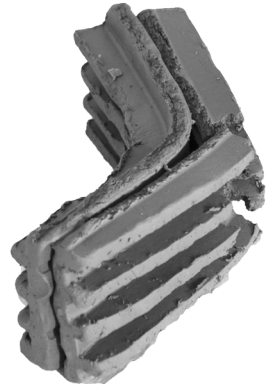
```
    speed;
```

```
    fold;
```

```
}
```

```
return = action (to bend), tool (hands)
```

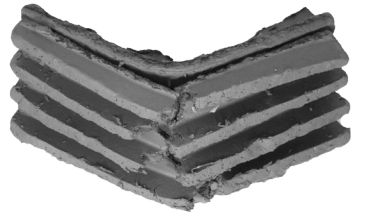
```
produce = obj 17.
```



```
import (user input)
```

```
{  
    churro ;  
    race ;  
}
```

```
return = action (to bend), tool (hands)  
produce = obj 17.
```





```
import (user input)
```

```
{
```

```
    broke ;
```

```
    point ;
```

```
    step ;
```

```
}
```

```
return = action (to bend), tool (hands)
```

```
produce = obj 18.
```



```
import (user input)
```

```
{
```

```
  view ;
```

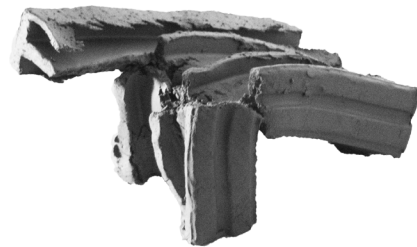
```
  extend ;
```

```
  project ;
```

```
}
```

```
return = action (to bend), tool (hands)
```

```
produce = obj 18.
```



```
import (user input)
```

```
{
```

```
    up ;
```

```
    bent ;
```

```
    crash ;
```

```
}
```

```
return = action (to bend), tool (hands)
```

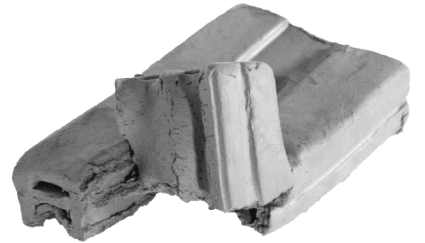
```
produce = obj 19.
```



```
import (user input)
```

```
{  
    raising ;  
    protest ;  
}
```

```
return = action (to bend), tool (hands)  
produce = obj 19.
```



```
import (user input)
```

```
{
```

```
  press ;
```

```
  thumb ;
```

```
  effect ;
```

```
}
```

```
return = action (to bend), tool (hands, surface)
```

```
produce = obj 20.
```



```
import (user input)
```

```
{  
    chair ;  
    mount ;  
}
```

```
return = action (to bend), tool (hands,surface)  
produce = obj 20.
```



```
import (user input)

{
  lines ;
  extend ;
  vase ;
}

return = action (to bend), tool (hands,surface)
produce = obj 21.
```



```
import (user input)
```

```
{  
    mechanical ;  
    cringe ;  
}
```

```
return = action (to bend), tool (hands,surface)  
produce = obj 21.
```





```
import (user input)
```

```
{  
    layering ;  
    flat ;  
}
```

```
return = action (to bend), tool (hands, surface)  
produce = obj 22.
```



```
import (user input)
```

```
{  
    closed ;  
    section ;  
}
```

```
return = action (to bend), tool (hands,surface)  
produce = obj 22.
```



```
import (user input)
```

```
{
```

```
  lean ;
```

```
  crack ;
```

```
  effect ;
```

```
}
```

```
return = action (to bend), tool (hands, surface)
```

```
produce = obj 23.
```



```
import (user input)
```

```
{
```

```
  blend ;
```

```
  mould ;
```

```
  embrace ;
```

```
}
```

```
return = action (to bend), tool (hands,surface)
```

```
produce = obj 23.
```



```
import (user input)
```

```
{  
    surround ;  
    broken ;  
    force ;  
}
```

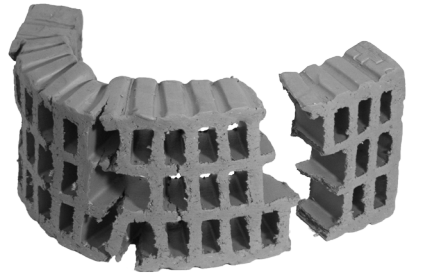
```
return = action (to bend), tool (hands,surface)  
produce = obj 24.
```



```
import (user input)
```

```
{  
    escape ;  
    open ;  
}
```

```
return = action (to bend), tool (hands,surface)  
produce = obj 24.
```



```
import (user input)
```

```
{
```

```
  force ;
```

```
  wobble ;
```

```
  effect ;
```

```
}
```

```
return = action (to drop), tool (hands, surface)
```

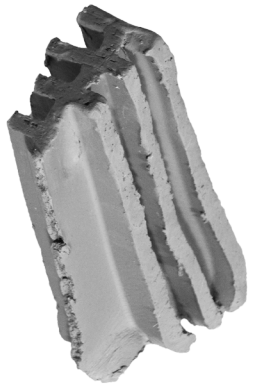
```
produce = obj 25.
```



```
import (user input)
```

```
{  
    built ;  
    receive ;  
}
```

```
return = action (to drop), tool (hands,surface)  
produce = obj 25.
```





```
import (user input)
```

```
{  
  prevent;  
  scream ;  
}
```

```
return = action (to drop), tool (hands,surface)  
produce = obj 26.
```



```
import (user input)
```

```
{  
  wiggle ;  
  block ;  
}
```

```
return = action (to drop), tool (hands,surface)  
produce = obj 26.
```



```
import (user input)
```

```
{
```

```
    snail;
```

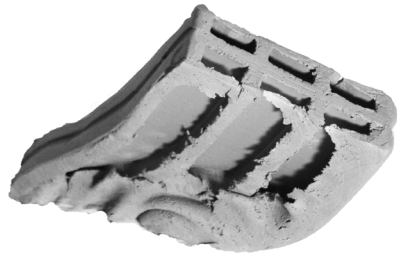
```
    structure;
```

```
    melt;
```

```
}
```

```
return = action (to drop), tool (hands, surface)
```

```
produce = obj 27.
```



```
import (user input)
```

```
{
```

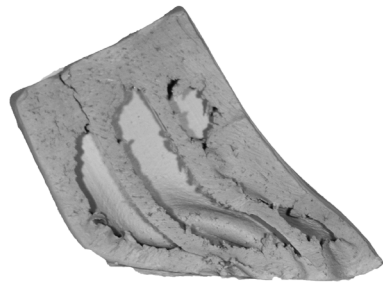
```
  lean ;
```

```
  slug ;
```

```
}
```

```
return = action (to drop), tool (hands, surface)
```

```
produce = obj 27.
```



```
import (user input)
```

```
{  
    xylophone;  
    ripple;  
}
```

```
return = action (to drop), tool (hands, surface)  
produce = obj 28.
```



```
import (user input)
```

```
{  
    climb ;  
    dent ;  
}
```

```
return = action (to drop), tool (hands,surface)  
produce = obj 28.
```



```
import (user input)
```

```
{
```

```
filigree ;
```

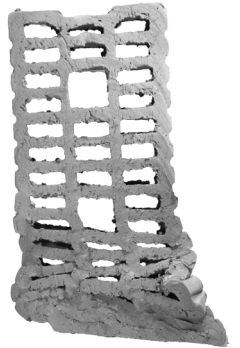
```
squished ;
```

```
mesh ;
```

```
}
```

```
return = action (to drop), tool (hands, surface)
```

```
produce = obj 29.
```



```
import (user input)
```

```
{  
    agglomerate ;  
    block ;  
}
```

```
return = action (to drop), tool (hands,surface)  
produce = obj 29.
```





```
import (user input)
```

```
{  
    filigree;  
    angle;  
}
```

```
return = action (to drop), tool (hands, surface)  
produce = obj 30.
```



```
import (user input)
```

```
{  
    destroy ;  
    fuse ;  
}
```

```
return = action (to drop), tool (hands,surface)  
produce = obj 30.
```



## Marine de Carbonnieres

Enoncé Theorique de Master

EPFL, ENAC, Architecture

Prof. Martin Fröhlich, professeur d'énoncé  
Prof. Alexandre Blanc, directeur pédagogique



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