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A marketplace for attention: Responses to a synthetic currency used to signal information importance in e-mail

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Abstract

The productivity of information workers is jeopardized by too much e-mail. A proposed solution to e-mail overload is the creation of an economy that uses a scarce synthetic currency that senders can use to signal the importance of information and receivers can use to prioritize messages. A test of the virtual economy with corporate information workers showed that people in a large company used different amounts of the currency when sending e-mail messages, and that the amount of currency attached to messages produced statistically significant differences in how quickly receivers opened the messages. An analysis of the network of virtual currency trades between workers showed the different roles that participants played in the communication network, and showed that relationships defined by currency exchanges uncovered social networks that are not apparent in analyses that only examine the frequency, as opposed to the value of interactions.

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Introduction and theory

The declining cost of electronic communication is transforming the nature of work. When messaging is cheap, more people can participate in decisions as companies grow and expand across business sectors and cultural boundaries (Malone, 2004). This is particularly true with asynchronous messaging that facilitates shared work across time zones and schedule incompatibilities. Work becomes more democratized and decentralized because people can intelligently choose how they will contribute and they can contribute from anywhere. Enterprise communication must now facilitate horizontal connections between people as well as vertical command and control.

A downside of cheap communication, however, is that there is way too much of it. The sheer volume of information flow seriously threatens the advantages of inexpensive communication as knowledge workers suffer from a chronic state of mental overload, reduced productivity and a declining sense of well-being (Zeldes, *et al.*, 2007). E-mail has created a tragedy of the commons, encouraging casual placement of cheap information in the in-boxes of all, with seemingly no regard to one's own information space. As is true eventually for most free goods, e-mail is overused.

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The problem of information overload exists for all enterprise communication channels. Instant messages, system alerts, phone calls, visits from co-workers and even self-interruptions occur so frequently that workers rarely have more than five minutes of focused work before an interruption occurs (González and Mark, 2004). The problem may be most acute, however, for corporate e-mail. In 2006, the average corporate e-mail user received 126 messages per day, an increase of 55 percent since 2003 (Radicati Group, 2007). If users take an average of one minute to read and respond to each message, the current volume consumes more than a quarter of an eight-hour day. With projected growth of incoming messages, a good bet because messages are perceived to be free and mobile access is increasing, workers could spend 50 percent of their workday managing e-mail by 2009.

E-mail may be the most pernicious form of information overload. E-mail not only interrupts workflow, it also carries a cultural expectation of response. E-mail accumulates into a queued stream of information governed by the expectation that new work will be initiated at the request of the sender, and all messages will be answered —

at least eventually. It's free to send the message, and only an additional click to copy many, yet the costs for recipients skyrocket while their productivity, quality of life and job satisfaction decline.

Ironically, information overload also leads to a hidden cost for senders. As in-boxes fill to the brim, the ability for recipients to quickly read and intelligently respond to messages declines. This results in e-mail traffic that is simply never answered, sometimes delaying important decisions and creating a frustrating and ambiguous work environment. This cost to senders is not associated with any one message they send; rather, it is a cost imposed by the aggregate weight of *all* messages.

Companies are beginning to investigate the financial costs associated with information overload. Research from one Fortune 50 company estimated the cost of information overload at US\$1 billion annually based on lost work time and reduced employee efficiency (Zeldes, *et al.*, 2007). This estimate did not include additional costs associated with reduced work quality, job satisfaction and innovation. The estimated cost of information overload for the larger economy is stunning — US\$588 billion annually (Basex Report, 2006).



Solution categories

E-mail overload is a complex and costly problem involving numerous daily exchanges between senders and receivers who change over time in number, purpose and connections. Although the problem is multidimensional, solutions are most often targeted at a single element of the system — receivers. Most solutions attempt automated analyses of recipient in-boxes with the goal of decreasing the time required for disposition of messages. Major product categories include filters, prioritization systems, content analysis, categorization schemes and presentation solutions.

The solutions for receivers, while often technically elegant, are incomplete because they attack only the result of the problem (recipients' in-boxes) rather than transactions between source and receiver, and they fail to address the inclination among senders to broadcast widely because messaging is free and easy. Additionally, it is difficult for automated systems to simulate completely the complex and dynamic judgments that people make about information importance.

A second category of solutions involves behavior change programs administered through IT departments. These programs attempt to persuade senders to change how they formulate, distribute and process e-mail. This category includes company advice (*e.g.*, rules for individuals who send and receive e-mail), system-wide policies (*e.g.*, no e-mail Fridays), and individual coaching about tactics for managing e-mail.

Programs that require cultural change have met with limited success. These programs often ask e-mail senders to adopt conventions aimed at making e-mail inherently easier to process. These include items such as standardized e-mail addressing conventions, and e-mail “forms” that dictate the arrangement and length of text in a message. Many of these efforts start with a burst of enthusiasm, but prove to be unsustainable because too much e-mail comes from outside the organization, or because the initial inspiration and energy fades.

Behavior change solutions are useful in that they attack the e-mail overload problem at its source: senders. A problem, however, is that there are few methods to continuously remind people about best practices or to rationalize the governor placed on a system by corporate programs recommending behavior change.

The solution tested in this study is targeted at transactions between senders and receivers. It introduces a marketplace — the creation of an economy for information exchange using a synthetic currency. This attention economy encourages senders to exercise judgments about the value of information before clicking “send.” The system goes beyond behavior change initiatives by offering a technology for signaling and evaluating the importance of information using software embedded in the e-mail system and it provides persistent motivation for people to participate.



An attention marketplace

E-mail exchanges depend a lot on barter, which often results in poor allocation of scarce resources. E-mail users trade attention under the implicit social contract that “I’ll read and respond to your e-mail if you’ll do the same for me.” At a macroeconomic level, it could be argued that barter actually undermines formal budgeting and planning. When people spend time solving problems associated with projects other than their own, they are effectively shifting resources away from their own work in favor of someone else’s. Considering the total time spent processing e-mail, the effective impact on project funding is large.

The notion of an attention economy was first proposed by Michael Goldhaber (see Goldhaber, 1997, for a review). He imagined a fundamental transformation of the way economies work, emphasizing the scarcity of human attention and not the scarcity of information itself. Our construction of an attention economy borrows from Goldhaber’s general sense that the scarcity of attention is real, limiting and valuable. But our use of the term is also narrower and focused on development of a software tool that can help solve the specific problem of e-mail overload.

The value of monetizing attention has been advocated previously (Davenport and Beck, 2004; Malone, *et al.*, 1989); however, to date there are no implementations that embed a

marketplace into a communication system so as to enable economic exchange about information. A marketplace forces participants to make judgments about relative value by pricing goods or in this case, information. Fueling an economy with a synthetic currency resolves the intractable problem of using real money as an enterprise currency (*e.g.*, problems of managing a micro-payment system, taxation and legal issues and human resource objections to accumulation of currency at work).

Recent evidence from the study of games shows people are equally motivated by real and virtual currencies. Points, gold pieces and tokens, as long as they are scarce and valued in the game, are as effective as real money in activating brain centers that regulate motivation (Elliott, *et al.*, 2000). Consequently, synthetic currency may work well as a metric for value and importance.

The solution tested in this study establishes a marketplace for information exchange whereby senders can signal the importance of outgoing information by attaching a scarce synthetic currency to a message (Seriosity, 2006). Users receive an allowance of 100 units of currency (known in this solution as “Serios”) per week. Receivers can view the amount of currency attached to messages in a special column in the e-mail in-box.

[Figure 1](#) shows a screenshot of 10 units of currency being attached to an outgoing message. [Figure 2](#) shows a receiver’s in-box with messages ordered according to the amount of currency received. In addition to the exchange of currency, a Web site allows each user to view their currency balance, information about the people they trade with (*e.g.*, the typical amount of currency a trading partner receives and the balance of trade with each partner) and information about their larger network that shows clusters of trading partners based on the amount of currency exchanged by all possible pairs in the network.

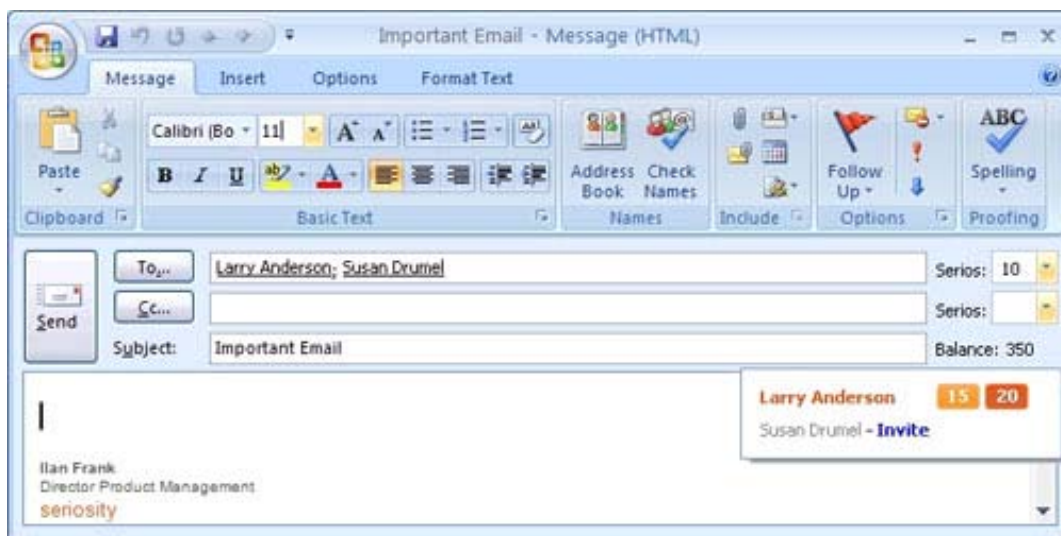


Figure 1: Sample e-mail screen for attaching virtual currency to an e-mail message.

From	Serio	Subject	Received	S...	C	V
David Meyer	50	Thanks	Wed 1/31/2...	1...		
David Meyer	25	Serios in the Real World - Wha...	Fri 1/12/20...	2...		
Larry Anders...	20	Release Planning Tool	Wed 1/17/2...	4...		
Helen Green	20	RE: Carbon Black Data, through...	Tue 12/12/...	2...		
Kenneth Rob...	15	Bunching Proposal	Fri 11/3/20...	1...		✓
Helen Green	10	+ RE: New Product Idea	Thu 3/29/2...	1...		
Larry Anders...	10	Serios Usage Stories for Custo...	Tue 1/16/2...	1...		
Greg Smith	10	+ Director of Marketing	Tue 1/16/2...	1...		
Dan Michel	10	FW: Summary & Action Items -...	Thu 1/11/2...	5...		
Mary Lerner	5	RE: Help Wanted: Serio Broker	Wed 1/24/2...	2...		
Greg Smith	5	Interview with - Hasmukh Pate...	Fri 1/12/20...	1...		
Jennifer Sun	5	We've tested the patch and se...	Fri 1/12/20...	1...		
Helen Green	5	RE: Attent Data Collection Fina...	Thu 1/4/20...	2...		✓
Brad Stein	5	Multiple Carbon Email	Tue 12/19/...	1...		
Mary Lerner	5	Questions on Serios	Tue 11/28/...	1...		
Kenneth Rob...	4	Minutes Dec 28	Thu 12/28/...	3...		
David Meyer	2	FW: Welcome to Carbon	Tue 11/21/...	2...		
Greg Smith	1	Rees seriosity address	Fri 12/29/2...	9...		
Ted Brown	0	Windows Mobile 6	Fri 2/9/200...	1...		
Brad Stein	0	+ New Web Site	Mon 1/29/2...	2...		
Dan Michel	0	RE: Data retention periods	Fri 1/19/20...	3...		
Jack William	0	Phorum	Fri 1/19/20...	1...		
Jennifer Sun	0	FW: No More Games? (Condi...	Wed 1/17/2...	3...		

Figure 2: Sample in-box screen for viewing messages with different amounts of virtual currency.

This study was a preliminary evaluation of the system described above. The research questions we addressed were the following:

1. Using a synthetic currency, will people differentiate outgoing information by assigning a value based on importance?
2. Will the amount of currency attached to messages change the speed with which people process incoming information?
3. How will users subjectively evaluate the use of a synthetic currency with respect to value and ease of use?
4. Can network analysis of exchanges between members of a group describe important communication patterns in the group?
5. Are networks based on currency exchanges different from networks based only on frequency of communication?

Research methods

The software for the synthetic economy was downloaded on participants' computers during a period that ranged from 11 to 18 weeks, depending on participant. The client software was a plug-in to a standard e-mail software program. Data about trading partners was available on a companion Web site that showed trading statistics and offered profile and transaction information.

Twenty-three people within one department participated in the study. They were members of several different work groups in six sites across three globally dispersed locations. Participants attended a 30-minute preview session that introduced the software and its intended uses. There was no requirement to use the system, and e-mail worked normally if people chose not to attach a currency value to messages.

During the test period, participants sent 535 messages with currency attached and all of those messages were included in the study. This total represents about one-third of the messages sent within this group. Only intra-group messages could be included in the study because those were the only ones that could include the synthetic currency (*i.e.*, both sender and recipient needed to have the software installed).

Research results

Results are organized around the five research questions above. The first question was about use of the currency. [Figure 3](#) shows the distribution of messages with different amounts of currency attached. There is an approximately normal distribution of currency in the four categories, suggesting that users differentiated outgoing information according to importance and that they attached varying quantities of currency to signal that importance.

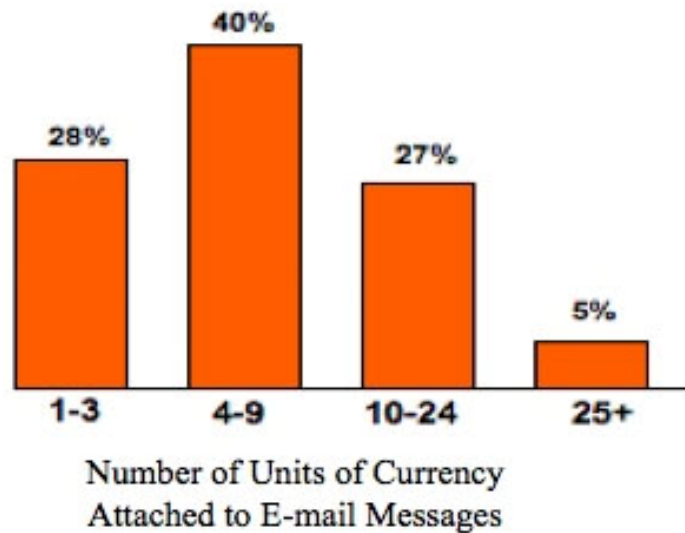


Figure 3: Percentage of e-mail messages with different amounts of currency attached (n= 535 e-mail messages).

The second question concerned behavior change. Would people use the currency as a signal of importance and alter the time it took for them to read a message? We measured read time by automatically calculating the difference in minutes and seconds between when a message arrived in an in-box and when it was opened. While this measure does not indicate the intensity of attention paid to information, it is a useful measure of selective attention that does not require people to answer questions about e-mail or remember how they processed particular messages.

To control for individual variation in read time, a repeated measures analysis of variance was done (23 participants x 5 currency categories). This analysis equally weighted all subjects in the study regardless of total amount of mail sent and the range of their read times based on their general use of e-mail.

This analysis ([Figure 4](#)) showed statistically significant differences in read time (within subjects ANOVA, $F=7.17$; $df=1,22$; $p<.01$). Sending 20 or more units of currency lessened read time by eight minutes or 30 percent. The pattern with the smaller amounts of currency, however, was different. When no currency was attached, read time was at the mean across all categories of currency (mean = 28.02 minutes). With the smallest currency attachments, read time *increased* significantly, in the case of four to nine units, by nine minutes. Attachments between 15 and 20 or more units were the attachments that decreased read time.

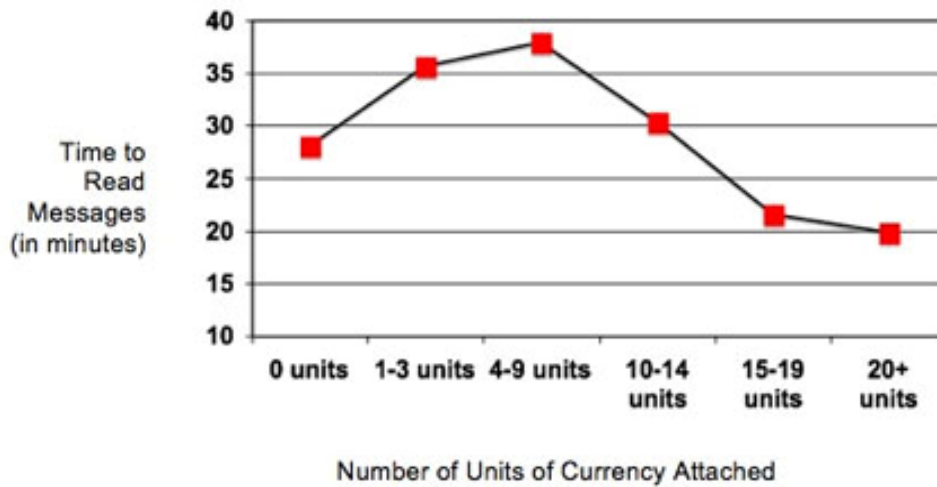


Figure 4: Amount of time in minutes to read messages once received by amount of virtual currency attached to messages.

In summary, when people didn't have any indication of the importance of information (zero units of currency), read time was the mean across all messages, likely because they were uncertain about importance until they were able to read the message. When people had low currency attachments, people took *longer* to read, presumably because they had a signal that the information wasn't critical. And when currency was large people read messages more quickly than they would have without any signal.

The data from the Outlook plug-in software tracked all e-mail interactions between senders and receivers in the system. These data were used to produce an n (people) \times n matrix where total currency transactions were the cell values. The cell values, indicating the strength of a relationship in terms of value transacted, created a distance matrix of relationships that was factored to produce a network picture of the economy (*i.e.*, who was transacting value with whom).

[Figure 5](#) represents the network of transactions between the people in the test. The network was produced using the UCINET 6 Social Network Analysis Software (Borgatti, *et al.*, 2002) and the metric multidimensional scaling algorithm within that program. The software was used to create a two-dimensional representation of the economy where each node represents a person in the network. The size of the nodes represents the degree of centrality of that node in the network. The proximity of nodes represents the amount of currency exchanged between each node pair (*i.e.*, the closer nodes transacted more currency).

The network on the right in Figure 6 is based solely on currency attached to the same set of e-mail messages for the same group of participants. The more currency exchanged the closer the nodes — regardless of the number of messages used to transport the currency. This network diagram reveals a hub-and-spoke pattern with a single central person. Currency exchanges, therefore, allow discovery of different communication patterns than are not apparent by merely examining frequency of contact.

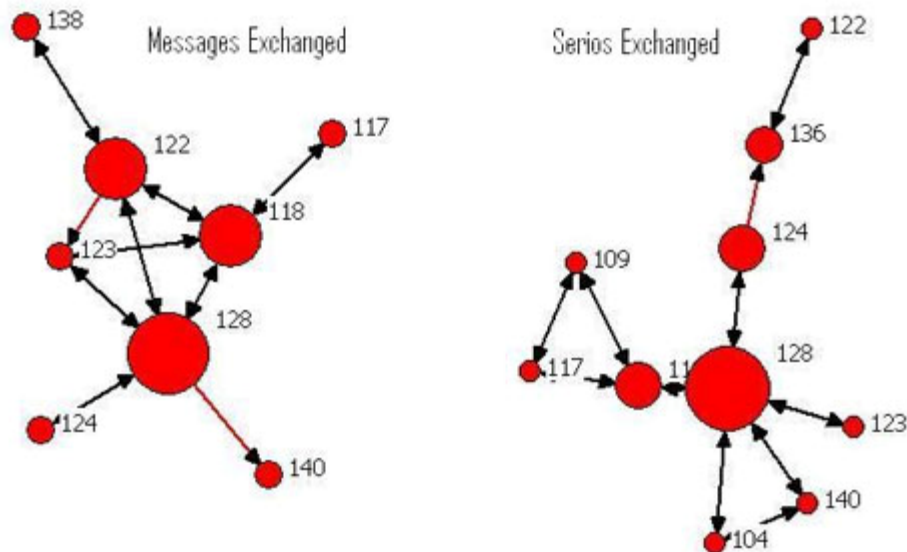


Figure 6: Comparison of exchange networks based on frequency of e-mail exchanges (left) and exchanges of virtual currency (right) — UCINET Social Network Analysis.

Fourteen of the 23 people in the pilot study were surveyed about their experiences using the currency system. They were asked four questions about use of the currency. Each question was posed using a seven-point scale. The major findings from the survey were:

- 10 respondents thought that the currency system was an effective way to get attention and a good way to react to important ideas and issues at work (>5 on 7-point scale).
- 12 people thought that the tool was valuable (>5 on 7-point scale).
- 11 people thought that attaching currency didn't take much time and it was easy to decide how much currency to attach (>5 on 7-point scale).
- 9 people thought that the currency made them more mindful of the e-mail messages they sent (>5 on 7-point scale).

The e-mail plug-in also included a non-currency reward mechanism in the form of “badges” that recognized certain desired behaviors, such as sending e-mail messages with widely varying levels of currency attached. Anecdotal evidence from the surveys

suggests that users were often motivated to change their behavior by the side-channel features of the system.



Discussion of results

Behavior change. The primary result of the study is that synthetic currency attached to e-mail can change communication behavior for senders and receivers of e-mail messages. This behavior change translated into an improved ability for receivers to prioritize incoming traffic, and for senders to get faster responses to important messages. The scarcity of currency in the attention marketplace encouraged judgments useful for marking and interpreting importance — judgments that are difficult absent a method to price information. A marketplace for corporate communication offers a viable solution to information overload and management of information efficiency.

Extension to other media and contexts. Although the present study was about e-mail communication, it is reasonable to assume that the same benefits could accrue to information exchanged in other modalities, including instant messaging, short message systems and digital voice communication. More importantly, the limits of barter economies now used in other areas of corporate communication suggest the potential for a broader application of virtual currency. An enterprise might do well to embrace a virtual economy as a core method of business. In this case, value could potentially be created by connecting the allocation of virtual currency to employees charged with leadership of horizontally constructed virtual project teams, giving these leaders a powerful tool to attract attention to their specific needs.

Virtual currency tags for information origin and importance. We also see promise in the idea of creating a market for ideas inside companies. Various approaches are possible, but the core idea would be to create persistent traceability for ideas that are published in an electronic ecosystem, coupled with a system of synthetic micropayments back to the author as that idea is circulated, used or re-published. This type of credit is sometimes attempted informally, but systematizing credit could solve a long-standing hesitancy that people have to contribute information to virtual groups because they are uncertain if they'll get credit as the information is forwarded and used. Other synthetic currency uses could include bids for scheduling priorities, auctions for scarce company resources (*e.g.*, conference rooms or server space), internal prediction markets where a scarce currency facilitates investments in ideas or outcomes and information tagging where the currency that accumulates around certain messages and information becomes a marker for corporate importance. We see significant value in establishing the value of a *single* currency across several different contexts because the value of the currency can be based on multiple references.

Benefits for distributed work groups. The problem of information overload coexists with an increase in the geographic dispersion of companies and even small teams within companies. Termed “virtuality” (Lu, *et al.*, 2006) this trend can be viewed as a critical cultural parameter to be managed, with different companies arriving at distinctly different solutions ranging from completely co-located to completely placeless teams. Each design entails trade-offs in terms of collaboration efficacy, access to specific skills and talents, access to lower cost labor and access to markets, but all designs could be helped by a pricing mechanism for information that could establish information importance for groups who otherwise have little opportunity for discovery via interpersonal conversation.

Currency exchange and corporate analytics. One promise for an information economy and for the analytics that describe activity in the economy is that enterprise decision-makers could for the first time have a rich set of data to help them understand the influence of virtuality in their business. The ability to quickly see new groups forming or places where expected communication is absent may enable management to intervene more quickly and encourage co-location, even if briefly, as a way to accelerate the progress of groups.

Identifying social networks. Examination of social networks using value exchanges rather than frequency of contact offers visibility into organizational communication that is not available with other social network data. Most network graphs are based on measuring frequency of contact (*e.g.*, number of e-mail messages exchanged) or merely whether or not contact has every occurred (*e.g.*, is a name in my contact database or not). Creating proximity in graphs based on *value* rather than *frequency* shows interaction patterns that are important and otherwise hidden. Pairs of people in a value network could appear close based on only a few messages with high currency, perhaps even a single message. Contact networks can mislead about proximity in graphs when they are based on a high number of low value messages.

There is also significant intrinsic interest in watching networks change. In this study, participants in the system were part of a larger and newly formed department. Management was interested in promoting synergy across the organization, and with the network diagrams, inter-group communication could be tracked and monitored not only from a message flow perspective, but also from the value of the information flowing.

Barriers to usage. Comments from people who used the currency did not uncover significant barriers to usage. One initial concern was that extra time would be required to attach the currency, and that would slow down messaging and cause people to withdraw from the system. More research is needed about the effort required to use this system, however, none of the participants in the study said the system was burdensome, and at least two people said they were able to decide on the amount of currency to attach and execute the attachment within three or four seconds. Further, it may be the case that any latency induced by making these judgments is desirable as the sender is using the extra cycles to ponder the importance of this particular message in relation to others.

Study limitations: sample sizes — messages and people. Two challenges encountered in the study are important. The first involved the volume of e-mail exchanges across participants during the test. While the number of participants and messages were enough to generate statistically significant differences, the number of e-mail messages with economic signals attached was low in comparison to all e-mails sent or received by the participants. The natural communication flow across the study group was such that the volume of intra-group e-mail was significantly lower than e-mail exchange with non-participants. As a result, people had only a small percentage of e-mail in their in-box with virtual currency attached. Future tests should track exchanges with cohesive teams that have a high level of intra-group exchanges and where participants need to respond to important, time-critical requests, and where there is strong management support for use of the currency. The particular system used is designed to track all mail in a system, making it possible for companies to gather population analytics without a need to sample messages and make statistical inferences.


Ethical and privacy issues. The long-term success of virtual currency depends on careful consideration of ethical and privacy issues. These issues will be important to any long-term success of a virtual economy. In this particular study, these issues were managed by fully disclosing the nature of the system and the test to all participants prior to their inclusion, and by making membership in the experimental group voluntary. Furthermore, a limited amount of information regarding an individual's trading activity was made available to the larger group and these limits were made explicit. For the limited duration and scope of this study, those methods complied with corporate policies in the participant company, and no one reported discomfort with the data collected or the reports generated from study data.

Looking toward a large-scale implementation, several issues will need to be addressed. The most challenging concern is the potential for misuse of data about communication networks.

Examples include:

- Management rewarding or punishing employees based on their implied level of connectivity with other team members.
- Management rewarding or punishing employees based purely on the amount of e-mail messages sent or received.
- Anyone with access using the analytic data to discover facts about correspondence or interpersonal relationships that may be damaging or embarrassing to the participants.

Sensitivity to disclosure of economic information does not imply that data about electronic connectivity and other e-mail behaviors should be excluded from performance or diagnostic evaluations. The attention economy, like the complex multi-player games that inspired it, is at its best when it provides compelling insights into work *as the work happens* rather than infrequently during formal reviews (Reeves and Malone, 2007). Pricing of information using a scarce virtual currency is a quick method — both for

managers and participants in the economy — to quantify importance and observe informal communities at work. 

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This paper includes use of software developed by Seriosity, Inc. Byron Reeves is co-founder and consultant to Seriosity, and Simon Roy is the Seriosity CEO.

Note

1. More people are represented in the network diagram than were included in the previous analysis of currency attachments and time to read messages. The additional people were from the software company that provided the virtual currency system. The blue line separates the two companies. The names in the graph do not correspond to real names in the companies.

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<http://www.uic.edu/htbin/cgiwrap/bin/ojs/index.php/fm/article/viewArticle/2100/1963>