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Technological Key Points

Coming into the 2011 US Open with a track record of winning all but one of the Grand Slam matches that he played that year, Novak Djokovic was facing Roger Federer in the semi-finals, the very man who had beaten him in his only Grand Slam loss of 2011. And ominously, he lost the first two sets, 6-7(7), 4-6 before rallying to take the next two 6-3, 6-2. It was now the final set and Federer, having just broken Djokovic's serve in the final set to go up 5-3, was serving at 40-15, with two match-points on his own serve. Upset at the crowd which was cheering Federer on wildly, Djokovic seemed out of sorts, angry at himself, perhaps, for being in this position despite playing a flawless third and fourth set.

The interpretation of what happened next remains a matter of dispute, hotly debated in tennis forums, YouTube comments, and the blogosphere. [1] Serving from the ad-court, Federer served out wide to Djokovic's forehand. It was not a bad serve, but Djokovic swung at it hard, and literally smashed it cross-court for a clean winner. There was shocked silence for a second before cheering erupted. Djokovic walked to the other side of the court, raised his hands and looked at the crowd. Appreciate me, he seemed to be saying. The crowd obliged even as a bemused Federer stood waiting to serve on the other side of the court.

It was still match-point. Federer threw a good serve straight at Djokovic's body, and a rally ensued, which ended, heartbreakingly for Federer, with his shot striking the net-chord and then dropping back on his own side. Deuce. Djokovic went on to win the game breaking Federer in the process. He then won the next three games as well, winning the final set 7-5 to defeat Federer and reach the final[2].

What was going on in Djokovic's mind when he hit that screaming forehand winner off Federer's serve? Was it hit in anger or was it a calculated risk? How much did Djokovic's gamesmanship – seeking the crowd's approval – affect Federer on his next serve? Tennis fans and analysts continue to debate this. My own thought, as I was watching the match, was that Djokovic, who can often be peevish and irritable on court, was angry with himself and swung at the ball, more out of pique than anything else[3]. But the shot went in, and Djokovic used it to rally the crowd to his own side. On the other side of the net, Federer

[1] It will, I suspect, continue to be so in the future.

[2] For a blow-by-blow account of the semi-final, see http://straightsets.blogs.nytimes.com/2011/09/10/2011-u-s-open-live-analysis-federer-vs-djokovic/. For a summary of what happened, see http://www.nytimes.com/2011/09/11/sports/tennis/2011-US-Open-semifinals-djokovic-federer-nadal-murray.html.

[3] The New York Times tennis blogger, Dave Seminara, says in his blog-post that he thought the same initially but changed his mind after watching other Djokovic matches where Djokovic used a similar return. He argues that what was unique was that Djokovic had never quite used this return at such a crucial stage. See http://straightsets.blogs.nytimes.com/2011/09/13/open-moment-before-and-after-that-djokovic-shot/.

suffered a dent in his own confidence, and this allowed Djokovic (who is undoubtedly the best and fittest player on the tour today) to put himself back into the match.

Both players themselves offered contradictory interpretations of the return[4]. "It's a risk you have to take," Djokovic told Mary- Joe Fernandez in the on-court interview. "It's in, you have a second chance. If it's out, you are gone. So it's a little bit of gambling." Federer, on the other hand, was having none of it. "Confidence, are you kidding me?" he scoffed in his post-match interview. "I never played that way. For me, this is very hard to understand how you can play a shot like that on match point." Djokovic acknowledged that he needed to "get some energy from the crowd." "Look, I was a little bit lucky in that moment because he was playing tremendously well with the inside-out forehand throughout the whole match. This is what happens at this level. You know, a couple of points can really decide the winner.[5]"

The Federer-Djokovic first match point is often what both tennis players and tennis analysts refer to as a "key point." These key points, as Djokovic points out in his post-match interview, are often the ones that "decide the winner." In the rest of this essay, I hope to show that this idea of "key points" as relevant to the outcome of a tennis match is possibly of interest to historians of technology.

What is a "key point"? A key point is a point (possibly among a set of points) which can be seen to have determined the outcome of the match, as seen by the players or the analysts (or both). Players often sense that a point will be key during the match itself and go all out in their effort to win it, perhaps by hitting extra hard, taking a risk, or by running down a ball they would rather have left alone to conserve their energy. Analysts too, as interested observers of a match, can sense whether a point will be key to the outcome, although they have no agency when compared to the players themselves.[6]

But while an upcoming key point can be sensed by the players and the spectators, key points can be *definitively* identified only after the match is over. In other words, *the identification of key points is contingent on the outcome*. In the Federer-Djokovic match we saw above, the courageous (or reckless) Djokovic return at 15-40 is a key point only because Djokovic won the next four games to win the match. If Djokovic had lost the next match-point, this point would no longer be talked about as a key point but as a fluke. Instead the game in which Federer broke Djokovic at 4-3 in the final set would have turned out to be the key to the outcome of the match. To restate this point, *the key to winning a match is to win the key points, but the points that are key to winning a match can only be determined after the match is won (or lost)*.

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[4] See Sam Tanenhaus' blog-post which has an almost literary analysis of their post-match remarks here: http://straightsets.blogs.nytimes.com/2011/09/11/after-the-match-federer-vs-djokovic-continues/. Another article from the Guardian here: http://www.guardian.co.uk/sport/2011/sep/11/us-open-2011-federer-djokovic.

[5] To watch the post-match interviews with Federer and Djokovic see http://www.youtube.com/watch?v=2h8tmtOFDVE and http://www.youtube.com/watch?v=nAKkTwRgXqk respectively.

[6] If one thinks of the tennis match as an interaction between whole networks of people (coaches, trainers, racket-stringers, racket-makers, nutritionists, crowds, fans and so on), then clearly all of them have *some* effect on the match outcome.

It is worth discussing an alternative explanation of match outcomes: that the more talented, or better, player wins the match. I quoted a part of Djokovic's post-match interview above. On actually watching the interview[7], it turned out that the quote left out a crucial part. Djokovic actually said: "This is what happens at this level – *when two top players meet*. You know, a couple of points can really decide the winner." [Italics mine.] The implication here is that it is only when players are evenly matched in terms of "talent" that the outcome hinges on a few key points. When players have wildly different talents, the outcome hinges on, say, the "talent" they possess (which will not be the same) and not on the key points.

How might the key point analytic relate to what historians – especially historians of technology – do to understand the past? As I see it, the topic of historians of technology (and of this class) is technological change. Our aim is to understand the past and to answer the question: why do certain things change while others remain the same? One might see this question as similar to those that tennis analysts pose to themselves: why did player X win against player Y? Why has player X consistently beaten player Y in their previous 5 matches?

Somewhat analogous to the two theories to explain the outcome of a tennis match – the "key point" theory vs. the "more talent" theory – one could oversimplify theories about technological change into two kinds. One theory might be that technological change happens because a certain technology is better at producing certain desirable outcomes (more profits, more efficiency, better living conditions, progress and so on). This theory would go under the name of "technological determinism" and would be similar to the "more talent" theory of tennis match outcomes. The other theory would postulate that technological change happens because certain groups of people – I will call them “interest groups” – are able to defeat, or persuade, their opponents through the channels available to them at certain crucial junctures. This theory would be similar to the "key point" theory.

How would the "key point" theory of technological change help avoid the pitfalls of technological determinism? As I see it, the main dilemma of any social science is the issue of predictability. Unlike the natural sciences which can predict the future behavior of their "actors" (the trajectory of a missile, the motion of the planets, the quantum states of atoms), the social sciences cannot (and with good reason) predict the changes of the future. They cannot because assemblages of human actors are unpredictable. They have agency. Harry Collins has shown how even the behavior of natural scientists – who produce natural science, the most “rational” of all the disciplines – is still unpredictable, and is better understood as the application of certain tacit skills, than as the brute application of some rule-bound "scientific method."[8]

The social sciences thus face two different questions. On the one hand, social scientists need to account for the sense of contingency and unpredictability that their actors often feel while thinking about the future. They also need to account for why their actors feel that certain actions are the key to changing the future. On the other hand, they (and here I speak of historians in particular) need to account for why the events of the past seem so inevitable, the way they seem to lead to the present so unproblematically.

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[7] See http://www.youtube.com/watch?v=nAKkTwRgXqk for a video of the interview.

[8] Harry M. Collins, *Artificial Experts: Social Knowledge and Intelligent Machines* (The MIT Press, 1992), 1.

Clearly actors in the past who experienced these "same" events did not know how things would turn out. How can historians account for the inevitability of the past for us and its contingency for the actors experiencing the past?

A theory of technological change that looked at "key points" as determining certain (technological/social) outcomes could be one solution to this. Key points in history would need to have the following characteristics. First, historical actors themselves should have some dim awareness that something important was happening and that different visions of the future are at stake. Second, the outcomes of these key points should result in the victory of one set of interest group over others, thereby setting in motion a certain kind of future. Third, these key points can only be determined retrospectively once the outcome is known (as historians always do). Fourth, key points preserve the agency of historical actors. Finally, key points in history can change as newer and newer outcomes arise. For example, historians now agree that Barry Goldwater's defeat by Lyndon Johnson in the 1964 presidential election, and the subsequent rise of grass-roots conservatism, is a key to understanding American politics today, even if no one seemed to be paying attention to it back then[9]. It was a key point for certain actors who were mobilizing to achieve their vision of the future, even if their ideological opponents were largely unaware of them.

To conclude this essay, I will now apply the "key point" method to two important historical studies we looked at in the class: Alfred Chandler's study of the rise of managerial capitalism in the US and William Cronon's story of the grain trade between Chicago and its hinterland. Both stories hinge on one key point: the rise of the railroads in the United States. But they differ in their account of the specifics.

For Chandler, managerial capitalism is the most efficient organizational structure that can cope with the new economy of railroads. This is akin to the "more talent" theory of tennis match outcomes: managerial capitalism is just better suited to the new economy of massive sites of production connected by railroads than other forms of social organization. It should be mentioned that Chandler's narrative is rich in details which makes it more than a just-so narrative. What it lacks, which the key point theory helped me understand, was that it does not involve actors fighting over the outcome. In his book on the history of American business schools, Rakesh Khurana points out that the emergence of the managerial corporation was hardly straightforward. Shareholders and owners remained suspicious of the new class of managers and often fought, unsuccessfully, to take control away from them. They did so primarily through legal channels by lobbying legislatures to change incorporation laws to restrict managerial control[10]. Yet perhaps share-holders had the last laugh as starting from the 1970s the role of managers came to be redefined: instead of management being seen as a profession with certain responsibilities to society as a whole, managers were now seen as responsible only for maximizing shareholder returns[11].

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[9] Rick Perlstein, *Before the Storm: Barry Goldwater and the Unmaking of the American Consensus*, Reprint. (Nation Books, 2009).

[10] Rakesh Khurana, *From Higher Aims to Hired Hands: The Social Transformation of American Business Schools and the Unfulfilled Promise of Management as a Profession* (Princeton University Press, 2010), 28.

[11] Ibid., 7.

In Cronon's story of the grain trade, the "logic of capital" seems to drive events towards their inexorable outcome. But it is also rich with accounts of fights between different historical actors. For Cronon, the key point in the transformation of Chicago and the Great West was the building of railroads that connected them. Then, to maximize the productivity of the railroads, the grain elevator was invented. Cronon is good at detailing how each step along the way was fought over by different sets of actors: the farmers, the Chicago Board of Trades, the grain traders, the elevator operators and regulators. Each group was responding to a vision of the future and each group was aware of the stakes. A key point in the transformation of the Great West was being enacted.