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Last week, our Director of Research Jacob Benedict was confronted with two particularly thorny assignments:

- First, he was asked to talk to one of his wife's high school classes about saving and investing. It can be hard to get teenagers excited about anything, much less Roth IRAs!
- Second, Jacob's ten-year old nephew is embarking on his first entrepreneurial endeavor – mowing yards. Jacob wanted to convince him to defer a portion of his weekly earnings into a custodial Roth IRA. How do you teach a ten-year old about saving and investing?

In the 1960s and 1970s a psychologist at Stanford University named Walter Mischel conducted a simple but innovative series of experiments. Mischel and his colleagues would lead a three, four, or five year-old into a room that contained nothing but a table with a single treat on it, usually a marshmallow, a cookie or a pretzel. The children were told that they would be left in the room alone for fifteen minutes. They were then told that they were free to eat the treat if they'd like, but if they waited to eat it until the fifteen-minute period was up, they would get a second treat. If they ate it before the fifteen minutes were up, they would receive no additional treat. The researchers then followed these children throughout the ensuing decades, and discovered that children who were able to wait longer for their treats tended to have better life outcomes across various measures, such as SAT scores, educational attainment, and body mass index (BMI). In other words, the kids that were blessed with the "delayed gratification gene" went on to achieve high levels of success relative to those that weren't born with it.

What is delayed gratification? It is simply the act of making a sacrifice today in order to enjoy a greater reward in the future. If you want to be in shape tomorrow, you have to work-out today. If you want to gain admission to a top college in the future, you have to put in the time studying now. And if you want to be financially secure, you have to forego current consumption in order to save and invest for tomorrow. The delayed gratification gene may be one of the most important endogenous factors to individual success.

The key follow-up question is this: Is the delayed gratification gene innate, or can it be learned? Warren Buffett's long-time business partner Charlie Munger responded to this question at the 2019 Berkshire Hathaway shareholder meeting:

I'll take that, because I'm a specialist in delayed gratification... And my answer is that they sort of come out of the womb with the delayed gratification thing, or they come out of the womb where they have to have everything right now. And I've never been able to change them at all. So, we identify it. We don't train it in.

Munger is probably right, which made Jacob's tasks all the more challenging. But he decided to give it a try anyway. We decided that his best bet was to use stories and simple figures in an effort to communicate the beauty and power of compound interest. [His comments echoed the ones presented in this note.]

The Wonder of Compound Interest

"Give me a lever long enough, and a fulcrum on which to place it, and I shall move the world." - Archimedes

"Compound interest is the eighth wonder of the world. He who understands it, earns it. He who doesn't, pays it." - Albert Einstein

"The greatest shortcoming of the human race is our inability to understand the exponential function." - Albert Bartlett

"If you don't find a way to make money while you sleep, you will work until you die. / Don't save what is left after spending, but spend what is left after saving. / Someone is sitting in the shade today because someone planted a tree a long time ago." - Warren Buffett

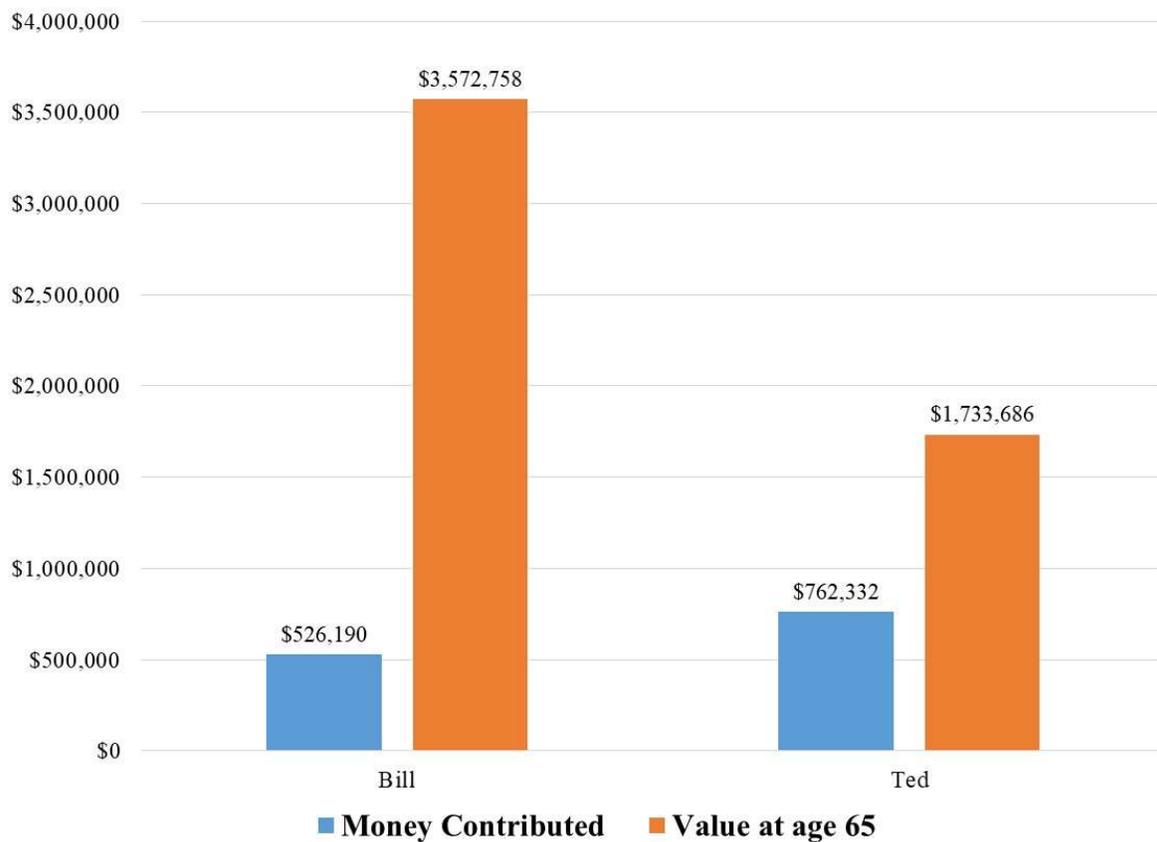
Why don't people delay gratification? Because it hurts! Sacrifices today are felt immediately, while potential benefits in the future are both distant and uncertain. But there is a big, massive trick: If you [A] start early and [B] do it intelligently, delayed gratification doesn't actually require that much sacrifice or pain. This is due to the wonder of *compound interest*.

What is compound interest? Compound interest is a mathematical concept that refers to the growth rate of something where growth compounds on top of growth. Say you have an investment account that returns 5% per year, but instead of taking that 5% and spending it each year, you reinvest the 5% back into the investment account, thereby earning an additional 5% on your 5%. Over a long enough timeframe, the effects of compounding can be enormous. This is evident not only in investing but in other fields such as population growth and bacterial development.

As Warren Buffett once remarked, "Life is like a snowball. The important thing is finding wet snow and a really long hill." (Buffett bought his first stock at age 11, giving him seven-plus decades to compound his capital.) Or consider the old parable about the sage who was offered a reward of his choice from an Indian King. The sage simply asked the king to put one grain of rice on the first square of a chess board, and then double it on every subsequent square. The King quickly agreed before realizing that by the time he reached the end of the chessboard, he had given away more grain than what existed in his entire kingdom! Humans have trouble wrapping their minds around the power of compound interest over a long timeframe. But if you tackle a big goal – such as saving and investing – by [A] starting early and [B] doing it intelligently, you can harness the power of compound interest for your own benefit.

[A] Start Early: Bill & Ted

Consider the example of two twin brothers, Bill & Ted. They both begin working at age 16, earning \$15 per hour. They work part-time until age 22, when they begin working full-time. Throughout their careers they both earn the same amount each year (\$15 per hour grown at 2% inflation). As soon as Bill starts working, he decides to save 10% of his pre-tax pay in a Roth IRA each paycheck. Ted, on the other hand, saves nothing until age 45, when he realizes that he has some catching up to do and begins saving 25% of his pre-tax pay each paycheck. Savings are invested in a tax-advantaged retirement account that earns 8% per year. The brothers quit saving when they retire at age 65. How prepared are Bill and Ted when they decide to retire?



Bill saved 10% of each one of his paychecks. What is the difference between 100% and 90%?

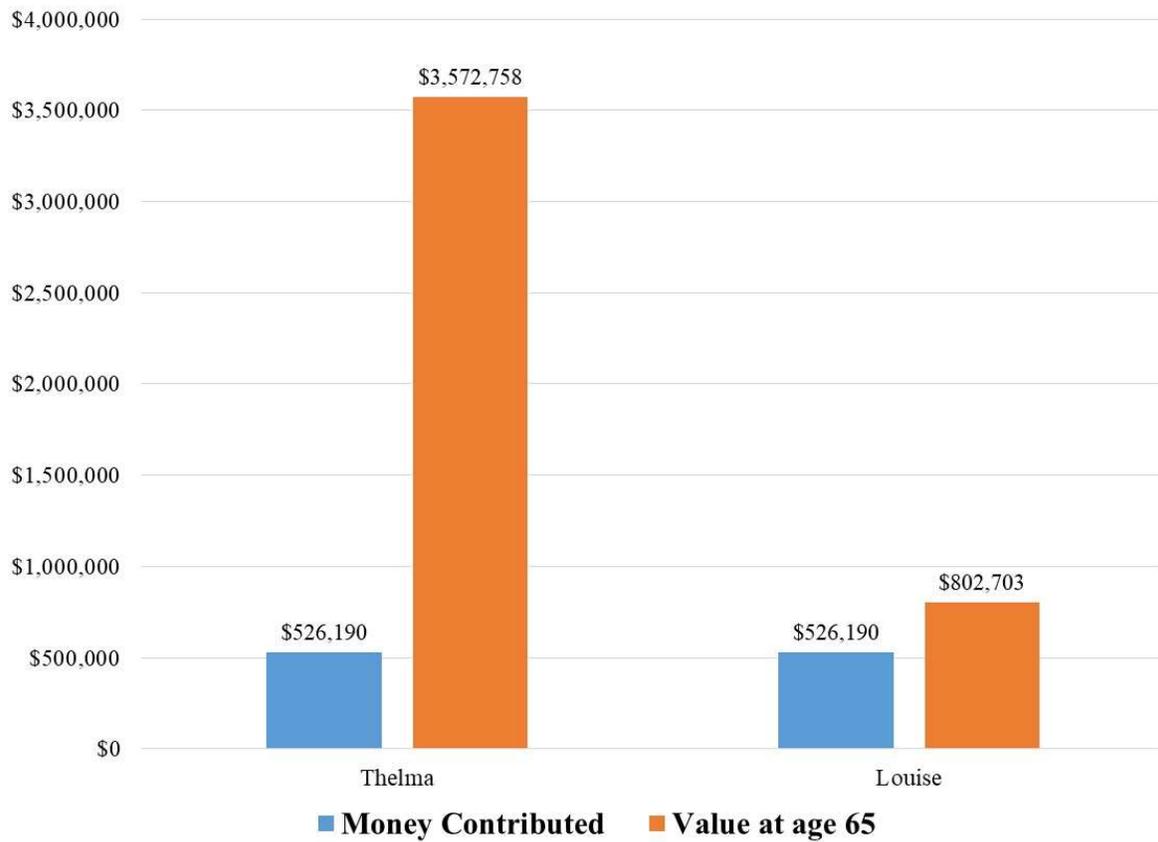
- That's the same as eating 9 M&M's instead of 10 M&M's.
- That's the same as playing 54 minutes of video games instead of one hour (60 minutes) of video games.
- That's the same as going on vacation for 9 days instead of 10 days.

10% is not that much! [Jacob tried to convince his nephew to defer 50% of his earnings from mowing yards into a Roth IRA. He was going from no income to income, so the difference between a \$5 paycheck and a \$10 paycheck wasn't really material. And while a custodial Roth IRA does place some restrictions on future withdrawals, contributions can be withdrawn at any time after the account has been opened for five years and earnings can potentially be withdrawn penalty-free prior to age 59 and ½ for qualified educational expenses or a first-time home purchase.]

[B] Do It Intelligently: Thelma & Louise

Now consider the case of twin sisters Thelma and Louise. Thelma and Louise both have the delayed gratification gene and, like Bill, they decide to defer 10% of every paycheck beginning at age 16 into a savings account for retirement. But Thelma invests hers in a tax-advantaged Roth retirement account that earns 8% per year while Louise invests hers in a taxable¹ savings account that only earns 2.5% per year. How do they fare?

¹ We assume a 12% federal tax rate and 4% state and local tax rate.

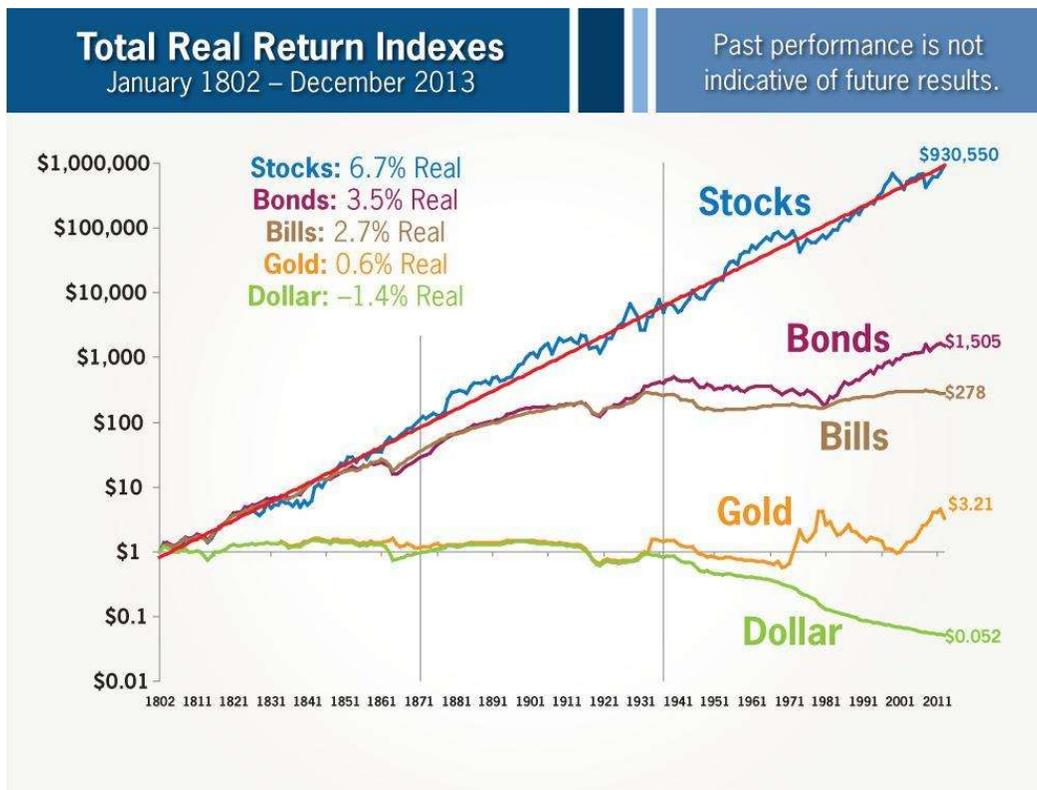


So was Jacob successful teaching delayed gratification? It's hard to know. His nephew agreed to fund the Roth IRA and at least one of the high school students went home and asked her parents about starting a Roth IRA. But perhaps these two were already blessed with the delayed gratification gene and Jacob was simply "preaching to the choir." (Indeed, the fact that his nephew has been itching for two years to start mowing yards says something about his willingness to sacrifice.) And we recognize that some people's financial realities make saving and investing a truly challenging endeavor. Nonetheless, we think it's important and worthwhile to "preach the gospel" about the importance of starting early and the wonder of compound interest.

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Appendix: Compound Interest at Work

It is hard to know exactly how stocks will perform in the future, but it seems reasonable to assume the future will have some resemblance to the past: Stocks should have more short-term variation but higher long-term returns than competing investments. Consider the graph below from finance professor Jeremy Siegel:



These figures have been adjusted to take into account the impact of inflation over time and they are exhibited on a logarithmic scale² in order to display everything on a single axis. But after adjusting for inflation over the 200+ year period:

- \$1 left in cash turns into \$0.05! (This starkly illustrates the adverse impacts of inflation, where steadily rising prices reduce the value of cash. “Under the mattress” is not a great investment account!)
- \$1 invested in gold turns into just \$3.21.
- \$1 invested in Treasury Bills turns into just \$278.
- \$1 invested in Bonds turns into just \$1,505.
- \$1 invested in stocks turns into \$930,550!

Most people fail to appreciate the power of compound interest because it is difficult to see so far into the future. But the wonders of exponential growth can be harnessed across a wide array of human endeavors – not just investing but also education, health, relationships, etc. Over a long enough timeframe, even small efforts – if implemented intelligently and consistently – can lead to huge results. So start early and be intelligent!

A fellow named Stephen Duneier gave an outstanding presentation on the power of compound interest at a TED^x Tucson conference. Check out the fifteen-minute video: Search YouTube for “How to Achieve Your Most Ambitious Goals” by Stephen Duneier.

² A linear scale is based on fixed intervals, i.e. 1, 2, 3, 4, 5, etc. A logarithmic scale is based on orders of magnitude, i.e. 1, 10, 100, 100,000, etc. (in this example a factor of 10x).