Payden&Rygel

POINT of VIEW

WINTER 2016

Our Perspective on Issues Affecting Global Financial Markets

An Open Letter to Taylor Swift: Spotify and Music's Future

* The italicized words and phrases appearing throughout the article are titles of Taylor Swift songs. Taylor Swift is an American singer-songwriter who has sold more than 170 million records worldwide as of 2015, making her one of the best-selling artists of all-time.

Dear Taylor,

We're seeing *Red**. Never in our *Wildest Dreams* would we have thought we'd go a day without hearing your music, but you give us little choice. You pulled your entire catalog from Spotify, the largest global music streaming service, making it difficult for us to enjoy your vivacious vocals and spectacular beats. In your *Wall Street Journal* op-ed explaining the move, you pointed out that "music should not be free" and that "piracy, file sharing and streaming have shrunk the numbers of paid album sales drastically."[1] Yes, we are fans, we enjoy everything you write, both music as well as opinion editorials in financial newspapers.

We don't agree with your decision–frankly it sounds like something from *1989*–and below we'll explain why. Music, even when enjoyed on streaming services, is not free. We know that you make most of your money from touring, but for other artists digital revenues are still incredibly important (representing $15 billion of the music industry's $68 billion in revenues in 2011).

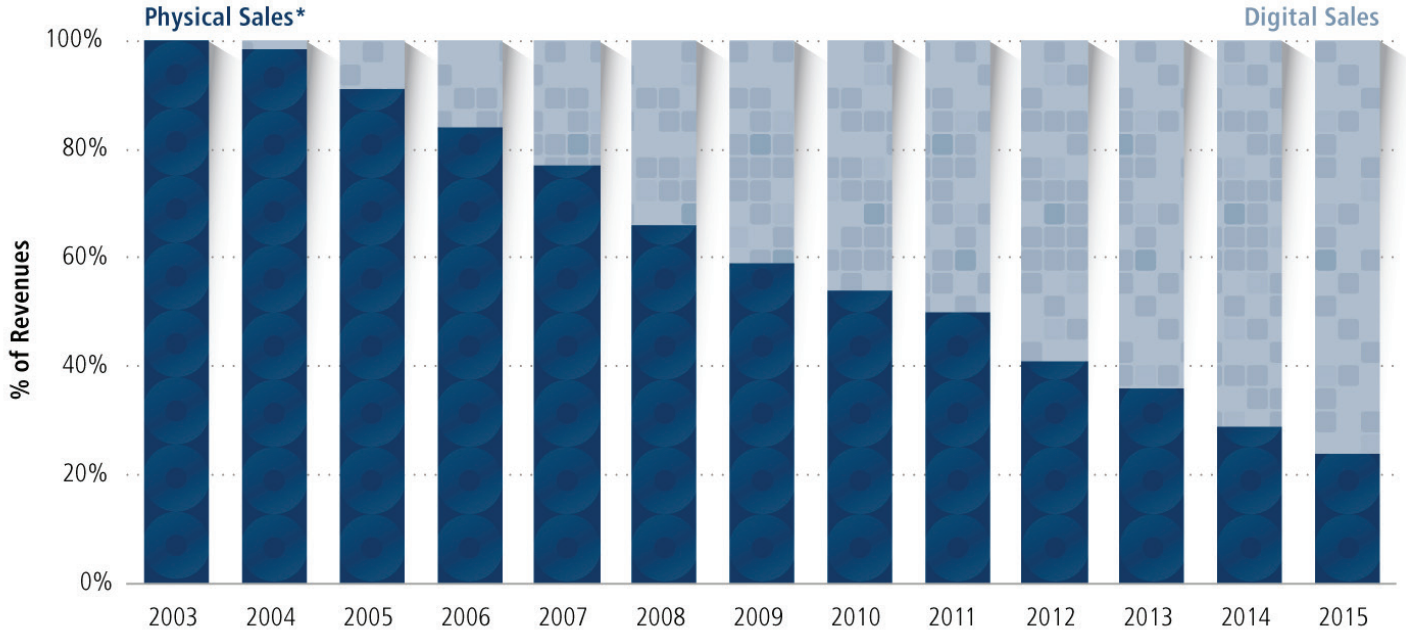
«WE DON'T AGREE WITH YOUR DECISION–FRANKLY IT SOUNDS LIKE SOMETHING FROM *1989*–AND BELOW WE'LL EXPLAIN WHY. »

Streaming is to modern listeners what the radio was in the old days, only better. It's here to stay. And based on our analysis, the music industry should embrace the model instead of trying, as it has so many times before, to "beat" technology.

WHERE ARE WE?

Let's face it: the music industry has experienced a massive upheaval since you moved to Nashville when you were just 14 years old (in 2004). Where listeners once had to purchase cassette tapes or CDs to enjoy music, today music is almost entirely digital. Believe it or not, when you started your career, digital revenues accounted for less than 2% of US

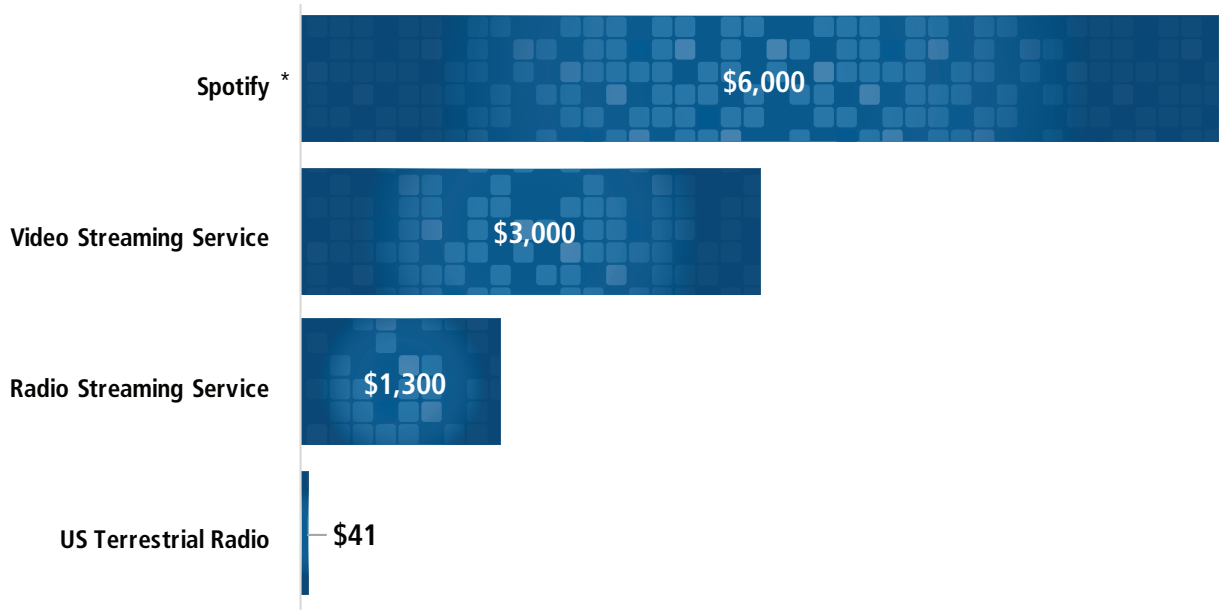
fig. 1 YOU, TAYLOR, MIGHT NEVER GO OUT OF STYLE…BUT PHYSICAL MUSIC SALES HAVE



Source: Recording Industry Association of America

*Includes physical CDs, cassettes, vinyl, etc.

fig. 2 NOT ALL STREAMING IS CREATED EQUAL: ROYALTIES PAID OUT PER 1 MILLION LISTENERS



Source: spotifyartists.com

*using lower bound of Spotify's Estimate

music sales. Today they account for 76% of music sales (see *Figure 1* on previous page). Is this *Bad Blood?* No.

The MPEG-1 Layer III format, better known as MP3, debuted in 1993 and proved to be the key innovation. While MP3s made song files 10 times smaller, to most of us (except those sound purist snobs) your voice still sounded as magical as it did before. We could load up our computers and MP3 devices with more of your songs than ever before. However, the digital files also led to piracy, as millions of users ripped tracks off their CDs and shared them for free on sites like Napster. When the courts finally stepped in, people were transferring at least 165 million songs every single day.[1]

EVERYTHING HAS CHANGED

As despair over piracy reached its zenith, Apple upended the music industry in 2003 when it created the iTunes Music Store. Why bother pirating songs when law-abiding fans could just as easily download individual songs or entire albums onto new gizmos called "iPods"? Music fans who believed artists should be paid fairly suddenly had a hassle-free way to put music into their portable music players. iTunes made digital music legal and compensated the music industry.

Just as the iTunes store replaced CDs, streaming has replaced iTunes. Consider Pandora. Founded in 2005, Pandora is your car radio in a web browser. However, it was Pandora's smartphone app, released in 2008, that "virtually doubled their growth overnight." By 2010, around 300 million smartphones had been sold around the world, and a lot of those had internet connectivity that made mobile streaming possible.[2]

Spotify is the next step in digital music's evolution. The service launched in the US in 2011 when it already had 10 million users in Europe, where it was founded in October 2008. Unlike Pandora, which controls which songs play next, Spotify let's you play specific tracks, create playlists, listen to entire albums or even entire artists catalogues. Spotify allows users to stream an unlimited numbers of tracks but also let users collect music in the native smartphone or computer applications to play offline (without internet connectivity). Once a user creates a profile, listening to music with commercials or commercial-free (for a $10/month subscription) is easy.

As you said in your *WSJ* op-ed, this is not looking like a great time for the music industry. But for any music listener, it makes sense. Why buy a CD when you can find all the music in the world for free?

"CUZ' THE FANS ARE GONNA STREAM, STREAM, STREAM, STREAM, STREAM"[3]

Look, Taylor, streaming is here to stay. Streaming is cheaper and provides a full library of music on your smartphone or computer. We have access to 30 *million* songs almost instantly. To put that into context, we would need to carry around 3,281 iPhones or have a stack of CDs that was taller than seven Empire State Buildings to build a music library of similar proportions.[4]

Taylor, you're a marketing machine, but with streaming we can be more adventurous and stream new, upcoming artists who might not be as famous as you. For example, as we listen to a new track by a novel electronic/dance artist, below on the artist's profile page we can see that they will be performing at a nightclub in London next week.

Streaming services also have built-in algorithms (check out our *Point of View* Article on Algorithms on page 10) that recommend new music to listeners based on what they already like. The novel, the new, the unexpected, are served up fresh daily. Streaming, for us, is like having our very own radio disc jockey at our fingertips, spinning songs and churning out information catered to our exact musical interests.

Instead of forking over $9.99 (and often more!) for a new album, which you may or may not like, with streaming you are free to explore. In fact, one of our economists listened to 954 different artists on Spotify in 2015, even though few of them have garnered superstar status like yourself. While you might argue the free version does not compensate artists by providing their music at no cost, there is still a benefit to artists and the industry at large. With Spotify's global platform, a vast array of artists are now given a virtual stage, a mic and a chance to achieve their dreams.

THE FREEMIUM MODEL WORKS

Taylor, Spotify follows the freemium model. Under this model, a "free" version of the software allows limited use of the product to convince users to upgrade to the "premium" version. Spotify's freemium model aims to bring consumers into the mix with a free version, which they then often convert a small fraction of users to the $10/month subscription once they see the benefits. Yes, one could "stream" your album *Fearless* for free, but they could not select the songs they would like to listen to or go mobile in their listening. However, does this switching actually happen?

We personally went from paying little or no money for music to paying the $120 each year to listen to your music at the office or on the go on our smartphones with our own customizable playlists. However, even if users are not forking over $120/year for the premium version, Spotify free users are still bringing in revenue through the commercials Spotify inserts into the broadcast stream. If you do not like that system, then why allow your music to be played on radio stations and Youtube?

Spotify pays artists based on how many streams (a user listening to your song once) you receive. While it might seem like the "per-stream" amounts are insultingly low, it is a lot larger than other platforms that have gained popularity with increased access to internet. As shown in *Figure 2*, for every million plays of a track, Spotify actually brings in more revenue than any other way of listening to music that is popular today. In fact, a million plays of your hit *Style* (our favorite track from your latest album) on Spotify would earn you more than the revenue of a million plays on YouTube, Pandora, and your local radio stations *combined*.

Artists are worried that they will not sell as many albums because their fans can now stream the music through services like Spotify (regardless of whether they are using the premium or free version). But a study published by the National Bureau of Economic Research found that 137 streams led to a reduction of a *single* track sale. However, they also found that this is offset by "new revenue generated through streaming payments (coming from formerly pirate consumers, buyers or individuals who used to forgo consumption)." [5]

WHAT'S NEXT?

As with most technological innovations, the period of transition is a tough one. There are winners and losers, but by embracing streaming, the music industry can once again find a way to make revenue when it was so brutally impacted by illegal internet users. Daniel Ek, Spotify's CEO, asked "what if you can make a better product than piracy?"[6] Now that artists have received more than $3 billion in royalties from Spotify, we believe we have found the answer to that question.

In conclusion Taylor, we do still love your music. We'll go to your concerts to support you. The freemium model got us hooked and then we realized the value of switching to premium streaming. We streamed your music until the last day you took it off Spotify. Without streaming we may never have met. So, *Shake it Off* and come back, TS!

Sincerely,

Payden Economics Team

The Payden Economics Team

SOURCES

1 Vroom, G., & Boquet, I. (2014). Spotify: Face the Music. IESE Business School.

2 Ibid

3 For those one or two readers who aren't fans, this title refers to lyrics from Swift's hit *Shake It Off*.

4 We assume that each song file is 7 megabytes. We know that each iPhone has 55.4 GBs of storage available to store just music and nothing else. Each CD fits 700 mbs and comes in a ~1cm thick album case.

5 Aguiar, L., & Waldfogel, J. (2015). Streaming Reaches Flood Stage: Does Spotify Stimulate or Depress Music Sales? *NBER*.

6 Seabrook, J. (2014, November 24). Revenue Streams. *New Yorker*.

Bribing the Maître D': Why Is It So Hard To Reserve a Table at a Fine Restaurant?

It is a Friday evening in early July. You've tucked away the last of the week's papers into the top drawer of your ash desk. Your thoughts turn to weekend plans: "Ah yes, that new French place just opened up, maybe we ought to head down there for dinner this evening." Your spouse celebrates the thought, but puts it on you to make reservations.

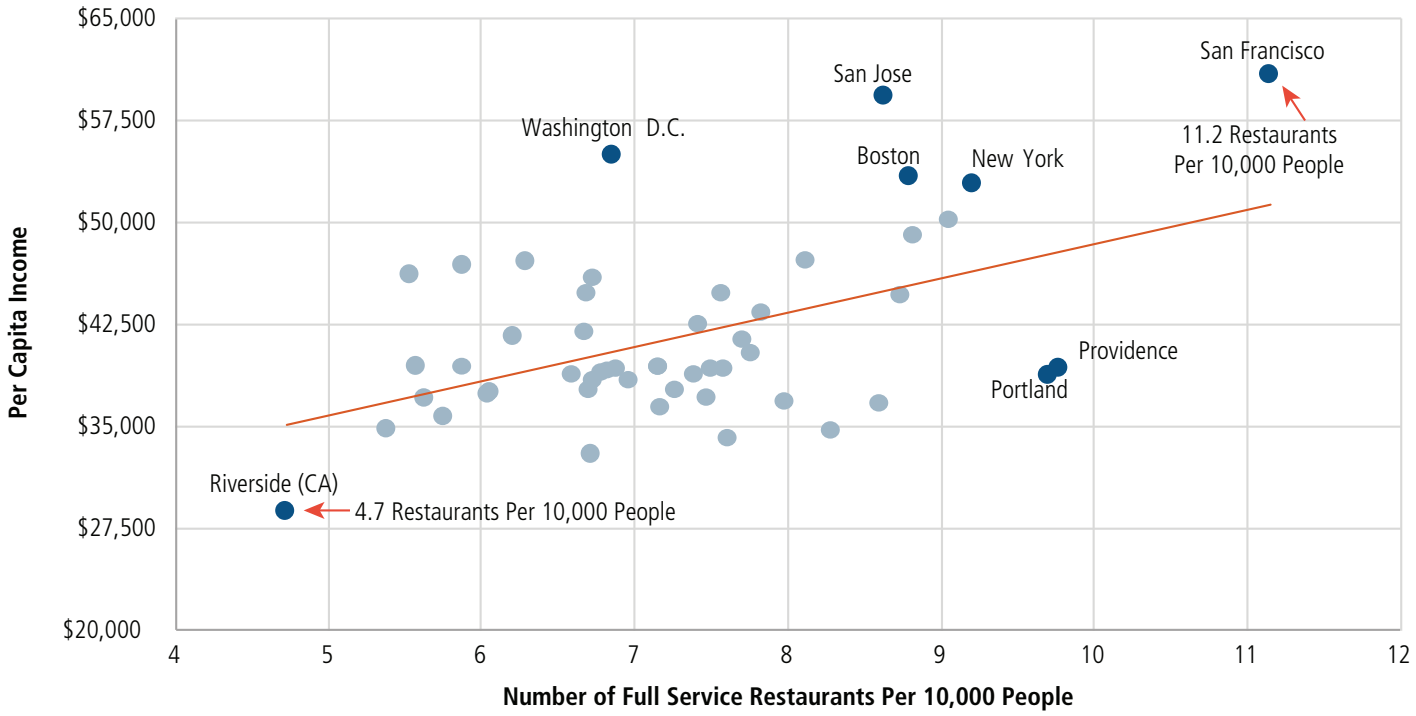
From here, what was once fanciful weekend planning turns into a procedural nightmare. You call up the restaurant, which hasn't been open since lunch, and greeting you on the other end of the line is an all-too-busy host with the bad news that no, the haute spot does not accept reservations. Prepare to stand in line, or wait at the bar for an hour before eating. Or maybe you call only to learn that the first open reservation is three months hence. Apparently you weren't the only couple in search of escargot and Bordeaux on a Friday night.

If we can contemplate sending humans to Mars (see our Centerpiece, "*Occupy Mars*" on page 8) then surely restaurants (especially popular ones) can ration their space in a better way. Don't believe us? Ask the taxi owners or hotel managers who have lost revenue to the likes of Uber and Airbnb—two companies among many set on putting existing capacity to better use.

«YOU CALL UP THE RESTAURANT, WHICH HASN'T BEEN OPEN SINCE LUNCH, AND GREETING YOU ON THE OTHER END OF THE LINE IS AN ALL-TOO-BUSY HOST WITH THE BAD NEWS THAT NO, THE HAUTE SPOT DOES NOT ACCEPT RESERVATIONS. »

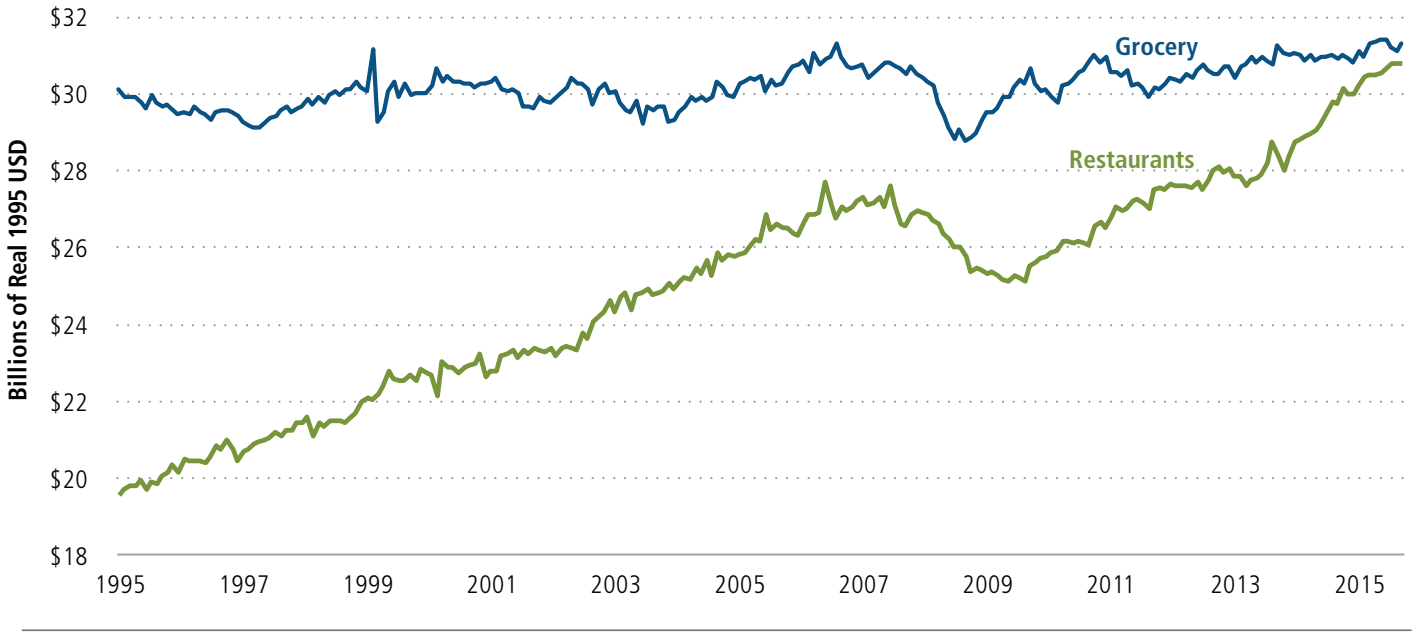
Up-scale restaurants and bars could lose long lines, make more money, and keep their tables occupied more consistently by adopting dynamic pricing, especially in the busiest foodie cities (see *Figure 1* below). Of course, our discussion is mostly limited to those institutions

fig. 1 MO' MONEY, MO' POSSIBILITIES: IT TURNS OUT, THE RICHER THE AREA, THE MORE RESTAURANT OPTIONS…WHO KNEW?



Source: US Census Bureau, City Observatory

fig. 2 LETTING SOMEONE ELSE DO THE COOKING: US CONSUMERS ARE SPENDING MORE AND MORE OF THEIR MONEY ON RESTAURANT FARE



Source: Bureau of Economic Analysis

which face such constraints. We are talking Wolfgang Puck more than Wendy's. But who knows, with the principles of dynamic pricing in mind, you might uncover other instances where constantly changing prices could revolutionize an industry.

DYNAMIC WHAT?

Before we reinvent the $2 trillion global restaurant industry, we first have to agree on what dynamic pricing means. At the highest level, dynamic pricing refers to a process where buyers and sellers pay different prices at different times for the same or similar goods, depending on the supply and demand constraints when they make their purchase.

Airlines are the most familiar example. Seat 13C from Heathrow to Charles de Gaulle will cost you more–or less–based on the characteristics of your purchase. Many people know that the price of an airline ticket can be higher or lower based on when you purchase, fewer know that airlines adjust the prices you see based on the day of the week, the time of day, the number of times you visited the reservations page, and much else (see the '*Did You Know?*' box on page 6).

RESTAURANTS FIT THE BILL

Now that we have defined dynamic pricing, we can articulate some of the factors which make restaurants candidates for dynamic pricing. While there are many features of markets best suited for dynamic pricing, fluctuating (or segmented) demand plus relatively fixed (and perishable) supply are defining characteristics.[2] It turns out restaurants experience both. And if Americans keep eating like they have been, restaurants will need to harvest all possible efficiency gains. Soon, it seems, most meals will be consumed outside the home (see *Figure 2* above).

As we know from our Friday night dining couple, the demand for restaurant food fluctuates and can be segmented into various demand types. There are Friday night diners who want the best table in the house, but there are also the young starving artists who might be happy to squeeze onto a bar stool at lunchtime on Wednesday and wolf down a pizza. Restaurants could ask the couple to pay a premium to reserve their preferred dining time (knowing they'll likely prefer Friday night to Wednesday afternoon). Meanwhile, the first-come-first-serve frenzy might work just fine at the bar for the young and hungry.

From the supply side, restaurants have fixed perishable inventory in two ways. Most obviously, the value of a meal is only economic right after it is made. Food doesn't last forever and if it isn't used by a certain time it is worthless. Second, like airlines, restaurants also offer an experience that requires the occupancy of physical space at a specific time. In other words, the value of a space at the hottest restaurant on the first Friday it opens is very different from the value of a space at the well-worn, but dependable, old Italian restaurant on the same night.

AN ENTRÉE TO DYNAMIC PRICING

To a certain extent, restaurants already move prices based on expectations of changing supply and demand. Anyone who has visited their favorite upscale lunch spot for dinner knows that the salmon salad they loved at $12 for lunch looks slightly less appetizing at dinner for $18. Bars and clubs also know that those customers interested in exclusivity and showy consumption are happy to spend lavishly for private rooms or bottle service.

Where once our information technology was insufficient to economically accommodate constant change, today's algorithms and mobile devices make the process painless and fast. Some restaurants (like Olive Garden) have replaced their waitstaffs' order notebooks with iPads at the tables. Early indications are that the iPads "speed up [the time each dining party spends at their table] and encourage additional spending with add-ons such as drinks and appetizers."[3] So much for the cost of menus prohibiting rapidly changing prices.

«EARLY INDICATIONS ARE THAT THE iPADS SPEED UP [THE TIME EACH DINING PARTY SPENDS AT THEIR TABLE] AND ENCOURAGE ADDITIONAL SPENDING WITH ADD-ONS SUCH AS DRINKS AND APPETIZERS.»

We think dynamic pricing in restaurants can go further, and that eaters and purveyors of fine food will be better for it. Of course, were it to become more pervasive, dynamic pricing could cause new problems. For instance, restaurants would have to moderate their price changes to avoid customer anger. But, for our more limited purposes here, the many (other unknown) difficulties with implementation and the possibility of consumer backlash will go unaddressed. Below we offer a few suggestions to benefit both bellies and bottom-lines by applying different prices across time.

FEEDING THE BEAST

First, restaurant goers should have to pay for their reservations. Sounds heretical, right? Who wants to pay in advance? Our conjecture is that the restaurant would be better off not giving their customers the free option to cancel their visit. The truth is, if you don't pay with money, you pay with waiting time. To keep lines manageable and to promote maximum revenue, the restaurateur can reward diners willing to plan ahead with lower prices, while adjusting the price higher for our lovely late-notice dining couple mentioned above.

Indeed, some fine dining establishments have instituted a charge for reservation cancellations within 24 hours of service (one preeminent place we discovered charges $100 per person for a reservation canceled less than a day before!). They are on the right track. The free option diners have to cancel not only represents the possibility of foregone revenue for the restaurant, but also means that other would-be eaters won't get their fill.

Our conjecture doesn't just work in theory. In 2013, online deal den Groupon acquired a small company, Savored, which offered discounts to diners willing to book their reservation in advance. The idea lives on

DID YOU KNOW?

The Benefits of Dynamic Pricing: It's Fare Game

All this talk of dynamic pricing and the most important question remains unanswered! When should I book my plane tickets? First off, the whole point of dynamic pricings is that the "best price" is not knowable to us beforehand. That said, excellent research conducted by the online booking behemoth, Expedia[1], gives us important clues. Please find your very own cheap travel checklist below:

1. For domestic flights, book two months in advance (actually 57 days to be precise). For international flights, your best bet is to book 6 months in advance (actually 171 days before you leave).
2. Anytime you have flexibility with departure/arrival days, use it! Travelers can find savings up to 25% off on short flights by leaving Saturday and returning Tuesday, rather than leaving Sunday and coming back Monday. On longer flights, leaving on Thursday and returning Monday shaves 20% off an itinerary which departs on Friday and returns on Saturday.
3. When you do book your flights, try not to do it on a Saturday or Sunday. Remember, you don't want to be buying when airlines know you are likely looking. Tuesday, Wednesday and Thursday (in that order) are the best times to book. Don't expect huge mark-downs, but 5% savings can't hurt.
4. Even though they seem like a gimmick, if you are interested in the lowest airfares, booking package deals–airfare, hotel, and rental car–can sometimes be the cheapest.

today in the form of coupons that one can buy to secure a reservation, at a discounted price, ahead of time.

«RESTAURANT GOERS SHOULD HAVE TO PAY FOR THEIR RESERVATIONS. SOUNDS HERETICAL, RIGHT? WHO WANTS TO PAY IN ADVANCE? OUR CONJECTURE IS THAT THE RESTAURANT WOULD BE BETTER OFF NOT GIVING THEIR CUSTOMERS THE FREE OPTION TO CANCEL THEIR VISIT.»

Because of the relatively fixed supply of space and food, restaurants could also price their food differently based on the day and time of day of consumption. For instance, on graduations and weekends, consumers ought to expect higher prices, knowing there are more of them shopping for (roughly) the same amount of food and space at existing restaurants.

At a more granular level, the restaurant could price its tasty morsels differently at different times of the day, based not only on the anticipated traffic but also on the supply available at the restaurant. Happy hour is a limited form of pricing food differently in expectation of demand. But with better models aiding restaurant managers in predicting demand, the price of the same offering could fluctuate more meaningfully: a burger at 3pm might cost you $5, whereas the same burger would ratchet up to $12 at peak hours.

What is more, because restaurants hold perishable inventory (food), we think there is a case to be made for pricing different menu offerings in such a way as to reflect the supply of the food inputs. For instance, if a restaurateur has failed to order sufficient quantities of short ribs, the price should rise as the supply falls. How often have you been frustrated to learn, upon ordering the most enticing item on the menu, that, "We no longer have any more of that"?

Taken in total, the nature of the upscale food business is such that restaurants and diners stand to gain by more fluid pricing. For foodies, it means less waiting and cheaper prices if you plan ahead or choose a less busy time to eat. For the restaurant owners and managers, dynamic pricing would both increase their revenue per table and would (ideally) lower costs by reducing food waste. Who knows, maybe in the next decade, we will find ourselves booking and paying for our meals at different prices on different days through phone applications or some other wonderful contrivance. Food for thought.

SOURCES

1 Expedia, Airlines Reporting Corporation (ARC). "Preparing For Takeoff: Air Travel Trends 2015".

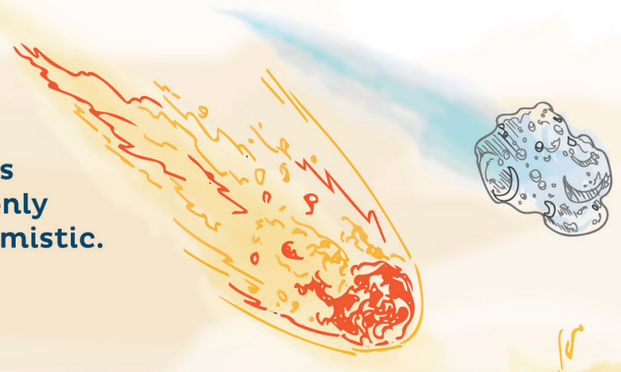
2 Kimes, S. E. (2010). Strategic pricing through revenue management. Retrieved [11/20/15], from Cornell University, School of Hospitality Administration.

3 Bartashus, Jennifer (2015). "Darden Primer" Bloomberg Intelligence. Retrieved 10/6/2015.

OCCUPY MARS

THE CHALLENGES OF MARTIAN COLONIZATION

The first human priority is to survive, the second is to explore. With the recent release of *The Martian*, we took it upon ourselves to contemplate some of the challenges humans will face in our eventual Mars landing. Solving lower gravity, tremendous distance, and an inhospitable atmosphere are only some of the difficulties we face. But we are optimistic. See you on the Red Planet!



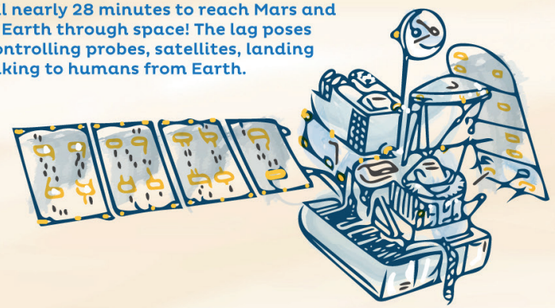
Challenge 1 – DISTANCE
Mars Is Not Exactly Next Door:

Mars is 225 million kilometers from Earth. Colonizing Mars requires a lengthy trip of just short of a year (we hope you use the bathroom before you leave!).

YOU ARE HERE!

Challenge 2 – COMMUNICATION BREAKDOWN:

It takes a signal nearly 28 minutes to reach Mars and bounce back to Earth through space! The lag poses challenges in controlling probes, satellites, landing aircraft and talking to humans from Earth.



Challenge 3 – GRAVITY:

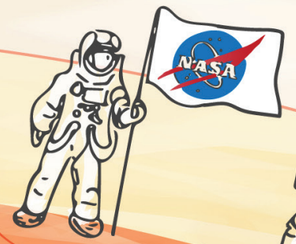
Martian gravity is just 38% of Earth's, meaning your muscles will slowly weaken the longer you stay on the surface. The good news? Even if your mass won't change, your weight will—get ready for some "Welcome to Mars Red Planet Velvet Cake."

PHOBOS (Mars's moon) orbits the planet at a distance of 9,377 km. That's close. Our own Earth moon orbits at a distance of 363,000 km. Phobos's proximity means it offers a possible human base for initial Martian colonization and exploration. Communication distance between Phobos and Mars is just 40 milliseconds and we have plenty of experience landing humans on moons. No experience landing humans on planets.

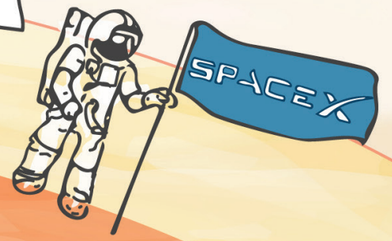
Challenge 4 – THE ATMOSPHERE IS TOO THIN TO SUPPORT LIFE:

The Martian atmosphere is 100 times thinner than Earth's, meaning temperatures are much cooler (approximately -60C or -80 F compared to Earth's 16C), asteroids and comets careen into the planet's surface almost undeterred and at such low temperatures liquid water would not exist for very long.

NASA plans to send astronauts to Mars by 2030 with its Space Launch System (SLS)...



Private venture Space X plans to land on Mars by 2025 with reusable rockets.



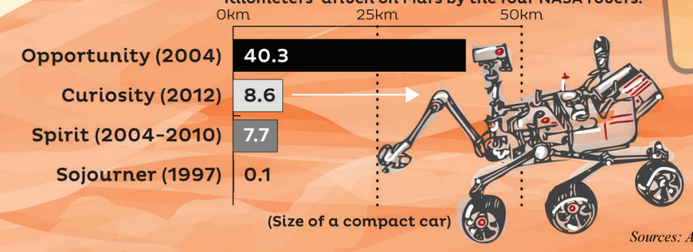
Bad news: Radiation would have killed the main character in ***The Martian*** within months of roaming around on the surface. He'd have to spend his time in an underground bunker under a 1 meter thick shield to protect himself.

2.7% Nitrogen
1.6% Argon
0.13% Oxygen
0.08% Carbon Monoxide

CO_2 95%

WHO INHABITS MARS NOW? (THAT WE KNOW ABOUT...)

Kilometers-driven on Mars by the four NASA rovers.



Good news: The sand storm depicted in ***The Martian*** would not happen, as a 150 mile-per-hour windstorm would feel like a 1 mph breeze on Mars.

Challenge 5 – SOIL:
MARS IS "A PLANET WHERE NOTHING GROWS":

NASA's Curiosity rover found that every cubic meter of Martian soil has 35 liters of water (that's at the Gale crater). A human on Mars might dig up and purify water from ice deposits in the soil. According to NASA, many of the key nutrients needed to grow plants are present in Martian soil, however fertilizer would likely need to be added.

CONCLUSION:

Let the robots roam the Martian surface. Phobos, not Mars, might be the next human colony.

Sources: Andy Weir, presentation at the Lawrence Livermore National Laboratory, 4 September 2015. Lee Billings. "Human Missions to Mars Will Look Completely Different from The Martian." Scientific American. 2 October 2015.

Going Up or Down?
What Elevators Tell Us About the Biggest Factor Altering the Global Economy Right Now

Algorithms, not politicians or central bankers, rule our world, but we don't think about the software gremlins until things go awry.

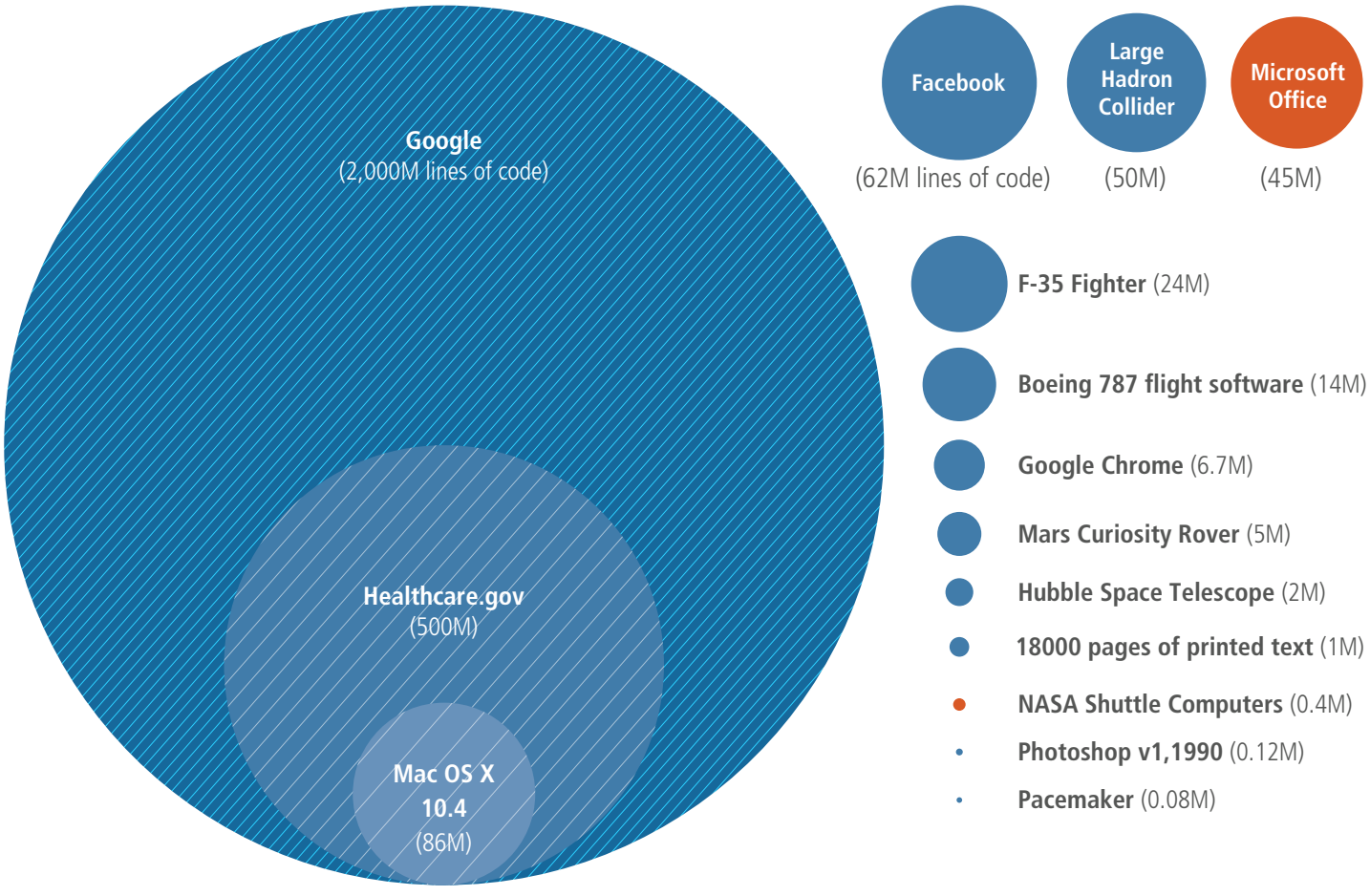
Such an occasion presented itself recently at Payden's Los Angeles global headquarters. Our landlord decided to upgrade the building's elevator system. Instead of passengers piling into the same elevator and only then manually selecting floors, travelers now punch in their destination floor on a lobby keypad and are then assigned a specific elevator car. The "algorithm behind the curtain" sorts and packs passengers in each car to like destinations, optimizing for the most efficient ride to the desired floor.

At least that was the plan.

The new elevator experience exposed much about our present and our future. Below we'll explain what an algorithm is and address many of the major concerns surrounding them. Specifically, the updated elevator system sparked concerns about "giving up control" to machines, disappointment that the "algo" did not always work as expected, and lessons about the interaction between the software and the "real" world.

But, instead of falling prey to the easy argument–that we should fear or regret that we've abdicated control to "the algos"–we come to the opposite conclusion. Algorithms are the instantiation of progress. The obvious human reaction is to oppose them, but algorithms augment specialization. They allow humans to worry about–focus on, fret about, occupy ourselves with–something else. We should embrace

fig.1 HOW MICROSOFT OFFICE IS MORE COMPLEX THAN THE SPACE SHUTTLE: LINES OF CODE IN TECHNOLOGY TODAY



Source: Information is Beautiful

them rather than worrying excessively about them. An elevator ride will make that clear.

ALGO-WHAT?

By now most people have heard of the "algos" that trade in the stock market and how "Flash Boys" "account for 70% of daily transactions."[1] (See also the Spring 2015 edition of the *Point of View*). Similarly, most people know that their Facebook news feed is optimized by an algorithm, that their Amazon home page is driven by an algorithm and that their Netflix movie recommendations are also the work, yes, of an algorithm. How does Walmart ensure its shelves are stocked with just the right products? An algorithm.[2]

But what *is* an algorithm? Put simply, an algorithm is a set of instructions to accomplish a task.[3] We use algorithms every day: in our morning bathing routine, the manner in which we brush our teeth or comb our hair, the route we follow on our daily commute to the office, how we prepare a sandwich, and our coffee brewing method.

For computers, algorithms become more than just a recipe, they are the most efficient way of accomplishing a task using available resources. For example, your Google Maps application uses an algorithm that finds the shortest route between A and B. An algorithm helps NASA arrange solar panels on the International Space Station given the sun's rays (an "optimization" algorithm). Computer scientists created a checkers program that never loses. How? It uses "minimax search algorithms" to find the best moves at all times.

But still the process is the same: follow a set of instructions to accomplish a task. The difference is the computer can do it faster, more efficiently and with reliable precision. Rarely do humans achieve such speed, efficiency, and accuracy with their toothbrush strokes. As such, wherever something can be subjected to the tyranny of an algorithm rather than manual human skill and logic, it should be.

OUT OF CONTROL?

Stepping inside the newly-renovated elevator at Payden HQ, passengers first noticed something disconcerting: *there were no buttons*. The elevator was completely automated, sort of like stepping inside a vehicle…without a steering wheel.

It should come as no surprise then that fear quickly set in. "I don't trust those devices," a colleague confessed in the elevator one early morning.

Under the old regime–first board elevator, then press button–a passenger had at least the illusion of control. To the human mind, there is something comforting about the idea that as you levitate toward floor 32, should you chose to do so, you can at the mere press of a button, stop at floor 23 and have a look around. No more. You're trapped in a capsule bound for your ultimate destination.

But the palpable fear of lack of control is misplaced. The machines are not in charge. Humans still reign. And this is the first lesson of the algos.

A century ago, each elevator car required a human operator. Actually, in the early days, an operator *and* an attendant–two humans–would be present, one to direct passenger traffic and the other to actually operate the machine along your journey. The attendant, knowing the names (or at least faces) of each passenger could herd riders into the optimal elevator car. Or, seeing the boss, the attendant might segregate lower level employees into a separate car, allowing the "higher ups" a more peaceful ride to the top without awkward conversation about the families and weekend activities.

«INSTEAD OF FALLING PREY TO THE EASY ARGUMENT– THAT WE SHOULD FEAR OR REGRET THAT WE'VE ABDICATED CONTROL TO 'THE ALGOS'– WE COME TO THE OPPOSITE CONCLUSION.»

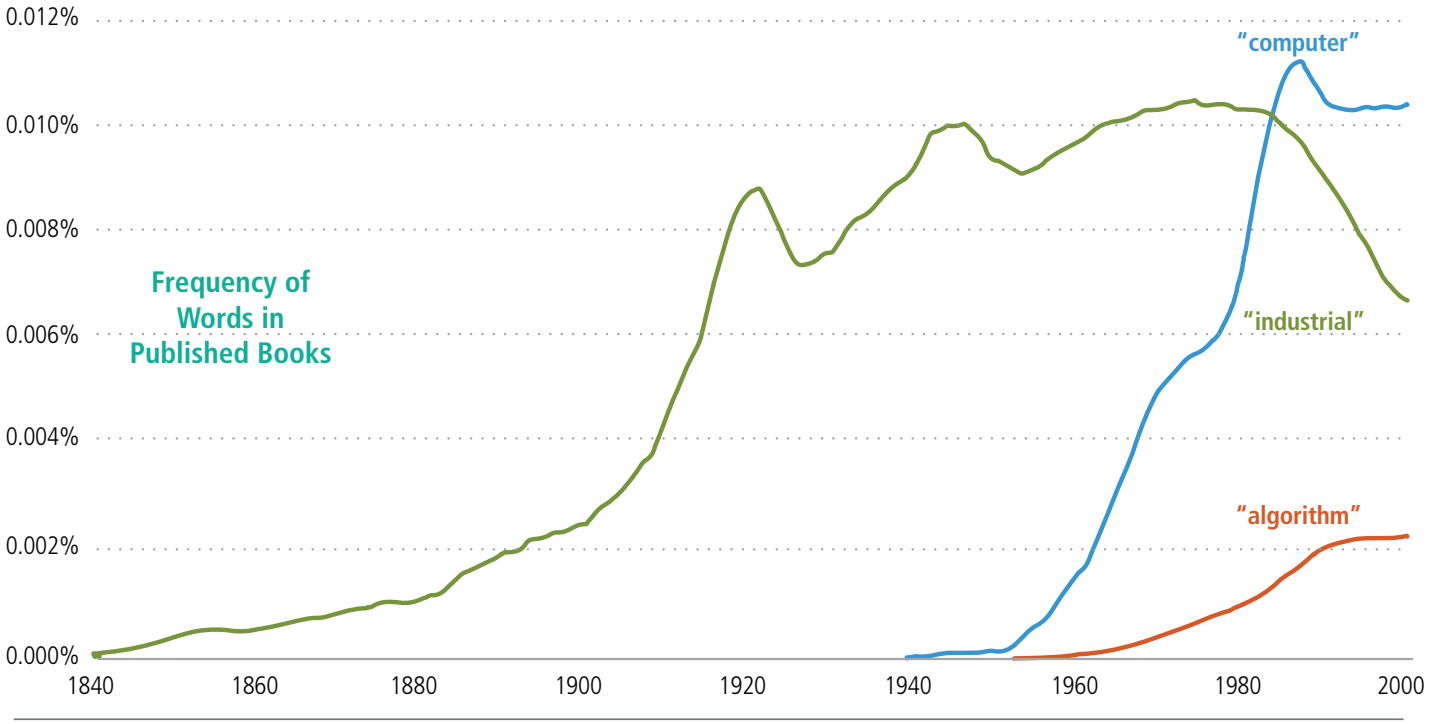
The logic employed by the attendant and operator has been replaced by an algorithm. But ultimately, it's the act of coming up with knowledge–writing the lines of code (see *Figure 1* on previous page)–that takes manual work. That's where the human effort remains crucial. That's where creativity is required. Automating things like elevators is not removing humans from control, it is actually putting knowledge to work. Humans are very much still involved. An algorithm is a product of human knowledge, not an abdication of control.

This is also not the first time elevators sparked fears among riders. About sixty years ago buildings began to switch away from human elevator operators to mechanical push-button "driverless" elevators. Passengers were horrified.[4] To this day some Manhattan elevators have operators who comfort passengers and soothe their fears.[5]

PACKING THEM IN

Installed in our building's elevator system is a "destination control" or "destination dispatch" algo. One version, the Swiss company

fig.2 THE INDUSTRIAL REVOLUTION, THEN THE COMPUTER REVOLUTION, AND NOW…THE RISE OF THE "ALGOS"



Source: Google Books Ngram Viewer

Schindler's "Miconic 10," promises fewer crowds in the lobby, a swifter ascent to your desired floor, and fewer unplanned stops along the way.[6]

The old days featured their own moments of annoyance, when an elevator wouldn't arrive for what seemed like minutes, for example. Or when multiple stops occurred *en route*, delivering passengers to floors along the way, like a local subway line instead of the express.

Elevator engineers use "probable stop" tables to gauge the likely number of stops that an elevator will make as it ferries passengers 10 floors above the street. With 10 passengers packed in, 6.5 stops are likely. Many factors are at play, of course, such as how long the doors remain open at each stop, how long they take to close, whether an unruly passenger on floor 9 decides to bring a mail delivery cart up to floor 10, etc.

This so-called "interfloor traffic" (Dear employee on the floor below us: please just take the stairs!) can further delay progress and speed. Once accounted for, the algo should reduce wait times, eliminate unnecessary stops as passengers are packed into cars destined for the same set of floors, and save energy. In short, the algo will seek the most efficient use of resources.

SOFTWARE MEETS REALITY

Of course, even with the new algo, not every ride works optimally. In our elevator bank, a major problem quickly arose: coworkers would see each other waiting near the elevator bank and assume that the correct destination floor had already been selected. The arriving employee would neglect to key into the lobby terminal, "piggybacking" on a colleague's ride.

As an elevator would fail to arrive, a crowd would form. The lobby security guard once had to alert the crowd around the elevator bank to the problem, exclaiming, "If you do not 'key' your floor into the system, the computer does not know that you are here waiting! Don't piggyback on other people," he admonished the waiting crowd.

«PUT SIMPLY, AN ALGORITHM IS A SET OF INSTRUCTIONS TO ACCOMPLISH A TASK.»

You see, the algorithm–without eyes, ears, or consciousness–had no idea how many passengers were lingering impatiently in the lobby, negating any efficiency an algorithm could provide. Passengers were left quietly cursing technology, even though the problem resulted more from lazy humans than the tireless algo. Once the technology collided with humans in reality, distrust grew out of misunderstanding.

ALL NATURAL, ORGANIC

Why the lack of trust for technology? We distrust because we love the natural; we abhor the synthetic. Organic food thrills and demands a

price premium, while we turn up our noses to anything "processed" or chemically-enhanced. We wield the same prejudice against the algorithms.

But as Nobel laureate psychologist Daniel Kahneman remarked, "Fortunately, the hostility to algorithms will probably soften as their role in everyday life continues to expand. Looking for books or music we might enjoy, we appreciate recommendations generated by software."[7]

Further, humans are "incorrigibly inconsistent in making summary judgments of complex information."[8] If we are to make progress, humans will be removed more and more from the loop. Despite concerns, algos already surround us, are a force for good, and will make your life better (despite your annoyance). This is not a utopian dream. It's progress. And, in fact, it is the only way progress occurs.

THE ALGOS: *THE* CURRENT STAGE OF ECONOMIC DEVELOPMENT

Consider the broader scope of economic development for a moment. Major developed economies underwent agricultural revolutions (ca. 16th-19th centuries), industrial revolutions (19th-20th), scientific revolutions (mid-20th), and are now in the midst of an algorithmic revolution (1990s-present) (see *Figure 2* on the previous page).[9]

How is an algorithm revolution different than a scientific revolution? In short, "the algorithmic model takes the costly process by which ideas are created, stored, shared, combined and, of course, connected to economic exchange as the central problem of economic life."[9] Goods are moved, services rendered, information shared, all based on algorithms.

As you expand your worldview, the more you will realize "they" (the algorithms) are already everywhere. Many of the things transforming the world on the surface–you know, the ones that get all the attention in the press and provide much fodder around office water coolers–are driven by algos: "globalization," telecom, the "gig economy," the "sharing economy," etc, are all just symptoms of the underlying algorithmic upheaval or reshuffling. They are all around us: Netflix, Uber, AirBnb, Spotify, OpenTable.[10]

NOW ARRIVING

Just as the overwhelmed elevator attendant would be unable to direct passenger traffic in a massive, modern skyscraper, the world in which we live is *only* possible due to the algos.

So the next time you scoff when Amazon recommends a book you have no interest in reading, remember: it's tempting to dislike algorithms because they're not "real". They don't behave the way we think they ought to, or we fear we've abdicated control. But that doesn't mean they aren't doing their job. In fact, it likely confirms that they are. It has always been this way–some system is used to optimize resources.

Algorithms are our past, our present, and our future.

<ding>

<door opens>

"Going up!"

SOURCES

1 Kevin Slavin. "How Algorithms Shape Our World." TedGlobal 2011. July 2011.

2 Constance L. Hays. "What Wal-Mart Knows About Customers' Habits." The New York Times. 14 November 2004.

3 Thomas H. Cormen. "Algorithms Unlocked." Cambridge, Massachusetts: The MIT Press, 2013.

4 Steve Henn. "Remembering When Driverless Elevators Drew Skepticism." National Public Radio. Planet Money. 17 August 2015.

5 Michael N. Grynbaum. "Subway Elevator Operators Dwindle in New York." *The New York Times*. 28 April 2011.

6 "Schindler Miconic 10 Destination Control." Retrieved December 2015 from schindler.com.

7 Daniel Kahneman. "Thinking, Fast and Slow." New York: Farrar, Strauss and Giroux, 2011.

8 Daniel Kahneman. "Thinking, Fast and Slow." New York: Farrar, Strauss and Giroux, 2011.

9 Hezekiah Agwara, Philip Auerswald, and Brian Higginbotham. "Algorithms and the Changing Frontier." *NBER* Working paper 20039, April 2014.

10 Danny Crichton. "Algorithms Are Replacing Unions as the Champions of Workers." *Techcrunch*. 17 August 2014.