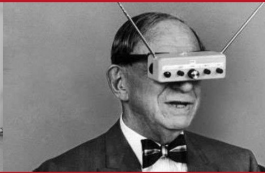


Inventions and Innovations



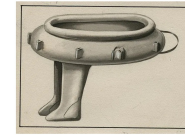
Can you guess what those inventions were made for?
Which problem were they supposed to solve?
Use the passive structure for your hypotheses.



Car with shield for pedestrians: Invented for the purpose of reducing the number of casualties among pedestrians; Paris, 1924.



Folding bridge for emergencies: The emergency bridge can easily be transported on a handcart; invented by L. Dech. The Netherlands, 1926.



Booted rubber boat: Drawing of a 'pneumatic sports-fish and hunt boat', an inflatable boat for one person with boots attached. The Netherlands, 1915.



Manual dredger: Workers operated the so-called bucket dredger with their arms and legs using stepper boards.



Amphibious bicycle: This land-and-water bike can carry a load of 120 pounds; Paris, 1932.



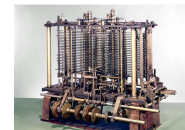
All-terrain car: This all-terrain car can descend slopes up to 65 degrees; England, 1936.



Fixed newspaper: In 1938, the world's first wireless newspaper was sent from WOR radio station in New York City.



Snowstorm mask: Plastic face protection from snowstorms; Canada, Montreal, 1939.



This analytical engine, the first fully-automatic calculating machine, was constructed by British computing pioneer Charles Babbage (1791-1871) - 1812.



Ice sailboat: In the 17th century, it was so cold that meteorologists spoke of a Little Ice Age. 1600.



Hambin glasses for reading in bed: A pair of spectacles especially designed for reading in bed; England, 1936.



Electrically heated jacket: developed for the traffic police in the United States, 1932. The power is supplied by electric contacts in the street.



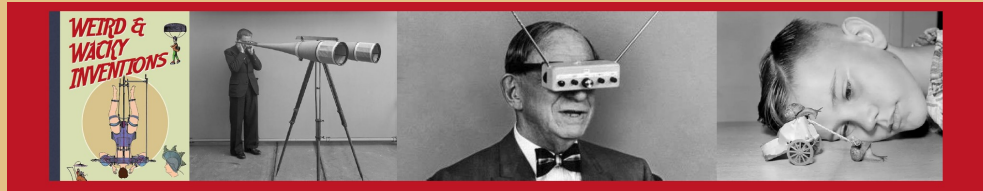
An early chainsaw, known as Osteotome, from 1780. The chainsaw as we know it appears to have begun life as a medical instrument—one used to assist in childbirth.



Mechanical tree, by Klaus Lackner, Professor in the School of Sustainable Engineering at Arizona State University. It shows that machines can be built to directly capture Carbon...

Insert your own

Inventions and Innovations



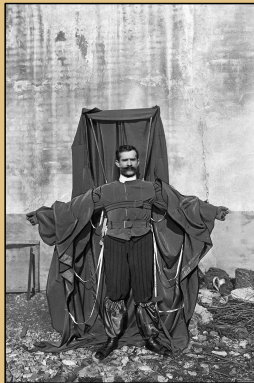
**In your opinion, what would be the worst-invention ever?
Why?**

Inventions and Innovations

5 of the world's **worst**-ever inventions

Which is the worst? Why are those terrible inventions?

Make sure to use the **comparative and superlative structures as well as the **passive voice** in your justifications.**



The Parachute Coat



Coffee Pods



Airships



Chewing gum



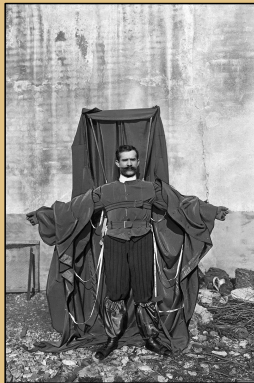
Plastic carrier bags

Inventions and Innovations

5 of the world's **worst-ever** inventions

Which is the worst? Why are those terrible inventions?

Make sure to use the **comparative and superlative structures as well as the **passive voice** in your justifications.**



The Parachute Coat

Franz Reichelt, tailor by trade, **was inspired** to design a suit that **could be used** as a parachute by pilots. After initial tests using dummies, he was so sure his design would work that in 1912 he decided to test it by jumping from the lower level of the Eiffel Tower and fell to his death.

Inventions and Innovations

5 of the world's **worst-ever** inventions

Which is the worst? Why are those terrible inventions?

Make sure to use the **comparative and superlative structures as well as the **passive voice** in your justifications.**



Coffee Pods

Coffee pods are one of those inventions that must have seemed like an amazing idea on the drawing board, but in practice, they are incredibly wasteful. Even their inventor, John Sylvan, regrets inventing them. Their annual global footprint is well over half a million tonnes.

Inventions and Innovations

5 of the world's **worst-ever** inventions

Which is the worst? Why are those terrible inventions?

Make sure to use the **comparative and superlative structures as well as the **passive voice** in your justifications.**



Airships

Zeppelin had a great idea – equip an airship with a luxurious cabin and fly people across the Atlantic Ocean quickly and comfortably. During the late 1920s and early 1930s, this became a popular means of getting from Europe to the USA. What was **less of a good idea** was to fill these balloons with highly explosive hydrogen gas – accidents were fairly common. By the time of the Hindenburg disaster of 1937, aircraft design was already catching up. However, the airship could soon make a surprising return as they use an estimated **80 per cent less fuel** than planes and **are now filled with** non-flammable helium.

Inventions and Innovations

5 of the world's **worst-ever** inventions

Which is the worst? Why are those terrible inventions?

Make sure to use the **comparative and superlative structures as well as the **passive voice** in your justifications.**



Chewing gum

One of the main ingredients in modern gum is polyvinyl acetate, a kind of plastic that is very difficult to remove when it comes into contact with things like shoes and pavements. And this also makes it very time-intensive and expensive to remove.

Inventions and Innovations

5 of the world's **worst-ever** inventions

Which is the worst? Why are those terrible inventions?

Make sure to use the **comparative and superlative structures as well as the **passive voice** in your justifications.**

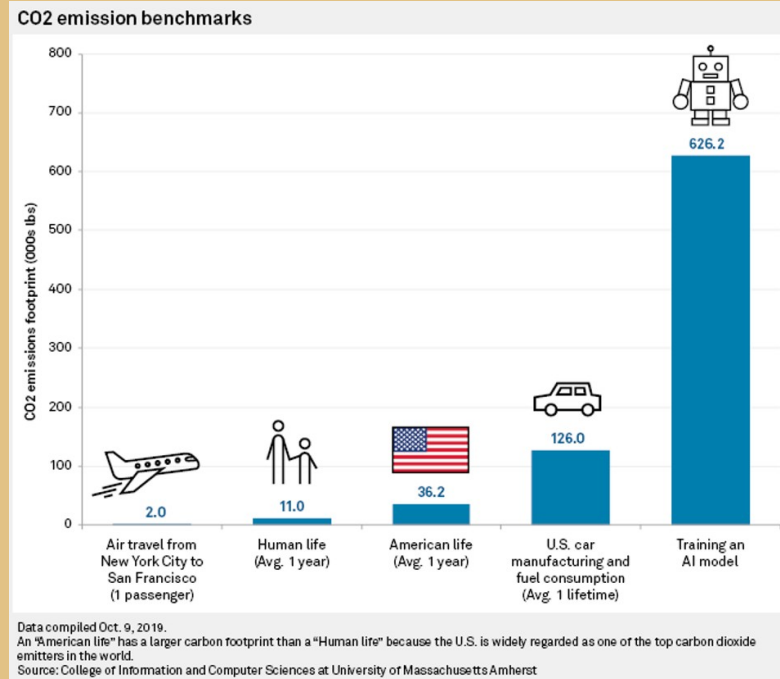


Plastic carrier bags

When invented by Swedish engineer Sten Gustaf Thulin in 1965, the plastic bag **was believed** to be an item that **could be continually reused**. But the world today has a massive problem with plastic pollution, with single-used plastic bags still **being used** in their millions. Some studies predict that by weight, there will be **more plastic in the sea than fish** by 2050.

Inventions and Innovations

5 of the world's worst-ever inventions



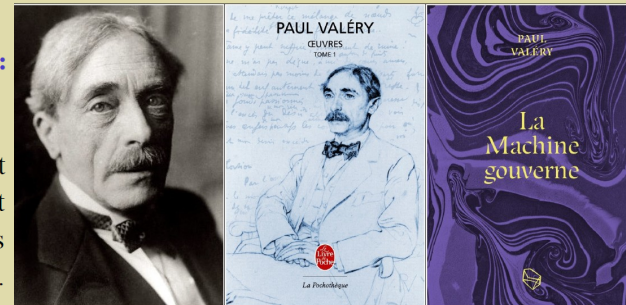
Inventions and Innovations



Translation

Paul Valéry, *Essais quasi politiques, Œuvres complètes*, Paris: Gallimard, Pléiade, 1957: 357

La machine gouverne. La vie humaine est rigoureusement enchaînée par elle [...]. Ces créatures des hommes sont exigeantes. Elles réagissent à présent sur leurs créateurs et les façonnent d'après elles. Il leur faut des humains bien dressés [...]. Elles se font donc une humanité à leur usage, presque à leur image.



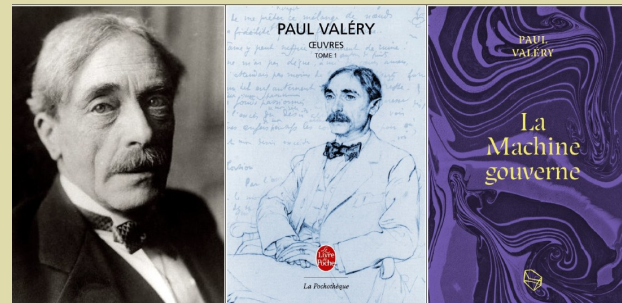
Inventions and Innovations



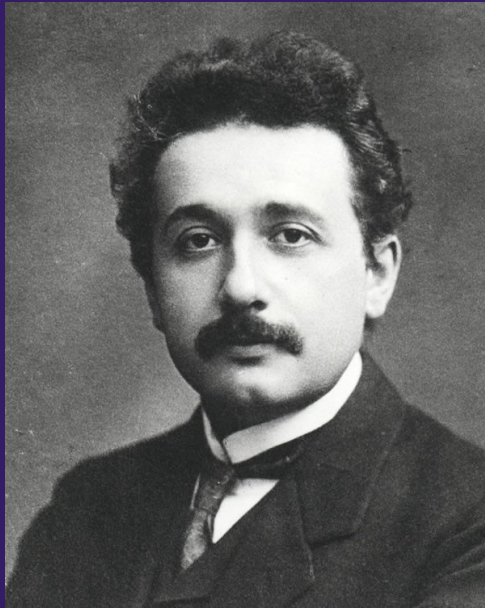
Translation

Paul Valéry, *Essais quasi politiques, Œuvres complètes*, Paris: Gallimard, Pléiade, 1957: 357

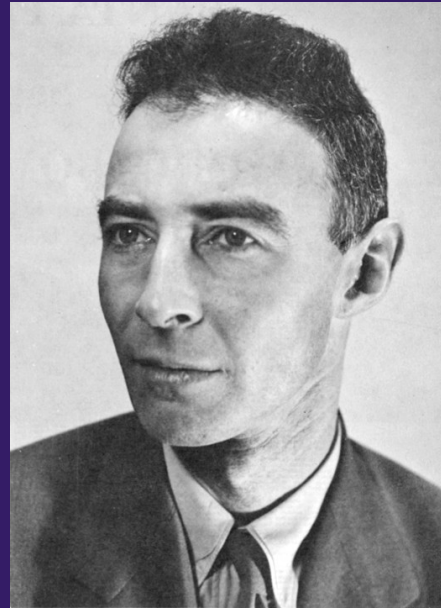
The machine rules. Human life is rigorously shackled by it / enslaved by it. These creatures made by men/humans are demanding. Now they react and impact their creators / they act back on their creators who are shaped / fashioned after them. They need / require well-tamed humans. They thus shape / fashion humanity according to their use, almost in their image.



Inventions and Innovations

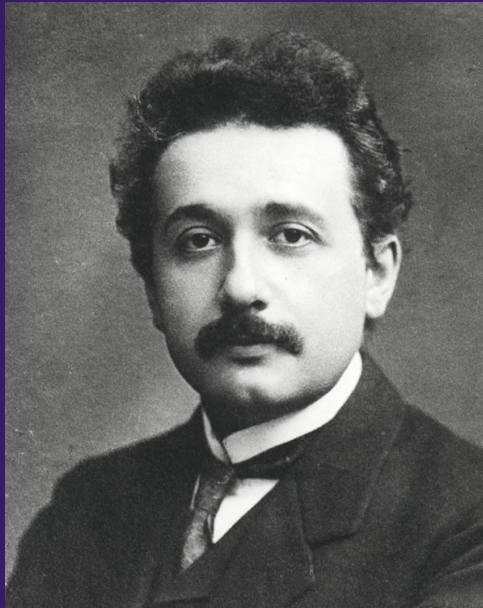


Albert Einstein

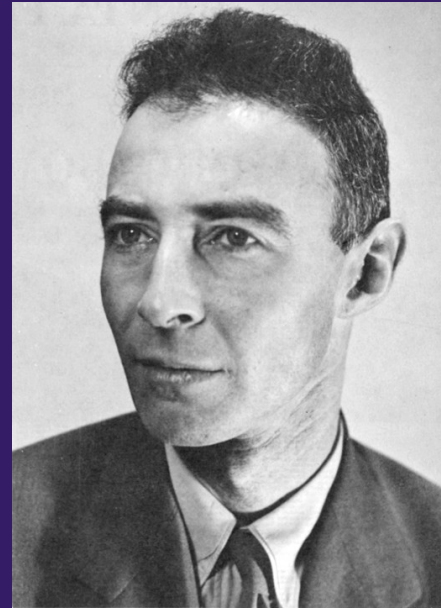


Robert Oppenheimer

Does Science Need War ? Case Studies

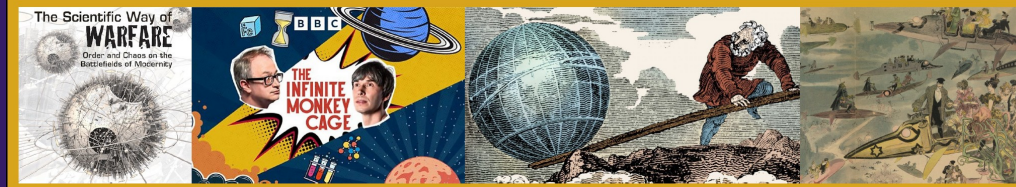


Albert Einstein



Robert Oppenheimer

Does Science Need War ? Case Studies



Does Science Need War?

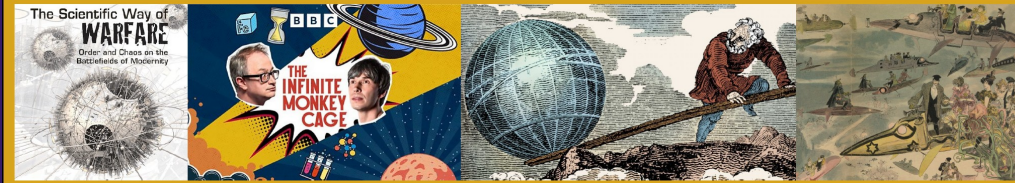
19:14-22:12

War, is it all the fault of scientists?
(simplistic question)

Some scientists have been compromised by war and yet war has generated new knowledge and integrated scientific innovations.

What does science do during war?
How did scientists behave during war?

Does Science Need War ? Case Studies

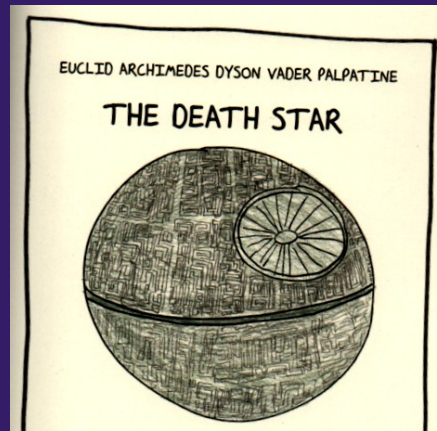


Domain of science discussed	Question	Topic chosen to give one answer to the question	Argument(s)	Precise example (with names, figures and details) to support the thesis

Does Science Need War ? Case Studies

Domain of science discussed	Question	Topic chosen to give one answer to the question	Argument(s)	Precise example (with names, figures and details) to support the thesis
Medical world	<p>When do we start to see the history of innovation changing due to war?</p> <p>Is the great advantage of war the fact that so many guinea pigs were created?</p>	<p>War advances certain branches of medicine > here focus on <u>traumatic surgery and the birth of reconstructive plastic surgery</u></p>	<p>Difficult relationship with <u>science and technology – neutral things that can both help us and hurt us</u></p> <p>The birth of plastic surgery as a very good example > not just an innovation but <u>an attempt by medicine to try and mitigate the consequences of a technology that helped you and then hurt you</u></p>	<p><u>Archibald McIndoe</u> <u>The Guinea Pig Club (1941)</u> Royal Air Force fighters – <i>Spitfire and Hawker Hurricane</i> fighter planes (<i>a fuel tank was placed directly in front of the pilot</i>) <u>Marvel of engineering</u> (three decades after the Wright brothers' first flight, can fly 400mph, can carry a formidable platform of weapons) > the problem is it is made out of wood, burst into flames as soon as you struck a light to it, filled with fuel while other pilots shoot bullets at the plane (bad idea) > <u>essential aircraft in the Battle of Britain BUT price to pay > people burnt beyond all recognition</u> What to do with people who have survived horrific injuries and are parachuted back to their country? > <u>do something to mitigate the consequences of that initial work of engineering</u> > Queen Victoria Hospital and Archibald McIndoe's team decided to try and reconstruct these people > <u>taking one step forward in what had been rudimentary plastic surgery</u> by rebuilding people's entire faces > birth of reconstructive plastic surgery (<i>cycle or spiral of innovation?</i>)</p>

Does Science Need War ? Case Studies



The Death Star: A Case Study in Engineering

“Geometry yields to no one, not even evil empires” (Ben Orlin)

1. Would you say the Death Star is a great design?
2. What (scientific) questions could you ask about it?

Questions in English

Question Word + auxiliary + subject + verb + [...] ?

Does Science Need War ? Case Studies



3. Look at the scraps from an engineer's calculations. What could he be studying in each case?

$$DS1_diameter = 120 \cdot km = 74.565 \text{ mi} \quad DS1_crew = 342953 + 843342 = 1.186 \cdot 10^6$$

$$D_{S2} = 35 \cdot km = 21.748 \text{ mi}$$

$$A_{S2} = \pi \cdot \left(\frac{D_{S2}}{2}\right)^2 = 371.474 \text{ mi}^2 \quad A_{S1} = 962.113 \text{ km}^2$$

$$SA_{S2} = \text{SurfaceArea}(DS1_diameter) - A_{S2} = 17095.376 \text{ mi}^2$$

$$WA = \sum_{j=1}^4 (\text{SurfaceArea}(DS1_diameter - 2 \cdot 3 \cdot km + 2 \cdot j \cdot 30 \cdot m) - A_{S2})$$

$$WA = 61735.5 \text{ mi}^2 \quad \text{Working Area}$$

1

$$Circumference(diameter) = \frac{\pi}{2} \cdot diameter \quad \text{Time}(distance, velocity) = \frac{distance}{velocity}$$

$$V_{TF} = 1200 \cdot \frac{km}{hr} = 745.645 \frac{mi}{hr} \quad \text{TIE Fighter}$$

$$V_{TCS} = 850 \cdot \frac{km}{hr} = 528.166 \frac{mi}{hr} \quad \text{TIE Command Shuttle}$$

$$\text{Time}(Circumference(DS1_diameter), V_{TF}) = 9.425 \text{ min}$$

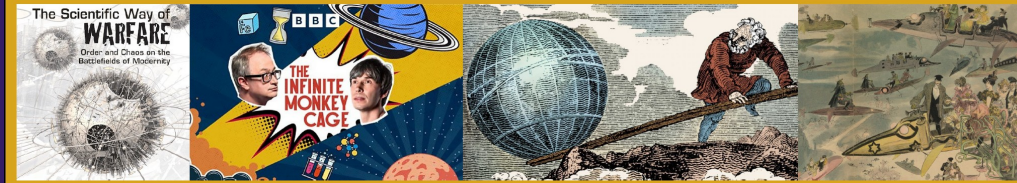
$$\text{Time}(Circumference(DS2_diameter), V_{TF}) = 12.566 \text{ min}$$

$$\text{Time}(Circumference(DS1_diameter), V_{TCS}) = 13.306 \text{ min}$$

$$\text{Time}(Circumference(DS2_diameter), V_{TCS}) = 17.741 \text{ min}$$

2

Does Science Need War ? Case Studies



3. Look at the scraps from an engineer's calculations. What could he be studying in each case?

$DS1_diameter := 120 \cdot km = 74.565 \text{ mi}$ $DS1_crew := 342953 + 843342 = 1.186 \cdot 10^6$

1

Account for Super Laser

$D_{SL} := 35 \cdot km = 21.748 \text{ mi}$
 $A_{SL} := \pi \cdot \left(\frac{D_{SL}}{2}\right)^2 = 371.474 \text{ mi}^2$ $A_{SL} = 962.113 \text{ km}^2$
 $SA_{DS} := SurfaceArea(DS1_diameter) - A_{SL} = 17095.376 \text{ mi}^2$
 $WA := \sum_{j=1}^4 (SurfaceArea(DS1_diameter - 2 \cdot 3 \cdot km + 2 \cdot j \cdot 30 \cdot m) - A_{SL})$
 $WA = 61735.5 \text{ mi}^2$ Working Area

How cramped are people? (population density)

2

$Circumference(diameter) := \frac{\pi}{2} \cdot diameter$ $Time(distance, velocity) := \frac{distance}{velocity}$

$V_{TF} := 1200 \cdot \frac{km}{hr} = 745.645 \frac{mi}{hr}$ TIE Fighter
 $V_{TCS} := 850 \cdot \frac{km}{hr} = 528.166 \frac{mi}{hr}$ TIE Command Shuttle

$Time(Circumference(DS1_diameter), V_{TF}) = 9.425 \text{ min}$
 $Time(Circumference(DS2_diameter), V_{TF}) = 12.566 \text{ min}$
 $Time(Circumference(DS1_diameter), V_{TCS}) = 13.306 \text{ min}$
 $Time(Circumference(DS2_diameter), V_{TCS}) = 17.741 \text{ min}$

If you have an appointment on the other side of the Death Star, how long would it take you to fly there?

Does Science Need War ? Case Studies

4. Match the title of the issue under study, the drawing exemplifying it, and the quotation alluding to it.

1. Throwing aerodynamics to the wind

a. The problem that still haunts me is the heating. It's outer space, right? Cold. You want to retain heat, and a sphere is great for that. Minimum surface area means minimum heat loss. But apparently, we did our jobs too well, because early simulations showed that the station would be prone to overheating. [...] [S]o [we] put in thermal vents. Nothing big. A few meters wide. Release the heat into space; problem solved. I didn't think... I mean, when I heard that the rebels had destroyed the station by exploiting a thermal vent...

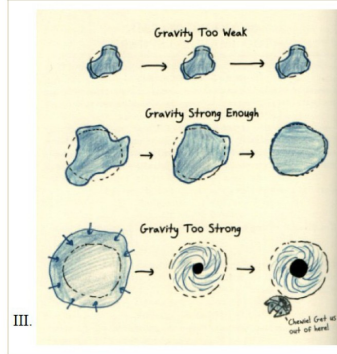
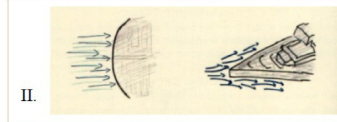
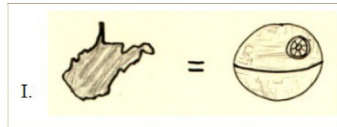
b. Look, I'm no propaganda expert, but the physics is pretty clear. All matter attracts all other matter. More matter, more attraction. [...] So, toss a bunch of ingredients together in the mixing bowl of space, and every bit is mutually drawn toward every other bit. They congregate around a kind of 3D balancing point: the center of mass. Over time, the outlying clumps and mire distant protrusions are drawn toward this center, until it reaches the final equilibrium shape: a perfect sphere. But that's only if you've got enough matter. [...] The magic size, where you're big enough to go spherical, depends on what you're made of. Ice will go spherical at a diameter of about 400 kilometers, because it's pretty malleable. [...] For a material like imperial steel, designed to withstand tectonic-level forces, it'd be even larger. Maybe 700 or 750 kilometers. And the Death Star? It was only 140 kilometers across. A pebble.

c. Imagine you're flying an airplane. No matter how good a pilot you are, you're going to have A LOT of collisions. I'm referring, of course, to air molecules. Best-case scenario? The air molecules travel parallel to your surface. Then, they won't impact you at all. They're like passing traffic in the neighbouring lane. The worst-case scenario is that the air molecules hit perpendicular to your surface, at 90-degree angles. Then, your vessel bears the full force of the impact. That's why you don't build airplanes with big, flat fronts: it'd be like trying to weasel through a crowd while wearing a giant sandwich board on your torso.

d. There were about 2.1 million people on the Death Star; that's counting droids. Meanwhile, with a radius of 70 kilometers, it had a surface area of almost 62,000 square kilometers. Now, assuming that you bring everybody to the surface level, you'll have a population density of about 30 people per square kilometer. That's five soccer fields per person. [...] Want to picture social life on the Death Star?

2. Too big to fail, too small to sphere

3. West Virginia, floating in space



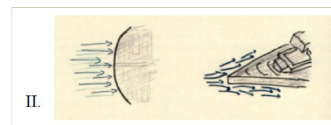
5. Imagine the corresponding title and drawing for the last one.

Does Science Need War ? Case Studies

4. Match the title of the issue under study, the drawing exemplifying it, and the quotation alluding to it.

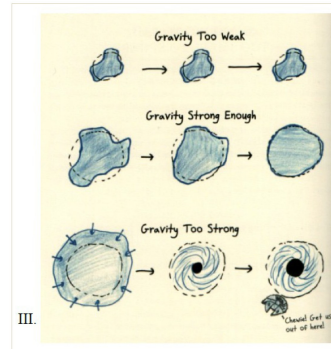
1. Throwing aerodynamics to the wind

c. Imagine you're flying an airplane. No matter how good a pilot you are, you're going to have A LOT of collisions. I'm referring, of course, to air molecules. Best-case scenario? The air molecules travel parallel to your surface. Then, they won't impact you at all. They're like passing traffic in the neighbouring lane. The worst-case scenario is that the air molecules hit perpendicular to your surface, at 90-degree angles. Then, your vessel bears the full force of the impact. That's why you don't build airplanes with big, flat fronts: it'd be like trying to weasel through a crowd while wearing a giant sandwich board on your torso.



2. Too big to fail, too small to sphere

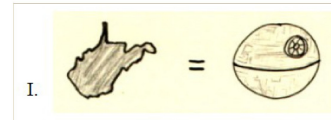
b. Look, I'm no propaganda expert, but the physics is pretty clear. All matter attracts all other matter. More matter, more attraction. [...] So, toss a bunch of ingredients together in the mixing bowl of space, and every bit is mutually drawn toward every other bit. They congregate around a kind of 3D balancing point: the center of mass. Over time, the outlying clumps and mire distant protrusions are drawn toward this center, until it reaches the final equilibrium shape: a perfect sphere. But that's only if you've got enough matter. [...] The magic size, where you're big enough to go spherical, depends on what you're made of. Ice will go spherical at a diameter of about 400 kilometers, because it's pretty malleable. [...] For a material like imperial steel, designed to withstand tectonic-level forces, it'd be even larger. Maybe 700 or 750 kilometers. And the Death Star? It was only 140 kilometers across. A pebble.



3. West Virginia, floating in space

It's about the same size, population and population density as West Virginia.

d. There were about 2.1 million people on the Death Star; that's counting droids. Meanwhile, with a radius of 70 kilometers, it had a surface area of almost 62,000 square kilometers. Now, assuming that you bring everybody to the surface level, you'll have a population density of about 30 people per square kilometer. That's five soccer fields per person. [...] Want to picture social life on the Death Star?



Does Science Need War ? Case Studies



5. Imagine the corresponding title and drawing for the last one.

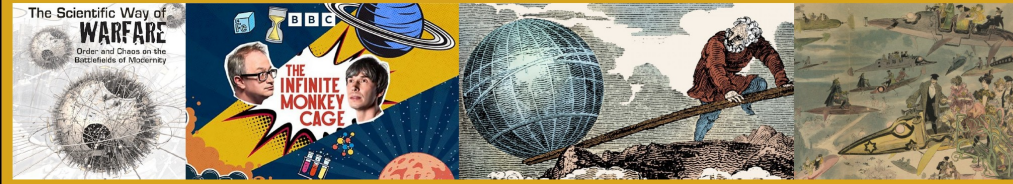
4. Maybe we did our jobs too well

a. The problem that still haunts me is the heating. It's outer space, right? Cold. You want to retain heat, and a sphere is great for that. Minimum surface area means minimum heat loss. But apparently, we did our jobs too well, because early simulations showed that the station would be prone to overheating. [...] [S]o [we] put in thermal vents. Nothing big. A few meters wide. Release the heat into space; problem solved. I didn't think... I mean, when I heard that the rebels had destroyed the station by exploiting a thermal vent...

6. Rephrase the following sentence resorting to the double comparative structure:

"Minimum surface area means minimum heat loss" > *The smaller the surface area, the less heat is lost.*

Does Science Need War ? Case Studies



The Death Star: A Case Study in Engineering

Summary: *public in mind, and never express "the other".*

1. Would you say the Death Star is a great design?

2. What (scientific) questions could you ask about it?

3. Look at the scraps from an engineer's calculations. What could be studied in each case?

4. Match the title of the issue under study, the drawing exemplifying it, and the question alluding to it.

5. Draw the Virginis, Resolving a square

6. Rephrase the following sentence resorting to the double comparative structure:

Real-World Math Shows the Death Star Was A Terrible Design

Drew Martin, 12/13/2019

How Cramped Are People?

I've always wondered how cramped people were on the Death Star. A buddy of mine from work took me on a tour of the nuclear attack simulator he served on in the US Navy, and he had with me vital lessons in a space the size of my bedroom. The director of "Star Trek 2: The Wrath of Khan" gave a talk at work and explained that he tried to convey the feeling of people being crammed for confined spaces like World War II trenches.

How Cramped Are People?

I calculated the population density using a variety of different methods, and finally settled on one that measured the surface area of the 4 decks located a distance below the dish around plating. That gets 1.19 million people over 42,870 square miles, for a population density of just over 19 people per square mile.

How Does It Take to Get Around in the Death Star?

The Death Star has a vast series of horizontal and vertical elevators for traveling from one place to the other. But the interior of the Death Star is largely taken up by the hypermatter reactor, repulsor, hypermatter, and outer shield engines. Other value people are trying to get between locations, other than take an elevator, they will actually fly from one lounge bay to another because it's faster.

Real-World Math Shows the Death Star Was A Terrible Design

Drew Martin, 12/13/2019

Acceptor and Inhibitor view try of the power weaknesses for the Death Star.

The Rebel forces attacked the Death Star with nearly 30 fighters: 5 Y-Wing bombers and 22 X-Wing fighters. The Death Star has over 1000 TIE Fighters. If only a half of those are available at any time due to maintenance and flight crew availability, imperial forces had an overwhelming air superiority of over 77 to 1.

Could it Stand Up to Small Fighters?

The area that they have to cover increases by the square with altitude (and of course the volume increases at a cubic rate). If you're a gun crew and you're engaging targets at a distance of 1,000 miles, the sector you have to cover is 161 square miles. There's a clear focus PFC likelihood during the coverage area for each weapon as a function of the distance from the Death Star surface.

The problem with such a huge weapon is that you have a huge space to defend and huge sectors of fire that you have to attack, and the Death Star lacked firepower to do so.

My Take?

When you do the math, you realize the Death Star was actually a terrible design with significant security and operational issues. No wonder such a small group of rebels at a technological disadvantage were able to take it out.

<https://www.mathcad.com/en/blog/engineering/the-death-star/>