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SYNTHESIZING AN AUTONOMOUS BUSINESS OUT OF SOCIAL PARTS: A COGNITIVE ANALYSIS

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ABSTRACT

A programmable autonomous business is a novel kind of business built entirely in software that is functionally indistinguishable from a conventional business—acquiring customers, providing a product to those customers, and making an actual profit for doing so. The difference is that the autonomous business has no employees or managers guiding it; all operations are automated in software. While we know that autonomous businesses are possible, we do not understand why. To address this issue I analyze a basic autonomous business as a distributed cognitive system. I show that an autonomous business is composed of a rather mundane set of social practices whose performance is mediated by online technology. These social practices when performed "offline" have nothing to do with business. However, the synthesis of these technological-mediated social practices results in the emergence of an autonomous business. I discuss why mediating the performance of these social practices with online technologies allows them to instantiate business processes, and conclude by describing the practical applications of the findings and outlining areas for future research.

INTRODUCTION

A "programmable autonomous business" (Flor, 2004a), or simply "autonomous businesses," is a profitable company that one can build entirely in software (programmable) and that once implemented can run itself with no human employees (autonomous). E-bay.com, a web-based auction site, is perhaps the most well-known example of such a business. While E-bay currently employs workers it, nonetheless, qualifies as a programmable autonomous business since it could continue to operate—bringing in new customers and generating income—even if all its employees were fired. The lack of the need for human control has been publicly acknowledged by the management of such companies, who have joked to the popular press that "a monkey could drive this train" (Lashinksy, 2003; in reference to e-Bay).

Although we know *that* programmable autonomous businesses are possible, we do not know how to systematically create them, as evidenced by the widespread dissolution of many allegedly promising such businesses during the dot-com crash of 2000 (Green, Yang, and Judge, 2000). However, systematically creating autonomous businesses requires first understanding how they operate. The objective of autonomous business research is to uncover the processes that allow programmable businesses to operate autonomously.

Autonomous business research is an outgrowth of research on virtual community business models (Hagel and Armstrong, 1997, Hagel, 1999). The term virtual community was coined by Rheingold (1997) to describe "social aggregations that emerge from the Net when enough people carry on … public discussions long enough, with sufficient human feeling, to form webs of personal relationships in cyberspace." Examples of virtual communities include chat rooms, forums, and Multi-User Dungeons (MUDs). A virtual community *business model* is a virtual community with commerce mechanisms added. Specifically, Hagel and Armstrong (1997, p.8-

9) define five elements of a virtual community business model: (a) distinctive focus; (b) capacity to integrate content and communication; (c) appreciation of member generated content; (d) access to competing publishers and vendors; and (d) commercial orientation.

Research on virtual community business models has mainly focused on how to harness virtual communities for business purposes. For example, Rothaermel and Sugiyama (2000) performed an inductive analysis of a successful virtual community business and derived seven propositions, which related community characteristics, such as membership size and scalability, to commercial success. Studies of virtual communities for marketing purposes include: Evans, Wedande, Ralston, and van 't Hul (2001), who proposed that marketers use virtual communities to facilitate three-way communication with a company, consumer, and between consumers; and Maclaran and Catterall (2002) who analyzed the potential for using ethnographic methods to extract marketing information from the many-to-many communications environment provided by virtual communities. More recently, Krieger

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CONTRIBUTION

The research in this paper contributes to our understanding of the phenomenon of autonomous businesses. An autonomous business is a business built entirely in software, capable of operating without human employees—both workers and managers. Examples of popular autonomous businesses include: the electronic auction, Ebay.com; the online diary, Xanga.com; the picture rating service, HotOrNot.com; and the teen advice forum, YesNoMaybe.com. It is not well understood how these businesses are capable of operating autonomously. This research contributes a novel solution to the problem of how online businesses can operate autonomously.

Specifically, the study demonstrates that an autonomous business is an emergent, complex system based on a rather ordinary set of pre-existing social practices, like advising and gossiping. Offline and *individually*, these practices may be unrelated to business activities. However, when information technology mediates the performance of these practices, it changes their characteristics so that *collectively* the social practices manifest business processes, such as supply and advertising. The research is conducted under the theoretical framework of distributed cognition, and is the first study to apply distributed cognition principles to the analysis of autonomous businesses. Finally, the research contributes to the larger theory of superorganizations, the artificial equivalent of the biological superorganism.

The study targets: information systems researchers interested in social and cognitive applications of information technology; applied cognitive science researchers; and both information systems managers and practitioners who have an interest in building autonomous businesses.

and Müller (2003) provided a four-step framework based on metaphors, for both building and harnessing the value generated in virtual communities for business purposes.

However, virtual community business researchers have not studied the potential for such businesses to operate autonomously, without employees or managers guiding their growth. They are indeed aware of this potential, e.g., Hagel and Armstrong (1997) mention "member-generated content" (p. 9) and "organic growth" (p. 155), but the research focus has been on discovering business applications of virtual communities rather than uncovering the processes that allow virtual community businesses to operate autonomously. The present study attempts to fill this research void.

Autonomous business research focuses on explaining the processes that allow virtual-community businesses and, more generally, programmable businesses to operate autonomously; a virtual community business is viewed as but one kind of autonomous business—there are others such as symbol-engine businesses (Flor, 2004b). One approach to uncovering these processes is to analyze an existing autonomous business as a cognitive system.

Under the theoretical framework of distributed cognition (Hutchins, 1995a) a business qualifies as a kind of supra-individual cognitive system and one can analyze a business the same way one would study any cognitive system, e.g., the brain, namely, by mapping the movement and transformation of information across the various agents in the system and from this map inducing underlying structures and processes. One of the central claims of distributed cognition is that intelligent behavior is an emergent property of distributed systems. Indeed, what may look like a complex behavior often emerges from the interaction between much simpler, distributed processes. Thus, what one would expect to find when analyzing an autonomous business as a cognitive system is a collection of simpler processes that taken as a whole instantiate a business.

In this paper, we examine a programmable autonomous business as a cognitive system with the aim of uncovering the processes that allow the business to operate autonomously. We will see that the business is composed of several rather mundane social practices that "offline" serve no business purpose. However, the mediation of these social practices with online technology allows them to instantiate business processes. The synthesis of these technology-mediated practices is what allows an autonomous business to emerge.

The paper is structured as follows. First, for comparison purposes, we examine the functional properties of a conventional business. Second, we describe the methodology and autonomous business analyzed in the paper. Third, we analyze key activities in the autonomous business with the aim of inducing the social practices that underlie their operation. Fourth, we discuss how social practices, which performed offline have nothing to do with business can, through technology mediation, synthesize to create an emergent autonomous business. We conclude by discussing practical applications of the findings and outlining future research topics.

A FUNCTIONAL OVERVIEW OF A CONVENTIONAL BUSINESS

The purpose of a business is to create value for its customers in the form of goods and services—collectively *products*—that it provides to customers (Hammer, 1996). These goods and services are created by processes operating within and between the business and its partners, which includes both other organizations and individuals. A business is deemed profitable if the income it receives for its products exceeds the expenses incurred by its processes. Although there is tremendous variability in how a business implements its processes, at a functional level we can identify five key ones: supply, production, consumption, income, and advertising. Figure 1 depicts these processes.

Briefly, a business (**B**) places *orders* for *raw materials* to suppliers (**S**), who deliver them in exchange for money (*$*). Workers (**W**) hired by the business shape and combine the raw materials into intermediate forms (*works-in-progress*), which are continually
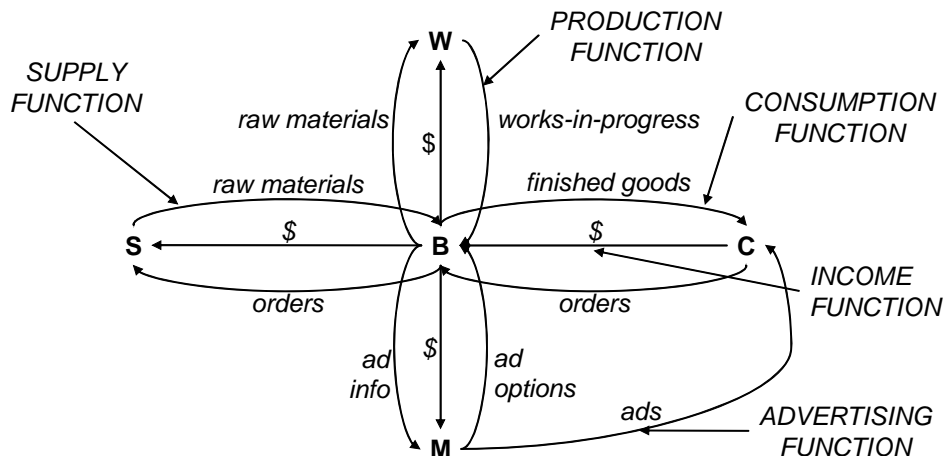
Figure 1. Functional blueprint for a conventional business

shaped and combined, until *finished goods* result. Finally, customers (**C**) *order* the finished goods from the business. To obtain customers, businesses rely on mass-media advertising firms (**M**) that have a number of different vehicles (*ad-options*) for reaching customers. These firms get advertising information (*ad-info*) from the business and then broadcast advertisements (*ads*) to potential customers.

METHOD

The objective of this research is to uncover the processes that allow a programmable business to operate autonomously. The study takes an inductive approach (Eisenhardt, 1989) to uncovering these processes—analyzing an instance of an autonomous business and inferring the processes from this analysis. The theoretical framework guiding the analysis is distributed cognition (Hutchins, 1995a).

Distributed cognition is a subfield of cognitive science, which conceives cognition as a dynamic process that can flexibly incorporate a distribution of mental and environmental structures, in order to resolve situations encountered during task performance. As an illustration, take the task of multiplying two numbers. If the numbers are small enough, one can rely purely on mental structures, such as memorized multiplication tables. However, if the numbers are too large, one must incorporate

environmental structures such as pencil and paper, a slide rule, or a calculator. Note that these environmental structures, *per se*, are not sufficient to complete the task; they must coordinate with the mental structures required to manipulate them. Thus, the multiplication task gets accomplished by a distributed system of mental and environmental structures.

From the perspective of a distributed cognition researcher, it is not just the person that constitutes a cognitive system, but rather the entire system of structures used during a task's performance, e.g., the person and slide rule in our multiplication example. Distributed cognition researchers have studied a wide variety of real-world systems as kinds of supra-individual cognitive systems, including: air traffic control (Halverson, 1995); aviation (Hutchins, 1995b; Hutchins and Palen, 1998); computer-mediated work (Rogers, 1993); commercial fishing (Hazlehurst, 1994); guitar song imitation (Flor and Holder, 1996); helicopter piloting (Holder, 1999); large ship navigation (Hutchins, 1990); puzzle solving (Zhang and Norman, 1994); side-by-side programming (Flor, 1998); and video-game playing (Kirsh and Maglio, 1994). In studying these systems, they employed a variety of techniques including field studies, experiments, and computational models, as a means of analyzing cognitive phenomenon conceived as a distributed process.

Most recently, Flor and Maglio (2004) argued that a business also qualifies as a kind

of supra-individual cognitive system. Specifically, they showed that a business is a cognitive system not because it contains individuals—managers and employees—who are intelligent, but rather because it collectively operates as a physical symbol system (Simon, 1981), and manipulates its symbols for adaptive purposes. Flor and Maglio (2004) went on to describe a general method for analyzing a business as a cognitive system known as "representational analysis." In the context of an information system, the terms symbol and representation are best thought of as information in some medium. The terms representation, symbol, and information are used synonymously throughout this paper, and reflect the interdisciplinary nature of the research this study leverages.

Using representational analysis, a researcher or manager analyzes the work activities in a business, and from this analysis identifies processes that could benefit the business if handled online. Representational analysis consists of three general steps:

1. Identifying the products—both physical goods and knowledge byproducts—of the work activity;

2. Modeling the representations and representational activity that contribute to the products identified in step 1; and finally,

3. Diagnosing computational opportunities, where a computational opportunity is a process (from step 2) that if placed online could benefit the business.

Step two is the key stage in representational analysis. In this stage the analyst first charts the movement of representations across the individuals, technologies, or other media (collectively "agents") that participate in a work activity. The chart, also known as a symbol vector map, depicts:

*   *Agents,* as labels.

*   *Representations,* as labels in the format *channel : content,* where channel is the medium that conveys the content, e.g. e-mail. When all communication occurs

over the same channel (as in this study), one can omit the channel part of the label.

*   *Exchanges of representations* between agents by arrows from the sending agents to the receiving agents. The arrows are annotated with the representations exchanged, in the format specified above.

It is the explicit depiction of the channels used to convey content that distinguishes symbol vector maps from other kinds of process maps, such as physical dataflow diagrams (DeMarco, 1979).

With the symbol vector map created an analyst next uses it to identify processes. A process is delineated by a group of agents that store, manipulate, or propagate a chain of related content; an agent can participate in more than one process within the same symbol vector map. Given a delineated process, the analyst characterizes the function of the process based on the content of the information exchanged and knowledge of the task domain. Appendix A provides a detailed example of step 2, applied to a portion of the information activity in the business studied.

Finally, recall that representational analysis was originally created to help analysts determine how to put offline business processes online. Since the business studied in this paper is fully online, step 3—diagnosing which processes could beneficially be placed online—is not applicable. Instead, in this study step 3 diagnoses why the processes uncovered in step 2 combine to form a business when mediated by online technology.

We will apply representational analysis to the following information system to uncover the processes underlying the activities of both posting topics and opinions, as well as the viewing of threads.

THE "PROGRAMMABLE AUTONOMOUS BUSINESS" AND ITS PRODUCTS

The business analyzed in this paper is the website YesNoMaybe.com, or simply *YNM*. YNM is a web-based forum developed by the author for Mental Systems, Inc., which has been in operation since February of 2000. It is the most popular (Alexa, 2004) and

largest teen advice forum in the Open Directory (www.dmoz.org, a hierarchical organization of web sites similar to Yahoo.com, but much larger and is outsourced to many of the top search engines, including Google.com and search.AOL.com)—for both its own category *Kids and Teens : Teen Life : Advice : Romance*, as well as its parent category—with over 60,000 registered users who have contributed more than 300,000 postings. YNM's forum consists of ten different categories, e.g., "Questions for Girls" and "Questions for Guys." Similar to other web forums, users can browse a list of topics (see Figure 2, left screen), read the content of those topics as well as replies (see Figure 2, right screen), or post their own topics and opinions (see Figure 2, bottom of screens). A poll of over 700 users indicates that 80% are females and 20% are males. 96% of the users are eighteen or under, with 62% below the working age of sixteen.

However, YNM is more than just a forum, it is also a business that has operated profitably since its inception in February of 2000. For example, in its first quarter of operation, when companies had large internet advertising budgets, YNM averaged $9500 per month in advertising revenues. Since then revenues have been more modest. Over the yearly period 9/1/2002—8/31/2003 (refer to Figure 3), YNM averaged $153/month in advertising revenues, with only $15/month in expenses (fixed web hosting fee)—a simply profitability index of 923%. Besides operating profitably for the past four years, YNM continues to grow its customer base, averaging 1031 new user registrations a month over the same period—all without any managers and employees guiding it. YNM is a prototypical autonomous business.

Thus, we have a web site that operates as both a virtual community forum and an autonomous business. What may not be apparent is that fundamentally *they are not separate operations at all*, merely different ways of labeling a common set of rather ordinary social practices that are performed online.

YNM is a good information system for inducing the processes underlying autonomous businesses, for two reasons. First, YNM has been a profitable autonomous business for over four years, during which it survived the dot-com crash of 2000 (Green, Yang, and Judge, 2000). Therefore, the processes derived from it are likely to be more robust than those derived from a short-lived autonomous business. Second, the characteristics of YNM's user environment are representative of all existing autonomous businesses. The environment consist of users that: (a) contribute topic content, e.g., help requests on YNM, items for auction on eBay.com, or diary entries on Xanga.com; (b) contribute opinions on the topics, e.g., advice, bids, comments; and (c) only view content without contributing, e.g., lurkers, auction watchers, readers.

MODELING THE SOCIAL PRACTICES UNDERLYING YNM QUA AUTONOMOUS BUSINESS

Table 1 depicts a related group of actual postings from YNM; only the names and specific dates have been changed. The first row is the topic posting, followed by several opinion postings. In forum terminology, a topic and its opinions denote a "thread."

Technology-mediated help-advice social practice ≡ Supply

If the postings on YNM result from social practices, we ought to be able to induce them using a representational analysis of this thread. The thread in Table 1 depicts an individual making a request for help and several people responding with advice. This kind of free exchange is a frequently occurring, taken-for-granted activity between members of a social circle (hereafter, "society"), and thus qualifies as a *social practice*. The practice is part of a larger activity whose aim is the sharing of cultural models, which Quinn and Holland (1987) define as "models of the world that are widely shared … by members of a society and that play an enormous role in their understanding of the world and their behavior in it" (p. 4). This social practice allows members of a society to effectively learn cultural models through talk (D'Andrade, 1991), without needing first-hand experience. Using terms from the participants' own discourse, we will refer to this process as the **"help-advice"** social practice. The general

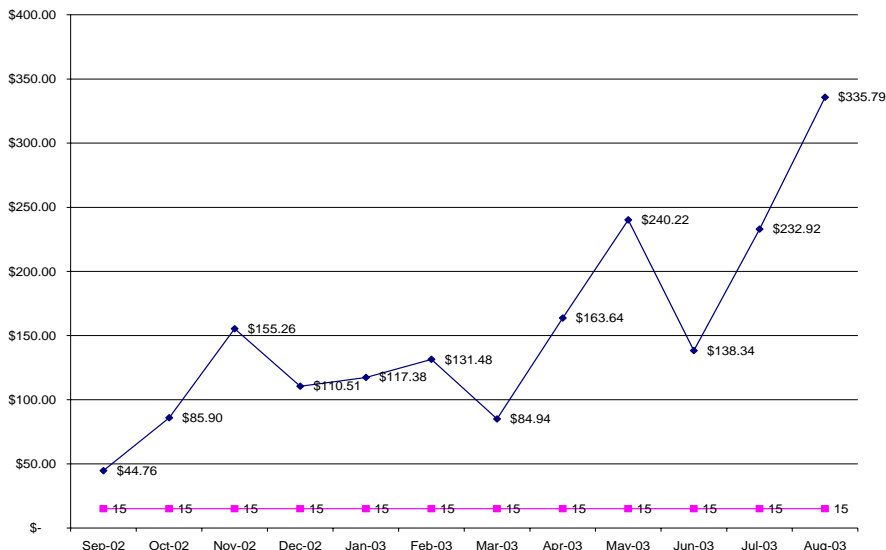**Figure 2. Screen shots: Topic list (left) and topic/opinion display**

Figure 3. YNM revenues (top line) and expenses (bottom line) from 9/1/2002 to 8/31/2003

Table 1. A common thread

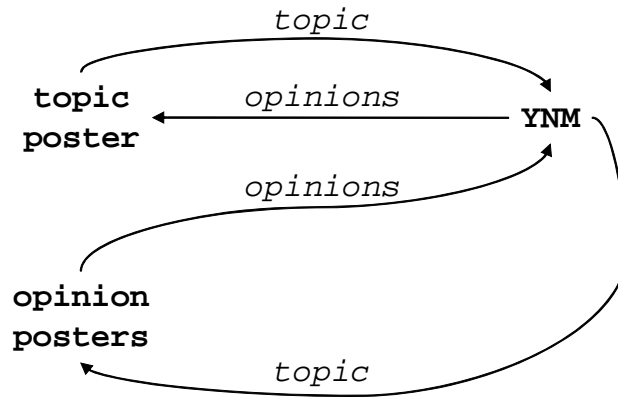| 0	Pebbles 4/17	Hey guys look I kno this may bug u but i could use sum serious help cause im really frustrated so if one of u would jus help me id apprecate it… ok last nite was the last dance of the year, and one of my good friends asked me out. i said yes, and it was really awesome. but like now im having alot of second thoughts cause ive been single for so long cause i didnt like any of the guys asking me out. its not like hes a jerk or anything im jus really confused, can sumone plz give me advice. thanxs.
1	Wilma 4/17	If you really like him, then there should really be no problem with it. If you don't, then maybe you shouldn't of said yes… You just need to make up your mind about how you feel about him, and then figure out how you want to handle it from there… hope i helped!
2	Betty 4/18	Confused about what? again… dont see the problem…
3	Jane 4/24	Hey, ya i was at the last dance of the year at my school too last night. your night sounded better than mine tho. and with your situation…ive been there and done that. its really tough.. i kno. but i dont want to be the barer of bad news, but in my experience it ended where i hurt my friend by stringing him along for a couple of months. i felt like shit because i was lying and he could have had other grls and yet he chose me. now how do you let down a guy like that? the answer is that you have to give it a try and not stop before you even begin. talk to him about it. it may help and it may bring you closer. if i had to do it over again i would have still gone out with him. i learned a lot from the relationship. im not tellng you to use your friend but give him a try and see if maybe you really do like him too. if you dont break it off easily. things in the beginning are always wierd.. but it passes. good news is that he is now my best guys friend. i hope it works out for you and you're not so frusterated.
4	Judy 4/24	Obviously you like it better being single so break up with that one guy… it might help and tell him exactly how u feel!
5	Lisa 4/25	It seems like your just not used too being with someone and its making you feel weird and worry. If you like this guy and want to be with him, just give it a try and see how it goes. If you dont WANT to be with him, then just explain to him. It sounds like you and this guy are good for each other and by what you wrote, it sounds like you DO like him. Your just not used to being with someone and are worried about it not working out, or something like that, just relax and let it flow.
6	Maggie 4/29	Well it's not like the two of you guys are dating now, all you did was go to a dance together. If you want to stay single then you do so, don't settle for less. I hope I helped because I didn't really understand your problem so I did the best I could.

Figure 4. General symbol vector map for the thread

symbol vector map for this process looks as follows (see Figure 4 and Appendix A for the full derivation of this map).

The most basic form of communication in the help-advice social practice is face-to-face discourse between an individual and his or her friends, family members, coworkers, and other associates in close proximity to one another. But the help-advice practice is not limited to face-to-face performance; it is a functional system capable of incorporating a variety of communicative media in its performance, such as the phone, e-mail, or chat rooms, to name a few. However, while the objective of the help-advice social practice—shared cultural models—can be accomplished using a variety of media, each medium changes the residual, structural, spatial, and temporal characteristics of the practice.

Lurking as browsing practice ≡ Consumption

Another common, taken-for-granted practice in societies is the simple browsing of multiple, potentially useful products, without necessarily any intent to acquire or purchase them. This practice is so common for merchandise that it has been institutionalized in dictionaries as the term "window shopping" (Websters, 2001). But window shopping is not limited to physical goods in stores; people also window shop for information online, a practice known colloquially as "web surfing." It is such a common practice that various virtual communities (Rheingold, 2000) have their own terms for the practice. In online forums the practice is known as "lurking," and the people engaged in this practice are called "lurkers"—members that read threads without posting or replying (c.f., Raymond, 1996). Table 2 is a posting from a member of YNM describing her lurking behavior.

The common objective of window shopping, web surfing, lurking, and other browsing practices is an understanding of the space of cultural structures, both physical and informational, available for future activities that an individual may participate in. In the case of lurking, individuals can also acquire cultural models for free by simply reading the forum's threads. Figure 5 depicts the general symbol vector map for lurkers selecting and viewing threads.

We will refer to this general process as the **browsing practice**; it is primarily an individual rather than a social practice.

The browsing practice and advertisements ≡ Income

In a conventional business customers pay for acquiring a product. In YNM, this would correspond to its users paying to read the threads. Unfortunately, the teens that comprise YNM are unlikely to pay money to read content for several reasons. As mentioned, 62% of YNM's members are under the working age of 16 and simply cannot afford to pay for the content. Even if they could pay it is unlikely that they would, since they are used to getting such information for

free. Finally, there are alternative sources on the internet where teens can freely get similar content, such as chat rooms and other forums. An income mechanism is needed where YNM can make money from teens, paradoxically, without the teens paying YNM money.

To resolve this paradox, YNM relies on advertisers for its income. The advertisers give YNM banner code (*bcode*), which results in *banners* displayed along with the *threads*. The typical banner graphically depicts the advertiser's products or services. The banners are located at the top and bottom of the topic list page (see Figure 2, left screen), and additionally before a posting and after a posting (see Figure 2, right screen). Each banner has a different payment condition: pay-per-impression, pay-per-click, and pay-per-lead. For pay-per-impression banners, advertisers pay YNM each time the banner is displayed. With pay-per-click banners, YNM gets paid when a user clicks on a banner. Finally, with pay-per-lead banners, the user must both click on a banner and fill out a contact-information form, in order for YNM to get paid. Figure 6 depicts YNM's income mechanism.

Users clicking on banners is yet another instantiation of the browsing practice. The banners depict products or services that may be useful to the user. Thus, he or she clicks on the banners, bringing up the advertiser's website where the user can browse even more information about products.

Technology-mediated gossiping practice ≡ Advertising

Aside from the listing on DMOZ, YNM does not appear in any of the top search engines for common search terms like "teens" or "teen romance." Moreover, keeping with the goal of autonomy, YNM's owners do not pay companies to advertise the site. As with the supply process, YNM relies on existing customers to promote the site by either word of mouth or by interacting with *social oracles* (Flor, 2005). A social oracle is a computer program that provides social information (*social asset*) to a user—entertaining information that users want to share with other friends and associates. YNM has two social oracles: a compatibility program and the "love detective" (see Figure 7).
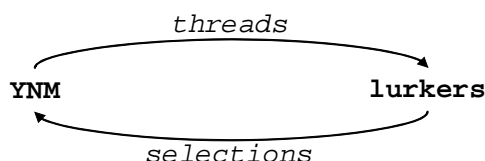
Figure 5. General symbol vector map for lurking
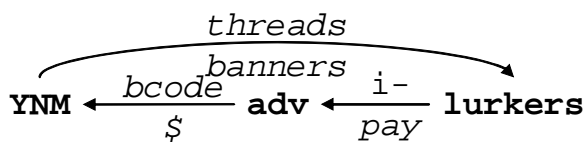
Figure 6. General symbol vector map for browsing advertisements

Table 2. A user posting that defines lurking

Sally 1/3	…aww spanx babe!!! dont worry theres msn for me and you! i might come back i don't know, right now im just **lurking around lolz i'll hardly post or reply to anything, like i did before,** but it'll be way less, aww i saw ur pic so purdey! anyways i g2g ciao babe talk to you soon!

Generally, social oracles work by taking, as input, information about a user's friends or associates (*friend-info*) and returning entertaining information about them—information that a user will want to share with others. For example, the compatibility program takes the names of two people and returns three compatibility scores along with an explanation of those scores. This entertaining information is used to construct a direct response advertisement. For instance, in the compatibility game, the user is given the option of e-mailing the compatibility report to a friend. Unbeknownst to the user, only the *scores* get e-mailed to the friend. To receive the *explanations,* the recipient is told to both click on a link (the direct response mechanism) that sends them to YNM, and to use the compatibility program. Matching the e-mails sent out with the registration e-mails in the new-user database, shows the compatibility program has a 14.46% response rate. The love detective, operating on similar principles, has a response rate of 30.22%. Both social oracles far exceed the 2% response rate that typifies direct mail advertisements.

The reason YNM's existing members use these social oracles—thus providing free advertising for YNM—is similar to why they supply topic and opinion postings for free, namely the social oracles are adaptations of existing social practices in which technology mediates the free exchange of information. The compatibility program, for instance, is based on the social practice of two people **gossiping** with one another.

Technology substitutes for the person who generates the gossip, e.g., the compatibility report, and helps spread the gossip as well. But although the social oracle is based on an existing social practice, the act of mediating the practice with technology—as was the case with the supply process—changes the practice's functional affordances, allowing gossip to serve an advertising function. For the social oracles this function was instantiated by having the technology deliver just a portion of the information to the recipient, e.g., scores but not explanations, forcing him or her to visit YNM to get the complete information. Figure 8 depicts the symbol vector map for YNM using social oracles for advertising purposes.

The mapping between social practices and business processes

Figure 9 superimposes all the technology-mediated social practices described above. The superimposition makes the mapping between social practices and business processes (see Figure 1) more explicit. Specifically, the help-advice practice instantiates a supply process. Lurking—the browsing practice for information— instantiates a consumption process. Viewing banner advertisements—the browsing practice for physical goods—instantiates an income process. Finally, the gossiping practice instantiates an advertising process.

Thus, it is apparent that social practices, properly mediated, can result in the emergence of an autonomous business. In the next section we discuss how the technology mediation adapts basic social practices into business processes.

DIAGNOSIS: WHY TECHNOLOGY MEDIATION CAN ADAPT SOCIAL PRACTICES INTO BUSINESS PROCESSES

The analysis showed that YNM is based on a number of rather ordinary social practices—help-advice, browsing, and gossiping—which in their non-technology mediated, "offline" forms have essentially nothing to do with business. However, mediating the performance of these practices with online technologies alters them in such a way that, taken as a whole, they instantiate an autonomous business. In short, the autonomous business is an emergent property of a distribution of technology-mediated social practices. In the following sections, we discuss some of the reasons why an online business can be built around social practices, as well as how the technology mediation adapts social practices into business processes.
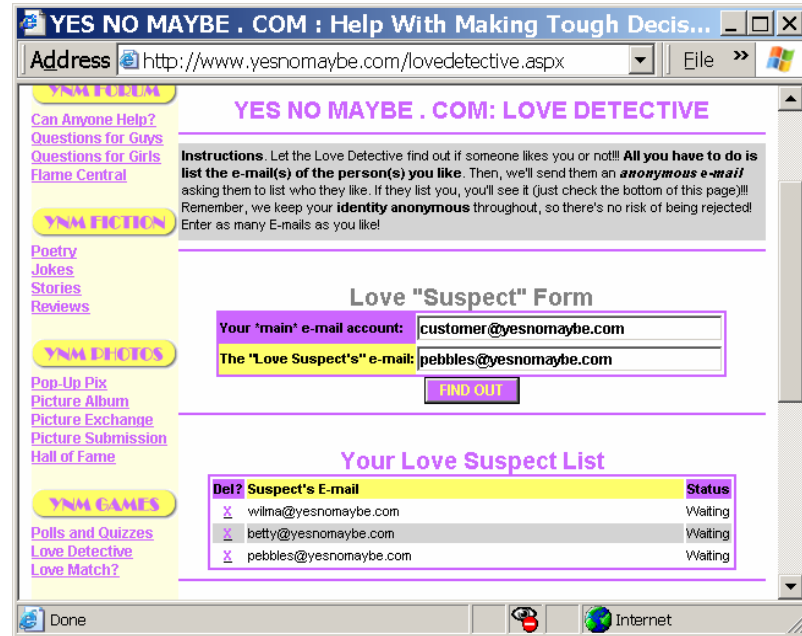
Figure 7. Social oracles for advertising
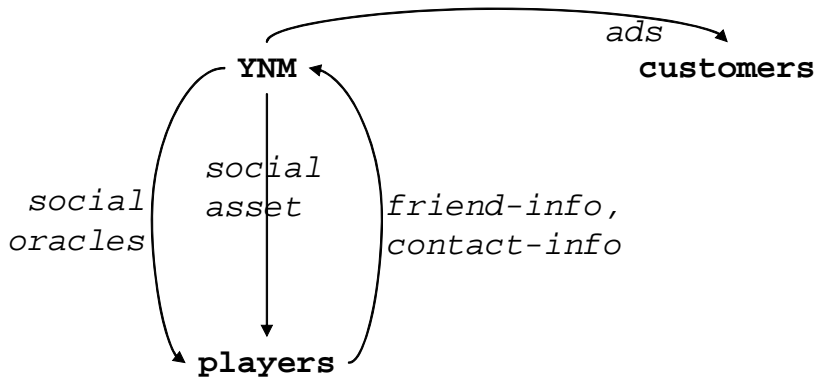
Figure 8. General symbol vector map of the gossiping practice
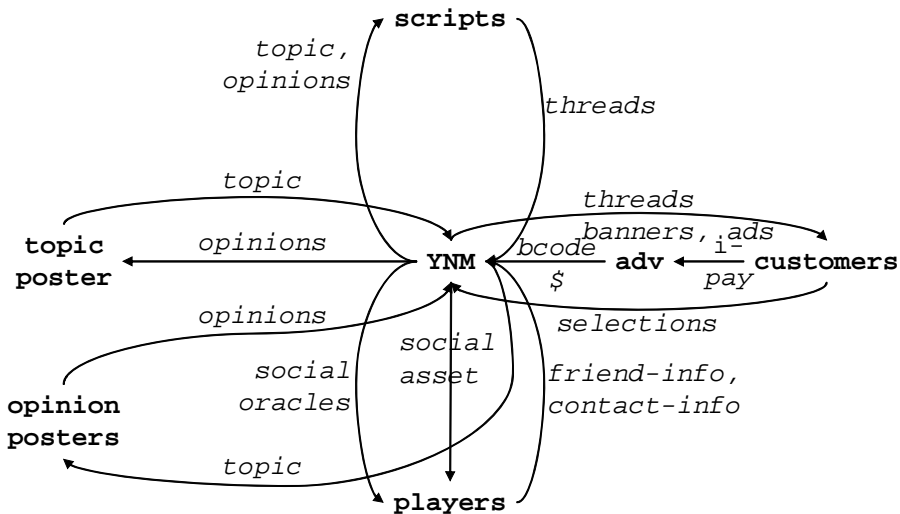
Figure 9. Social practices superimposed: The functional blueprint for a programmable autonomous business (c.f., Figure 1)

Certain social practices result in cultural models, a product that one can build an online business around

A necessary condition for any business is that it produces goods or services for consumers. Social practices, such as the help-advice practice in YNM, produce cultural models: "models of the world that are widely shared … by members of a society and that

play an enormous role in their understanding of the world and their behavior in it" (Quinn and Holland, 1987; p. 4). Because members of a given culture encounter common situations, these cultural models can be of value to other individuals—not just the original participants in the social practice. For example, the advice given in Table 1 can be applied by any person

who is in a situation where he or she is having reservations about accepting a social invitation.

Thus, social practices produce a product of sorts—cultural models—that one can build an online business around.

Online media incentivizes the performance of a social practice online by providing benefits unavailable offline

To build an online business around a social practice, the practice must be performed online. Individuals have several incentives for engaging online in those social practices like the help-advice practice, which result in cultural models. First, online media allow a more diverse set of individuals to participate in the social practice, which potentially results in more extensive cultural models for a situation. Second, the online performance of a social practice can hide the identity of the participants, which allows the construction of cultural models that are not feasible—for a variety of social reasons—when the participants are known to one another.

When performed online, social practices that result in cultural models instantiate a kind of supply process which is a necessary precursor to production and consumption processes in a business.

The residua of social practices performed online can be automatically captured, organized, and made available to other individuals

Performing a social practice online has a number of other benefits aside from providing a context in which a number of anonymous individuals can participate. When individuals engage in a social practice "offline" their discourse is transitory; there is no lasting record of it. However, when a social practice is performed online, software can automatically store the discourse for later retrieval. Moreover, related discourse can be organized together and retrieved as a package. The forum threads on YNM (e.g., Table 1) are an example of an automatically organized package of related content.

Performing a social practice online allows software processes to automatically record and organize the discourse used by the participants in constructing cultural models.

This record is then made available for retrieval by other individuals. These automated software processes correspond to production processes in a business.

Having online technologies mediate the distribution of social assets creates opportunities for bringing the recipients to the business

For those social practices where an individual spreads a single social asset to multiple friends and acquaintances, such as the gossiping practice, having technology mediate the spread of the social asset creates opportunities for bringing the recipient to the online business. For example, YNM forces recipients to visit the site by sending them an e-mail merely informing them of a social asset that could be viewed at YNM; not actually sending the asset in the e-mail.

Thus, a simple distribution social practice, through technology mediation, can be adapted into an advertising process for an online business.

Technology-mediated social practices can be coupled with income mechanisms

Individuals are always looking out for useful informational and physical goods. Since the advent of mass media, companies have taken advantage of this basic browsing practice by mixing advertisements along with content. Electronic media is no different. Companies will pay online businesses to display advertisements alongside content. Advertisements are more properly viewed as *catalysts* for new processes rather than content since their goal is to get users to perform some action, such as clicking on a banner or calling a phone number, which will engage the user in some new activity aimed at selling the advertiser's product.

Technology mediation allows mixing catalysts with content, which facilitates opportunistic switching between practices

The above discussion argued that social practices could be adapted into business processes. However, for a business to emerge, individuals must engage in all the various social practices that instantiate the supply, consumption, and advertising processes needed by a business. In an autonomous

business like YNM, bereft of human employees and managers, what mechanism guides users to engage in the various practices?

A subtle yet powerful property of online media is that *catalysts for new processes can be mixed-in with content for a current process*. Figure 10 depicts an example of mixing content for some current process with catalysts for new processes within the same web page on YNM. Thus, at any instant in time, a user can switch from being a consumer to being: (a) a supplier, e.g., by filling out a form; (b) an income generator, e.g., by clicking on a banner advertisement; or (c) an advertiser, e.g., by clicking on a link to play one of the social oracles.

This mixing of catalysts with content is a taken-for-granted property of electronic media like web pages. Yet without this ability to mix process catalysts and content, the switching between practices would not occur and a business would not emerge.

DISCUSSION: PRACTICAL APPLICATIONS

The primary goal in uncovering the social practices that constituted the autonomous business analyzed in this paper, was to use the findings to inform the design of new kinds of autonomous businesses. Discussion of the practical applications of the results must, therefore, be understood in the context of the practicality of the autonomous business concept. Thus, before examining the design implications of the social practices, we first review some of the practical applications of autonomous businesses.

The autonomous business has both research and business applications. For research, Flor (2004a) discussed ways that information systems researchers could use an autonomous business as a kind of computational laboratory to systematically study advertising and income-related issues for commercial web sites. The topics of study included: effectiveness of advertisement type and placement; alternative forms of computer-mediated, direct response advertising; and novel kinds of information payments and revenue streams. Similarly, a business can develop an autonomous business and use it as a test bed for discovering effective advertising and revenue mechanisms—translating successful findings to its commercial web
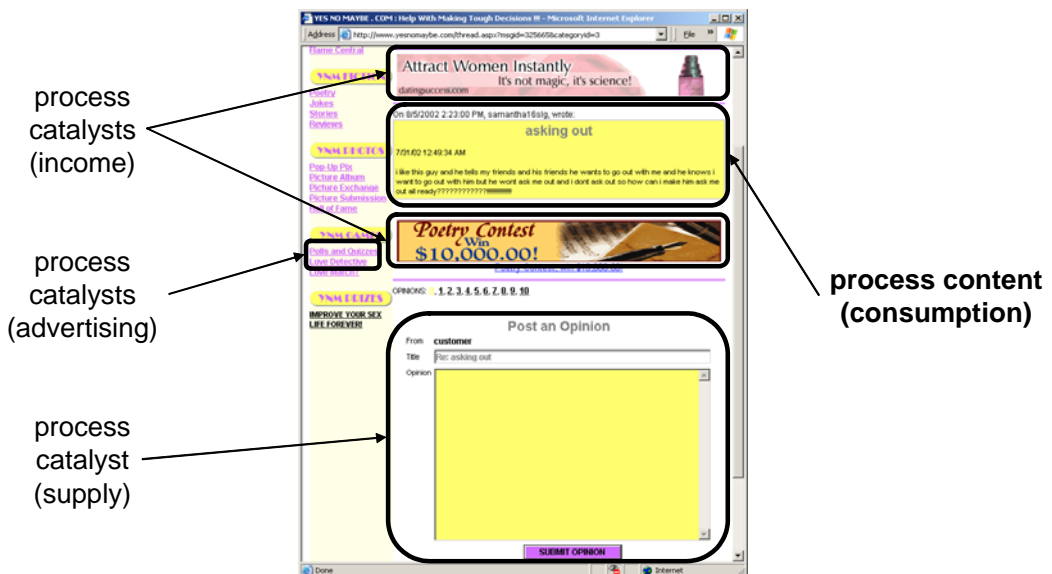

process catalysts (income)

process catalysts (advertising)

process catalyst (supply)

process content (consumption)

Figure 10. Mixing of content and catalysts within the same visual medium

sites. Alternatively, instead of using the autonomous business as a test bed for revenue and marketing mechanisms, a business could treat it as a strategic business unit that generates revenue and customers, which it then funnels to other areas in the business.

However, realizing the benefits of an autonomous business requires building one, which is non-trivial due to the unconventional way that autonomous businesses are formed. In a conventional business an entrepreneur determines a product, then builds the infrastructures for its supply, production, consumption, and marketing processes. In contrast, in an autonomous business, the architect must design a technological infrastructure, which allows customers to engage in pre-existing social practices that *systemically* manifest the business processes of supply, production, consumption, and marketing. Complicating the design of an autonomous business is that these practices may have nothing to do with business processes. Only in the context of a system of activities do these business processes manifest themselves. It is important to emphasize that it is the system of customer activities that manifests the business processes; from the customers' own perspectives, they are merely performing local activities, like helping and gossiping, unmindful of the global consequences—the business processes—that collectively result from their actions.

Therefore, knowing what social practices underlie an autonomous business is important because these practices are its foundation. Once these social practices are known there are at least two ways an architect for a prospective autonomous business can apply them. First, the architect can take the same social practices and merely apply them to different situational domains. Second, the architect can use the information infrastructures underlying the social practices to constrain the search for other social practices that can be harnessed as business processes.

Applying the same social practices uncovered in this paper—help-advice, gossiping, and browsing—to different domains is possible because like many social practices, they are general and pertain to a variety of

situations. For instance, the help-advice practice is not limited to teen social situations; helping and advising can apply (e.g.) to consumer electronic products, in which one user is having problems with a device and other users help solve the problem. By building online technology to support these different situations in which the help-advice practice applies, one has the beginnings of a supply process for an autonomous business. Although less obvious, the social practice of gossiping provides another example of a practice that can be applied to a variety of situations. Instead of spreading social assets, users could share various kinds of information assets, such as discoveries of best practices for a consumer product. By building online technology that supports this sharing of information assets between users, an autonomous business architect can leverage the activity for advertising purposes.

The social practices analyzed in this paper are not the only ones that one can use to synthesize an autonomous business; the difficulty lies in discovering what these other practices are. The information infrastructure underlying the social practices—represented by the symbol vector maps, e.g., Figure 4 — places constraints on the possible social practices. For example, take the help-advice practice in YNM. What is important for the architect of an autonomous business is not that people are asking for help and other people are providing advice, but rather that this social practice establishes an information infrastructure (see Figure 4) that can be harnessed as a supply process in an autonomous business. In particular, the symbol vector map depicts an information infrastructure where a user contributes a topic and other users add their opinions to the topic. Help-advice is but one of many practices that contain this infrastructure. For example, bidding in an English auction also has this infrastructure. A seller submits an item (topic), and potential buyers submit bids (opinions of its value). This practice has been harnessed as a supply process by online auctions like eBay.com. Story telling is another practice that has the requisite information infrastructure: a person tells a story and listeners comment on its quality. Diary web sites, also known as web logs or "blogs," like Xanga.com have

adapted this practice as their supply process. In short, knowing the social practices that constitute an autonomous business can inform the design of new kinds of autonomous businesses, and lead to the discovery of alternative social practices that one can harness for autonomous businesses purposes.

FUTURE RESEARCH

The analysis shows that YesNoMaybe.com (YNM) is a complex distributed system of social practices, which *emergently* functions as an autonomous business. Simon (1981) argued that "complex systems will evolve from simple systems much more rapidly if there are stable intermediate forms than if there are not" (p. 209). Thus, an agendum for future autonomous business researchers is to discover such stable intermediate structures that can be used as a foundation for different kinds of autonomous businesses. Of particular interest are stable intermediate structures that are common across a wide spectrum of autonomous businesses.

If there are stable intermediate structures within an autonomous business, they are likely to be found where activities are highest. In YNM, the main activities are users creating (see Figure 4) and viewing (see Figure 5) threads. Figure 11 highlights these activities in an autonomous business. As is evident, the main activities in YNM get accomplished by a blend of three distinct user groups (topic posters, opinion posters, and lurkers), surrounding a technology (YNM), exchanging various kinds of symbols (topics, opinions, and threads).

I refer to this particular blended organization of people around a technology as a "symbol engine" since it serves to maintain a constant stream of symbols for the autonomous business. The symbol engine seems to be a stable intermediate structure, common across a wide spectrum of autonomous businesses, to which one can attach different kinds of income and advertising mechanisms. For example, EBay.com (electronic auction), Xanga.com (web log / journal), and HotOrNot.com (online picture-rating service) all qualify as autonomous businesses, and all appear to have very different functionality. However, a representational analysis of their primary activities reveals a common symbol engine consisting of three user groups around a technology similar to YNM's. Figure 12 graphically depicts this common symbol engine.

The symbol engine works in an autonomous business as follows. An *initiator* supplies a *catalyst* to an online technology or *nexus* (e.g., a seller entering a description of an item into an online auction; or a person posting a topic on a web forum). A *responder* receives the *catalyst* and responds with *elements* (e.g., a potential buyer contributing a bid, or a person offering an opinion). The nexus organizes the catalysts and elements as a *packet* that can be acquired by *eavesdroppers* (e.g., an online auction making the current bid and bid history available to auction watchers, or a web forum making a topic-opinion thread available to forum lurkers). Initiators, responders, and eavesdroppers can switch roles at any time (e.g., an auction watcher can become a buyer or a seller; a topic poster can become an opinion poster or lurker; indicated by dashed arrows in Figure 12). Table 3 summarizes how the parts fit together in the four autonomous businesses mentioned.

The research task is to identify other stable blended organizations, "borgs" for short, like the symbol engine; explain how individual and social practices synthesize to create them, and finally to describe how one can adapt the blended organizations into various kinds of autonomous businesses.

CONCLUSION

We have seen how it is possible to create a programmable autonomous business by taking basic social practices that originally had nothing to do with business processes and mediating their performance with online technology. The act of mediating these practices with technology allows them to instantiate business processes and to interact in ways that would not be feasible if performed offline. The result is an autonomous business: an unmanned, automated business built entirely in software, which operates profitably and grows its customer base without any employees or managers directing it. As a consequence of being based on social practices,
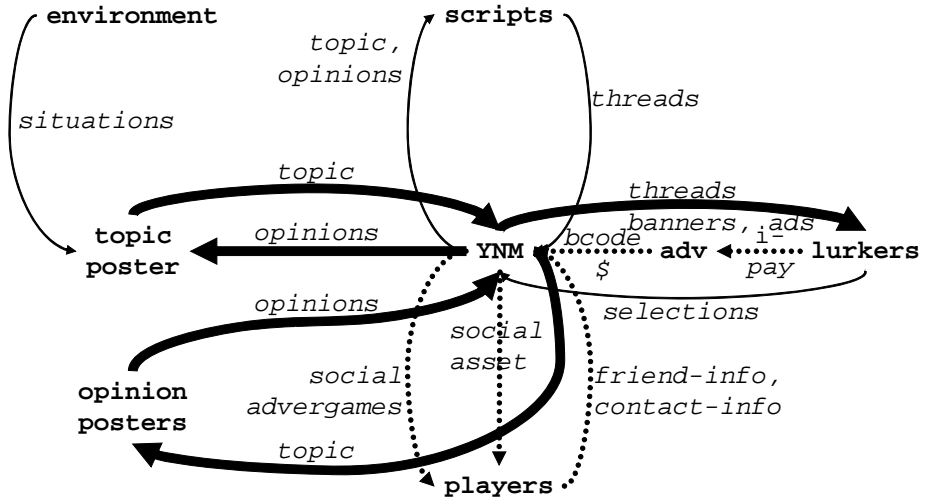
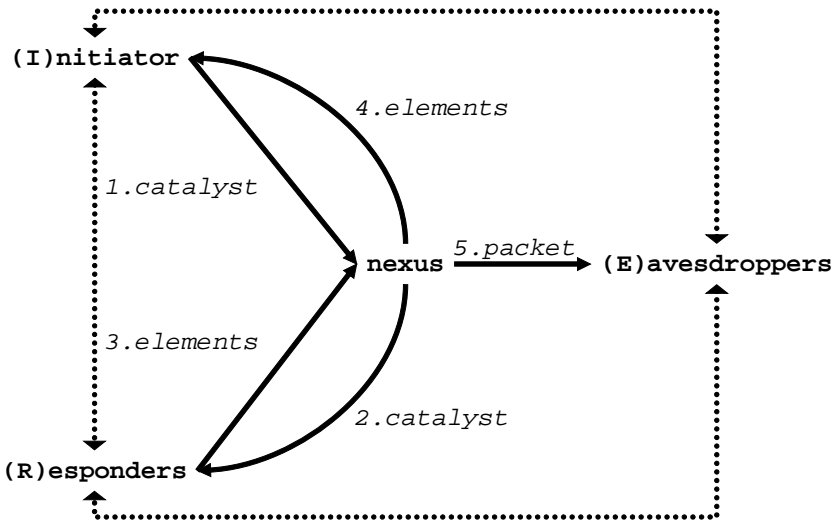**Figure 11. The creation and viewing of threads highlighted**

Figure 12. The symbol engine of an autonomous business

Table 3. Four autonomous businesses and their symbol engine parts

Business	Nexus	Initiator	Responders	Eavesdroppers	Catalyst	Elements	Packet
YesNoMaybe	forum	topic poster	Opinion posters	forum lurkers	topic	opinions	thread
HotOrNot	picture rater	picture poster	Picture voters	picture viewers	picture	votes	picture score
Xanga	blog	journal writer	Commentators	subscribers	entry	comments	diary annot.
EBay	auction	auction seller	Auction buyers	auction watchers	item info	item bids	bid history

customers in an autonomous business are more than just consumers of its products—they are also its suppliers and advertisers, and they supply and advertise freely, without monetary compensation.

In closing, rather than view the study of autonomous businesses as a study of community-based business models, one can view the study of autonomous businesses as part of the larger science of *superorganizations*—the artificial equivalent of the biological superorganism. Wilson (2000) defines a superorganism as:

"Any society, such as the colony of a eusocial insect species, possessing features of organization analogous to the physiological properties of a single organism. The insert colony, for example, is divided into reproductive castes (analogous to gonads) and worker castes (analogous to somatic tissue); it may exchange nutrients by trophallaxis (analogous to the circulatory system), and so forth." (p. 596).

In a superorganization the unit of composition is a functional grouping of processes, rather than functional groupings of colonial animals. For example, the analysis showed that YNM contained a help-advice social practice (analogous to a supply process);

a gossiping practice (analogous to an advertising process); and several kinds of browsing practices (analogous to consumption and income processes). Thus, an autonomous business is a superorganization since its overall function and functional composition (see Figure 9) are similar to that of a conventional business (see Figure 1)

In superorganisms such as ant colonies, complex structures such as leaf nests and ant bridges emerge from ordinary individual activities, in which the individuals performing the actions are not aware of their global consequences, as Holldobler and Wilson (1994) noted:

"The amazing feats of the weaver ants…comes not from complex actions of separate colony members but from the concerted action of many nestmates working together…one ant alone is a disappointment; it is really no ant at all." (p. 107)

Similarly, in an autonomous business the individual and social practices may appear quite mundane and have no resemblance to business processes. However, the synthesis of these practices, when mediated by technology, can result in complex superorganizations like the programmable autonomous business.

REFERENCES

Alexa, "Alexa: Advice : Most popular in advice," 2004. Available at: http://www.alexa.com/browse/categories?catid=468878, last accessed Retrieved 30 June 2004.

DeMarco, T., *Structured Analysis and System Specification,* New York, NY: Yourdon Press, 1978.

D'Andrade, R., "The Cultural Part of Cognition," *Cognitive Science,* 1981, 5, pp. 179-195.

Eisenhardt, K., "Building Theories from Case Study Research," *Academy of Management Review,* 1989, 14, pp. 532-550.

Evans, M., Wedande, G., Ralston, L., and van 't Hul, S., "Consumer Interactions in the Virtual Era: Some Qualitative Insights," *Qualitative Market Research*, 2001, 4, 150-159.

Flor, N., "Side-by-Side Collaboration: A Case Study," *International Journal of Human-Computer Studies*, 1998, 49, pp. 201-222.

Flor, N. "An Analysis of the Design of a Programmable Autonomous Business," *Journal of Systems and Information Technology,* 2004a, 7, pp. 111-118.

Flor, N., "The Architecture of the Symbol Engine in a Programmable Autonomous Business," *2004 IEEE Conference on E-Commerce Technology.* 2004b.

Flor, N., and Holder, B., "Seeing With the Eyes: A Distributed Cognition Perspective on Guitar Song Imitation," *Proceedings of the 18th Annual Conference of the Cognitive Science Society*, 1996.

Flor, N., and Maglio, P., "Modeling Business Representational Activity Online," *Knowledge-Based Systems,* 2004, 17, pp. 39-56.

Flor, N., "Social Oracles as Advertising Tools in Programmable Businesses," In *Contemporary Research in e-Marketing Volume 1,* S. Krishnamurthy (ed.), Idea-Group Publishing, Hershey, PA, 2005, pp. 1-37.

Green, H., Yang, C., and Judge, P., "THE DOT.COMS FALLING TO EARTH," *Business Week,* 17 January 2000, p.38.

Hagel, J., and Armstrong, A., *Net Gain,* Boston, MA: Harvard University Press, 1997.

Hagel, J. (1999). "Net Gain: Expanding Markets Through Virtual Communities," *Journal of Interactive Marketing,* 1999, 13, pp. 55-65.

Halverson, C. "Distributed Cognition in Air Traffic Control," *Unpublished Ph.D. Thesis*, Department of Cognitive Science, University of California, San Diego, 1995.

Hammer, M., *Beyond Reengineering*, New York, NY: Harper Business, 1996.

Hazlehurst B. "Fishing for Cognition: An Ethnography of Fishing Practice in a Community on the West Coast of Sweden," *Unpublished Ph.D. Thesis*, Department of Cognitive Science, University of California, San Diego, 1994.

Holder B., "Cognition in Flight: Understanding Cockpits as Cognitive Systems," *Unpublished Ph.D. Thesis*, Department of Cognitive Science, University of California, San Diego, 1999.

Hölldobler, B., and Wilson, E., *Journey to the ants.* Cambridge, MA: Harvard University Press, 1994.

Hutchins, E., "The Technology of Team Navigation," In *Intellectual teamwork: Social and Technological Foundations of Cooperative Work*, J. Galegher, R. Kraut, and C. Egido, (eds.), Lawrence Erlbaum Associates, NJ, 1990.

Hutchins, E., *Cognition in the Wild,* Boston, MA: MIT Press, 1995a.

Hutchins, E., "How a Cockpit Remembers its Speed," *Cognitive Science*, 1995b, 19, pp. 265-288.

Hutchins, E., and Palen, L., "Constructing Meaning from Space, Gesture, and Speech," In *Discourse, Tools and Reasoning: Essays on Situated Cognition,* L.B. Resnick, R. Säljö, C. Pontecorvo and B. Burge (eds.), Springer Verlag, New York, 1998, pp. 23-40.

Kirsh, D., and Maglio, P., "On Distinguishing Epistemic from Pragmatic Action," *Cognitive Science*, 1994, 18, pp. 513-549.

Krieger, B., and Müller, P., "Making Internet Communities Work: Reflections on an Unusual Business Model," *The DATABASE for Advances in Information Systems,* 2003, 34, pp. 50-59.

Lashinksy, A. "Meg and the machine: Unstoppable eBay is No. 8 among FORTUNE's fastest growing companies," *Fortune*, 1 September 2003.

Maclaran, P., and Catterall, M., "Researching the Social Web: Marketing Information from Virtual Communities," *Marketing Intelligence & Planning,* 2002, 20, pp. 319-326.

Quinn, N., and Holland, D., "Culture and Cognition," In *Cultural Models in Language and Thought*, D. Holland and N. Quinn (eds.), Cambridge University Press, New York, NY, 1987, pp.4.

Raymond, E., *The New Hacker's Dictionary,* Cambridge, MA: MIT Press, 1996.

Rheingold, H., *The Virtual Community,* Cambridge, MA: MIT Press, 2000.

Rogers, Y., "Coordinating Computer-Mediated Work," *Computer-Supported Cooperative Work*, 1993, 1, pp. 295-315.

Rothaermel, F., and Sugiyama, S., "Virtual Internet Communities and Commercial Success: Individual and Community-Level Theory Grounded in the Atypical Case of TimeZone.com," *Journal of Management,* 2001, 27, pp. 297-312.

Simon, H., *The Sciences of the Artificial,* Cambridge, MA: MIT Press, 1981.

Webster's unabridged dictionary. NewYork, NY: Random House, 2001.

Wilson, E., *Sociobiology,* Cambridge, MA: Harvard University Press, 2000.

Zhang J. and Norman D., "Representations in Distributed Cognitive Tasks," *Cognitive Science*, 1994, 18, pp. 87-122.

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APPENDIX A: DERIVATION OF THE GENERAL SYMBOL VECTOR MAP FOR THE THREAD

On 4/17, Pebbles posted a topic message on one of YNM's message boards (see Table 1). Over the course of nearly two weeks, six people responded with opinions. Although the data does not show when the respondents actually read the message, if we assume they responded shortly after reading the topic we can then map the information activity for posting and reading the topic message as follows (see top half of Figure 13).
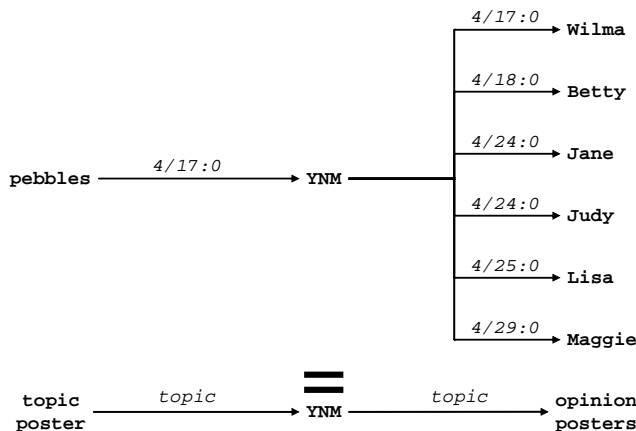

Figure 13. Specific (top) and general (bottom) symbol vector map for the user posting a message on YNM and six people reading the message

Briefly, in a symbol vector map, the nodes represent agents that exchange information, and the arrows denote the exchange of information between agents. In this particular map the arrows are labeled with the date the information was exchanged followed by an index to the information, which corresponds to a row in Table 1, e.g., 4/17:0. In a similar manner, we can map the information activity for the six people responding to the message (see Figure 14). Note that since we do not know when the topic poster (pebbles) actually reads the replies, the dates are left off of the indices in the arrow label between YNM and pebbles.

Figure 15 combines the general forms of both information activity maps.
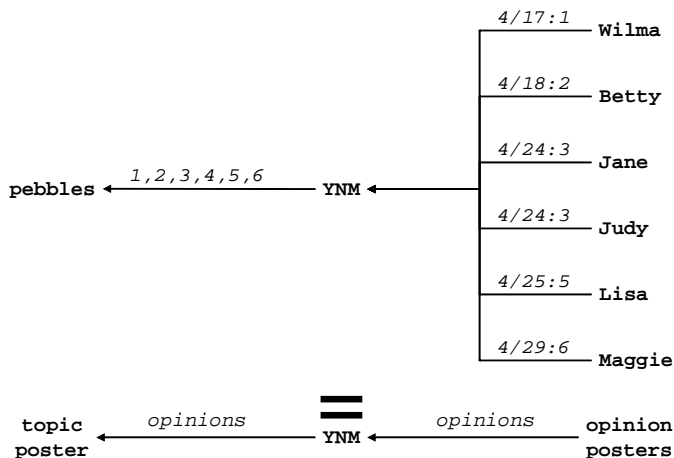
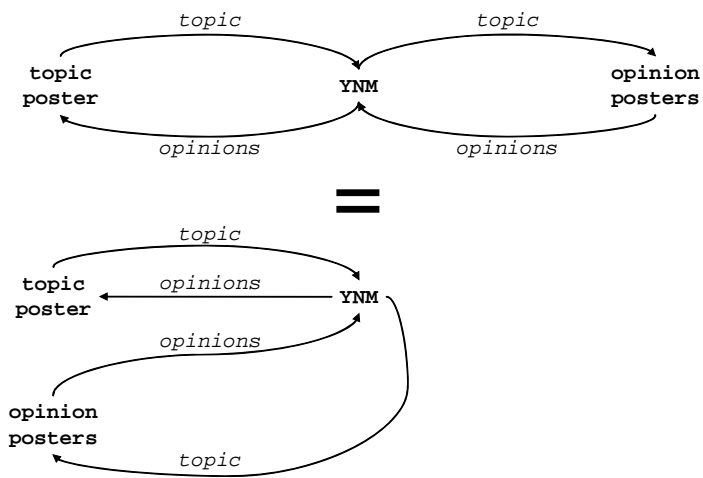**Figure 14. Specific (top) and general (bottom) symbol vector map for the six people responding to the message**

Figure 15. Combined symbol vector maps for the thread

All the general symbol vector maps in this paper were derived using a similar process.