INFORMED MATTER
Deformation, conformation and codification:
the ways information is stored in material

Ignacio Borrego Gómez-Pallete

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FOREWORD
MATERIAL. WORDS. ARCHITECTURE

Federico Soriano

A thesis is an intellectual, academic work that is not a project or design and that follows longstanding, clearly codified rules and structures. It is a lengthy scientific demonstration. Based on knowledge from academic and/or cultural surroundings, the author assembles these ideas with a solid foundation to support demonstrative, conclusive assertions.
Each thesis stands as an additional stone, yet another building block of knowledge in a structure to support further research. In present times, this pre-established coding is being called into question. Against the backdrop of this set of new treaties, having established the supremacy of scientific thought that this thesis spearheads, the thesis' first mission is to define and build its own theoretical structure, that is, the preliminary discourse that will justify or underpin judgements expressed. Here, they are the scientific surroundings themselves. No discourse involving previous authority or congruousness with a pre-established trajectory of knowledge is required to justify the ideas. In addition to establishing other swifter, closer, more accurate and incisive environments for research and testing, this thesis very importantly adds value: there is no time conditionality. Thinking that rests on certain conventions based on hindsight is indebted to the validity — and up-to-datedness — of the assertions that any thesis can weave, cast doubt upon, or even negate. This gives the thesis a timeframe and actually a certain 'shelf life'. The passage of time weighs heavily on the future. When the thesis defines its theoretical context, time belongs to the thesis and not its surroundings, meaning that the reading is always done in the present. This is characteristic of contemporary thought. It is not that one looks backward, but rather that the past, and the future, are brought to the present, the sole verb tense.
This book stands as a good example. The text sets out the preliminary discourse that will underpin the defence. And what is that discourse? Words. Words are newly defined, given a new meaning, forming their own universe of content. Material, energy and information. A traditional thesis would need to address, delve and relate the origin of each one of these words. But a contemporary thesis does not. Because we take three words and say that the three are one. That material is equal to energy and that material is equal to information. It is indifferent for us to speak of material because we may actually be speaking of information, information that the process of generating material conveys. Generation, manipulation or culture. Just as deformation is an accident, conformation is an instrument, and content is a code, and so on with all of the terms in the chapters and sections.

Words are recipients of history and culture. These open recipients, as they are palimpsestic – if you will allow me to coin a new term, as you probably will due to the contemporariness of this work, can build a specific, real theoretical corpus without needing to manipulate or twist their content. It is not a question of finding words from our time but rather or giving the words their current-day usage and meaning. But in a way that has never been used before. Citing Richard Rorty in *Contengency, Irony and solidarity*,

> *The method consists of once again describing many things until a pattern of linguistic behaviour is built that the upcoming generation feels tempted to adopt, and thus leading them to seek new types of non-linguistic conduct*.

This type of conduct produces cultures and habits that close the gaps opened by current-day evolution in our society.

Material, in architecture, has been tied mainly to language. Although its emergence and use came from new aspirations regarding space and building, the material wound up linking material to the meanings that *avant-garde* architecture put forward in its own language. Thus, stone from antiquity replaced wood and more recently concrete and glass. In its advent, concrete responded to the notion of an open floor plan, as glass did to the aspiration for modern transparency. However, they quickly adopted new language mechanisms giving rise to a grammar, form and meaning. This is why we recognize the date of modern architecture. And of any architecture. This relationship forms historical linguistic circles that this thesis has us read differently as it breaks through the eternal, unending 'form-language' cycle. In other words, it provides another way out of the dichotomy between the significant values conveyed by a material's substance and perceptive qualities or by a structure with a given form, and the signifiers that it manipulates abstractly.

Having replaced language with information, which is codified content without grammar, material is recovered in all of its facets and qualities, becoming more than a mere aseptic, nearly neutral support for a linguistic structure. Finally, materials are no longer merely tectonic. They are skin, colour, textures, and also processes, trajectories, social codes, events, appearances, autobiographies, memoirs and tools just as are the brief or space are. In the end, materials are words themselves. Let us say they are one and the same.

This thesis aims to analyse material's ability to store information and puts forward a taxonomy to classify all of its manifestations.

The focus is placed on describing storage procedures. There are three types in all, and each gives rise to a chapter of the book establishing how all of the processes to manipulate material that leave some sort of trace occur according to these procedures.

To arrive at this taxonomy, a thorough look is taken at different experiences in altering materials to give rise to an extensive classification. Tools are provided to interpret and classify any intervention. In other words, the aim is not so much to provide a classification of the most relevant interventions in History, but rather to reveal a taxonomy of these actions on materials enabling any past or present manifestation to be interpreted.

This examination aims to address a partial but fundamental aspect of construction that attaches priority to materiality without purporting to negate spatiality in the architectural form. The book focuses on the parameters relating to the interpretation of materials. Very close attention is given to the objects preventing them from being perceived comprehensively. Instead, they are addressed in terms of their partial intentions. The overall picture is slighted in order to decipher its fragments.

In architecture, materials have always been under investigation, making them recipients and storehouses of progress and achievements. This book's main focus is on the manipulation of material for building purposes. But architecture is more than building, and therefore aspects of and progress in other pursuits such as art and natural sciences have also been included. In fact, because they involve or reveal procedures pertinent to the field of work on materials, although many of these pursuits are unrelated to architecture, it is necessary to include them. By doing so, the book takes on an interdisciplinary, polyhedral approach to the possibilities found in actual constructions and potential applications.

Greg Lynn describes objects as going beyond the material.[1] Reality has certain specific characteristics and objects are supports accumulating events unfolding in and upon them.

In Ortega y Gasset's vision,[2] materials and their circumstances afford new value, a new ability that must be both explored and harnessed. Materials are subject to natural alterations produced by circumstantial events that are not necessarily intentional, and artificial events with some sort of intentionality. Among artificial intentionality we find two categories, those aimed at generating a product, and those using materials as a support for a message.

Consideration of the set of examples analysed points to a classification of stored information based on the nature of its origin and is divided into one of the following three categories: matter and deformation (circumstantial information), matter and conformation (instrumental information), and matter and content (codified information). As follows, over the course of this book, the aim is to highlight how all of the manifestations of information stored in a material substrate find their place in one of these three categories.

This classification is the fruit of the prism through which each built object is analysed.

1
Lecture at the Technische Hochschule für Architektur Darmstadt. Greg Lynn, December 11th, 1996.

2
Lecture at the Infanta Beatriz Theatre in Madrid, José Ortega y Gasset, May 17th, 1929. Published as "Lección XI. La circunstancia: fatalidad y libertad" in José Ortega y Gasset: *¿Qué es Filosofía?*, Madrid: Espasa Calpe, Collection Austral, 1999 (10th edition), pp. 229-252.

Each one focuses on specialized knowledge based on different fields or disciplines. The steps of a detective are followed in an attempt to extract material information from objects examined up-close under a magnifying glass. The context is momentarily slighted to heed the clues shown in each fragment. The information obtained from each observation differs considerably depending on each reading according to the observer's intentions and knowledge.

The conclusion regarding the deformation of objects is that knowledge is natural, that is, physical-chemical. Regarding conformation, the conclusion is that knowledge is the result of an artificial procedure, that is, technology. And in the conclusion on codification, knowledge is inscribed by a party communicating a message and interpreted by an observer, meaning that knowledge is cultural.

From this division into three categories of content stored in materials, we can extract information on the three key issues in the process of construction, that is to say, context, technology, and meaning. This constitutes a classification that, as an ambitious point of reference, pools from other triangular taxonomies that have occurred over the history of architecture such as *Utilitas, Firmitas y Venustas*,[3] or *Topos, Type and Tectonics*,[4] or even the specific study of materials in terms of *Form, Materials and Process*.[5]

The relationship between material and form

The Greek term *hyle* was originally used to signify 'forest', 'forest land' and 'wood'. It later became used to mean 'metal' and also a 'raw material' of any sort, that is, a substance with which one makes or can make something. The Latin word '*materia*' has had analogous meanings and has also been used to designate 'wood' and also any 'material' used for building.[6] Plato established a distinction between beings that are always, never-changing, and those that are never and are ever-changing. These beings cannot be any given reality because if they were, they would have a form and would thus not be ever-changing. Therefore, they could not be any of the pre-Socratic elements, so the conclusion would be that they must be something like the undifferentiated mass of elements before any formation, that is to say, what is common to all the elements. But in that case, it would be an empty receptacle able to encompass any form, which gives rise to identifying receptacles with material. Aristotle was the first Western philosopher for whom the notion of material acquired a technical philosophic nature. For Aristotle, receptivity is a characteristic that all material has in common. Whatever the material is, it is not material as such if it is not willing, so to speak, to receive some sort of determination. This means that there is no single species of material, which would be purely indeterminate, but instead there are several classes of material according to their type of receptivity. In nearly all instances, Aristotle's conception of material is examined metaphysically as one of the two terms within the two inseparable matter-form pair of concepts. From this standpoint, material is defined as that with which something is made. And the making can be a natural process or a human process. Animals are made or composed of flesh, bones, tendons, and so forth while statues are made of marble, bronze, and so forth.

3
Marco Vitruvio Pollion: *De architectura. Los diez libros de arquitectura*, translated from Latin and commented on by Joseph Ortiz Sanz. Alicante: Facsímil, Biblioteca Virtual Miguel de Cervantes, 2002. Digital reproduction based on the Madrid edition printed in the Imprenta Real, 1787.

4
Kenneth Frampton: *Studies in Tectonic Culture: The Poetics of Construction in nineteenth and twentieth century*, Architecture Cambridge, MA: MIT, 1995.

5
Adrian Beukers and Ed van Hinten. *Lightness: The inevitable renaissance of minimum energy structures*, Rotterdam: 010 Publishers, 2001.

6
José Ferrater Mora: *Diccionario de Filosofía Abreviado*, Barcelona: Edhasa Sudamericana, 1997, 1st edition 1976, pp. 229-32.

This confers a relative meaning to the concept of material in that it is always relative to form. This is why reality is neither material or form, but a combination of both. From the time that Aristotelianism was first fully accepted in medieval philosophy, there has been an increasing tendency to conceive material as subject to substantial transformation. Saint Thomas Aquinus stands as an example. He defined material, in the Aristotelian sense as something with which one makes or can make something. The notion of material is set against that of form. Aside from its form, material has no self of its own. In this sense, one can speak of raw material, a common and fundamental material. But several types of material can and must be spoken of. In the middle ages, there was much discussion about the relationship between material and form, and of the issue as to whether beings could be conceived without material. The natural-scientific conception of material in the Modern Age reflects a notion of material as something that fills space. Other notions come to overlay this, such as the notion that material in an impenetrable reality because, to the extent it is not, there are spaces to be filled. In other words, it is reality built of atoms since atoms are filled spaces. These properties of material are conceived according to the law of conservation of matter that understands matter as compact, constant, permanent and indestructible. In contemporary times, among the ideas mentioned regarding the nature of material (natural or physical) one that has been debated more than the rest: its atomic make-up. Indeed, the fact that material is filled space does not mean that it is necessarily comprised of indestructible elementary particles.

The shift from classical to contemporary physics marks a new conception of material. In the macro-physical world, material continues to be conceived according to mechanical properties. Yet several of physics' findings have forced Newtonian notions to be abandoned or at least set within a broader theoretical framework.

Nevertheless, because it is hard for man-made building processes to transcend mechanical properties, the classical framework remains fully applicable.

01. Matter and deformation.
Circumstantial information

Material has superficial qualities of hardness, porousness, fragility, cohesion, solidity, transparency, temperature, reflexivity, chemical re-actability, its carbon 14 state, and so forth, meaning that an object passively and extraordinarily accumulates circumstances occurring on or in it over time.

This alteration of material is accidental, in other words, the changes occur without altering its substance, without it ceasing to be the material it was,[7] and this occurs merely because a substance or object is exposed over a certain amount of time to the happenstance of the context. Material listens and reacts, or expresses itself according to its properties thanks t*o genius materiae*.[8] This type of accidental information would initially seem to lack intentionality. Yet the actions that enable or foster the material's appearance lead to results where, occasionally, we can read wilfulness.

The idea is to move away from the classical notion that material is exclusively a neutral substance

7
Aristóteles*: Acerca de la generación y la corrupción. Tratados de historia natural*. Introduction, translations and notes by Ernesto La Croce and Alberto Bernabé Pajares, Madrid: Gredos, 1987

8
Iñaki Ábalos: "El que escucha la materia", *El País*, Madrid, 14/07/2007.

performing an exclusively structural role begin to espouse a more contemporary notion where materials are understood as stimulatable by external events. Due to their intrinsic characteristics, materials can actively respond to external stimuli, for instance when they ignite if electrical currents pass through them, or if they dilate or contract prompted by changes in temperature or acidity. So-called smart materials with form memory are able to recover their previous shape after they have been deformed.

With the advent of new technology in materials, we are moving towards a new era in which the boundaries between materials and machines become blurred.[9]

Because these generally superficial alterations result from accidental or circumstantial events the knowledge of a scientist must be put towards analysing their traces, and special attention must be paid to natural processes.

02. Matter and conformation.
Instrumental information

Materials modify their qualities tremendously according to their superficial configuration. This was known at the very dawn of architecture when humankind began to use its ability to reason to modify its surroundings and make them more inhabitable. Flint's sharp edges enhance an object's material properties.

Material is the necessary ingredient for any type of construction. While generally speaking, the concern is regarding the final state, the material itself inevitably determines the outcome based on its characteristics and the process through which any formalisation is attained.

Unlike circumstantial alterations, these material alterations are intentionally triggered by directly manipulating the material either to modify its qualities or as the result of a building process.

This domestication of material was enshrined in the inscription that Roman engineer Cayo Julius Lacer left in the year 106 (Common Era) on the Alcántara bridge: "*Ars ubi materia vincitur ipsa sua*", meaning artifice through which material defeats itself.

Over history, not only the need, but also the desire to materialise objects has given rise to countless innovations in manufacturing methods that, over time, have characterised the different phases in the development of humankind. We find ourselves at a time when technological progress has reached a level of maturity that has displaced mechanical production methods in a shift towards new digital manufacturing. The scope of action for architectural production has continuously shrunk narrowing the distance between design and manufacturing. Yet increasingly, the division of labour and specialisation that has incessantly increased since the industrial revolution has specifically defined and specialised the role of architecture, particularly in the area of construction. And this has given rise to a dissociation between its technical, artistic and theoretical aspects taking us farther away from a comprehensive, coherent view of the entire process of material manipulation.

The traces of material's path to its final state generate a series of information and are read with the knowledge of a *constructor* heeding the technological process.

9
Philip Ball: *On Materials Science*, in Bruce Mau and Institute without Boundaries. "MassiveChange", New York: Phaidon, 2004.

03. Matter and content.

Codified information

The third category to be found of information stored in material includes all of the information that is not conveyed by circumstantial or building events as a preliminary in reaching its final state, but instead bears a message to be read.

With his intelligence, Man has been able to symbolically reflect information on a material support. Linguistic or at least cultural education is required for reading this message in order for it to finally be understood.

Any coding procedure involves representation, that is, replacing a given reality with a new reality that establishes some type of relationship with the object represented. A wealth of mechanisms are employed including abbreviations, allegories, appearance, figures, comparison, data, diagrams, effigies, emblems, falsification, figures, graphics, icons, ideas, ideograms, images, inscriptions, insignias, hieroglyphics, letters, marks, metaphors, messages, metonymy, models, personification, prosopopoeia, reproduction, portraits, acronyms, signs, symbols, similes, synecdoches, texts and so forth.

This information may take up surface areas with unequivocal messages, such as the hieroglyphics engraved in the Egyptian mastabas, or may be freer allusions such as those found in abstract art. But what they all have in common is the will to communicate. This information must be deciphered through the knowledge of a *spectator* sharing enough of a cultural basis with the codifier.

01. MATTER AND DEFORMATION. CIRCUNSTANTIAL INFORMATION

01.01. TRANSFER
01.01.01. Transfer without exchange of material 1
01.01.02. Transfer without exchange of material 2
01.01.03. Transfer recorded by an intermediate substance
01.01.04. Transfer with exchange of material

01.02. MOVEMENT
01.02.01. Geological movement
01.02.02. Hydrological movement
01.02.03. Vegetable movement
01.02.04. Wind movement
01.02.05. Man's movement
01.02.06. Artificially recorded movement

01.03. TIME
01.03.01. Cyclical accumulative time
01.03.02. Cyclical, non-accumulative time
01.03.03. Continuous time
01.03.04. Correlative time

01.04. APPROPRIATION
01.04.01. Instantaneous appropriation 1
01.04.02. Instantaneous appropriation 2
01.04.03. Instantaneous appropriation 3
01.04.04. Perpetual appropriation 1
01.04.05. Perpetual appropriation 2
01.04.06. Appropriation of thermal energy
01.04.07. Instantaneous appropriation of solar energy
01.04.08. Appropriation of energy

01.05. RECORDING
01.05.01. Microscopic recording
01.05.02. Archaelogical recording
01.05.03. Geological recording
01.05.04. Historical recording

01.06. DEGRADATION
01.06.01. Degradation by erosion
01.06.02. Degradation through deformation
01.06.03. Degradation by combustion
01.06.04. Degradation through ceansing and abrasion

01.07. ATTRACTION
01.07.01. Gravitational attraction
01.07.02. Vibratory attraction
01.07.03. Superficial attraction
01.07.04. Nanometric superficial attraction
01.07.05. Chemical attraction
01.07.06. Electrostatic attraction

01.01. TRANSFER

Material has the property of appropriating information through contact between one object and another, and deformation can occur on the two surfaces because one of the materials is relatively harder than the other or because there is an exchange of superficial particles passing from one body onto the other and adhering to it. In the latter case, where there is an exchange of material, superficial fragments may fall off or a tertiary or intermediate substance may pass from one place to another and become lodged because of either mechanical or physical-chemical affinities serving as vehicles for impregnation.

These transfers are inert processes very similar to learning that occurs between living beings. In fact, etymologically speaking, the Latin verb for learn, *apprehendĕre*, coincides with the word "apprehend" which is directly linked to transfer.

Experience accumulated by a living being is transmitted to individuals that one relates to by extending the existence of this knowledge.

This chapter on accidental storage analyses transfer occurring due to the fact that two objects spontaneously coincide in time and accidentally exchange information.

Living matter is made up of a series of entities that reproduce in life other combinations to regenerate themselves, and they are able to forget or at least heal these wounds.

Contrarily, inert matter is able to store this information, traces of contact or aggression, indefinitely. Dead objects are those that cannot cure themselves and are passive reflections of occurrences, objective diaries of unfelt experiences.


UNITED
STATES

The moon has a virtually non-existent atmosphere because its scant gravity is unable to maintain gas molecules on its surface. The lack of air and therefore of wind prevents the moon's surface from eroding and from earth and sand to be swept up and smooth out to cover its irregularities. This means that the traces of astronauts' steps and tracks of vehicles used in the 1970s remain intact on the surface of this natural satellite.

Likewise, the lack of atmosphere also means that the moon's surface has no protection against sporadic bombardment by comets and asteroids. Once their impacts have occurred, the craters they generate virtually do not degrade over time because of the lack of erosion.

The moon's surface is a highly sensitive film that stores a log of all of the material contact produced over the last three billion years, since its volcanic activity ceased.

David R. Scott and James B. Irwin's footprints. Apollo 15 (AS-510), July 1971. Photograph: NASA.

The fifteenth flight of Apollo (officially known as AS-510) was launched on 26 July 1971 by a Saturn 5 rocket towards the moon. After descending from the "Falcon" lunar landing module, astronauts Scott and Irwin were the first to use an LRV (Lunar Roving Vehicle) that covered a total distance of 27.9 kilometres. Of the 77 hours and 55 minutes spent on the surface of our satellite, they availed themselves of 18 hours and 35 minutes to take their lunar walks.

This transfer between two objects may be direct and enduring in a more aggressive situation than the previous exceptional example of the lunar surface, for instance in the forming of fossils.

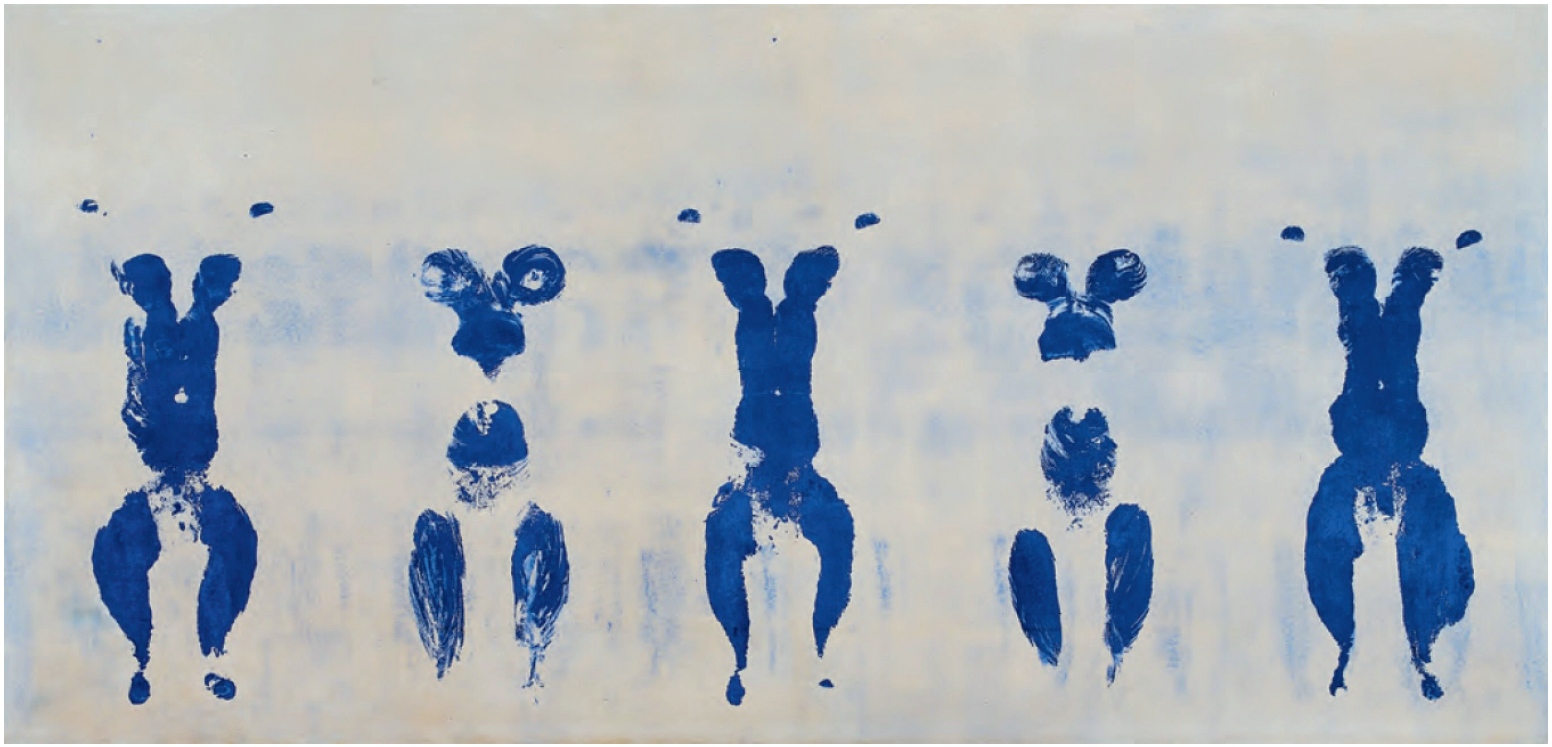
If we visit the Tadao Ando conference pavilion in Weil am Rhein, following its architect's indications, we reach the pavilion after passing through a long corridor along a concrete wall. The path's geometry involves a concatenation of straight stretches of corridor set out obliquely against each other avoiding direct access by means of a lawn. Although Tadao Ando's excuse for building this entrance path is of a supernatural origin, in any event it grabs the visitor's attention. Just as we pass beside the tree closest to the wall, we hear a dialogue between the elements. The tree does not merely cast its shadow against the uniform wall representing its silhouette, but also lends some of its leaves for the processing of the concrete. These leaves were trapped in the concrete mixture and those remaining on the surface against the mould are now visible like fossils on the wall. One can deduce that the wall was built in the autumn.

In all likelihood, the tree was damaged during the construction work, but its nature allowed it to cure or partially forget these transfers, leaving only scars.

Life is regenerating movement.

Tadao Ando. Conference pavilion for Vitra in Weil am Rhein, 1993.

Tadao Ando was born in Osaka in 1941. The Conference pavilion for Vitra in Weil am Rhein was his first international commission and was completed in 1993.



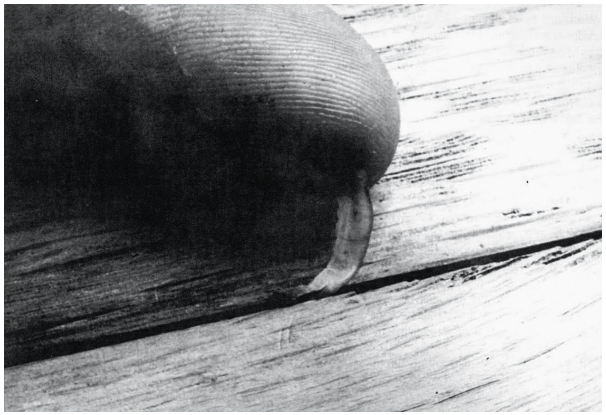
In 1955 Yves Klein had his first public appearance in the *Salon des Réalités Nouvelles* where he showed his monochromatic works to the astoundment of the art world. In his performances made publically as of the 1960s, Yves Klein used one or several models doused in ultramarine blue who would then roll themsleves on canvasses set out on the floor and also leaning against the walls, accompanied by music that he himself composed and with which he guided the human paintbrushes along the canvas.

The canvases were able to trap the trajectories of the bodies rolling across them thanks to the medium of paint whose solid colour emphasized the process itself.

This process of physical transfer by which the artist left the impression of the models' naked bodies on the canvass does not differ from the conventional process used by art: Yves Klein used his models as if they were "living paintbrushes". Yet what is of interest here is not so much what is represented, which shall be addressed in detail in the third chapter on codified information, but rather the material consequences of the contact between the two objects at a given point in time, the trace of the contact that may be read later by heeding the prints left on the surface.

Yves Klein. *Untitled Anthropometry*, 1960. Hirshhorn Museum and Sculpture Garden, Smithsoniam Institution, Washington, DC.

Yves Klein was born in Nice in 1928 and died in 1962. During his brief career, Klein's work stood as a major precursor to artistic movements such as minimal art, conceptual art, land art, and preformative art. Klein patentened Internacional Klein Blue, a highly intense ultramarine blue that he created with the help of a chemist.



During the 1960s, Dennis Oppenheim, Robert Smithson and other artists sought to free sculpture from its pedestals in galleries and museums and chose to craft ephemeral, anti-monumental works that were inextricably tied to the places they emerged. They depended on photography to prove their existence. Oppenheim was particularly interested as much in landscape as he was in the human body as a potential field for action.

In 1970, he used photographs to record interaction between the two elements, his own body and the wooden flooring in gallery where he was intervening. In the first scene of the photograph, a wooden splinter becomes inserted in the skin on his finger. The second scene shows a fingernail fragment trapped between the two pieces of the same wood.

Both surfaces were modified after the mutual contact was made through an exchange of material. The new material lodged in the body is the record, the proof that the contact took place.

Dennis Oppenheim. *Material interchange,* 1970.

Stage #1. Fingernail lodged between gallery floorboards.
Stage #2. Splinter from gallery floorboards lodged under skin.