

The Attention Economy

0: Preamble

Today begins a series where I clarify and explain the [#AttentionEconomy](#). There is much confusion and uncertainty over what an Attention Economy is, how it works, and what it means for our present and our future. I have some answers to these questions, but they are just rough stones; I hope together we might polish them into something far more valuable. I cannot do this work alone. Over the course of these posts I will try to lay out both the theoretical and scientific justifications for the view. I will also talk about issues of implementation, engineering, and design for an Attention Economy, as well as its implications for politics, governance, and the sustainability of the human population.

These are among the most important topics of our time, and I know my communities are filled with incredibly bright people tackling these issues from humbly diverse and creative perspectives, at times with inspiring success. My ideas here are meant as contributions to this shared project; I hope the view will tie together some of the disjointed threads that might otherwise fray loose. Although I do have some academic goals for this work, I have no special interest, financial or otherwise, in writing these posts. My interest in the topics, and the urgency and earnestness with which I write these words, is entirely a product of being alive in the year 2012.

Enough preliminaries, there's work to do. If you appreciate this work, please participate.

I: Thinking about yourself in a complex system.

"Attention Economy" is something of a buzzword among startups in the social media business, but the idea of "managing attention" has a long history as a design philosophy and marketing strategy. The idea has also found some use in the cognitive sciences. The term itself traces to Herbert Simon, a computer scientist and one of the pioneers of Artificial Intelligence. I plan to discuss all these uses of the term "Attention Economy" in future posts, especially Simon's work (which I know best).

But for now, I'll be talking about the **Attention Economy** as a way of *modeling attention behavior in a complex, organized system of attenders*. This is technical, and it will take a long time to parse what this means in clear and precise ways. We'll need to do some math. However, this approach is in line with work being done across many disciplines, in both the physical and social sciences, in the study of [#complexity](#) and [#complexsystems](#). If you feel comfortable with

the idea (and mathematics) of complexity, you might want to just skip ahead to the good bits and just read this article:

<https://plus.google.com/u/0/117828903900236363024/posts/484P2wKMjei>

I was not involved with this research, but everything I hope to say will be of a piece with the science and methodology presented there. In a future post I will go through this article in detail. However, the paper is difficult and we need to know why we are doing it. **In the next post** I want to motivate the approach by giving you a simple, intuitive model for thinking about your role in the Attention Economy. Understanding how the model works will be an important tool for understanding the discussion that will follow. **In this post**, however, I want to lay down the basic picture of how the Attention Economy functions.

I'm talking about the Attention Economy in the present tense, because the article above makes it clear that an Attention Economy is *already operational*:

*"... the abundance of information to which we are exposed through online social networks and other socio-technical systems is exceeding our capacity to consume it. Ideas must compete for our scarce individual and collective attention. **As a result, the dynamic of information is driven more than ever before by the economy of attention...**"*

You can think of the "economy of attention" as our method for collectively organizing and managing our total "attention resources", which are finite and must be distributed selectively among all the things you and everyone else spends their time doing. The paper attempts to model this "dynamic of information" that *already exists* in the Attention Economy, in this case by measuring Twitter users and their management of screen space for their tweets. Measuring the attention economy within that ecosystem is only the tiniest fraction of the overall Attention Economy, but this ecosystem provides a model for thinking about the general case. Visualizations of the model's dynamics are snapshots of the growth of an organized social system and are absolutely fascinating:

http://www.nature.com/srep/2012/120329/srep00335/fig_tab/srep00335_F1.html

These models of attention are generated by describing the "diffusion of memes" in terms of the probability that a person will retweet a meme. You can see the description of this "minimalist model of information spreading" here:

http://www.nature.com/srep/2012/120329/srep00335/fig_tab/srep00335_F5.html

As I said, we'll go over the details of this article in a later post. The point for now is that **we can generate models** for characterizing the way this crowd of Twitter users manage their attention, and **these models are predictive of their collective behavior**. These models can't predict *an*

individual's chances of retweeting some particular tweet better than giving the probabilities, but we can nevertheless describe the dynamics of the whole system, and those dynamics tell us a lot about how the system is behaving.

This is part of what it means to describe the collective behavior of the Twitter users as **complex**. Complex doesn't mean "unpredictable" or "magical", it means that the system in question can be viewed from many different perspectives, some of which might seem incommensurable with one another, but each of which can be adopted to build genuinely useful predictive models. Consider the global climate system, a paradigm case of a complex system. Specifically, consider the relationship between local weather events and climate events. While it is (so far) very difficult to model weather at a sufficiently detailed scale to predict (say) the fall of individual raindrops, we have pretty good models for predicting--even very far into the future!--what the prevailing conditions will be at a particular place and time. It's worth emphasizing that both these perspectives--the perspective of the system as a collection of local, short-time-scale weather events and the perspective of the system as a collection of global, long-lived, very large climate conditions--are both different ways of looking *at the same system*. Moreover, the two perspectives are (at least to a degree) independent of one another: we can adopt one or the other to make accurate predictions about the system without necessarily paying much attention to what's going on at the other level(s). Complex systems are *pattern rich* systems: systems that can be modeled from many different perspectives. There is more (much more) to say about complexity. If you are interested, we'll be dealing with it a lot, so you might start here:

<http://www2.econ.iastate.edu/tesfatsi/abmread.htm#ComplexABM>

http://columbia.academia.edu/JonLawhead/Papers/1257114/Lawhead_-_Concepts_in_Complexity

http://columbia.academia.edu/JonLawhead/Papers/1257111/Lawhead_-_Dissertation_Chapter_Two_Whats_the_Significance_of_Complexity_/

And if you are ambitious: <http://necsi.edu/publications/dcs/>

The purpose in this series of posts is to describe how this modeling would work in contexts beyond the behavior of Twitter users sharing tweets. The meme diffusion model described in Weng et. al. has obvious and significant applications beyond these cases; even still, these cases yield some surprising conclusions, which move the authors to the following dramatic call to action:

*"Our results do not constitute a proof that exogenous features, like intrinsic values of memes, play no role in determining their popularity. However we have shown that at the statistical level it is not necessary to invoke external explanations for the observed global dynamics of memes. This appears as an arresting conclusion that makes information epidemics quite different from the basic modeling and conceptual framework of biological epidemics. While the intrinsic features of viruses and their adaptation to hosts are extremely relevant in determining the winning strains, **in the information***

world the limited time and attention of human behavior are sufficient to generate a complex information landscape and define a wide range of different meme spreading patterns. This calls for a major revision of many concepts commonly used in the modeling and characterization of meme diffusion and opens the path to different frameworks for the analysis of competition among ideas and strategies for the optimization/suppression of their spread."

My goal, our goal, is to take up this call.

An Attention Economy *in the grandest sense* is the situation where all system management decisions are made by appeal to models describing the flow and concentration of attention across a network of connected attenders. Although this is an idealized case, my view is that **using attention models will increasingly be preferred to other kinds of economic models (especially financial models) as the primary tools for social organization**. Right now, financial models are responsible for nearly all social organizing decisions: both for the distribution of labor and resources but also for the policy decisions that shape our systems of governance. I will argue later on that attention models are fundamentally a measure of **consensus** and therefore may function as the legitimate grounds for a self-organized system of governance, while *at the same time* working as a model for collectively planning the production, distribution, consumption, and recycling of our natural resources. In this sense, an Attention Economy is a *complete* system for social organization, and therefore may function in the ideal case without significant contributions from either money or centralized political institutions. Although we are far from the ideal case, this systemic reorganization is simplifying and unifying, and is a fundamental component in the package of solutions that humanity has been slowly preparing as the systemic failures of the late 20th century continue to mount. I think the Attention Economy is the kind of fundamental reorganization that will prepare us for the century we currently find ourselves in. I also think that we are already well into the development of an Attention Economy. Still, **this is not an easy solution** and our success is by no means certain. It will require cooperation on a global scale to reorganize our social institutions equitably and peaceably, and the sooner we understand how it works the sooner we can start to prepare. I am getting far ahead of myself, but I hope we discuss all these things with far more depth and care.

The most immediate and obviously pressing issue is: what does this look like for *me*, as an *individual*, as a member of a society organized by attention? Am I *just* a node in the network?

I cannot answer this question with any precision; such outcomes very much depend on the steps we take from here. I have important things to say about the humanitarian and digital values that inform the directions I would hope to see a mature attention-based economy grow. I believe that if realized properly, an attention economy will generate profoundly liberating and creative human actions, at a scale suited to the incredible challenges we face. But this is all lofty idealism, and there will be time for that later. I plan to continue these posts on a weekly basis, and **in the next post** I want to give you a simple, intuitive description of how an attention

economy would work on an individual, practical, day-to-day scale. I will describe a **simple idea**, a toy model, that is meant to make the behavior of an attention economy understandable and intuitive, yet give some sense for how those actions scale up to the level of complex systems management on the order of global human populations. As we continue to discuss the Attention Economy, this model will be a useful reference point for describing the dynamics of our future.

Part of the fun will be figuring out the formal structure of the toy model as we go.

The [#attentioneconomy](#) is a unified model of social organization. In the previous post, I described some very general features of the attention economy, and hinted at your role in it. In this post, I will describe a simple thought experiment for thinking about how the attention economy might serve as a general organizational infrastructure.

10: The Marble Network

Imagine that everyone straps a little box on their foreheads. These little boxes produce tiny invisible marbles at some rate, say: 10 marbles every second. While you are wearing the box, it shoots invisible marbles out at the objects you happen to be looking at. Those objects along with everything else in the environment are equipped with little devices that register and absorb the incoming marbles, so that all your marbles get absorbed by something. These marbles are a crude approximation of the attention you pay. Every time you pay attention to some object, it gets bombarded with the marbles shooting from your forehead.

The idea seems silly because it is. I'd never suggest we actually fling high speed projectiles in arbitrary directions from boxes mounted on people's foreheads, that would be dangerous and irresponsible. If this is to be implemented at all, it would of course be rendered digitally and transparently as best as our technology will allow. Moreover, the direction a person's head is facing is a terrible indicator of where their attention is being paid; to do this precisely, we'd need something far more sophisticated. But leave these technical details aside for the moment. This is a toy model, and I'm describing it in some detail to help us think about what the attention economy is doing, and what we are doing in it. So boxes on foreheads with marbles shooting out with some frequency and getting absorbed by other objects. Still with me?

If not, refer back to the meme diffusion model from Weng et al. in Post 1:

http://www.nature.com/srep/2012/120329/srep00335/fig_tab/srep00335_F5.html

The meme diffusion model is a model of the “use” of Twitter. The *frequency* of use is described by the probabilities, but the *character* of the user’s behavior itself is “minimal”. There’s lots of things that users do with Twitter-- some of which might matter for the way memes spread-- but the study reduces all those behaviors to the minimal model it describes. That’s good enough for Twitter because the act of retweeting is literally as simple as the push of a button and we can track the propagation of the *content* over time with the model. But to run an entire social economy we’ll need something more flexible, something that will account for the variety of use behaviors that characterize our daily lives. Even if we just stick with Twitter, the minimal model doesn’t describe anything the user actually does; they might retweet immediately without a second thought or they might concentrate intently, contemplating every last character. The marble network I’m describing gives this interaction more granularity so we catch these kinds of differences. The difference between spending 5 seconds or 15 second reading a tweet might not seem like much, but in the attention economy every quanta of attention counts. The marble network will let us count them.

To be absolutely clear, the attention economy *is already online*; we are already deeply immersed in the task of allocating our finite attention resources across our various projects. The marble network I’m describing is a model for understanding, simulating, and ultimately managing the economy of attention. Thinking about the flow of marbles in this network will help us discuss how the attention economy works and what we can do with it. Consider once again the specific diagrams being used to represent the behaviors in Twitter. In this network, each user is a node on a graph, and edges represent the connection (“following”) between them. When a user sends a tweet to its followers, think of this as opening an “attention channel” between the user and the follower, connected *by the tweet itself* as both an object of the follower’s attention *and* a product of the tweeter’s labor. If our marble network is working properly, opening this attention channel would allow marbles to flow between the two nodes. The flow of attention is a *directed* graph; in this case, the marbles will flow from the foreheads of every follower, back to the user who first sent the tweet. The followers are “paying attention” to the content *producer* by *looking at the content they produced*, and that attention flow is captured by the number of marbles that flow across that channel as long as the follower’s head is pointed at the tweet.

Weng et al. gives us a minimal model of attending behavior in Twitter. A fully realized attention economy would involve models that characterize all other user behaviors, for all other uses of all other objects. Every time I use a pen, or drive on a highway, or take my heart medication, or smell a rose, I am paying attention to the products of the labor of others in many indirect ways. The attention economy accounts for these complex interdependencies that form the material basis of social organization. In exactly this sense, these attention models are *economic* models: they allows us to model the collective production, distribution, and consumption of real-world labor and resources.

So here's the trick, and what makes this flow of attention different from every financial economy we are familiar with: *you can't store attention*. You can't stockpile attention or reserve a bank of attention units. There is no debt in an attention economy and there can be no surplus of

attention. There is just the total amount of attention being produced, and the many ways we allocate that attention among all the things we spend our time doing. Attention must always be paid as it is produced or acquired, and there are no leftovers. So when people pay attention to some node in the network, the recipient of that attention can't put marbles in a jar for a rainy day. Instead, when you are the target of incoming marbles, *your rate of marble production increases*. Increasing your rate of marble production is a bit like "compensation" for the attention you've attracted, but the metaphor with money will only go so far so let's stick with marbles. My followers only pay attention to the meme I created for a few seconds, but those brief moments of attention result in at least some marbles flowing across the network that are *aimed at me*. I can't put those marbles in my wallet, though, because you can't store attention; it is as if the marbles flow right through me, increasing the rate of marbles I'm producing from the box on my forehead. Say that, for every 10 people paying attention to my meme, the rate at which I produce marbles increases by one marble a second for some short duration of time; I was producing marbles at 10 marbles/second, and now because of the attention I've attracted the box on my forehead begins producing 11 marbles/second. The more attention I get, the faster my rate of marble production.

Producing marbles at a faster rate doesn't mean I suddenly have more attention to give; nothing about my abilities (cognitive or otherwise) have changed by increasing my marble production. Instead, what changes are *the objects I'm attending to*. Because I'm producing more marbles, the objects I'm attending to are now receiving more incoming marbles than they were just moments before. My higher rate of marble production means I have slightly more influence on the flow of marbles across the network. I'm paying attention to a lot of objects, and each of those objects are only getting a small fraction of the marbles shooting from the box on my forehead. Still, they each have a chance at getting slightly more marbles now that my own rate of marble production has increased. Since more marbles are flowing my way, slightly more marbles flow down the network through the various objects I use. Of course, all those objects in turn are also "memes" that were produced by other people who are the target of my now-slightly-increased rate of marble production. My "popularity" as a producer has made my use salient against the background of users. So in the attention economy, if your goal is to maximize the marbles headed your way--and if it isn't obvious already, we will see shortly why this isn't always the case!-- it is "more important" for +Lady Gaga to see your memes than for +Daniel Estrada to see them, because Lady Gaga is herself the focus of far more attention and is going to have far more ripples in the overall network than me. This is just what it means to have more *influence* in the network. It's not just because Lady Gaga has more money (though she has that too), but rather that she occupies the attention of far more people than I do. The marble network not only captures the dynamics of social attention but also the dynamics of social influence. The more marbles I produce, the more influence I have over the flow of marbles throughout the network. And I can change my level of marble production by producing things that attract the attention of others.

For this reason, it will be helpful to treat **attention as the inverse of influence**, and to treat your role as a node in the attention economy as something like a switch, turning the collective

attention you attract into influence at how the network develops in the future. When you "pay" attention to something, you are effectively "trading" that attention for influence. This dynamic should be familiar from even non-technical treatments of the Attention Economy, and even in non-digital contexts. The movie I pay attention to, for at least the time I am paying attention to it, has some degree of influence over my thoughts, experiences, desires, and interests. When I pay attention to my work, I have influence over anyone who benefits or interacts with the products of my labor. I say that attention is "traded" for influence, but this transaction doesn't look like the kinds of trades that take place in a traditional market, even while they might be just as competitive and lively. I "pay" attention, and though my attention is a finite resource and can only be split so many ways, it is also a resource that I produce constantly, simply in virtue of being conscious; from my perspective it seems like I have an unending supply of attention and I never seem to run out. I can have difficulty paying attention or keeping my attention focused on some particular thing, so managing my attention is no trivial task. Some people are better or worse at it for a variety of complex cognitive and social reasons, and either way distractions abound. Still, paying attention to *something* is a task that everyone is constantly engaged in, naturally, as a fundamental part of being alive, and each act of attention has material consequences for the production, consumption, and distribution of our collective labor and resources. The model of attention I'm describing connects each of us through the vast network of technological infrastructure that we together have created for ourselves. This network not only models the development of that infrastructure over time, but also allows us to distinguish each node uniquely and directly in proportion to their individual contributions to the collective.

From Part 1, I described the attention economy as a way of "*modeling attention behavior in a complex, organized system of attenders*", and hopefully we are getting a better sense of what this means. In the attention economy, you are an *attender*. We all are. In the attention economy, there is no sense in distinguishing between producers and consumers, because "consumers" themselves contribute to production in the very act of consumption. Some attenders are more productive than others, and those attenders may tend to attract the marbles flowing around the network and attain significant influence in shaping its growth. This marble network is decentralized and competitive in many of the ways that are fiercely defended by proponents of traditional capitalist markets. But regardless of anyone's productive abilities, and indeed regardless of whether any of us can *pay* for those uses, we are all participating in the same networked system of use. *The attention economy is a way of modeling our collective attending behavior*, and it will let us account for the variety of objects we use, consume, produce, and share with each other as we organize ourselves.

The central thesis of this essay, as stated in Part 1, is that "**using attention models will increasingly be preferred to other kinds of economic models (especially financial models) as the primary tools for social organization**", and we can now explain what this means in somewhat more detail. Attention models are models of user-behavior; attention models give us information about what people are actually concerned with and how they spend their time. As we collectively confront problems that require social, coordinated action, human societies will increasingly appeal to attention-based models rather than other kinds of models for

solving coordination problems. This is not an idealistic prescriptive claim that we *should* use these models, or a futurist prediction that we *will* use these models. This is a descriptive, observational claim: we are already doing it, and we do it with more deliberate self-confidence by the day. My argument for this thesis is that the attention economy is a **unified** model of social organization, and so we therefore have some reason to prefer this model over the existing models. The attention economy unifies what have traditionally been considered the “separate magisteria” of human social organization: the domains of economics, of governance, and of culture, each of which are traditionally assumed to operate by their own internal dynamics. In fact, these domains are deeply interconnected, and an attention economy will allow us to visualize these relations directly. On my view, the attention economy is literally a model of culture (of the networks of practices of individuals) and these models have direct and clear consequences for questions of economics (the distribution of labor and resources) and governance (ensuring a just, consensus-based society). By explicitly understanding the attention economy in this way, we can start to see what a new social organizational structure might look like. **In this post** I described a simple thought experiment for thinking about where you fit into this complex, interconnected network of attenders. There is a lot to say about the consequences this model has for questions of governance and economics, and hopefully the marble network helps us think about those questions carefully when we deal with them in future posts. But **in the next post** we’ll need to do a bit more groundwork, to set us up for those discussions. We need to talk about what it means for a collection to be self-organized, and what reasons we have to use attention as a metric for self-organization.

Part 11 stuff below, won’t get published this round.

When I pay attention, all I get in return is whatever value has accrued from the attention paid. When I watch a movie, I get its entertainment in return; its entertainment value is usually why I pay attention in the first place. When I build a chair, I get the chair I built, paid for only and entirely by the effort and attention it took to build. I can’t lose attention, and though some might try to attract my attention, no one can take it from me. I cannot go broke by paying too much attention; again, there is no debt in an attention economy. However, that doesn’t mean that my attention is not valuable; indeed, in the Digital Age it is one of the only scarce resources left with intrinsic value, and it must be managed with care. What I lose by paying attention to X is an *opportunity cost*, since time spent attending to X is time not spent doing Y or Z. As I have only a limited amount of time to spend my attention, I must learn to spend that attention wisely. And since in the attention economy *we all depend on how our collective attention is spent*, it matters to all of us that you make good use of your time.

Traditional markets and economies take the *trade* as a basic unit of economic activity. A trade is (ideally) an **agreement** between two people to exchange something considered by both to be of equivalent value. In other words, it is an abstract relation *between persons* that is designed to

approximate the value of the resources being shifted around. In an attention economy, the basic unit of activity is *attending*, which is an action which takes place not just between persons, but also between *persons and objects*. In other words, not all acts of attending are acts of agreement; sometimes, I pay attention to things that I don't agree with at all. For instance, the traffic accident on the side of the road may attract my attention, even while I lament the event and openly wish that it hadn't happened. The notion of agreement is of vital importance, not just for the structure of the marble network, but for its role in our understanding of #consent and #consensus. My crux of my argument is that *attention models are a measure of consensus*, and so discussing its relation to agreement will be fundamental to laying out a picture of the attention economy as a basis for legitimate governance.

The more obvious question, though, is

Part 0: <https://plus.google.com/u/0/117828903900236363024/posts/HzYnTDErEhf>

Part 1: <https://plus.google.com/u/0/117828903900236363024/posts/Rsk9wDvSP5i>

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