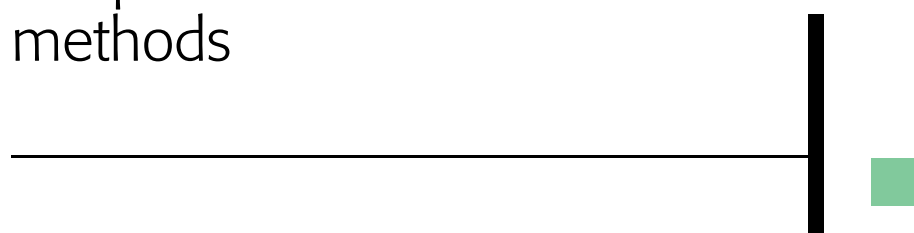


Opening minds: Cultural change with the introduction of open-source collaboration methods



A. Neus
P. Scherf

As open-source software becomes accepted worldwide, open-source collaboration and development methods are also gaining greater momentum. Collaboration based on the open-source paradigm is increasingly being used to improve multisite development and teamwork inside companies. Drawing on experience in projects for improving multisite collaboration, this paper explains how we evaluate communication and collaboration problems, assess obstacles to change, and facilitate the change by introducing employees to the benefits of the collaborative model over traditional development projects in a workshop setting. This method has proven to be a valuable “mind-opener” and helps identify specific obstacles that need to be addressed as part of the introduction of open-source development and collaboration methods. The paper concludes with lessons learned for facilitating the introduction of these methods in an organization.

With open-source software becoming established in many companies, the methods and ideas on which it is based are gaining popularity as well. The concept of collaboration based on the open-source paradigm is being used to improve multisite development and collaboration inside companies, and has even spilled over into the area of collaborative documentation and knowledge management with public and high-profile projects such as the Web site wikipedia.org or the “OpenCourseWare” project¹ at MIT (Massachusetts Institute of Technology).

The open source collaboration process is based on widespread access to source code and open collabora-

tion—a meritocratic philosophy that invites feedback from everyone, regardless of official status or formal training, and frequent releases of interim versions to encourage testing, feedback, and quick evolution of solutions. As Nobel Laureate Richard Feynman said, “Science is the belief in the ignorance of experts.”²

©Copyright 2005 by International Business Machines Corporation. Copying in printed form for private use is permitted without payment of royalty provided that (1) each reproduction is done without alteration and (2) the Journal reference and IBM copyright notice are included on the first page. The title and abstract, but no other portions, of this paper may be copied or distributed royalty free without further permission by computer-based and other information-service systems. Permission to republish any other portion of the paper must be obtained from the Editor. 0018-8670/05/\$5.00 © 2005 IBM

Changing an organization is never easy. Asking employees to believe in the benefits of collaborating under an open-source paradigm is particularly tricky, as they may perceive its openness and transparency—the core of the open source model—as an attempt by management to gain total control. They may be concerned about accountability issues for interim code, and that sharing their source code may publicize their mistakes.

Therefore, in order to effectively work in a collaborative fashion, a change in culture, beliefs, and behavior of concerned employees needs to be facilitated. People need to understand the open-source approach. They need to experience its benefits before they can be reasonably asked—with any chance of success—to try it out and change their behavior.

THE OPEN SOURCE PARADIGM: BROOKS' LAW VS. LINUS' LAW

In order to understand the issues involved in introducing an open source approach inside a company—and the organizational challenges involved—it is important to consider different perspectives. Based on our experience, we believe that very few challenges are the result of limits in technology, tools, or processes—rather, they are often the result of limits and boundaries in people's minds. In order to explore, understand, and overcome these boundaries, we compare and discuss two competing paradigms.

The traditional paradigm of collaborative development, following what is often called “Brooks' Law” (after Frederick P. Brooks, author of *The Mythical Man-Month*³), can be summarized with the saying “Too many cooks spoil the broth.” This paradigm assumes that only a small and select circle of designated experts should be allowed to design, create, and improve high-quality code or information, thus forcing the vast majority of practitioners into a passive or execution-oriented role, wherein they are expected to provide little or no feedback to improve the overall design.

Based on his extensive experience with large software projects, Brooks discusses the inherent complexities of coordination and states that as the number of involved contributors (N) rises, the work performed also scales with N , but the complexity and vulnerability to mistakes rises as N^2 , in

accordance with the number of communication paths required to coordinate the contributors. To achieve quality, Brooks therefore recommends a minimum of contributors: “Conceptual integrity in turn dictates that the design must proceed from one mind, or a very small number of agreeing resonant minds.”³ Conversely, Brooks' Law predicts that “a project with thousands of contributors ought to be a flaky, unstable mess,” as Eric Raymond put it.⁴

The open-source paradigm, on the other hand, assumes that quality is the result of massive collaboration. How was this new paradigm, using massive collaboration, able to overcome the limits postulated by Brooks' Law? The explanation lies in the changing economics of information and has been called “Linus' Law,” in honor of Linus Torvalds, the former computer science student from Helsinki, Finland, who spearheaded the mainstream success of the open-source model by developing the Linux** kernel. Based on the success of Linux and some of the more prominent results of virtual collaboration, it became obvious that Brooks' Law cannot be the only force at work.

Linus' Law is usually stated in its informal version: “Given enough eyeballs, all bugs are shallow.”⁵ The key to the success of the collaborative-development model is based on the lower transaction cost for information, enabling the separation of the identification and solution components of quality problems and spreading these tasks over a much larger population than could sensibly be done in traditional hierarchical approaches.⁶

The traditional development approach is based on construction and the attempt at perfection. The software is designed once in a “top-down” mode, and then programmers execute the design. In contrast, the open-source approach relies on evolution or improvement over a series of versions or releases, taking advantage of the negligible cost of electronic collaboration, updates, and multiplication today. Eric Raymond calls this policy “release early, release often” in his famous essay *The Cathedral and the Bazaar*.⁴

Ives and Jarvenpaa have predicted a “revolution in knowledge creation” as the open-source method moves beyond software to include information, and as the review process becomes more open and information less static. “In the past, journals were

Table 1 Contrasting characteristics of traditional and open-source approaches

Traditional Approach	Open-Source Approach
Brooks' law	Linus' law
Hierarchy	Network
Experts	Peers
Teams	Communities
Cathedral	Bazaar
Perfection	Improvement
Construction	Evolution

archived in research libraries where they remain unchanged. But living web documents are considerably more volatile. Simple errors, typographic and otherwise, can be quickly repaired before they are inaccurately cited.”⁷ The contrasting concepts underlying these two paradigms are shown in *Table 1*.

WHY A CULTURAL CHANGE?

A change in perspective from the traditional collaboration approach to an open-source approach requires a change in people's minds. The tools, processes, roles, and organizational charts for supporting multisite collaboration in an open-source method exist and are freely available on the Internet. So why should it not be possible to simply install the tools at a company, communicate the new processes, roles and organizational charts, and proceed? The resistance comes from the organization's informal side, that is, its “culture.”

There is a regrettable tendency to see an organization through its formal artifacts. This focus on the formal aspects is understandable because formal aspects are easy to identify and handle. However, this view is not sufficient for understanding an organization, and certainly not for facilitating the introduction of any significant change.

CULTURE—THE INVISIBLE ORGANIZATION

The visible organization—made up of the organization's formal tools, processes, roles, and so on—is the tip of the organizational iceberg. The organization's cultural identity lies “under the waterline.” The following definition of culture was developed in the Complex Change Facilitation group⁸ and is

useful when assessing or changing an organization's culture: Culture is a complex system of shared beliefs, values, language, customs, behaviors, and artifacts that the members of a group use to cope with their environment and with one another.

Culture has a strong influence on the thinking, acting, and decision making of individuals, and must be addressed when expecting people to change their behavior. Because culture is the result of long-time learning through observation, interaction, and experience, changing it requires simultaneous, well-coordinated interventions in a system of complex and evolving patterns that is reinforced through its members' mutual adjustment and shared environment.

MOVING AN ICEBERG

It is helpful to use the iceberg model when introducing changes in an organization. Like real-life icebergs, the model states that the formal organization represented by easily visible artifacts such as tools, processes, roles, and organization charts, actually makes up only a small part of an organization; whereas, the largest part of the organization—its cultural side—is invisible under the waterline. This culture is made up of behaviors, customs, language (jargon, etc.), values, heuristics, beliefs, stereotypes, and taboos, as shown in *Figure 1*.

If we try to introduce a new way of collaboration using the open-source model, we are effectively asking people to make a shift from the paradigm of Brooks' law (i.e., “too many cooks spoil the broth”) to Linus' law (i.e., “the more, the merrier”). We are asking them to believe that not only designated experts, but also common practitioners and even end users can make a significant contribution to the development and quality of software or documentation.

For many, this is a big leap. It is a shift in basic beliefs in how the world works—or at least, how it should work. When we try to introduce this change in an organization—such as by introducing a more open collaboration approach based on the open-source paradigm—solely by managing the visible parts of the organization, we are bound to run into trouble. This is because we have not actually moved the organization; we have moved only the visible tip



Figure 1
The iceberg model of an organization

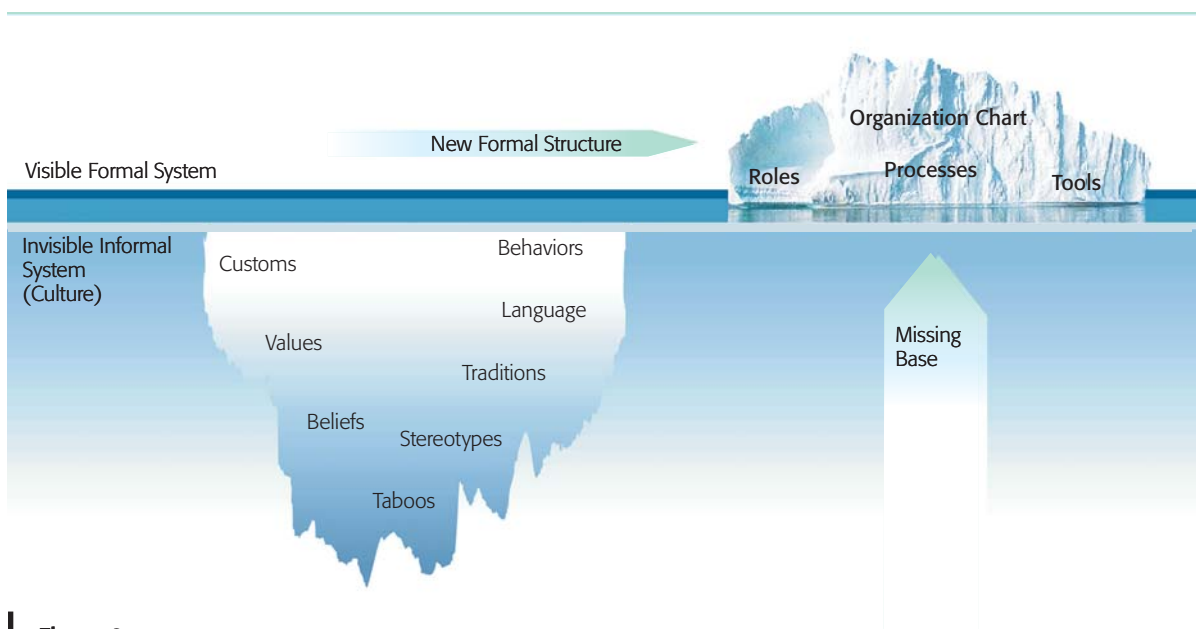


Figure 2
Result of poorly planned organizational change

of the iceberg, leaving it to slowly sink without its base, as seen in *Figure 2*.

COMPLEXITY OF ORGANIZATION CULTURE

We are used to dealing with complicated things. Computers are complicated, but can be analyzed and planned, and are generally predictable by using an analytical and engineering approach. However, organizations are not only significantly more complicated than their organizational charts or process maps, but they are also complex in the sense of the definition supplied by Chapman: "Complication is a quantitative escalation of what is theoretically reducible; whereas, a system is said to be complex when the whole cannot be fully understood by analyzing its components."⁹ This is a key difference that needs to be carefully considered to avoid trouble in a project involving change.

An organization with its many human actors influencing and being influenced by their organization's culture, is a complex, adaptive organism that will change its behavior in ways that are difficult if not impossible to predict.¹⁰ For example, all organizations develop a kind of "immune system" to fight off new, potentially disturbing changes. Consequently, the new organization is not just the result of the new organizational design, but rather the result of the reaction of the old organization to the new organizational design.

The assumption that human behavior is rational is one of the most problematic when introducing change. In fact, human behavior can be much better predicted based on understanding the culture (customs, beliefs, heuristics, stereotypes, etc.) which people use to deal with their environment, rather than any objective knowledge about the environment itself. This can cause problems when a system unexpectedly does not react to an intervention in the way that was rationally planned. Humans can make logical and rational decisions only within a limited area—where the factors are few and the rules are simple and obvious. As soon as a system becomes complex, we tend to fall back on cultural factors. People in an organization undergoing assessment and change act not on the properties of the formal organization, but on the beliefs and heuristics that they have found to work in the organization. These heuristics are key components in the organization's culture and are usually communicated only verbally.

Some heuristics serve to stabilize the organizational system, such as, "Don't fight the system—game it!" "Don't bring bad news to the management's attention—they shoot the messenger"; and "Don't rock the boat." Alternatively, the heuristics may be innovative, such as, "Come to work every day ready to be fired for supporting a good idea," though this is less common.

To change human behavior, we need to change the beliefs and heuristics that people find useful in dealing with their work environment. If we try to affect a change in the organization's culture but design the new organization in such a way that most of the old beliefs and heuristics still work, behavior will not change. We may observe "camouflage" activity, as people simulate adoption of the new approach, while leaving their basic behavior and performance unchanged. This camouflage activity may detract from productivity. Therefore, we need to change top leadership behavior (not just their rhetoric), affect changes at the group level, and involve individual employees in experiencing the benefits of change.

Of course the initiators of change need to recognize that their own ways of dealing with organizations are also based on traditions, beliefs, and heuristics. Therefore, it is important that the approach to change management be systematic, based on proven methods and modules, in order to prevent the initiators from falling prey to their own heuristics. Situations should be actively sought where heuristics will be challenged so that those which are not helpful can be weeded out.

CHANGE TOWARDS OPENNESS MEANS OVERCOMING RESISTANCE

It should be remembered that, as stated by Machiavelli, there is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things.¹¹ This is because the innovator has for enemies all those who have done well under the old conditions, and lukewarm defenders in those who may do well under the new.

A change introducing more openness—while clearly beneficial for the company as a whole—can be met with strong resistance by people whose status is based on the lack of openness, perhaps because it

makes them gatekeepers of privileged information or because it keeps them safe from criticism. Therefore, to overcome inherent resistance, it is not sufficient for management to stand up and proclaim that open collaboration is a good thing. People require an answer to the most overlooked question: “What’s in it for me?” Without this answer, the adoption of open-source methods of collaboration to drive greater speed, quality, and efficiency in physically dispersed organizations can fail.

EXAMPLE: INTRODUCING A NEW CULTURE

To illustrate this point, we describe some steps we took with a client who asked for an assessment of the culture and practices of multisite collaboration in his organization in order to help introduce a new culture and collaboration model based on the open-source approach.

The client situation

The client was a software and services company with more than 3000 employees; it had undergone a number of mergers in the years prior to this project, resulting in five major application development centers spread across Germany. Against this background, the client was struggling with consolidating tools, methods, and development approaches.

The head of the development and methods division was our senior management sponsor. A main task of his division was to drive the consolidation on the tools side while rolling out a number of new systems that required creating many end-user instructions and copious support documentation.

The challenge

As the client was in the IT (information technology) business, open source was not at all new to them. On the contrary, like many companies, they were running major parts of their operation on open-source solutions around the traditional “LAMP” software: Linux, Apache,** MySQL,** Perl/PHP. They were pleased with the quality of their system, but they were using open-source software only as efficient tools, not making use of the organizational principles for organizing collaborative work, running projects, and supporting solutions that have been developed and refined over the last decades by the Free Software and open-source communities.

Our senior management sponsor had read a paper on virtual collaboration using the open-source model¹² and invited us for a workshop to discuss

ways of introducing open-source methods in his organization. The challenge—as our sponsor stated it—was this:

Every evening I can see thousands of members in the open-source community—most of whom have never even seen each other!—working together on sites like sourceforge.net to create top-quality software in an open, collaborative fashion. There is no central authority, and many of them do not even get paid for that work. When I come to work the next day, I see a merged organization with a central authority that is explicitly designed to create, document, and support software, but I cannot seem to get our people to really openly collaborate across multiple sites. What can we do to change this?

The assessment

We started with formal and informal interviews with employees to better understand where the difficulties were coming from. An assessment of the communication culture and the multisite collaboration work quickly revealed that while some issues were due to incompatible or limited tools, most of the problems were of a cultural nature: Each site had a strong local culture, and its own methods, language, and traditions. This led to a wealth of anecdotes regarding difficulties in understanding and dealing with employees from other sites. During mergers in previous years, these factors had apparently not been properly addressed, and there had been no dedicated network-building activities like rotations, cross-location mentoring, buddy systems, and so forth.

Social network analysis

A high-level, anonymous social network analysis was performed, questioning employees about informal contacts in other locations. This confirmed a disturbing pattern: the employees were very poorly connected with their peers in other locations, and the longer someone had been with one of the pre-merger companies, the less likely they were to successfully network across sites. Another observation was that first- and second-level managers were highly connected across the locations due to their job profiles. This made it even harder for them to recognize the kind of problems their employees were facing.

We felt the organizations was still recovering from the merger. People were erring on the side of

keeping code and information closed and hidden on their own computers, rather than exposing themselves to potential criticism or even perceived “theft” of their work.

The “emperor’s clothes” test

When we go into an organization and examine quality problems in collaboration or knowledge management, we use the “emperor’s clothes” test: we find out if there are ways in the organization that allow a novice (e.g., an intern) to publicly call attention to the emperor’s (i.e., the expert’s) lack of clothes (i.e., to raise quality issues), or if all internal communication addressed to a larger audience has to go through some gatekeepers. In this specific organization, the job of the novice was made difficult because everything had to go through an administrator before being published internally on the intranet.

The experience workshop: Drawing an elephant

After this assessment, it became clear that introducing open-source collaboration methods in this organizational context was challenging and would certainly not be achieved by preaching alone. Our intention was to change minds by making people understand the value of change. Therefore, we had to involve them, turning them from observers into actors. Several change agents for each of the client’s major sites were asked to participate. We had insisted on getting change agents who were the best and most respected people, even if they were available only for a fraction of their time. In our experience, a change agent is only as good as his reputation, credibility, and informal network—qualities that are more important than the agent’s amount of available time.

This meant that we did not have much time to let these busy stakeholders experience what an open approach to collaboration meant. We organized a full-day workshop to establish their commitment to change and energize them with a message they not only heard, but intimately felt.

The blind men and the elephant

The conceptual foundation of the workshop can be beautifully illustrated using the ancient Indian fable of the blind men and the elephant. (See *Figure 3*.) In this fable, a powerful leader summons a group of wise men—all of whom happen to be blind—to his castle, to confront them with an elephant, an animal

which none of the wise men has encountered before. The wise, blind men are asked to touch the elephant and describe what this creature resembles. Each of the wise men can perceive only a part of the elephant and believes this part to be characteristic of the whole animal. Inevitably, the wise, blind men then start a fierce argument over what an elephant is like—each convinced that he is right and everyone else is wrong—because none of them is able to perceive the whole elephant and put his part into a proper perspective.

Drawing an elephant, part 1

Having introduced this fable to the workshop participants, we asked them to join in an elephant-drawing project. Because of workload and time constraints, we asked each of the participants to take charge of a piece of the elephant and draw this part on a transparent overhead foil in such a way that, stacked together with the other slides from the other project members, the desired elephant would result.

Following some initial coordination, we asked the participants to start drawing simultaneously. They were allowed to speak with each other (i.e., conduct “project status meetings”), but not to exchange their foils or place them on top of each other. After a few minutes, the foils were collected and stacked, and the result was displayed on the overhead projector. The result resembled a Picasso painting: One could guess that the image was supposed to be an elephant because all the pieces were there, but they were hopelessly jumbled together, not forming any coherent image.

The visual impression left by this image is very strong, because it shows that a team of highly trained professionals was apparently not able to do together what any child could have done, that is, draw a respectable elephant. Looking at the result, then turning to the participants and asking “Why doesn’t that look like an elephant? Don’t you know how an elephant looks? Can’t you draw a line?” puts additional pressure on the participants and sets the stage for letting them relate their experience and their frustration about the project and its failure.

Making the experience explicit and collecting anecdotes

The project raised issues like coordination problems, unclear goals, time pressure, peer pressure,

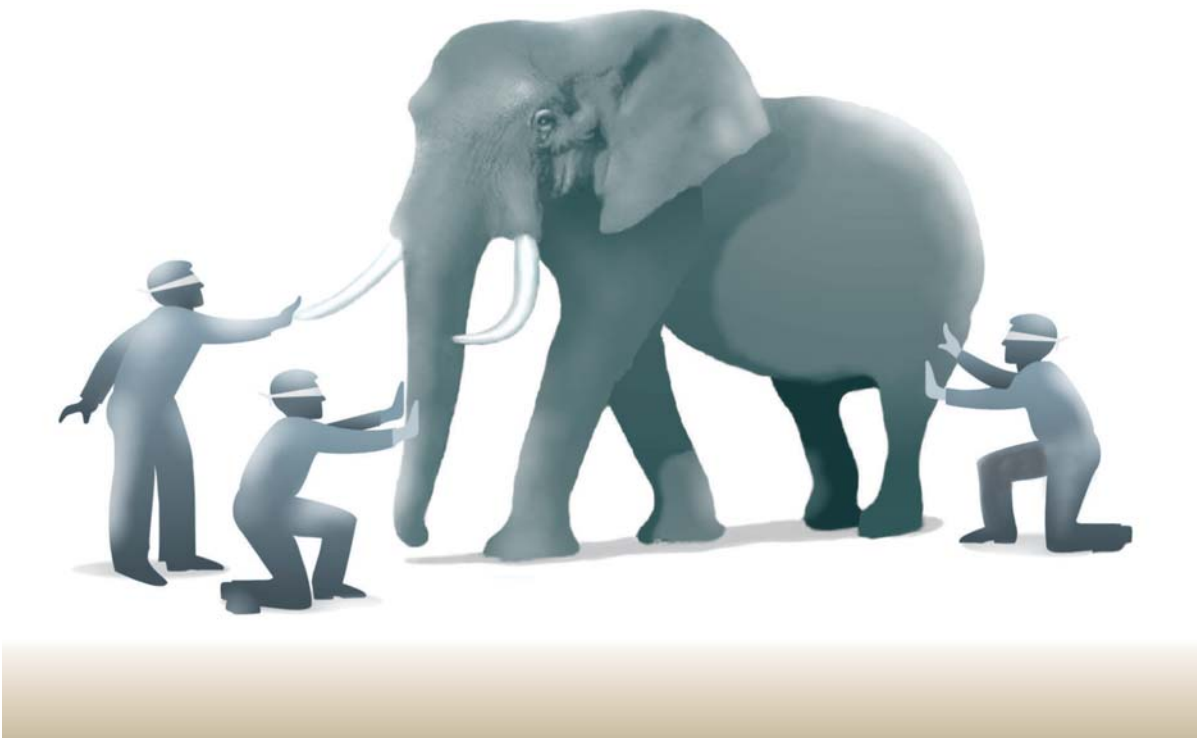


Figure 3
The blind men and the elephant

and so forth. We then asked participants, using semistructured questions, to tell us how they experienced this situation, what they felt the problems were in this exercise, and what kind of pressure they felt. This allowed us to reap a rich harvest of anecdotes about similar problems in real-life work situations, especially projects that participants were reminded of because they were similar to this experience.

By artificially creating these kinds of coordination problems, which are common in multisite development and documentation work, and by making it clear that even a trivial exercise like drawing an elephant can be foiled by simple lack of transparency in the overall progress of the project, we helped the participants see previous problems and projects from a new perspective. Although previously the inherent difficulty of a task or the incompetence of a colleague may have been blamed for a failure, it became clear that some projects were bound to fail, simply because of the kind of conditions we simulated in the elephant-drawing exercise.

The content of the anecdotes was very important, not only because it created a common feeling among the participants concerning where problems lie, but also for the later analysis by the IBM Change Team, because it allowed us to identify past or even present problems in collaboration. These problems are amenable to solution by introducing an open-source approach, and a few of them were carefully selected for later interventions.

Drawing an elephant, part 2

We announced a second attempt at drawing an elephant, because the first project obviously did not yield the desired result. We asked participants to assemble with their pens around a flipchart, and informed them that they would be drawing on the same flipchart, all starting at the same time. We asked everyone to find a suitable place to start drawing their part and waited until everyone was assembled around the flipchart with their colored marker in the starting position. Although this can get a little crowded with 7–10 people (with everyone reaching over or under someone else), this serves as a nice team-building exercise because it makes the

participants feel (literally) that they are really working together on creating something, not sending off their isolated part of some larger project.

On the flipchart, the participants instinctively started adapting their drawing and their lines to what they saw the other participants doing. Accordingly, they filled in gaps between parts of the elephant, making a line a little longer or shorter than they had previously intended, all to accommodate the common goal: a better elephant.

The result of this second exercise—immediately visible to the participants—was clearly superior to the elephant previously created in isolation. The pieces of the elephant fit with each other, the proportions were about right, and the elephant was a complete shape without gaps.

The final insight

The final touch—a powerful demonstration of the strength of the open-source approach—came when the whole team stood around the flip-chart and examined their collaboratively created elephant. It revealed that the project breakdown, which assigned pieces of the elephant as tasks to participants, was incomplete: no one was assigned the job of drawing the elephant's eye. Typically, someone steps forward on his or her own initiative and draws an eye in order to complete the elephant, without it being his or her "task." This is possible only because there is an open collaboration space (in this case the flipchart) where every project member can see the status of the whole project and not just one's own part. Someone notices the eye is missing and fixes it, not because it is his or her job, but because it is obvious that it hasn't been done and needs to be done. This reflects traditional project experience: no matter how carefully you plan and break down the work, there is often a gap because in a changing world, no amount of planning will ever yield perfection.

Aftermath

At this point, we again asked participants to explain how they felt, especially in contrast to the first setting. Many reported seeing parallels to projects that worked well because of a collaborative context. These are projects that can be used to seed and scale this kind of open collaboration because they have proven to be successful in this organization before.

Opening information

Using the elephant-drawing exercise, we succeeded in getting the message across and opening the change agents' minds to a new way of working and its potential to make their work easier. It was then time to follow this up by "walking the walk," that is, proving that it could be done successfully in their organization.

After analysis of the anecdotes collected in the assessment phase and in the workshop, it became clear that one "pain point" regarding multisite collaboration was documentation, user support, and FAQs (frequently asked questions) for an ongoing software roll-out. It was the first major roll-out impacting several of the locations, and the client was already struggling because traditional methods of putting documentation on the intranet and keeping FAQs current were not proving responsive enough. As a result, the client had already put up a makeshift feedback forum to enable employees to quickly enter questions or comments on a Web site, but it was a linear discussion board, and hard to structure and maintain. In discussions with the client, it was determined that introducing a "Wiki Web" server to allow collaborative authoring and editing of content would address both this immediate problem of responsiveness, and serve as a proof-of-concept of the power of the open-source collaboration method.

A Wiki Web system (wiki is Hawaiian for "quick") is a Web site content management system that allows collaborative creation, linking, and editing of content. The revolutionary idea is that users can affect changes without going through the bottleneck of an administrator or review board. Quality control is maintained by keeping a detailed versioning history (to track the changes made and their authors) and the ability to undo a change if it is later deemed inappropriate.

Wiki pilot system

The client's IT staff installed the system quickly with our support. We then pre-structured the shared space and designed FAQs and a charter on the etiquette of using the system. After only two weeks, more than 100 new content pages had been created by the employees, most on the documentation of the new software rollout. About half of the pages were FAQs and notes that people had previously created for themselves, which had been locked away on their own computers because they did not want to bother

going through the process of publishing them on the intranet. The other half were topical pages, mostly concerning the software roll-out, which quickly evolved from a few lines to several screens in length.

The sponsor in the client organization realized that this new collaborative approach was very effective at speeding up the tasks and getting information out of hiding and onto an intranet server. The project was successful, and the knowledge transfer to the client was very effective, because we involved the client staff intimately in every step, coaching them around pitfalls, but encouraging them to take ownership of the transformation.

LESSONS LEARNED FOR INTRODUCING OPEN-SOURCE COLLABORATION METHODS

The following are some of the principles we learned from the example project which are applicable in many situations.

1. *Keep it simple.* We used a few simple methods in assessment and intervention that were accessible to the client's employees. We did not overload them with methodology or jargon.
2. *Find passionate people.* To drive change, you need passion. You need people who understand and are excited about the change.
3. *Do the "emperor's clothes" test on the organization.* Don't require the novice to ask the emperor's advisor for permission to spread the word about change.
4. *Involve me, and I will understand.* Cultural change cannot be forced; it can only be facilitated. Nothing is as powerful a teacher as first-hand experience. We allowed people to experience what open-source collaboration could mean for them in their working environment.
5. *Start small, grow fast.* Start small with a limited scope and the mission to solve a concrete problem. Demonstrate value; then grow.

CONCLUDING REMARKS

Since developing the elephant workshop and successfully piloting it with this client, we have run it over a dozen times with diverse participants ranging from MBA (Master of Business Administration) students to senior managers. While there may be some initial resistance, especially in organizations that have a culture dominated by numbers and facts, the workshop has never failed in its ability to make people change their perspective and open their

minds through their placement (physically and emotionally) in an open, collaborative project setting rather than a closed and isolated one. This activates "war stories" about examples of either type of project in that organization that are very useful for designing a focused intervention.

As useful as the workshop is, taken in isolation, it is not sufficient to change behavior. It prepares and opens people for accepting a new approach to collaboration, but this approach also has to be delivered and guided in a way that it can be experienced. We have found that initial skepticism and resistance towards a change to open-source collaboration methods can be overcome.

ACKNOWLEDGMENTS

We would like to thank the project team at the client again for working hard with us to introduce a new, more efficient and more responsive way of collaboration. We could not have done it without passionate people who shared our vision and worked hard to make it a reality.

We would like to thank our colleagues at the Cynefin Centre for Organisational Complexity, with special thanks going to David Snowden, Dr. Anthony Mobbs, Dr. Peter Schütt, and Silvia Ligabue for inspiration, insight, and valuable discussions on understanding the human factor in complex organizational change projects. Thanks are also due to Professor Richard Wang and Michael Mielke of the MIT Information Quality Program, and to Professor Martin Eppler of the University of Lugano, for discussions on change management and shared spaces in knowledge management projects. We would also like to thank our colleagues in the Communications Strategy and Change practice, the KM-Blue and open source communities, and the Complex Change Facilitation group, who are a great source of insight and new ideas. Naturally, our valued colleagues and friends are not responsible for any shortcomings of our paper.

**Trademark or registered trademark of Linus Torvalds, The Apache Software Foundation, or MySQL AB.

CITED REFERENCES AND NOTE

1. MIT OpenCourseWare, OCW Home, <http://ocw.mit.edu/index.html>.
2. R. Feynman, *The Pleasure of Finding Things Out*, Perseus Books Group, New York, NY (2000) p. 187.

3. F. P. Brooks, *The Mythical Man-Month*, Addison Wesley, Reading MA (1975).
4. E. S. Raymond, *The Cathedral and the Bazaar*, O'Reilly & Associates, Cambridge, MA (2001), <http://www.tuxedo.org/~esr/writings/cathedralpaper.html>.
5. L. Torvalds and D. Diamond, *Just For Fun: The Story of an Accidental Revolutionary*, Harper Business Press (2001).
6. R. H. Coase, *The Firm, the Market, and the Law*, University of Chicago Press, Chicago, IL (1990).
7. B. Ives and S. L. Jarvenpaa, "Will the Internet Revolutionize Business Education and Research?" in *Knowledge, Groupware and the Internet*, D. E. Smith, Editor, Butterworth-Heinemann (2000).
8. The Complex Change Facilitation Group is a small, invited group of experienced practitioners and researchers in IBM who are working in the area of complex adaptive systems.
9. G. Chapman, "The Epistemology of Complexity and some Reflections on the Symposium," in *The Science and Praxis of Complexity*, S. Aida et al., Editors, United Nations University, Tokyo (1984).
10. D. Snowden, "Complex Action of Knowing," *Journal of Knowledge Management* 6, No. 2, 100–111 (2002).
11. N. Machiavelli, *Il Principe*, Chapter Six, paragraph six (1905).
12. A. Neus, "Managing Information Quality in Virtual Communities of Practice," in *Proceedings of the 6th International Conference on Information Quality*, MIT Press, Cambridge, MA (2001), pp. 119–131.

integrated into IBM BCS in 2002. He has been involved in numerous innovative projects related to the areas of organizational change, knowledge management, and CRM. In his role as a consultant, he has developed and designed strategies, processes, and organizational structures for clients, providing guidance and support for inducing the necessary changes to achieve the desired transformation. He is also a member of the Complex Change Facilitation group. ■

Accepted for publication November 12, 2004.

Published online April 7, 2005.

Andreas Neus

IBM Business Consulting Services, Beim Strohause 17, 20097 Hamburg, Germany (andreas.neus@de.ibm.com). Mr. Neus is a senior strategy and change consultant with IBM Business Consulting Services in Hamburg, Germany, focusing on organizational change, knowledge management, and innovation, and is a member of the Complex Change Facilitation group. He studied organizational psychology with a specialization in communications research at Bonn University and has worked on innovation projects at Trier University and the Ministry of Education in Luxembourg. Mr. Neus has more than 10 years of experience with innovative collaboration and knowledge management projects and co-founded Metabit, a company focusing on patterns and generative systems before joining IBM's e-business and interactive media consulting practice in 1999. He is an associate with the Cynefin Centre for Organisational Complexity in London and serves as a guest lecturer on organizational change management with the Information Quality program at MIT.

Philipp Scherf

IBM Business Consulting Services, Beim Strohause 17, 20097 Hamburg, Germany (philipp.scherf@de.ibm.com). Mr. Scherf is a senior strategy and change consultant with IBM Business Consulting Services (BCS) in Hamburg, Germany, focusing on organizational change, knowledge management, and customer relationship management (CRM). He received a B. A. degree in humanities at the University of Brighton and an M. A. degree in international political economy at the University of Warwick. After his studies, he joined the IBM Unternehmensberatung GmbH, a subsidiary of IBM specializing in management consultancy, which was