

3. Fundamentals - read as much as you can.

Every time someone asks Elon how he has learned to build rockets, he goes:

"I read books."

I admit it is hard not to laugh. It sounds like he's making fun, except he's not.

Before launching SpaceX he gathered information, studied books, envisioned possibilities, and realized that the space industry was covered with dust, all the hardware old and extremely expensive, with too many middle-men and on top of that, run by governments or space agencies willing to pay whatever amount of money it took... Well you know... they are public.

It is not just Elon that reads; a large majority of successful people are deliberate readers. Just to name a few current ones you know of: Bill Gates, Oprah Winfrey, Mark Cuban, Warren Buffet, Mark Zuckerberg, Tony Robbins.

Thomas C. Corley went on a five year road of researching the daily habits of 177 self-made millionaires and stacked it all together into 'Rich habits.' A decent book, I have to say. So, do they read? Hell yes - 88% of moneyed folks: "devote thirty minutes or more each day to self-education or self-improvement reading"

Aha. Well noted.

Considering Elon, he has said there was a time in his life when he was reading 2 books per day. Yes, TWO books PER DAY -

which makes over 700 books in a single year. That is far more than an average person reads during their entire lifetime. In interviews, Musk has contended that reading is what has made him successful.

In front of me, I have an article which states that in my country (Hi Poland), throughout 2018, 37% of people read at least one book. The other 63% of respondents didn't touch one. Only 9% of my country's population finished more than 7 books. I don't think those numbers are even correct, considering that 'everybody lies', especially in questionnaires about themselves.

~ Everybody Lies: Big Data, New Data, and What the Internet Can Tell Us About Who We Really Are.' A book by Seth Stephens-Davidowitz - a brilliant hardcover to put on your shelf.

Is not reading really that bad?

Entrepreneurship should go hand in hand with knowledge. If reading really doesn't work for you, try other ways - podcasts, browsing the internet, talking with experts, internet forums. Whatever works for you, set your standards high and learn as much as you can.

Others about Elon:

Scott Haldeman, Elon's uncle: "He never went anywhere without a book in his hand. He was always reading, and it was often advanced books. That was one of the earliest things you started seeing. It was this intense reading, and they were books about the future and about success."

Warmer, warmer here - we know a bit more of what has shaped this character.

reading interrupter #3



Musk - "...then to accelerate the license plate will lower and behind it the rocket engine is activated. It's totally James Bond." If you could choose between world peace or all of Elon's money, what color would your Roadster be?

Reading is the best and most accessible way to build up your knowledge. When you read a lot, it allows you to amass information as well as combine different topics and find the links and dependencies between them (and to be more chatty & witty whilst hitting that blonde one). Simply put, it allows you to connect the dots - more about that in chapter 7. No boundaries - why billionaires are polymaths (so is Elon Musk). What makes books so special? There is not a single existing topic that has not been widely described. Let's take someone who wants to lose weight. If you put the term 'losing weight' in an Amazon search, you will find over 20,000 books on this topic. What's more, you have ratings, readers' opinions - all that makes it easier to choose the best publications (doesn't mean it always works). Choose any topic, pick up 10 books with the best ratings and opinions. And this is a really good starting point to master any discipline or solve any problem. Literally you can choose any topic, no matter how exotic, and you will always find some decent books on it. And it's important to indeed choose a range of topics. To not focus solely on one. Reading only fantasy novels or crime fiction won't give you much knowledge of the world.

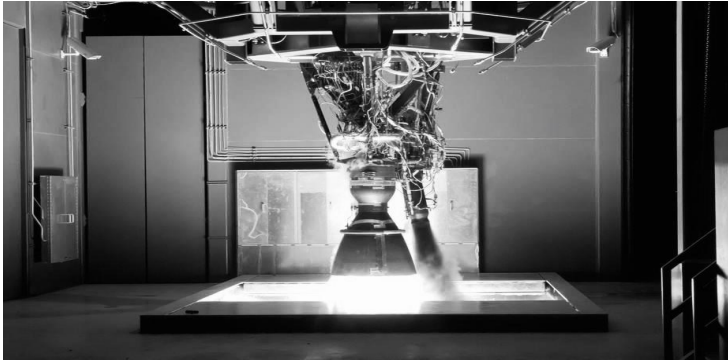
An alternative source of knowledge.

The rise of the internet is as important as the invention of pizza. It's my personal opinion and I keep my rights reserved. The internet works well as an alternative for books. Like everything, it has flaws, but it also has certain advantages over books, mainly:

- current information can appear way faster in the web.
- it can appear in the form of news.
- Information is easy to put there, it means that anyone can put data on the internet - good or bad.
- it might be in a short, or condensed form, which is sometimes great if you are not planning to dive deep into a certain area.
- information can be quickly modified when it is incorrect.
- In contrast to books you can ask anything in specialized forums, groups, or at quora.com - a global Q&A service (highly recommended).

You can find articles, the latest scientific research, decent meritocratic Youtube channels, and a variety of podcasts where people are talking about any topic you would like to hear of. The amount of decent sources of knowledge is just staggering and growing by the day. It's in your best interest to use many sources of knowledge, they all might be incredibly useful. However, I still consider books as the most important ones and in most cases, they help understand ideas more profoundly and are probably less biased than the internet might be.

reading interrupter #4



In this case... it is rocket science. Doing business in the space industry is as complicated as this engine looks. Test firing of the Merlin 1D at SpaceX's McGregor test stand.

Elon recommends.

"I was raised by books. Books, and then my parents."

Rolling Stone magazine, November 2017.

1. "Zero to One: Notes on Startups, or How to Build the Future" by Peter Thiel and Blake Masters*
2. "The Hitchhiker's Guide to the Galaxy" by Douglas Adams
3. "Benjamin Franklin: An American Life" by Walter Isaacson
4. "Structures: Or Why Things Don't Fall Down" by J.E. Gordon
5. "Life 3.0: Being Human in the Age of Artificial Intelligence" by Max Tegmark
6. "Ignition: An Informal History of Liquid Rocket Propellants" by John D. Clark
7. "The Lord of the Rings" by J.R.R. Tolkien
8. "Superintelligence: Paths, Dangers, Strategies" by Nick Bostrom
9. "Our Final Invention" by James Barrat
10. The "Foundation" series by Isaac Asimov
11. "The Moon Is a Harsh Mistress" by Robert Heinlein

12. "Merchants of Doubt" by Naomi Oreskes and Erik M. Conway
13. "Einstein: His Life and Universe" by Walter Isaacson
14. "Howard Hughes: His Life and Madness" by Donald L. Barlett and James B. Steele
15. "Look to Windward" by Iain M. Banks
16. "Lord of the Flies" by William Golding

Fun fact:

*Peter Thiel (a tech-billionaire, who co-founded PayPal with Elon Musk) has written a masterpiece in the science of business - "Zero to One: Notes on Startups, or How to Build the Future." Definitely the best business book I have ever touched. I have gone through more than 30 business-related titles and I don't think any of them come close to how condensed, engaging, and complete this one is.

Fun fact: #2

"You should try to take the set of actions that are likely to prolong civilization, minimize the probability of a dark age and reduce the length of a dark age if there is one."

Above is the lesson that young Elon drew from Isaac Asimov's Foundation series. Honestly, it is amazing how books can shape someone's life. Can we say that books are parenting us or would it be an abuse?

Concerning Elon's selection, I was biased enough to think that someone who does hardcore engineering wouldn't touch a non-scientific book. Dead wrong. There are as many as seven books of fiction there - mostly science-fiction (no surprise there). "The heroes of the books I read ... always felt a duty to save the world," he told The New Yorker. Hmmmm, now we are seeing how those books have influenced him to do meaningful things.

Concerning one of his projects, Neuralink, Musk has said that the idea was inspired from a science fiction concept named "neural lace," which originated from The Culture novels written by Iain M. Banks. Imagination is so, so underrated today.

"Imagination is more important than knowledge. Knowledge is limited. Imagination encircles the world."
- Albert Einstein.

I have to admit that, after listening to Elon, I realized I had underrated novels and their ability to engage imagination. Big mistake there - fortunately, you don't have to make the same one. Learning from someone else's mistakes is probably better than learning from your own. Biographies should be a heavy shelf in your library. You go through someone's life story, you see failures, struggles, achievements, obstacles, the prose of life, and also - the mistakes. You understand that a hero is only a human built of a bunch of cells, as you are. Perhaps an even better thing about biographies is the fact that they inspire. Watching how someone started from zero and through time managed to get where they were aiming is an injection of motivation and courage. Musk gave a lot of credit to Benjamin Franklin's biography and several times has admitted he considers Benjamin Franklin as one of his heroes: "He was an entrepreneur. He started from nothing. He was just a runaway kid." Then he added: "Franklin's pretty awesome." Elon also took some manufacturing principles from another entrepreneur: Henry Ford. Surprisingly for many people, Musk claims;

"Tesla's long-term competitive advantage will be manufacturing."

We are talking here about a company, which might be considered as one of the greatest in history (time will tell). Who would have thought that the driving force behind it was something Elon took from a book?

Overall, it's most important to center your search on books, any books, with good ratings, as that way you'll find yourself engaged while exploring new interesting topics. I don't remember any book that wasn't somehow an inspiration for me or that didn't teach me something new, though there were some books that were boring and hard to finish.

Websites such as [goodreads.com](https://www.goodreads.com) help in finding good content, and again don't be afraid to touch a variety of topics. In your to-read list, why not include science books, biographies, self-help books, and fiction books as they all can help expand your knowledge and imagination.

Reading Tip: A good point to start is to read at least 30-60 minutes every morning and every evening before falling asleep as it is said that sleeping right afterward helps to consolidate what you have read. Doing this rather than looking at your phone screen or TV will also protect your eyes from blue light exposition, which can badly affect your sleep cycles. Personally, I have set my goal to reading 50 pages per day. Within a week I can finish a 350-page book, so that's 4 books a month and 48 books a year.

Musk on college education:

"I think college is basically for fun and to prove you can do your chores, but it's not for learning. You can learn anything for free."

Summing up this chapter: choose books that interest you, read a wide variety of things - use different sources of knowledge - and learn as much as you can.

4. Thinking process - First Principles, a way to be disruptive.

Interview by Kevin Rose. Source: YouTube

~ (an online platform with cats, dogs, make-up tutorials, fail compilations and some decent content mixed in)

Elon **explains** first principles:

"I think it's also important to reason from first principles rather than by analogy. The normal way that we conduct our lives is we reason by analogy, we're doing this because it's like something else that was done, or it's like what other people are doing. It's kind of mentally easier to reason by analogy rather than from first principles. First principles is a kind of physics way of looking at the world and what that really means is you kind of boil things down to the most fundamental truths and say: Okay, what are we sure is true, or as sure as possible is true, and then reason up from there. That takes a lot more mental energy. Somebody could say, in fact people do, that battery packs are really expensive and that's just the way they'll always be, 'cause that's the way they've been in the past. Well, no, that's pretty dumb you know, because if you apply that reasoning to anything new, then you wouldn't be able to ever get to that new thing. You can't say nobody wants a car, because horses are great and we're used to them and they can eat grass, there's lots of grass all over the place, there's no gasoline that people can buy so people are never gonna get cars. People did say that. And for batteries, they would say, historically it's cost \$600 per kilowatt-hour and so it's not going to be much better than that in the future. What are batteries made of? So first principles would be: What are the material constituents of the batteries? What is the spot market value of the material constituents? Okay, it's

got cobalt, nickel, aluminum, carbon and some polymers for separation, and a steel can. So break that down on a material basis and say... What if we bought that on the London Metal Exchange, what would each of those things cost... Geez, it's like \$80 per kilowatt-hour!"

Elon Musk in his own words about **applying** First Principles Thinking:

1. Ask a question.
2. Gather as much evidence as possible about it.
3. Develop axioms based on the evidence, and try to assign a probability of truth to each one.
4. Draw a conclusion based on cogency in order to determine: Are these axioms correct, are they relevant, do they necessarily lead to this conclusion, and with what probability?
5. Attempt to disprove the conclusion. Seek refutation from others to further help break your conclusion.
6. If nobody can invalidate your conclusion, then you're probably right, but you're not certainly right.

"That's the scientific method," Musk concludes. "It's really helpful for figuring out the tricky things."

But he also says that most people don't use it.

They engage in wishful thinking.

They ignore counterarguments. They form conclusions based on what others are doing and aren't doing. The reasoning that results is: "It's true because I said it's true," but not because it's objectively true.

"The fundamental intention of Tesla, at least my motivation, was to accelerate the advent of sustainable energy. That's why

I open-sourced the patents. It's the only way to transition to sustainable energy better."

"Climate change is the biggest threat that humanity faces this century, except for A.I."

Example 1.

1. Company X aims to build a new model of motor scooter.

2. What does the motor scooter look like and what parts does it have?

What are the beliefs? It has two wheels, a step-through frame, a gasoline engine, handlebars, mirrors, etc.

What are the assumptions? Which of them is wrong? What can company X do better?

3. What we can be sure of that applies to the motor scooter?

It is a vehicle that is rather unstable, usually has two wheels, has a frame that connects those wheels, has an engine that moves the rear wheel. How about if we use an electric engine instead of an ICE engine? Do we really need to use a step-through frame? Wouldn't it be better to use a higher frame to make all construction more durable and rigid? How about mirrors? Instead, can we use wide-angle cameras - displaying on a big waterproof screen to show what's going on behind us? Are we obliged to use one wheel in the front? Maybe two would be better? Two front tires would have 200% firmer grip, thus safer to operate.

First Principles Thinking is useful when dealing with designing or engineering problems, but might be applicable to any given dilemma.

Example 2.

1. Alexis has a headache. Assumptions: this is a common situation, taking a painkiller is the solution (reasoning by analogy).

2. Why do people have headaches (research - gathering information)? How is the human head built? We can distinguish skin tissue, connective tissue, bone tissue, some membranes, brain - nerve tissue. What is tissue made of? A bunch of cells and fluids (blood, lymph). What is a cell made of? More than 70% is water. How does it run? A glucose metabolism provides fuel for the brain through the creation of ATP.

3. Solutions: taking a pill might help...However, does it have anything in common with the cause of a headache? Considering the fact that water is the main substance constituting the brain cells, does dehydration have an impact on headaches?

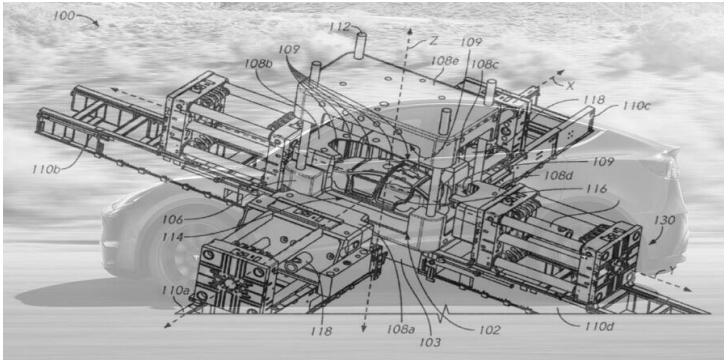
We can refer to a study which involved 34 persons who were having headaches. Researchers found that approximately 2 cups of water eased the symptoms for 22 of the subjects within a half hour. An additional 11 people felt complete relief 1-3 hours later after drinking about 3 cups of water.

~ Blau, J. N., Kell, C. A., & Sperling, J. M. (2004). Water-deprivation headache: A new headache with two variants. *Headache: The Journal of Head and Face Pain*, 44(1), 79-83.

Solution 1 (reasoning by analogy, what most people do): Problem left unsolved - painkillers just block the pain sensation. Not to mention the side effects of pharmaceuticals.

Solution 2 (reasoning by First Principles): Problem solved. Drinking water hydrates the brain tissue, increases the blood flow and oxygen passage in the head area.

LIKE ELON MUSK



You think decades of manufacturing technologies are good enough for Musk? No, darling. The Model Y is going to be "a revolution in automotive body engineering." Confirmed: Volvo imported a Model Y to Europe to reverse engineer it.

Knowledge as a tree.

"It is important to view knowledge as sort of a semantic tree - make sure you understand the fundamental principles, i.e. the trunk and big branches, before you get into the leaves/details or, there is nothing for them to hang on to."

- Elon on gathering knowledge.

First, you need to gather information and think about something. Before you dive deep into the topic, you should understand the fundamentals and most of the general truths. Once you're sure you fully understand the basics, you might get into the details a little bit more. It demands more "mental energy," but it greatly increases the chances of solving the problem by finding a breakthrough solution.

"If I had an hour to solve a problem, I'd spend 55 minutes thinking about the problem and 5 minutes thinking about solutions." - Albert Einstein

When you use First Principles Thinking, basically you should question everything from the past. F*ck ups, where have you been hiding?

Examine: Why was it done this way? Were they correct to do it in this way?

It's good to be critical. You don't have to say out loud what you're being critical of, but think about it internally at least, focusing on the bad sides. It helps in the process of building a better product, redefining something, or, the case of Musk, completely changing an industry. Electric vehicles are an example of applying First Principles, so are reusable rockets. Questioning and being critical towards ecology, the economy and the efficiency of gas-powered vehicles definitely helped when Tesla's founders started their venture.

"You should take the approach that you're wrong. Your goal is to be less wrong." - Elon Musk

The quote above is the act of being critical towards yourself, is an expression of being humble, which is really important. Many people imagine business people as really self-confident, daring, infallible. Terms such as "magnate", "tycoon", and "potentate" all relate to something unbreakable. Don't be fooled, most successful people in any domain are humble. They have to be. They make mistakes, they have fear and uncertainty. This is normal, healthy, and it really should be this way. A common pitfall: people let themselves be humble only when they begin. At the start of entering a new arena, they may feel lost, they don't know squat. Over time they learn, and eventually start believing they are 'experts at this.' Usually, that is the point when they loosen up, stagnate, and hit their plateau. After 25 years it doesn't seem like Elon has hit his plateau. He does the same thing every single day and he's still humble about it in his way.

His tweet from Apr 13, 2018:

“Yes, excessive automation at Tesla was a mistake. To be precise, my mistake. Humans are underrated.”

He was not obliged to post anything. But he did, and from this short tweet, we can draw three conclusions. He is humble. He takes full responsibility. He gives a lot of credit to the people that work at Tesla.

Being humble is underrated. It's worth knowing that pride has brought down many wannabes. “Ego is the enemy” is the name of a brilliant book written by Ryan Holiday which should be a bible for everyone who wants to be successful, no matter what field they have chosen.

Says billionaire, Ron Baron: “Whether Elon Musk is successful or not I am really glad to have invested in this company because I'm helping – this guy is saving the Earth. Brilliant guy, great businessman, and saving the planet.”

Summing up this chapter: When approaching any given problem, try to gather as much information as possible and reason through the problem using First Principles. Question everything done in the past, even standardized processes, focus on the bad sides, be critical towards your actions and, if you are aiming for breakthrough moments, avoid reasoning by analogy at all costs.

5. No boundaries - why billionaires are polymaths (so is Musk).

~ Polymath - (Greek: polymathēs - "having learned much;"). A person of wide knowledge or learning.

We tend to specialize. We follow the trends (instead of creating them), which is reasoning by analogy, by the way. We choose to be professionals, a path that will give us a secure job. We keep the frameworks of our parents and, in the worst-case scenario, we realize their dreams, which is sadly still quite common.

"Wonder is the beginning of wisdom." - Socrates.

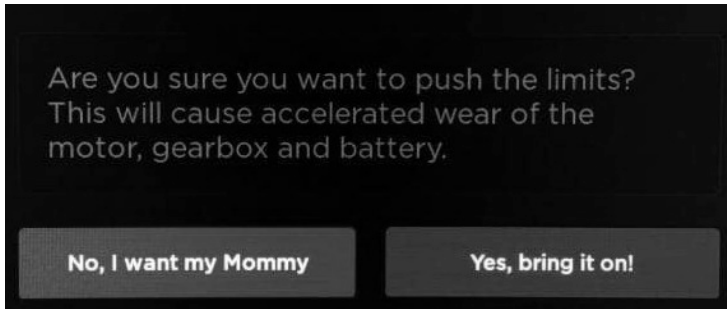
By contrast, when we are young we don't seem to be so picky. We enjoy almost anything. Kids have curiosity, they ask questions, they are not afraid to ask anything. That's how they build up their wisdom.

"Mom, why does this dog have no tail? Why do I grow so slow? Why is the sun yellow? Dad, why do you have to go to work? Why does the world spin?"

Then, somehow we lose our curiosity about the world. And it's the worst thing that could happen, to exit the learning phase, to no longer experiment freely. Curiosity, learning and experimentation - the foundations of breakthroughs.

We live in one universe, and everything is connected. It's hard to define the borders between physics and chemistry, for example - we are the ones that make those borders, divide sciences and other fields. Perhaps these borders set up limits of thought. Ignoring these limits and learning different things helps to gain perspective and an overall concept of the world.

This window pops up when you want to enable ludicrous mode in Tesla.



Are you sure?