Chapter 9

The economies of online cooperation

Gifts and public goods in cyberspace[1]

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The Internet is filled with junk and jerks. It is commonplace for inhabitants of the Internet to complain bitterly about the lack of cooperation, decorum, and useful information. The signal-to-noise ratio, it is said, is bad and getting worse.

Even a casual trip through cyberspace will turn up evidence of hostility, selfishness, and simple nonsense. Yet the wonder of the Internet is not that there is so much noise, but that there is any significant cooperation at all. Given that online interaction is relatively anonymous, that there is no central authority, and that it is difficult or impossible to impose monetary or physical sanctions on someone, it is striking that the Internet is not literally a war of all against all. For a student of social order, what needs to be explained is not the amount of conflict but the great amount of sharing and cooperation that does occur in online communities.

Rheingold (1993) has described interaction in one online community (the WELL) as consisting of a gift economy, in which help and information is offered without the expectation of any direct, immediate quid pro quo. Even in more anonymous settings, such as Usenet discussion groups, there is a surprising amount of free help and information given out, often to complete strangers whom one may never meet again.

In comp.sys.laptops, a discussion group on Usenet devoted to notebook computers, it is commonplace for participants to contribute detailed specifications and reviews of new models as they come onto the market. Participants also respond to questions that other users post with detailed advice and answers to technical questions. Personal computer consultants will offer similar advice for about $40 per hour. In comp.lang.perl, a discussion group devoted to the computer language Perl, participants

routinely help others out with their technical questions and contribute new computer code for others to use. An accomplished Perl programmer can charge $75 per hour. In a number of online discussion groups for lawyers, participants routinely offer each other detailed legal advice concerning cases on which they are working (Simon 1996). The lawyers report that they often refuse to give similar information over the phone or charge up to several hundred dollars an hour for the same advice.

Why would anyone give away such valuable advice? What can explain the amount of cooperation that does occur in online communities? In this chapter I wish to analyze how the economies of cooperation change as one moves to the Internet. I argue that there are fundamental features of online interaction which change the costs and benefits of social action in dramatic ways.

Because the metaphor of gift-giving has been used to describe online interaction and exchange, I will begin with a brief discussion of the concept of the gift. I then discuss social dilemmas – situations in which individually reasonable behavior leads to collective disaster – and in particular examine the challenge of providing public goods (to be defined below). Subsequent sections detail the shift in the economics of cooperation, discuss the motivations that drive contributions and collaboration, and provide two striking examples of online collective action. I close with a strong caution against assuming that the shifting economics of online interaction guarantee high levels of cooperation.

Gifts

What is a gift? Carrier (1991: 122) expands on the classic work by Mauss (1935) to define a gift as (1) the obligatory transfer, (2) of inalienable objects or services, (3) between related and mutually obligated transactors.

Unpacking this further, a gift transaction involves a diffuse and usually unstated obligation to repay the gift at some future time. Gift exchanges should not involve explicit bargaining or demands that the gift be reciprocated, but a relationship in which there is only giving and no receiving is unlikely to last. The contrast to a gift exchange is a commodity transaction, in which no obligation exists after the exchange is consummated – the bottle of water purchased at a convenience store does not create an obligation to buy something there again. A gift is also tied in an inalienable way to the giver. This is to say that gifts are unique: it is not simply *a* sweater, but rather *the* sweater-that-Bill-gave-me. In contrast, commodities are not unique and derive no special value having been acquired from person X rather than person Y – a pound of flour is a pound of flour is a pound of flour when purchased at a supermarket. Finally, gifts are exchanged between individuals who are part of an ongoing interdependent relationship. In a commodities transaction, the individuals are self-interested, independent actors (Carrier 1991).

Another distinction between gifts and commodities is made by Bell (1991), who focuses on how individuals can increase the benefits of their exchanges. In a gift economy, benefits come from improving the "technology of social relations" by, for example,

increasing the range and diversity of one's social network. In commodity economies, the benefits come from making improvements in the technology of production. Thus, gift economies are driven by social relations while commodity economies are driven by price. It is also important to note that gift exchange and commodity transactions are ideal types, and any economy will be a mix of these two types of exchange as well as many intermediate cases between them.

Using these definitions, are the acts of sharing information and advice that we see on the Internet examples of gifts in a strict sense? While gift giving as classically defined certainly occurs in the Internet (e.g. colleagues emailing each other useful information), much of the help and sharing that occurs is actually different than traditional gift exchange. When people pass on free advice or offer useful information, the recipient is often unknown to them and the giver may never encounter the recipient again. Thus, the usual obligation of a loose reciprocity between two specific individuals is difficult or impossible. Indeed, gifts of information and advice are often offered not to particular individuals, but to a group as a whole. Gifts of information might be offered to a group that has a clearly defined membership (a private discussion list, for example) or to groups that are more loosely defined – for example, information posted in a Usenet discussion group. Even more striking, if the information is posted on a World Wide Web page, there may be only the most tenuous sense of the group – the information may be offered to an unknown set of recipients.

The relative or absolute anonymity of the recipient makes it all the more remarkable that individuals volunteer valuable information – one cannot realistically count on the reciprocity of the recipient in the future to balance the gift that has occurred. While a balanced reciprocity with a particular individual may not be possible, there is a sense in which a balance might occur within a group as a whole. When, for example, skilled programmers who participate in the Perl discussion group volunteer an answer to a tricky programming question, they may have no expectation of being helped in return by the recipient. They may, however, feel entitled to, and believe they will receive, help from some other member of the group in the future.

This kind of network-wide accounting system, in which a benefit given to a person is reciprocated not by the recipient but by someone else in the group, is known as "generalized exchange" (Ekeh 1974). To offer an example from face-to-face interaction, if I help a stranded motorist in my community, I do not expect that motorist to return the favor, but I may hope and expect someone else in the community to offer me aid should I be in a similar situation (cf. Yamagishi and Cook 1993).

This system of sharing is both more generous and riskier than traditional gift exchange. It is more generous because an individual provides a benefit without the expectation of immediate reciprocation, but this is also the source of risk. There is the temptation to gather valuable information and advice without contributing anything back. If everyone succumbs to this temptation, however, everyone is worse off than they would have been otherwise: no one benefits from the valuable information that others might have. Thus, generalized exchange has the structure of a social dilemma – individually reasonable behavior (gathering but not offering information) leads to collective disaster.[2]

Public goods

In particular, many of the benefits provided in cyberspace have the quality that they are public goods, which are goods that anyone might benefit from, regardless of whether they have helped contribute to their production. A public good is defined by two characteristics. First, it is to some degree nonrival in that one person's consumption of the good does not reduce the amount available to another. One person's viewing of a fireworks display, for example, does not reduce what can be seen by another person. Second, a public good is to some degree nonexcludable in that it is difficult or impossible to exclude individuals from benefiting from the good – one receives the benefits of a national defense system regardless of whether one pays taxes. In most cases a public good will exhibit these two qualities to some degree only; pure public goods are the exception.

Everyone in a group may be made better off by the provision of a public good, but that in no way guarantees that it will be produced. Because excluding others from consuming the public good is difficult or impossible, there is the temptation to free-ride on the efforts of others, enjoying a public good without contributing to its production. Of course, if everyone tries to free-ride, the good will not be produced and everyone suffers, hence the social dilemma.

Providing public goods poses two key challenges. The first is the issue of motivation: getting individuals to contribute to the provision of a public good despite the temptation to free-ride. The decision not to contribute may spring from at least two sources – the desire to take advantage of someone else's efforts (greed), or an individual may be willing to cooperate but feel that there is not much of a chance that the good will be successfully provided and so does not want to waste his or her efforts (a concern with efficacy). The second challenge is one of coordination: even if a group of individuals are motivated to contribute toward a public good, they will need to coordinate their efforts and this will involve its own set of difficulties and costs.

Because the costs and benefits of providing some types of public goods change radically in online environments, so too do the dynamics of motivation and coordination. The next section will explore these shifts in the economies of cooperation.

Digital goods

Online communities exist within a radically different environment. The setting is (1) a network of (2) digital (3) information, and each of these three features drives important changes. It is a world of information rather than physical objects. Further, it is digital information, meaning that it is possible to produce an infinite number of perfect copies of a piece of information, whether that be a computer program, a multimedia presentation, or the archives of a long email discussion. As Negroponte (1995) put it, the setting is one of bits rather than atoms. And finally, this information is being produced not in isolation, but in an interwoven network of actors.

To draw the contrast differently, Carrier (1991: 130) argues that "in societies of the gift, gift relations are oriented to the mobilization and command of *labor*, while in capitalist societies commodity relations generally have been oriented to the mobilization and command of *objects*" (emphasis in original). In online communities, exchange relations are oriented to the mobilization and command of information.

The fact that online communities exist in a network of digital information means that there are significant changes in the costs of producing public goods, in the value of public goods, and in the production function of a public good, i.e. the relationship between the amount contributed toward a public good and the proportion of the public good produced.

Changes in costs

Online interaction can reduce the costs of contributing to the production of a public good in numerous ways. Consider, for example, collective protest designed to change the policy of an organization (Gurak, Chapter 10 in this volume; Mele, Chapter 12 in this volume). Even if one believes in the goals of the protest, the temptation is to let others do the work and avoid even such small costs as composing and sending off a letter of protest. To the extent costs are lowered, the more likely it is that individuals will take part in the collective action.

To take the example of a protest letter, Gurak (Chapter 10 in this volume) demonstrates how online interaction reduced the costs of sending a letter out to near zero. Sample letters were sent around the Internet so that individuals did not have to write their own. The usual cost savings of email also meant that there was no need to prepare an envelope, add a stamp, and walk down to the postbox to mail the letter. Online petitions were also circulated in which all one had to do was add one's name to the list and then forward it on. In this case the cost savings may seem trivial – how much effort, after all, does it take to mail a letter of protest? Yet reducing a small cost to near zero can have profound behavioral effects. Consider, as an example, the difference in television viewing habits caused by a remote control. The costs of getting up and changing the channel are very small, but reducing the costs still further (to essentially zero) by use of a remote control creates a dramatically different pattern of channel surfing. A small change in costs can have a disproportionate impact on behavior.

Coordination costs can also be reduced as a result of online interaction. Meeting with other people involved in a social protest or finding out information about the current situation and future plans can become trivially easy online. The formation of a new discussion group in Usenet devoted to a protest, for example (Gurak, Chapter 10 in this volume), creates a natural meeting place for those interested in the issues, and an easy way of distributing information. People can meet, plan, and discuss issues without regard to physical location or time.[3]

Changes in benefits

The value of a public good can also shift as one moves to online interaction. The fact that many of the public goods produced on the Internet consist of digital information means that the goods are purely nonrival – one person's use of the information in no way diminishes what is available for someone else. It also becomes easy and very cheap to distribute information across the Internet. While these feature are troubling for those concerned with intellectual property rights, they also create powerful incentives for groups interested in providing public goods. Once produced, the good can benefit an unlimited number of people. This is unlike physical public goods – there is a large though strictly finite limit to the number of people who can benefit from a fireworks display, a lighthouse, or even national defense. If an individual is motivated in even a small way to benefit the group as a whole, the fact that digital public goods are purely nonrival can be a significant incentive to contribute toward the public good.

And while the provision of many public goods requires the actions of a group (e.g. staging a social protest, writing a new operating system), the nature of a digital network turns even a single individual's contribution of information or advice into a public good. Any piece of information posted to an online community becomes a public good because the network makes it available to the group as a whole and because one person's "consumption" of the information does not diminish another person's use of it. This is a remarkable property of online interaction and unprecedented in the history of human society.

Thus, a clever bit of programming in a Perl discussion group, advice on how to cope with a serious illness posted to a discussion list, or a collection of restaurant reviews gathered onto a Web page can end up benefiting an unlimited number of people. In contrast, consider the same goods in the absence of a digital network. An individual or group may have useful advice on dealing with Alzheimer's patients but the information may remain known only to the group and their local contacts. Eventually the information may diffuse through people's social networks as they talk to each other or write letters, but this may take time and has its own set of costs associated with it. Even if the group is motivated to try to distribute the information widely as an act of cooperation, the costs of doing so may be huge. Few groups have the resources, for example, to publish a national magazine or buy commercial time on the radio or television. And even if such ambitious actions were possible, commercials eventually stop airing, magazines are lost, and it is difficult or impossible to keep the information current and let others add to the information. An online support group solves each of these challenges and each piece of new advice or information becomes instantly available to the group as a whole.[4]

Changes in the production function: the new ubiquity of privileged groups

The provision of public goods usually requires the concerted effort of a group. Sometimes most or all the members of a group must help out to produce the good. At

other times, the good may require the efforts of only a smaller subgroup within the community. This relationship between the proportion of the group contributing to a public good and the proportion of the public good that is produced is known as the production function.[5]

I discussed above that a remarkable characteristic of the Internet is that any piece of information posted to an online group becomes a public good. A second remarkable characteristic is that the size of the group necessary to produce many public goods is often reduced to one. Groups in which an individual is able and willing to pay the costs of providing a public good by himself or herself are known as "privileged groups" (Olson 1965: 49–50).

Until the advent of online interaction, privileged groups were considered an unusual exception – most public goods required the actions of a group. While very small privileged groups can easily be imagined (someone planning a party for friends), very large privileged groups, while logically possible, were so rare and exotic that they were the stuff of legends. A famous example of a public good provided by a single individual within a huge group is retold by Hardin (1982):

> Consider the actual case of billionaire Howard Hughes, whose tastes ran to watching western and aviation movies on television from midnight to 6:00 AM. When he moved to Las Vegas where the local television station went off the air at 11:00 PM, his aides badgered the station's owner to schedule movies through the night until the owner finally challenged a Hughes emissary: "Why doesn't he just buy the thing and run it the way he wants to?" Hughes obliged, paid $3.8 million for the station, and ran movies until 6:00 AM. The potential audience for these movies was a quarter of a million people.
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> (Hardin 1982: 42; the story was originally reported in *Time*, April 8, 1974: 42)[6]

What makes this story newsworthy is that it took the resources of one of the world's most wealthy persons to create a public good that could benefit hundreds of thousands of individuals. This is no longer newsworthy – a single individual with access to a thousand dollars of computer hardware can now produce information and Web content that might be viewed by and benefit a potential audience of millions.

The fact that many digital public goods can be provided by a single individual means that in these cases there are no coordination costs to bear and that there is no danger of being a sucker, in the sense of contributing to a good that requires the efforts of many, only to find that too few have contributed. Thus, an important category of costs is eliminated, as is the fear of contributing to a lost cause. And while the fact that something has the quality of a public good has usually meant that it might be difficult to motivate individuals to produce it, in the case of a privileged group the fact that one's solitary contribution becomes a public good can actually serve as a positive motivation for the person to provide it – there is the hope that it will be seen by and benefit a potentially huge audience.

Shifts in the economies of production mean that individuals are able to produce many public goods on their own. And the decrease in contribution and coordination costs

as well as the potential amplification in the value of the contribution (because of the huge audience) makes it more likely that an individual will experience a net benefit from providing the good.

Motivations for contributing

The specific effects of changes in the costs and benefits of online cooperation will depend on what general motivations are driving the decision to cooperate. In this section I discuss a list of possible motivations for providing public goods. I begin by examining motivations that do not require any assumptions about altruism or group attachment. In other words, these motivations rest on self interest (either short term or long term). I then discuss possible motivations for this kind of cooperation that relax the assumption of egoism and take it for granted that individuals care to some degree about the outcomes of others.

One possibility is that a person is motivated to contribute valuable information to the group in the expectation that one will receive useful help and information in return; that is, the motivation is an anticipated reciprocity. As I discussed above, it is sometimes the case that reciprocity will occur within the group as a whole in a system of generalized exchange. This type of network-wide accounting system creates a kind of credit, in that one can draw upon the contributions of others without needing to immediately reciprocate. Such a system, in which accounts do not need to be kept continually and exactly in balance, has numerous potential benefits (Kollock 1993). If each person shares freely, the group as a whole is better off, having access to information and advice that no single person might match. A loose accounting system can also serve as a kind of insurance, in that one can draw from the resources of the group when in need, without needing to immediately repay each person.[7]

While participants may accept the existence of outstanding debt, there is likely to be some sense that there should be a rough balance over time. Someone should not simply take without ever contributing to the group. Members may eventually shun those who never give or conversely make an effort to help those who have contributed in the past (helping the "good citizens" of the group). Indeed, some observers (Wellman and Gulia, Chapter 7 in this volume; Rheingold 1993) have reported that individuals who regularly offer advice and information seem to receive more help more quickly when they ask for something.

If the possibility of future reciprocation is the motivation driving an individual's contribution, then the likelihood of providing public goods will be increased to the extent individuals are likely to interact with each other in the future and to the extent that there is some way to keep track of past actions (for example, by making sure contributions are seen by the group as a whole or by providing archives of past actions and contributions). Identity persistence is also a very important feature in encouraging contributions based on reciprocity. If identities are not registered to particular users and stable across time, and if there is no record of past actions and contributions, an account of past contributions, however loose, cannot be kept (Kollock 1996, 1998). A final

feature that would encourage reciprocity over time is a well-defined and defended group boundary (Ostrom 1990; Kollock and Smith 1996). If the population of a group is extremely unstable, there is the temptation to come into a group and take advantage of its resources and then leave. Contributing something to the group today in hopes of taking something back later amounts to making a loan to the group. If the recipients of the loan leave, the system of generalized exchange breaks down.

A second possible motivation is the effect of contributions on one's reputation. High quality information, impressive technical details in one's answers, a willingness to help others, and elegant writing can all work to increase one's prestige in the community. Rheingold (1993) in his discussion of the WELL lists the desire for prestige as one of the key motivations of individuals' contributions to the group. To the extent this is the concern of an individual, contributions will likely be increased to the degree that the contribution is visible to the community as a whole and to the extent there is some recognition of the person's contributions. The inherent nature of online interaction already means that helpful acts are more likely to be seen by the group as a whole. And the powerful effects of seemingly trivial markers of recognition (e.g. being designated as an "official helper") has been commented on in a number of online communities. In addition, each of the features that encourage reciprocity – ongoing interaction, identity persistence, knowledge of previous interactions, and strong group boundaries – would also work to promote the creation and importance of reputations within an online community.

A third possible motivation is that individuals contribute valuable information because the act results in a sense of efficacy, that is, a sense that they have some effect on this environment. There is a well-developed research literature that has shown how important a sense of efficacy is (e.g. Bandura 1995), and making regular and high quality contributions to the group can help individuals believe that they have an impact on the group and support their own self-image as an efficacious person. If a sense of efficacy is what is motivating someone, then contributions are likely to be increased to the extent that people can observe changes in the community attributable to their actions. It may also be the case that as the size of the group increases, one will be more motivated to contribute because the increasing size provides a larger audience and a potentially greater impact for one's actions.

For none of these three motivations do we need to assume that the individual is altruistic – simple self-interest is enough. However, it may sometime be the case that an individual values (at least to some degree) the outcomes of others. In this case a fourth possible motivation is need, that is, one may produce and contribute a public good for the simple reason that a person or the group as a whole has a need for it. Rheingold (1993) again draws from the WELL in giving examples of members producing software tools for the community's use after the need for such tools had been discussed. If someone's or some group's needs are what motivates an individual, then their contributions will likely be increased to the extent that the needs of the group are clearly known and communicated. An ongoing record of the group's discussion is useful here, as are central meeting places (e.g. a "public square") where important issues and needs can be discussed and displayed.

More generally, an additional possible motivation is the attachment or commitment one can have to the group. In other words, the good of the group enters one's utility equation. In this case one contributes to the group because that is what is best for the group – individual and collective outcomes are thus merged and there is no social dilemma. However, complete devotion to a group is rare. It is much more likely that even if an individual feels an attachment to the group, it will be moderated by other desires and the price of helping the group. A literal altruist – who works for the good of others without any regard to self – is very rare indeed. Nevertheless, to the extent that someone feels an attachment to the community, that person's contributions will likely be increased to the extent that the goals of the community are developed, clearly articulated, and communicated to the members.

In all the cases mentioned above, whether the motivation is based on some form of self-interest or altruism, the kinds and quantities of public good produced will be sensitive to the costs and benefits involved. This is the theme from the first part of the chapter, and it is worth stressing again that regardless of what motivation or mix of motivations is driving a person's actions, the shifting economies of online cooperation will make many kinds of public goods possible and profitable that otherwise would not be.

As a last example of these effects, consider the impact of the fact that the distributions costs for a piece of information can be near zero. While it may be the case that many people spend time and effort producing goods they intend to contribute to the group, another path to the production of public goods is as a simple side-effect of private behavior. People may need to write a particular computer program for their own use with no thought to anything other than solving their particular problem at hand. Having written the program, the costs of now sharing and distributing it with others may be near zero: they can simply post it in an appropriate discussion group or other online community. Here again, the ease with which this can be done, and the manifold benefits it might have for others and for themselves, mean that the fruits of one's private workshop can be distributed to the world.

Illustrations

While I have made the point that many digital public goods can be provided by single individuals, other public goods certainly require the coordinated actions of a group. In order to explore the additional challenges that are created when a group must act in concert to produce a public good, and in order to illustrate the dynamics I have been discussing, I will describe two striking examples of online collective action. The case studies are the 1996 effort to wire California's elementary schools for Internet access, known as NetDay 96, and the production of a new computer operating system, known as Linux, through the use of voluntary labor.

Linux: the "impossible" public good

Consider the following goal: to create a clone of a powerful and complex computer operating system by asking programmers from around the world to donate their time and effort to the project. The operating system would be made available free to anyone who wanted it, regardless of whether they had contributed to the project.

Such a project seems doomed to failure. The temptation to free-ride is huge for two separate reasons. First, because the program (should it be successfully developed) would be made available to anyone at no cost, there is the temptation to let other people write the program and then enjoy the fruits of their labor. Second, even if one were willing to contribute to the project, there is a very serious risk that the project would fail if not enough people contributed their efforts. The risk of contributing to a lost cause could dissuade even those who wanted to support the project. Remarkably, this goal was accomplished. In a little over two years time a clone of the Unix operating system named Linux was created.

Linux began in 1991 as a private research project of a computer science student in Finland who wanted to write a Unix-like system for his 80386 computer. His name is Linus Torvalds and in the early history of the project he wrote most of the code himself. After a few months of work he had succeeded in developing a version of the program that was reasonably useful and stable. There was still a tremendous amount of work to be done, but the fact that his program was now usable encouraged a great number of people to contribute to the project. By the beginning of 1994 Linux had become a powerful and useful operating system and was officially released as version 1.0. It is available free to anyone who wants it and is constantly being revised and improved through the volunteer labor of many programmers.

How can we account for the production of such an improbable public good? The question has been asked to Linus Torvalds in a number of interviews, and his comments and the comments of others involved in the project suggest a number of reasons why the Linux project succeeded.

One of the points made by Torvalds and others was the ability of the Internet to facilitate collaboration. Early in the project Torvalds made use of the Internet to get help with the development of the program and to gather suggestions and advice about the features the program should contain. As people began to experiment with his program they sent in bug reports to let Torvalds know about problems with Linux. Some programmers also sent in computer code with their bug reports in order to fix the problem. Eventually, people volunteered to write new code for the program in order to expand its list of features and usefulness. Here we see the reduction in communication and coordination costs that was mentioned above – online interaction made it easy to send in comments and suggestions and to keep everyone who was interested up-to-date on the current state of the program. Torvalds flatly states that "without net access, the project would never have even gotten off the ground" (Torvalds 1993).

But these savings in the costs of communicating and collaborating are not enough to explain the success of Linux. There are a great many programs that would be useful for the Internet community and yet have not been developed in the same decentralized way

as Linux. Torvalds has stated that programs which are collaboratively developed on the Internet usually share two features:

> (a) Somebody (usually one person) wrote the basic program to the state where it was already usable. The net community then takes over and refines and fixes problems, resulting in a much better program than the original, but the important part is to get it started (and channeling the development some way). The net works a bit like a committee: you'll need a few dedicated persons who do most of the stuff or nothing will get done.
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> (b) You need to have a project that many programmers feel is interesting: this does not seem to be the case with a lot of the application programs. A program like a word processor has no "glamour": it may be the program that most users would want to see, and most programmers would agree that it's not a simple thing to write, but I also think they find it a bit boring.
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> (Torvalds 1993)

The first feature implies that the shape of the production function also played a role – even though many people were needed for the eventual success of the project, the ability of a small number of people (or even one) to get the project under way may be crucial. The second feature suggests that the intrinsic interest and challenge of the project can be important. If people find the task interesting and useful for themselves, then the production of the larger public good must deal with issues of coordination but not motivation: the project was interesting for many programmers and they were helping to develop something that would be personally useful to them. Indeed, as programmers began to contribute code to the project, their contributions were often directed at making the operating system useful for themselves (e.g. writing device drivers for the operating system so that they could use hardware and peripherals that were of interest to them). Once these subprograms were developed, it was very easy to share the work with the entire Linux community because of the extremely low costs of posting and distributing the information.

A key reason why people were willing to share their work was the fact that the Linux project was put under a particular copyright agreement known as the GNU General Public License.[8] Under the terms of this copyright agreement the source code for the program would be freely available to anyone.[9] Further, anyone who modified the program was required to add the modification to the source code and make it available to all. The arrangement creates an incentive structure in which programmers are encouraged to contribute modifications to the program because they are assured that everyone will have access to their contributions and that they will have access to any modifications other people have made, either currently or in the future. This helps create a healthy generalized exchange system. Further, because the source code is available to all, it is open to the inspection and critique of others. This makes the programmer's contribution public and creates an informal monitoring system as others review the code. Thus, there is an incentive to contribute well-written code.[10]

NetDay 96: a modern barn raising

In 1995 John Gage of Sun Microsystems and Michael Kaufman of KQED in San Francisco came up with an audacious idea: to wire all of California's public and private schools for connection to the Internet using an army of volunteers. The campaign focused on a single day – March 9, 1996 – when most of the actual wiring would take place. The event was a classic example of a public good – the potential gains to the schools and to the communities as a whole were great, but those benefits would be enjoyed regardless of whether one volunteered for the project. Thus, there was the temptation to free-ride on others' efforts, but if everyone tried to free-ride, the campaign would fail. Because this was a public good that could only be provided by the efforts of a very large group, there was the additional challenge of trying to recruit and coordinate the large number of volunteers that would be needed. Even if one could assume that there were thousands of willing contributors, there would still be the problem of distributing them across different schools, assuring them that their efforts would not be in vain, training them, and keeping both volunteers and schools up-to-date on how things were progressing.[11]

Remarkably, the effort was in large part a success and generated the endorsements and attention of prominent business, community, and political leaders. On NetDay itself, over 2,500 schools were wired by approximately 20,000 volunteers (Colvin 1996). While the goal of wiring every California school was not reached on NetDay 96, the effort was successful enough that further NetDay events were held in California, and similar programs have been set up in all the US states and in several other countries.

Even more striking was the fact that the NetDay organization had no offices, budget, paid staff, mailings, or even a receptionist to answer the phone.[12] Instead, the overarching promotion, recruitment, and coordination for the campaign was carried out via the World Wide Web. In order to save time, effort, and money, the plan was to use the Web as a decentralized organizing tool. The Web site was carefully designed to facilitate the recruitment and coordination of volunteers and took advantage of the shifting economies of online interaction as well as new software technologies that had been developed by a number of companies.

One of the most innovative features of the site was a clickable map of California that listed every school in the state and provided a visual representation of the level of volunteer activity at each school. By repeatedly clicking on an area of the map, people could zoom in on their own county, city, neighborhood, and even block to search out schools in their area. Schools were represented by colored dots, with a red dot signifying that the schools had no volunteers for NetDay, a yellow dot indicating one to four volunteers, and a green dot indicating more than four volunteers. The data were updated hourly, and so the map provided an up-to-date visual accounting of volunteers across the state. This made it easy for volunteers to discover where they were needed and for schools to track the number of volunteers who had signed up to help their school. The map also had the additional effect of advertising the fact that many people had already volunteered and that more were doing so every day. This is an important point because even if people are willing to contribute to a public good, they may not want to participate unless they know enough others will contribute to make the event a success.[13]

As one zoomed in on the map to view a particular neighborhood, any of the dots representing schools could be selected. This brought up a Web page for the school that provided basic information and allowed one to sign up as a volunteer, organizer, or sponsor. Volunteers entered personal information onto an online form and listed the skills they had as well as any additional comments. Once volunteers signed up, they were automatically added to a list on the school's page. Their names, email addresses, skills, and comments were listed. Online sign-up forms were also available for those who wished to be sponsors or organizers for the event. Sponsors were responsible for purchasing the wiring kits that each school would need and for providing technical assistance. Online descriptions of the wiring kits and order forms were also provided on the site so that ordering the kit for the school could be done as easily and quickly as possible. Organizers were responsible for contacting the school, contacting the registered volunteers, and arranging a meeting of the volunteers prior to NetDay.

Thus, the school Web pages made it easy for volunteers to see what help was needed, to sign up, to contact the school and other volunteers, to inform the school and other volunteers of their skills and experience, and to keep up-to-date on organization efforts. Further, all of this was accomplished in a decentralized way without any staff.

Information that would be needed for the effort was also made available via the Web – everything from To Do lists for volunteers and organizers to a large Frequently Asked Questions file was provided. There was also the issue of training the volunteers. Even though it was hoped that individuals and organizations with technical expertise would be on hand to help with the installation, not everyone would have experience installing this particular kind of wiring, and some volunteers would want to learn about the process before showing up on NetDay. To meet this need, an online wiring installation guide was created that provided pictures, animation, and detailed step-by-step instruction for wiring the classrooms.

The campaign also advertised endorsements and corporate supporters on the Web site. The list of endorsements was an impressive roster of leaders in government, education, and business. From the standpoint of the person making the endorsement, adding his or her name was trivially easy, involving almost no time or effort, and the long list of dignitaries helped to provide legitimacy for the campaign. A list of corporate supporters was also provided, and the corporations were ranked according to how many volunteers from the company were participating. Research on social dilemmas and public goods has demonstrated that people are more likely to cooperate if their actions are public (Kollock 1998). This list made the support of companies public, while inviting comparisons and competition between companies. The list also served as an acknowledgment of the efforts of top companies.

It is important to note that while a great deal of the organization occurred online, there were also many face-to-face meetings. In particular, the California Department of Education organized regional meetings for schools and districts who wanted information or assistance with NetDay activities. At the school level, face-to-face meetings were also common among school officials, organizers, and volunteers. Thus, the NetDay Web site facilitated local organization and meetings rather than completely supplanting them.[14]

The Web site provided a database that displayed and updated information on volunteer activities without the need for any staff. Online resources also reduced the costs of signing up for the campaign as well as contacting other volunteers. The color-coded map served to assure others that many people were involved in the project, helped direct volunteers to where they were needed, and allowed everyone to keep track of the current status of efforts. And the nature of digital information also made it extremely cheap to distribute information to anyone who was interested and to broadcast such things as the rankings of corporate supporters and list of endorsements. Consider how expensive each of these functions would be if organizers had to rely on mailings, or had to buy time on radio, television, or in newspapers.

The usual benefits of digital goods were also a factor in that informational resources – such as the installation guide, To Do lists, and the Frequently Asked Questions file – once produced were available to an unlimited audience. The resources could also be produced with fewer individuals than would be the case if the material had to be physically published and distributed. This demonstrates again changes in costs and the production function as one moves to digital goods. The online resources helped create a quickly organizing and highly efficient federated system that supported more conventional face-to-face meetings at the local school level.

NetDay is also an interesting case in that it demonstrates the use of digital goods in the service of producing a physical good. Unlike most of the other illustrations discussed in this chapter, the final public good was not some type of digital information, but rather physically upgraded classrooms. NetDay demonstrates that the economies of online interaction can be used to facilitate the production of some physical goods as well.

The limits of online cooperation

The previous examples were designed to illustrate the ways online interaction can significantly reduce the costs of providing some public goods. However, I do not wish to imply that online interaction solves all problems of cooperation and collective action. The shifting costs, benefits, and production functions of online interaction make a certain class of public goods more likely, but it is important to recognize the requisites of this online cooperation in order to appreciate its limitations.

Torvalds suggested that Linux was successfully developed in part because Linux was considered inherently interesting and because one person was able to write the core of the program. Each of these features suggests limits to the decentralized cooperation of the Internet. A new operating system has been created, but it is far less likely that equally useful, but much less interesting, programs such as a word processor or spreadsheet will be collaboratively developed by a network of volunteers. I would also hazard to guess that if NetDay had been directed toward patching the roofs and repairing the plumbing of schools – an equally important but less technologically interesting goal – the turnout would have been significantly less.

Torvalds' second point implies another limitation. The nature of digital goods and the economies of online interaction mean that many public goods can be produced by

small groups or single individuals. But many public goods, even digital public goods, require the coordinated activities of a large group from the very beginning. Such public goods are less likely to be produced, though NetDay demonstrates that a very large project requiring close coordination among thousands can be orchestrated and augmented via online interaction.

It is also true, of course, that many of the public goods a healthy community requires are physical in nature and cannot be provided solely through online interaction. Roads, hospitals, and schools must be built and maintained, and while the Internet can certainly facilitate the production of physical public goods (again, as demonstrated by NetDay), in the end bricks and mortar must be laid.

Thus, as remarkable as the products of online cooperation and collaboration have been, it may be that we have been picking the "lowest hanging fruit" – supplying interesting digital goods that can be provided by single individuals while ignoring duller, more complex, but no less useful public goods. I do not mean to slight the benefits that online interaction has brought, and further advances in hardware, software, and connectivity may reduce the cost of producing public goods still further and create new "low-hanging fruit." Nevertheless, it is crucial to avoid an empty-headed extrapolation from current success to utopian visions of fully cooperative communities.[15]

It is also useful to consider what changes in the structure of online communities might encourage or discourage online cooperation. One place to start is the previous discussion on motivations. Although a number of different motivations for contributing to a public good were discussed, three structural features are common in many of the cases and can be regarded as the basic features required of any successful online community (Kollock 1996). These features are ongoing interaction, identity persistence, and knowledge of previous interactions. If members of a group will not meet each other in the future, if there is no stability in the names and identities that people adopt, and if there is no memory or community record of previous interaction, it will be very difficult to create and maintain a cooperative online community.[16]

Among the other structural features discussed that can encourage cooperation are making sure that contributions are visible and that contributors are recognized for their efforts, and well-defined and defended group boundaries. To make a broad statement, to the extent an online community lacks each of these features, we can expect that cooperation and collective action will be less likely.[17] Of course, if a certain motivation turns out to be especially significant in people's decision to cooperate, then the structural features that encourage this motivation will be particularly important. For example, if most people contribute information and advice because they anticipate receiving information at a later point in time, then well-defined group boundaries will be particularly important because a successful generalized exchange system requires a reasonably stable population.

As a final note, it is important to point out that a cooperative group is not always a good thing for the wider society. The very same economies that enable people to collaboratively build software and plan school improvements also make it easier for violent and racist groups to organize and collaborate. To the extent one wishes to fight against such groups, then the lessons of this chapter need to be inverted in order to discourage group cooperation.

Conclusion

This has been a chapter on incentive structures, but incentive structures are not the same thing as actual motivations. Thus, an important direction for additional research is identifying which motivations in particular are driving people's decisions. Detailed case studies of online collective action are one way of addressing this question, and the chapters by Gurak, Uncapher, and Mele in this volume provide valuable information on the motivations and structural conditions necessary for collective action.

Future research should also examine the importance of various structural features: are strong group boundaries important, for example, and if so, does this imply a higher rate of contributions (or better quality information) in a closed mailing list versus a Usenet newsgroup? Are public goods less likely to be provided when they require the contributions of a large group versus being able to be provided by a single individual? The pattern of reciprocity in online groups is another important research topic. Do people who have helped in the past receive more help when they are in need? Does a strong group boundary encourage a healthy generalized exchange system? Such studies will be increasingly important as our lives move more and more into online worlds.

The purpose of this chapter was to begin to map out an explanation for the striking amount of cooperation that exists in online communities. This is not to say that online cooperation is inevitable or expanding. Nor is it to say that online cooperation and collective action is always a benefit to the larger society. However, the changing economies of online interaction have shifted the costs of providing public goods – sometimes radically – and thus changed the kinds of groups, communities, and institutions that are viable in this new social landscape.

Notes

1 Direct correspondence to Peter Kollock, Department of Sociology, University of California, Los Angeles, CA 90095–1551 (Kollock@ucla.edu). This chapter complements an earlier article (Kollock and Smith 1996) on "Managing the Virtual Commons." The earlier article discussed the basic social dilemmas that occur in online interaction, using Usenet discussion groups as the case study. It used as its framework Ostrom's (1990) work on common pool resources. The present chapter concentrates specifically on public goods and the shifts in the costs and benefits of providing public goods.

2 See Kollock (1998) for a review of research on social dilemmas, and Kollock and Smith (1996) for a fuller discussion of social dilemmas in online interaction. The link between generalized exchange and social dilemmas is investigated by Yamagishi and Cook (1993).

3 Another cost that can be associated with collective action is the cost of bargaining (Heckathorn 1996). The effects of online interaction on bargaining costs are more uncertain, and it is unclear whether the costs of bargaining are accentuated or attenuated (cf. A. Smith, Chapter 6 in this volume).

4 See Slatalla (1996) for a description of an online support community for those caring for Alzheimer's patients.

5 Strictly speaking, the production function refers to the level of resources that are

contributed rather than the number of actors that are contributing. See Heckathorn (1996) for a very useful analysis of production functions and the provision of public goods.

6 Of course, this example assumes other people also valued late-night westerns.

7 One hears stories, for example, of people who have faced an impossible deadline for a report and have turned to their online network to gather the information necessary to quickly complete the task.

8 The license was developed by the Free Software Foundation: http://www.gnu.ai.mit.edu/copyleft/gpl.html.

9 The source code is the plain text version of a computer program before it is digested by a compiler into instructions for the computer. Having the source code means that the inner workings of a program can be examined, studied, and modified by a programmer.

10 I note in passing a few other features that may have contributed to the successful development of Linux. Torvalds depended on a set of software tools (the GNU tools) that had previously been developed in a similar collaborative project. Bentson (1995) also suggests that the project was helped by the fact that there was a fairly large population of programmers to draw from who had the requisite skills. He also suggests that the prevalence of personal computers may have helped in that programmers had more freedom to explore and experiment on their own systems rather than monopolizing and potentially introducing buggy software into larger mini and mainframe computer system.

11 Note that coordination for NetDay posed a more severe challenge than the coordination of the development of Linux because NetDay was organized around a particular day when most of the activities needed to be accomplished.

12 The only phone number that existed was a single number with a voice mail system that provided basic information.

13 The possible effects of advertising the number of current volunteers brings up some interesting strategic concerns. Might it be better, for example, to wait until a certain number of people had volunteered before making the map public during the early stages of the campaign? In this way new potential volunteers would not confront a map devoid of contributors, which could discourage them from signing up. This is, in fact, the strategy of many fund raising campaigns – they are not publicly announced until a significant proportion of the goal has already been met. And there is also the possibility of using deceit: organizers could inflate the number of reported volunteers early in a campaign in order to encourage others to join. (Of course, I do not mean to imply in any way that the number of volunteers reported for NetDay was inaccurate.) For a general discussion of the dynamics of such "critical mass" phenomena, see Schelling (1978).

14 Local organization and coordination with school officials was not as great as it should have been during the first NetDay. California's second NetDay (on October 12, 1996) placed an emphasis on coordinating more closely with local schools and giving them more time to prepare and train volunteers (Pool 1996).

15 Purveyors of utopian visions rarely seem to realize the irony of the term itself. Coined by Sir Thomas More in 1516, "utopia" literally means "not a place," that is, a place that cannot be.

16 These three features turn up repeatedly in the research literature of social dilemmas (Kollock 1998). Axelrod (1984), for example, identifies them as the most important prerequisites for cooperation.

17 This list of features partially overlaps the list of design principles Ostrom (1990) identified in her study of communities managing common pool resources (see also Kollock and Smith 1996).

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