

## Google

## Fuzzy maths

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**In a few short years, Google has turned from a simple and popular company into a complicated and controversial one**



MATHEMATICALLY confident drivers stuck in the usual jam on highway 101 through Silicon Valley were recently able to pass time contemplating a billboard that read: “{first 10-digit prime found in consecutive digits of  $e$ }.com.” The number in question, 7427466391, is a sequence that starts at the 101st digit of  $e$ , a constant that is the base of the natural logarithm. The select few who worked this out and made it to the right website then encountered a “harder” riddle. Solving it led to another web page where they were finally invited to submit their curriculum vitae.

If a billboard can capture the soul of a company, this one did, because the anonymous advertiser was Google, whose main product is the world's most popular internet search engine. With its presumptuous humour, its mathematical obsessions, its easy, arrogant belief that it is the natural home for geniuses, the billboard spoke of a company that thinks it has taken its rightful place as the leader of the technology industry, a position occupied for the past 15 years by Microsoft.

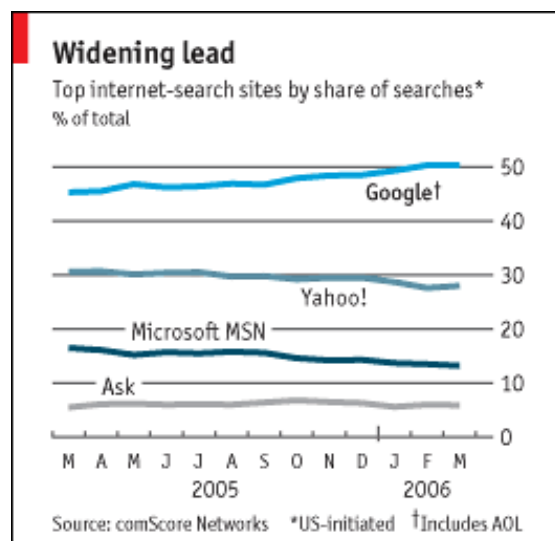
In tone, the billboard was “googley”, as the firm's employees like to say. That adjective, says one spokeswoman, evokes a “humble, cosmopolitan, different, toned-down” classiness. A good demonstration of googley-ness came in the speeches at a conference in Las Vegas this year. Whereas the bosses of other technology companies welcomed the audience into the auditorium with flashing lights and blasting rock music, Google played Bach's Brandenburg Concerto Number Three and had a thought puzzle waiting on every seat. The billboard was also googley in that, like Google's home page, it had visual simplicity that belied the sophistication of its content. To outsiders, however, googley-ness often implies audacious ambition, a missionary calling to improve the world and the equation of nerdiness with virtue.

The main symptom of this, prominently displayed on the billboard, is a deification of mathematics. Google constantly leaves numerical puns and riddles for those who care to look in the right places. When it filed the regulatory documents for its stockmarket listing in 2004, it said that it planned to raise \$2,718,281,828, which is \$e billion to the nearest dollar. A year later, it filed again to sell another batch of shares—precisely 14,159,265, which represents the first eight digits after the decimal in the number  $\pi$  (3.14159265).

The mathematics comes from the founders, Sergey Brin and Larry Page. The Russian-born Mr Brin is the son of a professor of statistics and probability and a mother who works at NASA; Mr Page is the son of two computer-science teachers. The breakthrough that made their search engine so popular was the realisation that the chaos of the internet had an implicit mathematical order. By counting, weighting and calculating the link structures between web pages, Messrs Page and Brin were able to return search results more relevant than those of any other search engine.

So far, they have maintained this superiority. Danny Sullivan, the editor of *Search Engine Watch*, an online industry newsletter, ranks Google as the best search engine, Yahoo! as second-best, Ask (the re-named Ask Jeeves) third, and Microsoft's MSN last among the big four. Google's share of searches has gone up almost every month of the past year. Including those on AOL, an internet portal that uses Google's search technology, Google had half of all searches in March. Excluding AOL, the figure was 43%. This is why people "google"—rather than, say, "yahoo"—their driving directions, dates and recipes.

Mathematical prowess is also behind the other half of Google's success: its ability to turn all those searches into money. Unlike software companies such as Microsoft which get most of their revenues from licence fees, Google is primarily an advertising agency. It does not sell the usual sort of advertising, in which an advertiser places a display on a page and pays per thousand visitor "impressions" (views): it has perfected the more efficient genre of "pay-per-click" advertising. It places little text advertisements ("sponsored links") on a page in an order determined by auction among the advertisers. But these advertisers pay only once an internet user actually clicks on their links (thereby expressing an interest in buying). This works best on the pages of search results, which account for over half of the firm's revenues, because the users' keywords allow Google to place relevant advertisements on the page. But it also works on other web pages, such as blogs or newspaper articles, that sign up to be part of Google's "network".



## The world brain

These two interlocking "engines"—the search algorithms coupled with the advertising algorithms—are the motor that powers Google's growth in revenues (\$6.1 billion last year) and profits (\$1.5 billion), as well as its \$117 billion market capitalisation. Its horsepower is the reason why Andy Bechtolsheim, Google's first investor (as well as a co-founder of Sun Microsystems, a big computer-maker) still holds on to all his shares in the firm. It's all about advertisers "bidding up the keywords" in Google's auctions, he says. "How far this thing could go, nobody can say."

Since its stockmarket debut, however, Google has been adding new and often quite different products to this twin engine. It now owns Picasa, which makes software to edit digital photos on computers; Orkut, a social-networking site popular mainly in Brazil; and Blogger, which lets people start an online journal. It also offers free software for instant-messaging and internet telephony, for searching on the desktop computers of users, for (virtually) flying around the Earth, for keeping computers free of viruses, for uploading and sharing videos, and for creating web pages. It has a free e-mail program and calendar. It recently bought a firm called Writely, which lets people create and save text documents (much as Microsoft's Word does) online rather than on their own computers. Google is

also scanning books in several large libraries to make them searchable. It is preparing to offer free wireless internet access in San Francisco and perhaps other cities, and dabbling in radio advertising. And that is only the start of a long list.

Whether these are arbitrary distractions or not depends on one's point of view. For Messrs Brin and Page, they make mathematical sense. Mr Brin ("the strategy guy") has calculated that Google's engineers should spend 70% of their time on core products (ie, the search and advertising engines), 20% on relevant but tangential products, and 10% on wild fun that might or might not lead to a product. The result is that lots of tiny teams are working on all sorts of projects, the most promising ones of which end up on the prestigious "top 100" list that Mr Page ("the product guy") spends a lot of his time on. Most of the items on that list in theory have something to do with Google's mission, which is "to organise the world's information". Scanning and indexing books, for instance, brings offline information online.

The outside world increasingly sees it differently. Among Google fans, the company has come to epitomise the more mature (ie, post-bust) internet generation, which goes by the marketing cliché "Web 2.0" (see [article](#)). In this context, it is assumed to be working on absolutely everything simultaneously, and every new product announcement, no matter how trivial, is greeted as a tiny step toward an eventual world-changing transformation.

At a minimum, this hypothetical transformation would consist of moving computation and data off people's personal computers and on to the network—ie, Google's servers. Other names for this scenario are the "GDrive" or the "Google grid" that the company is allegedly working on, meaning free (but ultimately advertising-supported) copious online storage and possibly free internet access. Free storage threatens Microsoft, because its software dominates personal computers rather than the internet; free access threatens other internet-access providers.

At a maximum, the transformation goes quite a bit further. George Dyson, a futurist who has spent time at Google, thinks that the company ultimately intends to link all these digital synapses created by its users into what H.G. Wells, a British science-fiction writer, once called the "world brain". Google, Mr Dyson thinks, wants to fulfil the geeks' dream of creating "artificial intelligence". Passing the so-called "Turing test", created by Alan Turing, a British mathematician, to determine whether a machine can be said to be able to think, would be the ultimate reward.

## From primes to share prices

But many who deal with Google in their daily lives are getting fed up with such grandiose notions. Google's shares, after nearly quintupling since they began trading, have fallen in recent months. Pip Coburn, an investment strategist, says that "Google was a simple story at one point: online ads on top of the most popular search mechanism on the planet. Simple. But now it is pretty much a mess and to get the stock going again, the company may need to work on its own simplicity so as to match the simplicity of the Google home page itself."

Mr Sullivan of *Search Engine Watch* says Google has become distracted. "Oh, give me a break," he wrote in his blog after yet another product announcement. "A break from Google going in yet another direction when there is so much stuff they haven't finished, gotten right or need to fix." He points to a rule in Google's corporate philosophy that "it's best to do one thing really, really well," and suggests that the company is "doing 100 different things rather than one thing really, really well."

Google is thus starting to look a bit as Microsoft did a decade ago, with one strength (Windows for Microsoft, search for Google) and a string of mediocre "me-too" products. Google Video, for instance, was supposed to become an online marketplace for video clips, both personal and business, but has been overtaken by [YouTube](#), a start-up that is a few months old but already has four times as much video traffic. Google News, where the stories are, characteristically, chosen by mathematical algorithms rather than by editors, perennially lags behind Yahoo! News, with its old-fashioned human touch. Google's instant-messaging software is tiny compared with AOL's, Yahoo!'s and MSN's.

Google is beginning to resemble the old Microsoft in another way, too. A decade ago, Microsoft stood accused of stifling innovation, because entrepreneurs would stay away from any area of technology in which it showed any interest. Google, whose slogan is "Don't be evil", hates this comparison and wants to think of itself as ventilating rather than stifling the ecosystem of developers and entrepreneurs. "I don't see how they can say that," says an

entrepreneur and competitor who is too afraid of unspecified consequences to speak on the record. Like most of Silicon Valley these days, he finds Google's slogan ridiculous, because "we're not evil either, we just don't go around saying it."

Entrepreneurs like him are getting annoyed by Google's seemingly endless "betas", also known as "technical previews", when new products are not yet officially launched but available, ostensibly for testing and review. Traditionally, beta reviews were meant to last weeks or months and were targeted at testers who would find and report bugs. Google seems to use betas as dogs sprinkle trees—so that rivals know where it is. Google News recently graduated out of its beta after about four years.

In fairness, Google's role today is more complex than Microsoft's was in the 1990s, when start-ups often hoped to "exit" by listing their shares on the stockmarket, and were occasionally expunged by Microsoft before they got there. Today, start-ups (such as Writely, Picasa, Orkut and Urchin) often use Google (or the other internet titans) as the exit, selling themselves to the big guy. It works for individuals too. Paul Rademacher is a software engineer who last year came up with a clever way of combining Google's interactive maps with other websites. Google hired him.

To Google's initial surprise and subsequent chagrin (is it not enough to vow never to be evil?), it alienates more groups of people as it enters more areas of modern life. It appeared to be genuinely taken aback that some book publishers oppose its plan to scan their books and make them searchable. Google also seemed surprised when privacy advocates voiced concerns over its practice of placing advertisements in contextually related e-mail messages on its webmail service, and again this year when it announced a Chinese version that censors the search results.

Slowly, the company is realising that it is so important that it may not be able to control the ramifications of its own actions. "As more and more data builds up in the company's disk farms," says Edward Felten, an expert on computer privacy at Princeton University, "the temptation to be evil only increases. Even if the company itself stays non-evil, its data trove will be a massive temptation for others to do evil." In a world of rogue employees, intruders and accidents, he says, Google could be "one or two privacy disasters away from becoming just another internet company".

Such concerns are forcing Messrs Brin and Page, still in their early 30s, and Eric Schmidt, whom they hired as chief executive and who is in his early 50s, to behave increasingly like a "normal" company. Google recently sent its first lobbyists to Washington, DC. Its decision to build an "evil scale" to help it devise its China strategy was more unusual, but its hiring of Al Gore, a former American vice-president, to aid the process, was just the kind of thing that old-fashioned empire-building firms do all the time.

Other companies are reacting in traditional ways to Google's dominance. Former rivals, such as eBay, Yahoo! and Microsoft, are exploring alliances to counter its influence. When Microsoft tried to buy AOL from its parent, Time Warner, Google's Mr Schmidt flew in for talks that led to Google taking a defensive stake in AOL, thus keeping it out of Microsoft's and Yahoo!'s reach. In response, Microsoft has contemplated buying all or part of Yahoo!, and has recently announced a vague but large increase in research spending which amounts to an arms race. Google is now alleging that Microsoft is unfairly steering users of its web browser to MSN for searches, and is preparing to dispatch lawyers to keep Microsoft in check.

Google thus finds itself at a defining moment. There are plenty of people within the company who want it to play the power game. "The folks who are closest to Larry and Sergey are very, very worried about Microsoft, as well they should be," says John Battelle, the author of a blog and a book on Google. Yet the company's founders themselves may not be prepared to drop their idealism and their faith in their own mathematical genius. They have always wanted to succeed by being good and doing good. "Never once did we consider buying a big company," says David Krane, Google's 84th employee, by way of example. It would not be googley. It would, he says, be "yuck".

**Information technology****Is Google the new Microsoft?**

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**In some ways, yes—but the differences matter more**

JUST AS human history has been shaped by the rise and fall of successive empires, so the computer industry has, in the few decades of its existence, been dominated by one large company after another. During the mainframe era, IBM wore the crown. But it fumbled the transition to smaller machines in the personal-computer era, and the throne was usurped by Microsoft. Now, at the dawn of the new era of internet services, Google is widely seen as the heir to the kingdom. As the upstart has matured into a powerful industry giant, the suggestion that “Google is the new Microsoft” has become commonplace in computing circles. Is it true?

The comparison is both a compliment and a reproach. It is a compliment because it implies that Google has now become the company that defines the environment in which other technology firms operate, just as IBM and Microsoft once did. As with Microsoft in its heyday, Google is the technology firm where the smartest geeks aspire to work; it embodies the technological zeitgeist; and it is a highly regarded company that has become a household name. But the comparison is also a reproach, because it highlights growing concern that Google is now too powerful for its own good, or that of the industry, or indeed that of the world at large.

For many people, Google provides the front door to the internet. For many online businesses, their position in its search ranking—the workings of which are a closely guarded secret—is a matter of life or death. Too much power is thus concentrated in Google's hands, say critics, including Microsoft's Bill Gates. Microsoft and other big internet firms, including eBay, Amazon and Yahoo!, are now said to be negotiating various alliances in order to provide a counterweight to the new behemoth. Smaller firms feel even more vulnerable. As soon as Google says it is moving into a particular market, small fry in that market now dart for cover, unless they are lucky enough to be acquired by Google.

It is not just a matter of business. Google irreparably damaged its reputation with the more idealistic geeks in January when it set up a censored version of its search service for Chinese users. Caving in to the Chinese government, argued Google's critics, made a mockery of its corporate motto, “don't be evil”. Having started out as nothing more than a search engine, Google's ever-greater ambitions—augmented by a range of new initiatives unveiled at its annual media day this week—now make it seem both creepy and incoherently sprawling (see [article](#)). A similar fate befell Microsoft.

**Spot the difference**

Yet there are some crucial ways in which Google differs from Microsoft. For a start, it is a far more innovative company, and its use of small, flexible teams has so far allowed it to remain innovative even as it has grown. Microsoft, in contrast, has stagnated as a result of its size and dominance. It is least innovative in the markets in which it faces the least competition—operating systems, office software and web browsers—though it is, curiously, still capable of innovating in markets in which it has strong rivals (notably video gaming).

More important, however, are the differences that suggest that Google will not be able to establish an IBM- or Microsoft-style lock on the industry. IBM's dominance was based on its ownership of the proprietary hardware and software of its mainframe computers. In the PC era hardware became a commodity and Microsoft established a lucrative monopoly centred on its proprietary operating system, Windows. But in the new era of internet services, open standards predominate, rivals are always just a click away, and there is far less scope for companies to establish a proprietary lock-in.

Try to avoid using Microsoft's software for a day, particularly if you work in an office, and you will have difficulty; but surviving a day without Google is relatively easy. It has strong competitors in all the markets in which it operates: search, online advertising, mapping, software services, and so on. Large firms such as Yahoo!, which previously farmed searches out to Google, have switched to other technologies. Google's market share in search has fallen from a high of around 80% to around 50% today. Perhaps the clearest evidence that Google's continued dominance is not inevitable is the fate of AltaVista, the former top dog in internet search. Who remembers it today?

Without a proprietary lock-in to protect its dominant position, Google will have to work hard to stay on top. And that, ultimately, is where the comparison with Microsoft breaks down. Google may be the nearest thing to the new Microsoft of the internet era, and the two companies clearly regard each other as their main rivals. But one of the best things about the internet age is that it may well not end up being dominated by a single, Microsoft-like giant at all.