Marx and the moral depreciation of technology

Labor value as information

Marx and the moral depreciation of technologies

For Marx, technologies are either tools or machines and both are physical things. He was interested in the study of their *intrinsic* labor value in the capitalist production process. He recognizes that the life of a machine depends first on two physical factors: 1) erosion by *use* and 2) corrosion by *abandonment*:

> The material wear and tear of a machine is of two kinds. The one arises from use, as coins wear away by circulating, the other from non-use, as a sword rusts when left in its scabbard. The latter kind is due to the elements. The former is more or less directly proportional, the latter to a certain extent inversely proportional, to the use of the machine. [1]

For Marx, the productiveness of a technology is "inversely proportional to the value transferred by it to the product. The longer the life of the machine, the greater is the mass of the products over which the value transmitted by the machine is spread, and the less is the portion of that value added to each single commodity."[2] We discover here some inconsequence; Marx acknowledges the transference of physical information and matter from the technological device to the product, which is clearly wrong:

> In the first place, it must be observed that the machinery, while always entering as a whole into the labor - process, enters into the value - begetting process only by bits. It never adds more value than it loses, on an average, by wear and tear.[3]

When Marx talks about "transference of value" he is talking about physical erosion by use and corrosion by misuse:

> By wear and tear (moral depreciation excepted) is meant that part of value which the fixed

[1] Marx, Karl. Capital ; A Critique of Political Economy. Volume I Book One: The Process of Production of Capital. Chapter 15: p. 273.
[2] Marx, Karl. *Capital ; A Critique of Political Economy*. Volume I Book One: The Process of Production of Capital. Chapter 15: p. 272. http://www.marxists.org/archive/marx/works/1867-c1/ch15.htm
[3] Ibid. p. 264-265.

> capital, on being used, gradually transmits to the product, in proportion to its average loss of use-value.[4]

However, Marx recognizes also a third "moral"[5] factor that depreciates the productivity of a machine:

> But in addition to the material deterioration, a machine also undergoes what we may call a moral depreciation. It loses exchange-value, either by machines of the same sort being produced cheaper than it, or by better machines entering into competition with it. In both cases, be the machine ever so young and full of life, its value is no longer determined by the labor actually materialized in it, but by the labor-time requisite to reproduce either it or the better machine. It has, therefore, lost value more or less. The shorter the period taken to reproduce its total value, the less is the danger of moral depreciation; and the longer the working day, the shorter is that period. When machinery is first introduced into an industry, new methods of reproducing it more cheaply follow blow upon blow, and so do improvements, that not only affect individual parts and details of the machine, but its entire build. It is, therefore, in the early days of the life of machinery that this special incentive to the prolongation of the working day makes itself felt most acutely.[6]

Observe that this "moral depreciation" of a technology is referring to the cognitive condition of human technological capacities at some point of history and not to any physical property. According to Marx, a machine bears the sign of a cognitive knowing-how which is short-lived. This knowledge cannot be measured in reference to any physical property and has nothing to do with the tears and wears of a device. If some measurement can be performed it must be the measurement of cognitive capacities expressed through praxical applications. From the point of view of the 21th Century, is easy to conclude that the problem with Marx' view is that it is too narrow and that the only essential depreciation of value which is interesting for a theory of labor value is that of "moral depreciation". Consider for instance the technology of a computer program; because it is not a physical thing, it will not erode or corrode; at the other hand, it would be its "moral life" the only intrinsic factor that decides its value. Considering only the moral depreciation of value, the productiveness of e.g. a computer program, depends on the time it is *irreplaceable*. In my terms, during that time it is a "whole technology" otherwise it would be a "broken technology". To have full value, the computer program must be unique in the market. In other words, the condensed work power that it contents, depreciates as soon as a contender program *works better* (meaning with "better" that it does the same work in a shorter time). Because we know that physical energy cannot be transmitted into the product, the question is if it is some transference of value, and in that case, which kind of substance is this and how is it transferred. Marx measurement is based in hours of work, the hours of the life of the persons involved in the production process. However these hours

[4] Capital. Volume II; Chapter VIII ; p. 100.
[5] Marx uses the term "moral" in the modern sense of "cultural". The term is very common from the 14th Century and after, meaning "pertaining to character or temperament", from Latin moralis "proper behaviour of a person in society," literally "pertaining to manners." (Online Etymology Dictionary).
[6] Op.cit. p. 273.

cannot be transferred to the product either. The product is not a time-container. The consumed time is paid out time for the worker and for the society in general but not for the device. For instance, considered as non-physical thing, the computer program can exist eternally. We believe that the correct substance of this created value is *information*, a concept which was not developed at the time of Marx.

Marx epistemology

During the years of Marx' intellectual development, the consequences of the Kantian revolution and its differences with the precedent Cartesian philosophy were not definitely established. It was necessary to wait until the work of Husserl to get this difference clear. As a consequence of this, Marx' thought oscillates sometimes between the empiricism of Natural science (Marx and Engels were clearly influenced by the epistemology of Natural Sciences) and the embryonic phenomenological methodology that they could found in Kant and Hegel. For that reason, I believe that some of Marx' ideas about labor value must be revised. One is that I would call the "container theory of value" according to which he understood the condensed labor in a commodity as *residual static energy* from a past time. The labor value of a commodity for Marx is inside the commodity which acts as a energy-container. A second idea to be revised has to do with Marx' own contribution to the field of philosophy: the concept of *praxis* or "knowledge in action". Marx distinguished between "commodity" and "technology" and did not see that *any commodity is a technology* and therefore, that they are both the medium and the consequence of praxis in labor. A theory of intrinsic value then must be a dynamic theory of value liberated in action. A consequence of this is that in the labor process only cultural products are involved to produce new cultural products; no matter if they are machines, tools or *materia prima*. For example, both "air" and "water" are cultural products from a phenomenological point of view. Being phenomenologically consequent, there are no "natural", pure objective items outside knowledge and it is therefore impossible to differentiate "intrinsic labor" from "labor as action proper". If a machine does the work of 200 men, then, there must be as 200 men "working inside the machine". The labor value is not "saved or condensed value", is always "active value". Marx' mixing of different perspectives of analysis, changing unexpectedly from empiricism to phenomenology and vice versa, affect also other aspect of his theory as the understanding of concepts as "exchange", "value" and "price". For Marx "value" is sometimes a *natural magnitude* (empirical fact) and sometimes a *moral multitude* (cultural phenomenon). In some part of Marx' discourse, his materialism become physicalism. This misunderstandings need to be corrected introducing the definition of labor value (and action value in general) as *information*. Notice that one of the most important consequences of the modern use of the term" information" had some importance to Marx materialism:

> The mechanical brain does not secrete thought "as the liver does bile" as the earlier materialist claimed, nor does it put it out in the form of information, as the muscle puts out its activity. Information is neither information, not matter nor information. No materialism, which does

not admit this, can survive at the present day.[7]

Rafael Capurro introduced a very interesting connection between the technological meaning of information and the phenomenological field of philosophy[8]. According to Capurro, information is *fragmented intentionality*. Capurro understands the modern age of informatics as postmodern phenomena, which can be found already in the philosophy of Husserl and Heidegger. Another important difference is that communication of information leaves behind the opposition between object and subject and substitutes it with inter-subjectivity and context; in the new reality the informational content is not attached to a subject.

Information is the substance of labor

Let us here, study closer which kind of "substance" is labor. It cannot be considered a natural substance, as if it were natural "energy", because the physical energy involved in the physical act of labor is completely consumed in the labor act. If some labor energy can be found into the product of labor, it cannot be of a physical nature. We can conclude then, that the physical and the moral spheres of reality are independent from each other. If labor cannot be a physical substance, the only open alternative is that of considering it as *information*. Let us be more specific because the concept of "information" is used in different contexts. It is used in connection with natural sciences and technology with a specific technical signification and in social and human sciences with among others meanings: advise, reportage, testimony, communication, explanation, advertency, inquire, etc.[9] The term comes from Latin and originally meant "to form" something. It can be found already in Publius Vergilius Maro and after him in Augustine and Thomas Aquinas. Later it appears again in Descartes and the new philosophy showing already the two main different meanings, at one hand, "to form matter" and to the other hand "to communicate something to someone". In our times, the term became fixed in association to the theoretical and technological developments in the fields of mathematics, communication technologies and computer science and to the names of men of science as Norbert Wiener, John von Neumann and Claude Elwood Shannon. Especially important is the book by Shannon *A Mathematical Theory of Communication* from 1948. Shannon distinguished the meaning of the term "information" from that of the term "meaning". According to Shannon, "information" does not need to be meaningful. "Information" to Shannon is the measure of a "difference" between signals. The binary difference between "yes" and "no" is the simplest of all possible contents of information. This measure defines a binary unit or "bit". The richer the amount of alternatives, the richer will be the content of information in the message. I will follow in this article a meaning of information defined by Wiener according to which information is the expression of at one hand "organization" and "order" (that is the structure of a cluster of connected alternatives) and at the other hand a measurement of "communication".

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[7] Norbert Wiener. *Cybernetics*, 2nd edition, p.132 . MIT Press, 1961.

[8] Capurro, Rafael. *La Hermenéutica y el Fenómeno de la Información.* Cuaderno de psicoanálisis freudiano 8, 1987.

[9] A complete study of the history and the definitions of the term can be found in: Capurro, Rafael and Hjørland, Birger: *The concept of Information*. Annual Review of Information's Science and Technology. Ed. Cronin. Vol. 37, 2003.

> Messages are themselves a form of pattern and organization. Indeed, it is possible to treat sets of messages as having entropy like sets of states of the external world. Just as entropy is a measure of disorganization, the information is a measure of organization.[10]

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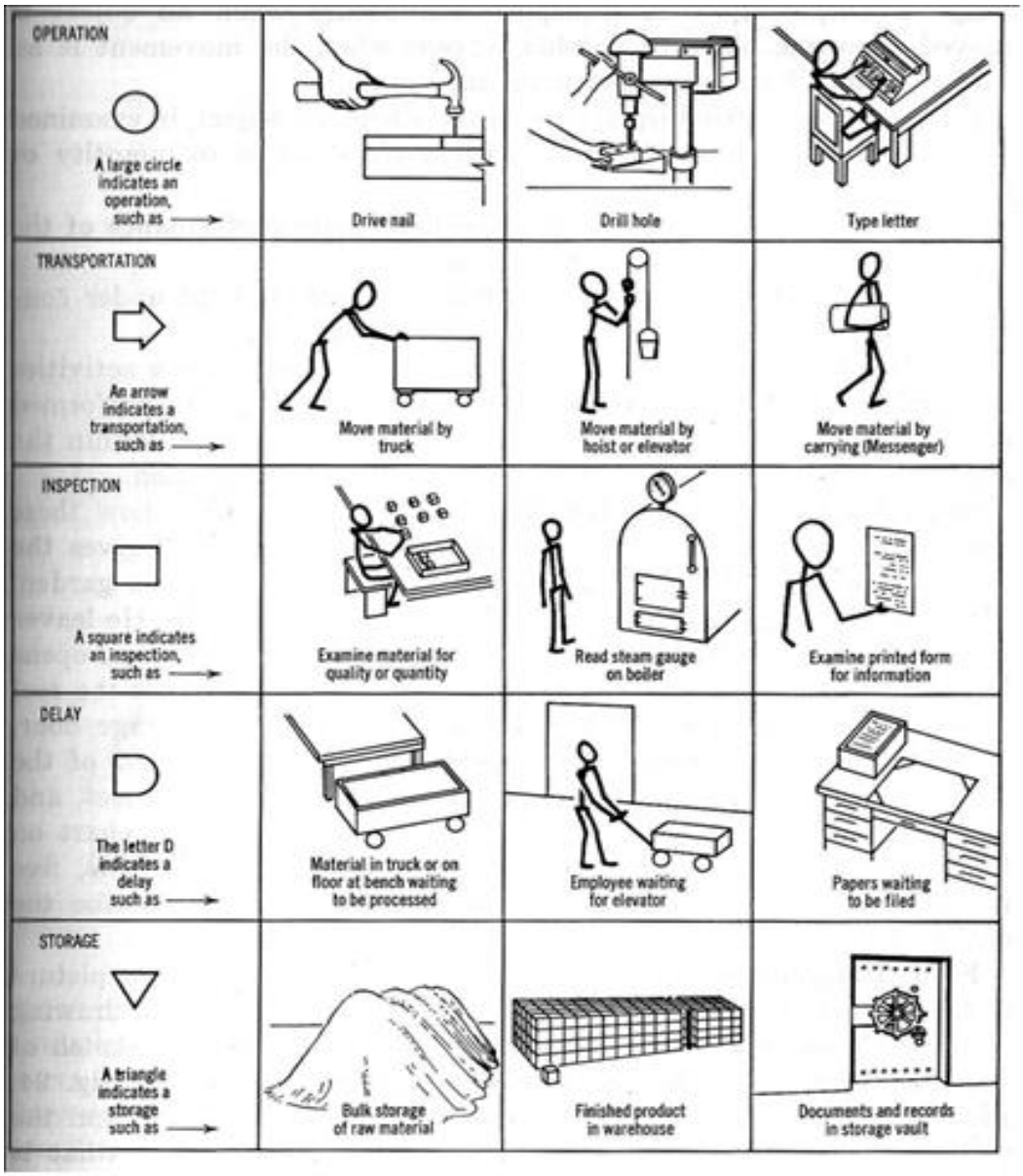
Absolute **and** ***Relative*** **labor value**

The informational value of a task produced by labor and measured through the *actual options* involved in the global process, is *absolute*. This value is independent of the time and place of the task and therefore is also independent of the price of it (device, result, commodity, etc.) in the market. The absolute value of the task is a percentage of the social informational value for a specific historical period for just this task. By the development of knowledge and experience, the number of options necessary to produce the task diminishes and with it, diminishes the absolute value of the task. This second value is also *absolute*. However, the comparison of the earlier and the actual value give us the relative value of labor. This relative value is the measurement of *modernization*.

I believe that it is possible to learn from the work of Taylorists and others in their study of the measurement of the movements and time during the labor process. I believe that he program of "scientific management" started by Frederick Winslow Taylor (1856–1915) –and aimed to improve "modernity" and assure "progress" –can be revealing for our own project. In 1911 Taylor published *The Principles of Scientific Management* starting the study in detail of the labor process. I believe that is possible to convert their results into a theory of labor value as information. Ralph M. Barnes[13] and others, develop a methodology to study the different aspect of the labor act reducing it to a few

[10] Wiener, Norbert. *The Human Use of Human Beings. Cybernetics and Society*. New York, 1967.
[11] Capurro, Rafael och Hjørland, Birger: *The concept of Information*. Anual Review of Informations Science and Technology. Ed. Cronin. Vol. 37, 2003.
[12] Capurro, Rafael. *La Hermenéutica y el Fenómeno de la Información.* Cuaderno de psicoanálisis freudiano 8, 1987.
[13] Barnes, Ralph M. *Motion and Time Study. Design and Measurement of Work*. New York, 1963 .

moments. Barnes used symbols denoting some fundamental stages of every labor process: *operation, transportation, inspection, delay* and *storage*.



Presentation 1: 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. In information theory, one bit is typically defined as the uncertainty of a binary random variable that is 0 or 1 with equal probability. En bit is the unity of information and is defined as log2 Pk in which Pk is the probability of the event k to happen. A very likely event implies little information while a very unlikely event implies high information. 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

By the same reason if the choice is between to different kind of acts as to choice between transportation and inspection, the information involved in the act is of 2 bits:

Transportation	**Inspection**	**Code**
Yes	Yes	11
No	Yes	01
Yes	No	10
No	No	00

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

Choice moments	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

Let us here follow one of Barnes' examples. Barnes tells us the case of Mr. John Smith, who decides to water his garden. I divided the act of watering in 9 stages each step produces more information:

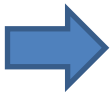
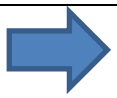
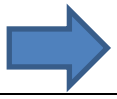
Action	Symbol	Description	Distance	Time
1		Move to the garage's door.	25,5 m	30 s
2		Open the door.		5 s
3		Move to the tool box.	3, 0 m	15 s
4		Open the tool box.		5 s
5		Move to the back door of the garage.	4,5 m	15 s
6		Open the back door.		5 s
7		Move to the faucet.	3, 0	10 s
8		Connect the hose to the faucet and open it.		15 s
9		Water the garden.		1800 s

Table 1: John Smith, watering his garden

Consider two possible solutions to Table 1; the first produces 4 bits:

Move to the garage's door	0000
Move to the tool box	0001
Move to the back door of the garage	0010
Move to the faucet	0011
Open the door	0100
Open the tool box	0101
Open the back door	0110
Connect the hose to the faucet and open it	0111
Water the garden	1000
With a rest of 7 free options	...

The second solution consumes 2 bits + 3 bits; 4 Transportations: 2 bits and 5 Inspections: 3 bits.

Move to the garage's door	00
Move to the tool box	01
Move to the back door of the garage	10
Move to the faucet	11

Open the door	000
Open the tool box	001
Open the back door	010
Connect the hose to the faucet and open it	011
Water the garden	100

The measurement of relative labor value

Let us distinguish between the *moral-value* as the relative measurement of two qualities or also the *ratio* between *multitudes* from a *price-value* which would be the consequence of the *rate* of *magnitudes*. A *ratio* is a multiplicative relation between two natural numbers different from 0. We are talking about "two to three", "4 to 10", "6 to 5", etc. For example, if a group of people there are 18 adults and 27 children, we will say that the ratio between the number of adults and children is "2 to 3", i.e., that "there are 2 adults for every 3 children". In this case, the ratio between the number of children and adults is the inverse, "3 to 2", i.e., that "there are three children for every 2 adult". It is necessary then, to distinguish between the concepts of *ratio* and *rate*. The latter refers to the relationship between the part and the respective whole. In the example above, 2/5 represents the rate - already simplified - corresponding to the number of adults (18) with respect to the total of people present (18 + 27 = 45). The concept of rate is the relationship between the parts to the whole. Marx starts his study of exchange between use-values considering then as *ratios* and *proportions* but then he changes directly to consider them as *rates*. Let us see how Marx makes this jump; in the following text, Marx tries to justify the abstract labor theory of value:

> If we say that, as values, commodities are mere congelation of human labor, we reduce them by our analysis, it is true, to the abstraction value; but we ascribe to this value no form apart from their bodily form. It is otherwise in the value relation of one commodity to another. Here, the one stands forth in its character of value by reason of its relation to the other. By making the coat the equivalent of the linen, we equate the labor embodied in the former to that in the latter. Now, it is true that the tailoring, which makes the coat, is concrete labor of a different sort from the weaving which makes the linen. But the act of equating it to the weaving reduces the tailoring to that which is really equal in the two kinds of labor, to their common character of human labor. *In this roundabout way, then, the fact is expressed, that weaving also, in so far as it weaves value, has nothing to distinguish it from tailoring, and, consequently, is abstract human labor.* It is the expression of equivalence between different sorts of commodities that alone brings into relief the specific character of value-creating labor, and this it does by actually reducing the different varieties of labor embodied in the different kinds of commodities to their common quality of human labor in the abstract.[14]

The jump from a phenomenological perspective to an empiricist perspective makes the "ratio" a "rate". From the consideration of their respective "sizes" inside a "proportion", Marx jumps to a relation between the "part and the whole". Making this change, it is inevitable to confuse "moral value" with "price value". "Price is the money-name of the labor realized in a commodity."[15] This confusion has lead Marxism to a fruitless searching of a method that permits the calculation of price from intrinsic labor.

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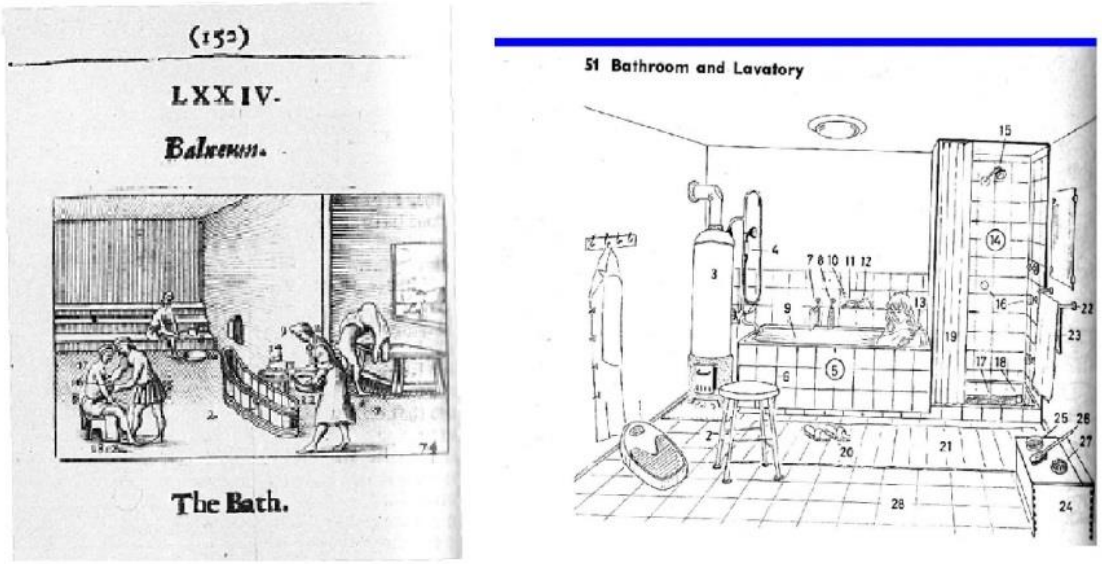
[14] Karl Marx. Capital Volume One. Part I: Commodities and Money. 1. The two poles of the expression of value. Relative form and Equivalent form. Cursive mine;
http://www.marxists.org/archive/marx/works/1867-c1/ch01.htm#S3a

[15] Op.cit., Chapter 3, p. 69.

Aganometric value as a measure of archaicity respective modernity

I will refer as *aganometry* the measure of the brokenness of an environment; from *aganos* the Greek word for "broken".[16] 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, dividing the archaic value (AV) with the modern value (MV), the *relative brokenness* of the renaissance milieu with respect to the contemporary milieu will be 1/2. We say that the *aganometric value* @ of the particular milieu of Renaissance, with respect to a particular contemporary milieu with respect to a certain task/environment is @= 1/2



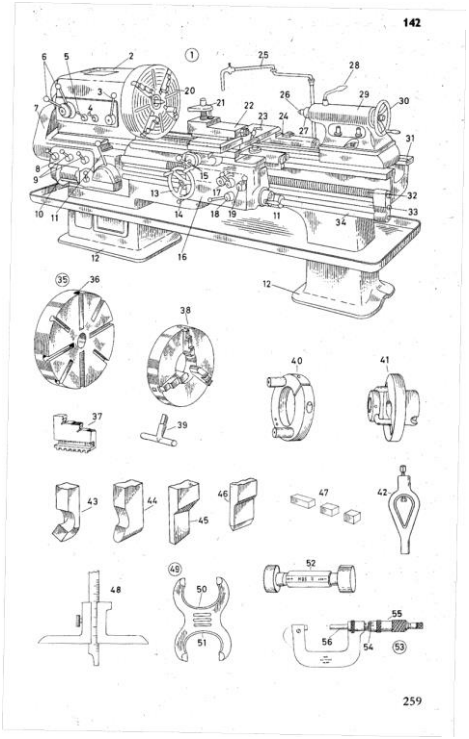
Presentation 2: The bath now and then. To the left the "bath" according to Amos Comenius, *Orbis sensalium pictus. Den synliga werlden. Le Monde Visible*. På Latin, Swenska och Fransyska. Stockholm, 1796; and to the right, the "bath" according to the *Duden Bildwörterbuch, 1960.*

In **Fel! Hittar inte referenskälla.**, Amos Comenius presented a bath from the 18th Century 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 aganometric value is 18 (AV)/28 (MV) = 0, 64 @ is. We notice that @= 0 could represent the "absolute contemporaneity" of two environments; further, the value @= 1, will mean the opposite, the "absolute archaicity" of the older in respect to the newer. If we invert the quote putting the modern first, 28 (MV)/18 (AV) = 1, 55 1/@, the numeric expression 1/@ could be interpreted as the "wholeness value" (Greek

[16] Aganos, on, (agnumi); *broken,* xulon a. sticks *broken for firewood,* S.Fr.231. Henry George Liddell. Robert Scott. A Greek-English Lexicon revised and augmented throughout by Sir Henry Stuart Jones with the assistance of Roderick McKenzie. Oxford. Clarendon Press. 1940. Perseus Digital Library. http://www.perseus.tufts.edu/hopper/

athroos[17]) or *modernization value* of a technological environment.

Unfortunately, in real situations, the things to be counted are not previously numbered as in our examples. So, how to measure the things around me? The problem is serious, because the world of things has parts and these parts are also things. Everybody knows by experience that some of these parts can easy be listed as "things" but most of them are in a grey zone. We can say that the number of parts of the things of the world are "too many", that means, much more that anybody could count; they are therefore "infinite" in a pragmatic sense of the word. The solution could be to count only "wholes" and never "parts", or to define what parts can be counted as "parts" and which not. With other words, the solution is pragmatic but the results can be usable if the criterion used is applied with consequence. There is one case in which the parts must be counted, and that is the case of the machine. The essential difference between a tool and a machine is that the machine consists of parts working together. So, we must expect a very high @ value comparing an archaic procedure that uses tools with a modern procedure that uses machines.



Presentation 3: the complexity of a machine with respect to the tool. From *Duden Bildwörterbuch, 1960.*

We notice that the evolution of praxis from archaic to modern solutions, involve some times more artifacts than before, as in the case of the machine with respect to the tool, but 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. In this last case, the value

[17] athroos , a, on, (os, on D.19.228, *Arist.PA675b21*, etc.), hathroos in *Hom.* acc. to *Aristarch.* ap. Sch.Ven.ll.*14.38* and Att.(also some times hathrous , oun, as *Ar.Fr.633*, Hyp.Eux.33, D.27.35), poet.acc.pl.

of @ will be bigger than 1. We could say, that when @ < 1, the historical evolution of praxis as "progress" has enriched the world of artifacts, while when @ > 1, the rise of modern world has simplified the lifeworld reducing the number of involved artifacts which could be interpreted as a movement *to more basic technological environments than the archaic* (which is expressed by @=1) That means that it would be necessary to distinguish two different cases of modern technological environments. For example, a remote control with a few alternatives to choose will be simpler than one with more alternatives without being archaic. That means that, if the aganometric value shall be used to measure modernization it must also be two concepts to distinguish the modernization process: "modernization by enrichment" from "modernization by simplification".

@ < 1	**@ > 1**
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.
Introduction of machines instead of tools.	Dressing during the 18th century with respect to the dressing of today.

But, why enrich sometimes and simplify in other cases? I discover that in fact, *it is the same procedure* in both of the situations. In the case of enrichment, modernization implies the substitution of one or more tools by a machine. So, the first moment is that of simplification of the whole technological environment by substituting one point in the structure by a complex item. The phenomenon enlarges the amount of parts but at an incongruent level; with other words, in another dimension. However, with the introduction of complexity in the form of a machine, the whole process becomes enriched by the *aggregation of a new dimension* to the original one. In fact this is the way *progress* works, expanding the phenomenal world till new dimensions.

In the case of modernization by the simplification of a technological environment, some tools are eliminated or they are substituted by a less number of new tools/functions. In this case, progress works through the archaicization of an archaic technological environment producing a *meta-archaic* dimensional context.

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Marx, Karl. *Capital. A Critique of Political Economy. Volume II Book One: The Process of Circulation of Capital.* Edited by Friedrich Engels Written: in draft by Marx 1863-1878, edited for publication by Engels; First published: in German in 1885, authoritative revised edition in 1893; Source: First English edition of 1907; Published: Progress Publishers, Moscow, 1956, USSR; Transcribed: by Doug Hockin and Marxists Internet Archive volunteers in the Philippines in 1997; Proofed: and corrected by Andy Blunden and Chris Clayton (2008),

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