

# The Evolutionary Theory Of Value

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## Abstract

We propose the first economic theory of value that actually works. We explain evolutionary causes of trade, and demonstrate how goods have value from the evolutionary perspective, and how this value is increased with trade. This “Darwinian” value of goods exists before humans assign monetary value (or any other value estimate) to traded goods. We propose objective value estimate expressed in energy units.

## 1 Synopsis

The proposed theory has its goal to give physical meaning to the notion of “value” that is basic for economics.

Synthetic Theory of Evolution is the only working theory of the life on Earth. Every biological phenomenon requires evolutionary explanation.

The pinnacle of STE, the extended phenotype theory suggests that all behaviours and cultures of animals are parts of their respective species phenotype.

Since the economic activity of humans is a biological phenomenon (a part of the extended phenotype of humans) it requires an evolutionary explanation.

The selfish gene theory postulates the gen-o-centric measure of reproductive success. The reproduction of genes (as opposed to bodies) is the cause of all biological phenomena.

The present paper shows that economic activity brings reproductive success to the economy participants (in the gen-o-centric sense).

The hypothesis of “needs” is no longer needed in economics.

If reproductive success is measurable then we can use it as a measure of commodity value, because trade is pursuit of value acquisition and a biological phenomenon and the only value with evolutionary meaning is reproductive success.

The present paper postulates that *value* is a function of two variables, i.e. it depends simultaneously on the customer and the commodity inherent properties.

Life is a chain of energy transformations. The reproductive success depends on the energy efficiency of this process. Therefore we can express reproductive success in energy units.

Thus we can express *commodity value* in energy units (not to be confused with the energy cost of production!).

The objective value independent of human mind does exist.

The absolute majority of traded goods possess this value.

This value determines the value creation by the trade.

The value of trade (exchange) itself does also exist independently from human mind.

## 2 Introduction For Biologists

By *reproductive success* we mean *fitness*. We avoid using the proper term *fitness* because it is ridiculously confusing for normal people, due to the vast semantic distance from all classical dictionaries and common parlance.

The English *fitness* implies a counterpart: a fitness for what? – apparently, for reproducing your genes. But biological jargon *fitness* is not even the fitness for reproduction – it is precisely THE END RESULT OF EXERCISING THIS *fitness* – therefore the term *reproductive success* and in comparative sense *reproductive advantage* (which is a difference in fitness).

## 3 Introduction For Non-biologists

If you are a biologist you may skip this section.

It is difficult to “debunk” the evolutionary theory because it is almost tautological (for many this simplicity is also the major emotional obstacle for accepting evolution): whatever thing has a strong tendency to reproduce – does reproduce – whatever thing does reproduce better than other things – does persist in generations. Where by the “tendency to reproduce” we mean a physical phenomenon not a mental one. Viruses, bacteria, and humans share the same tendency to reproduce. None of the rationalizations that humans invent for their reproductive behaviour does matter. Those rationalizations have very little bearing on the actual evolutionary process, and they are all always completely false (if judged as a statement of fact).

We must emphasize the most important corollary to the evolutionary theory: **EVO-LUTION IS ABSOLUTELY AIMLESS**. None of the extinct species ever violated laws of evolution! This is very important for our proposal, we always keep this idea in mind, it is thereafter implied. Contrary to this, human intuition is based upon aims and goals, this is perhaps why the evolutionary reasoning feels counter-intuitive to many people.

The Selfish Gene theory formulated by Dawkins under the influence of Hamilton gives us a perfect tool of explaining all apparent “contradictions” between animal behaviour and Darwinian “motivation”. It explains the balance between reproduction and self preservation (including all its weird forms), it explains altruism, and kin selection, and anything you may find “contradictory” to Darwin. On top of this theory stands the theory of Multilevel Selection by E.O.Wilson which gives us very detailed exhaustive explanations for all forms of altruism no matter how complicated and selfless. But it is beyond the scope of the article, it is only important to understand that biology has already answered all the questions you have.

In the modern evolutionary theory personal goals of an individual animal are NOT postulated. There is no axiom of a goal or pursuit and the subject of the evolutionary process is not a body of an animal. The subject of the evolutionary process is a variant of a gene or a polygenic complex (a mere chunk of a molecule). This renders irrelevant all possible “objections” originated from the vantage point of motivations of individual animals exposed to natural selection.

Whole intricate complex of animal behaviour ascends from a superposition of physical laws governing the existence of a DNA molecule. And this superposition itself evolves in a strictly Darwinian sense.

When we deduce behaviour of a population from behaviour of an individual animal and in turn we deduce that from the interactions of genes and their differential survival (which is linked to the differential fitness of phenotypic traits they encode) then we do not need a hypothesis of a rational mind that governs complex behaviours. On the contrary, this rational mind FOLLOWS from the evolutionary theory as a tool for governing complex behaviours, that have differential effects on fitness of some genes. And when rational minds are subject to the evolutionary process they do not have to understand this process, do not even have to be aware of this process, and their roles in it, and any viable strategies, and even themselves.

Developing the idea of gen-o-centric evolution, Dawkins formulates the notion of *extended phenotype*: *All effects of a gene upon the world. As always, “effect” of a gene is understood as meaning in comparison with its alleles. The conventional phenotype is the special case in which the effects are regarded as being confined to the individual body in which the gene sits. In practice it is convenient to limit ‘extended phenotype’ to cases where the effects influence the survival chances of the gene, positively or negatively.*

Apparently the entirety of social behaviours, organizations, and material culture of animals are included into *extended phenotype*. In order to copy themselves, genes “utilize” all available means: along with organisms, their societal structures, and tools and cultures created by those organisms, and science, and traditions, and ideas – everything that may differentially affect fitness.

*Replicators are not, of course, selected directly, but by proxy; they are judged by their phenotypic effects. Although for some purposes it is convenient to think of these phenotypic effects as being packaged together in discrete “vehicles” such as individual organisms, this is not fundamentally necessary. Rather, the replicator should be thought of as having extended phenotypic effects, consisting of all its effects on the world at large, not just its effects on the individual body in which it happens to be sitting. (Dawkins, 1982).*

Thus any economic activity is just a part of the human extended phenotype. Therefore the market phenomenon requires an evolutionary explanation.

Note that we use biological lexicon in its scientific sense, which differ significantly from common parlance.

Particularly we insist that economic activity is driven by *reproductive success*. It does not mean that it is driven by the pursuit of reproductive success! It does not require your personal assessment of your reproductive success! And the “success” itself stands for evolutionary success of a gene, which may have no relation to individual success. The *success* of a gene is a physical phenomenon, the amount of its copies propagating into future generations. This is the meaning of *reproductive success* we use thereafter.

In common parlance when we speak about *success* we assume an underlying goal-driven strategy that is a product of some rational mind. This has nothing to do with the

evolutionary sense of *success*.

Reproductive success of a gene might be expressed in a single generation as any combination the following three factors: the amount of individual organisms carrying this gene, quality of these individuals promising better success in the next generation, quality of life of these individuals to the same effect.

When we say quality of life affects reproductive success we mean the success of a gene being carried by a conventionally successful (well fed) body promising some increased amount of copies of the gene in the next generation. What is good for you is typically good for your genes – but this alliance is conditional, it is predicated on the reproductive strategy of large mammals which makes your early death very detrimental for your genes – human children require a lot of care and are capable of receiving resources and benefits from their parents until their own death, this fact dooms humans for longevity, unlike salmon, whose longevity would spell death to the entire next generation in the jaws of their parents and uncles, the safest way for salmon's genes to reproduce is to kill salmon as soon as it reproduces.

Reproductive success is not to be confused with birthrate. Absolute value of birthrate depends more on one's reproductive strategy rather than the success of this strategy. Equally successful species adhering to opposite strategies differ in birthrate by 6 orders of magnitude or more: an r-strategist specie produces millions of offspring per mother, while a K-strategist specie produces 2 or 3 children per mother and nurture them to the same degree of reproductive success over several generations combined. Humans for example are more successful than salmon, in terms of their genes survival prospect for the next 100 generations (the human biomass alone is the highest among all animals of the same size).

It is necessary to distinguish between the reproductive success and the reproductive function.

Reproductive success does not require reproductive function, e.g. ant workers successfully copy their genes using their queen for this purpose. (Hamilton, 1964, *The Genetical Evolution of Social Behaviour*. II). Similarly (not an exact analogy), blood relatives help each other in human families, and the intensity of cooperation directly depends on the genetic closeness of these relatives, odds are by helping your relatives to survive you are helping your genes to survive within them.

The reproductive success is a larger phenomenon than the reproductive function and therefore is subject to more subtle influence of much greater variety of factors, apparently there are economic factors among them. We must stress that our theory does not suggest that traded goods should be in any way related to reproductive faculties of economy agents.

Returning to the detachment of the rational reasoning from evolutionary determined motivations, if there is any connection it is one-way: evolution determines what you think about it. As we are claiming economic activity to be driven by reproductive success, it does not require your awareness about this drive, let alone understanding consequences of your actions. Even the lack of physical possibility to accomplish an evolutionary determined program does not inhibit the evolutionary programed motivation to execute the program. The simplest example: vasectomy does not inhibit sexual attraction. More advanced example: Hawaiian crickets *Teleogryllus oceanicus* had lost serration on their legs which was used to produce their calling song; it is an adaptive mutation – a parasitic fly *Ormia ochracea* uses this song to find its victim; but the mute

crickets keep rubbing their legs the same way their non-mute relatives do when they call a mate – the absence of the result, and the apparent impossibility of this result have no bearing on the behaviour. [9] Which means the infertility of some individuals can not be an argument against our theory that claims that economic activity is motivated by reproductive success.

Thus, the entirety of one's life affects one's reproductive success and the quality of this life is determined to significant degree by one's economic activity. *Quality of life* is a highly multidimensional parameter, why do we reduce it to the single dimension of *reproductive success*? Because we can, and have to. Multidimensional values do not compare to each other in a linear fashion, any meaningful comparison requires some projection that reduces the dimension; and the evolution offers us a physically meaningful such projection, the ultimate measure of any particular life; and this measure is THE ONLY ONE that really matters in the evolutionary context, the evolution simply ignores all other results of your life.

## 4 State Of The Art

This paper does not analyze existing theories, neither it disputes any opinions about free markets. This paper proposes a new foundation for the economic theory – the notion of value that does not create contradictions intrinsic to all existing notions of value. The proposed notion of value is derived from biology, not economics, thus breaking the circularity of the modern economics, and reducing its axiomatic base.

Economic activity is a biological phenomenon therefore any economic theory should be a continuation of the evolutionary theory of life. We transcend the artificial meta-physical division between biology and economics. We postulate the absence of any and all supernatural differences between the subject of biology and the subject of “social sciences” (e.g. holy spirit, consciousness, mind, humanity, rationale, life force).

The modern economics has very few theories of value: Labour theory, Monetary theory, Political Power theory, Utility theory, and Exchange theory. But the most popular view nowadays is the belief of principal immeasurableness of value – this belief corrodes economics as a science.

Monetary theory has huge practical utility in analyzing markets, but does not attempt to explain the origin of value (although being habitually misused for this exact purpose).

Utility theory provides a great insight into market actor's motivations, but leaves the question of quantification the utility open. It recognizes the subjective (situational) aspect of value and IMPLIES the objective (utilitarian) aspect, but fails to recognize the crucial importance of this duality (described in Section 5.1), which results in the famous “paradox of water and diamonds” [3, Chapter IV].

Labour theory (with all its variations and upgrades) has no connection with reality at all. Ironically, Marx in his own words explicitly refused to relate value with utility: *use-value [utility] as such lies outside the sphere of investigation of political economy* [4, p.276], at the same time acknowledging that consumers are valuing utility: *nothing can have value, without being an object of utility* [5, Ch.1, Section 1] – thus you can cite Marx himself in order to show his total irrelevance.

Exchange theory tries to improve Labour theory by debunking it, while remaining

formally Marxist (with a predictable outcome). The value of this theory is in the admission of the objective/subjective duality of the value, but the theory fails to elaborate it and confuses everything. [6]

Political Power theory describes merely one pathological case of value assessment, although in a social setting it could be seen as a special case of the proposed Evolutionary Theory (as “political power” being advantageous from the evolutionary perspective).

Marx wanted to measure “intrinsic value” of goods by the amount of invested labour. Which is obviously irrelevant to any sensible notion of value from the consumer’s perspective. We can immediately destroy the Marxian theory of value by producing two identical shoes: one made by a skilled craftsman in his shop, and another made by him in the same shop with prison moons attached to his legs. The clever correction “socially necessary labour” does not remedy the stupidity of the labour theory of value. The socially necessary labour to build Titanic in Himalayas is much higher than the socially necessary labour to build Titanic in Belfast – according to Marx, Titanic is more valuable in Himalayas. Apparently, Marx completely failed to capture the idea of value, therefore will be ignored from now on.

The monetary value of goods is the only value estimate practically available to us. Markets use prices with great success in order to establish tolerably unfair exchange rates of goods. People successfully use prices to reason about the value of goods and the value of transactions. However, it is a huge mistake to say that the price is the value.

The very decision to enter the marketplace and the decision to approach a particular supplier is usually made regardless of the pricing information. Let alone the manufacturing cost! – this parameter never enters your evaluation. Prices may limit your trading options, but they do not affect your internal estimate of the value of goods (excluding pathological cases such as conspicuous consumption). Moreover, you decide whether to make a transaction according to the discrepancy between the price and the value. Therefore, if the price IS the value, then you must commit all transactions within your financial capabilities, and you have no reason to deny any deal you can afford – which is apparently absurd.

The neoclassical economics acknowledges the fact that the *perceived value* must exceed the price. Thus our observations and the dominant school of thought in economics agree that *value* is neither *cost* nor *price*, therefore we must abandon all existing theories of value. But the neoclassical economics offers no theory of value that would allow us to estimate the value of goods, and the entire economics depends on a notion of value that is not “analytical”.

We attempt to formulate a measurable notion of *value* by revealing its physical meaning. More specifically the part of this physical meaning which is shared by all goods and services and motivates trade.

Since the price is determined by demand, we suggest that the demand is the expression of how much people VALUE goods.

In order to explain demand, modern economics utilizes the notion of *need* or *needs and wants*. This notion is made the (often unspoken) basis of modern economics – the entire economic theory implies that all economic activities of people are originally motivated by *needs and wants*. What is *need* economists vaguely understand, it is any necessity for sustaining one’s life. But no economist has any idea of how to define *want*. People have desires of all sorts, relating to one’s quality of life to various degree. And this entire

phenomenon is outsourced to psychology, as if it solves the uncertainty. Still worse, in order to tackle the *wants*, the rational choice theory was developed [7], which does (instead of defining *want*) add yet another axiom to the system, the assumption of *rational mind*. Then it was superseded by the theory of bounded rationality [8], which retains the basic assumption of *rational mind* and retains close ties to psychology, which does not add clarity.

And while *wants* remains undefined the distinction between *wants* and *needs* is moot, because the whole aggregate is undefined regardless of the distinction and the definition of *needs*. Thus the entire economics hangs on the undefined prime mover.

The evolutionary perspective allows us to reveal a simple universal foundation of all *wants and needs*, without assuming *rational mind*.

## 5 The Value

### 5.1 The Domain Is 2-dimensional

*The major debate about value has always been about whether it is inherent in things, or is a function of human desires. Plato regarded value as inherent in a commodity, but Aristotle attributed it to a commodity's utility, and he said the standard of value lies in wants.* [10] The sheer age of this debate suggests the futility of the traditional approach to the problem that has been exercised so far.

We insist that the both sides of this debate are right in their positive argumentation and wrong in the refutation of another side, and consequently any theory that adheres to either side fails to grasp the whole idea of value.

We recognize the fact that individual customers value goods differently. Moreover, this fact is necessary for a market to exist. If two people value an item equally, they have no motive to trade this item. If the value of goods is 100% intrinsic then all well informed people value all things equally, then no honest trade is possible, which is contrary to the observable reality.

At the same time the very existence of any demand suggests that goods do have intrinsic value. Shoes make your life objectively better by being shoes themselves. Shoes have a valuable function which is enabled and defined by the physical properties of the shoes. The attribution of the shoes' value to the physical property of the shoes is easy to reveal by merely wearing several different shoes – by being able to compare these shoes you admit that your evaluation depends on the physical properties in question.

Moreover, this objective value is necessary for a market to exist. Lets make another thought experiment. A pair of boots reduces my energy expense for heating my feet by 1MJ/day while I am hunting. Note that this amount will not change if the price of my boots change on the market. However, the price change can motivate me to sell my boots, if the price covers my expenses for inventing and implementing another method of heating my feet. It does not mean that my boots lost their value, it means that I exchange their value for a greater value. And this greater value is represented by the boots price in the act of selling the boots. Without this difference the transaction is not possible, and by extension a transaction is not possible. Therefore the objective value is necessary.

Thus, the value is “objective” and “subjective” at the same time – it depends on both intrinsic properties of goods and the customer (alongside all his local circumstances). Two men value the same pair of boots differently, but they both value them for their physical properties. In other words, **the economic value is a function of two variables:** a customer in a particular local situation, and a goods item of certain properties.

A proper theory of value must reflect this fact.

## 5.2 The Co-domain Is 1-dimensional

All our feelings, cravings, needs – all are products of adaptation – congenital analgesia causes death. You are able to feel thirst and you can not resist it only because those who could resist it, or did not feel it failed to reproduce. It does not depend on what you think about this statement and the feeling of thirst. You think that thirst is “natural”, “INEVITABLE”, the suggestion of improper reaction to thirst seems insane to you, you think that thirst could not be misinterpreted – this very thought, this obviousness is also a result of adaptation.

Same with economic *wants* – if those wants do not affect our reproductive success, we would not be able to feel them, and those who did not feel them are long gone. In the end the natural selection decides who was better at assessing goods value and smarter at trade.

Only as much as your quality of life affects your reproductive success the evolution grants you the ability to assess the *quality of life*, and it does that inevitably. We can think and talk about comfort, health, safety (whatever particular aspect of your life motivates you to buy or sell anything) only because this very ability to reason about these things has evolutionary significant impact on your reproductive success. This is the general fundamental property of all traits of all life.

A man thinks that his *wants* are motivated by expected increase of his quality of life. The quality of life is a very multi-dimensional object, impossible to be formally accounted for. But we live within the evolutionary framework, and Darwinian evolution reduces all properties of our life (however multi-dimensional) to a single dimension *reproductive success* (so called *fitness*). Such complex objects as quality of organization of multicellular bodies, or efficiency of a hunting strategy, or man’s life comfort – are all being reduced to the amount of genes’ copies being propagated to future generations (the only tricky part of this measure is to account for more than one generation).

The simplicity of evolution allows us to model the *value* with a 1-dimensional function – for the measure of the value we must use the measure of reproductive success (more specifically the difference: how much the reproductive success is affected).

## 5.3 The Ineluctability Of The Intrinsic Value

Every phenomenon existing within a biological system must have been evolved in the Darwinian sense.

Markets exist within a biological framework: the extended phenotype of Homo Sapience. [2]

Therefore markets have to have an evolutionary “reason”, simplest and likeliest of which is the reproductive advantage.

On the other hand, a market is merely a collection of transactions, so it must derive its survival value from its transactions.

Thus transactions must have objective intrinsic Darwinian value.

Whereas transactions can only derive this value from the goods that are being exchanged.

Therefore the goods must have some intrinsic value that is also Darwinian.

Here we made a tiny leap of faith focusing on the reproductive advantage and dismissing “indirect” evolutionary “reasons” such as side effects of other evolved traits, or preservation of neutral traits, etc. Further reasoning (section 5.4) supports this assumption by demonstrating the presence of real reproductive benefits.

The requirement of the reproductive advantage for an evolved phenomenon has two weak spots: sexual selection (which happens to be arbitrary in many cases) and parasitic memes (such as religions). However, a religion shapes human behaviour in a way that creates artificial selection (e.g. killing infidels) that creates “artificial” reproductive advantage, whereas sexual selection provides value in and of itself (whatever neutral or even detrimental trait is sexually selected for it is responsible for some reproductive advantage due to the fact of the selection itself). That means markets require a Darwinian explanation involving aforementioned “intrinsic value” anyway.

## 5.4 The Source Of The Intrinsic Value

We use boots as an example of goods because the reproductive advantage created by food is too obvious (no food – no reproduction; a feedback loop that short does not allow us to illustrate a general case). Boots, on the other hand, encompasses all properties of a tool, and could be easily replaced with any other tangible item of value without disturbing the argument. On the example of boots, we can see that the following reasoning could be applied to all goods.

A pair of boots gives its owner a reproductive advantage over himself without the boots. The owner saves energy on heating his feet, on healing damage to the soles (which is inevitable if walking bare feet), he saves lots of energy required for thickening his soles. And all this is compounded with the energy required to acquire extra food that is his only energy source. His life with boots is significantly more energy efficient than without. All in all he uses some animal skin INSTEAD of growing his own – all the expenses are shifted onto another animal.

The vast majority of all things traditionally traded in the world’s markets provide reproductive advantage to buyers. Before anything else, it is FOOD; then clothing; then tools; then housing; then fuel; then medicine – all these things one way or another prolong one’s life and save labour, which translates almost inevitably into greater reproductive opportunity (not only more offspring, but also better reared ones).

Naturally, the buyer’s perception of the goods value is not perfectly accurate and his psychology is exploitable and the market (as a finite knowable aggregate of human strategies) is also exploitable. This fact allows for fake-value goods (e.g. rhino horns, eye-phones, fridge magnets) to be traded. Those goods do not affect our reasoning for two reasons: (a) fake-value goods are vastly outweighed by real-value goods, food alone trumps all “gadgets” combined (b) market exploiting strategies are secondary to the market, a market exploit, in order to evolve itself, requires its victim market to evolve earlier.

As we are comparing (from the evolutionary perspective) the “no-market” situation vs a situation of arbitrarily early phase of market development (reasoning about the cause of the market itself), we can safely discard these issues.

## 6 The Transaction

### 6.1 The Social Value

Evolutionary processes typically run with positive feedback. Every trait that exists in multiple generations and millions bodies, once was a single mutation of a single body. Evolution is a process of magnification of small “positive” deviations – a mutation that is “slightly better” in Darwinian sense becomes a new norm. This allows us to reason about an isolated trait not as a mere example but a signifier of an evolutionary trend. Demonstration of a slight particular advantage constitutes a demonstration of an entire evolutionary trajectory. Thus we can maintain the generality of our reasoning while only focusing on local competitions between particular traits.

Let's assume 4 men: 2 from tribe  $A$ , and 2 from tribe  $B$ . The men of tribe  $A$  manufacture 2 spears and 2 axes. The man  $A_1$  creates 1 axe and 1 spear, the man  $A_2$  creates 1 axe and 1 spear. As they complete the task they are ready to conquer the tribe  $B$ . They spend energy on the task:  $E(\text{spear}, A_1) + E(\text{axe}, A_1) + E(\text{spear}, A_2) + E(\text{axe}, A_2) = E_A$ . At the same time in the  $B$  tribe, the men  $B_1$  and  $B_2$  (similar in skills and all characteristics) create the same set of weapons, but they are capable of trade. Since it is easier for  $B_1$  to manufacture an axe than it is for  $B_2$ ,  $B_1$  creates 2 axes, and  $B_2$  creates 2 spears. Then they trade 1 axe for 1 spear between them, and become equally equipped for the conquest of the tribe  $A$ . They spend energy on this preparation:  $2E(\text{axe}, B_1) + 2E(\text{spear}, B_2) = E_B$ . Since  $E(\text{axe}, B_1) < E(\text{axe}, B_2)$  the tribe  $B$  saved some energy. If we assume everything else being equal, except for the distribution of labour, then  $E_A > E_B$ . The tribe  $A$  spends more energy to achieve the same result as tribe  $B$ . When they go to war, who is likely to eat whom? Tribe  $A$  eats tribe  $B$  or vice-versa? Obviously the tribe  $B$  eats tribe  $A$ .

The assumption of “everything else being equal” is legitimized by the law of large numbers. The “all things being equal” is a metaphor for a very large sample in which all variants are presented, so that our deviation (the advantage represented by the example) has a chance to express itself in the whole spectrum of circumstances. Obviously, if the capability of trade spawns in a weak tribe, its genes will perish, but evolution is a long process and over time this ability will spawn in many different circumstances.

We can now assume a tribe of  $N$  people, each of them demand a certain set of goods. If they are unable to trade then each of them has to manufacture all the goods he needs. In other words, from all possible variants of the labour distribution the one is fixed. Highly unlikely this variant is the least energy expensive. It is even possible to prove rigorously. Let's say people  $P_1..P_N$  manufacture goods  $G_1..G_M$ , their energy expense is a  $E_{min} = \sum_{i=1}^N \sum_{j=1}^M E(P_i, G_j)$ . If this an optimal labour distribution then any reassignment of labour will increase the expense. Let's investigate a minimal re-assignment:  $P_n$  works on 2 items  $G_m$ , and  $P_k$  works on 2 items  $G_p$  (it affects only 4 members of the sum, other elements remain the same). From optimality of  $E_{min}$  follows:  $2E(P_n, G_m) + 2E(P_k, G_p) > E(P_n, G_m) + E(P_k, G_p) + E(P_n, G_p) + E(P_k, G_m)$  Therefore:  $E(P_n, G_m) + E(P_k, G_p) > E(P_n, G_p) + E(P_k, G_m)$  From this follows that the opposite

reassignment will give us reduction in expense:  $E(P_n, G_m) + E(P_k, G_p) + E(P_n, G_p) + E(P_k, G_m) > 2E(P_n, G_p) + 2E(P_k, G_m)$  Which means that  $E_{min}$  is not optimal. This contradiction proves that the original assignment can not be optimal unless all assignments are equal. Thus our tribe without trade stuck with a non-optimal distribution of labour.

On the other hand, if they are capable of trade, they are free to explore all possible combinations, among which there are more energy efficient combinations than the current one. **The trade opens up a possibility to minimize aggregate energy expense of a tribe's industry.**

We omit the topic of theft because the theft is not evolutionary stable – a tribe can not contain a majority of thieves and survive.

## 6.2 The Personal Value

A second pair of boots provides much less value to the owner relative to the first pair, because two pairs can not be worn simultaneously. The aggregate value of these two pairs of boots is lower than the double value of one of them. However, a man having no boots does value your second pair as high as you value the first pair. If you sell your second pair to him you receive from him in compensation as much value as he acquires with these shoes. As the result you end up having the double value of a pair of shoes, which is much greater than the value you had before the transaction. Since the motivation is symmetrical, the buyer must have increased the aggregate value of the things he owns, e.g. he had two identical pelts and he gave you one in exchange for your boots. Both participants benefit from the transaction – this benefit sums to the value of the transaction.

The cost of production adds more motivation for trade. If you spend less energy/labour to produce a pair of boots than another man does it is advantageous for him to buy boots from you rather than manufacture them (which is explained in 6.1) – and this is how you end up having two pairs of boots in the first place.

Still the motivation of all parties is strictly selfish: a transaction is motivated by the increase of value being owned on both sides, and the division of labour is motivated by the decrease of energy expense on both sides.

## 6.3 The Model Of Transaction

A simple transaction consists of:  $User_1, User_2; Item_1, Item_2$

where  $User_1$  owns  $Item_1$  and  $User_2$  owns  $Item_2$ , then the items change hands.

Users value items with the value function:  $Value(User, Item)$

The aggregate value before the transaction is:

$$Value(User_1, Item_1) + Value(User_2, Item_2) = V_b$$

The necessary condition is:

$$Value(User_1, Item_1) < Value(User_1, Item_2) \text{ and } Value(User_2, Item_2) < Value(User_2, Item_1)$$

The aggregate value after the transaction is:

$$Value(User_1, Item_2) + Value(User_2, Item_1) = V_a$$

The condition explains PURELY SELFISH motives of the transaction participants, they do not care about the “global” aggregate value (social value of the transaction), they both

increase the value of goods they personally own. Nevertheless, corollary to the necessary condition the aggregate value  $V_b < V_a$ , i.e. (without any intent by participants to increase it) the transaction increases the aggregate value of goods in the market.

## 6.4 The Value Of The Market

The model of transaction 6.3 shows that the market (as a collection of transactions) increases the aggregate value of goods. This increase of the social value of goods is the intrinsic value of the market, and it is derived from the intrinsic value of goods.

At the same time market (as an evolved phenomenon) must have Darwinian value. And we have already established that market increases reproductive advantage of the participants (relative to those who don't participate).

Thus, the argument to equate goods value with reproductive advantage works both ways bottom-up and top-down.

Please note:

1. a market does not create goods (although it consistently increase value)
2. a market in our theory is not an axiom, but a product of evolution
3. the proposed theory defines the value independently from the market, and derives market from it
4. goods, transactions, and market share the same physical notion of value that can be measured in same units same dimension.

Apparently, goods value can change. Not so long ago 5-inch magnetic disks were valuable, not today. Mainstream economists tend to blame the market for that: "price fell"; whereas the real reason, of course, is the invention of better data storage devices; without this invention the price and the value would not fall (this is an example of the causation confusion trap set up by monetarism).

As we equated value with reproductive advantage, and made it a basic notion, we must conclude on the role of a market: **A market does not determine value of goods, a market estimates the value.**

## 7 The Measure

Apparently the intrinsic value of goods is multidimensional. Food alone has many dimensions of value: sugars, fats, proteins, multitude of vitamins and micro-elements, essential amino acids, and something we do not know yet – all these are required in certain proportions rendering one-dimensional comparison between different food types impossible. Shoes and axes add some more fully independent dimensions of value... However, food is consumed for some purpose, tools are used for some purpose too. From the evolutionary perspective this purpose is ultimately the reproductive advantage. From the multitude of properties through the several intermediate goals (satiation, resting, lust, etc) to merely one measurable parameter the reproductive success.

We can compare goods (being consumed/used by people (remember the value is a function of two arguments)) by how much they affect the consumer's reproductive success (perceived or potential success or the expected value of the success in the probability theory terms).

Somewhat counterintuitive we propose to use energy units for this measure, i.e. translate “reproductive advantage” into the amount of energy saved (compared to what competitors have spent or might have spent). This makes sense because the energy saved by a person does translate into reproductive success of this person – the less energy you spend for a unit of food, the more/better offspring you can rear.

Another reason to use energy units is that we can express in energy units the cost of an item of any level of refinement. Because all we harvest or manufacture costs human labour, which is ultimately what we eat, and all we eat is ultimately stored sunlight, the cost of converting sunlight and storing it in chemical bonds is again energy. The forms of stored energy (different fuels and foods alike) are all interconnected with energy conversion paths of certain specific cost for each – it allows us to use single abstract energy unit for all forms of energy.

Example: to extract nutrients and energy from grass you need to spend some energy (some in form of digestion, some in form of labour (to harvest and chew the grass), and some in the form of waste); a cow can do the same job much more efficiently with much less waste; by eating a cow you save plenty of energy – you shifted the largest part of the expenses onto the cow; and by taking care of a domestic cow, you save energy that you would otherwise spend on hunting a wild one; and by manufacturing tools involved in the process you save your labour (which is also a form of energy).

Although it is difficult in a general case to compute the exact amount of energy invested in an item and the exact amount of energy it provides to the consumer, still it is fundamentally possible, and the energy measure can be used for “local” comparison without knowing the absolute energy value.

**We can compare (and ideally calculate) how goods affect energy efficiency of consumers lives, and express this value in energy units.**

## 8 Discussion And Refutations

We excluded from the scope all pathological market phenomena. Because they all require the existence of a “victim”-market to parasitize on. Therefore a market should evolve first, to give room for pathological phenomena.

The theory explores the origins of the market, not the transient contemporary excesses.

The conspicuous consumption does not destroy the reasoning above, it does provide reproductive advantage through sexual selection.

The theory does not have to explain phenomena of the physical realm that prevent a market from evolving. There are physical circumstances that make markets and the notion of value negligible. From this fact nothing follows. The theory does not promise a creation of a market.

The theory does not claim that the capacity for trade causes humanity to choose the optimal variant of development – evolution does not guarantee optimality in any sense at all – any specie would go extinct with or without capacity for trade.

The theory does not claim that no value will be lost.

The theory does not make any claims about “items of art”, neither it demands any properties from them. As *value* is a function of two variable, there will be regions where one variable’s impact dominates the other (e.g. the variation of subjective value of items

of art dwarfs the variation of physical value). From this fact nothing follows. The proposed theory does not limit the shape of the value function.

In connection with the above it is often said: “art experts determine the value of art and it is perfectly legit”. Although it has no impact on the proposed theory, we must note that the art evolved BEFORE “art experts”. Therefore the evolutionary value of art does not depend on “art experts”, even though it is out of the scope of our theory.

The theory does not make statements quantified as *all goods and services*. The theory says *there exist enough goods and services of a given property*.

A market follows from food and cloths, from tools and fuel, and many various tangible valuable goods each of which is SUFFICIENT to give rise to a market. Does a market follow from “items of art” we do not know. Thus the “items of art” is an invalid counter-example.

The aesthetics and entertainment value require more research to understand how they could be (if at all) represented with the present theory. However, there are no visible obstacle for this line of reasoning: aesthetics is involved in very basic biological processes such as resting, it could be argued that aesthetics decrease stress, increase diligence, etc, and thus improve one’s energy efficiency.

## 9 Conclusion

The Evolutionary Theory Of Value does not add new axioms. It uses the existing axiomatic base of biology, that is supported by a colossal corpus of research and evidence. The theory explains the cause of *demand* while removing the axioms: *wants and needs*, and *rationality*. A market participant exhibit some behaviour because he is programmed to do so, no understanding nor optimization nor even rationalization is required on his part. The irrational behaviour of a participant is no longer a paradox nor a hindrance for the theory. Optimal behaviour is not exceptional either. Furthermore, as an agent is biologically driven, it is not enough to provide relevant market information to him in order to change his behaviour, but it is possible to replace the agent along the course of evolution. People trade with profit because this profit is evolutionary reinforced, evolution reinforces any profit, regardless of rationality, but rationality is also reinforced if and only if it is profitable. This argument purifies economics from both teleology and moralism.

The theory reveals common foundation of all wants and needs and allows to formalize and quantify it.

From the evolutionary explanation of human behaviour follows ineluctability of a market.

The theory ends the debate between subjectivists and objectivists – the value is subjective and objective simultaneously necessarily.

The theory solves the “water and diamonds” [3, Chapter IV] paradox (without specifically targeting it).

The popular belief that the value is fundamentally unmeasurable is now totally refuted. We do not claim it is easy or even feasible, we claim that the value is in principle measurable, and even without knowing its absolute value we can compare values, which is the foundation for development of adequate relevant measures to replace ill-defined

monetary indicators (e.g. GDP)) Parameters that were believed to be unmeasurable can now be measured, statements that were believed unverifiable can now be verified.

We created an extremely simple yet rich mathematical model of a transaction, which also shows how the market creates value.

**The proposed theory is ontological, it explains the mechanisms and origins of phenomena, which is a huge advance for economics.**

Civilizations with all their cultural and physical artifacts live on biological substrate, so we can not ignore the effects of biological factors on the development of civilizations. Conversely, on a sufficiently large time span we can not ignore the effects of civilization on the human genome, because civilizations are powerful machines of selection. Various civilizations develop in different ways, and only one of them associates with a rapid scientific and technological progress; we hope we touched ONE of the root causes of this difference.

From the proposed theory follows that anti-market arguments are outside the scientific framework completely.

Monetarism causes confusion between money and value. Money replace real value in all practical calculations, although they merely represent value in SOME cases. Monetary metrics expel understanding of physical meaning from economics. This dirty trick was enabled by the lack of proper (non-contradictory, and functioning) theory of value. The evolutionary theory of value closes this gap.

Money lose the monopoly on representation of value, and we can now assess the validity of monetary indicators, that were ASSUMED to be relevant so far. For example, from the evolutionary value perspective, in GDP loses are added to gains.

**The Evolutionary Theory Of Value returns physical meaning into economics.**

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