# 7

The Internet

Interviews with Terry Winograd, Larry Page and Sergey Brin of Google, Steve Rogers, and Mark Podlaseck

I did a calculation in the mid nineties of the number of documents that the seated user at home could get to within a minute and found that over a period of four years the number increased by a factor of ten thousand. One order of magnitude came because the disks are bigger, and three orders of magnitude came because of the Internet. That's a huge change in a short time. If I want to know, for example, whether "foodchain" is spelled closed up, or if there's a space between food and chain, I can whip over to my workstation, type it in both ways, find the number of people on earth who have used it each way, and know definitively where the majority usage is. I would never have known that before, and it happens in almost the same amount of time that it takes me to search my own memory. It's as if I have a strap-on cortex!

Stu Card,[1] March 2002

THE KIND OF enhancement to our abilities that Stu Card revels in is enabled for most people by using the Google search engine. This chapter features an interview with Larry Page and Sergey Brin in the spring of 2002, when they were still in their twenties and there was no talk of going public any time soon. They were making light of their achievements and engagingly modest about their designs, but it was already obvious that they had successfully resisted the dot-com madness and had survived through the crash and the period of "dot-gone."

Professor Terry Winograd teaches computer science at Stanford, and he was advisor to Larry Page when Larry and Sergey were developing their first prototypes; in the first interview of the chapter, he talks about the reasons behind the extraordinary success that Google has enjoyed and gives an

Percentage change

NASDAQ

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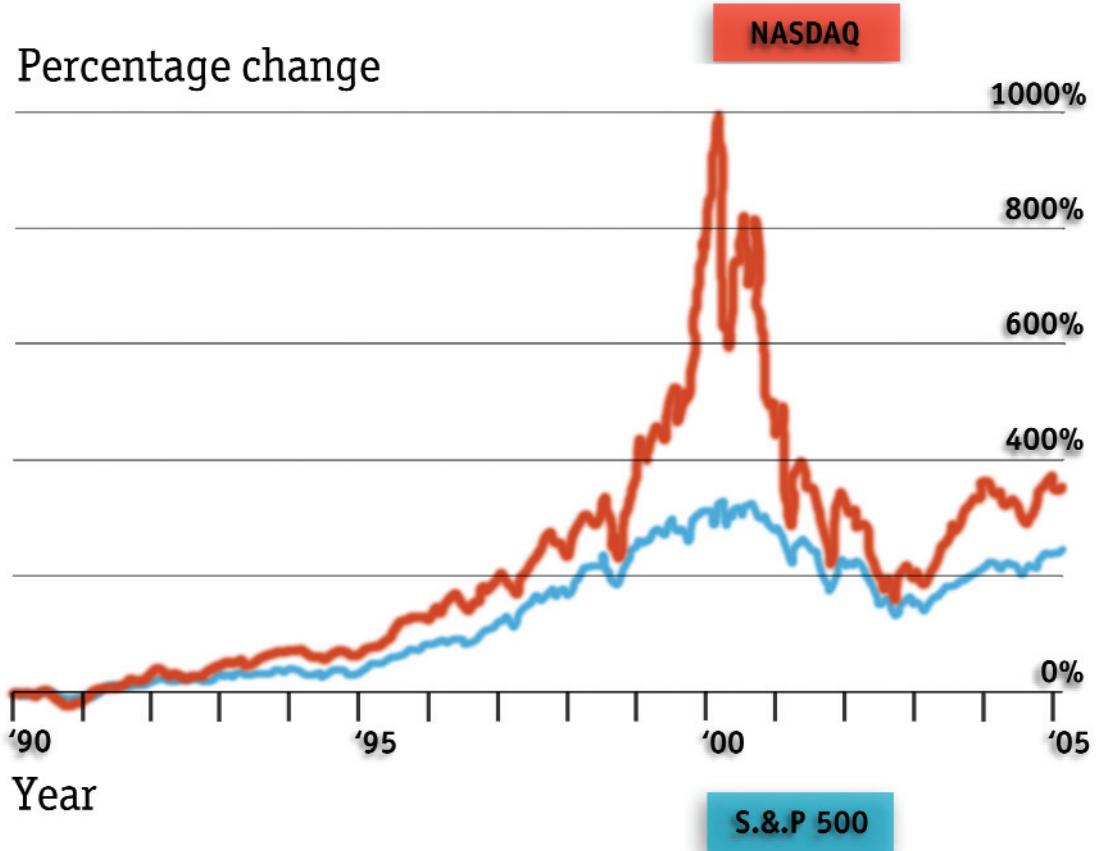
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overview of the development of the Internet. An interview with Steve Rogers, head of production at BBC New Media, discusses the design of the BBC homepage, which is shown as a case study. Mark Podlaseck, who researches the navigation of large databases at IBM, describes in his interview the rationale behind his beautiful design for the "glassengine," a Web site that allows you to browse the music of Philip Glass.

This chapter only touches a tiny part of the design of the Internet, which is a gigantic subject worthy of many books, but it offers some illustrative expert opinions and examples.

Dot-com madness

Do you remember the heady days of the dot-coms? You had to be living in the San Francisco Bay area to appreciate the full extremes of the craziness. Silicon Valley was powering along, to keep pace with the need for server farms, routers, and of course chips, chips, chips. Up in San Francisco, the area between Market Street and the bay was being redeveloped at breathtaking speed, housing an endless flood of startup e-commerce businesses and Web design consultancies. The business plans for the startups often projected no more than banner ads as a revenue stream, and still they were generously funded by venture capital. Townsend Street was dubbed "Multimedia Gulch," housing design shops such as Razorfish, Sapient, and Scient, which were surfing the wave of change as every company in the USA added a Web site, and many of them added an e-business arm to their portfolio. Junior designers were commanding six-figure salaries and being charged to clients at $2,000 a day. Rents in town were skyrocketing, driving away the residents who were not benefiting from inflated salaries. It was nuts!

With a little common sense, it was easy to see that the design boom was not going to last very long. The wave of change that accelerated demand was only going to continue until all the companies had their first Web site or their first e-business. Once that was in place, they would only need a low level of design effort for maintenance or an update several years down the line. It was also easy to see that many of the e-commerce business

ventures were founded on speculation rather than realistic revenue projections. Investing in market share was only going to pay off for the small number of enterprises that would end up dominating in the areas where there was a genuine value proposition to build on.

At last the crash came. The downturn was much more dramatic in San Francisco than elsewhere, because Multimedia Gulch and Silicon Valley had been the center of the madness. When people move to another town, the least expensive way to take their things with them is to rent a U-Haul trailer, load it up with all their stuff, and pull it behind their car: it was hard to find a U-Haul trailer in San Francisco after the crash, as the traffic was one-way outbound! Property started to be more available, the rents fell, local unemployment soared, and lots of investors were deeply distressed. Why did the madness continue for so long before the crash came? Perhaps it was because there was a genuine revolution going on, and that moving into the information age is as significant a change as was the arrival of the industrial age. Life really is different because of the Internet, and the interviews in this chapter show us an inkling of the design implications of the change.
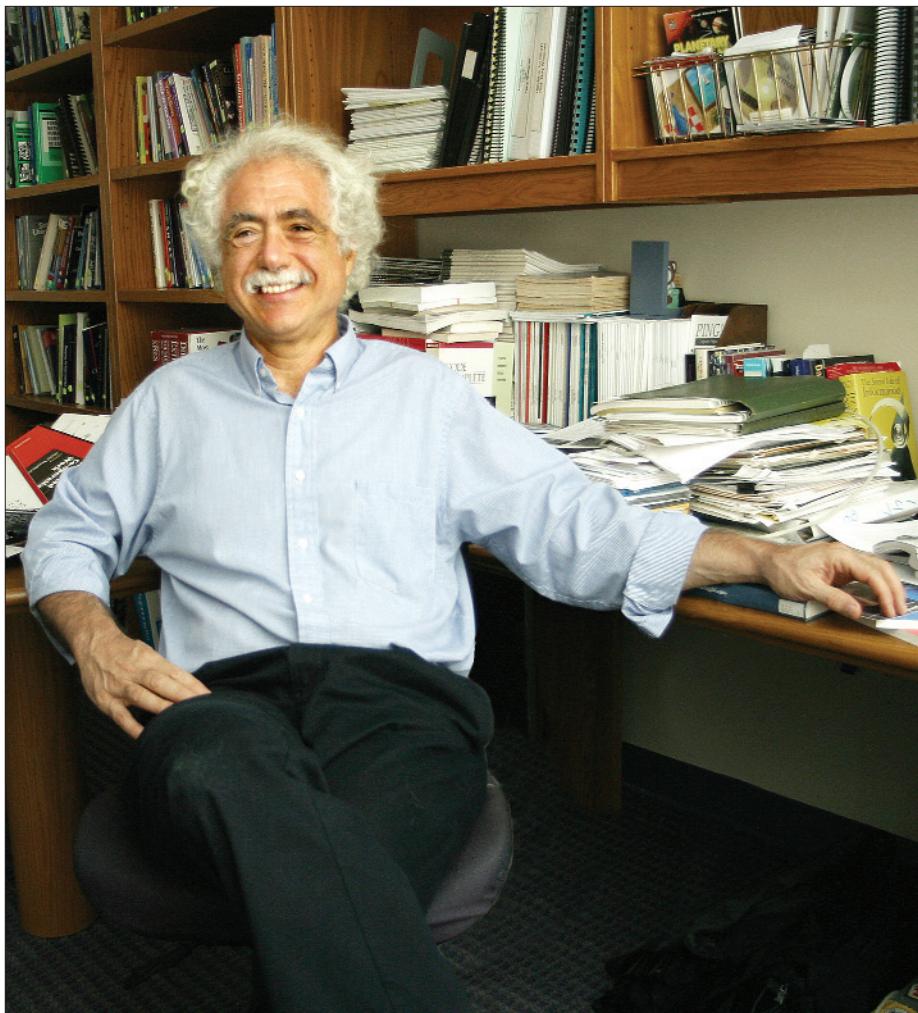
How have the Internet and the World Wide Web emerged from the downturn? The Internet as a whole continues to be a communication medium, dominated by email and chat, while the Web is the part where people look for information as well as buy and sell things. The communication component of the Internet is closer in some ways to other communications services, like telephone and mail. There is convergence there as well; we call it email because it is easy to see the similarity to snail-mail, but now we also have streaming audio, allowing us to use the Internet for telephone calls and to listen to the radio. Phones have built in cameras, so people send images to one another. Streaming video is just around the corner for the Internet, so we can expect a surge in video calls and TV watching soon.

The Web was the part that took off with such flamboyant growth, and is now the extraordinary new world of information that is instantly accessible to everybody with a browser. In the

preceding chapter, Takeshi Natsuno described the content portfolio that he created to understand the "Internet way of thinking" as it could be applied to a cell phone service. He named information-based content, database-based content, and entertainment-based content." In the transaction category he thought first of banks, credit card companies, and security companies. For the information and database categories, he was looking for news, yellow pages, recipes, timetables, and so on. For entertainment he looked for online games and found Bandai as his first content provider in the category. When we look from an overview position at the successful companies that have emerged from the downturn, it is interesting to see if Natsuno's portfolio seems relevant, or if his categories are only applicable to the specifics of a Web access provider that is also a Japanese cell phone service.
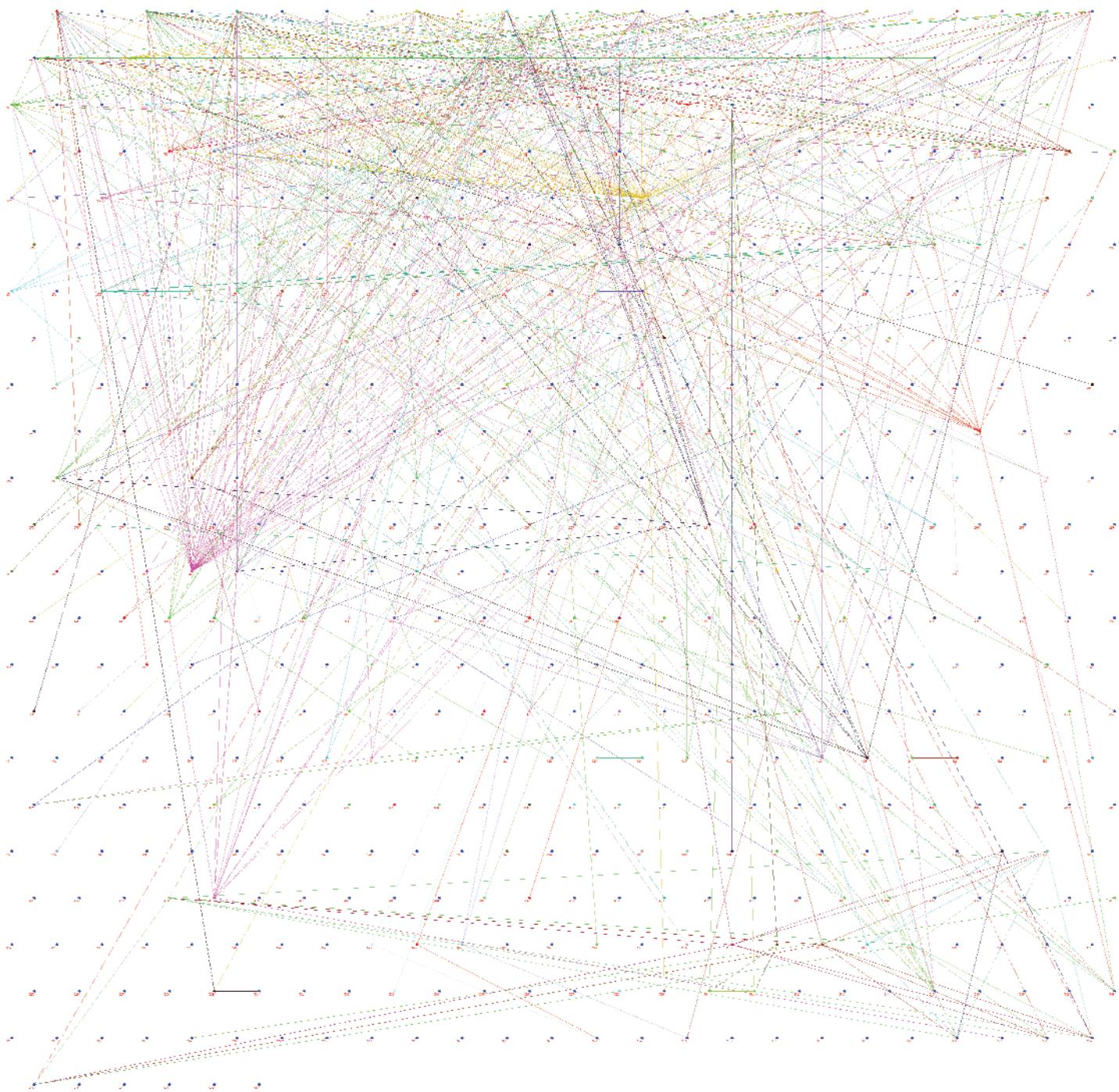
Terry Winograd starts by explaining the difference between the Internet and the World Wide Web, and comparing them to ubiquitous computing.

Terry Winograd

Terry Winograd is a professor of computer science at Stanford University, where he has developed an innovative program in software design, with a focus on human-computer interaction design (HCI). His BA was in mathematics in 1966 and his PhD in applied mathematics at MIT. He went on to teach and study in the Artificial Intelligence Lab at MIT before moving to Stanford in 1973. He consulted with Xerox PARC with the goal of getting computers to understand natural language but became frustrated with the slow progress in the field. "A reason to have computers understand natural language is that it's an extremely effective way of communicating. What I came to realize is that the success of the communication depends on the real intelligence on the part of the listener, and that there are many other ways of communicating with a computer that can be more effective, given that it doesn't have the intelligence. At that point, I shifted my view away from what would be thought of as artificial intelligence to the broader question, 'How do you want to interact with a computer?' Then I got interested in what makes interactions with computers work well or fail and what makes them fluent. That's been the direction of my work." In parallel with his teaching at Stanford, he has also consulted with Action Technologies, Interval Research, and Google. His most recent book is *Bringing Design to Software*,[2] a compilation of contributed chapters and interviews, with interleaved profiles each describing a successful project related to the contributed material. He is also a founder and past president of Computer Professionals for Social Responsibility.

Terry Winograd

The Internet or the Web?

A LOT OF people wonder what the difference is between the Internet and the World Wide Web, usually referred to as the Web. Terry Winograd defines two differences, one technical, the other social–historical:

> At the technical level, the Internet is a set of protocols for communicating between machines, sending information around. One particular protocol, which got built on top of those protocols, is called http, the HyperText Transfer Protocol. That was the protocol that created the Web. If you want to be technical, applications that use the http protocol are using the Web, while others that use other protocols on top of the underlying Internet protocols are just part of the Internet. By that definition, ordinary email is not part of the Web, as email is transported through the Internet, but not via the Web. But then you may use a Web-based reader to read it on the Web once it's gotten delivered, so it's confusing. Now, protocol differences may be interesting for techie people, but it's not a very interesting distinction for most people.

Terry thinks of the other distinction more in a social context. The Internet was first developed by a collection of people who were computer-savvy, mostly computer programmers or scientists, so it was designed and optimized for that community. The Web also started that way, as physicists, who were using it as a way to communicate their preprints and papers among themselves, created the http protocol. Then a surge of growth started to expand the Web, and the dot-com boom took off. Every business realized that they needed at least a Web site and possibly an e-commerce arm to stay competitive. There was a sudden shift from the specialist technical community to a new commercial consumer space full of business opportunity.

> I think that, as a social phenomenon, this was a tremendous explosion that was different from the underlying social phenomenon of the Internet.

Ubiquitous computing versus the Internet

The way that people interact with computers has shifted over the years, although not as rapidly in some ways as people expected. When Terry started working with computers, you punched decks of cards, put them into card readers, and waited for them to return printouts. He had his first chance to experiment with interactive timesharing at the Artificial Intelligence Lab at MIT, where he had a machine, he did something, and it did something right back. There wasn't this gap of giving it a bunch of stuff and waiting for a result.

Then, when he was given an Alto at Xerox PARC, he had the chance to use a graphical user interface, allowing him to use the visual space of the screen to let the computer know what he was doing by pointing. Terry explains the next vision:

> The desktop and the mouse have really dominated the way we interact with computers, pretty much for the last twenty years. We think of it as sitting down, interacting by doing things with our hands, primarily typing, because that's a very efficient way to get large quantities of text in, and also by pointing, dragging, moving, and drawing, and so on.

■ Early time-sharing on Univac
■ Xerox Alto

There is a next vision, which has been put forward and explored but certainly hasn't taken over. Mark Weiser, who was also at Xerox PARC at a somewhat later period than I was, developed a notion he called "ubiquitous computing."[3] The basic idea is that people don't want to interact with computers. People want to get something done. They may want to write documents, they may want to draw pictures, they may want to turn the lights on and off. Whatever they do, the fact that there's a computer involved in an interaction is instrumental. It's not the purpose; it's the way they get things done.

The question Weiser was asking was, How can we make computers become invisible? How can we interact with environments, rather than interacting with computers, where the computers now become the medium through which we interact? That includes a lot of different kinds of devices, so instead of sitting in front of a computer, or holding a computer and doing something to it, you simply operate in a space. You're in a room and you're doing things. You're writing on a board, you're moving around; you're doing whatever it is that is important for you, in terms of why you're there. The computers are in the background both helping you get things done and providing "affordances"—ways that you can make things happen.
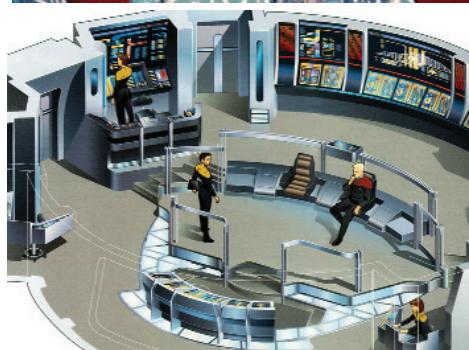
The idea of ubiquitous computing is to move away from the desktop toward multiple devices. Rather than thinking about using a computer, you think about using a room, a world, or a whole environment of computers. You move away from simple one-to-one interactions toward more implicit interactions:

What you do with the computer, and around the computer, is being interpreted, and that can help you, but that can be difficult. The fantasy is the Star Trek computer.

You say, "Computer do this, computer do that," and it just happens. That's very hard to design.

The reality, which is what the research is really on, is how to put computers into the tangible real world we're in and have them do things that don't require the inference and intelligence that people have.

One of the initial points in Weiser's work on ubiquitous computing was to envision a spectrum of computers. He called it computing by the inch, by the foot, and by the yard. Computing by the inch was something called the PARCtab, which was the predecessor of today's

Mark Weiser ■
Star Trek bridge ■

- "Inch"—PARCtab
- "Foot"—Microsoft tablet PC
- "Yard"—large wall displays in the Gates iRoom at Stanford

PDAs.[4] By the foot was a little tablet, which was a predecessor of things like the Microsoft tablets.[5] And by the yard was big displays on the wall. The goal was not to have to choose one, but to be able to smoothly integrate among them.[6]

There were two really different strands operating and developing in the nineties. One was, as I said, the move away from the desktop toward ubiquitous computing. The other was toward more connectivity, toward more things that happen on your desktop, while being connected to everybody else in the world's desktop, and servers, and so on.

These trends are complementary. Most of the stuff that's gone on in the Internet doesn't challenge the basic interaction desktop metaphor. What's new of course is what's going on that screen, who's putting it there, and how you're interacting with it.

Interval Research took the interaction design direction that was more toward ubiquitous computing and tangible interfaces at a time when, for financial commercial reasons, the direction that was really happening was the other one, which was the Web. Everybody was eager to put things onto the Internet, get them off the Internet, send information, find information, sell things, and buy things. I think there were a lot of ideas that would have developed much further, if all of the resources and attention hadn't shifted in massive focus to what we could do on the Web, and as we saw a few years later, that was a bubble that has now been corrected.

From direct manipulation to "being there"

Terry suggests that we interact with the world around us in three main ways; manipulation, locomotion, and conversation. In manipulation you move things around with your hands; for locomotion you move yourself from place to place; and in conversation you say something and another person says something back. Terry explains the relationship between those three interactions and computers:

If you look at computers, all three of those metaphors are present. The early ordinary timesharing system was conversation. I type something in; it types something back.

The Xerox Star and the Macintosh—that whole line of interfaces—is manipulation, and in fact Ben Shneiderman coined the title "direct manipulation" for it, as you actually move things around.

As the Internet became popular and shifted to the Web as we now know it, the metaphor shifted toward locomotion, even without much change in the technology.

I used to say things like, "I'm going to retrieve a file from somebody else's computer and bring it up on my screen."

That's manipulation: I retrieve it; I bring it up.

Now I say, "I'm going to go to their homepage." I'm doing exactly the same thing. I'm retrieving a file from their computer and I'm bringing it up on my screen, but I've shifted my thinking away from doing things to moving. There's a space—there's a place.

One of the things that made the Web very appealing and effective in many of its applications was the shift to a metaphor of locomotion and place, where I think of it as a set of places I can go to and be in rather than a set of objects I can do things with.

The location metaphor goes along with the initial Web as primarily a read-only medium. Most users could see things, but you can't easily change things. That is changing today with what people call "Web 2.0," a style of Web programming that integrates the full power of direct manipulation into Web-based applications, along with the use of Web-based information services.

Technical people understand networks, routers, servers and all the rest of the hardware that makes the Internet and the Web work, so they have a conceptual model that looks like a system diagram of hardware components, supporting software structures and protocols. Most of the people who go online don't think that way; in fact, they don't even know what hardware is where. They think of the Web in terms of sites and pages that belong to some person or organization. If you say,

"Well, is there a server? Where is that site?"

"It's at Somebody.com. It's on their site."

They don't think of it as being on a server in some computer center, they think of it as being at Somebody.com. In their mind, the geography of the sites has to do with what pages are connected to Web addresses. That is a geographic conceptual model, but it is completely different from the physical one of networks, routers, and servers.

MANIPULATION

LOCOMOTION

CONVERSATION

Three main ways that we interact ■

■ Buying a book on Amazon
■ Trying on clothes

The immediacy advantage

> When you compare the Internet to earlier forms of communication, it has one obvious huge advantage, which is its immediacy, which is independent of geography. No matter what I do on the Net, it could be having an effect anywhere in the world, basically at the same instant, microseconds. There are a lot of things for which that's really important and where it made a big difference. I think the fallacy was in assuming that that's what everybody wanted for everything, and therefore all kinds of transactions, all kinds of communications would just shift there, when of course no medium is right for everything. And I think people have learned that for certain kinds of things Internet communication is really wonderful, used all the time, and for other kinds of things, it doesn't work.

Shopping is an example. If you want to buy a book, and you already know the title and the author, and you just want to order it fast, something like Amazon is wonderful. You type it in, order with one click, and soon it arrives. Buying clothing is quite different. Looking at pictures on the Web is not the same as touching the clothes and trying them on. Terry explains that it is a communication issue:

> I think one of the interesting things about the Internet is that it's very new, but it's not new. Obviously it provides a technology; it provides a speed and ease of communication, which is very different from what it was before, but in the end it's a communication medium. People have had new communication media over time, over many centuries, and there are certain things that people care about that they will then adapt to whatever new medium they have.
>
> When you look at the original idea of the Internet, if you actually go back and look historically, it was for people to be able to run programs on somebody else's computer. So I could be at MIT, which was one of the early branches of the Internet, somebody could be here at Stanford, and they could run my program while sitting at their terminal at Stanford. Things like email weren't even part of that original notion. They got sort of tacked on as it went, and when they did, people realized that the real power of this networking was the communication part.

If you look at the Internet as a whole and ask what is most used, of course it's communication through things like email and chat. Those have been really dominant applications. In the future I think we're going to see many more applications that depend on the high bandwidth of sending video images. Right now video is still a second-class citizen because technology doesn't make it really easy, really smooth, really efficient and cheap. I think that the video phone, which never worked in it's earlier incarnations, is going to be much more successful. I think we will see a lot of video applications, a lot of video surveillance, video distribution, and other ways to make use of the extra bandwidth that's coming with broadband.
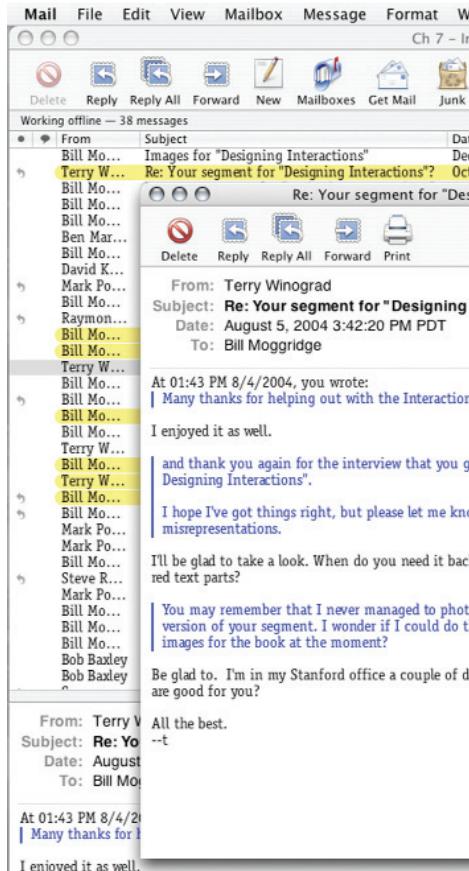
Online communities have worked very well in certain kinds of niches. There are online communities of people who are sharing and helping each other, who don't necessarily live in the same place, and maybe aren't physically able to get out and see each other, and really get a tremendous benefit out of that. But, in general, it hasn't replaced your company, your neighborhood, your school; the kind of communities that are really built on a richer set of interactions that include linguistic and visual communication; they're built on a sharing of a physical space. I think we're still inherently physical animals, and what we do in a physical space really effects us on a psychological level, even if in some abstract sense you could say it's the same information that we would get over a screen.

Google

During the 2002/3 academic year, Terry Winograd took a sabbatical from Stanford to spend a year at Google. He already knew Larry Page and Sergey Brin very well as they had been his students before they founded Google, and Larry was his advisee. He was excited to be there, because this was the first company that he had consulted with that was having a major impact on the marketplace. The others had been research laboratories, and he enjoyed the direct connection to the needs and demands of serving hundreds of millions of people and trying to understand what kinds of things they use and do. He compares it to the academic situation:

From a human-computer interaction research perspective it was incredible. We struggle and struggle in our lab at Stanford to set up

Email
Chat

an experiment with twenty or forty people. At Google, they can run an experiment with a hundred million people by just sticking something on the Web. So it's been a very useful experience for me in broadening out my sense of how things work.

I think they've been very successful for a number of reasons, but largely because they've respected what it is they think users can do and what users want. I think that's a big lesson from Google. They don't say, "Here's what we're going to force on you, here's what we think we can sell you."

They really started from a point of view of, "Here's what we hope will be useful. Let's find out. Let's try it." Certainly the culture is very user-empirical driven. For a lot of questions, the answer is, "I don't know, let's put it up and experiment and see what people do."

Here is another example of a process that combines the focus on people with prototyping. Throughout this book, as with Bill Atkinson and Larry Tesler designing the Macintosh pull–down menus, we keep seeing examples of successful design that combine efforts to understand the needs and wants of users with rapid iterative prototypes to test the concepts. The dramatic difference in the Internet age is that the prototypes can reach millions of users immediately. Terry also observed that Larry Page had a surprisingly diffident attitude to money:

In the early years of Google, Larry Page, who was my student, used to come in, and we'd chat. I'd worked with him some on the algorithms they used for the search, so he'd come in and he'd talk about what they were doing with the algorithms and how they were improving the search and so on, and I'd say, "How are you going to make money?"

At that point there were no ads, it was just a straight search engine. They were providing it as a free service. He would do his little smile and say, "Well, we'll figure it out later."

I think that really got it off on the right foot. The starting point was not, "How do you make money on the Web?" The starting point was, "I have an idea for a search engine that's going to be better. Let's get it out there and see if people want to try it. Then, we'll figure out later where to go with it."
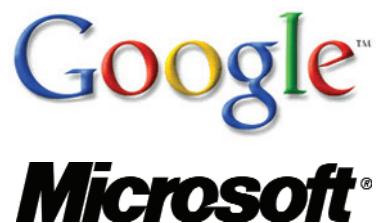
So when they started putting ads on, instead of starting with, "What's the way we can maximize advertising revenue?" they said,

"What's the way we can give something that's useful to users without getting in their face too much?"

The use of small text ads in place of banners and pop-ups was driven by a sense of thinking what it's going to mean to the user. I've heard commentators complain that Google is too much driven by the technologists, that the people who are running it care more about having good technology than whether it makes money or not. I think that's still true, although it has certainly moved into the world of making large amounts of money.

Google established its position by providing quality, because when they started out, they were not the only search engine. People used Alta Vista, people used Lycos, and there were several other search engines. Google, by being respectful, that is, by not dumping stuff in people's face, and also by providing better-quality results, gradually took on more of the market. At this point they have a very large share, and it's growth was self-feeding in the sense that people who used it told their friends, and more people used it, and it built up a momentum.

The obvious big threat to anybody in the computer business is Microsoft. Microsoft has the same advantage they've had in every other area they've gone into: they own the desktop. So right now when you want to search on Google, you go to the browser and you search. But there's no reason Microsoft couldn't put a search box into Word and Excel and so on, which goes to their search engine, and you don't have to go to the browser. They've got your eyeballs on their applications, and they can control much more where you go. I don't think Google feels threatened that other search engines are going to beat them on quality. They're getting better. All of them are getting better, and everything improves, but Google got a good head start, and they have a lot of smart people developing better quality. I think the real questions that are going to come up are how this integrates into these larger pictures, like who owns the browser? Who owns the desktop? As we know, that's been played out in many other areas in court in the commercial field.

Larry Page and Sergey Brin

Larry Page and Sergey Brin founded Google together in 1998. Larry is now "Co-Founder & President, Products" but was the CEO for the first three years, growing the company to more than two hundred employees and profitability before he found Eric Schmidt to take over as CEO and chairman. Larry was brought up in Ann Arbor, Michigan, where his father was a computer science professor at Michigan State University. He was passionate about computers from the age of six and graduated with honors from the computer engineering program at the University of Michigan, where he built a programmable plotter and inkjet printer out of Legos. He went on to the PhD program in computer science at Stanford University, where he met Sergey Brin. Sergey, originally from Moscow, graduated with honors in mathematics and computer science from the University of Maryland and is now "Co-Founder & President, Technology" at Google. He is fascinated by the challenges of extracting information from the huge unstructured world of the Internet and has published more than a dozen academic papers. He was working on "data mining" at Stanford when he met Larry. After lots of stimulating arguments, they found they shared a passion for understanding information structures and started working together. They were looking at the structure of links and accidentally ended up with a method that could improve the ranking of results, so they said, "Why don't we build a search engine?" Their interview was in the spring of 2002. At the time of writing, in late 2004, they have successfully taken Google public, with strong financial results and a share price that has pleased their owners.

Google™

Advanced Search
Preferences
Language Tools

[Google Search]   [I'm Feeling Lucky]

Advertising Programs - Business Solutions - About Google

Larry Page and Sergey Brin

From its humble beginnings in Larry Page's and Sergey Brin's Stanford dorm room six years ago, the company has become the latest mecca for clever engineers and a $2-billion-a-year growth machine.

Fred Vogelstein, *Fortune* magazine, December 13, 2004

Successful Searching

SERGEY BRIN AND Larry Page met at a spring gathering of new Stanford University PhD computer science candidates in 1995, when Sergey was twenty-three and Larry was twenty-four. This is what they say about the encounter:

■ Google homepage
June 2005

> SERGEY We met for the first time when Larry was visiting Stanford, when we were recruiting him as a prospective PhD student for the Computer Science Department, where I already was.
>
> LARRY And I thought Sergey was very obnoxious!
>
> SERGEY I also thought Larry was obnoxious, and I definitely haven't changed my mind. We went on a trip to San Francisco, where we were taking the prospective students, and Larry and I got into continuous arguments all the way, about the value of the real estate, about building codes, about any number of possible things.
>
> LARRY We had interesting and stimulating arguments!

By the end of 1997, they had collaborated to develop technology that would become the foundation for the Google search engine. They started with an interest in data mining, the study of patterns and relationships in data, and went on to develop

PageRank, a software tool to compare one Web page with another. They added a search engine called BackRub, named for its ability to analyze the "back links" pointing to a given Web site:

> Sᴇʀɢᴇʏ I was working on data mining, which broadly stated is analyzing large amounts of data for patterns and relationships.
>
> Lᴀʀʀʏ I started gathering all the links on the Web, and Sergey naturally fell into this thing of, "There's all this good data to look at," so we started working together. We've been working together since. We sort of accidentally stumbled into designing a search engine. We didn't intend to do a search engine at all. We were doing data mining, we were looking at link structure, and we ended up accidentally with a method that could rank results better, so we said, "Why don't we build a search engine?" Once we decided to build a search engine, we thought that there were a lot of things that we could do that people aren't currently doing. We set out to build a prototype that would let us experiment. One of the things we were working on was link structure and looking at which links were important on the Web. We evolved this thing called PageRank which let's you determine the importance of pages based on the links to them.

PageRank does not count links; instead, it uses the vast link structure of the Web as an organizational tool. It interprets a link from Page A to Page B as a "vote" by Page A for Page B, and then assesses the importance of a page by the "votes" it receives. It also analyzes the pages that cast the votes, so that votes cast by pages that are themselves "important" weigh more heavily and help to make other pages important.

> Sᴇʀɢᴇʏ This was just a way to compare one Web page to another Web page. Web pages are very different from one another. You have something like the White House homepage versus I have a page that tells you what I had for lunch on a particular day; we have a café at Google, so all the lunch menus are online. The relative significance of that page is very different from the White House homepage. Compared to almost any other medium, the difference is much greater. Even though you have some books that are much more important than other books, with Web pages it is a much more exaggerated difference. PageRank was a way of comparing one page to another,

and in the end the way we evaluated it was to do little searches. For example, we'd see how all the Web pages that mentioned the word "University" ranked up. We noticed that you've got all the major universities at the top, with Stanford and Harvard and so forth, and of course we'd always compete because everybody wanted their alma mater to be at the top.

Once we did these little experiments, just trying to figure out how good PageRank was, we realized that this was a pretty good way to search. Search had originally been a validation test of PageRank. It turned all the way the other way round, and search became our primary focus, with PageRank becoming one of the tools that made it work well.

Larry It's a good example of how, when you're doing research, you don't really know what you're going to end up with. We had no intention to build a search engine. We sort of stumbled into it, and we've been working on it ever since.

Sergey Next, we just continued to play with the technology, to make it a little bit better. We pursued it with purely scientific interest. At some point, we started having a demo up so that everybody on the Web could use it. In the old days of the Web, people just put stuff up and everybody would play with it. It started getting traction; people liked it, and we started talking to the existing search companies, asking, "Well, wouldn't you like to use this technology?

They were kind of interested, but the talks didn't really go anywhere, partly because we weren't that motivated, as we were interested in the purely research aspects. At the time, search engines like Excite, Lycos, and Infoseek were already becoming portals, emulating Yahoo, so they weren't that interested.

Eventually, what had been our little demo prototype, really ballooned out of control. We had to keep accumulating lots of hardware from all over the department. We had to borrow it from different groups.

Larry We would hang out at the loading dock, waiting for equipment to come in, and then we'd bug the professors.

Sergey We'd borrow it. Sometimes we wouldn't really mention it because we figured they would never miss a machine or two. This was in order to accommodate the traffic and also the experiments we wanted to do.

1999 special logos
During beta testing ■
"Uncle Sam" search ■
Halloween ■
Thanksgiving ■
Holiday season ■

LARRY We had to download the entire Web, and store it and process it.

SERGEY It was more than just the two of us. There were two other people working on it: Scott Hassan, who went on to found the company eGroups that got purchased by Yahoo, and Al Steremberg who founded The Weather Underground.[7] That's one of the main weather Web sites. It's pretty funny that out of that group there are three companies.

LARRY To download the Web you start with a Web page, actually we started with my homepage, and you just follow the links. It's like you're surfing. You just follow the links from that page, and keep doing that until you have the whole Web. It's very much a discovery process.

SERGEY You record everything as you go, and you do it at a rate much faster than a person would; a thousand Web pages per second or something. At the time we didn't do it nearly that quickly.

Larry and Sergey continued to work on search technology during the first half of 1998. They bought a terabyte of disc memory at bargain prices, maxing out their credit cards to do it, and built their own computer housings in Larry's dorm room. Sergey set up a business office in his room and started talking to potential partners who might want to license search technology that worked better than the other options available at the time. They failed to interest the major portals of the day and therefore reluctantly decided to make a go of it on their own. All they needed was a little cash to move out of the dorm and pay off the credit cards, so they wrote a business plan, put their PhD plans on hold, and went looking for investors. They managed to raise a million dollars in funding from family, friends, and angel investors to start Google.

On September 7, 1998, Google was incorporated and moved into its first office, in the garage of a friend in Menlo Park, California, a mile from Stanford University. The garage came with a remote control to open the overhead door, a washer and dryer, and a hot tub. There was also a parking space for the first employee who joined them, Craig Silverstein, who became director of technology. By the end of the year they were

■ Original storage
■ "Corkboard" computer
■ Google servers
■ Al Steremberg, founder of www.wunderground.com

answering ten thousand search queries a day, in spite of the fact that they were still in Beta testing. In December *PC Magazine* included Google in the list of "Top 100 Web Sites and Search Engines" for the year.

> LARRY We spent a lot of time on the name for the company because we figured that would be important for people to be able to remember it, and for it to be reasonably short. We wanted a name that was fun. Yahoo is a good example of a fun name. We were looking at all sorts of information. We wrote programs to look at domain names. Eventually we ended up with this list of large numbers, and at the top of the list is googol. It seemed like a fun word; it's pretty short, with six characters, and it means ten to the one hundred, a one followed by a hundred zeros. That's pretty much what we wanted to do. We wanted to do really big things! We did have this unfortunate incident where we misspelled it.

> SERGEY That's true, it was before the Google spellchecker!

> LARRY We didn't have the spellchecker, but it turned out that domain name was available, and the one spelled correctly was not. It's okay, everyone spells it the way we do now!

By early 1999 they were answering half a million search queries a day, and had grown to a group of eight people. They were already too big for the garage, and moved another mile to an office on University Avenue in Palo Alto. Their first commercial search customer, Red Hat, signed on partly because of their commitment to run their servers on the open-source operating system Linux. By the middle of the year they had secured $25 million in equity funding from two of the leading venture capital firms in Silicon Valley, Sequoia Capital and Kleiner Perkins Caufield & Byers. In August they moved again to the heart of Silicon Valley and officially launched their Web site in September. By the end of the millennium they were performing three million searches a day and had proved that they were more than just a university research project.

The Google headquarters was starting to express a unique company culture. Lava lamps in every possible color were oozing and blobbing contentedly on shelves. The boardroom was a

2000 special logos
March 17, St. Patrick's Day ■
June 18, Father's Day ■
July 4, Independence Day ■
November 7, Election Day ■
November 15, Shichi-go-san ■

cluster of mobile office chairs around the ping–pong table. People worked on simple desks made of wooden doors propped up on sawhorses, but they were equipped with the most sophisticated computers.

Offering employees a free lunch in the company canteen encouraged the exchange of ideas. Charlie Ayers, the company chef, who had become well known while cooking for the Grateful Dead, prepared delicious meals. Part of the parking lot was roped off twice a week for roller hockey games, encouraged by Sergey's passion for roller blades. He often arrives at work on his blades, wearing a crumpled and sweaty tee shirt emblazoned with the Google logo. He grabs a fresh new one from the store to start the day.

After the initial venture round of funding, Google managed to eke out their resources until they were able to become self–sufficient and profitable.

> LARRY Sergey was very focused on building a profitable company.

> SERGEY We really wanted to be profitable. It was as much an ego thing as anything, I just felt it was lame to have one of these big unprofitable Internet companies.

■ Google lobby

Photo
Author

In the first quarter of 2001, Google was answering more than a hundred million searches per day, and the demands of running the company were growing all the time. Larry set out to replace himself as chief executive, and successfully recruited Dr. Eric Schmidt, chairman and CEO of Novell and a former CTO at Sun Microsystems, to join Google as CEO and chairman of the executive board. Schmidt focused on building the infrastructure for the company to continue along the path of rapid growth and sought the best possible balance between speed of development and high standards of quality.

> LARRY Our growth is based on the quality of our service. We've done almost no marketing. We don't spend any money in order to get people to use Google. A friend tells them to use Google or they read about it. Some of our competitors were spending over a hundred million dollars on TV advertising. We didn't do that, which was good for our business.

Our revenue started with text ads [as opposed to banner ads with intrusive graphics], which I think was a good break for us. The reason people like this is that they usually just click on search results, and as those are just text, we decided to just have text ads that are relevant to the search results. At the time I remember our sales team was very upset with me; I had to argue with them everyday about this. We've actually had very nice pick up with this kind of program in advertising. The ads are good for our users; if you search for golf clubs you've got some place to buy golf clubs, that's a useful thing for the user. The advertiser makes money and so they pay us some of it. It's not a very complicated decision to say, "I'm an advertiser, and I'm making $3.00 on every user that Google sends me, so it's OK for me to pay Google a $1.50 fee."

By the beginning of 2002 the size and scope of searchable information available through the Google search engine had grown to three billion Web documents, including an archive of Usenet messages dating back to 1981. New services were added as tabs on the home page, without cluttering up the design. These included searching news headlines, images, and catalogs.

LARRY We've added a lot of services. It's a design challenge to add services without increasing the complexity, and we've spent a lot of time on the design. We have tabs now so that you can search for images, or you can search over groups. We have about 300 million images and about 700 million messages on groups. Those were pretty significant enhancements, but it was a complicated design process, to give you access to those features without complicating your normal tasks. We went to a tab design that really helps you with that, so that you can easily do your search on images or groups, and know that those things are possible, but not in such a way that impedes your normal activities.

SERGEY I think one of the other interesting things that we do is that, in a normal Web site, when you add a new service, you deploy it right there on the main site and see how well it does, and then keep it there or take it off. In our case we really insist on initially deploying a new service (like we did with images, or right now we have catalogs, or news search, things like that) off the main page. We insist that they get a lot of traction on their own, without the benefit of that top-page promotion. If they have user pickup at that

- Craig Silverstein, Google's first employee
- Dr. Eric Schmidt, CEO and Chairman

level, we will go ahead and bring them up as a short cut or convenience to users.

It's really a different way of thinking about it. We're not trying to thrust services on to users; it's only when they actually find the services we are producing useful that we'll give them a more convenient way to get to them. There's huge variety in the kind of needs people have. The diversity of people's search needs has gone up over time. When we started the company, the top ten queries accounted for 3 percent of the searches, but now the top ten queries account for under half a percent of the searches. The diversity of people's needs has gone up over the last few years and I think it will continue to do so as the Internet grows.

On August 19, 2004, Google went public. Larry and Sergey look like mature and purposeful young men as they peer at you from the cover of the December issue of *Fortune*. The subtitle raises the question, "Is this company worth $165 a share?" and the feature article inside argues both sides of the answer. Four months after the IPO the stock is worth about double the initial value, and advertising revenues are growing healthily. It remains to be seen whether they emerge as a real competitor to Microsoft or fade away more like Netscape. Whether you bet on a positive future for them or not, it is certainly amazing to reflect on how far they have come. Recall Terry Winograd's question of only five years earlier, "How are you going to make money?" It is poignant to think of Larry's little smile and his answer, "Well, we'll figure it out later."

One has to remember that they started Google at the height of the dot-com madness, when venture capital was flowing to people with any harebrained idea and the business model for most of the startups was revenue from banner ads. This made most of the dot-com sites horrible to read, as you were constantly bombarded by the animated advertisements. Browsing was like standing in Times Square. Larry and Sergey resisted the temptation to ride this wave, staying focused on developing real value for the users of their product and making their product perform. The approach certainly worked.

When you browse www.google.com it is easy to find out a lot about the company; they are very open in their approach to

2001 special logos
March 9, Indian Festival of Color ■
April 22, Earth Day ■
July 14, Bastille Day ■
August 15, Korean Liberation Day ■
December 10, Nobel Prize centennial ■

sharing information. Take a look, for example, at the "Letter from the founders,"[8] which explains why Google is not a conventional company.

The first sentence of the company overview says that Google's mission is to "Organize the world's information and make it universally accessible and useful." Larry sums up the philosophy behind this statement:

> The perfect search engine would understand exactly what you mean and give back exactly what you want. I think the main issues with search are not so much around interaction. I think it has more to do with just pure quality in understanding. We like to say that we're focused on the ultimate search engine. The ultimate search engine would basically understand everything on the Web, it would understand exactly what you wanted, and it would give you the right thing or the right things. We're a long way from that. In computer science we call that AI-complete, meaning that it requires artificial intelligence; it would have to be smart. If you had the perfect search engine, you could just stop working, because it would just do anything; it could answer any question. We have a long way to go before we can get to that, but we will continue to make advances that really are significant for people.

■ Nasdaq launch—Larry Page signs

Google Truths

Under the heading "Our Philosophy," Google publishes "Ten things Google has found to be true":

1   Focus on the user and all else will follow.
2   It's best to do one thing really, really well.
3   Fast is better than slow.
4   Democracy on the Web works.
5   You don't need to be at your desk to need an answer.
6   You can make money without doing evil.
7   There's always more information out there.
8   The need for information crosses all borders.
9   You can be serious without a suit.
10 Great just isn't good enough.

These ten things form a manifesto, both for the design of their product and for the development of the company. The first three are about the design approach, so here they are in full, augmented by some comments taken from the interview. The others are more generally about business issues, so if you want to see the full text, look on the site.

1 Focus on the user and all else will follow.

From its inception, Google has focused on providing the best user experience possible. While many companies claim to put their customers first, few are able to resist the temptation to make small sacrifices to increase shareholder value. Google has steadfastly refused to make any change that does not offer a benefit to the users who come to the site:

- The interface is clear and simple.
- Pages load instantly.
- Placement in search results is never sold to anyone.
- Advertising on the site must offer relevant content and not be a distraction.

2004 special logos
January 1, Happy New Year ▪
January 15, Spirit on Mars ▪
February 3, birthday of Julia Gaston ▪
February 14, Valentine's Day ▪
February 29, Leap Year ▪

By always placing the interests of the user first, Google has built the most loyal audience on the Web. And that growth has come not through TV ad campaigns, but through word of mouth from one satisfied user to another.

Sergey is self-deprecating about the design of the site, and it is true that the typography of the home page is not likely to win any awards in graphic design annuals. The most important qualities of the design derive from the focus on performance and Sergey's insistence on a simple and quiet design. There is a dramatic contrast between the open white space of the Google homepage, and the throbbing and pounding of typical pages with animated banner ads. The embellishments of the logo for special occasions also provide some charm and humor.

Sergey makes light of his initial design and talks about the importance of user testing:

> Originally I was the Web master and I designed the page, and I wasn't about to spend a lot of time on it, so I just put a search box in there, a search button, and the logo. Eventually we added a little bit of stuff about the company, but it was still quite small and compact, and we realized how powerful that was. It actually matters when you go to the homepage of a search engine: you don't want to spend a lot of time trying to find the search box. You want people to be able to come there, and right away use it for what they want. After that we made a conscious decision that we were going to take things off that page. If you look at the amount of white space, it has actually gone up over time, even over the last couple of years; we've made a number of revisions to it that have made it even lighter, less cluttered. I designed the basic logo originally, and we had a graphic designer tweak the font. The logo is one of my proudest accomplishments. The coloring was very important; the original thought behind the logo was that it was meant to be playful in terms of the coloring, but also with a 3D very solid quality to it, so that it would be both friendly and reliable.
>
> One thing I've learned over time is that it is very hard to predict what will make the designs for our products great to use, so actually we do a lot of testing. We have people come by our offices, and we have a whole test lab, where we look at them through one-way

mirrors and things like that. One of the really important things to us has always been to have our own Web site. Other companies just try to provide search services to others, but for us, having our own Web site has allowed us to have a direct interaction with users. It has allowed us to run tests, and to be able to really learn about how people use the site.

For example, we always wondered about how many search results we should display. I have my default, I always show fifty search results, so I thought, "Why would you want to have just ten?" It turned out in testing that people really wanted just ten. Sometimes your personal bias really colors your way of thinking. I don't know that we've fine-tuned it between nine, ten, or eleven, but once you're in that range, ten is a number that people deal with pretty well.

2 It's best to do one thing really, really well.

GOOGLE DOES SEARCH. GOOGLE DOES NOT DO HOROSCOPES, FINANCIAL ADVICE, OR CHAT. WITH THE LARGEST RESEARCH GROUP IN THE WORLD FOCUSED EXCLUSIVELY ON SOLVING SEARCH PROBLEMS, GOOGLE KNOWS WHAT IT DOES WELL AND HOW IT COULD BE DONE BETTER. THROUGH CONTINUED ITERATION ON DIFFICULT PROBLEMS, GOOGLE HAS BEEN ABLE TO SOLVE COMPLEX ISSUES THAT STYMIE OTHERS AND PROVIDE CONTINUOUS IMPROVEMENTS TO A SERVICE ALREADY CONSIDERED THE BEST ON THE WEB. INNOVATIONS LIKE GOOGLE'S SPELL CHECKER AND THE GOOGLE TOOLBAR, WHICH ENABLES USERS TO SEARCH USING GOOGLE FROM ANY WEBSITE, MAKE FINDING INFORMATION A FAST AND SEAMLESS EXPERIENCE FOR MILLIONS OF USERS. GOOGLE'S ENTIRE STAFF IS DEDICATED TO CREATING THE PERFECT SEARCH ENGINE AND WORK TIRELESSLY TOWARD THAT GOAL.

We all know how hard it is to be efficient and productive if we are being constantly interrupted by meetings, phone calls, or urgent emails. The culture of a development organization is often in danger of similar types of distraction at a larger scale. Think of Apple in the years when John Sculley was CEO, when there was little focus, and the development organization was creating a huge array of new products; it took the return of Steve Jobs to bring

2004 special logos
May 9, Mother's Day ■
June 8, Venus transit ■
Summer Olympics in Athens ■
September 7, Google's sixth birthday ■
September 23, Birthday of Ray Charles ■

back a cohesion and effective concentration on a narrower set of objectives. Similarly with Palm, it was Jeff Hawkins's insistence on doing a limited set of things really well on the Palm OS that led to such a successful design.

Larry and Sergey spent years relentlessly focused on the well-defined and simple goal of being the best at search. They had to accept that the perfect result is not possible every time; here they talk about how the impossibility of achieving their goal gave rise to the "I'm feeling lucky" button:

> LARRY We are trying to build a search engine that's so good that you don't even need to look at the results. It's a kind of interaction design thing, that instead of looking at the results you could go directly straight to the first result. You never even see the results; if you type Stanford you just got the Stanford homepage. It doesn't quite work yet. It's not the case that you always get the best thing first, because we're not perfect. We want to be fun about it and not over-promise, so if you click on the "I'm feeling lucky" button, that means that you think you're going to get the right thing. Most people don't necessarily know what it means, but it becomes an interesting conversation topic for people, saying, "Now here's Google. What does this 'I'm feeling lucky' button do?" It has a lot of marketing value I think.

> SERGEY It's kind of a fun thing to have on our site, but it also keeps our engineers target sights in view for what we want to do, which is to always keep the one result on top, the correct one every time. It's impossible to do this every time but you can always do it a greater percentage of the time than before; it's like Xeno's paradox, get half as close to the goal.

3 Fast is better than slow.

GOOGLE BELIEVES IN INSTANT GRATIFICATION. YOU WANT ANSWERS AND YOU WANT THEM RIGHT NOW. WHO ARE WE TO ARGUE? GOOGLE MAY BE THE ONLY COMPANY IN THE WORLD WHOSE STATED GOAL IS TO HAVE USERS LEAVE ITS WEBSITE AS QUICKLY AS POSSIBLE. BY FANATICALLY OBSESSING ON SHAVING EVERY EXCESS BIT AND BYTE FROM OUR PAGES AND INCREASING THE EFFICIENCY OF OUR SERVING

ENVIRONMENT, GOOGLE HAS BROKEN ITS OWN SPEED RECORDS TIME AND AGAIN. OTHERS ASSUMED LARGE SERVERS WERE THE FASTEST WAY TO HANDLE MASSIVE AMOUNTS OF DATA. GOOGLE FOUND THOUSANDS OF NETWORKED PCS TO BE FASTER. WHERE OTHERS ACCEPTED APPARENT SPEED LIMITS IMPOSED BY SEARCH ALGORITHMS, GOOGLE WROTE NEW ALGORITHMS THAT PROVED THERE WERE NO LIMITS. AND GOOGLE CONTINUES TO WORK ON MAKING IT ALL GO EVEN FASTER.

The search time is displayed prominently at the top of every result. For example when I type an esoteric query about a little known aluminum trailer into the search box, the header says:

Results 1–10 of about 167 for Southland Runabout Trailers. (0.29 seconds)

By contrast if I try the well-known publisher of this book, the header says:

Results 1–10 of about 5,620,000 for MIT Press. (0.16 seconds)

How amazing that both results arrive so quickly! It does make you feel that the whole world of information is at your fingertips, and it must also please the people at the MIT Press to be above the five million mark. Sergey and Larry comment on the time question:

SERGEY We measure the time from when a user has some information need until we've satisfied it. That includes going to the Google homepage, finding a search box (which is pretty easy to find on the Google homepage), actually getting the results, so that computation is pretty fast, being able to look through them and to pick one out. Obviously, having right ones there is the most important thing.

LARRY The "snippets" are another example that save the user time. The summaries that we generate are actually specific to the search. In the little two-line summaries we give you, we show you where your search terms match in the document. That requires extra work for us, but it saves you time in deciding which things to click on; actually it might even have what you are looking for in the summary itself.

2004 special logos
October 4, SpaceShipOne wins X Prize ■
October 31, Halloween ■
November 2, Vote ■
November 25, Thanksgiving ■
Season's Greetings ■

These three "truths" are serving Google well as design principles or guidelines. Larry is also interested in a future where dialogue is intrinsic to the interaction design:

> I do think that in terms of interaction, there's lots of things we can do to make Google better. Right now, if you type a query, you get back some search results, some images, or some discussion information. Potentially, there are a lot of more kinds of data that you could get. You might want to have a dialogue with the search engine, so that when you type a query, it replies, "Did you mean this, or did you mean that?" The challenge with those things is that they haven't so far been useful enough to warrant the extra communication. We have people who try all sorts of different things, and it's really hard to predict what is going to work well. Mostly it's really important to be able to try out many different things quickly. You can pretty much tell whether they go to work after you've done a simple prototype.

BBCi

THE BBCi HOMEPAGE[9] contrasts strongly with Google. The BBC is a publicly owned organization, funded by license fees that are decreed by government, so it is beholden to the general public, whereas Google is a business aiming to develop a product that will please individuals. This leads the BBC to try to maintain a strong sense of local community and social responsibility, but Google strives to design for the best results, while remaining politically and socially neutral.

The BBC has a long tradition as a media provider, so the content of their Web-based offering is inextricably intertwined with their parallel media offerings in TV and radio, and the BBC brand is dictated by the public's preconceptions of the organization. Google, on the other hand, has a razor-sharp focus, as defined in their second truth, "It's best to do one thing really, really well—Google does search."

Steve Rogers was responsible for leading the team that designed a new homepage for BBCi in 2002, and in the interview that follows, he takes us through a case study of the design development. He contrasts the priorities for a portal like BBCi with a search engine like Google:

Google has made an enormous impact. They did the same in the Internet world as Palm did in the PDA world; they looked at that whole business, which was becoming bloated and unusable, and said, "Okay, what's important about a search engine? What do I actually need this thing for? Let's strip out everything else, get rid of it!" What's important about a search engine is that it loads fast; it gets you what you want—that's it!

Three things are important about a portal like BBCi. First, you want to recognize where you are and feel comfortable; second, it should answer your needs personally, but not necessarily everyone else's in the world; and third, you want to get through it to your destination quickly.

A search engine succeeds by saying, "We don't have anything here, but we can find you everything you need."

A portal for a site like the BBC says, "We can find you exactly what you need. We think that we've probably got the answer within the BBC, so we're going to make it as easy as possible for you to get that answer. And, by the way, if you can't get that answer within the BBC, we're also going to make it as easy as possible for you to find it anywhere." This means including a search engine as an option within the portal experience.

Steve Rogers

Steve Rogers is head of production for BBC New Media and in 2002 was responsible for leading the team that designed a new homepage for BBCi. He studied transportation design, but lost interest in becoming a car stylist when he realized how narrow the specialization was. He moved into industrial design instead and found a job with Philips Electronics, where his main task was designing VCRs. This triggered a fascination with user interface design: "When you've designed fifty or a hundred video recorders, you realize there's very little wrong with the way a video recorder looks. There's one thing wrong with a video recorder: no one can use the thing!" He was able to work on enhancing the interaction by using the TV for displaying control information. His expertise in interaction design gave him the chance to set up the Philips Multi Media Center in California's Silicon Valley to look at the impact of digital media on product design. This was at the beginning of the dot-com boom, so there were a lot of exciting innovations in the air. His center hosted a stream of visitors from Philips Design, with the remit of demonstrating future technologies, for example, a portal that he developed that gave the user the chance to personalize their home page. At the height of the dot-com boom in 2000, Razorfish offered him the opportunity to lead their product development team with a goal of integrating hardware and software, but the crash came all too soon, and he was only there for one year. When the opportunity to develop BBCi came up, he welcomed it.

Steve Rogers

We wanted to create a page where users would feel at home and that they would adopt as their own homepage. It had to have character as well as appearing to respond to them: or even mould itself around them. . . . Just like a pair of shoes really.

Quote from *The Glass Wall*[10]

BBCi

■ Well-worn boots from Doc Martens

Photo
This image, and the others in this Steve Rogers interview, are taken from *The Glass Wall*, the documentary book about the BBC homepage redesign, 2002

Steve Rogers had been suffering at Razorfish during the downturn and hating the fact that his job had become one of managing the process of downsizing. He felt that he had learned a lot about the design of online services and understood the business model. He was interested in getting closer to the creation of actual content and wanted to understand where content comes from, how it is created, and how you build the stuff that drives the whole system. The BBC seemed the perfect place to do that:
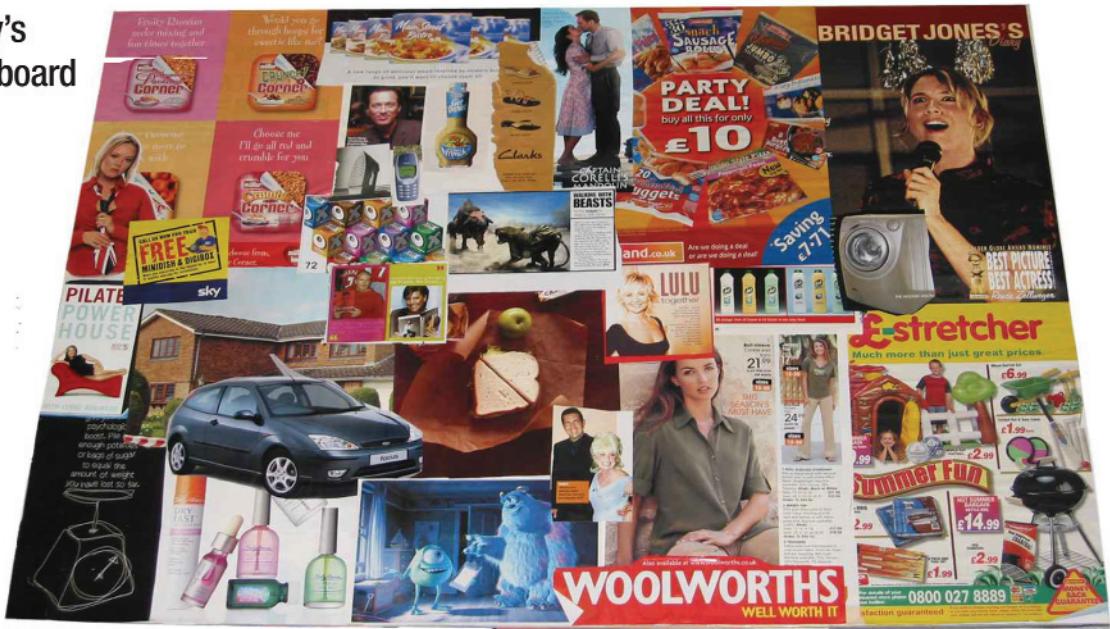
> I was phenomenally excited when someone phoned me up and said, "I'm not sure if you're interested in working for the BBC?"
>
> Given the state of Razorfish at the time, my first answer was "yes," and the second answer was "and, what is it to do?"
>
> Then to find out that the opportunity was to build and head up design navigation within BBC New Media was just a phenomenal opportunity. Fantastic!
>
> The BBC has one of the most visited, one of the most successful Internet sites in the world. It has over a million pages of content, which is just massive. One of the statements within the BBC at the moment is, "Move from monologue to dialogue." This means moving from an old world broadcast environment, where you're talking at the
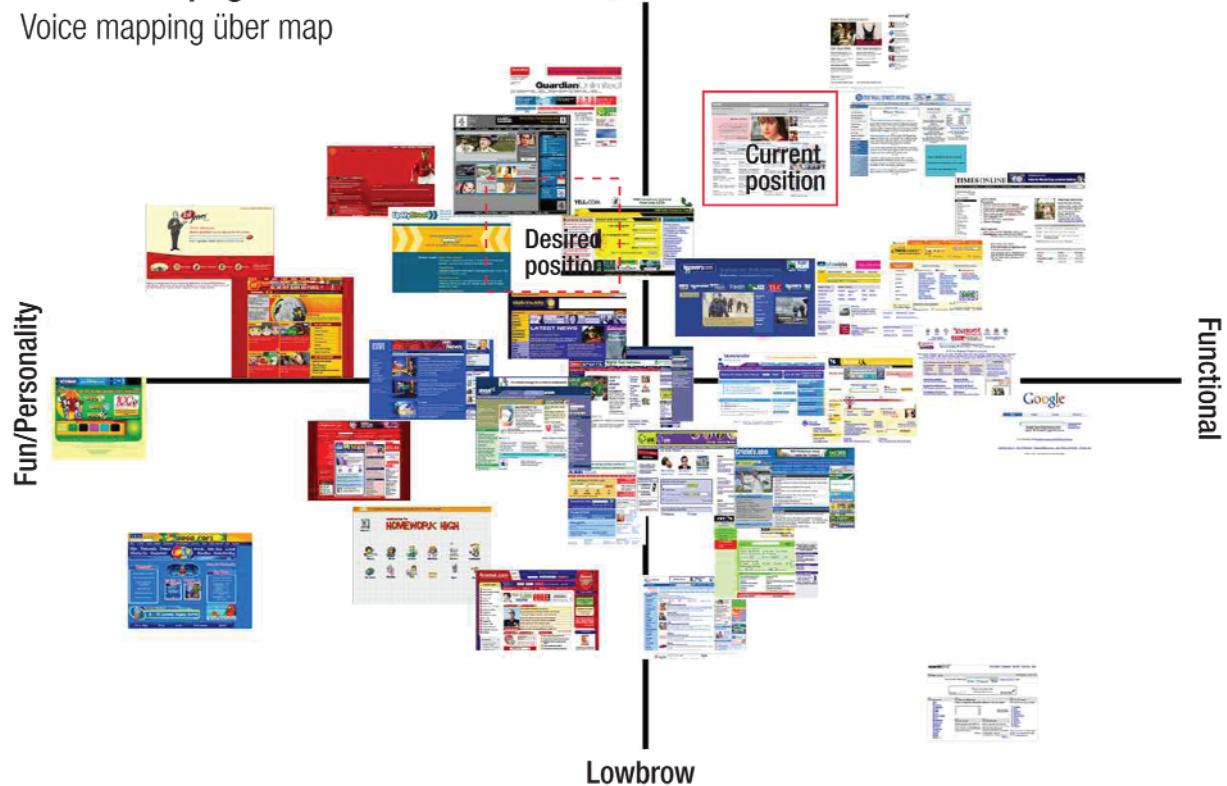
Mandy's mood board

BBCi homepage

Voice mapping über map

Highbrow

Fun/Personality

Functional

Lowbrow

Current position

Desired position

audience, to a two-way dialogue with an audience; you can really understand what people want to get from the design.

A policy goal of the BBC is to help people become engaged in the digital world, so they want to build engaging services for people who are not used to the Internet, or to any other digital media. For the design of the BBCi homepage, that means trying to make it really intuitive to explore the site, making sure that people have the opportunity to find what they want easily. It also means helping them engage in dialogue by offering a simple way to comment on something they've seen, or send an email. Live chats and message boards are offered and connected with the BBC programs, so there is more two–way traffic.

There is a popular community site called "h2g2," which is built by the audience. At the other end of the scale, "Video Nation" makes it possible for people to publish short films, diaries, and stories about their own life. The goal is to encourage dialog across the UK as a whole. Steve talks about the implications of this for interaction design:

If you are enabling interactions between people and BBCi as a service, you've got to do it in a way which people understand and actually want to engage with. One of the things that we've spent a lot of time doing is understanding our audience, understanding who it is that's likely to get involved in the sort of communities that we have. If you take a typical Web community, it's not a typical BBC Web community. A typical BBC Web community might be around gardening. It might be around antiques, all sorts of rather unusual topics for the Web. We have to visit people, talk to people, do a certain amount of ethnographic research, start to build personas, understand what those personas mean, start to live those personas. One of the luxuries we have at the BBC is that we're not reliant on advertisers to tell us what to do. That allows us to build a best practice in things like user-centered design, so if we feel it's appropriate to involve users in the process, then we really do it.

One of the things that's very key to the BBC is that it seems a safe place, so parents will allow their children to use it; so we've got to be damned sure that it really is. It's not at all easy. At the moment, almost all of our chat rooms, and certainly all the chat

The early years of BBC Online
up to 1997

Launched in 1998

Diversions

The history

The BBC homepage has been through three major changes in its life, most recently the launch of BBCi in November 2001. Along the way it has seen many ideas and concepts for new brands and radical layouts.

Run up to 2001 relaunch

One of many iterations of a new design

Diversion

One of many iterations of a new design

The 'new look' launched autumn 2001

rooms that are aimed at young people, are fully moderated, so that parents know that if their children are using a BBC chat room, there are BBC staff watching what's going on all of the time. With the more grown up chat rooms, something like gardening, we start to allow the community of the chat room to moderate itself, but still with BBC moderators looking over what's going on at regular intervals.

The Homepage

The "BBC Networking Club" was started in the mid nineties to experiment with the Internet. It created the first BBC homepage, which looked a bit like a parish magazine. Other areas of the BBC Internet, like BBC News and a lot of the entertainment sites, soon realized that the Internet is a medium worth taking seriously and moved their designs forward, but the basic navigation of the site stayed as it was. When Steve Rogers was given the chance to apply for his job at the BBC, the first thing he did was to look at the homepage.

■ The historical development of BBCi

I looked at the basic skeleton and navigation of the site, and it was atrocious; it was awful. The content was wonderful, but the site was fragmented and very difficult to get around; it had no clear voice. At the interview, when I was asked what I thought of it, I said, "It's not very good. The navigation really isn't very good, and there doesn't seem to be any focus."

Luckily, that was what they all thought too, so it was not difficult when I arrived to say, "We need to get things moving and changing very, very quickly."

The old site had four or five ways to get to the same information. It had incredibly differing ways of indicating something was a link to somewhere else. It also had a frightening amount of information. It is a tough information architecture challenge to develop a site that needs to get across as much information as a massive destination site like the BBC. If you then duplicate links three or four times, you've just made your task three or four times harder.
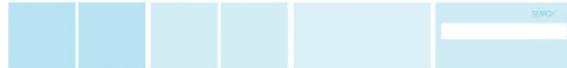
One of the first things we did was look at that and say, "Realistically, for a site this size, we need some anchor points."

TV   RADIO   COMMUNICATE   WHERE I LIVE   INDEX

TEXT ONLY VERSION
THURSDAY 15TH AUGUST 2002

SEARCH
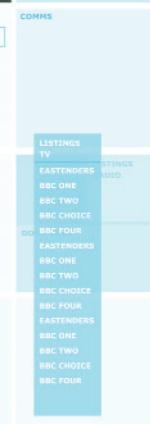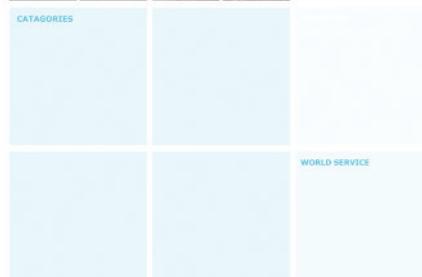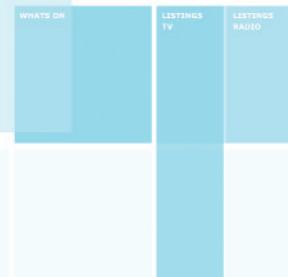
Promos Transparency

A transparent object, especially a photographic slide that is viewed by light shining through it from behind or by projection. Also trans-par-ence.
The quality or state of being transparent. through it from behind or by projection. Also trans-par-ence. The quality or state of being transparent.

NEWS

SPORT

POSTCODER

COMMS

CATAGORIES

WHATS ON

LISTINGS TV

LISTINGS RADIO

DON'T MISS

WORLD SERVICE

> We introduced a toolbar, which was effectively an anchor point for the user, so that stayed on every page on the site. We gave it a visual language that was almost like a browser or a widget, the "browser" of the BBC environment.

This global toolbar is subtly designed in neutral grey, forming a header across the top of the window. It always allows you to return to the homepage, to search for specific destinations, or to jump straight into the main categories. The enormous archive of over a million pages makes navigation difficult, so a good search capability is essential. A lot of the archive is old news, but still interesting for research, and the BBC wants to offer the British public the opportunity to access it. There is a specific archival search within news but not within the rest of the site. The search demonstrates that you are looking at UK information, thus differentiating itself from search engines like Google. So for example, if you put in "Football," you will find soccer, and if you look for Hampshire, you will find Hampshire in the UK, not New Hampshire. It also has very carefully structured parental filters built into it, so that children can search safely, and BBCi is seen as a "trusted guide." Steve uses the analogy of a pair of comfortable shoes to communicate the aesthetic values of this sense of trust.

> If you go to into a shop to buy yourself a pair of Doc Martens, they're not actually that comfortable. Once you've worn them every day for about six months or so, then they start to mold themselves to your foot, and they are comfortable. If you leave them in the cupboard for another six months or a year, then pick them up and put them on again, they're still comfortable because they are still adapted to you. One of the nice things about digital technology is you can do that same thing.
>
> We also wanted to make sure that the graphic language of the site said that it was trustworthy, said that it was professional, but at the same time was at least somewhat engaging and intimate. That's one of the reasons why the clearly dominant main promotional image at the top of the page is always a very personal image. We have a very elegant looking structure, which is then supported by a very intimate image, appealing to people's soul, to their emotions. It's very often a picture of a person, often a face close-up, or if not, it's always a very emotive image.

■ *Top*
Grid for layout of homepage

■ *Bottom*
The color of the images in the promotional material drives the color of the page

BBCi

Text only | MAKE THIS YOUR HOMEPAGE   Wednesday 20th November 2002

SEARCH THE WEB

[ ] SEARCH

◉ the Web ○ BBCi only

POPULAR SEARCHES RIGHT NOW ARE:
- bitesize
- eastenders
- fantasy football

Why search the web with BBCi?

"Sex Bomb"

That's what they're saying about Ainslie on the **message board**... but which **Fame Academy** student do you support? Have your say!

Vote to help your favourite along the road to success.

Would you like to be in the limelight? Get top tips from the professionals at **OneMusic**.

▸ NEWS   Audio | Video

- Race to contain tanker disaster
- Forces chief deals strike warning
- Cervical cancer vaccine success

News in 43 languages عربي | TÜRKÇE

▸ SPORT   Audio | Video

- England wait on Crawley
- Gabbidon out for Wales
- Broadhurst secures Tour place

▸ TV

- BBC TV schedules
- Digital TV
- A-Z of BBC programme websites

▸ RADIO

- All BBC radio
- Launch radio player
- Radio schedules

▸ WORLD SERVICE

News in 43 languages عربي | TÜRKÇE

- Arabic
- Chinese
- English
- Hindi
- Russian
- Spanish
- Urdu
- Others...

DON'T MISS

THE CHANGING FACE OF TV & RADIO

▸ WHERE I LIVE

To get information for a different location, enter a postcode or town

[ ] GO

e.g. HR4 9AR or Hereford

▸ Weather for SE5 8UT

light rain
min 7°C max 11°C

View the **5 day forecast**

Your local BBCi site:
- **London**

What's on for London: South:
Cinema, Clubs, Music, Comedy, Theatre, more...

Your BBC local radio station:
- **BBC London 94.9**
- **Schedule for BBC London 94.9**

Your local school league tables:
- **Primary schools**
- **Secondary schools and colleges**

▸ COMMUNICATE

Your thoughts, your views
From antiques to holidays and gardening, share your ideas on the **Lifestyle** message boards.

▸ BBCi DIRECTORY

A B C D E F G H I J K L M
N O P Q R S T U V W X Y Z

Business & Money
Small Business, Money, News, Programmes, Work & Careers...

Children's
CBBC: Club, Art CBeebies: Games, Stories...

Education & Learning
Schools, Colleges, Revision, Languages, Subject Listing...

Entertainment
Comedy, Drama, Films, Games, Lottery, Teens...

Health
Fitness, Healthy Living, Medical Conditions, Nutrition, Parenting...

History
Ancient History, Great Britons, Historic Figures, Pyramid, War & Conflict...

Lifestyle
Antiques, Food, Gardening, Holiday, DIY...

Music
News, Reviews, TV/ Radio, Gigs/Concerts, Listen...

News
Business, Local, UK, Weather, World...

Science & Nature
Animals, Birds, Genetics, Robots, Space...

Society & Culture
Communicate, Crime, Disability, Religion & Ethics...

Sport
Cricket, Football, Motorsport, Other Sports...

View all categories...

YOUR BBC

- Contact us
- Help
- Jobs at the BBC
- About the BBC

BBC Shop
Buy BBC products

CBeebies
Play and learn with CBeebies

Learning
BBC Learning resources for all

CBBC
Access your favourite shows

"Digital patina" is a way that the design of the homepage expresses the fact that it is adapting itself to you. This is achieved by an algorithm that selects any of the areas that are separately "cookied" on the page, and changes the intensity of the colors. The areas that you visit frequently pump up slightly in intensity, and the areas that you use less often fade a little. The effect is random, so that it is not predictable or repetitive. The result is that, after you have used the page for a while, the areas that you are most likely to be interested in become more prominent on the page without you having to do anything.

> We chose to cause the effect of "digital patina" through the gradual fading in color, because we wanted to make sure that anywhere you wanted to go was still as easy as it would anyway have been. We wanted to say, "Actually, this is somewhere that you've been to more often." At that point it really feels like your page.

This example of the design for the BBCi homepage shows how a Web portal can provide a gateway to more than one medium, helping people navigate and choose what TV to watch or radio to listen to. At the same time, it offers an adaptable quality that is uniquely facilitated by the Internet, allowing people to access local events, weather, and community, with the "digital patina" developing an appearance that reflects a pattern of personal preferences.

The example that follows, in the interview with Mark Podlaseck, also connects to media and provides personalization, but in a very different way. The site www.philipglass.com/ glassengine is designed to help you find any piece of music composed by Philip Glass that you want or need, based on attributes that you can navigate by direct manipulation, with the gratification of being able to hear what you have chosen in streaming audio. Before reading the interview, please try the "glassengine" Web site yourself.

■ BBCi homepage at launch in 2002
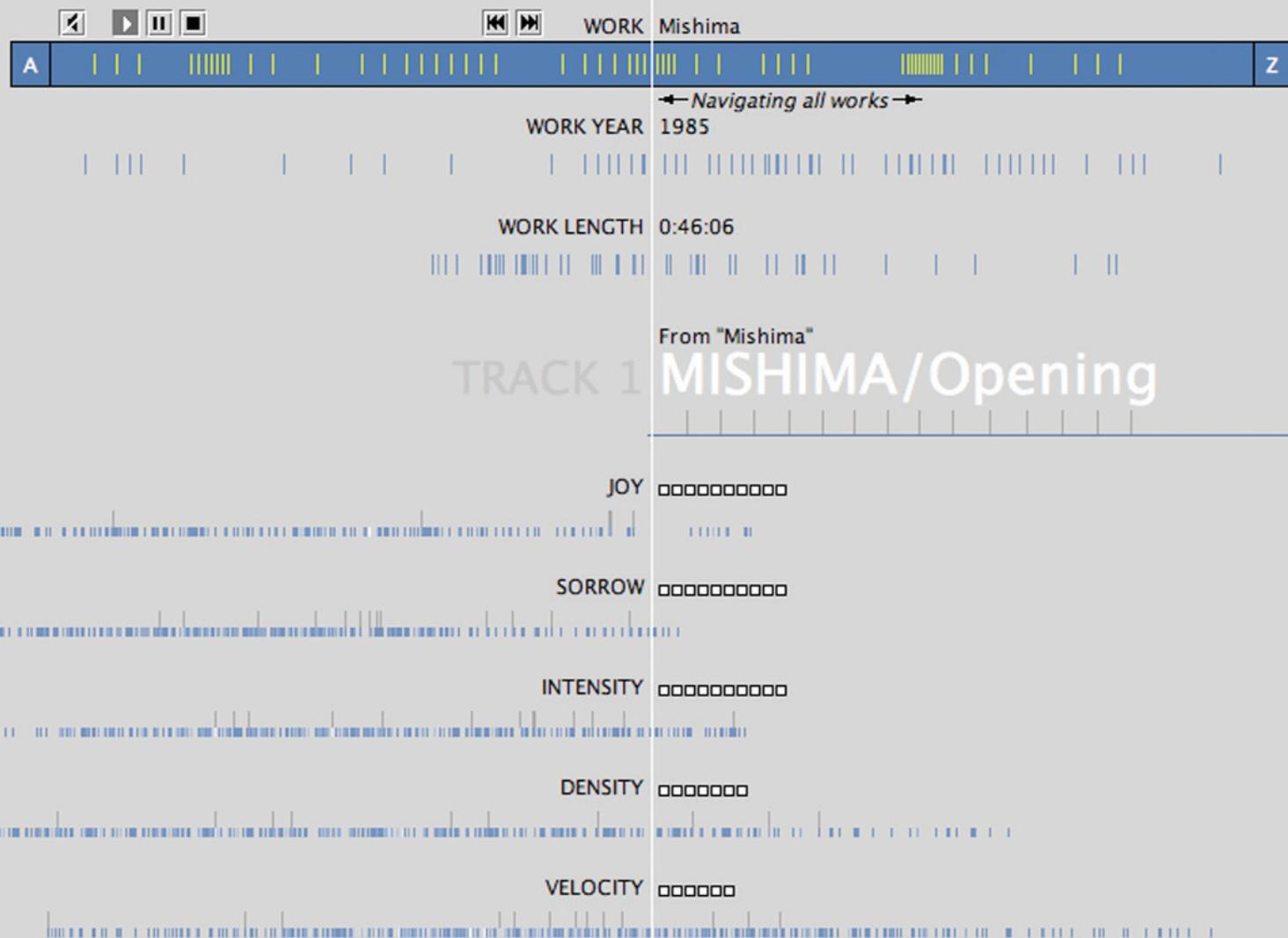
Mark Podlaseck

The design for the Glass Engine started as a skunkworks project. Philip Glass had worked with Mark Podlaseck on another project a few years before, and he decided he wanted a Web site. This was in the middle of the dot-com boom, so he asked Mark who would be a good designer for the project. They went to various agencies, but no one was willing to talk about anything less than a million-dollar project, so Mark thought, "I'll take a stab at it." Mark works at IBM's T. J. Watson Research Center, in upstate New York, and his research director was sympathetic, believing that there are a lot of large databases giving people navigational problems; a Web site for Philip Glass might offer a solution that could be generalized for access and browsing, as well as having high-profile cultural appeal. Mark originally studied English literature and then shifted to computer science. He got his first job as a system programmer for IBM in 1988 and soon transitioned into design. He was always ambivalent about whether his first love was cultural or technological in bias, so when he found himself at IBM Research working on a program to help Philip Glass, he felt that he had found his niche. The connection between composer and designer/programmer had come about five years before. Mark had brought in the set designer Robert Israel to create three dimensional and theatrical effects for a CD-ROM version of IBM's first interactive annual report. Robert was also designing sets for Philip Glass, so he made the introduction. The three of them later collaborated on a project for interactive opera called *Ghost Dance*.

FILM SCORE **Mishima**

Score for Paul Schrader's film about the life of Japanese writer Yu[...]
section.

WORK	Mishima	

A ‖ ‖ ‖ ‖ ‖‖‖‖‖ ‖ ‖ ‖ ‖ ‖‖‖‖ ‖ ‖ ‖ ‖ ‖‖‖ ‖ ‖‖ ‖ ‖ ‖ ‖ ‖ ‖ Z

←— *Navigating all works* —→

WORK YEAR 1985

WORK LENGTH 0:46:06

From "Mishima"

TRACK 1 **MISHIMA/Opening**

JOY □□□□□□□□□

SORROW □□□□□□□□□

INTENSITY □□□□□□□□□

DENSITY □□□□□□□

VELOCITY □□□□□□

Mark Podlaseck

Glass had described a musical scrollbar which people could use to navigate his works chronologically. We had jokingly referred to this as "Radio Philip Glass," but this nickname captured two important qualities: its simplicity and its fundamental quality as a listening device.

Excerpt from "This Is Not a Catalog: Philip Glass's Works Online"[11]

The Glass Engine

Try going to www.philipglass.com/glassengine. The first screen has a bold red button labeled "LAUNCH," three iconic operating instructions and two iconic "warnings," plus some text about compatibility and answers to frequently asked questions. At the bottom of the page is a request for feedback from the designer, Mark Podlaseck, with an email contact link.

■ Selecting and listening to Philip Glass's soundtrack for the film *Mishima* by its title

Click on the "LAUNCH" button, a dialogue box tells you that the program is loading, and then suddenly you are there. Philip Glass music is flooding over you, and your screen is filled with the simple and elegant browsing interface that helps you discover the range and richness of more than sixty Glass compositions. The screen is a neutral gray all over; there is no button bar, address bar, favorites bar, status bar, or links to Amazon: you are just in a magical musical place. The title tells you that the introductory sequence is the first track from *Mishima*, the score from Paul Schrader's film about the Japanese writer Yukio Mishima. It plays for just under a minute. There is a delicate white vertical cross hair in the center, and a series of horizontal bars, labeled with the attributes of the music:

Mishima

Score for Paul Schrader's film about the life of Japanese writer Yuk
section.

WORK	Mishima
WORK YEAR	1985
WORK LENGTH	0:46:06

From "Mishima"

TRACK 2 **November 25: morning**

| 1 | |

←—*Navigating tracks from Mishima*—→

JOY □

SORROW □□□□□□□

INTENSITY □□□□□□□□

DENSITY □□□□□□□

VELOCITY □□□□□□□

We had this idea of a number of spectrums that represented these various attributes, and we started looking at analog devices for navigating the spectra. First we looked at TV or radio, that nice feeling of flipping through a series of arbitrary content without having to make any decisions. Just pushing a button up or down, and something is always playing, and you stop at something you like.

It seemed like the idea of making these micro-decisions; "I don't like it, I don't like it, I do like it," was more appealing than, "I'm looking for something with these qualities," and having to de-formulate these qualities and navigate in, and then find out there's nothing with the qualities in there. It was the idea of scrubbing or surfing across a characteristic to see if there's something there you like. We give someone the full representation, "This is everything that's here; you won't find it anywhere else if it's not here. Start browsing!" The sliders give you direct control, but they are also interlinked, so that they connect to pieces of music that are composed and actually there.

Perhaps you would like to hear more of the *Mishima* work, and you notice that one of the horizontal bars indicates the tracks, so you click on it. It highlights to the darker blue, showing that it is selected, and the cursor changes to a two-way arrow. As you move across to the second track, all of the other horizontal bar indicators slide deliciously to the right or left, sorting themselves into the attributes for the new track. This one, "November 25: morning," is sad (low on the joy scale), sorrowful, intense, dense, and fast (fairly high on the velocity scale). It's interesting that several of the other tracks are high on both the joy and sorrow scales—how ambivalent these musicians are! But the music does seem to trigger both of those emotions.

■ Navigating sequentially through the tracks of *Mishima*

Navigation

ALL OF THE sliding bars contain the full selection of over sixty works by Philip Glass, and each work is represented by a vertical stripe. You can browse to choose any of the pieces based on the attribute of the sliding bar, and the sliders are linked so that they will magically move to show you the other attributes of the piece as you roll over it on the active bar. Mark explains:

> The idea was, "How do you represent a bunch of different attributes in a way that if you learn the representation of one, it works for all the rest?" The goal was to have a consistent encoding. Once you unlock the key for one, they all work in exactly the same way. It is a set of dimensions, or characteristics. In most multidimensional browsing or visualization, you start with 2D space and you say the X is here, the Y is there; now the Z is going to be the color of the space, and the ZZ is going to be the size. You end up having these different encodings for different attributes.
>
> We used an analog radio dial to explain this to people, especially the business people, to say that there's something great about it. If you're in a new city you can go to the radio and say, well I like NPR, those stations are usually at the bottom. You go to the bottom of the dial, and you don't hear anything you like. But it's not as if there's nothing left; you just keep on moving until you find something.
>
> I drew a picture of what I wanted the thing to look like. And it was a bunch of little colored bands, each one representing a piece of music, and I thought, "I like this!" As I started explaining it to people, the radio thing kicked in. The way to think of this is as a radio. That was what got people to understand it much quicker than, "This spectrum represents one characteristic, this spectrum represents another characteristic, and so on." How to navigate, and all that stuff, fell out much later.

This browsing structure works well if you are already in a category that you understand and want to roam around in a layered structure to explore qualities. Picking up on the analogy of the radio, you have already decided that you want to browse among public radio stations rather than "country" radio stations, so you choose that part of the dial. To find a good song on the

- Philip Glass
- Traditional radio dial tuner display

Web, you normally choose a category or genre first, but once you are in "country" for example, all you are allowed to do is dive deeper into another hierarchical tree of structured choices, like "bluegrass" or "hot country," and there you find a very limited list. This forces you to wade out and back in again, without the chance to browse based on different attributes.

The qualitative browsing structure that Mark has designed for Glass could be generalized for any other attributes where qualities are more relevant than categories. Choose a category first, and then explore through layered attributes.

> When we show it to IBM customers, the first comment they have is, "This is really cool for classical music, but I can't imagine using it for sleeping bags." So just recently we drew up a set of pictures to show how you can navigate sleeping bags. It is basically the exact same thing, but we used pictures of sleeping bags, and all of a sudden people said, "Oh! Now I get it." They really needed to be shown how to make the jump.
>
> The attributes of sleeping bags are the weight, the cost, the lowest temperature you can sleep in it at—those kinds of things. It shows a picture instead of playing the music. So it also has constant feedback, so you're never only in navigation land, you're always hearing or seeing the content at the same time; you're always experiencing something. Wherever you slide to you're always seeing the sleeping bag, instead of having to make a decision about, "What brand am I interested in?" or "What temperature am I interested in?" You are always looking at something.

In the case of Philip Glass, the motivation was to help people choose music to license as well as to enjoy. Glass has more than seventy works recorded, comprising over five hundred tracks. He makes some income from commissions, but his earnings come more from licensing existing pieces.
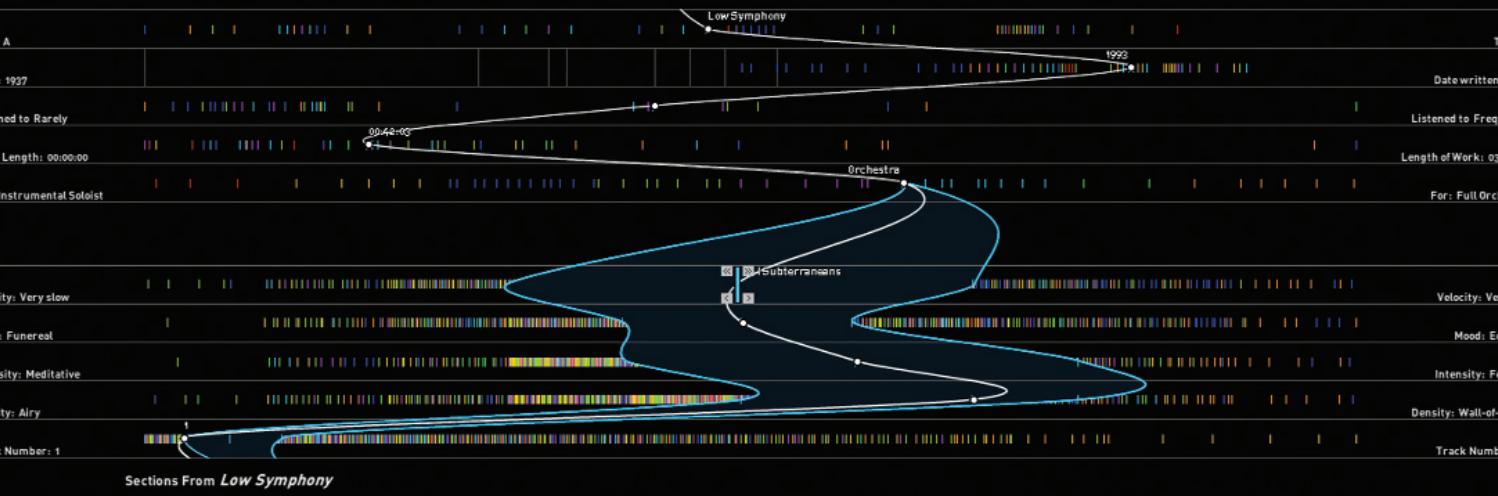
As part of his research for the design project, Mark Podlaseck sat with the people behind the licensing desk for a couple of days and heard them receive phone calls such as this: "I'm looking for something. I have this commercial that has these qualities, and I'm looking for something like this." That research helped him to decide what kind of attributes would be relevant for the Glass

Sleeping bag navigation ▪
Detail of sleeping bag attributes ▪

Low Symphony: Symphony from the music of David Bowie & Brian Eno

Low Symphony

1993

Date written

A

: 1937

ned to Rarely

Listened to Freq

Length: 00:00:00

Length of Work: 0

00:42:00

Orchestra

Instrumental Soloist

For: Full Orc

Subterraneans

ty: Very slow

Velocity: Ve

: Funereal

Mood: E

sity: Meditative

Intensity: F

ty: Airy

Density: Wall-of-

Number: 1

Track Numb

1

Sections From Low Symphony

Kundun: Soundtrack for Martin Scorsese film

Kundun

1997

Date written

A

: 1937

ned to Rarely

Listened to Freq

Length: 00:00:00

Length of Work: 0

01:00:00

Acoustic Ensemble

Instrumental Soloist

For: Full Orc

ty: Very slow

Velocity: Ve

: Funereal

Mood: E

sity: Meditative

Intensity: F

ty: Airy

Density: Wall-of-

10: Norbulingka

Number: 1

Track Numb

Sections From Kundun

PHILIP GLAS

Engine, and he also worked with Philip and his musical team to develop a list of the kinds of things people would look for.

The first design had a parallel coordinate representation of various lines crossing the dimensions, and you manipulated the line. Mark prototyped it in Shockwave and then put it in front of some users:

> When I started designing this particular project, I was designing it for myself as a listener of Philip Glass. That was my first approach; if I was at this Web site, this is what I would want. Once we had a prototype, putting it in front of people was a complete shock, because this was perfect for me, and then to see other people use it; it was like, "You IDIOT! Can't you see that you can get to the music by moving this thing?"
>
> It was extremely painful. It's funny, because most projects, if you're designing for financial analysts or something, it's not you, so it's easier to think about being in the other person's shoes. You can remove yourself because it doesn't interest you that much. But in this case, I wasn't able to achieve that kind of distance immediately, and that was the hardest part.
>
> We had a couple of reactions. One would say, "Whoa, this is very scientific!" It looked like a scientific visualization, and that was probably inappropriate to the music. The second thing was that people started navigating using the rollover technique to access the music directly. They played with the cursor and figured that each colored line represented a piece of music. I was trying to decrease the cost of commitment to zero, both for selection and listening. I assumed that if it was zero, or close to it, the information that was revealed during rollover would be superfluous. I was convinced that no one would bother to roll over pixel-wide hot spots in order to read titles like "Symphony No. 2; 3rd Movement" when they could play the same piece for half the effort! I was dead wrong about that.

Early design with attributes in fixed locations, and the line manipulated

◖ *Top*
Selecting and listening to a track from Glass's *Low Symphony* by "Velocity." In the bottom half of the screen, the line opens up to show the boundary conditions for the tracks from this symphony.

◖ *Bottom*
Navigating Glass's soundtrack for *Kundun* in the traditional manner, that is, track by track.

For the second iteration, Mark and his team solved the rollover dilemma by separating the cursor manipulation from the music, only allowing the pointer to be used for adjusting a characteristic that is interesting. When the cursor was used to select one of the horizontal adjustment bars, the normal selection pointer was replaced by a two-way arrow, indicating that the cursor could manipulate the value, instead of pointed at

WORK TITLE Compassion in Exile (Track 4: Cue 5)

WORK YEAR 1992

TRACK TITLE Cue 5 (Track 4 from Compassion in Exile)

TRACK LENGTH 0:01:48

Compassion in Exile 4. Cue 5

Score from the Micky Lemle documentary film about the 14th Dalai Lama.

JOY □□□□□□□

SORROW □□□□□□

INTENSITY □□□□□□

Low   High

DENSITY □□□□□

VELOCITY □□□□□□□

something. This breakthrough led to the elegant graphics with the horizontal bars and central hairline. Mark is very modest about the design, and is surprised that it looks good enough to be the work of a professional graphic designer. He remembers showing a version with a black background to a designer friend, who said, "It's very nice, but it needs a gray background. Simplify it." So he turned the background gray.

The earlier versions had colors representing various categories of the music, yellow for opera, red for symphonies, but that started to look fussy in the dense areas of overlap between the categories, so he decided to simplify:

> We ended up with this monochromatic thing. I think this is much more appropriate to the music, because there's so little to look at, and it allows you to focus on what you are listening to. The most satisfying designs for me are those that are paired down to the bare essentials of what is being communicated; there are no excess gestures, pictorials, or experiences. It's just completely about that thing. That to me is the ultimate pleasure—laser-sharp focus!

■ Final design: browsing by intensity. The endpoints of the bar ("Low" and "High") can be dragged to filter out, for example, all high-intensity tracks. Manipulating the endpoints on multiple bars enables complex filtering and queries like "I want to hear only the slow, melancholy, low-intensity tracks."