The informational foundation of the act

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Introduction

We find the term "act" and its derivations; "action", "actual", "actuality", "change and movement", "living", "existence", "labor" "praxis", etc., at the center of the history of the philosophy of the 20th Century. The concept "act" which appears in the metaphysics o Aristotle and then in the metaphysics of Scholasticism, from Latin *actus* "a doing or a driving, impulse; a part in a play" and *actum* "a thing done," "to do, set in motion, drive, urge, chase, stir up"[1], is a basic concept to understand intentionality, technology and labor and any other concept that implies movement whatever intellectually or physically. In the Greek of the New Testament the word *ergon* is used to mean: "an act, deed, thing done" and related meanings. In the same context the word *praxis* is used to mean "a doing, a mode of acting, a deal, a transaction; the doings of the apostles; a thing to be done, business."[2] Just because of its semantic amplitude this term and related forms are problematic. Aristotle recurred to the term "actuality" to define change and movement as the consequence of the confrontation of substance and form. The first is general the second particular. Now, there is one class of existent things which we will call *substances*, including under the term: first, matter, which in itself is not a this or that, not a particular; second, shape or form in virtue of which it is then a this or that, a particular; third, the composition of the two. Matter is potentiality; form, actuality. And "actuality" is used in two ways: knowledge illustrated the one, exercise of knowledge the other.[3] Aristotle introduces then, indirectly, a difference between "knowing" and "exercising knowledge". "Aristotle's terminological distinction in this regard is between *poiesis* as a kind of productive activity related to what is outside the agent and *praxis* as the activity concerned with the life (*bios*) of the

[1] Online Etymology Dictionary.(2011-05-08).
[2] The New Testament Greek Lexicon http://www.searchgodsword.org/lex/grk/view.cgi?number=2041 (2011-05-15).
[3] Aristotle. The Anima Book II. Published in Aristotle's De Anima in Focus. Michael Durrant (editor). Routledge 1993; p. 21.

human agent (Aristotle 1962: 1140 b 3-4). The knowledge about how to produce something outside the agent is called *techne*. In other words, *techne* and *poiesis* – the knowledge on how to produce something external to the agent and the production process itself – correspond to *phronesis* and *praxis*, i.e. to the knowledge about good life and the activity of good life itself."[4] To act for Aristotle, is a property of the living and implies the involvement of the soul. Following Aristotle it is possible then to affirm that knowledge is formal and actual and that there are two modalities of it: knowledge as thing, and knowledge as acting. Putting this in our words, we can say that Aristotle uses the term "actuality" to define knowledge and praxis (as exercising knowledge).

Marx uses the term "labor" (Arbeit) to denote the economic manifestation of an act, emphasizing the semantic associations between the concept of "labor" and the subjective feelings associated to pain and fatigue which are not semantically associated to the term "act". The term "labor" is a derivate from Latin *laborem* meaning just this "hardship, pain, fatigue". As a verb the term means "perform manual or physical work; work hard; keep busy; take pains, strive, endeavor". The term "act" at the other hand, means "something done, deed, action," the term is closer to the English term "work" which comes from Proto-Germanic *werkan*; for instance, the denomination "working class" is from 1789.[5] This unnecessary distinction between labor and acting, led the work of Marx and the work of the philosophers of economy in general, to unnecessary difficulties. Marx purpose was that to explain the mechanisms of capitalism and in this attempt he emphasized the role of industrial acting over any other form of acting. As it was noticed by Hannah Arendt, for Marx, not all acting was interesting, the part of the industrial acting which was really interesting for him was the part which was not remunerated; that part that was appropriated by the capitalist. He called this no remunerated part of work "surplus labor". The concept of surplus labor is important for the Marxian theory of exploitation of the worker by the capitalist as the source of the creation of new capital. We believe that this circumstantial fact has contributed to the misunderstanding of the creative powers of acting in general.

Searching carefully in Marx' texts we found that Marx acknowledges two groups of labor-acts. For instance in Book III of Capital he distinguishes between "universal labor" and "co-operative labor". The first category includes "all scientific labor, all discoveries and all invention" and is based in both the "the co-operation of the living, and partly on the utilization of the labors of those who have gone before". In our words that refers to vital acts. The second "is the direct co-

[4] Rafael Capurro; "Toward a Comparative Theory of Agents": http://www.capurro.de/agents.html

[5] Online Etymology Dictionary.

operation of individuals." This other acts include destructive acts, mechanical acts, and ludic acts. Work and labor then in the economic sense of the word would be the co-operative form of action. Let see how Marx explains this:

> Incidentally, a distinction should be made between universal labor and co-operative labor. Both play their role in the process of production, both flow one into the other, but both are also differentiated. Universal labor is all scientific labor, all discoveries and all invention. This labor depends partly on the co-operation of the living, and partly on the utilization of the labors of those who have gone before. Co-operative labor, on the other hand, is the direct co-operation of individuals. The foregoing is corroborated by frequent observation, to wit: 1) the great difference in the cost of the first model of a new machine and that of its reproduction. 2) The far greater cost of operating an establishment based on a new invention as compared to later establishments arising *ex suis ossibus*.[6] This is so very true that the trail-blazers generally go bankrupt, and only those who later buy the buildings, machinery, etc., at a cheaper price, make money out of it. It is, therefore, generally the most worthless and miserable sort of money-capitalists who draw the greatest profit out of all new developments of the universal labor of the human spirit and their social application through combined labor.[7]

From Marx' words can be deduced that he believed that the development of new embodiments (prototypes) includes the labor of earlier generations and therefore includes much more informational value that a standard produced artifact which only consumed the labor of the actual generation of workers. From Marx words can also be deduced that this "universal labor" is the theoretical and praxical knowledge that has been inherited from the experience of earlier generations. As Marx shows, the first implementations of new technologies imply always very high costs. These costs are originated in the necessary succession of decision, which are tentative and prone to be wrong. The trial and error method, which is the natural way to implement new technologies, consumes much more information than well-known processes.

[6] [*from their very bones*].

[7] Capital Vol. III Part I. "The Conversion of Surplus-Value into Profit and of the Rate of Surplus-Value into the Rate of Profit Chapter 5. Economy in the Employment of Constant Capital V. Economy Through Inventions." Marx Internet Archive. https://www.marxists.org/archive/marx/works/1894-c3/ch05.htm

Information and negentropy

Having introduced the idea that work and labor as any other act have an informational character, we will now introduce a general theory of culture as *order*. This order will be described as the resistance to entropy or "negentropy". The German physicist Rudolph Clausius (1822-1888) one of the founders of thermodynamics described the phenomenon of *entropy* (from the Greek Gk. *entropia* "a turning toward," meaning with it the "measure of the disorder of a system"). The second law of thermodynamics establishes that in thermally isolated systems, entropy runs in one direction only (it is not a reversible process). The second law of thermodynamics describes an active world which becomes increasingly disordered, changing from specificity to indefiniteness. In such a world, the entropic change moves forward into an irreversible future. In our terms this would mean that because *entropy* the world is *losing information*. The second law of thermodynamics has big consequences to the humans in this entropic universe. To be alive is to have been born, to grow, and to die but also *to act against entropy*, trying to delimit its effects. Erwin Schrödinger (1887–1961) noticed that the movement of life strives to preserve order against disorder. Schrödinger named this *negentropy* as the results of the intersection of entropy and life.[8] Human acts in general then, are the attempt to preserve order against disorder. The most of these acts are just aimed to preservation of a status quo but by necessity, each act implies something new. The general human strategy against entropy is the development of an ordered artificial world, which reduces the high concentration of information in human life to the predictable and simple world of a cyborg. Paradoxically, this movement against the effects of entropy –negentropy, which we also call "modernization"- would need to reduce the amount of information in the lifeworld. Considering the amount of information in the life world constant, modernization would imply the transference of information from the lifeworld to an artificial world of things with the obvious consequence of an increment of the number of artifacts in culture, each with a little part of the previous amount of information.

Bases to a theory of the human act

The common way to classify the human act is that to distinguish between simple and complex acts. For example let us study the work of Donald A. Norman. According to Norman everyday tasks shows a simple structure:

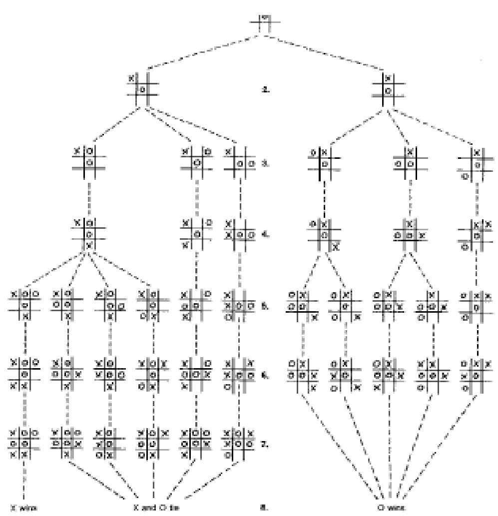
[8] These ideas were published in Erwin Schrödinger's book from 1944: *What is Life?*

> Everyday activities are conceptually simple. We should be able to do most things without having to think about what we're doing. The simplicity lies in the nature of the structure of the tasks.[9]

Norman distinguishes between wide and deep action structures which he represents as the sequences of a decision tree. An example could be the study of the game of chess:

> The sequences can be represented on a decision tree, a diagram that in this case takes the current board position as a starting point and shows each of my possible moves, each of the possible countermoves, each possible counter-counter move, each possible counter-counter-counter move, and so on, as deep as time and energy permit.[10]

The diagram of the decision tree of the game of chess is wide in the sense that for each choosing moment there are many open alternatives and it is deep in the sense that the consequences of each choice have far-reaching consequences. A simpler case is the game tic-tac-toe which is presented by Norman as follows:



Presentation 1: The decision tree of the game of tic-tac-toe according to Donald Norman.

[9] Norman, Donald A. *The design of everyday things*. The MIT Press; London, 2001; p. 119.
[10] Ibid. p. 119.

Donald Norman studies the number of choices that have to be made during a game of chess. The decision tree for chess would be of the same kind of that of tic-tac-toe in Presentation 1. With Norman words:

> Consider the game of chess, an activity that is neither everyday nor simple, at least, not for most of us. When it is my turn to play, we have a number of possible moves. For each of my moves, my opponent has a number of possible responses. And for each of my opponent's responses, we have a number of possible counter responses. The sequences can be represented on a decision tree, a diagram that in this case takes the current board position as a starting point and shows each of my possible moves, each of the possible countermoves, each possible counter-counter move, each possible counter-counter-counter move, and so on, as deep as time and energy permit. The size of the tree for chess is immense, for the number of choices increases exponentially. Suppose that at each spot there are 8 possible moves. At that spot we must consider 8 initial moves for me, 8 X 8 = 64 replies of my opponent, 64 X 8 = 512 replies We can make, 512 X 8 = 4 096 possible replies by my opponent, and then 4 096 X 8 = 32 768 more possibilities for me. As you can see, the decision tree gets large rapidly: looking ahead five moves means considering over 30 000 possibilities. The tree is characterized by a vast, spreading network of possibilities.[11]

In other words, assuming eight possible choices per move, five movements of chess produce 15 bits:

32768 (possibilities) options	2^{15}	15 bits

Presentation 2: Approximately, five moves of chess demand 15 bits.

On the contrary, everyday activities are much simpler; they do not show the complexity of the alternatives of the game of chess. Norman says that the structures of everyday actions are instead either shallow or narrow. As an example of a narrow structure, Norman presented the recipe of a cook book while as a shallow structure he refers to a menu:

[11] Ibid.; p. 119.

> The menu of an ice cream store provides a good example of a shallow structure. There are many alternative actions, but each is simple; there are few decisions to make after the single top-level choice. The major problem is to decide which action to do. Difficulties arise from competing alternatives, not from any prolonged search, problem solving, or trial and error. In shallow structures, there's no problem of planning or depth of analysis.[12]

For Norman, everyday activities are performed mechanically; they do not need or use much mental resources:

> Everyday activities must usually be done relatively quickly, often simultaneously with other activities. Neither time nor mental resources may be available. As a result, everyday activities structure themselves so as to minimize conscious mental activity, which means they must minimize planning (and especially any planning with extensive looking ahead and backing up) and mental computation. These characteristics restrict everyday tasks to those that are shallow (having no need for extensive looking ahead and backing up) and those that are narrow (having few choices at any point, and therefore requiring little planning). If the structure is shallow, width is not important. If the structure is narrow, depth is not important. In either case, the mental effort required for doing the task is minimized. [13]

The alternatives of actions according to Donald A. Norman could be summarized as follows:

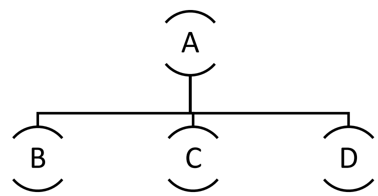
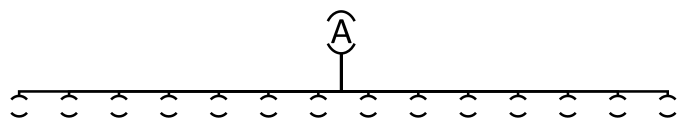
	Shallow: Few levels.	Deep: Many levels.
Narrow: Few decisions at the same level.	The most of everyday activities; e.g. making a cup of coffee, go, taking a bus, etc.	Some everyday activities which imply large narratives as reading a book, playing a videogame, following the events of a film, etc.
Wide: Many decisions at the same level.	A Menu, choosing a TV channel between 30 others.	Playing chess, writing a novel, etc.

Presentation 3: Norman's categories applied to everyday acting.

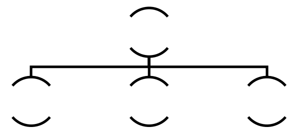
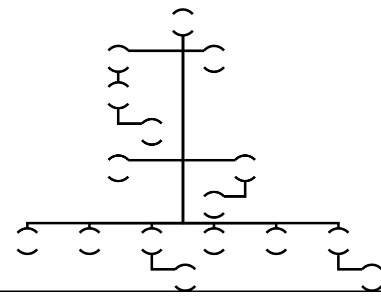
Norman's approach of construing decision trees to study the development of a chain of acts, is very helpful for our approach because each choice made can be homologated to a bit of information independently of the nature of the act. Following Norman we can say that there are two

[12] Ibid.; p. 121.
[13] Ibid.; p. 125.

basic forms of human acts: 1) *horizontal* acts or acts that are enchained but are independent to each other and 2) *vertical* acts that are built on some previous act. Horizontal acts are chains of independent acts, which can be represented as horizontal trees as in Presentation 4:

Horizontal acts	
Narrow acts: few decisions in the same level.	
Wide acts: many decisions in the same level.	
Presentation 4: Independent horizontal acts.	

An example of such an act could be that of the election of a plate from a menu in a restaurant. Each election is independent from any other. Elections can be combined in different forms. Another example could be that of preparing a fried egg and fried potatoes putting them side by side in a plate. Horizontal acts are for example get dressed, move to another place, counting the number of items in a list, etc. Vertical acts are those which are dependent of each other. In a chain of acts each act depends on a previous act and would not exist without the existence of a previous act. We represent these acts by decisions-trees of many levels:

Vertical acts	
Superficial (shallow): tree with few levels.	
Deep: tree with many levels.	
Presentation 5: More or less deep trees.	

An example of a horizontal act could be that of combining an egg and some potatoes to make an omelet. Here many simple acts must be combined in vertical acts to produce the final result. Of course, a better chef will produce better omelets because it will be capable of more vertical combinations. Examples of more deep verticality could be that of reading, writing and understanding a text, also playing a game. Performing a vertical act implies to move between different levels of reality.

Developing complexity

Decisions in connection to acts create informational value that can be expressed as the series of 0 and 1 in a decision-tree. The informational value intrinsic to human acts is related to decisions that either open for an act in the same level of acting (horizontal decision-tree) or decisions that open for an act in another level of acting (vertical decision-tree). In the first case the act increases the amount of information by repetition; in the second case the amount of information increases by complexity. To study the concept of "complexity" we will use spatial references. Complexity in acting is achieved moving from the large to the little, from the unspecific to the specific, from the general to the particular. Each decision opens a space of new possibility that increases the amount of information by adding new options on that level that accumulate with previous ones. Notice that the everyday world is organized in levels of size among which the size of the human body is the natural point of reference or first level. That allows us to assemble the human acts in groups of frequencies of 0 and 1.

Drawing from the frequency interpretation of probability developed by von Mises[14] and taking into consideration neighborhood relations, Popper[15] presented the concept of freedom in finite classes of occurrences of binary events. We will use this concept to describe the level of complexity of acts. A sequence of occurrences is said to be 1-free if it is insensitive to selection according to a single predecessor, i.e. if the resulting frequency (probability) does not change when taking all elements succeeding a 0 or a 1. Similarly, sequences can be 2-free, 3-free …n-free depending on the number of predecessors that the sequence is insensitive to selection. A sequence is 0-free if any selection from any number of predecessors results in a constant sequence of 0s or 1s. A 0-free sequence is therefore predictable and presents a low level of informational value. We argue that human acts present levels of freedom that are equivalent to Popper's description of freedom. Namely, each decision will increase in one unit the complexity of the act characterized by the sequence of occurrences that it represents. Higher values of freedom correspond to higher levels of complexity and informational value, and lower levels of predictability. Acts can therefore be set on a continuum according to its complexity in correspondence to the human and social levels of acting.

Degree of freedom in different levels of lifeworld complexity							
← Decreasing complexity Less information More predictability More order				Increasing complexity → More information Less predictability Less order			
Micro-level. Non-visible by the eye.	The level of the human finger	The level of the human hand	The level of the human body	The social level of a building	The social level of a city	The social level of a country	Ideas, emotions, feelings, desires
0-free	1-free	…	10-free	…	10^3-free	10^6-free	∞-free
	Presentation 6: The scale of freedom of decisions						

Donald Norman[16] studies the human act dividing it in the categories shallow, deep, narrow and wide (see Presentation 3 above). We can match his criteria with ours as follows:

[14] von Mises, Richard. *Probability, statistics and truth*. MacMillan; New York, 1957.
[15] Popper, Karl R. *The logic of scientific discovery*. Hutchinson; London, 1980; p. 159.
[16] Norman, Donald A. The design of everyday things. The MIT Press; London, 2001; p. 119.

Vertical (decisions) / Horizontal (choices)	Shallow, few or one series of decisions: Complexity equal or lower than [$C=k \times 2^n$]	Deep, many series of decision: Complexity higher than [$C=k \times 2^n$]
Narrow, few choices at the same level. Complexity equal or lower than [$C=n \times 2^k$]	The most of everyday activities; e.g. making a cup of coffee, go, taking a bus, etc.	Some everyday activities which implies large narratives as reading a book, playing a videogame, following the events of a film, etc. Combining acts of high complexity but limited options
Wide, many choices at the same level. Complexity higher than [$C=n \times 2^k$]	A Menu or choosing a TV channel between 30 others. Combining acts of low complexity but with a wide range of options	Playing chess, writing a novel, etc. Complex and with many options

Presentation 7: The complexity value of Norman's categories.
Where *k* is a constant and *n* is a variable. In the vertical level, the number of decisions will grow (and the size of the tree will grow exponentially) for a constant number of options per level. In the horizontal level, the number of options per level will grow (resulting in a linear growth in the size of the tree) for a constant number of decisions.

The majority of the traditional human acts have low complexity and therefore a low informational value. That is the case of getting dressed, eating, going, etc. Modern life increasingly combines low complexity chains with high complexity chains. Productive activities in contemporary societies shows an increment of the relevance of deep-wide-acts with an increasing importance of memory and mental scenarios in the performing of human acts (including the development of machines that support intelligent processes) something that we expressed in Presentation 6 introducing the dimension of intangible acts as the eidetic act, the emotional act, and their like.

Probability, complexity and the informational value of human acts

Von Mises quantifies probability as the relative frequency of the repetition of a given attribute in a collective. He defines a collective as a sequence of uniform events or processes which differ by certain observable attributes. Before considering any probability, a collective must be described. Then probability is only concerned with the odds of encountering a given attribute in a given collective. Popper takes the frequency theory of probability developed by von Mises introducing order neighborhood selection in order to develop the concept of n-freedom of finite sequences. Popper ideas allow us to redefine complexity in terms of levels of n-freedom for human acts, laying the foundations to quantify its informational value.

Let's assume that we have a non-empty reference class α of a finite number of occurrences of a given act; for example, the class of plants that I watered yesterday. $N(\alpha)$ is the number of elements in α. Now β is a property class, for instance a rosebush. The class of elements that belong to both α and β is called the product-class and it is denoted as $\alpha.\beta$; that in our example will represent the class of plants that I watered yesterday that were rosebushes. The relative frequency of the property β within the finite reference class α, or the α-frequency of β, is defined as:

$$_{\alpha}F''(\beta) = \frac{N(\alpha.\beta)}{N(\alpha)}$$

Now we are going to consider a finite reference class α and two properties, β and γ. Following our example we can imagine that γ is the red property. If we take $\alpha.\beta$ as new reference, we can select $_{\alpha.\beta}\mathrm{F}''(\gamma)$ which denotes the frequency of γ in $\alpha.\beta$; or in our example the frequency of red rosebushes that I watered yesterday in relation to all the rosebushes that were watered yesterday. If $_{\alpha.\beta}\mathrm{F}''(\gamma) = {}_{\alpha}\mathrm{F}''(\gamma)$ we say that β and γ are mutually independent or that α is insensitive to selection according to β property. In terms of our example, the frequency of red rosebushes that were watered yesterday is equal to the frequency of red plants that were watered yesterday, so being a rosebush (β) and being red (γ) are mutually independent and the class of plants that I watered yesterday is insensitive to the selection of being a rosebush (β).

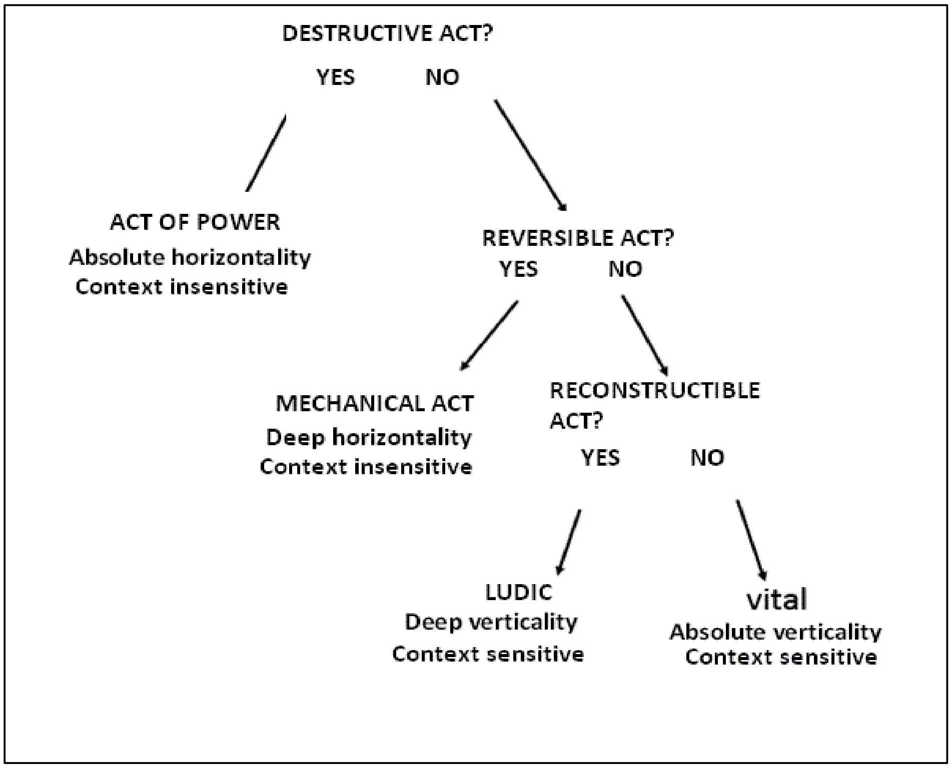
To simplify things and following Popper description in what follows we are going to consider a binary reference class, which is a class with only two primary properties in which each single occurrence is denoted as 0 or 1, for instance heads and tails for a coin toss. We can also consider secondary properties and in this case we only need a neighborhood property as secondary property like 'succeeding a 0', or 'successor of heads' for a coin toss. A reference class in which neighborhood relations are taken into consideration is called a sequence. A binary sequence α is insensitive to selection of a single predecessor if $_{\alpha.\beta}\mathrm{F}''(0) = {}_{\alpha}\mathrm{F}''(0)$ and $_{\alpha.\beta}\mathrm{F}''(1) = {}_{\alpha}\mathrm{F}''(1)$ where β is the property "immediately succeeding". In this case α is also said to be free from the after-effects of single predecessors or 1-free. An example of 1-free sequence is the infinite sequence 1100110011001100… If we take the subsequence of occurrences that immediately succeed a 0 we get the sequence 01010101… which has the same relative frequency of 0s and 1s as the original one (F=1/2). Similarly we can define a 2-free sequence by repeating the generating period 10111000, meaning that the sequence of occurrences generated from repeating this period is insensitive to the selection of any two predecessors (00, 01, 10 and 11).

Higher levels of freedom require more information as measured by the number of bits to encode a generating period, so sequences with larger levels of freedom have a higher informational value. As they provide more information, they are also more complex and less predictable because they have higher entropy; taking Shannon definition of entropy as a measure of unpredictability in information content[17]. We argue that human acts can be classified and measured according to their informational value by estimating the number of bits necessary to encode a generating period of a given freedom. Simple acts, like watering a plant, produce less information, are more predictable and less complex. Complex acts, like designing a computer, produce more information, are less predictable and more complex. We argue that there is a limit for the amount of information that the acts of a single individual can produce and that collective acts performed by many individuals produce huge amounts of informational value.

A relational theory of human acts

There is another dimension in the study of human acts that complement the study of its complexity. We are referring to an act's relation *to other acts and to itself*. Let us present a general methodology to analyze the relational aspects of human acts. We will ask us if acts are *destructive, reversible or reconstructible*. Each answer will give us a family of acts as follows:

[17] Shannon, Claude E. (July–October 1948). "A Mathematical Theory of Communication". Bell System Technical Journal 27 (3): 379–423. Shannon concept of informational entropy can be matched to Schrödinger's formulation of negentropy if we consider an equivalence between predictability and order: Lower informational entropy means more predictability, more order and therefore more negentropy.



Presentation 8: A relational theory of human acts.

Let us study these new categories of acts independently from each other.

The destructive act or act of power

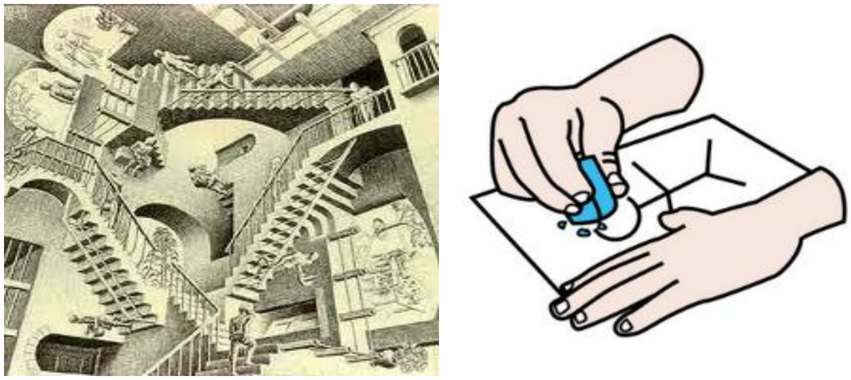
Building towers is a game that children find amusing (Presentation 9). The fun is not so much in the building, but it is in the irresistible desire to knocking down the tower; first the patient building of informational value condensed in the tower-form, then the destructive act which reinstall entropy. While building the tower is a productive act, destructing it is a consumptive act.

Presentation 9: Information that construct and information that destruct.

Beating the tower at the other hand, is to *destroy* the existing informational value, (it is not a "deconstruction") and it is reestablishing an entropic point in the lifeworld. The destructive act is an act of power, through which existing information value is transformed into disorder augmenting the entropicity inside the lifeworld. Of course, the destructive act is registered in the lifeworld as experience and therefore implies an increment of the total informational value but the produced value is always inferior to the destroyed value and that is what validates the existence of destructive acts.

The mechanical act

We will call "mechanical" or "technical" those acts which fulfill the condition of being reversible but also "circular". Circular acts are these in which the ego-body-reference of the act is both an actor and a recipient of the act, which gives the act a 'narcissistic' character. It is as *if they were performed in front of a mirror*. Because the mirror image of the self is also "the other", it is a circular communication process. Its circularity avoids changes imposing instead repetitions that characterize their automaticity.



Presentation 10: Reversibility (going up and down) and irreversibility (erasing).

The ludic act

We will call reflective those acts that are de-constructible without being technical; they are game-like acts. To deconstruct a tower is not a destructive act and therefore also it can also be a productive act. To deconstruct the tower will be a reversible act in the same way of constructing it. The acts that are necessary to construct a tower will be reversed in deconstruction to produce the same amount information but with opposite results; a constructed and deconstructed tower is richer than a constructed tower. Productive informational value never disappears; it will be lagged as experience. The informational value of the deconstruction act ads to the informational value to the construction act. Reversible acts are these that can be annulled without consequences as going up and down stairs. At the other hand an example of an irreversible act could be to erase a mark on a paper.

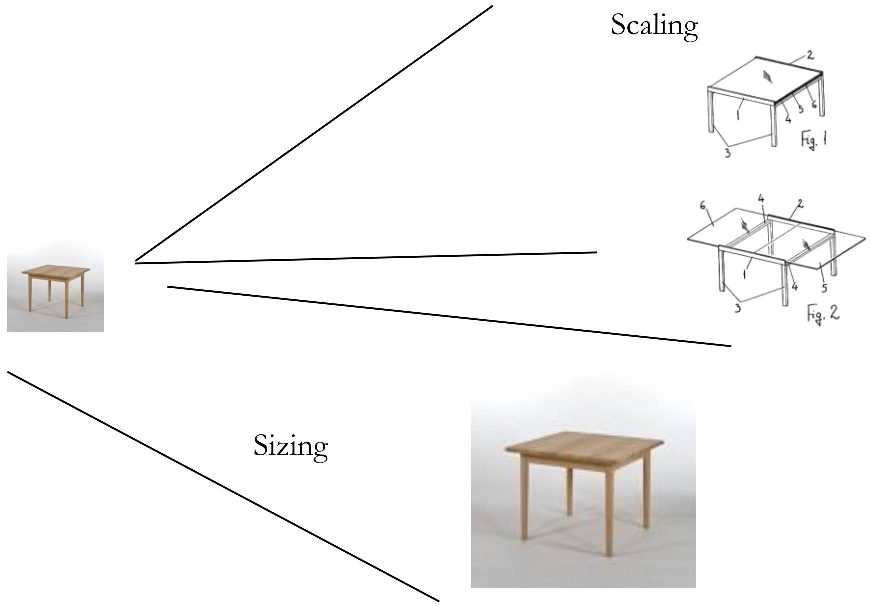
Presentation 11: Impossibility of playing with the self.

For example, some aspects of the action of playing chess can be technical, but because chess is a "game" can never be performed automatically. Games are not narcissistic acts because it is impossible to play with one self, or in front of a mirror. Some games are very close to the mechanical act as in the cases of games like "solo". It is possible that a computer program can imitate the game of chess, but this act is not an act of "play" in the strict sense, but a technical act that simulates a reversible act. The definition of "game" involves reversible, non- automatic acts. Training to improve the playing of chess or trying to improve the playing of a musical instrument in front of a mirror is a futile effort because the automatic acts inherent to these activities, although present, are not essential.

Vital acts

A last category of act is that of the vital acts; vital acts are the acts *of the soul*. While the mechanical and the ludic act are studied in relation to the *sizes* of the items through which the act is directed, to understand the nature of the vital act we have to consider also the *dignity* of the act.

We understand as "dignity" the geometric dimension of the item, e.g. the dimension zero of "the point", the dimension 1 of the "line", the dimension 2 of the "area", and the dimension 3 of "volume". The complexity of the vital act must be considered as a kind of "plasticity", such as e.g. the pure acts of the soul (ideas, emotions, feelings, etc.); this plasticity lies in the radical verticality of the intentional act; a verticality that surpasses the size-dimensions of the surrounding world. During the processes of intentionality and knowing, the vital act covers not only the size of the surrounding world but also all its projections in any other dimension, including the fractal dimensions of an item. We say that the soul adjusts itself making transcriptions of mental contents to be congruent with the world. During this process, the soul shows the ability to reorganizing its power and resizes itself, adapting its values to the vital item. We will call this movement of the soul as zooming. The idea of zooming is constructed upon the ideas of dignity and size of a vital-item. It supposes the movement of the soul trough different dimensions and different sizes of a presentation of the item.



Presentation 12: Scaling and sizing

Vital acts-items cannot belong to two or more dignities or to two or more size–levels without going through a *stretching* process. This stretching transforms the vital-item into a geometrical *fractal*. To illustrate the fractality of the presentation in respect to dignity, we shall introduce a brief example. Let us picture a man or woman who is working as a cleaner in a butcher's shop. Every evening after closing time, the cleaner is expected to clean the entire place plus the butcher's tools in such a perfect way that no trace of meat or grease could possibly be detected. In fact the limits of the cleaning are not specified and cannot be specified either. How thorough should the cleaning be? Let us accept that the place is of 40 square meters and is expected to be cleaned up to an m–level. When the cleaner begins the work, the total area becomes the perceived object of the act of cleaning. As a first step, the worker cleans the rests of meat and grease that are of the largest size. We may say that the cleaner begins with a presentation of the space in a size–level which is *congruent to the size of his or hers own body*. A second step of the work, would be to clean the same area but departing now from a more detailed presentation. With other words, the cleaner changes the stick with which he/she measures both the room and the objects in it, for instance the pieces of meat and grease. The cleaner goes from a larger size of particles to a smaller size of particles of grease. Later the cleaner uses chemical products to penetrate in a deeper level of the world. The immediate consequence of this is that implies a change in the *scale* of the act, with the consequence that we have a different working area.

Chemic cleaning implies a radical diminishing of size conducting the cleaner's soul, from the body-sphere into the sphere of thought. We have to consider now the fact that when the worker cleans the room in step 2, his/her body is still in size–level 1, a level that the worker has as a natural point of departure and which he/she cannot leave. Getting deeper in scaling implies that the worker's soul is stretching deeper in the more free dimensions of the world.

Informational value in the relational theory of human acts

As we have already suggested the categories of acts are also related with the informational value. Mechanical acts are repeatable, reversible and circular. A sequence of mechanical acts is highly predictable representing a low level of freedom and a low informational value, if any. We argue that purely mechanical acts performed by machines produce have 0-freedom and have no informational value. They represent absolute order and highest negentropy. They can be larger or shorter but always predictable. A mechanical act can have multiple steps with many options but its results are always expected given the initial state and the procedure to complete it; so mechanical acts are easy to automate and more likely to be programmed. Vital acts represent the highest degree of freedom and of informational value. They are deeply rooted in experience and learning accounting for important amounts of decisions in wide spaces of options. Vital acts, like those of an expert chef, can be even difficult to express or communicate embodying years of experience and accrued knowledge. Ideas, emotions and feelings have the highest level of informational value; an infinite level of freedom that represents pure information and absolute unpredictability.

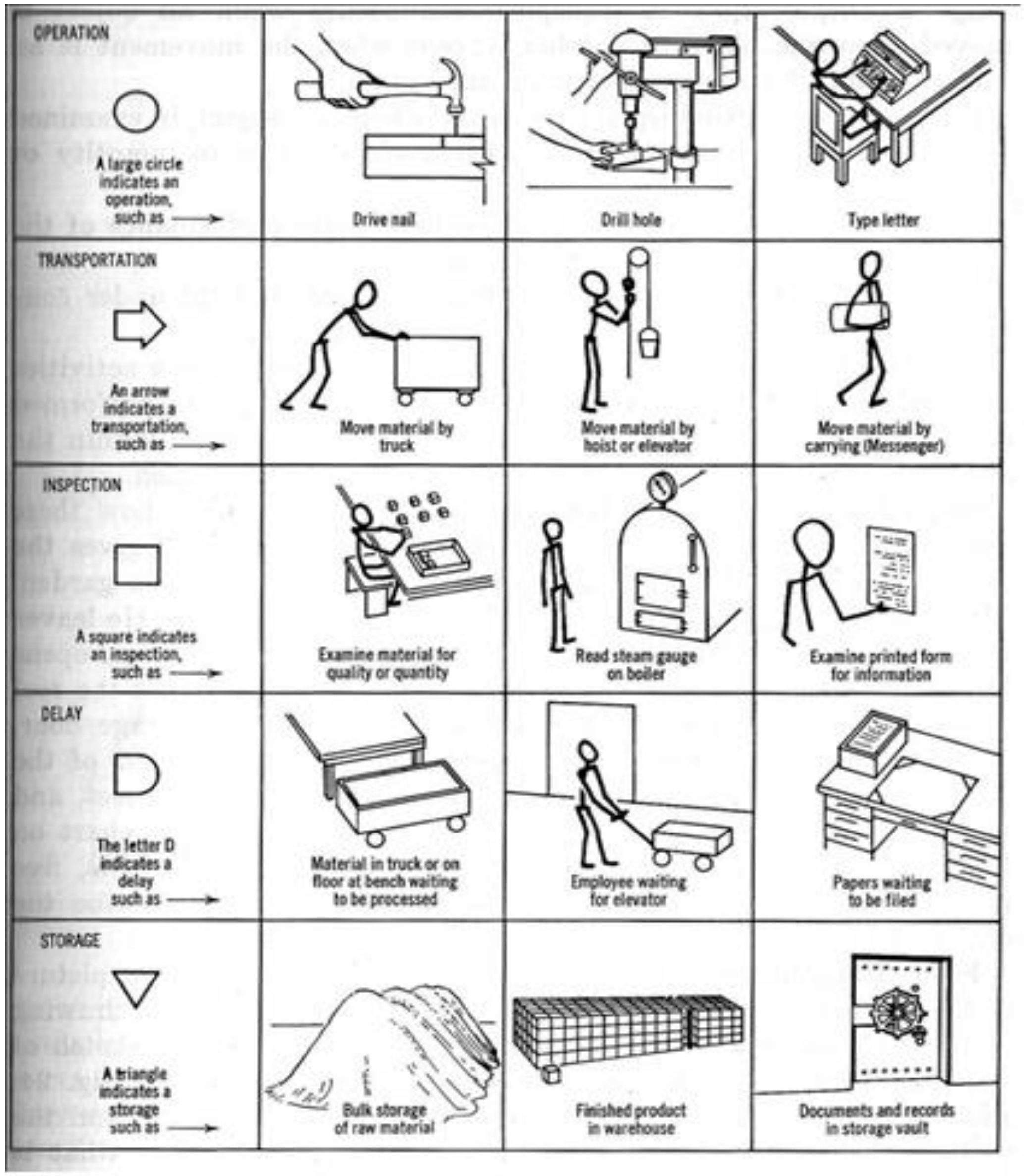
Ludic acts lay in-between mechanical and vital acts. They can be deconstructed and explained but they still have a given degree of freedom that makes them less predictable and not easy to program. Varying degrees of freedom could possibly be observed in ludic acts as we can argue that playing chess is more complex than constructing and deconstructing a tower, because in chess many moves (decisions) are made and each move has multiple options (which piece and to which position). So playing chess produces more informational value. Finally, acts of power carry a reduction in the space of options and decisions that can be made. They take part of the freedom away constraining action and therefore turning sequences of acts into more predictable and less complex structures. They destroy existing informational value and as such they reduce the amount of information.

<table>
<tr><td colspan="8">Degree of freedom in different levels of lifeworld complexity</td></tr>
<tr><td colspan="4">← Decreasing complexity
Less information
More predictability
More Order</td><td colspan="4">Increasing complexity →
More information
Less predictability
Less order</td></tr>
<tr><td>Micro-level. Non-visible by the eye.</td><td>The level of the human finger</td><td>The level of the human hand</td><td>The level of the human body</td><td>The social level of a building</td><td>The social level of a city</td><td>The social level of a country</td><td>Ideas, emotions, feelings, desires</td></tr>
<tr><td>0-free</td><td>1-free</td><td>…</td><td>10-free</td><td>…</td><td>10^3-free</td><td>10^6-free</td><td>∞-free</td></tr>
<tr><td>Mechanical act</td><td colspan="6">Ludic acts</td><td>Vital acts</td></tr>
<tr><td></td><td colspan="7">Presentation 13: The scale of freedom of categories of acts.</td></tr>
</table>

Measurement of informational value

The program of "scientific management" started by Frederick Winslow Taylor (1856–1915) – and aimed to improve "modernity" and assure "progress" –can be help us to understand the task of measuring informational value. Following Taylor, Ralph M. Barnes[18] and others, developed a methodology to study the different aspects of the labor act reducing it to a few fundamental movements. Barnes used symbols denoting some fundamental stages of every labor process: operation, transportation, inspection, delay and storage. The simplification of acting presented by Barnes can help us to convert acting in informational units. Let us first show how Barnes reduces labor into acting schemas (Presentation 14):

18 Barnes, Ralph M. Motion and Time Study. Design and Measurement of Work. New York, 1963.



Presentation 14: Ralph M. Barnes fundamental stages of the labor process.

The measurement of the information involved in a labor act can be achieved considering the numerical value of each choice as 1 bit. A bit is the basic unit of information used in both computing and communication. A bit can have only one of two values. The term *bit* is a contraction of “binary digit”. For instance, if we have to decide if we are going to transport something or not, the information involved in the act will be of 1 bit:

Transportation	Code
Yes	1
No	0
Presentation 15: Two options, one binary digit (bit).	

By the same reason if the choice is between two different kinds of acts as to choose between "transportation" and "inspection", the information involved in the act will be of 2 bits:

Transportation	Inspection	Code
Yes	Yes	11
No	Yes	01
Yes	No	10
No	No	00
Presentation 16: Four options, 2 bits.		

In general $\log_2$ (n) options will generate n bits of information; e.g. 1000 options correspond to 10 bits because 2^{10}=1024.

Decisions	Number of options		bits
1	2 options	2^1	1 bit
2	4 options	2^2	2 bits
3	8 options	2^3	3 bits
4	16 options	2^4	4 bits
5	32 options	2^5	5 bits
6	64 options	2^6	6 bits
7	128 options	2^7	7 bits
8	256 options	2^8	8 bits
…	…		…
---	$\log_2(n)$ options	2^n	n bits

Presentation 17: the informational structure of the world summarized with numbers.

Individual human acts

In this way we can quantify the number of bits required in the horizontal level for one single decision as the $\log_2(n)$, where n is the number of choices for that decision. As for our vertical axis, each new decision adds as a space for n new choices and adds a new bit to the amount of information required to represent the act, so we need k bits for k decisions. Considering both levels, the total informational value of an act will be given by $k \times \log_2(n)$. Now to determine the number of choices provided by a given tool or instrument (i.e. to determine n) we will adopt the following convention: the number of elements that a tool offers as its *interface* will determine the number of choices. For instance, a shovel is designed to be used with both hands so we will consider that its interface has two entry points and therefore the number of choices of a shovel will be two and only 1 bit will be required to quantify it since $\log_2(2)=1$. More sophisticated tools have more complex interfaces offering more choices (e.g. a typewriter) and requiring more bits to quantify the number of possible choices. As for the vertical level (i.e. to determine k), decisions will be quantified according to the dimension of the element involved in the act according to Presentation 18. Dimension represents the number of levels in a decision tree. It is the number of decisions required to complete an act. Taking the human body as a reference, the simplest act can be performed with one finger, e.g. pressing a button, and this will represent one bit of informational value. More complex acts require more dimensions involving more decisions. The next dimension is given by a limb. For instance we use the arm to hammer. Following dimensions involve using two limbs, as in using both arms to pour a glass of water, and four limbs as when digging a hole with a shovel. Finally we consider a dimension that corresponds to acts that require using the complete body, like playing football. Distinction between the two final categories, four limbs and human, body can be subtle and open to interpretation but we want to distinguish between acts more or less mechanical that require arms and legs to be performed from more complex acts that require a coordination of all the parts of the body usually involving higher intellectual skills. It should be noted that our classification takes the human body as a reference and it is arbitrary, and as so future experimental research may determine that different figures are more representative.

Dimension	Number of bits
One finger	1 bit
One limb (either hand+arm or leg) (wheel)	2 bits
2 limbs (steering wheel, propeller)	4 bits
4 limbs	8 bits
Human body	16 bits

Presentation 18: the informational value of dimensions taking the human body as reference

We will now provide several examples. The act of using a shovel to lift will produce 4 bits of informational value ($4 \times \log_2 (2)$). If we also want to move sand using the shovel, then we will be arguably using the whole body to lift and move, so the informational value will be 16 bits ($16 \times \log_2(2)$). Assuming that I am using an ideal mechanical shovel that has for entry elements, say two levers and two pedals, and that each entry element has two positions, say on and off, then the interface will have 8 options. If I need to use the whole body to operate the mechanic shovel then the informational value of the act will be $16 \times \log_2 (8) = 48$ bits. Using similar analogies we can also calculate the informational value of physical magnitudes. For instance a horsepower (HP) is a unit of power commonly used in the description of machinery that represents the power necessary to lift 75 kilograms by one meter in one second. If we consider that two people are needed to lift 75 kilograms, then the informational value of a horsepower will be 32 bits (assuming just one entry point to pull or lift). We can also consider the technologies that act as non-natural body parts or their analogical equivalents such as the wheel, the propeller or the steering wheel. Providing that these technologies are designed to dock a part of a human body, we argue that in terms of informational value, a wheel is equivalent to a limb (leg), a propeller is equivalent to two limbs (e.g. as when rowing) and a steering wheel will have the informational value equivalent to two limbs (both arms).

Collective acts

Taking a single person as reference, we can extend the formulation to compute the informational value of collective acts by adding new dimensions based on the number of people involved in the act under the assumption that more people will be making more decisions resulting in added informational value (Presentation 19).

Dimension	Number of bits
One finger	1 bit
One limb (either hand+arm or leg) (wheel)	2 bits
2 limbs (steering wheel, propeller)	4 bits
4 limbs	8 bits
Human body / 1 person	16 bits
2 people	32 bits
3 people	48 bits
4 people	64 bits
n people	$n \times 16$ bits

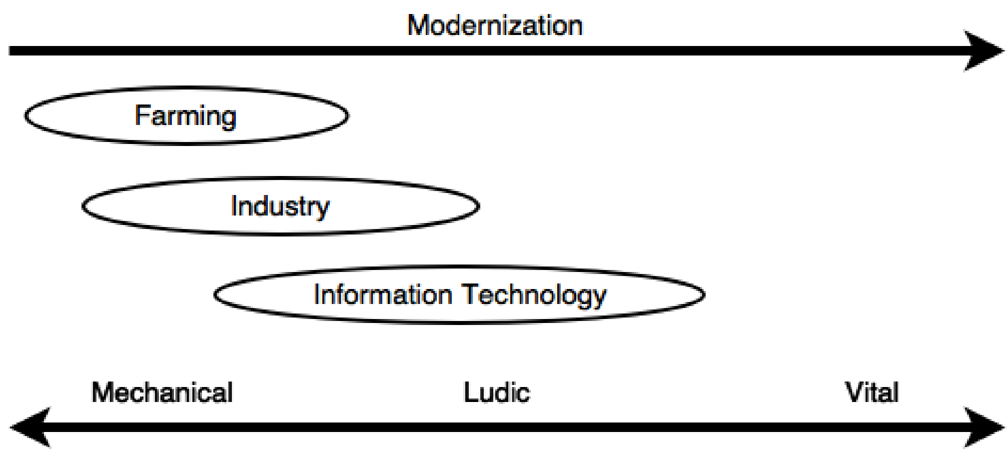
Presentation 19: the informational value of dimensions of individual and collective acts

Let's consider the informational value of sorting waste in a country in which 1 million people perform that act. Assuming that waste has to be sorted in ten different elements (paper, glass, …), the total informational value will be 10^6 people × 16 bits per person × $\log_2(10)$ options in the interface, resulting in 64 million bits, or approximately 7.63 megabytes of informational value. We can see that the number of people, the number of choices (options) and the number of decisions (dimension) influence the informational value. Imagine another country with the same number of citizens but that only sorts garbage in four elements. The informational value of the collective action will be $10^6 \times 16 \times \log_2(4) = 32$ million bits (3.81Mb approx.) which is one half of the informational value of sorting the garbage in ten elements. For the sake of simplicity we are considering that collective acts require the use of the whole body for each individual but it is obvious that less complex acts like pressing a button will result in less informational value that can also be computed. Assuming that the button has only one position in the interface, the informational value of 1 million people pressing a button is $10^6 \times 1 \times \log_2(2) = 1$ million bits (122Kb or 0.12Mb approx.).

Embedded Information

Mechanical acts are easy to automate and as so they are also likely to be automated. The informational value of a simple sequence of decisions and options with a low degree of freedom can be extracted and modeled in a design or procedure that is subsequently reflected in an artifact built to facilitate or perform the initial act. So *artifacts embed the information* of the act that they embody. A shovel embeds the information of the act of using the hands to dig a hole. Using the artifact represents a reduction in the informational value of the final act, when compared to realizing the same act without the artifact. However such reduction of the informational value is also reflected in an increased efficiency of the act. With a shovel I can dig faster and deeper in the same amount of time. This does not increment the informational value of the act of digging. In the best case, the same informational value improves productivity resulting in higher throughputs when using the shovel. If I want to dig a similar hole with my hands and with the shovel, using the shovel reduces the amount of informational value of the act of digging.

In informational terms, modernity implies a kind of "mechanization" of human acts of increasing levels of complexity by means of producing artifacts that embed increasing degrees of information (Presentation 20). Modernization reduces the informational value of acts embedding informational value in artifacts. Different historical stages show the embedment or mechanization of human acts in artifacts. Farming is a modernization of the primary acts related with agriculture, hunting and fishing. Industry aims to modernize crafting by substituting workshops with factories that serialize the production of goods. A machine in a factory embeds not just the power necessary to complete acts that many humans can do (e.g. fold steel), but also the informational value of the acts which represent a large sequence of decisions and choices that "reproduce" the actions of a craftsman.



Presentation 20: Modernization in different stages as the embedment of informational value of acts

Information technology epitomized by the computer and by communication networks automates the processing of information. Fast processing of information has undoubtedly improved the services of post-industrial era facilitating different activities like transport, communications, trade and commerce. Information technology has also improved the services that support the organization of the modern society and modern states including bureaucracy, education and health care among many others. But we can also see that information technology has automated ludic acts embedding their informational value in cultural artifacts. Ludic acts like sports or entertainment represent sequences of decisions and choices of high informational value with a high degree of freedom. Ludic acts have been captured in modern cultural artifacts that are offered to the public in different products like simulations or videogames. Information technology then facilitates the modernization of culture characterized by the mass-production of cultural artifacts that embed ludic acts.

We may then argue that the next step in modernization is to capture and embed the informational value of acts with the highest degree of freedom. The next stage is to mass-produce artifacts that embed acts related with the higher intellectual skills like art, music or science. Modernity continues its way towards the embedment of vital acts in the next generation of artifacts. Artificial intelligence can be an example of this later attempt to develop artifacts that simulate intellectual skills and embed the complexity and higher dimensionality inherent in human acts. Whether the modernization of human acts is ever to come is a question that also opens a discussion about the limits of informational value and about the limits of embedment. Dreyfus and Dreyfus in their discussion about intelligent machines argue that the developments of artificial intelligence will never parallel human expertise because expertise embodies a kind of intuitive knowledge that could not be formalized in any computational system[19]. At best, computer systems, driven by the information processing paradigm, can only exhibit the behavior of a competent human. Our characterization of vital acts as having a highly fractal nature agrees with Dreyfus and Dreyfus characterization of the kind of knowledge that can be formalized in computational systems. We suggest that there is a limit to the informational value that can be embedded in artifacts using the current information processing paradigm. Such limit lies in the threshold between vital acts and ludic acts. Quantifying the information value of this limit is difficult in the current stage of our development and we can only speculate about its existence providing, at best, estimations about its order of magnitude.

Conservation of Information

Our discussion in the previous section suggests the existence of a kind of a law about conservation of information that we can state as follows: The total amount of information of an isolated system remains constant. A *system* in the simplest case comprises an act and the set of artifacts to complete the act. If we perform any act with one artifact and then we complete the same act with another artifact of a different kind, the total informational value of the act and the artifact remains constant for any combination act-artifact. For instance, the informational value of digging a hole using our bare hands is equivalent to the informational value of digging the same hole using a shovel *plus* the information embedded in the shovel. It follows that the information of digging (act + artifact) using any other kind of tool, like a mechanic shovel, also remains constant. The informational value of the act of digging with a mechanical shovel is lesser because the informational value embedded in the mechanical shovel is higher. Modernizing acts reduce the dimensionality of the decision tree that expresses the act. They primarily reduce the vertically of the tree by embedding decisions in artifacts resulting in a reduction of our levels of freedom when compared with archaic acts and their informational value.

Generalizing the rule of the conservation of information for multiple acts, we can formulate it as $\sum_i a_i e_i$, where a_i is the informational value of the act, e_i is the informational value embedded in the artifact or set of artifacts that are used to complete the act, and i is the set of acts to complete a given task or job (this act has to be an isolated system)[20]. It then follows that in its simplest form, the

[19] Dreyfus, H. L. & Dreyfus, S. E. 1986. "Mind Over Machine: The Power of Human Intuition and Expertise in the Era of the Computer", New York, The Free Press. Formalization is a requirement for the automated processing of information.

[20] In physical terms the law of conservation of energy has different formulations. We have taken the approach of the conservation of momentum, originally attempted by Leibniz, to derive our formula. Other formulations, like in terms of

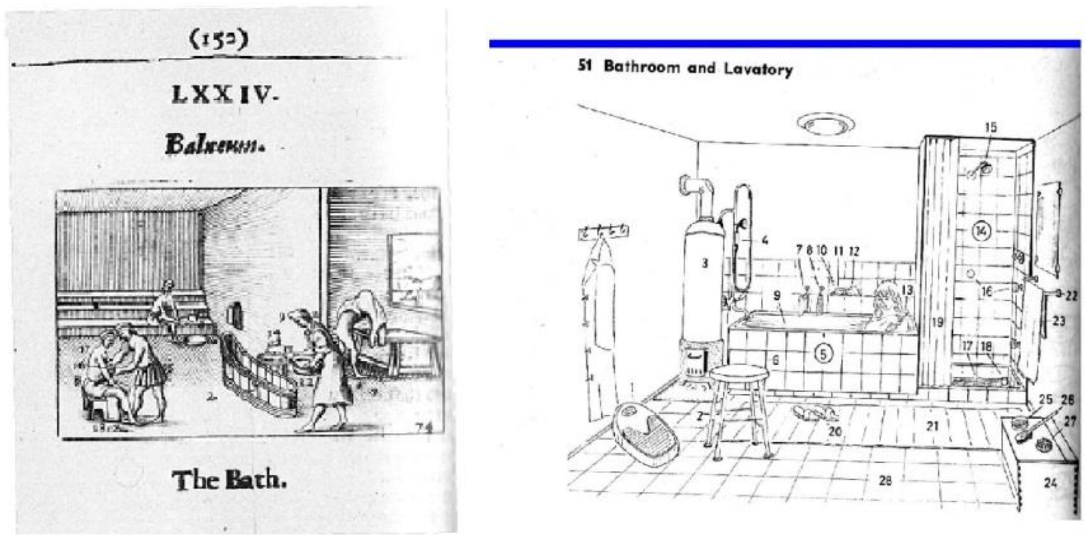
maximum informational value of any act results from completing the act without any artifact using just our body. We can call this the *pure informational value* of an act. Given this pure informational value, the informational value embedded in any other artifact used to complete the same act can be computed by considering the difference between the informational value of both acts (with and without the artifact). For more complex acts, especially ludic and vital acts, it can be argued different paths (decisions and choices) can produce the same outcomes resulting in different informational values for the same act. It could then be concluded that computing the pure informational value is not possible and the conservation of information does not hold. Our theoretical system holds under the assumption that equal acts are compared under equal conditions. The easiest way to ensure this is to assume optimality in human acts and in human designs.

Modernity, understood as an ever-evolving attempt to reduce the informational value of human acts by embedding information in the artifacts around us, does not increase the informational value of our acts but it happens that the total amount of information remains constant. This invariability holds for different historical periods. Modern artifacts reduce the amount of informational value that we have to "input" to perform any action because they embed increasing amounts of information. The reduction in the amount of informational value invested in our acts results in more informational potential available to complete other acts. Artifacts don't increase the informational value of our acts; they just allow us to redistribute our informational potential.

Agnumetry, quantifying modernization

We will refer as *agnumetry* the measurement of the brokenness of an environment; from *agnumy* the Greek word for "break". The presence of broken technologies makes an environment more or less broken. The measurement of this grade of brokenness could be an interesting manner to compare these environments with each other. For example, if to perform a certain task we use today 10 artifacts and to perform the same task during the Renaissance we used only 5 artifacts, relating the older informational value to the modern informational value we get the *relative brokenness* of the renaissance milieu with respect to the contemporary milieu. We will get the *agnumetric value* of a particular milieu of Renaissance with respect to a particular contemporary milieu with regard to a certain task/environment.

thermodynamics or mathematical (Noether's theorem), are also possible. Although different formulations will change the formula, the conceptual model is not affected.



Presentation 21: The bath now and then. To the left the "bath" according to Amos Comenius, *Orbis sensalium pictus. Den synliga werlden. Le Monde Visible*. På Latin, Swenska och Fransyska. Stockholm, 1796; and to the right, the "bath" according to the *Duden Bildwörterbuch, 1960*.

In Presentation 21, Amos Comenius presented a bath from 1658 which shows 18 artifacts and it can be compared to a bath presented in the *Duden Bildwörterbuch*, from 1960 in which 28 artifacts are numbered. In that particular comparison, the agnumetric value shows an increment of the number of artifacts used in the bathroom. We notice that the evolution of praxis from archaic to modern solutions, involves some times more artifacts than before. Nevertheless, in some other cases, "progress" implies the engagement of less artifacts than before. For instance, to take care of your own body today demands a lot more artifacts than in earlier ages. But to e.g. be dressed fashionably today, may involve fewer artifacts than during the 18th Century. We assume that the amount of informational value inside the lifeworld is transformed into informational value inside an artificial world created by culture. However, in spite of the transformation of information from vital to artificial, the process maintains *invariable* the total level of information value. So the *increment* of the number of items in a particular environment means that the amount of information available has been *distributed* among the new items. At the other hand, a *reduction* the amount of items in a new environment means that the earlier existing amount of informational value is now concentrated into fewer items which must be the expression of a higher informational density. So the increment or decrement of the level of complication of an environment is equally a sign of modernization in spite of showing a different agnumetric value. That means that it would be necessary to distinguish two different cases of modern environments: "modernization by enrichment" and "modernization by simplification".

Modernization by technological enrichment; *increment* of the artifacts or parts involved in the task.	Modernization by technological simplification; *diminution* of the artifacts or parts involved in the task.
Example: the introduction of machines instead of tools.	Example: dressing during the 18th century with respect to the dressing of today.
Presentation 22: Modernization by enrichment and modernization by simplification.	

In both cases, the amount of informational value in the artificial world increases with respect to the amount of the informational value in the lifeworld.

In terms of our previous formulation for the conservation of information we can say that two isolated environments designed to perform the same set of tasks, E_1 and E_2, have the same informational value as expressed by the product of the informational value of the acts and the informational value embedded in the artifacts, formally $\sum_i a_i^1 e_i^1 = \sum_i a_i^2 e_i^2$, which can be also expressed as a ratio $\frac{\sum_i a_i^1 e_i^1}{\sum_i a_i^2 e_i^2} = 1$ and used as the basis to compare the informational value of acts or artifacts in both environments. We will compute the agnumetric value, denoted as @, to compare the informational value of two environments as $@ = \frac{\sum_i e_i^1}{\sum_i e_i^2}$. An agnumetric value larger than 1 means that E_1 has more information embedded in its artifacts, meaning that E_1 is more modern. An agnumetric value equal to 1 means that both environments have exactly the same level of modernity independently of how the informational value is distributed among their artifacts. An agnumetric value lesser than 1 means that E_1 is more archaic. Similarly we can also compare the informational value of acting in both environments, but given the agnumetric value just defined it follows that the inverse, $1/@$ or $@^{-1}$, also represents such a ratio to compare acts. In this case, archaic environments will return an inverse agnumetric value larger than 1 when compared to modern environments. Modernity then implies ever-increasing agnumetric values when recent environments are compared with a fixed archaic environment.

Our formulation also implies a kind of *relativity of modernization*. Taking astronomical observation as an example, we can take an ancient archaeoastronomical site like Stonehenge as reference point and compare it with a modern astronomical observatory. We will then compute a very high value for @ and very low value for $@^{-1}$. Now if we take a different reference point like Tycho Brahe's Uraniborg observatory build in the sixteenth century we will compute a lower agnumetric value but still a very substantial figure. The value will be reduced significantly as we move the reference point towards the present. Agnumetric values are then relative to the reference points under comparison. Agnumetry can also be used to study the acceleration and deceleration of modernity in different historical periods.

Operative information

Technologies are the expression of knowledge in general and knowing-how in particular. They are the consequence of a sum of choices materialized as information value. These technologies are aimed to consumption; they facilitate the realization of useful acts which in their turn are also built on choices materialized in informational values as well. Each act generates information and consumes information, and how we want to describe it depends on the chosen point of view for the analysis. We can say that an item is the expression of order produced by labor and then that its informational value is *objective*, but also it is possible to say that the production of this item *cost basic* information, assuming that this information was provided by the producer's embodied context. This information which is the sum of experiences that the worker achieved individually and collectively is then consumed during the act of production. The information attached to the worker under the labor process is not energy nor is time; it is pure information materialized as social competence. A worker is not something natural, it the results of the whole complex process of choices that make us "human".

Let us ask now which is the existing relationship between the process of creating value and that of consuming it? We understand by "demand" the choices involved in the act of appropriating an item (acquiring, exchanging, etc.). These acts should not be confused with acts of consuming the appropriated item neither with the acts of producing the item. The acts involved in e.g. buying a kg of apples, have nothing to do with the acts involved in eating them and cultivating them. We will call the first kind of acts *technologies of the market*, the second kind of acts *technologies of consumption* and *the third kind technologies of production.*

Leaving the technologies of the market for a while we can say that the informational value inherent to the technologies of production of an item *tends to be higher than the informational value of the technologies of consuming it.* This is a historical law of the development of knowledge and experience or *modernization process*. We assume that originally, *these two values were close to each other*. The informational value of the production of e.g. a stone-knife is very similar to the informational value inherent to use it. For example, flint was used in the manufacture of cutting tools during the Stone Age. The cutting artifacts were produced by splitting the stone into thin, sharp fragments. This producing-splitting-act and the using-cutting-act of using the artifact in everyday life, were similar acts from the point of view of their informational value.

Presentation 23: A sharp tool from the Stone Age made with flint.

A very different case is that of a computer, the informational value necessary to its production is very much higher than the informational value necessary to use it. The more modern a technology is the greater is the difference between the production informational value and the informational value necessary to use it. We will call this difference the *operative informational value*. Comparing two technologies, the larger difference between them the deeper will be the item's modernity. Relating this to our earlier thoughts about the agnumetric value of an environment, we can say that the modernization process increments the number of items that are more and more difficult to produce and more and more easy to use. Assuming a constant level of information in both environments implies that information flew from the one to the many and from consumption to production.

The relation between informational value and price

Our standpoint is that there is no information *as a substance*; informational value is always *a specific order of items*. It is true that we can measure information, but as the ordinal numbers expressing the order and turn of choices, never as cardinal numbers as it were a homogenous substance. Because information is saved as order, forms, structures, designs, it is found in artifacts and services, in methodologies and technologies. The social information needed to produce an item, is therefore in the *choices made to produce it*. By the same reason, if the social information has been transformed into an artifact by the acts of workers, the informational value of the produced item is never included as a part of the product's physical manifestation. Information is always *in the choices made and nowhere else*. That means that the informational value of an item follows the flow of choices that a society makes.

It is possible to the see the process of valorization from two points of view: the point of view of the producer and the point of the consumer. Let us first see the valorization process seen *from the point of view of production*. In this case the informational value is produced by the actual choices of an act. The act produces informational value that is moved to the artifact during the embodiment process. If the artifact does not exist, it is created by this informational value. Let us secondly, see the valorization process seen *from the point of view of consumption*: if the artifact does exist –as when we buy an item—the informational value moves to the item as well, but no to create the item, but to sum the new value of usefulness to the intrinsic value of the item. Because the *multistability*[21] of any item, the productive-identity of an item does not need to coincide with its consumption-identity; that means that consumption adds informational value to the item. However, besides these two moments of enrichment of the item's informational value –production and consumption- a third moment must be considered: the market's informational value or *price*. The "market's price" works according to the principle of supply and demand. That means that demand increases the value of the item and this is what we call the *price* of the item. As we said above, the price (the informational value associated to buying and selling) is very different from the informational value of producing and the informational value of consuming an item. The price is defined by the demand and this demand is expressed as *money*. The historical development of money is associated to the process of modernization, according to which the amount of items in each environment tends to increase as well as the operative information; this complexity moves the barter exchange to the periphery. The price of an item is

[21] Don Ihde discovered an important particularity of the process of developing technologies which he named *multistability*. He explains multistability as the phenomena in which the "same technology takes quite different shapes in different contexts." Don Ihde. Janus Head: "Technologies—Musics—Embodiments": http://www.janushead.org/10-1/Ihde.pdf p. 13.

expressed in monetary units, as if the informational value of demand were a substance. Items without price are the expression of the informational value of production and consumption alone. That is the case of homemade products and also many out-of-date items. The decreasing market value of e.g. an old item is caused by an uninterested market, in which an increasing number of consumers move their decisions (information value) to new items.

To become a commodity and be expressed as a price, the item has to fulfill two conditions: *first* it has to be produced outside the family level of needs and wants in an amount of units that can satisfy a larger group of persons; *secondly* it has to achieve a level of quality which can be acceptable even by persons that are not members or friends of the family; both these demands are expressions of their high informational value. However, before becoming a commodity the item needs to exist as a *broken* one, as a *tentative* and more or less *fruitless* project. In this sense to cultivate potatoes at the family backyard is family labor (producing prototypes of commodities) as long as the informational level of the production is low. On the contrary, if the amount of information of the labor process rises to a higher level and the amount and quality of potatoes surpasses the needs of the family, the family backyard's production becomes *business* and the potatoes become commodities. This *knowing how* configures the informational level of labor in general and of human acts in particular. Another example could be the following: a family member can take care of a sick member of the family without being a health professional. At home it is possible to be a practitioner of folk medicine (including magic) without being a licensed medical doctor. But if this praxis shall be applied at the whole society and it is intended to be compared as a way to earn money, you will need a social license according to the standards of up-to-date technologies to practice medicine. In other words, to *dock to the social corpus* demands a specific informational value that is historically determined. Transcribing family labor to the social level as informational content, gives us some explanations. When family labor is competing in an open market, it has a lesser informational rank in society and has therefore the lowest salary standard. To work as e.g. a "house keeper" does not differ so much from the work at home; it demands the same level of knowledge and experience. These jobs fit in the category of *non-qualified* jobs and are usually announced, with the label of "no previous experience is needed". It is not difficult to trace these jobs in history; they have almost been the same situation throughout time, from the slaves of Antiquity to the modern housekeeper of the 20th Century.