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Prototype

Fred Turner

Silicon Valley is a land of prototypes. From cramped, backroom start-ups to the glass-walled cubicle farms of Apple and Oracle, engineers labor day and night to produce working models of new software and new devices on which to run it. These prototypes need not function especially well; they need function hardly at all. What they have to do is make a possible future visible. With a prototype in hand, a project ceases to be a pipe dream. It becomes something an engineer, a manager, and a marketing team can get behind.

But this is only one kind of prototype, and in many ways it's the easiest to describe. Silicon Valley produces others, sometimes alongside software and hardware, in the stories salesmen tell about their products, and sometimes well away from the digital factory floor, in the lives that engineers and their colleagues lead. When salesmen pitch a new iPhone or, say, new software for mapping your local neighborhood, they often also pitch a new vision of the social world. Their devices Will Change Human History For The Better—and you can glimpse the changes to come right there, these hucksters suggest, in the stories they tell. As they enter the marketplace, the technology-centered worlds these storytellers have talked into being become models for society at large. Likewise, when engineers and their colleagues gather at festivals like Burning Man, or even when they huddle in the tiny, underfinanced, hyperflexible teams that drive start-up development, they engage in modeling and testing new forms of social organization, often self-consciously. Like the constellations of people and machines described in marketing campaigns, these modes of gathering have technologies at their center, but they are also prototypes in their own right—of an idealized form of society.

These *social* prototypes present a puzzle for those who take *prototype* to be a digital keyword: How is it that a term so closely wedded to engineering practice should also be so clearly applicable to the nontechnical social world? Much of the answer depends on the work of hardware and software engineers, who have exported their modes of thinking and working far beyond the confines of Silicon Valley. But much also depends on the peculiarly American context in which these engineers work. In the United States, the concept of the “prototype” has a dual history. It is rooted in engineering practice, but it is also rooted in Protestant and especially Puritan theology. Few if any Silicon Valley engineers would call themselves Puritans, of course. But by briefly tracing these two traditions, I hope to show how a region long thought to depend on a uniquely Californian ideology has in fact anchored its work in some of the deepest harbors of America’s capitalist mythos.¹ In the process, I hope not only to excavate the history of the term *prototype* but, through it, to begin to explain how and why Silicon Valley has itself become a model metropolis in the minds of many around the world.

The Prototype in Software Engineering

Within the world of software and computer engineering, the prototype is a relatively new arrival. In other industries, three-dimensional models of forthcoming products have been the norm for generations. Architects have long built scale models of houses, for instance, just as ship-makers have built scale models of their vessels. These models give three-dimensional life to measurements first defined on a blueprint, just as the blueprint gives two-dimensional form to ideas that emerged in conversations between the architect, the ship-maker, and their clients. For industries such as these, prototypes have long constituted an ordinary link in a chain of activities by which ideas become defined, modeled, and built.

Until the late 1980s, most software architects approached a new project simply by attempting to define its features on paper in something called a “requirements document.”² Many still do today. One technical writer describes the process thus: “Take a 60-page

requirements document. Bring 15 people into a room. Hand it out. Let them all read it."³ This process has a number of advantages. First, such documentation produces very precise specifications in a language that all developers can understand. Second, the document can be edited as the project evolves. Third, because it lives on paper and usually in a binder somewhere in an office, the continuously updated requirements document can serve as a repository, a passive reminder of what the team has agreed to do.

Unfortunately, requirements documents can also leave developers unable to see their work whole. After handing out a large requirements document and letting everyone read it, the technical writer above says, "Now ask them what you're building. You're going to get 15 different answers." Requirements documents can confuse developers as well as inform them. They can also leave out users. Developers routinely talk with their clients before drafting requirements documentation, but they often discover that users' actual needs change as systems come online. Translating these changes into the requirements documents and then back again into the product can be complicated and time-consuming. Finally, diagrams do little to help systems developers and clients create a shared language in which to discuss these changes.⁴

Enter the prototype. In a 1990 manual for developers entitled *Prototyping*, Roland Vonk argued that building a working if buggy software system could transform the requirements definition phase of system development. The prototype could become an object, like an architect's model, around which engineers and clients could gather and through which they could articulate their needs to one another. It would speed development, improve communication, and help all parties arrive at a better definition of requirements for the system.

It would also be fun. "Prototypes encourage play," wrote one developer.⁵ In the process, they also allow various stakeholders to make an emotional investment in the future suggested by the model at hand. Being by definition incomplete, prototypes encourage stakeholders to work at completing the object. Playing with prototypes helps stakeholders not only imagine, but, to a limited degree, act out the future the prototype exemplifies. The experimental aspect of prototypes also renders the projects they represent

especially available to the kinds of performances and stories out of which marketing campaigns are made. Consider this brief account, penned by the designer of a computer joystick:

Our first prototypes gave [the client firm] Novint and its investors a first peek at what was an exciting, yet nascent, concept. We started with sexy prototypes (we call them *appearance models*) that captured a vision for what the product might become down the road. By sexy, I mean models in translucent white plastic and stainless steel that took their cues from the special effects found in science fiction movies that gamers enjoy. This created a target for what the final product could be and also helped the company build investor enthusiasm around the product idea.

With . . . our first prototypes in hand, Novint could create a narrative about where it was headed with this product. It was a story that now had some tangible components and emotional appeal, thanks to the physical models prototyped by [our] designers. That was a promising start.⁶

As Lucy Suchman and others have pointed out, information technologies represent "socio-material configurations, aligned into more or less durable forms."⁷ Prototypes represent sites at which those configurations come into being. Prototypes simultaneously make visible technical possibilities and actively convene new circumstances. These stakeholders can help bring the technology to market, but they also represent new social possibilities in their own right. The pattern in which they've gathered can itself become a model for future gatherings, within and even beyond the industry in question.

Daniel Kreiss has put this point succinctly: "While most of the literature on prototypes focuses on small-scale artifacts and research labs, there is no theoretical reason why prototypes do not also exist at the field level."⁸ Kreiss has tracked the use of what he calls "prototype campaigns" across several presidential voting cycles. In a 2013 paper for *Culture Digitally*, he explored two: the Howard Dean and Barack Obama campaigns of 2004.⁹ The Dean campaign took exceptional advantage of digital technologies. It recruited leading

consultants and computer scientists, built powerful databases of voters, and established a visible web presence. Dean staffers called their work an “open-source” campaign. In the process, as Kreiss explains, they not only aligned various stakeholders around computers and data; they also turned their use of computers and data into evidence that they belonged at the center of a much larger cultural story. Through that story, they claimed the kind of cultural centrality and national legitimacy that most outsider candidates can only dream of.

When the Dean campaign imploded, the Obama campaign was only too happy to adopt key members of his technology team and to claim that Obama too was running a bottom-up, technology-enabled campaign. As Kreiss has shown, they were not. On the contrary, the Obama campaign used computers to centralize and manage the same kinds of data and power on which elections have always depended.¹⁰ But as a symbol, the Obama campaign seemed to model a world emerging simultaneously in the computer industry, a world that Americans could imagine would be open, networked, individualistic, and free.

Change by Design

There is a tension here between the sense of the campaign itself as a prototype and its depiction as a prototype. In Suchman’s account, information technologies generate social arrangements. In Kreiss’s, the sociotechnical arrangements of campaigns become elements of stories that in turn legitimate future actions. For the designers of the Novint joystick, prototypes play both roles. Taken together, these three accounts remind us that the material, technical, and organizational elements of prototypes are always also potentially symbolic. Advocates within an engineering firm or a political campaign can turn them into stories. Outsiders such as journalists can also take them up and turn them into the elements of national or even globe-traveling narratives. In each case, particular socio-technical configurations become available as potential visions of a larger and presumably better way of organizing society as a whole. Within Silicon Valley, there are a host of organizations devoted to identifying and promulgating promising social prototypes.

These include futurist outfits, research firms, and venture capitalists, among many others. Few firms transform engineering prototypes into social prototypes more self-consciously or more visibly than the Palo Alto-based design firm IDEO. Founded in 1978, the firm applies what it calls “design thinking” to every aspect of its client organizations, including individual products and brands, as well as software development, communication strategy, and organizational structure. For any given product, the firm can coordinate every aspect of the prototyping process at the engineering level; at the same time, it can link the devices and processes that emerge to new kinds of stories.

To get a feel for how IDEO transforms engineering prototypes into social prototypes, one need only consult CEO and president Tim Brown’s 2009 book, *Change by Design: How Design Thinking Transforms Organizations and Inspires Innovations*. Part business how-to, part advertisement for IDEO, the book outlines the firm’s philosophy of “design thinking” and shows how it has worked in a variety of specific cases. Within design thinking, prototyping occupies two places. The first would be easy for most anyone in Silicon Valley to recognize as an ordinary part of manufacturing. Prototyping stands as the opposite of “specification-led, planning-driven abstract thinking.”¹¹ IDEO founder David Kelly calls it “thinking with your hands.”¹² As Tim Brown points out, prototyping can be cheaper and faster than simply drawing diagrams, and it can engage users in shaping products as they emerge. Brown also argues that to enable prototypes to have real impact, designers need to embed them in stories. These “plausible fictions,” says Brown, help designers keep their end users in mind and help potential customers, within and outside the firm, imagine what they might do with the objects and processes being prototyped.¹³

Thus far, Brown’s discussion of prototypes echoes conversations in most any prototype-oriented engineering space. But toward the end of his book, Brown takes a millenarian turn. “We are in the midst of an epochal shift in the balance of power,” he argues. Corporations have turned from producing goods to producing services and experiences. Customers have become something more than mere buyers. According to Brown, they have become collaborators, coconstructors of the product-experiences they acquire. Last

the reader imagine this to be a purely commercial transformation, Brown argues that “what is emerging is nothing less than a new social contract”—a contract so revolutionary that it could save the planet: “Left to its own, the vicious circle of design-manufacture-marketing-consumption will exhaust itself and Spaceship Earth will run out of fuel. With the active participation of people at every level, we may just be able to extend this journey for a while longer.”¹⁴

The notion that consumer choice and political choice can be fused, and that, together, they can save humanity from itself, has haunted the marketing of digital media for more than twenty years. But there is more than marketing at stake in *Change by Design*. For Brown, prototyping has become a way to transform the local, everyday work of engineering into a mode of personal spiritual development. “Above all, think of life as a prototype,” writes Brown:

We can conduct experiments, make discoveries, and change our perspectives. We can look for opportunities to turn processes into projects that have tangible outcomes. We can learn how to take joy in the things we create whether they take the form of a fleeting experience or an heirloom that will last for generations. We can learn that reward comes in creation and re-creation, not just in the consumption of the world around us. Active participation in the process of creation is our right and our privilege. We can learn to measure the success of our ideas not by our bank accounts but by their impact on the world.¹⁵

For engineers, prototypes must be things or stories. For analysts like Suchman and Kreiss, as well as for engineers, they can be constellations of people and things that become elements in narratives that in turn have marketing or political force. But for Brown, prototyping is something much more. Prototypes as he describes them belong to a way of looking at the world in which individuals constantly remake themselves, in which they test themselves against the world and, if they find themselves wanting, improve themselves. Their quest for self-improvement in turn models the possibility of global transformation. In this vision, making a better product in the factory models and justifies the process of making

a better self in everyday life. Making both together, through the process of participation and with proper attention to metrics and measurement, might even prevent the apocalyptic crash of Spaceship Earth.

Puritan Typology

Brown’s world-saving rhetoric is a staple of Silicon Valley. But it did not originate there. To understand how Brown and his readers could imagine themselves as prototypes, we need to turn backward in time, trek three thousand miles to the east, and revisit the Puritans of colonial New England. When the Pilgrims landed on Cape Cod, they brought with them an extraordinarily rich practice of biblical exegesis that they called “typology.” In their view, as in the view of biblical scholars all the way back to Saint Augustine, events in the Old Testament served as “types”—which we would now call “prototypes”—of events in the life of Christ recounted in the New Testament.¹⁶ When Jonah spent three days in the belly of a whale, for example, he foreshadowed Christ’s burial and resurrection.¹⁷ For the Puritans, types were not simply symbols in stories; rather, they represented God’s efforts to speak to fallen man through his limited senses. In this biblical view, Jonah really did go down under water, and when he rose up, he sent word out through time that soon Christ himself would go down under the earth and rise up too.

For the Puritans, typology did not stop at the level of the text. Rather, it offered them a vision of the world *as a text*. In the typological view, God had written his will into time. History consisted of a series of prophecies, rendered in the world as prototypical events, and fulfilled by later happenings. The biblical exodus of the Israelites, for instance, foreshadowed the migration of the Puritans themselves from England to the New World. To their congregants, the Puritan ministers of Boston and Cambridge seemed to have been prefigured by the saints of the Bible and to serve as types of saints yet to come. Each individual’s life was little more than a single link in a chain of types. On the one hand, an individual such as the prolific New England Puritan minister Cotton Mather might see himself as the fulfillment of a mode of sainthood prophesied in the Bible. And on the other, his congregation might see him as an

example to follow into a heavenly future. For the Puritans, history moved ever forward toward the completion of divine prophecy. But the type—or, again, prototype—pointed both forward and backward in time. The Puritan type was a hinge between past and present, mortal and divine.

For individual Puritans, the ability to read the world as a series of types carried enormous meaning. The doctrine of predestination, to which all New England Puritans subscribed, asserted that God had already decided whom to save and whom to send to hell. There was nothing anyone could do about his or her fate. As Max Weber pointed out long ago, this belief set off an extraordinary effort among living Puritans to spot signs of their possible election.¹⁸ After all, what God could be so cruel as to curse in life those he was about to save for all eternity? By the early 1700s, the signs of likely salvation included most prominently the ability to read the natural world of New England as a series of types, written into history by God. Prototyping has long foretold brighter futures.

By now, you may have begun to wonder what, if anything, seventeenth- and early eighteenth-century theology might have to do with contemporary science and engineering. One answer is simply that Silicon Valley is suffused with the same Protestant ethic that drives other manufacturing regions. But there is another, more historically specific answer too. It was in early eighteenth-century New England that Newtonian physics met Puritan theology, and it was there that American scientists and engineers first linked scientific progress and Puritan teleology. No one did this more gracefully than the minister Jonathan Edwards. Though many remember Edwards today as the author of the quintessential fire-and-brimstone sermon “Sinners in the Hands of an Angry God,” Edwards also wrote widely on science and philosophy. Throughout his life he kept a notebook in which he recorded his struggles to fuse the scientific and the divine. Published under the title *Images or Shadows of Divine Things* in 1948, the notebook simply records the types that Edwards believed he saw in nature.

Consider the following fairly representative entry:

The whole material universe is preserved by gravity or attraction, or the mutual tendency of all bodies to each other. One

part of the universe is hereby made beneficial to another; the beauty, harmony, and order, regular progress, life, and motion, and in short all the well-being of the whole frame depends on it. This is a type of love or charity in the spiritual world.¹⁹

For Edwards, gravity explicitly modeled God’s love for man. But implicitly, Newton’s discovery of gravity and Edwards’s own ability to recognize gravity as a type marked Newton and Edwards as potential members of God’s elect. In Edwards’s typological history, theology and science marched hand in hand toward the end of time, each illuminating God’s will and each producing saints to do that work.

Which brings us back to Tim Brown, IDEO, and Silicon Valley. For some time now, analysts have suggested that the digital utopianism that continues to permeate Northern California came to life only there. In fact, an archeological exploration of the term *prototype* reveals that the habit of linking scientific and engineering practice to a historical teleology rooted in Christian theology can be traced back to New England, if not farther. As he declaims the power of design thinking to save the world, Tim Brown echoes the Puritan divines of centuries past. They too called on their readers to see their lives as prototypes, and to see prototyping as a project that might save their souls and perhaps even the fallen world. Though Brown nowhere refers to God, his volume fairly aches with a longing to find a global meaning in his life and work, to know that he and IDEO are on the side of the angels, that they are not just fallen souls, marketing their wares as best they can, in the corrupt metropolises of capitalism.

So What Are Prototypes?

With this brief history of Puritan typology in hand, we can begin to complicate both the picture of prototypes that we have received from engineering and the picture of Silicon Valley that we have received from historians and marketers. In computer science and many other disciplines, engineers build prototypes to look forward in time. They hope to anticipate challenges, reveal user desires, and engage stakeholders in the kinds of experiences that will generate

buzz about the product, within and beyond the boundaries of the firm. In Silicon Valley, as elsewhere, intermediaries such as IDEO turn these constellations of technologies and people into elements in stories that can in turn serve to legitimate and even model new social forms. To the extent that we see prototypes as exclusively forward looking, then the process of turning engineering and its products into models of ideal social worlds may look simply like another stage in the conquest of everyday life by the information industries of Silicon Valley.

Yet, as Puritan typology reminds us, prototypes always look backward in time as well as forward. The means by which they gather society and technology have their roots in worlds that precede and prefigure the futures they will call out for. And the particular mode of prototyping practiced by Tim Brown and many others in Silicon Valley has its roots not only in the world of engineering, but in the theology of Puritan New England. When he and others turn individual products and processes into prototypes of an ideal social world, they are following in the footsteps of Puritan divines like Jonathan Edwards. They are hardly Puritans in any theological sense. But they are not just contemporary Californians either. Like the self-proclaimed prophets of seventeenth-century New England, they are seeking to reveal a hidden order to everyday life. They too hope to uncover a hidden road to heaven and to take their place as saints along the way. They too are wondering whether they have been chosen. And they are offering prototyping to their audiences as a method by which they too might discover their own election.

The affordances of engineering prototypes assist in this process. Because prototypes are incomplete, half-cooked, in need of development, they solicit the collaboration of users and others in the building of a particular future. Because prototypes emerge from the laboratory or the office, they can seem to have no politics. They become enormously difficult to recognize as carriers of a particular teleology. On one hand, they begin to shadow forth a new social order, one in which engineers and marketers become ministers, the marketplace a kind of congregation, and Silicon Valley a new sort of city on a hill. On the other, the seeming ahistoricity of the prototype shields its makers and the breadth of their ambitions from recognition.

For all of these reasons, we need to ask new questions of the prototypes we encounter. We need to ask, How does a given prototype summon the past, as well as foreshadow a particular future? For what purposes? What sort of teleology does it invoke? And what sort of historiography does it require? How do prototypes leave the lab bench and the coder's cubicle to become elements in stories about the world as a whole? How do engineering prototypes become social prototypes? And who wins when they do?

By answering these questions, we might finally begin to stop thinking of our lives as prototypes and of new technologies as foreshadowings of a divine future.

See in this volume: algorithm, analog, archive, cloud, digital, gaming, internet, surrogate

See in Williams: art, consumer, development, image, industry, institution, myth, production, progressive, representative, technology, work

Notes

- 1 Richard Barbrook and Andy Cameron, "The Californian Ideology," <http://www.imaginaryfutures.net/2007/04/17/the-californian-ideology-2/>.
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- 6 John Edson, *Design Like Apple: Seven Principles for Creating Insanely Great Products, Services, and Experiences* (John Wiley & Sons, July 10, 2012), Safari Books Online, sec. entitled "Prototype and the Object."
- 7 Lucy Suchman, Randall Trigg, and Jeanette Blomberg, "Working Artifacts: Ethnomethods of the Prototype," *British Journal of Sociology* 53(2) (June 2002): 163-79; 163.
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- 9 *Ibid.*
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- 11 Tim Brown and Barry Karz, *Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation* (New York: Harper Business, 2009), 89.
- 12 Kelly, quoted *ibid.*
- 13 Brown, *Change by Design*, 94.
- 14 *Ibid.*, 178.
- 15 *Ibid.*, 241.
- 16 Ursula Brumm, *American Thought and Religious Typology* (New Brunswick, NJ: Rutgers University Press, 1970), 26.
- 17 Perry Miller, introduction to Jonathan Edwards, *Images or Shadows of Divine Things*, ed. Perry Miller (New Haven, CT: Yale University Press, 1948), 1–42; 6.
- 18 *Ibid.*, 27; Max Weber, *The Protestant Ethic and the Spirit of Capitalism* (London: Routledge 2001), 65–72.
- 19 Edwards, *Images or Shadows of Divine Things*, entry 79, p. 79.

Sharing

Nicholas A. John

Sharing, in digital contexts, can simply refer to the transfer of data from one place to another, or to making some data available to other people or machines. This is certainly how the term was used in describing the various arrangements by which data were transported between the entities and programs exposed by Edward Snowden in the summer of 2013. However, while the term *data sharing* would not appear controversial in any way, the same certainly cannot be said of *file sharing*, despite its equally deep roots in the field of computing. File sharing, assert certain representatives of the state and the entertainment industry, is not sharing, but rather theft. Critical voices of quite a different ilk might point out that Facebook, Google, and the rest do not “share” information about users with third parties, which is the language used in such companies’ terms and conditions; rather, and more linguistically accurately, they sell it. Both of these objections to the use of the word *sharing*—despite their quite different political motivations—are equally revealing. What they reveal is that, for many people, sharing is a cherished notion that must not be sullied; some things may properly be described as sharing, while others most certainly may not.

The layers of meaning conveyed by the keyword *sharing* often escape our attention. According to popular wisdom, sharing is caring, and an online image search for that phrase—which produces an abundance of teddy bears and pink hearts—uncovers a deep well of cultural associations that it draws from.¹ Without these cultural associations, it is hard to account for the icon chosen by Dropbox to accompany the word *Share* on its website: while the words *File*, *Photos*, and *Links* have quite standard icons by way of illustration, the small image next to the word *Share* is a rainbow.



Tom Boellstorff and Bill Maurer, series editors

This series presents innovative work that extends classic ethnographic methods and questions into areas of pressing interest in technology and economics. It explores the varied ways new technologies combine with older technologies and cultural understandings to shape novel forms of subjectivity, embodiment, knowledge, place, and community. By doing so, the series demonstrates the relevance of anthropological inquiry to emerging forms of digital culture in the broadest sense.

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Digital Keywords

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To our students, past and future
And to those who inspired this book
and cannot read it

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