

Chapter Sixteen **Beyond Money:  
Offer Networks, a  
Potential Infrastructure  
for a Post-Money  
Economy**

By Ben Goertzel

The idea of something as basic as money going obsolete may seem farfetched. On the other hand, the idea of paper money and coins being largely supplanted by virtual electronic funds would have seemed farfetched not too long ago – not to mention the prevalence of complex financial derivatives, high frequency trading, and so forth. Finance has been the subject of a variety of radical innovations over the past century, and may be transformed even more dramatically during the next. It is far from obvious that an economy focused on money is going to remain an effective means of mediating interactions as technology advances, the current forms of material scarcity recede, and interactions between minds, and between mind and matter, complexify.

Some SF writers have envisioned radical future transformations of the world of finance that enhance rather than de-emphasize money's role. For instance Charlie Stross, in *Accelerando* (2005) hypothesizes vast communities of posthuman

intelligences taking the form of digital corporations interacting via complex forms of auctioning. This is indeed one thinkable sort of possibility. On the other hand, it also seems feasible that advanced technology will both enable and encourage the development of alternative, more sophisticated methods of exchange. It may be that from the point of view of a post-Singularity society, or even a pre-Singularity society a bit more advanced than ours, money will seem a crude instrument, a woefully inadequate way to represent preferences and guide exchanges and formalize “value.”

One hint at a possible direction beyond money as currently utilized is the observation that the values that we assign to various things, in our minds, are complexly multidimensional (or actually, probably better modeled as nondimensional). *Human value* is not one-dimensional like cash value – and as I’ll discuss below, projecting it into one dimension doesn’t always make sense. Yet for so many aspects of our lives, we’re study with a system that treats value as one-dimensional.

Mathematically, one may say that human beings’ value systems are “partial orderings” – they allow a person to say whether X is more valuable than Y, in a certain context. But money requires something stronger than this – it requires the arrangement of all entities to be valued in a “total ordering”, so that any X and Y can be compared as to their relative values. This has the merit of simplicity; it allows values to be arranged along a number line, so that one can assign each entity whose value is of concern a single number representing its value. But it has the shortcoming of not actually agreeing with the way human minds think and feel about values. In a partial ordering, mathematically, two entities X and Y may simply be incommensurable. N-dimensional vectors (for  $N > 1$ ) are like this; it doesn’t always mean something to say that vector X is “greater than” vector Y. In a value system that is a partial but not total ordering, there may be entities X and Y whose values are incommensurable – there is no clear answer regarding whether X is more valuable than Y or vice versa. This is how

human value systems work, even though it's not how money works.

In this chapter I'll outline an alternative methodology for systematizing exchange, which embraces the partial-ordering aspect of human value systems, and which I call an *Offer Network*. Offer Networks, like Bitcoin and other contemporary cryptocurrencies, would be enabled by Internet technology and advanced computer algorithms. Using Offer Networks, people would be able to make bids to provide one good or service in exchange for getting (not necessarily from the recipient of said good or service) some other good or service that they want. A computer algorithm would reconcile different peoples' offers and try to find collectively satisfying arrangements.

Using Offer Networks, people would be able to get what they need and some of what they want, and offer what they are willing and able to, without having to pass all their preferences and values through the single dimension of cash value. A kind of cash value – which I call OfferCoin -- would still exist, but defined emergently in terms of a network of formalized non-monetary exchanges. So in simple cases where projecting the value of an entity into a total ordering is unproblematic, it can still be done. But in more complex cases where value must be treated as multi or non-dimensional – and partially but not totally ordered – the use of money values is not required, and one can instead use direct exchanges, which may be mediated according to the partial-ordering value systems of the parties involved.

Expressed abstractly like this, the idea may sound pretty complicated – but actually using an Offer Network would be no more complex than using contemporary Internet transaction systems like eBay or Match.com.

There are echoes of SF tales like *Accelerando* and *Down and Out in the Magic Kingdom* (Doctorow, 2003) in the Offer Network idea -- but when one gets down to nitty-gritty details, the system I propose here is a bit different. Partly, perhaps, because I'm trying

to propose a variety of post-money (and in some potential futures even post-economic) system in a straightforward and realistic way without too many fun, whimsical SF overlays.

Whether Offer Networks are really the future of economics, I don't know. But as Abe Lincoln and others have said, "The best way to predict your future is to create it." Perhaps by promoting the idea of Offer Networks now, the odds of something like it coming to pass can be increased!

My conjecture is that something like Offer Networks is coming, and is going to play a key role in smoothing the socioeconomic changes we're going to see during the next decades – as technologies like AGI and robotics advance and gradually conquer the job market. But I'll get back to that aspect after elaborating on what an Offer Network actually is.

#### **Alternative Currencies and Economic Frameworks as of 2014**

The notion of Offer Networks and OfferCoins is somehow a natural thing to propose in 2014, given the recent attention paid to cryptocurrencies and their potential for revolutionizing exchange. Bitcoin is the most popular of the new digital currencies, and is notable due to its relative popularity, but it's not necessarily the most interesting of the bunch. And beyond crypto currencies per se, a number of parallel proposals for complex network based, Internet and cryptography leveraging, economic frameworks have emerged recently. None of these does what Offer Networks does, but some of them do have properties that Offer Networks seek to achieve in a somewhat different way.

For instance, there have emerged various social-good-oriented cryptocurrencies such as DevCoin (<http://devcoin.org>). DevCoin automatically donates a certain percentage of newly created currency units to the common good, where the latter is voluntarily determined. According to the DevCoin site, the point is "allowing people to come together and vote on projects that the money should be spent on, thereby creating what is essentially a

(voluntary) 'world government' that funds itself from the revenue from generating new currency units. "

Somewhat similar is SocialCoin (<http://www.soccoin.com>), which aims to give a certain amount of free SocCoin money to each person each year. If SocCoin were widely adopted, this would amount to a universal guaranteed income. OpenUDC<sup>110</sup> is another effort along these lines (forked into Ucoin<sup>111</sup>).

Abstracting from the specifics of DevCoin, SocCoin, UCoin and other similar currencies, what one sees is the idea of a mechanism that

1. gives a certain allowance of money to each person each year
2. gives additional allowance to people satisfying certain criteria
3. allows (online) voting regarding which people satisfy said criteria
4. uses cryptographic methods to ensure unique identities for voters (e.g. Buterin, 2013, reviews details of this aspect)

In theory, with broad buy-in, this would be a democratic, global method of executing social welfare.

Ethereum<sup>112</sup> is a software infrastructure intended to be used to implement various novel media of exchange (e.g. "traditional" cryptocurrencies, multidimensional money, or essentially any kind of contract that can be expressed as a computer program...). For example Gregory Maxwell (Maxwell, 2013) showed how it could be used to create a fully automated, self-propagating business: an online storage facility that advertises itself, secures new customers, and then rents new space when its current storage space runs out.

Approaching the issue of exchange from a different direction,

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<sup>110</sup> <http://project.openudc.org/>

<sup>111</sup> <https://github.com/ucoin-io/ucoin>

<sup>112</sup> <https://www.ethereum.org>

Open Value Networks<sup>113</sup> provides a model for collaborative organizations founded on open, egalitarian exchange and collaboration – intended as an alternative to corporations in their traditional form. As the web page states,

Open Value Network is an approach to commons-based peer production. It allows individuals and organizations to co-create and aggregate value through lateral and large scale coordination, cooperation and collaboration

- to serve as a responsible steward of commonly held wealth and assets
- to account for various inputs and outcomes in a common ledger system
- distribute value equitably and intentionally within and beyond the network
- and to share returns amongst contributors, in proportion to their contributions

One of the goals of Open Value Networks is to encourage direct exchange among individuals who have something to offer each other, eliminating middlemen as much as possible, since in the current scheme of things middlemen often couple moderately useful informational functions with a high degree of value extraction. As Open Value Networks advocate Apostolis Xekoukoulotakis (2013) put it,

*[I]t is important to note that there are 2 graphs. On the one hand is the graph of offers and needs and eventually the transfer of products that fulfills those needs.*

*On the other hand, there is the graph of transactions, the graph that shows the changes of ownership of commodities from one person to another.*

*For each edge of the first graph there can be multiple edges*

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<sup>113</sup> [http://p2pfoundation.net/Open\\_Value\\_Network](http://p2pfoundation.net/Open_Value_Network)

*in the second because of the introduction of middlemen.*

*My proposal tries to subjugate the graph of transactions (and money) to the first graph.*

*Due to lack of information on the needs and offers of people, we need middlemen and money. A posteriorly, then, we have to find rules that define transaction equivalences that can eliminate the previous transactions of middlemen.*

*This is similar to giving zero interest to a loan, but only applied on multi barter networks.*

Less concrete in nature but similar in concept, theorist Dirk Helbing has written a number of papers about the future of economy, including one tantalizingly titled *Economics 2.0*. He proposes a kind of multidimensional money, in which each unit of currency comes attached with multiple value indicators. E.g. instead of just having a dollar, you might have a dollar that comes with 100 default cents, 70 environmental-responsibility cents, and 35 end-poverty cents. The additional values would indicate the extent to which the processes used to earn the dollar have worked toward other goals such as environmental responsibility and the ending of poverty.

One interesting point raised in *Economics 2.0* is the potential existence of a "tipping point" of sociality.... In some simulations he reports, if each agent in a society has a utility function of the form  
personal utility + others utility \* k

then the higher k is, the more each agent cares about the other agents (and acts on this care). What he notes is that there can be phase transitions in social structure based on k. Sometimes a small increase in k can cause a large change in the social order – a tipping point.... Very roughly speaking, it could be that widespread use of a system like Offer Networks could help to nudge k up toward the threshold level.

### **Does More Than One Dimension of Value Make Sense?**

The various crypto-currencies at play today are exciting and

interesting, but have in common with traditional money the projection of value into one dimension. Dirk Helbing's speculations about multidimensional currency are a welcome exception.

Many thinkers, however, believe that the one-dimensionality of money is not just a convenience, but a reflection of a fundamental one-dimensionality of value. The most common argument in favor of the effective one-dimensionality of value is based on the idea that rationality implies transitivity of preference.

An agent is said to have transitive preferences if it organizes its preferences in a linear order, where for every class of goods/services X, Y and Z, "X is preferred to Y" and "Y is preferred to Z" implies "X is preferred to Z". One can prove fairly easily that if an agent's preferences are NOT transitive in this sense, then it can be manipulated by other agents in a series of trades that rob it of its property and leave it in a subjectively undesirable situation (Hansson et al, 2012). If preference is associated with monetary value, the series of trades involved in this argument is typically called a "money pump". But actually the argument holds even outside the context of money, e.g. one can set up a barter-based "money pump" that causes the victim to trade away all his stuff in a series of circular trades.

But the money pump argument is founded on the assumption that intelligent agents necessarily have a fixed preference ranking over all the alternatives available to them, based on assignment of these alternatives to well-defined categories. That is: in the mathematical terminology I introduced above, it assumes that human value is a total ordering. Real minds are complex dynamical systems, with preferences that are shifting and context-dependent, especially when dealing with situations they're not that familiar with. Often a real-world agent will be indifferent between multiple options that it doesn't know much about, or will make up its mind about how much it likes something only while experiencing it – thus rendering its valuation system a partial



rather than total ordering.

Some kinds of exchanges really are well modeled in terms of classes of repeated goods/services, about which an agent has a clear and stable set of preferences – in these cases the money pump argument is applicable. Other kinds of exchanges are far more fluid in nature, and may be more naturally modeled in different sorts of ways.

It would seem that when an agent is in a new sort of situation, where it isn't clear how to effectively divide the various available options into categories, then transitivity of preference is likely to be violated for the relevant categorizations of options. But in practice this wouldn't necessarily make the agent susceptible to a money pump, because in the course of doing the repeated trades needed to bilk it, the agent would learn more about the domain and form new preferences.

In short, transitive preferences and linearized values seem most sensible in cases where repeated instances of the goods/services in question can be very neatly divided into categories, and the agent has had enough experience with goods and services in the different categories to really know what it prefers. In a novel domain of experience, however, the flexibility to be intransitive may be helpful for creativity and learning. Prematurely settling on a linear ranking of values in a new domain may prevent an agent from more deeply understanding what its preferences should be, based on the rest of its mind.

Currently, with our limited ability to transform matter, we humans are in a domain where we're often exchanging goods and services that fit naturally into predefined categories. Mass production has increased the degree to which this is the case – in traditional tribe or village society, more exchanges were "special cases", making it more difficult to divide all exchanges into neatly defined categories. Two McDonald's hamburgers are pretty much alike, but two donkeys may be pretty different, and informal exchanges in a pre-industrial context were able to take into account

the particularities of the entities being exchanged, in a manner defying easy formalization as a brief set of rules.

As technology advances, matter will become more pliable via nanotechnology (and perhaps femtotech and beyond), and cognitive and relational goods will become as prevalent as physical goods or more so. Ongoing rapid change will be the norm, meaning that a preponderance of exchanges will regard novel situations. On the other hand, everyday goods like food and shelter and Net connectivity may become freely available, as is currently the case for water from public drinking fountains, or space for walking on the sidewalks. The domain in which transitive, linearized preferences are optimal and relevant may end up being a relatively uninteresting little corner of the total scope of exchanges.

### **What is Money, Anyway?**

Offer Networks, which I'll describe here, are a specific method for handling exchanges among a population of people or other agents, which doesn't intrinsically rely on the projection of every offered good or service into a linear scale of values.

I'll work up to the Offer Network idea via incremental steps... starting in a hypothetical little village, and ending up eventually with an advanced AI-mediated post-economy.

We use money constantly, yet we don't reflect often on what money really is. I'll try to elucidate the nature of money by means of some very simple example cases.

First, let's consider a very simple monetary-exchange scenario in a small community:

- Dean borrows \$20 from Todd.
- Bob picks some strawberries from his farm, and sells them to Dean for \$20.
- Bob then buys a hamburger from Karen for \$20, which Karen produces from her own cow.
- Karen takes the \$20 and uses it to buy home repair services

from Jack; and Jack uses the \$20 to buy some apples from Jane (who picked them on her farm).

- Jane takes the \$20 to buy some oranges from Dean.
- Dean pays Todd back the \$20 he borrowed.
- What are the actual exchanges that have happened here?
- Bob supplied strawberries to Dean, and got a hamburger from Karen
- Karen supplied a hamburger to Bob, and got home repair services from Jack
- Jack supplied home repair services to Karen, and got apples from Jane
- Jane supplied apples to Jack, and got oranges from Dean
- Dean supplied oranges to Jane, and got strawberries from Bob
- Todd just served as the bank, giving a no-interest loan
- The exchange of the \$20 is just a way of mediating this network of exchanges of goods and services.
- Now envision a different way of doing the same set of exchanges, with no \$20 involved:
- Bob publishes desire to exchange Strawberries for Hamburger
- Karen publishes desire to exchange Hamburger for Home repair services
- Jack publishes desire to exchange Home repair services for Apples
- Jane publishes desire to exchange Apples for Oranges
- Dean publishes desire to exchange Oranges for Strawberries

Then, the whole little community looks at the various exchange-desires that have been published, and figures out the exchanges that can be done to make everyone satisfied. And Todd has nothing to do with it.

In this particular case, there's no harm to using money; it's just a simple way to mediate the exchanges that would happen

anyway.

But in more complex cases, money may fail to capture the nuances of the desired exchanges; and can lead to various pathologies as we see in the modern world.

### **Offer Networks: A Simple Case**

The example I've just run through leads up to a simple case of the Offer Network idea.

One elementary type of Offer Network would be defined as follows:

1. Each person publishes (into a secure clearinghouse system) their willingness to exchange  $X_i$  (some good or service) for  $Y_i$  (some other good or service)... Then
2. A "clearinghouse" algorithm figures out how to propagate exchanges so that each person gets some exchange that is acceptable to them.

A more sophisticated version would involve bidding, a la eBay and other auction systems. In a bid based Offer Network, each person would specify various possible exchanges ( $X_i$ ,  $Y_i$ ) and assign each one a degree of desirability.

Then, e.g.: Bob may be willing to offer an hour of medical consultation to get half an hour of skiing lessons. But first he may offer half an hour of medical consultation in return for half an hour of skiing lessons. If that fails he may up the offer to an hour.

(Or more generally: even if a person is willing to offer  $X_i$  to get  $Y_i$ , he may first offer some  $X'_i$  that is dominated by  $X_i$  (i.e. he would prefer to exchange  $X'_i$  for  $Y_i$ , than to exchange  $X_i$  for  $Y_i$ ). If this initial offer fails to get him a good enough result via the clearinghouse, he may offer some other  $X''_i < X'_i < X_i$ , etc.)

A few more examples of specific exchange-pairs might be:

- Ben is happy to exchange knowledge about AI for knowledge about physics or biology
- Mary is happy to exchange home repair services for piano

lessons. She'd rather exchange home repair services with a young guy for piano lessons, but is willing to accept someone between 40 and 50 if needed.

- Todd is happy to exchange 5 kilos of strawberries for 10 steaks or 3 whole chickens

An issue that arises immediately in the context of a system like this is the risk of dishonesty and deception. In the simple case of a small community (like the 5 people in the example given above), there is a strong reason for each participant to make good on whatever they've promised to provide in a given exchange. If they don't, everyone else will see that they're unreliable or dishonest, and will avoid entering into exchanges with them in future.

In a larger society this kind of direct social pressure can't work, but alternatives exist, e.g. a reputation management system similar to that used in today's online stores, in which each person rates each transaction they've had, so that each person gets an overall reliability rating. More complex variants are possible as well, e.g.

- reliability ratings that are context-specific (Jack sometimes reneges on offers to participate in musical jams; but always comes through with offers to provide programming services)
- an algorithm to determine the reliability of each person *as a rater*, based on whether their ratings tend to be outliers
- an algorithm to estimate the average rating given to a certain provider in a certain context, by raters with criteria similar to one's own (e.g. you may not care if a house-cleaner shows up late; but John may... so if John down-rates Fred's cleaning services because Fred shows up late sometimes, you may wish to ignore said down-rating)

Potentially, reputation management could end up being the most complex part of an Offer Network system – much as fraud detection is the most complex part of a system like PayPal.

### **Beyond Traditional Economic Exchanges**

The above kind of Offer Network is already pretty interesting. But it gets better – a moment's reflection indicates that traditional exchange of goods and services is only a fragment of what this kind of system can handle.

An offer such as

*Agent A is willing to exchange  $X_i$  for  $Y_i$*

is just a special case of a more general offer of the form

*Agent A is willing to carry out action  $A_i$ , which has post-condition  $Z_i$ , IF precondition  $Y_i$  is met*

Everyday examples of offers that aren't classic economic transactions might be

- Matilda is willing to put 10 hours/week into a project aimed at emulating Oculus Rift in open source hardware (postcondition), if 10 other people with advanced degrees in science are also willing to put at least 10 hours/week into that project
- Maria is willing to go on a date on Friday 11/7 at 8PM with anyone living in the San Francisco area, if they are under 25, employed full-time, have a "Yahoo date rating" of at least .7, and have done at least 5 hours of verified social-welfare volunteer work in the last month
- Ben is willing to go play kazoo at Open Mic Night at Peel Fresco on 12/17, if there will be a drummer and a bass player there
- More advanced and complex offers could be issued by various sorts of AI agents, as AI develops.

The clearinghouse can then have knowledge of which post-conditions imply which pre-conditions, and the whole process of clearing everyone's offers becomes the execution of a giant "production system" style logic engine. Economy becomes cognitive in a very obvious and transparent sense. There is the possibility for the clearinghouse to optimize the degree of overall

desire fulfillment via heuristically or probabilistically predicting which post-conditions are most likely to lead to which preconditions (or which combinations of post-conditions are most likely to lead to which combinations of post-conditions). And of course these calculations would be taken into account in the calculations defining the OfferCoin value of an offer.

Traditional economic actions involving exchange of goods and services become freely intermixed with other kinds of actions involving context-dependent willingness to commit to carry out various sorts of activities. But of course these more general actions are "economic" too in a broader sense, because they involve agents carrying out actions, hence expending energy...

As a simple example indicating the flexibility of this sort of system, various variations of "buy local" or "buy from a group I like" could be easily be achieved via an Offer Network system . For instance I could offer a discount on some service I offer to anyone who participated in online transhumanist discussion... or to people who live in my village... etc.

There is a surface parallel between Offer Networks and old-style socialist ideas about computer-controlled centrally planned economies. In these old ideas, as in Offer Networks, a massive integrative system was often posited to balance everyone's desires against each other. But a critical difference is that, in the Offer Networks approach the clearinghouse doesn't try to determine what anybody's needs or abilities are. Instead, people specify their offers based on their own value systems; and the clearinghouse just mediates the transactions, in a way that respects the various individuals' desires and values insofar as they have articulated them within their exchange offers.

### **Emergent Money**

Generalized offers as supported by Offer Networks have a richness and humanity to them that purely quantitative financial calculations do not. They also allow people to propose and execute

exchanges that are faithful to the nontransitivity of their preferences.

However, money does have a certain simplicity to it. In some cases specifying exchange-pairs will feel overly complicated and the simplicity of some sort of money will be preferable. For this purpose, it is possible to define a sort of emergent money based on an Offer Network.

Further, it is difficult to see how a pure exchange network, with no abstract quantification of value into some money-like entity, would handle *nonspecific deferred gratification*. If everyone were just living in the now and exchanging today-stuff for other today-stuff, then you could just have a clearinghouse of offers, with no need for symbolic, money-like tokens of value. OR, if everyone were exchanging {today-stuff or specific promises of specific future stuff at specific times} for {today-stuff or specific promises of specific future stuff at specific times}, a pure exchange network would still work as well.

But the problem is that we don't know what we're going to want a week from now let alone 5 years from now... Yet we do want to be able to perform some services today, or exchange some perishable goods today, in exchange for being able to get some of "whatever we're going to want" a year or 5 from now...

This kind of nonspecific deferred gratification is critical to the creation of large projects of any type, at least in the current era or any era before scarcity is wholly abolished. And it seems that to make nonspecific deferred gratification work, you need some abstract token of value, that can be cashed in for specific goods or services at the future time when you decide what you want...

To enable this within an Offer Network as described above, the most natural route is to estimate an "emergent money value" for a given offer, via defining a measure of how many "exchange units" or "OfferCoins" a given offer is worth.

One way to do this would be as follows:



- The raw OfferCoin value of X is: what percentage of all offers is dominated by X (in terms of what they could obtain in exchange, via the clearinghouse).
- The final OfferCoin value of X (the number of OfferCoins X is worth at a given point in time) is then a normalization of the raw value of X
- Say:  $1 \text{ trillion} * \text{raw value} / (\text{sum of all raw values})$

The OfferCoin value can also be used in exchange-pairs. That is, barter can be mixed with \$\$ purchases. Someone can offer 500 OfferCoins for a side of beef. The going rate for a side of beef in terms of OfferCoins can then be determined via auctioning, similar to on eBay.

In a sousveillant society (where auctioning is less relevant as real preferences are more transparent), everyone's desires can be made open, meaning the whole clearing house can be open. Otherwise, the clearinghouse could be made auditable but secure, using strong encryption methods.

Note that qualitative offers could mix with quantitative OfferCoin-based ones in various contexts; e.g. the kazoo-playing example given above could mix with:

- Jim is willing to pay 20 OfferCoins for a drink at Peel Fresco on 12/17, if there will be a kazoo player there
- Jean is willing to open her nightclub Peel Fresco for Open Mic Night on 12/17, if she has commitments for at least 500 OfferCoins worth of drinks to get bought

and the open source hardware example given above could mix with:

- Jack is willing to put 10/hours week into any available open-source hardware project in the gaming space, if he can find a Ruby programming contract paying him at least 50 OfferCoins per hour, for between 15 and 20 hours per week (or, if the contract involves developing open source code, he will accept a price of 40 OfferCoins per hour)
- Lisa is willing to pay up to 60 OfferCoins per hour for a

Ruby or Python programmer who is also an active contributor to the open source community (at least 5 hours per week); she is also willing to donate 5 OfferCoins to African medical care for each hour that this programmer works

It might be desirable to enforce a fairly high inflation rate on OfferCoins. So, if someone's precondition for an action involves getting OfferCoins, then they can receive OfferCoins and bank them. But if OfferCoins decay in value intrinsically, based on the time since they have been received, then hoarding intrinsically becomes infeasible.... Perhaps the inflation rate could be adapted dynamically via voting among all exchange members.

A big plus of an Offer Networks type system is that it allows one to flexibly embody various values into one's exchanges and other offers. It's straightforward to embody values besides simple monetary values in one's exchange offers (e.g. the desire to hire a programmer who is an open source contributor; the desire to date someone who has done volunteer work; etc.)

To formalize things slightly more, the definition of "monetary value" implicit in the OfferCoins defined above is

*OfferCoin\_value(offer A) =*  
*(normalization of the rank value of A, when all current offers made by all people are rank-ordered in terms of what could be obtained from the offer via a complex series of trades)*

\*

*(fraction of total OfferCoin value that is assigned to current versus past offers)*

The latter fraction is determined via the inflation rate: the higher the inflation rate, the greater the fraction of OfferCoin value assigned to the present time.

So as opposed to a Marxist "labor theory of value", this approach is quite pragmatically assigning an OfferCoin value to

something that is roughly proportional to what one could get by trading that thing. However, this calculation is made over the totality of specified non-monetary (i.e. non OfferCoin based) exchanges as well as over OfferCoin based exchanges.

If the inflation rate is voted to be reasonably high, then accumulation of wealth will be difficult and more of the wealth will go to people who are offering goods/services right now that are judged valuable right now....

The inflation rate toggles between meritocracy and inheritocracy, in a sense (where I consider "inheritocracy" as the practice of assigning value to those whose past selves or ancestors provided perceived value at past times)

Of course the idea of grounding some kind of money in exchange is not new and is wholly obvious. But one thing that's different here is the free intermixture of OfferCoin-based and "barter specification based" exchange ... this keeps the OfferCoins quite directly grounded in peoples' specified values. For instance, if

- X can be exchanged for 800 OfferCoins plus a few songs and paintings and happy wishes
- Y can be exchanged for 1000 OfferCoins

then X could be judged more valuable even if nobody wants to pay OfferCoins for the songs, paintings and happy wishes (but some people are willing to exchange other valuable things for these items)...

### **Antimoney**

A speculative possible addition to Offer Networks would be the concept of anti-money introduced in (Schmitt, 2013). This is an innovative mechanism, reliant on the Internet and cryptography, intended to replace the mechanism of borrowing with interest. Two kinds of currency, money and antimoney are introduced. In exchange for a good or service, someone can provide money or receive antimoney. Two individuals can also trade money for

antimoney, at an agreed-on rate of exchange. To avoid exploitation, a cap may be placed on the total amount of antimoney any one person can collect (or more sophisticated, analogous methods may be used). If someone defaults (declares bankruptcy) then their antimoney is returned to the folks who gave it to them. The risk of default would be part of the calculation in setting an exchange rate with a given transaction partner.

Antimoney could potentially be introduced to Offer Networks as a kind of anti-OfferCoin, to be devalued at the same rate as regular OfferCoins. This would provide a built in method of small-scale borrowing. The viability of this sort of mechanism would need to be explored via simulations before widespread implementation. But at very least, antimoney serves as an example of the kind of innovation that is possible within this kind of framework.

### **Futarchy**

As a bit of an aside, there seems to be a natural connection between Offer Networks and Robin Hanson's fascinating, hypothetical political scheme of Futarchy (vote on values, bet on methods for maximizing the values).

For instance in Futarchy, a vote could determine a goal such as: providing free health care meeting certain specific criteria to all people in a certain country, by a certain date. Then, various plans could be put forward by different people or groups, suggesting methods for achieving the stated goal. Then people would be invited to vote for or against the success of each plan. The plan that gets the highest odds of success is the one put into place, and then the bets for and against the plan are paid off once the success of the plan is observed. The underlying concept – which has a fair degree of empirical validation -- is that groups of people betting their own money tend to make more accurate judgments than groups people simply expressing their opinions.

Futarchy would emerge from the Offer Networks system if

- people make offers of goods/services in ways that are based on their values
- people make bets on outcomes of attempts to realize their values
- institutions make choices (postconditions) based on observations of peoples' betting behavior (preconditions)

Bets fit perfectly well into the Offer Networks framework; they are offers to give something in the future (the postcondition), conditional on some condition obtaining in the future (the precondition). Reputation ranking can be used to make it likely people pay up when they lose a bet... A few renegers won't matter much with political-type bets, as futarchy counts on a large number of small bets being made...

On the other hand, it is not clear to me that futarchy as specified by Hanson would really be needed in an Offer Networks context. It might be that betting turns out to be unnecessary and many aspects of appropriate governance can self-organize via the network of exchange.

#### **Isn't It Too Complex?**

To implement an Offer Network effectively in reality would require a lot of art as well as engineering and science. But for a society that has implemented eBay, PayPal, Facebook, Bitcoin, Bittorrent and the like, it doesn't seem beyond the pale.

It may at first seem very complicated for a person to have to specify offers involving pre and post conditions, rather than just specifying the price one is willing to pay for something. But I think this complication could be mostly eliminated via development of appropriate user interfaces.

Also note that, while there is a central clearinghouse in the above, it doesn't actually have to be implemented in a centralized, monolithic way -- it could be implemented as a distributed peer to peer system with no owner, using strong cryptography to maintain integrity, and spare computer cycles to do calculations.

I don't think that the complexity of Offer Networks is greater than that of the current financial system, with all its derivatives and credit default swaps and central banks and what-not. It's a different sort of complexity, though -- more focused on individuals and their interactions and values than on the actions of specialists and large institutions.

The current, complex financial system emerged gradually, and I suppose that if a system like I've described here is going to happen, it's also going to emerge gradually. I'm not sure what the first steps will be, but I suppose that they will occur in some online marketplace -- or maybe even inside some multiplayer game. Perhaps they will happen in the developing world, where typical 21st century financial systems are not that well developed -- there is a possibility for the developing world to leapfrog past the perversions of contemporary Wall Street into a more advanced sort of exchange network.

#### **Algorithmics of the Clearinghouse**

Detailed design of the Offer Networks clearinghouse algorithm has not yet been carried out. However, I have thought through two possible approaches, and formed a tentative opinion on which would be best. More mathematical analysis will be needed before a concrete approach can be definitely formulated.

The material in this section assumes some understanding of machine learning and simulation theory; the reader with little technical background may wish to skip to the next one.

One possible approach would treat the clearinghouse's operations as an optimization problem, solvable perhaps by evolutionary algorithms. One could, for instance:

1. Formulate an evolutionary learning problem, where each genotype is a set of pairs (person, action-set), indicating a set of possible actions undertaken by the people involved in the network; and the fitness of the genotype is: 0 if anyone in the network is doing something they're

unwilling to do; otherwise, the total sum of the weights that each person assigns to the (actions of which X is giver, actions of which X is recipient) set in which they are involved.

2. Fitness evaluation involves calculating the barter chains involved in an optimal implementation of a given genotype. This can be done via some sort of heuristic search algorithm. Dynamic programming is too expensive, so some approximative approach must be used. The fitness evaluation therefore will just involve an estimate of the actual fitness of the genotype, indicating the fitness according to the best corresponding barter chains that the heuristic search algorithm can find.
3. Fitness estimation will be critical, and will involve caching of information about barter chains found during prior fitness evaluations, to speed up heuristic search (e.g. by allowing rapid discarding of genotypes containing combinations previously found infeasible)

An alternative would be a Monte Carlo approach, involving the creation of a simulated agent for each member of the Offer Network. One would then let the simulated agents trade with each other for a while and see what results from all the trading. The whole simulation would be run many, many times, and the results would be recorded. Then, from all the simulations, one would measure the fitness of the end result (via the same method suggested in Step 1 of the evolutionary approach, above). The clearinghouse would then recommend the assignments that would result from the best simulation world found.

Of course, the effectiveness of this approach would depend on how dumb the simulated agents are. Caching information about barter chains found in prior simulations, as in Step 3 of the evolutionary approach mentioned above, would make the simulated agents less stupid as the series of simulations proceeds, and improves the ultimate result found in most cases.

My preliminary intuition is that the simulation approach would be better, as it seems easier to tune. However, both approaches would be computationally expensive and it's hard to compare them in depth without going a lot further along the path of implementation/experimentation. Perhaps some alternate approach will ultimately prove preferable.

### **Possible Psychosocial Effects of Offer Networks**

The impact of the money economy on psychology is subtler than commonly realized. It is plausible, though certainly not demonstrated, that transcending or augmenting the money-based method of assigning value, in the way that Offer Networks do, would help resolve various problematic issues in modern society. For example, Offer Networks might end up wreaking exciting and positive havoc with our traditional notions of social status...

Modern first world capitalism has a significant aspect of *"Spending your life doing things you don't want, so you can afford to buy things you don't need."* (And as it happens, modern Chinese socialist capitalism has this aspect as well.)

Given current technology, it seems it would likely be possible for most people in the developed world to work 15-20 hours per week at most, not 40 – and to spend the rest of their time simply enjoying themselves, or pursuing creative activities of some sort. Yet this is not the direction society has gone in. Instead, work hours are still fairly long, and work increasingly spills over into off-work hours. Salaries are largely spent in a consumerist way, doing things like upgrading one's cellphone every year, or buying overpriced, toxically sugary Starbucks coffee concoctions.

Of course, people are aware of the possibility of working less and living a less consumerist lifestyle; and there is a "simple living" movement tending in this direction, it's just not very popular.

Why are we willing to work so hard at things we don't like doing, in order to buy so many things we don't need?



Part of the answer is addiction – we become psychologically addicted to certain routines and possessions, e.g. eating out in restaurants instead of cooking at home, or driving in a private car instead of taking public transport, or the feeling of wearing new & different clothes or jewelry.

And part of the answer is social status. Having a lot of money is itself an indicator of high social status; and money can be used to buy other status indicators. A tremendous amount of money is spent on status symbols of one sort or another. Of course, money is not the only status indicator. Einstein had a very high status in the public eye, yet was not terribly rich. The same for Linux Torvalds. But overall, money is surely the best single proxy for social status in modern societies.

Offer Networks could disrupt both of these factors, in indirect but powerful ways.

There is a great deal of data showing that addiction is most powerful among people (or animals) whose lives are not richly satisfying, including in social dimensions. A rat in an empty, boring cage will become addicted to morphine rapidly, after brief exposure to the joy of the drug. A rat in a cage full of fun, bustling social activity will ignore the morphine dispenser at the end of a tunnel attached to his cage, even after he's felt the joy of morphine (Mate', 2010). Because the warmth of his social environment makes the morphine high unnecessary.

Offer Networks could offer more than just a replacement for many monetary exchanges – they could offer a flexible medium for obtaining all different sorts of interactions with other human beings. They could provide a richer social web, thus reducing the psychological emptiness that allows the addictive psychology of consumerism to take hold.

And Offer Networks would also provide alternative means of establishing and measuring social status. Reputation points would provide one means – and could be context-specific. Getting a high reputation score among people who tend to participate in a

particular variety of exchange, would provide a form of status within a certain subgroup. Feeling the positive feedback of the people with whom one has done exchanges, may substitute somewhat for the status symbols that now provide people with ego boosts.

Exactly how the sociodynamics of Offer Networks would play out, nobody knows. But I think they have significant potential to disrupt the addiction and status dynamics that largely govern our society today. Doubtless they would bring new peculiarities and problems as well, only to be discovered once the actual usage patterns of Offer Networks have settled in.

### **Smoothing the Path to the Era of Abundance**

What is the relation between Offer Networks and the Singularity?

Peter Diamandis has phrased the Singularity in terms of “abundance” (Diamandis and Kostler, 2012). Today we live in an era of relative scarcity. The resources we feel we want to fulfill our human desires, are often difficult for us to come by. But when technology has advanced enough, this may no longer be so. Infinite resources are unlikely to be available even post-Singularity, but one can only eat so many chocolate bars or surf so many waves each day. There may come a point where, relative to the scope of human desires and capabilities, scarcity is no longer a factor.

On the other hand, the same technologies that have potential to lead to radical abundance also have the potential to obsolete human labor. If we really reach a point where robots and other automated devices are doing most of the work, then we will have to face questions like: A) what will everybody do with themselves instead of working?; B) how will people get money or other resources, when they don't have the option to get paid for working?

My suggestion is that moving to a different, non-monetary

method of exchange – like Offer Networks -- might smooth out these difficulties considerably.

As material scarcity decreases, more and more of our exchanges will involve our deeper engagement, rather than merely our "putting in time" carrying out an activity, or providing a material object to someone else. The conditions under which humans are desirous of providing deep engagement to some activity are more complex than a simple monetary exchange, making the specification of more complex offers more appropriate. This relates to the point made above in the context of money pumps – when one is in a domain where most exchanges involve novel situations, and are difficult to definitively divide into categories, and then projecting preferences into a linear ordering doesn't necessarily make sense.

In the end, once automation has rendered "working for a living" unnecessary, human beings may end up spending most of their time exploring novel forms of social interaction and aesthetic creation, mediated by Offer Networks or similar systems. Beyond work and beyond money, but not beyond meaningful social interaction and exchange; not beyond creativity; not beyond the joy of life.

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**With Francis Heylighen, David Weinbaum (Weaver) and  
Ben Goertzel**

**Francis:** This is a really great idea! I particularly like your way of representing individuals as bundles of "production rules" that specify "if I get this, then I am willing to do that in return", coupled with the "clearinghouse" (or what I would call a "stigmergic medium" or "message board"), where all the production rules try to find the best match for their input and output conditions. This exactly fits my view of how the Global Brain would help to find the most synergetic possible interactions between all the individual agents, and thus boost cooperativity, distributed intelligence, and the creation of welfare and abundance.

I also like your description of the wicked psychological side effects of our present money system, such as "Spending your life doing things you don't want, so you can afford to buy things you don't need." :-)

There is of course a lot of work that needs to be done in better specifying the precondition-action-postcondition rules, reputation systems, clearinghouse, user interfaces, emergent values ("offer money"), etc., of your proposed offer network. But I think that we already have the conceptual, mathematical and technological infrastructure to do this work.

The components we work with in our Challenge Propagation model at the Global Brain Institute should be able to simulate a kind of economy like the one you propose. The general idea also fits in perfectly with our objective of specifying a system of distributed governance

**Weaver:** Understandably the article focuses, for the sake of simplification, on the exchange of what I would call atomic units of value e.g. a hamburger, and hour of programming etc. This

simplification however hides and perhaps overlooks the vast complexity of the current economic machine and its transactions. I tried to play with the idea a bit and could not come up with an obvious or less obvious way of how can the mechanism of an offer network be scaled up to meet the complex challenges of today's economy. For example how can an offer network deal with the following complex operations?

1. Designing producing and distributing silicon chips (including the machines involved in the process). I use this example because of the criticality of this specific category of products to the future information society.
2. Building a highway from city A to city B (same goes for an overseas shipping route, flight routes etc.).
3. Run a biotechnological facility capable to research and produce a vaccine against say Ebola virus (lately on the news) or a medicine for Alzheimer (including setting research priorities etc.).
4. Building AGI agents capable of operating in physical space and interacting with humans.

**Francis:** These are just a few examples where the exchange process is extremely complex, involves a highly coordinated operation of hundreds and sometimes tens of thousands of agents, legal operations, budgeting, risk taking and long term planning in conditions of uncertainty.

These are indeed complex challenges that are not obviously resolved by an offer network. On the other hand, they are not obviously resolved in a purely capitalist market economy either. That observation is the origin of the field of "institutional economics", which argues that market transactions alone cannot solve these kinds of problems: you need pretty complex and solid institutions and organizations, such as companies, governments, laws, etc. to regulate non-money-based interactions (such as those between the employees of the same firm).

A global-brain-like organization of the world system will obviously require pretty complex institutional and organizational arrangements to coordinate a massive amount of "atomic" interactions into a coherent, synergetic whole. I don't think offer networks make this intrinsically more or less difficult than a traditional money-based system, but this is something that will require a lot of deep reflection, and probably trial-and-error...

One possible approach is to define an organization as a higher-order agent in the offer network, i.e. a subnetwork that can be "blackboxed" into a single agent. The organization as a whole offers certain things and is entitled to receive other things. Within the organization, this input-output stream is decomposed into substreams that are allocated to the different individual agents depending on their skills and needs by some kind of internal management or governance structure that is more specific than the one used by the global offer network. This is in essence how an organization works today, except that the internal offer stream is reduced to a wage, complemented by possible bonuses or benefits in kind, that is paid to each employee at the end of the month.

That simplifies the internal governance somewhat, but does not eliminate complexity. Indeed the allocation of tasks to the employees remains a non-quantitative and very context-dependent process that requires intelligent supervision. Offer network algorithms based on stigmergy may strongly simplify that allocation of tasks, as I have argued in my papers on "**Getting Things Done**" (last section) and "**Mobilization Systems**". What needs to be added is a similar self-organizing allocation of rewards for the tasks performed, which may take the form of allowing an employee to select a portion of the offers that are in the organization's buffer of things it is entitled to consume.

If all these different allocation algorithms are well coordinated, the boundaries between organization as subnetwork and offer network as a whole may blur, thus making the whole system much more flexible and transparent. For example, in the

present system employees of a firm are not supposed to provide services to a rival firm, because they might spill trade secrets or other specific advantages of their original firm to competitors. In a true offer network economy, exchange and collaboration would not have such artificial limitations, increasing the potential for highly synergetic exchanges...

**Ben:** Yes... I tend to agree with Francis's comments....

Also, I agree w/ Weaver's comment that offer networks do not give a mechanism for coordinating among multiple people to carry out complex tasks. But again, offer networks aren't intended to solve all possible problems of society; like money (but with greater generality / flexibility) they are a tool that can be used in various ways...

Open Value Networks, which I mentioned briefly in my article, are one possible mechanism for forming organizations to get complex tasks done, in a way that would be very compatible with offer networks and might bypass many of the difficulties seen with existing systems like governments and corporations. Basically an Open Value Network is a group of people who have agreed to combine certain resources according to a certain contract, with the aim of achieving a certain collective goal (and to share the results of this work according to a certain method specified in the contract).

However, there are incompletely resolved issues with Open Value Networks too, such as assignment of credit. It seems possible that a well-tuned collaborative reputation assignment network could suffice to assign credit to individuals for their contribution to the overall doings of an Open Value Network. But this is an area in need of research and experimentation about the role of market versus institutions.

Historically, it does seem that having an effective and stable set of institutions has been key to the success of nations. Economic markets are not enough, on their own. Indeed, an effective set of



institutions is important for maintaining an effective market. The book *Why Nations Fail* makes this case fairly compellingly.

On the other hand, we are entering a new era of very rapid change, in which institutions are going to need to adapt more flexibly than has previously been the case. So it's not clear what form the effective institutions of the future are going to take. They may be networks formed from materials like Open Value Networks, Offer Networks, and collaborative reputation systems rather than traditional institutions like corporations or government agencies.