



THE ACADEMIC RESEARCHER AND FATHER TIME

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*A person who has not made his great contribution to science before
the age of thirty will never do so. Albert Einstein*

Recently, I ran across several articles on the research productivity of academics over the life cycle. Do you love your research and don't want it to stop? Are you searching for the "Holy Grail" in your field and want to know your "peak age". Or are you an administrator who looks at his older faculty as an untapped resource? All of this makes a difference. But then you might just be curious about how the inexorable hand of Father Time touches all of us academics.

First to clarify. The subject is academic *research* productivity. Teaching productivity is difficult and subjective to measure, and I have seen no journal mentioning of it, except those that say that it is difficult and subjective to measure. Publications in refereed journals are public and widely understood, whereas teaching is only locally known. Whether we decide that the one or the other is more important, it is understandable that publications are the measure of productivity most accessible to research.

If this is the first time that you have studied age and productivity, there are some natural questions to ask, such as "Why would aging affect our productivity anyway?" To answer this

question, let us first begin on a ground where we all agree: Athletic ability and age.

We are aware that age affects athletes harshly. Start with kids playing sandlot ball, then perhaps moving into Little League. From there only a few make it on the varsity high school team, and then scouts across the country pick only a few of these to train in the minor league farm teams. Then only a few are called up to the majors. Let's say that one makes it at age 21, how long does this baseball player have in the sun? According to *Baseball Prospectus* the peak age for baseball players is 27. His athletic life may not be brutal but it *is* short. This fact compels a different understanding of the phrase "boys of summer". Football is similar. The best age for footballers is about the same, 27 years, though quarterbacks peak a little later. Pro ballplayers in their mid 30's must think hard and often about Father Time; Bob Dylan might say, "they hear the clock tick". Do you remember Olga Korbut and Nadia Comeneci? They drove the over-the-hill twenty-somethings out of women's gymnastics at ages 17 and 14 respectively.

There are exceptions, too. Back when I was a solidly loyal fan of the Minnesota Vikings, football fans generally admired a certain really antique oldster. His name was George Blanda. An "ironman", he played for 26 seasons, longer than anyone else. At age 43 and playing for the Oakland Raiders, he rescued five games in a row with last second spectacular plays. When he could no longer quarterback, he led the league in points with his kicking. From notes I found on the internet, he was still playing, for the Oilers, at age 48, when he finally retired. The Oakland Raiders in those days collected old and discarded players and turned them into championship teams; the young footballer's prayer in those days was: "Lord when I get old, let me play for the Oakland Raiders". I think that the sports metaphor I draw from all this is that life is brutal and short, but there are some amazing exceptions.

Of course, such exceptions are just anecdotes and don't establish a rule. Yet it intrigues me that these rules of aging, while apparently hard to beat, are not hard and fast. The ex-

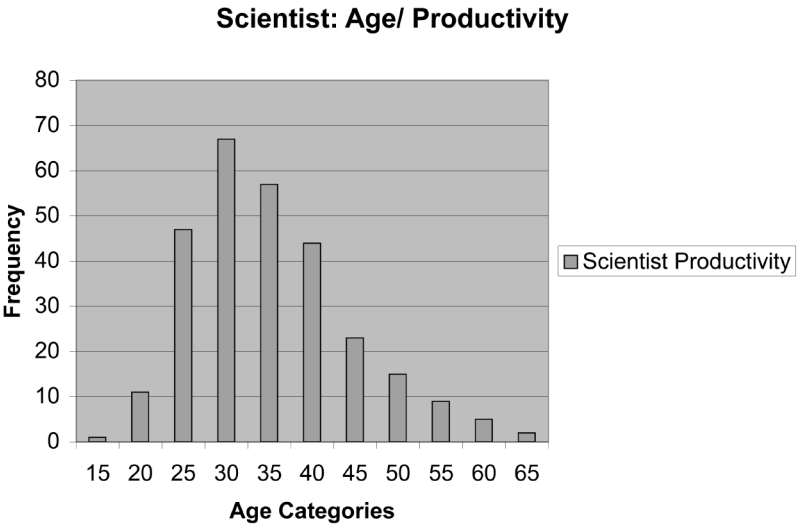
ceptions are found in every field. One source claimed that age 19 was the peak for musician performance; but I doubt this because there are so many exceptions they seem in the majority. Artur Rubenstein's piano concerts at age 90 sometimes inspired poetry. Dave Brubeck, Leonard Bernstein, the Rolling Stones; the list is long. So I wonder about music; in fact, one study even shows that top classical composers simply got better with age. Not Mozart, of course. One wonders what music would have been like had he lived to an old age. Yet he wrote some of the world's most awesome music before dying at age 36. If I sound like a teenager to you, I dare you to listen to a good CD of "Requiem" without having the word *awesome* come to mind. I double dare you.

Nevertheless, the age/productivity patterns that I have seen for jazz musicians, painters, and literature authors, are all inverted U shaped, something like irregular bell curves with age scaled along the horizontal axis and the peak age of performance coming somewhere in the thirties or early forties.

Yet if these fields reveal detrimental effects of aging that seem ironclad and even cruel, most of us in academe are neither athletes nor artists. We call our fields "cognitive". Surely cognitive skills are less susceptible to aging. But are they? Perhaps you have seen many of the same facts that I have, but to make it explicit, here is a sketch of what I have seen. Mathematical and analytical skills decline from an early age, but the decline can be small if you use these skills on a regular basis. The peak age for verbal skills is said to be 55 (I enjoy explaining to my teenage daughter, Ingrid, that the reason it is hard for her to beat me at crossword puzzles is that I am closer to age 55 than she is). Starting at age 50, we decline in our ability to remember long strings of numbers or words that have no apparent pattern or logic (As I interpret this last factoid, when you reach 50 you are no longer interested in nonsense).

So, fine. There is short term memory loss, so you take more notes, you organize your files and papers. Who cares as long as you can still get it done? And there is ample evidence that many post 50 academics can still get it done. But do they?

Take a look at the reality. This bar chart reproduces data from an article about 280 leading scientists since the year 1800, and it graphs for each given age category the number of these scientists who achieved their most significant work at that age.



What about Einstein’s claim that great contributions to science are all made before the age of thirty? Einstein was close. The peak age is 30. Nearly a quarter (23.6%) of great scientists made their most significant contribution in their career during the five years around age 30. Two thirds (65.0%) made their most significant contributions before their mid-thirties; 80% before their early forties. We see in the graph though that there are many exceptions, major contributions made past the age of 50, and there are also other kinds of exceptions. It might matter, for example, whether you are primarily doing “conceptual” work versus “experimental” work. For Nobel Prize winning economists, conceptual economists peaked at 43 years but experimental economists peaked at the ripe old age of 61.

But why? People theorize, of course, because they want to understand why things happen and want to be able to predict

what happens next. Following a theory piece I found in the *American Economic Review*, think of these age/productivity patterns as occurring for two reasons. (1) First, academic researchers are more productive if they enjoy doing it. This may sound circular, but many papers left out this obvious idea. Researchers are often people who loved to solve puzzles and problems from an early age; and, surely some like it more than others. (2) Second, research has its rewards both in money and status. To become viable in research, or in other words to “bring yourself up to date”, you must study and learn—economists say you *invest in your research capital*. Time doesn’t stand still and you need to keep investing since your accumulated stock of knowledge will eventually become obsolete—economists say that it *depreciates*. That’s it! That’s basically the theory.

One implication that comes out of this is that as an academic nears retirement he has less and less reason to invest in his research capital. We invest because we expect to get returns over the coming years, but for the fellow nearing retirement his payoff years are truncated. For part of what would have been the payoff years, he will be out on Torch Lake with a fishing pole. Another implication is that researchers who love their work will have a “flatter” age profile, that is, there will be less of a decline in productivity as they age. But the only people who incur no decline whatsoever will be those who love their work in the extreme. Nothing else, not even investment returns, is needed for them. So far the only such case I have read about is that of particle physicists.

The model also explains why productivity often peaks only 10 or 15 years past the PhD. Graduate school can be thought of as an intensive investment in the latest research capital, it is natural for the research productivity to peak shortly after this. It also helps to explain the observations that more recent PhDs tend to be more productive at each stage of their life cycle than earlier PhDs. This is said to occur in fields where knowledge generally progresses; more recent PhDs will have been trained in a better knowledge base.

By the way, the authors of that theory showed that it fits

well for several different groups of natural scientists. They find an inverted U shaped age/productivity profile in all cases—except one: Particle physicists have a flat age curve, their steady output of articles never stops as they age. Apparently research in particle physics (say these authors) is like a religious quest in search of the Holy Grail of the unified field theory, “the explanation of everything”. Neither money nor leisure get in their way.

Mitigating as Well as Aggravating Factors:

The most fascinating stray fact that I found was in an article that studied submitters to a top economics journal, where success at acceptance proved to be unrelated to the submitter’s age. Those under 35 years had 12.2% accepted, those 36–50 years had 11.4% accepted, and those over 50 got 12.3% accepted. This result reminded me of many comments I have heard and read from researchers—a great deal depends on whether you want to do the work and whether you persevere. As Woody Allen once advised: “90% of success in life is showing up.” The second most interesting tidbit I ran across was this: An important predictor of whether you publish after age 50 is simply whether you published prior to age 50.

Motivation for success in the arts and sciences framed the theory of the most entertaining of the 12 articles that I read. An evolutionary psychologist from New Zealand writes that men seek top achievement in their field while in the hot competition for a mate. The author’s main evidences are of two kinds. One, he documents that the inverted U age/productivity curve we have discussed applies in the main to a vast array of fields of male endeavor, including crime. Two, he demonstrates, with some success, that productivity declines once the guy gets married! Did this happen to you? What I didn’t understand in his theory is why the young “Newton” doesn’t return to top productivity once he has deposited his genetic material. And one wonders whether women researchers are immune to this syndrome.

An administrator who wants his division to do well in publishing might well heed yet another article I found. Assignment to a chairmanship or other administrator position is a killer for research. Not only does it depress research output during the person's tenure as chair, but it also depresses his output *thereafter*. They call it the "curse of professional recognition". If there is a general administrative principle to be found in what I read, it might be called "The Pleasure Principle for Research Productivity." By providing ample research support, recognition and access to world peers, the administrator invests in his division's continued productivity.

What about the researchers themselves, the great majority of us at this research university? The age/productivity profile, the "inverted U", is so common that there must be more to it than I was able to examine. There are, however, just as many evidences of the possibility for success throughout one's career that to invoke this curve is a weak excuse for one's pessimism.

People who are aware of what economists do, whether to praise or to blame, know that economists commonly describe humans as rational hedonists. People do what they have an interest in doing, given the constraints they face. So, is the reduced research productivity we observe as the "over-30s" age due to reduced interest or due to increasingly binding constraints? The safe answer, of course, is "both". In social science, that kind of answer can't miss. But a better question to ask instead is: What's the main thing? My bet is on interest: 1) financial incentives for pursuing research are substantially attenuated with tenure and with one's increasing net worth; 2) status relationships in one's department tend to get rigidified; and 3) many older academics lose faith in the mission or method of the field that they had chosen when younger. These are my "bets" or guesses, but the articles I read provided no evidence of that sort. What their evidence amply supports, however, is that there are many, many examples where the desire to "show up" leads to success at any age. And, then, of course, there's always George Blanda.