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THE TECHNOLOGICAL THEORY OF VALUE: Towards a Framework for Value Management

Dan A. Seni, P. Eng., Ph.D

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ABSTRACT

The paper focuses on a discussion of the pluralism of value. It briefly outlines some of the theories of kinds of value, and proposes how they can be integrated so as to influence our understanding of the way value management is practiced. It sketches out what is known from the general or philosophical theory of value, the psychological theory of value, and the economic theories of value, and builds on them to suggest how the value management might operationalize the idea of *technical value* that the community implicitly purports to improve.

1. INTRODUCTION

What do we need to know about value in value engineering, value management and the other value disciplines? Obviously a lot, since, in practice, these all involve designing, creating or improving the value of things. The ideas of improvement of the value of artifacts through engineering, design, and the innovation of systems requires that practitioners and technologists *look upon value as a technological attribute* of the things they make. In other words, we need a technological concept of value in value management.

A quick perusal of the pertinent literature shows that, apart from basic ideas of the notion of “quality” arising from the “quality movement” in management there is little in the way of a clarification, let alone any formalization, of the notions of technological value. The very basic idea of value is itself, it appears, taken to be self-evident. And, of course, as is often the case with self-evidence, there is much avoidable confusion. In this paper we shall first sketch out some of the things we do know about value that comes to us from a study of the various fields that deal with the topic. We will then build on these and point the way towards an eventual concept of *technological value*.

2. THE STUDY OF VALUE

Value (i.e. that which is good and is right) has been a subject of reflection from the beginning of recorded thought. For purposes of exposition we shall consider how organized bodies of knowledge deal with value and what, on the whole, we may usefully derive from what they have to say. This organization, in turn, is reflected in the theories of value in the respective fields and in their evolution.

Theories of value fall into three broad classes, as shown in Figure 1: (a) general or philosophical theories of value; (b) scientific theories of value; and (c) technological theories of value. They vary according their respective breadth and level of generality; philosophical theories being the most general whilst scientific theories are the more specific. They also vary as to the kinds of questions they answers they provide.

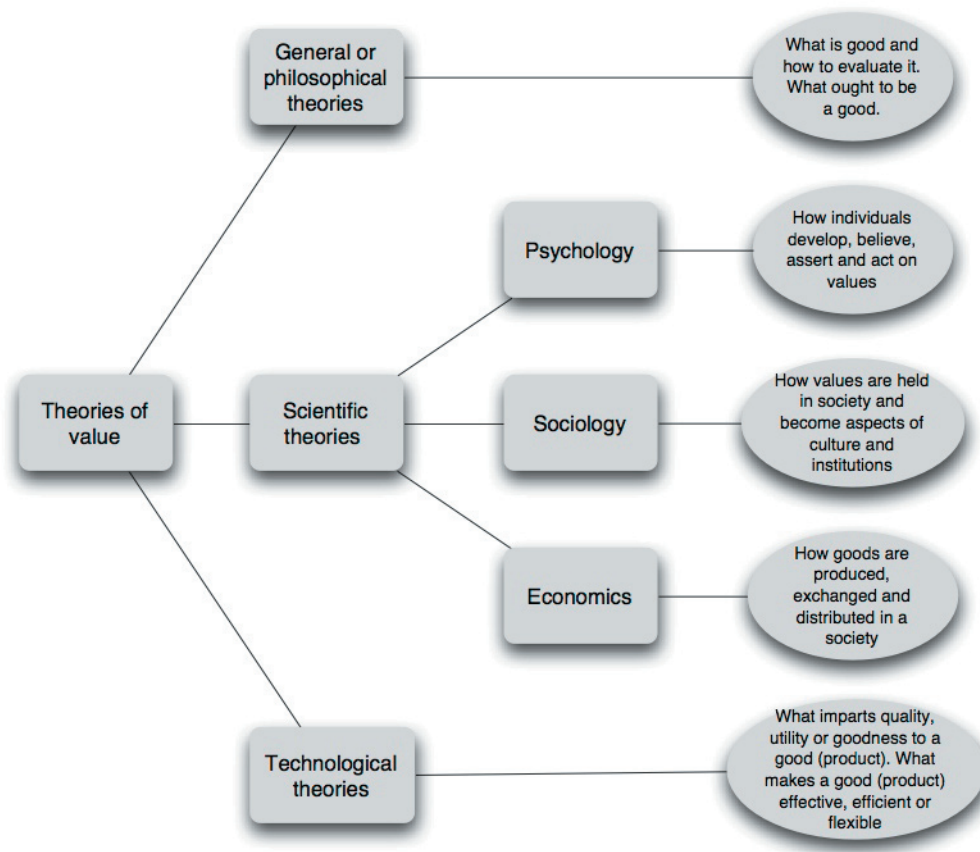


Figure 1: The organization of the study of value.

Axiology or the general or philosophical study of value

Axiology or the general philosophical study of value raises and attempts to deal with the following kinds of questions:

- What is the value or the goodness of a thing? Is it a quality, an essence, a property, a sen-

sation? Is it material or ethereal?

- Is the value of a thing an objective quality (objectivism) or is it a mental construct or sensation (subjectivism)?
- Are there different kinds of value (value pluralism) or are they all reducible to a single kind (value monism or nominalism)?
- Are there ultimate values from which all others can be derived or are values incompatible?
- How does one value and evaluate? Is it by a mental act? Is it by an affective act? Is it by an emotional act?
- When does one value and under what circumstances?
- Is valuation cognitive, emotive or instinctive?
- Are there collective or systemic values or are all values individual, so that social value is simply the aggregation of individual value (utilitarianism as moral theory)?
- How is value manifested: Pleasure (hedonism)? Happiness (eudaemonism)? Or utility (utilitarianism)?
- What is a life of value, that is, what is a good life (ethics)?
- What are the virtues or the qualities of goodness in a life well lived (ethics)?
- Is man the only animal that values things and that evaluates them or are there other animals that do so (science)?
- Does value precede or pre-exist action or can new values be *created* by action? In other words can new value emerge from the activity of men or is all value preordained and predetermined (moral theory and technical axiology)?

Many of these questions touch on basic and complex issues raised in the study of ethics and moral theory. We shall not attempt to deal in any depth with them here. However, even this partial list illustrates an important point: both ethics and moral theory rest in turn on concepts of the good and the bad, the good and the evil, the right and the wrong, the just and the unjust. In other words, both ethics and moral theory require an axiology or a theory of value.

The scientific study of value

The life sciences logically precede and deal directly with value and the goal-directed or regulative mechanisms in the living world upon which all other theories of value, including those of the social sciences, rely. On the other hand, every one of the social sciences rests on, and deals with, concepts of value. And every social science is both descriptive in addressing how value is actually organized in social institutions, and it is normative as well, in the sense that it deals with how value ought to be reflected in an ideal society. The sciences of value are covered by at least the following fields:

(1) *Human and animal psychology* (ethology) deals with how humans and animals value and evaluate the things that meet their needs and wants, and how their behavior is directed at meeting them. The grounding of psychology in biology and the idea that the biology of an animal drives the need for individual welfare is taken as a general axiom underlying all of psychology: Every living organism, from the simple paramecium to the complex mammal (of which man is, of course, one among several species) behaves so as to attain

and maintain a state of well being conducive to survival and reproduction. Thus various kinds of things are valuable to every living organism. And every living thing values some things positively (thus contributing to its welfare) and values others negatively (which reduces its misery). The behavioral impulsion towards wellbeing in the animal is genetically programmed, therefore, on what it *needs* and *wants* to survive well and reproduce in a given environment. *Needs and wants, in a given environment, drive behavior and are at the origin of value.*

(2) The *sociology* of value deals with how collective values such as tolerance, reason, justice, freedom, benevolence, dignity, and others, emerge and develop, how they are coded in culture and in social norms, and how they are embodied in the organization, the structure and the institutions of a society.

(3) The *economic theory of value* deals with the social organization of the production, the distribution, the exchange and the consumption of things of value in a society. In particular, it deals with how productive and exchange relations ought to be organized in an ideal society.

The technological study of value

Technology involves embodying value or goodness in an artifact in the form of a “product”. Thus the technological study of value deals with issues related to the practical value of things and artifacts, and how issues of value arise in the invention, the design, the making, the production, the sale and the use of practical things, artifacts, or products.

The axiology or general theory of technological value deals with three fundamental kinds of practical value, namely *effectiveness*, *efficiency* and *flexibility*. These basic or fundamental technological values are:

Effectiveness or goal attainment is an end-to end comparison involving the relation of actual to ideal state or performance.

Efficiency or the economy of means is a means-to-ends comparison involving the relation of the economy of means to the achievement of an end.

Flexibility or polyvalence and adaptability to alternative options or uses is a means-to-means relation involving the capacity of an artifact to serve several possible ends.

The technological theory of value (Seni, 2000) is the least understood and least developed of the fields of study of value, although, of course, all fields of technology and engineering deal implicitly with the practical value of things. The sole area of technology that focuses deliberately on the value of systems in an explicit and general way are the disciplines of value engineering and value management.

3. PHILOSOPHICAL AXIOLOGY OR THE GENERAL STUDY OF VALUE

This is a large area covering ethics, moral philosophy and political and social philosophy. Histor-

ically, the area originated in Antiquity and is still very much alive among modern moral philosophers. For purposes of exposition we shall keep to a few simple ideas derived from a *realistic* (as opposed to an *idealistic*) and a scientific or *objective* (as opposed to a *subjectivist*) conception of axiology.

An objective theory of value, as proposed for instance by the philosopher of science Mario Bunge (1989) rests first on the fact that reality is independent of perception. If an animal does not exist to perceive it, reality is nevertheless there. Moreover, real things have objective properties many of which cannot be changed at will, yet which can all in principle be observed, learned and known. As a consequence, men can act on some of these properties while others may be fully invented and completely created anew. Again, these properties are characteristic of real things not of our perception of them.

An important class of properties pertains to those aspects of things that contribute to the wellbeing, the needs, and the wants of animals. These are *good* or *valuable* for them; they *have value* for them.

The value of goods is then explained as an objective relationship between the attributes of things, human knowledge and judgment about these attributes, subjective attitudes and beliefs of how these attributes can satisfy needs and wants and explicit judgments in knowledge about their effects and consequences. Thus a fundamental and oft confused axiological distinction needs to be made between the three different but related concepts of *value*, *valuation* and *evaluation*:

- *Value*: is an objective property of the relation between an animal and the properties of a thing. A thing is of value to someone.
- *Valuation*: is an attitude or subjective act or disposition of an animal in favor of a particular value relation.
- *Evaluation*: is a cognitive act of judgment concerning the value of a thing to an agent.

Value as an objective property.

Obviously, if value is an objective property, then one can rightly inquire as to its location. An ancient debate, still very much with us and which still persists to this day, concerns whether the value of a thing is *intrinsic*, that is, “in the valued object”, or whether it is *extrinsic* or “in the subject” that does the valuing. A realistic, objective response is that the value of some thing to some animal is neither a quality contained in the object nor is it solely in the animal; it is *in the relationship* between the extrinsic or objective properties of the thing and the subjective or intrinsic needs and wants of the organism. Value is objective because both the property of the object, the fact of valuation and the relation between object and valuation are all objective facts.

Only animals or organisms entertain relations of value between the properties of things they interact with and their need to survive and thrive. In other words, only organisms behave so as to regulate their action to meet *needs* and *wants*. Only organisms are open to an environment and goal-directed.

Human beings, like all living organisms have needs and wants. By virtue of being alive, humans have needs, some of which may be particular to each individual. Humans do not exist outside

of reality - their needs and wants express their search for continuous improvement in living. Some needs are basic and universal, like water or air; other needs may be individual, like eyeglasses. Needs are objective in the sense that knowingly or unknowingly they are constitutive of wellbeing. They are “subjective” in the sense that they are felt or are believed to be the case. The “subjectivity” of needs, wants, and value is an objective fact of valuation.

In this regard, a thing of value meets some need by the *function* it performs in the meeting of the need of the organism. *The function is valuable, not the thing itself.* The function of the thing again is objective and relational, that is, it is characteristic of the interaction between an organism and the properties of an object. Figure 2 illustrates and summarizes some of these ideas.

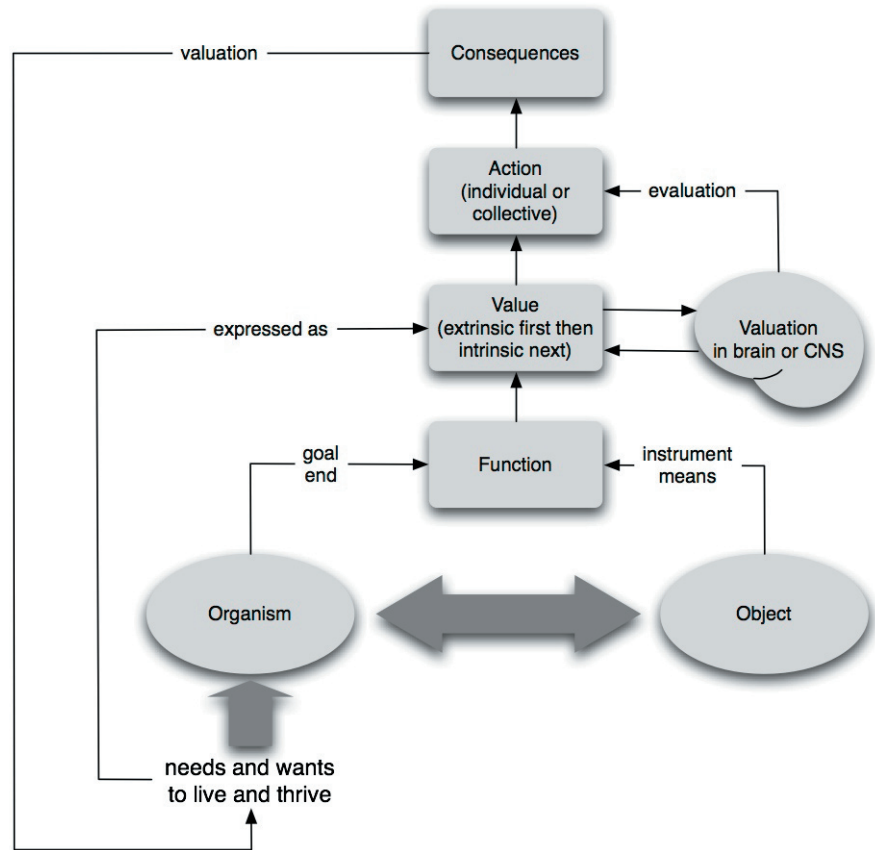


Figure 2: Value as an objective relational property of the function of a thing for an organism.

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Valuation or the attitude of valuing or believing in value

Once a certain level of development attained, an animal manifests and expresses dispositions, drives and instincts of value and disvalue towards things. They thus have positive and negative attitudes, and in the case of man, beliefs, concerning things of value. These attitudes express acts of *valuation*, wanting or desire. Wanting and desiring require a level of self-consciousness and cognitive development and a degree of psychological development that relies both on the rational and the emotional development in the animal (Damasio, 2003).

This underlines the idea that every living organism values what allows it to live and thrive. The roots of value then are biological, not social. Figure 3 summarizes the evolution of valuation in living organisms across the phylogenetic scale. Figure 4 proposes a simple classification of the various kinds of value.

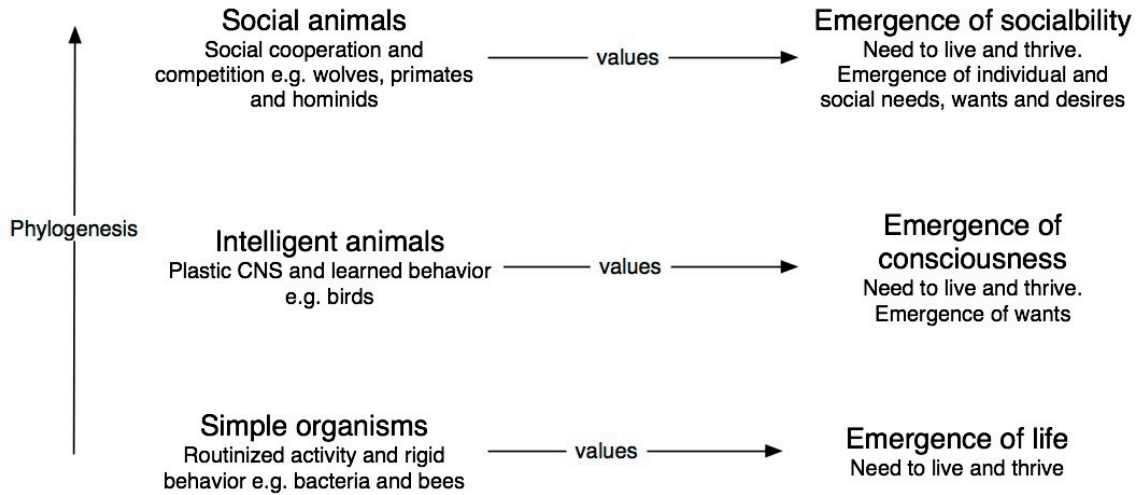


Figure 3: Value and biological evolution

Evaluation or value judgment

Human beings live and improve by dint of knowledge and reason. Unlike most animals, they do not satisfy their needs by purely by instinct (except for the most basic needs), but (1) by their knowledge of the facts of reality, and (2) by the use of that knowledge to judge the means for satisfying their needs and wants, and (3) by the rational weighing of both the means and the ends. In other words, they not only value things by dint of attitude and belief, but evaluate them in knowledge as well. The capacity to know leads men to deliberate, to evaluate, and to judge

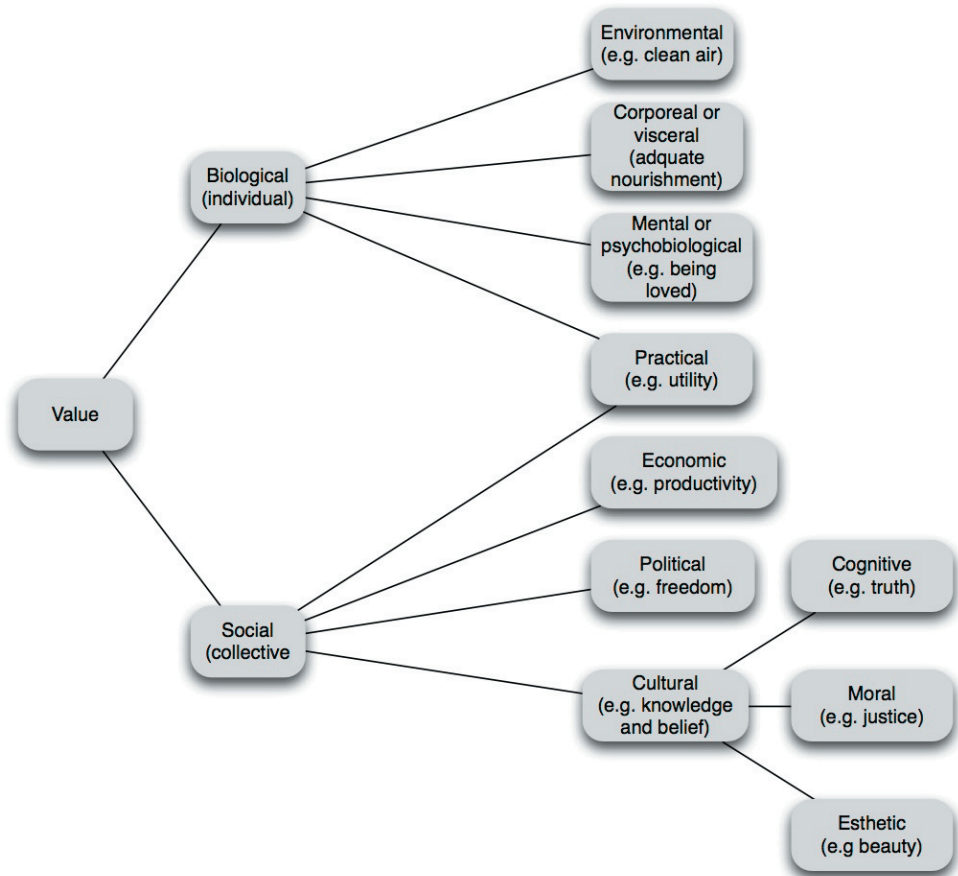


Figure 4: The plurality of values: A simple classification

value according to the consequence of their action and behavior on their circumstances.

The following example illustrates some the preceding ideas: A Neolithic hominid hunter *needs* meat for nourishment; because of its caloric value, meat has *objective value* for him. He also *values* the food as taste. He observes that a stone falling on an animal may kill or injure it. After a number of such observations, he may conclude that a striking stone has the property of killing an animal. This becomes part of the hunter's *knowledge* or *belief*. Because of this belief, stones also have *value* to him as a tool for hunting. The *objective value* of the stone is its *function* as a weapon. Its value is in allowing the hunter thus armed to kill animals. This requires both the extrinsic property or value of stone, as well as the subjective or intrinsic property or valuation by the hunter. The extrinsic property of stone is its hardness and heaviness and possibly the property of having an edge. The subjective *need* for nourishment has to be present as well. Armed with his knowledge the caveman is able to *evaluate* stones for their fitness as tools for hunting. Eventually he may even be able to modify stones by cutting their shape. He thus becomes able to *create new value*, as he becomes a toolmaker.

4. THE PSYCHOLOGICAL STUDY OF VALUE

The literature on the psychology of value is large and there are innumerable schools of thought, clinical and experimental, concerned with the relation between perception, cognition and emotion, and the behavior of individuals in various social settings. For the sake of brevity, let us restrict the discussion to one of the best-known models of needs-based action and development in human psychology, Abraham Maslow's and Lawrence Kohlberg's model. Figure 5 summarizes the model.

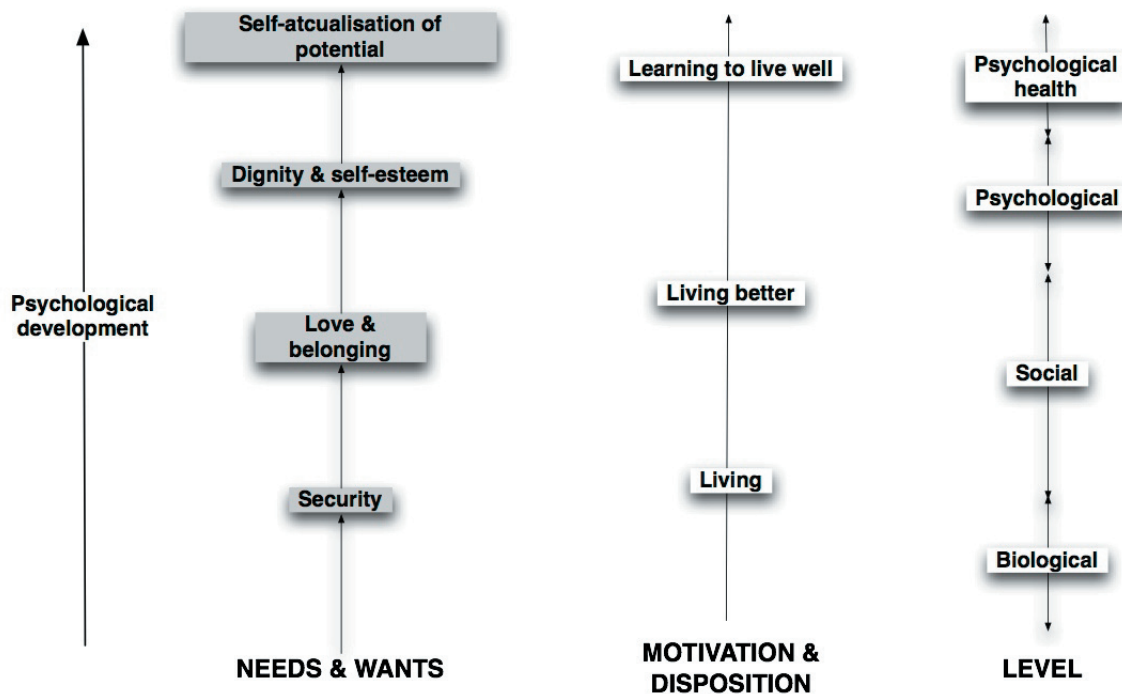


Figure 5: Maslow & Kohlberg's psychological axiology

The model is based on the idea that the *behavior* of the individual is triggered by *motivations* that are in turn determined by the organization of *needs*. This is true in general, and is a property of human nature, that is, it is a property of man in the biological state.

Needs and wants are organized by priority and level – first comes basic needs, then those of a secondary order, tertiary order, and so on. A need becomes “active” when those below it have been met or satisfied. As long as a need is not met, it remains active.

The model is also based on hierarchical threshold effects. At any given time, the needs that motivate action depend on two factors: (1) the more a need is met, the less active it is. A need that is fully met is no longer active. (2) As Figure 5 shows, needs are hierarchically organized in levels, from the most basic or biological to the self-reflexive or psychological.

The psychological axiology in the Maslovian model has a number of inherent limitations. First, it is individualistic, that is it interprets value in terms of individual needs and desires. It explains action in terms of means and ends rather than as the result of valuation, evaluation and attempts to achieve valuable states. Second, it is often interpreted as subjectivist in that value resides in the individual and his psychological states. In particular, it tends to lead to reduction of value to pleasure and desire, with no reference to the properties of the object. Thus psychology often is misunderstood as proposing a needs-based but relativistic theory of value.

5. THE ECONOMIC THEORY OF VALUE

Psychological axiology deals with *individual value*, while economic axiology deals with *social value*. In fact, on the one hand, the theory of economic value deals *descriptively* with how things of value are produced, distributed, exchanged and consumed in the economy. On the other hand, it deals *prescriptively* with how an economy and a society ought to be organized so as attain the highest level of social value or welfare.

There are two main classical theories of economic value. Both have their roots in the Enlightenment. These are the *price theory of value*, on the one hand, and the *labor theory of value* on the other. To each of these, there corresponds a social utopian régime or an ideal of how society ought to be organized; *classical liberalism* is the utopia of the first, and *classical socialism* is the utopia of the second. All actual modern economies are variations, combinations and permutations of these two economic themes.

Again, for the sake simplicity let us restrict our comments to these two main schools of thought.

The price theory of value and classical liberalism (Smith, 1776)

The price theory of value traces its lineage from the medieval scholastics to the French physiocrats of the 17th and 18th centuries, to Jeremy Bentham and the British utilitarians, then to Adam Smith, its most articulate spokesman, and on to the economists Jevons, Walras, Marshall, Dupuit, Edgeworth, Pareto and the other founders of the marginal utility theory of price. Most modern economists are neo-classical liberals.

Today, for most people, and for the average economist as well, the value of any thing is what it

will fetch in the market, that is, its exchange value. Thus most would agree with the distinction we owe to Aristotle between the *value in use* or the *utility* of a good and its *value in exchange* (Aristotle, Politics 1257a). Most would also agree with him that these values are different. And most economists agree that economics ought to deal only the latter since the former is an individual matter, not a social one. Most would say, then, that the value of a good in a given economy is the value that society determines it should have, and that this value *is the same* as its *price*.

A more thoughtful and deeper social philosopher such as Adam Smith would agree. This is indeed the case, he clearly explained. *However, he would point out that this is true only under certain very strong conditions! Only in the ideal classical liberal society is the value of a good the same as its price.*

The ideal society requires the following conditions:

1. That every individual knows his interest, acts on his interest and is free to do so.
2. That every good be held under private property.
3. That every good be bought and sold in an open market.
4. That every thing of value be freely exchangeable.
5. That all things of value (goods) be produced, bought, and sold in perfectly competitive markets.
6. And that perfect competition meet the following conditions:
 - Atomicity of buyers and sellers.
 - No barriers to entry or exit from markets.
 - Perfect mobility of factors of production (land, labor and capital).
 - Perfect homogeneity and divisibility of goods. All goods are non-differentiable.
 - That all markets be free of state intervention and control.
 - That all buyers and sellers be perfectly informed.

Under these conditions, and given appropriate institutions in society required for sustaining them, the value $V(x)$ of good x is its price $p(x)$. It should be emphasized that we are not saying that the value of a thing is *reflected* in its price; we are saying that the value of a thing actually *is* the price.

It should be emphasized that under the above conditions, buyers express their evaluation by the demand for goods and sellers express theirs by their supply. Moreover the conditions of perfect competition ensure that both supply and demand are mutually independent, so that the price arrived at expresses a rational and free judgment made by society as a whole of the value of all goods. In other words, the prices of all goods constitute a social value system.

Finally, it should be made clear that this system of economic evaluation by society contributes to social welfare, or to the “wealth of nations” to use Smith’s famous term, in several ways:

Exchange and trade is never a zero sum game when it is undertaken under voluntary and free conditions. All voluntary exchange and trade is mutually beneficial in the sense that it creates value both for the buyer and for the seller at the same time since each enters exchange with the expectation that he receives more than he gives to the other party.

The act of exchange or trade increases the total wealth in a society since all parties are better off after a trade than before it.

Consequently growth and wealth result from trade where sellers compete to produce more of what is demanded, less of what is not wanted, all at a decreasing price.

In fact, perfect competition ensures that prices are driven down to cost and that consequently the distribution of resources is optimally or efficiently allocated.

The system is socially just since “each receives in proportion to his contribution” (Smith).

The labor theory of value and classical socialism (Marx, 1867)

In the first chapter of his famous book, Smith starts with the distinction between the “real value” of things and their “nominal value”. The “real value” of a thing is the “difficulty in obtaining it”, that is, the labor involved in making it useful, or the quality and the quantity of work it embodies. On the other hand, the nominal value of the thing is its value in exchange, which of course depends on its “real value” since without it, there would be no exchange.

Approximately one hundred years after Smith’s “Wealth of Nations” first appeared, Marx’s critique of the liberal utopia and the institutions of capitalism laid the way for a second social utopia along with a second theory of economic value based on Smith’s and Ricardo’s labor theory of value.

Marx’s critique of the liberal utopia essentially consisted of underlining and arguing the fact that it assumed an even and just distribution of wealth “from the start”. Not only was it utopian, it was unattainable. As Marx pointed out, the distribution of wealth had already been historically determined in the West by the system of social classes and property rights. Wealth and the “means of production” were already in the hands of the capitalists, the aristocracy and the emerging bourgeoisie. The worker, which provided the “real value” of goods in society by his work, had only his labor to sell and was brought into a labor market in which he was compelled to participate in order to survive. Moreover, because he exchanged labor for wages he became *alienated* from his labor by the *surplus value* he created for the capitalists and in which he did not participate.

Marx’s socialist utopia was founded on the following principles:

1. The collectivization of all goods and property, i.e. the elimination of private goods and private property.
2. The elimination of markets and exchange, in particular the elimination of the labor market.
3. The social and democratic planning of all quantities of goods of value and of all prices for these goods.

Rather than a society in which justice was defined as “to each according to his contribution”, Marx proposed a system in which justice was based on the principle of “to each according to his need”. Unfortunately, this kind of socialism is expensive. It requires a very wealthy and prosper-

ing economy as well as a democratic participatory state and political institutions. In fact Marx himself was very clear on the fact that his proposed utopia was *post-capitalist*. Thus, it has never been tried, except in a few of the very wealthy walled-off experimental residential communities in the United States.

Whereas the liberal theory of value considers social value from “in front of the counter”, that is, from the demand side and the customer’s viewpoint, the labor theory of value considers that social value is created “behind the counter”, that is by the makers and suppliers of goods. This idea had already been well developed by Smith and had its origins in Plato, Aristotle and the scholastics. But it found particular favor in David Ricardo, who was its most explicit, although not its most articulate, spokesman. Karl Marx adopted it and turned it into a full-fledged theory of value on which his socialist utopia rested.

According to Ricardo and Marx $V(x) = L(x)$ where L is the *quantity* of labor that goes into making it. The economic value of any good in an economy is the amount of labor invested (by society) and embodied in the product. Moreover, for Marx as for Ricardo, pure exchange created no value, since free exchange involved no labor. No value was added.

As an economic axiology, the labor theory of value has been severely criticized by modern economists who have adopted the marginal utility theory of value. Economists have criticized the labor theory of value on several grounds every single one of which infirms the theory wholesale:

The theory relies on the idea that the value of a good is proportional to the *quantity* of labor (e.g. the number of man-hours) rather than to its *amount* – that is, to the *quality* of work, to the quality of the artifact, to technique and skill, to the amount of technology involved, and to the knowledge embodied in the artifact.

It does not take into consideration the value and welfare actually created by free exchange.

It does not take into consideration the freely expressed needs and wants of individuals, that is, it does not consider the demand side of the economy since, for Marx, the individual was the pure creation of his class. For Marx, there were no free individuals - all were enchained to history.

No serious economist today would even contemplate the faint relevance of the labor theory of value to the economy. The only people who still use these ideas are the engineers, the designers, the technologists and the managers, although they don’t always know that they are doing so. They, unlike the economists, are concerned with making things that really work, with artifacts that function well, with designing and making them. And all this, technologists know, depends to a large extent on the quality of thought and work that gets built into their products, that is, that is embodied in the artifact.

TECHNOLOGICAL VALUE: THE FUNCTION THEORY OF VALUE

Although it has roots in the practical philosophy of Plato, Aristotle and the classics, and although the technological theory of value relies heavily on moral philosophy, the philosophy of action, the theory of economic value, the theory of decision and utility and the engineering theories of

design and systems, the theory of technological value has never been systematically addressed (save for a small number of canonical works, such as Kotarbinsky, 1965). In our opinion, the axiology of technology is still in its infancy. Let us hope that it will grow.

The technological theory of value or axiology is *mechanismic* (Bunge, 2006), *functionalist* and *teleological*. It is based on the idea that artifacts meet the needs and ends of a user through some mechanism, some causal system or network of material relations. It is *functionalist* in the sense that it relies on the idea that the value of a thing does not reside in its form or in its substance (i.e. intrinsic). Neither is it in the attitudes, desires, pleasures, opinions and beliefs of a user (i.e. extrinsic). In a technological axiology, the value of an artifact in meeting needs and ends lies in the performance of *functions* through the user-artifact interaction that the artifact allows. Thus the technological value of thing lies in the functions it allows some user to perform. These functions depend on how the artifact “works”, that is, on its mechanism. Finally, a technological axiology is *teleological* in the sense that artifacts are designed to perform certain functions for predetermined ends.

From economics, technological value theory takes both the price theory of value (the theory of value in exchange) and the labor theory of value (the theory of value in use) and integrates them into an overall framework and a set of indicators of value for their management. From the *price theory of value*, it takes the concept of the price of inputs required to produce or acquire and use an artifact. The price of acquisition of inputs is one of several costs to be borne either by the maker or the user. The full costs are the life cycle costs associated with the artifact, either from the maker’s side or from the user’s side. From the *labor theory of value* technological axiology takes the concept of the performance of functions by the artifact as the cost of the embedded work and knowledge required in making and using the artifact in performing its desired functions.

The technological value of a thing to some one then is the cost to him of producing or acquiring and using an artifact that allows him to perform the functions he wants or needs, given available techniques, resources, options and circumstances. Thus the technological value to a *buyer* is the *worth* to him of performing the needed functions. In other words, $V(x) = W(x)$ where the $W(x)$ of some thing x to someone is its opportunity cost or what she is willing to forego to obtain it. This value is the “difficulty in obtaining” the thing - what she is willing to pay for it. The technological value to a *producer*, on the other hand, is the opportunity cost of designing and making an artifact with the required functions.

Technologists are optimistic idealists: they are trained to strive for an ideal or an optimum. From a technological point of view, the ideal artifact to someone, is the one that allows him to perform exactly those, and only those, functions he needs and wants. Why only the functions he wants? Because every unwanted or *needless* function increases the cost of the artifact and detracts from value, regardless of what functions it performs.

However, every artifact is imperfect in some respect (whence the requisite optimism of the technologist). And every artifact is designed and can be improved. Thus the actual technical performance of any artifact can be measured against its technical value ideal. In other words, the *technical value index* of an artifact is defined as the ratio of the functional cost of the ideal to the

functional cost of the actual artifact.

In the case of a *user*, this is simply the ratio of the cost of the artifact performing exactly and only those functions needed or demanded to the cost of the actual artifact evaluated. In other words, the technological value index is $VI(x) = W(x)/C(x)$ for the *user*, where $C(x)$ is his life cycle cost. The technological value of a thing to a *producer* is the opportunity cost $c(x)$ to him of offering or producing an artifact that he has designed and produced to perform exactly and only those functions *he believes his customer needs or wants*. His actual costs $C(x)$ will be greater since in general he will not design and produce the ideal product for every user. The value index for the producer then is $VI(x) = c(x)/C(x)$. As before, both indices express the ratio of *ideal to actual functionality*.

Finally, it is necessary to consider, from a technological perspective, the social values created by the production, sale and purchase of artifacts by members of an economy. In other words, it is necessary to consider the exchange value of goods made, bought and sold.

Let us consider again, for the sake of brevity, the simplest case of exchange. The relevant quantities are: $C(x)$ = the cost of producing the demanded functions (land, capital, labor, knowledge, technology, acumen, etc.); $W(x)$ = the worth of the product's functions to the customer; $p(x)$ = the transacted, market or negotiated price of exchange in the economy. The distribution of value created in the exchange transaction is the following:

- The value created for the buyer or user is the consumer surplus $W(x) - p(x)$.
- The value created for the producer or seller is the producer surplus or profit $p(x) - C(x)$.
- The total value created to the society or to the economy by the trade is $W(x) - c(x)$.

Clearly, the *distribution* of value (not the total value) depends on the price paid. In turn, it depends on a host of factors such as industry and market conditions, industry structure, firm level strategies, regulatory environment, production technology, and so on. However, for the technologist, two important determinants of the exchange value or price are:

- The goodness or quality of the artifact.
- The relative power of negotiation of buyers and sellers respectively in the market and in the economy.

CONCLUSION

We have briefly sketched out some of the conceptions of value that come to us from the immense body of knowledge on the subject. We have integrated a number of them into a concept of technical value. Finally, we have emphasized the need for further development of the technological theory of value. Without such work, the value of the work of value managers will remain ambiguous and dubious.

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AUTHOR INFORMATION



Dan A. Seni, P. Eng., Ph.D
Professor, Department of the Management of Technology
School of Management
University of Quebec at Montreal
PO Box 6192-A
Montreal, Qc., Canada, H3C 4R2
T: 514-987-3000 ext:8200
F: 514-987-3343
e-mail: seni.dan@uqam.ca