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The Value of Counterfactual Analysis: Investigating Social and Technological Structure

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In "Not the Eads Bridge: An Exploration of Counterfactual History of Technology," Jack Brown offers up both an extended consideration of the counterfactual's potential as a tool for historical investigation. "Counterfactual history" typically brings to mind open-ended "what if?" meditations that imagine the implications that would follow if some event did not occur. Such "contingent counterfactuals" are not Brown's main focus however. Rather, he focuses on "constrained counterfactuals," which examine concrete alternatives that decision-makers considered, but did not choose. In his essay Brown explores the un-built Boomer/Post bridge, a proposal which competed with, but lost out to the celebrated, Eads Bridge of St. Louis. Brown examines why the Boomer/Post bridge did lose, despite the fact that, in some ways, it enjoyed some technical advantages with respect to the Eads crossing and its backers were better positioned and connected.

Brown's essay was quite interesting, but I was struck by the fact that what seemed to most interest Brown was exactly the opposite of what interested me about it. Brown repeatedly emphasizes how the constrained counterfactual highlights the role of contingency in history, whereas I found the essay's most compelling insights in its analyses of social and technological structures.

This short essay will dig into the value of counterfactual analysis, by exploring the role of contingency in the history of technology, and in science and technology studies more broadly, and offer some reflections on the role of structure in constrained counterfactuals.

Contingency

Running a Google NGram on "contingency" (a tool that shows frequency of use of phrases by year, based on books digitized by Google) finds that the use of the word remained relatively stable from about 1860 to the late-1950s and then shot up beginning in the early 1960s, nearly doubling by 1980.

In other words, like lots of things, we can blame contingency on the '60s! The postmodern mindset that developed during the 1960s and 1970s and had come to roost quite comfortably in academia by the early 1980s included the idea that historical outcomes were arbitrary and contingent, that they were the products of the caprices of power and not the result of a purely and deliberately rational process. The historically and culturally relative conditions that inform this process are themselves punctuated by massive changes in worldviews. (See Kuhn and Foucault.)

This isn't to say that attention to contingency is entirely a result of this particular moment in history. Indeed, professional historical reasoning has always assumed the importance of contingency. William Sewell argues just this in his book the *Logics of History*. Sewell approvingly quotes Steven Jay Gould who called contingency "the central principle of all history" and went on to say that historical explanation "does not rest on direct deductions from laws of nature, but on an unpredictable sequence of antecedent states, where any major change in any step of the sequence would have altered the final result."

At the same time, however, we know that the Social Construction of Technology—one methodological innovation in science and technology studies that heavily emphasized contingent processes—was, in part, a product of the politics of the 1960s and 1970s. The core principle for the SCOT group was that technological change was not "natural" or inevitable, but arose from human processes that could have turned out otherwise. All of this paints an unholy picture of young, radical scholars working in the emerging field of STS, sitting around in the late-1970s and early-1980s, discussing the horror that is nuclear power, and, between tequila shots, saying, "Things could be different, man. NO!! *Things should be different*." Contingency was a political proposition, for some.

Brown gets to the idea of contingency through his use of the counterfactual. The notion of the counterfactual first arose out of the field of philosophical, especially symbolic, logic in the 1940s and 1950s. (Nelson Goodman's 1947 paper "The Problem of Counterfactual Conditionals" is a good candidate for the kick-starter of the discussion.) The notion was quickly picked up by quantitative social scientists, who in the post-World War II era had taken to running computer-based statistics and regression analyses to work through questions about causality. For both the logicians and the social scientists, the importance of the counterfactual is this: if you want to argue that A causes B, then you really should consider a situation—the counterfactual—in which A did not happen. In the

A-less situation, did B still happen? If yes, then A doesn't cause B. If no, then you are one step closer to demonstrating some causal relationship. Logicians and social scientists could either run an experiment or use certain statistical methods to examine the counterfactual.

For the purposes of writing history, these reflections on counterfactuals bring to mind the old problem of the explanation-interpretation fence. Many historians prefer to remain firmly planted in interpretive work, avoiding the slide to facile determinism that "explanation" seems to presage. With its talk of causes, "explanation" gives some historians the heebie-jeebies.

More importantly, adopting the method of counterfactuals and then finding contingency is a little like adopting a pragmatist perspective and discovering that everyone is using mental tools, relying on rational choice theory, and maximizing their utility. Contingency is a core assumption of counterfactual analysis. The question for the logicians and social scientists described above is, "contingent upon what?"

In Brown's analysis, the construction of the Eads Bridge—and its victory over the Boomer/Post bridge—was largely contingent upon the personality of James Eads himself. As Brown writes, "Eads would push past Boomer and through innumerable contingencies and challenges largely because he structured the venture to enlist self-interested allies and their capital . . . " In this way, Brown's findings accord with a great deal of research from the last three decades that emphasizes the importance of entrepreneurs—with all of their charisma, doggedness, and perhaps insanity.

Brown's question is "why this bridge and not that one?" And in answer, he finds contingency. It strikes me, however, that if one pulls back (or up) to focus not on the bridge itself or the decision to build it but on how the bridge fit into the world, contingency would become less interesting than structure. The counterfactual is helpful for thinking about structure in at least two ways, by considering the broader sociotechnical structures that prevailed *before* the bridge was built—structures that fostered that construction—and those that came into being *after* the bridge ways built. Another way of looking at this is that the event under counterfactual analysis acts can act as a hinge point between the structures that fostered it and the structures that followed it.

I have no time to offer extended analyses of both of these structural moments—the before and the after. Instead, I will focus just on the second one. But I will say in passing that one upshot of counterfactuals for the first case is that it leads us to reflect on our level of analysis. A historian interested in the bridge will look at the topic differently than a historian interested in railroads, who will see the bridge as just one more link in the system.

The Bridge and Structures After the Bridge

The strength of Brown's analysis comes from the fact that he takes the differences between technological systems seriously. He details the proposed structure of each of the

bridges, and he considers what these different structures might have meant. The Eads Bridge differed in consequential ways from the Boomer/Post one. My favorite moment in the essay comes when Brown writes,

> By 1888, an average of 1,390 freight and passenger cars crossed over Eads's arched spans *each day*. With its single track of mixed gauges, the Boomer/Post bridge would have been entirely inadequate to meet that demand, assuming that it remained in service at all, not obliterated by a tornado or replaced by a larger crossing. Furthermore, it seems implausible that St. Louis's railroads and shippers would have generated such high demand for rail services if the city of the 1880s had to rely solely on the Boomer/Post crossing. Eads's bridge, tunnel, and associated rail lines and terminals helped foster this commerce.

It seems to me that you could go even further with this kind of analysis and, indeed, that it could lead to a different kind of empirical work on the consequences (or implications or outcomes) of building the bridge. Obviously, we are dancing on dangerous territory here. "Are you saying that the bridge *determined* some set of things?" No. But it seems clear that—at least since the rise of SCOT, maybe even since the birth of SHOT—historians and others in STS have experienced an epidemic of the terrifying mental disorder known as *Techno-aitiaphobia* (that is, fear of technological determinism). We need to develop ways to talk about what comes after a given technology's initial construction—and to approach these topics with confidence, not fear.

Other scholars of technologies studies give hints about how we might think about this issue. In *The Automobile Age*, James J. Flink quotes the architect critic Reyner Banham, who argued that the rail system "constitutes the bones of the skeleton on which Greater Los Angeles was to be built, the fundamentals of the present city where each of these old lines is now duplicated by the freeway." And "subdivision of the adjoining land proceeded as fast as the laying of the rails . . . Before 1880 then, the railways had outlined the form of the city and sketched in the pattern of movement that was to characterize its peculiar pattern of life." As LA-based actors created the structure of the built environment, they shaped the logic by which both real estate developers and future infrastructure designers would make their choices.

To give related example, I live in Maplewood, New Jersey, a suburb of New York City. For a long time, the commuter train that runs through here ended in Hoboken, New Jersey, where travelers would have to transfer to a ferry or subway to get to Manhattan. About a decade ago however, the train began running to Penn Station, which immediately raised home prices here because the location was now more desirable to wealthy commuters who wanted an easy way to work.

This talk of rail lines and bridges focuses on the relationship between physical infrastructure and social structures. But we should not forget other kinds of "structures" that attend technological systems. For instance, in *Recent Social Trends* (1933), William F. Ogburn listed fifteen "social effects" that radio had on sports, including these: "The

broadcasting of boxing matches and football games tends to (1) to emphasized big matches to the neglect of smaller and local ones, (2) increasing even more the reputation of star athletes." And, "(12) Broadcasting of sports has led to the developing of a special skill in announcing the movements of athletes not at times easy to see, a skill rather highly appreciated." Ogburn's formulations often had dimensions of technological determinism, but you do not need to be a technological determinist to believe that commercial radio opened up a new field of strategic action in which individuals competed to be the most skillful and famous radio announcers. And if the radio system had developed differently—say if Susan Douglas's radio amateurs had retained control—this field of action might have worked differently.

Returning to Jack Brown's bridges with these thoughts in mind, we might be drawn to examine fire insurance maps, newspapers, city directories, and other period sources to examine how actors constructed and re-constructed St. Louis's built environment and commerce around the potentials inherent in the Eads Bridge. And, to follow the constrained counterfactual tool through to its conclusion, we might consider how these developments may have gone differently if the Boomer/Post Bridge had won the day.

To examine how and why people make choices given technological potentials and affordances, we could draw on work in sociology (especially field-theoretic varieties) and certain corners of market research. To explore how cities are reconstructed and resident behavior patterns change after infrastructure is built, we could turn to urban geography or even economics. (How do economists focused on infrastructure try to calculate the benefits and hidden costs of new structures? And if we have no faith in their calculations, do we even know this history?)

In other words, the counterfactual, a tool drawn from other fields, would lead historians of technology even further afield, to explore and encounter still more literatures and disciplines. Like Jack Brown, I think that's a great thing.

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