ENGINE OF ILLINOIS INNOVATION

Edited by Frederick E. Hoxie
Mosaic
The First Point-and-Click Internet Browser

Jimena Canales

Point, click, and scroll. Are these natural ways of signaling, communicating, and navigating? Or are they advanced cultural techniques used to navigate our networked world? You probably point, click, and scroll while browsing the Web with Safari, Firefox, or Chrome. You may have previously used Netscape and Explorer. You might remember Mosaic—the first widely used point-and-click interface to the internet.

Before the development of Mosaic, most users could only access the internet with a command-line computer interface, usually by typing instructions after the small blinking cursor following the “unix%:” prompt. Today, your browser probably appears as an icon on the desktop of your computer or laptop. It is usually the first window you open from the operating system to access a Website on the internet. This innovative arrangement, now the standard one in most personal computers, was the product of a complex series of events and negotiations that involved the University of Illinois, federal officials, private investors, lawyers, students, and computer programmers. At some point in 1994, it seemed like computers and the internet might abandon its democratic roots and move in an entirely different direction.

Interfaces are strange entities. In one sense, they are quite new. The modern meaning of the word “interface,” referring to “a means or place of interaction between two systems,” dates only as back as the 1960s and is tightly connected to the increase use of computers. But in another sense, interfaces have always been around. Handles, knobs, keys, windows, and screens we routinely use to
step into or peer into different worlds can be considered interfaces. Through them, we can gain access to a portal, cross a threshold, or simply peer into a different space while at a safe distance. Often, interfaces are the places were “flesh meets metal” but their benefits reside in removing any sense of contact so that interactions are as seamless as possible. Interfaces are generally overlooked: a good one is defined by its very unobtrusiveness (its user-friendly quality). Although interactions through interfaces have long played prominent roles in fairytales and myths, it is only recently that contemporary scholars have started to focus on them in order to fully understand social and material relations around us. Why?

Interfaces are often needed to begin an action. We employ them to set off a chain of related effects somewhere else. Through them we feel like free agents, as subjects exercising our wills. Interfaces stand guard at the door of history, permitting us to boldly venture into the future or to hold back if we do not dare. Consequences follow. Interfaces can transform minor movements (left or right, up or down, open or close, click or unclick) into decisive actions. But they are also what make us feel less free. In his analysis of film, the philosopher Stanley Cavell described watching the movies as a predominantly masochistic pastime because of how we permit others to live life for us. In comparison, trolling and so-called “click activism” appear to have a uniquely sadistic component.

In fairy tales, interfaces appear at key turning points in the storyline, when seemingly minor actions can lead to entrapment or liberation. The spell is broken only after we smash the glass, spill the potion, or look behind the curtain. Today we can shut down the browser and admire the http code traffic. We can see every request and response taking place between our computers and many others.

What are the origins of this innovation? Who invented Mosaic? Marc Andreessen, a computer science undergraduate at the University of Illinois is generally acknowledged as “author of the Mosaic Web browser.” This attribution is hardly controversial. Standard accounts of Andreessen’s invention were detailed in numerous publications ever since the new browser emerged as the “hot product” of the 1990s. But back then, attributions of the invention of Mosaic to a single individual were also understood as a commercial strategy, essential for the task of transforming innovative software into a successful business product. The National Science Foundation (NSF), the European Organization for Nuclear Research (CERN), the National Center for Supercomputing Applications (NCSA), and the University of Illinois all played critical roles in the Mosaic story.

In December 1993 the New York Times introduced Mosaic to the world with an article that made no mention of Andreessen. Instead, the news identified NCSA director Larry Smarr, project coordinator Joe Hardin, and their team as responsible for offering a powerful new software for free. A year later (1994) computer programmer Eric Bina was inducted to the Hall of Fame at the WWW (World Wide Web) Awards ceremony as the person who “wrote most of the code for Mosaic.” GQ magazine even labeled Andreessen as an imposter. If Andreessen was not the inventor of Mosaic, then who was?
It was a tool that “gives the Internet what the Macintosh gave the personal computer: a navigation system that can be understood at a glance by anybody who can point and click a mouse.”

Its use was exploding. The first “academic” prototype had attracted more than 3 million users in 1993. Back then, nobody was making any money from it—yet.

The Silicon Valley entrepreneur and venture capitalist Jim Clark saw an opportunity. How could he transform a freely available product created by a group of individuals working for public institutions into a commodity that a private corporation could sell? The University of Illinois asked him to pay a licensing fee. After all, the program had been produced as part of a campus project. Clark refused. What if Clark could argue that the product was not the university’s in the first place? The Bayh-Dole Act (1980) had only recently changed the rules of the game with regard to intellectual property rights from federally funded projects at universities. The law spelled out how universities could profit from inventions they had sponsored. Would this legal provision apply to a widely shared computer code that could be easily copied, pasted, and even rewritten?

The arguments that soon erupted were delicate ones: the funding for the project that created Mosaic at Illinois had come from NSF grants. But did NSF own this new product? Did Illinois? Did anyone? These questions became more complex when it became apparent that, as a student working on the project, Andreessen had simply “looked around the Internet and discovered that he didn’t have to start from scratch.” Insiders knew that he had used “an existing code base available from CERN,” which “meant that his work could progress very quickly.”

He had made $6.85 an hour working at the university, he had just received his degree, and he was looking for an opportunity. He was more than happy to talk to Clark.

The invention and ownership of Mosaic quickly became an intellectual-property issue. Clark moved fast. From a temporary office at the University Inn, he interviewed and hired students who had worked on Mosaic and organized them into a new company named Mosaic Communications Corporation.

Smarr, who managed hundreds of employees and projects as director of the National Center
for Supercomputing Applications (NCSA), and who considered Clark a friend and supporter of the university, was shocked. Clark was raiding his center. Clark viewed the situation quite differently: he was merely hiring recent graduates. Students (and Smarr) should be grateful.\textsuperscript{17} Hard feelings spread rapidly across the Urbana-Champaign campus, even reaching the programmers’ hangout at Espresso Royale coffee shop, “where late-night brainstorming sessions had first shaped the software that would transform the computer world.”\textsuperscript{18}

Tensions came to a head at the Second World Wide Web conference (October 1994), where participants witnessed a “family feud” in which Smarr publicly chastised “people who take and don’t give back to the community.”\textsuperscript{19} Twenty companies were paying a licensing fee for it. Ten million copies of NCSA Mosaic had already been licensed, but Clark did not like the terms offered to him.\textsuperscript{20} When Andreessen and his team “tried to attend the conference press briefing, an NCSA spokesman blocked the door and refused to admit them because they weren’t official vendors.”\textsuperscript{21}

What is in a name? After seeing that the University of Illinois was considering “potential legal moves” against Mosaic Communications, Clark struck the first blow.\textsuperscript{22} He sued the University of Illinois in U.S. District Court in San Jose, California. His legal team argued that “NCSA was a fumbling, short-sighted organization that wasn’t sure what Marc had created, and where it fit inside their organization.”\textsuperscript{23} Clark promoted Andreessen as boy genius and managed his public persona to reinforce his lawsuit.\textsuperscript{24} The former student’s university colleagues were not pleased. Andreessen soon quickly “drew resentment from insiders after articles credited him with the original idea.”\textsuperscript{25}

The attacks on Andreessen backfired. The University of Illinois eventually won back the name “Mosaic” and was awarded $2.7 million in settlement payments. Clark’s Mosaic Communications Corporation was ordered to rewrite the code for their browser. Clark was unfazed. He announced that this rewrite “was relatively easy to do because it [the original] was done by a bunch of amateur students.”\textsuperscript{26} The company also had to find a new name for itself and for its browser. They agreed on Netscape. (It had originally been “code-named Mozilla—a monster to destroy Mosaic.”)\textsuperscript{27} The Illinois alumnus was now alienated from his alma mater: “You go to school, you do research, you leave and they try to cripple your business—is this the way you want to be treated?” Andreessen asked right after the settlement. “Had I known this would happen, I would have gone to Stanford,” he concluded.\textsuperscript{28}

For Profit or Against?

The line between innovation and grand theft started to blur. The two Janus sides of science, one where it is meant to serve the public good, the other where it is used for profit and for the benefit of the few, once again competed. The philosophy of Clark and Andreessen clashed starkly against that of Tim Berners-Lee, the English computer scientist who is generally acknowledged as the inventor of the World Wide Web at CERN. Berners-Lee had dreamed of an open world of shared knowledge instead of profitability. But as in every good drama, the two opposing parties needed each other. The Web needed a browser just as much as a browser needed the Web: “The combination of Tim Berners-Lee’s Web protocols, which provided connectivity, and Marc Andreessen’s browser, which provided a great interface, proved explosive. In twenty-four months, the Web has gone from being unknown to absolutely ubiquitous.”\textsuperscript{29} Users quickly noticed that “there are two ages of the Internet—before Mosaic, and after.” With both, the growth of the internet seemed unstoppable: “Last year there were a handful of these Mosaic ‘sites’; today [1993] there are more than 10,000, including such blatantly commercial ventures as the California Yellow Pages and the Internet Shopping Network.”\textsuperscript{30}

Fights over the ownership of the Mosaic invention quickly became intertwined with the fight over the history of Mosaic.\textsuperscript{22} The line between innovation and grand theft started to blur. The two Janus sides of science, one where it is meant to serve the public good, the other where it is used for profit and for the benefit of the few, once again competed. The philosophy of Clark and Andreessen clashed starkly against that of Tim Berners-Lee, the English computer scientist who is generally acknowledged as the inventor of the World Wide Web at CERN. Berners-Lee had dreamed of an open world of shared knowledge instead of profitability. But as in every good drama, the two opposing parties needed each other. The Web needed a browser just as much as a browser needed the Web: “The combination of Tim Berners-Lee’s Web protocols, which provided connectivity, and Marc Andreessen’s browser, which provided a great interface, proved explosive. In twenty-four months, the Web has gone from being unknown to absolutely ubiquitous.”\textsuperscript{29} Users quickly noticed that “there are two ages of the Internet—before Mosaic, and after.” With both, the growth of the internet seemed unstoppable: “Last year there were a handful of these Mosaic ‘sites’; today [1993] there are more than 10,000, including such blatantly commercial ventures as the California Yellow Pages and the Internet Shopping Network.”\textsuperscript{30}
still a student working at the University of Illinois.” Clark’s genius, in turn, was due to “recognizing the vast potential of what Andreessen had created.” While he described Andreessen as the “young pioneer,” other collaborators were relegated to the role of “engineers who worked with Andreessen.” Clark and Andreessen were a Batman-and-Robin “one-of-a-kind team . . . enthusiastic and driven on the one hand, experienced and industry savvy on the other.” At the height of the first dot-com bubble and right before its impending crash, Netscape was bought for $4.2 billion by AOL (America Online). It was one of the first companies to go public without ever making money.

Enter Microsoft

In August 1994 the university, eager to make money from projects originally supported by NSF, reached an agreement with Spyglass Inc. to become their licensing agent for Mosaic. Spyglass had been created by the university to commercialize innovations created on campus, and several Spyglass engineers were students at UIUC. Profits soon exploded: “It appeared that Spyglass had struck gold with Mosaic.” At the end of 1994 Microsoft bought a license for $2 million for the rights to include Mosaic-based technology in its new Internet Explorer product that would soon be included in the Windows 95 operating system. And the bonanza only increased, as “by the end of 1995, the company was pulling down $20 millions annually in licensing revenue alone.”

In times of war, coding can be used to foster or prevent our ability to comprehend, navigate, and conquer desired territory. When the Russians invaded Czechoslovakia in 1968 they found it impossible to use their maps because resistance fighters had torn the road signs from their posts along the highways. Computer codes can be manipulated in similar ways. What if Mosaic could be adapted to permit only certain computers access to the internet and to specific regions of it, but not to others? When the leaders of Netscape saw that Bill Gates appeared to be lining up with Spyglass and the university, it tried a different strategy. A browser could defend itself from the competition by choosing which network extensions would catch on. Competing browsers would be unable to read sites created with different, incompatible specifications. Clark and Andreessen started creating an alternative to the HTML markup language developed by Berners-Lee and used by most of internet. They also started convincing some of the most popular content providers to switch to their standard. If their strategy worked, then Netscape’s edge would reside in its capacity to read these vendor-specific Web pages, while Mosaic and Explorer would not. The university and Microsoft would be stuck with useless maps like Russian tank commanders had back in Czechoslovakia. The result would be what Clark had wanted all along: “The Net on the Net.” If it became dominant enough, Andreessen and Clark’s browser could theoretically have an effect on which underlying operating systems clients would choose. It could even make operating systems completely obsolete. Microsoft could be vulnerable.

Barners-Lee and many others were horrified by the idea that access to particular sites and areas of the internet would be potentially cut off and that users would see only what their browsers allowed them to access. He left CERN to found the World Wide Web consortium (W3C) to ensure the long-term growth of the Web. In response to the development of unique proprietary standards by Netscape and others, it placed its weight on a Netscape-incompatible HTML standard for its 4.0 version. Berners-Lee and his colleagues managed to gain an advantage. Netscape was forced to retreat and rewrite its codes. Its attempt to privatize the Web had failed.

Eventually, Microsoft pulled the plug on Spyglass, Netscape, and others by giving away Explorer for free. Spyglass started losing money by the millions. The period that has come to be known as the “Browser Wars” came to a rapid end. (Although Spyglass suffered at the client side of its business, the server side continued to grow apace. The company licensed commercial Web servers to Oracle, and in 2000 it was acquired by OpenTV for $2.5...
billion.) As most of the world adopted the HTML standards backed by the W3C, Netscape made its remaining technology available as an open-source product by giving its code to the community-based, not-for-profit Mozilla Foundation, now creators of Firefox.35

Was Netscape Communications Corporation doomed now that browsers were practically free? Clark and Andreessen had sold before the boom went bust, and they were feeling optimistic that the government would intervene against Microsoft’s growing dominance. Netscape was one of many plaintiffs in the U.S. antitrust case brought against it in 1998 for monopolistic practices. The antitrust suit significantly curtailed Microsoft tentacles, opening the door to many other smaller startups. Clark moved on to develop other software ventures. Andreessen has sat on the board of directors of Facebook and eBay and has invested in Twitter, Pinterest, Foursquare, and Skype. As a prominent Silicon Valley venture capitalist, he knows who he is looking for. A 2015 article in the New Yorker reported that Andreessen declared, “We are not funding Mother Teresa . . . we’re funding imperial, will-to-power people who want to crush their competition.”36

The Map (Browser) and the Territory (the Web)

What, then, is Mosaic? Is it a tool? Is it a map? Its developers and users have consistently described it in those terms. It is a “navigational tool for the emerging data highway” and “a map to the buried treasures of the Information Age.”37 Mosaic’s salesmen understood it in terms of “the ages-old Problem of Navigation,” drawing, in particular, inspiration from Zadok Cramer’s The Navigator (1802), the field guide that had helped open up the American West to European exploration.38 But Mosaic was much more than a map, a tool, or even a technology (in the usual sense of these words).39 Mosaic was a world-making software that turned the dream of the internet into a reality.

When we say we just found something “on” the Web, it is as if it were a stable, concrete thing, not unlike a table “on” which we find other things. But what gives the Web this thingness?40 In part, it is the browser that permits us to see it that way, because we understand it as a mere interface to something else. Mosaic was the first successful browser used to access a system of networked computers, one so successful that most users were unconcerned with the essential role it played in producing the internet as a concrete reality. A look behind the scenes reveals otherwise: the success of the Web as we now know it hinged on complex negotiations that extended far beyond the lines of code that constituted Mosaic as a software product. That all of these elements disappeared so readily from view was a testament of how useful it was—so much so that it shows, by its very unobtrusiveness, how our contemporary point-and-click existence came to be.

Notes

2. For a critique of the teleological and “Whig” aspects of most work on the history of the internet see Campbell-Kelly and Garcia-Swartz, “History of the Internet.”
9. Ibid.
11. Because of the stipulations connected to its funding, the NCSA was obliged to make its research available “for academic, research and internal business purposes only.” Dougherty and Koman, Mosaic Handbook, 13.
17. Ibid.
18. Ibid.
20. Clark explained why he did not want to buy a license: “The university wanted us to take a license, but they didn’t have a reasonable license to offer us. They wanted us to pay an ongoing per-copy royalty. And I said, ‘Look, we’re not going to do that, our business model won’t allow that.’ I didn’t tell them, but we had intended to allow people to download it, and they were going to charge me.” Nee, “Jim Clark.”
21. Crawley, “University of Illinois Moves to Enforce.”
22. Ibid.
23. Dougherty and Koman, Mosaic Handbook, 13. But the role played by NCSA was not so easily dismissed, as it had hired many other students to develop Windows and Mac versions.
25. Andreessen’s supervisor, Ping Fu (3D graphics expert who had studied at UIUC on a doctoral assistantship from Bell Labs), claimed it was her idea to incorporate graphics into the browser. Dave Thompson, a key programmer, was sidelined, as was Rob McCool. Another student (Chris Wilson) took Mosaic with him to Seattle and eventually partnered with CompuServe and later Microsoft. CompuServe’s Spry/Internet Division created and trademarked “Mosaic in a Box” and “Internet in a Box.” “The project coordinator, Joseph Hardin, however, said the idea arose ‘organically’ from discussions among Andreessen, Bina and another NCSA programmer, Dave Thompson, as well as key managers, including Ping Fu, Andreessen’s supervisor. Fu herself recalls suggesting the idea of a graphical browser to Andreessen.” Andrews, “Profit without Honor.”
29. Mark Pesce, “A Brief History of Cyberspace,” ZDNet, October 15, 1995. Mosaic’s main benefit was how it provided access to the World Wide Web, but it also incorporated content found via FTP, Gopher, and WAIS.
31. “Your Window to the Internet.”
32. Tim Krauskopf was co-founder, Chief Technical Officer and Vice President of Research and Development for Spyglass. Chris Nerney, “The Up and Coming: Get to Know Five Companies That Could Shake Up the NW200 in Years to Come,” Network World, April 20, 1998, 60.
34. “Your Window to the Internet.”
35. Rosenberg, Open Source.
36. Quoted in Friend, “Tomorrow’s Advance Man.”
38. Dougherty and Koman, Mosaic Handbook, 42.

Sources
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