

From ancient iron to sustainable steel: a material history in 25 minutes

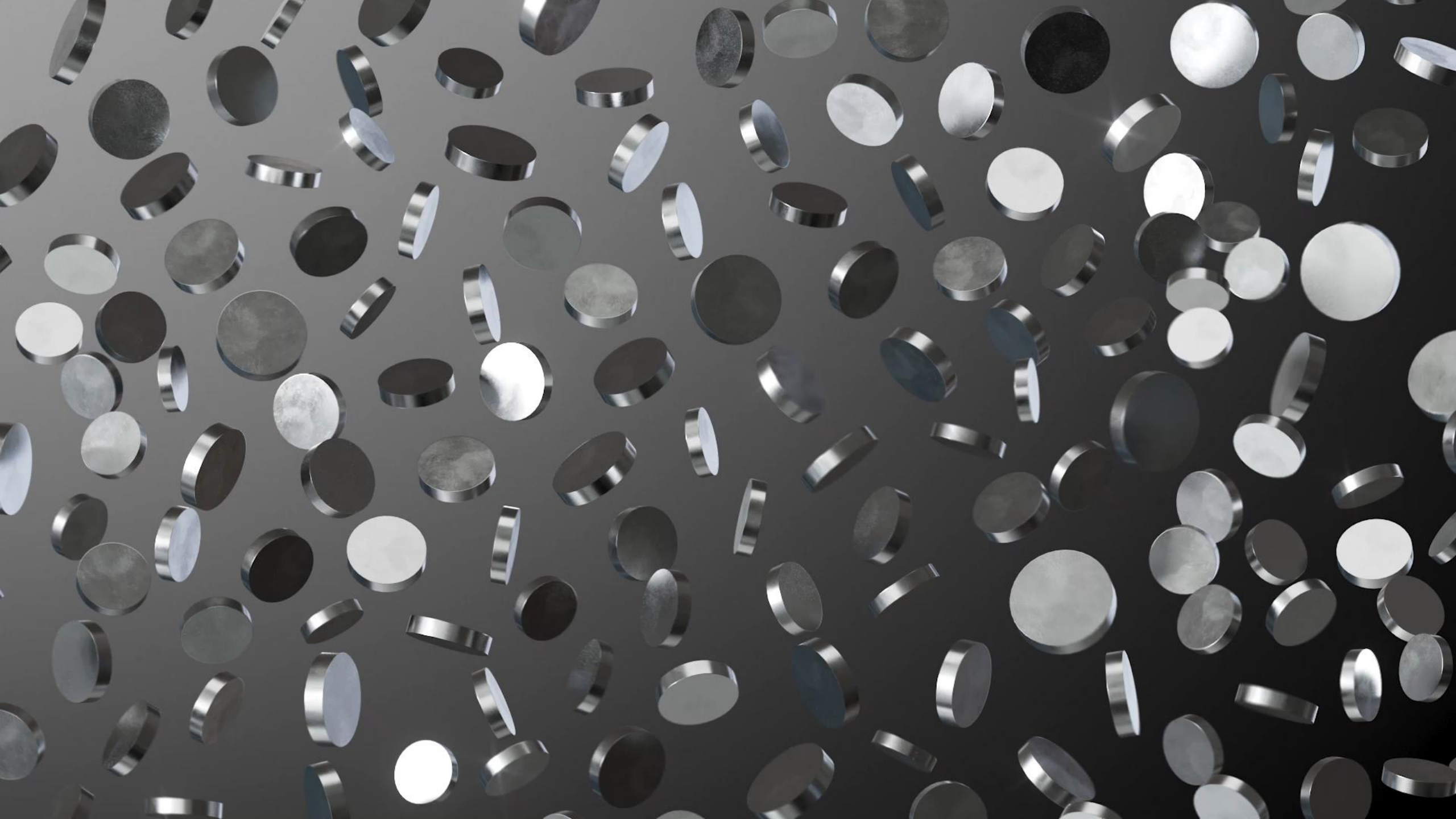
Maikel Kuijpers

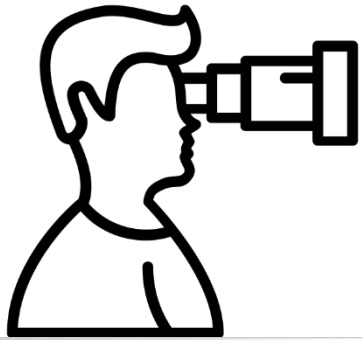
Steel for Sustainability,
Delft, 31 March 2023



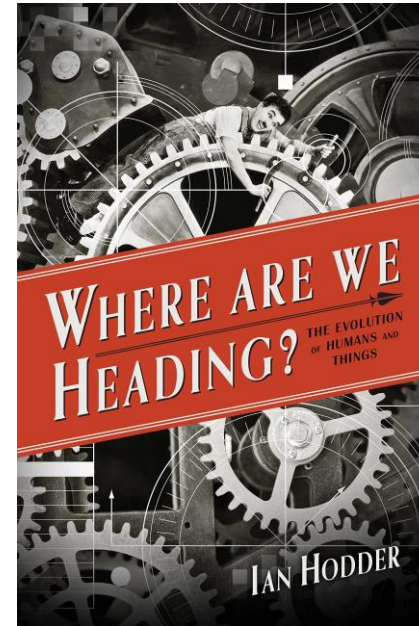
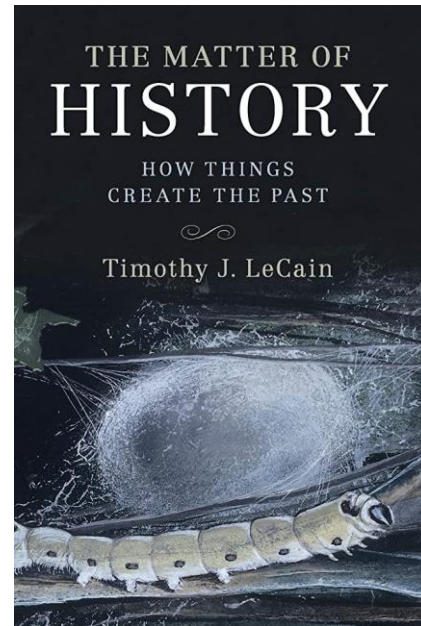
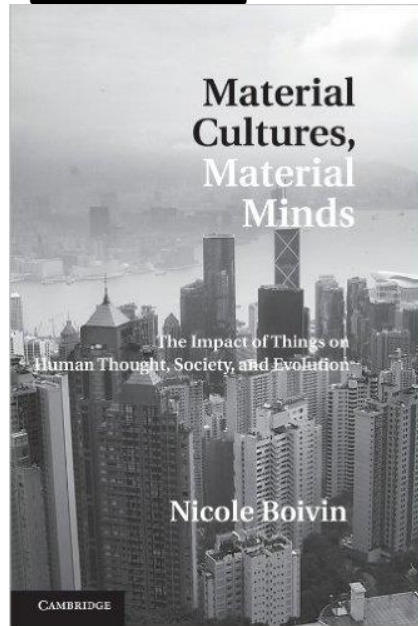
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New Materialism



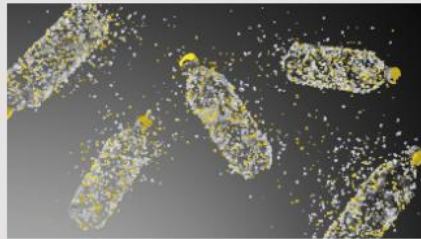
Human cultures are embedded in and derived from the material world.

Humans think through and with materials.

Constructing a cleaner world

The four materials that make up almost everything – concrete, steel, plastic and fertiliser – are also some of the biggest polluters. Maikel Kuijpers examines the alternatives for a more sustainable future.

5 stories since 1 September 2020



Plastic is a brilliant material. But our relationship with it is trash

Maikel Kuijpers

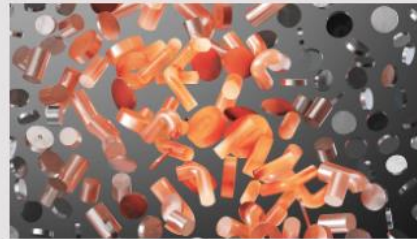
14 min



The most important invention of the 20th century keeps us alive but is killing the environment. The solution? Eat less meat

Maikel Kuijpers

13 min



We can't stop using steel. Here's how we can make it the foundation of a new, sustainable iron age

Maikel Kuijpers

13 min



A history of humankind explored through our relationship with the materials that shape the modern world.



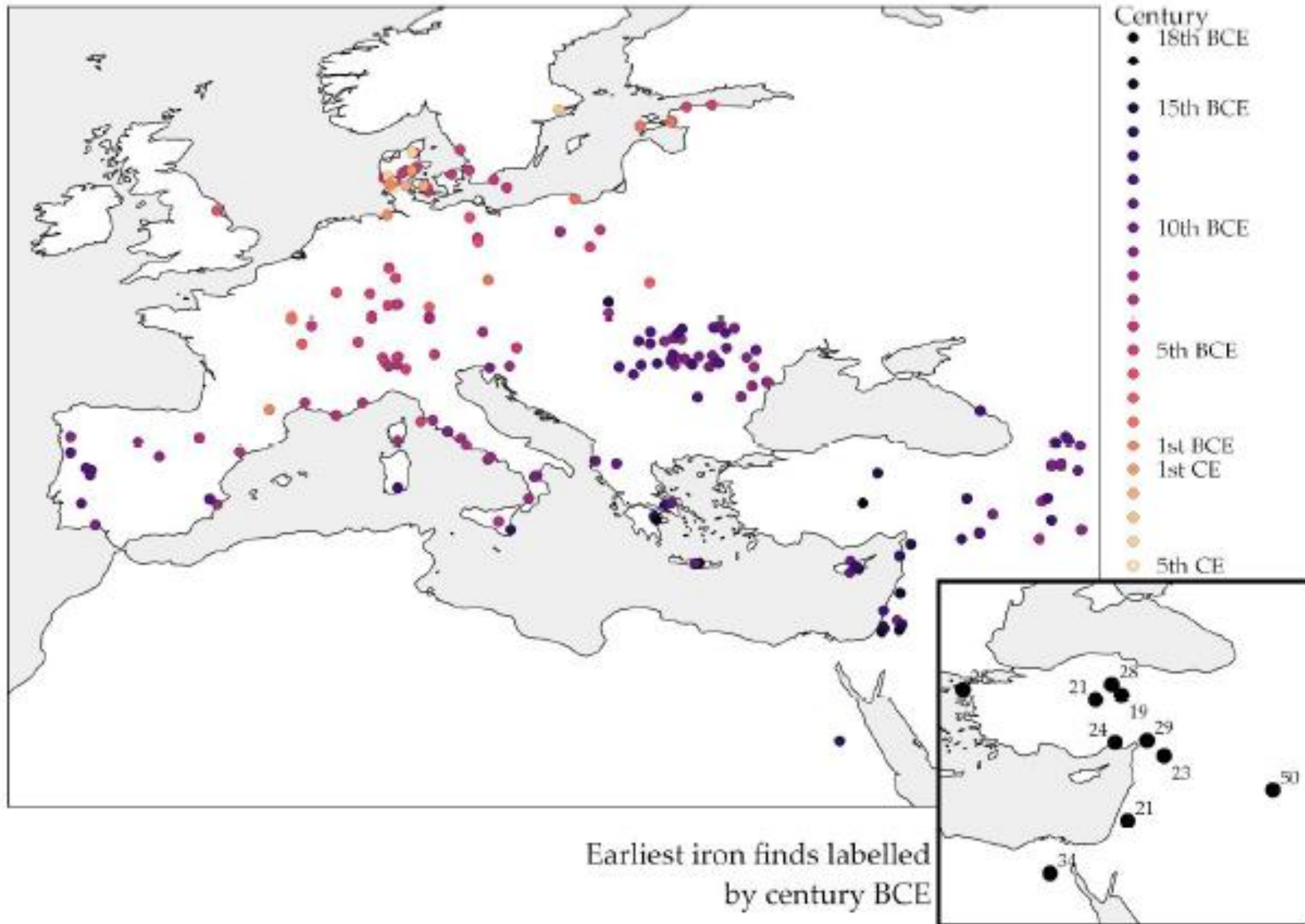
“Fire from the sky”



5th century BCE



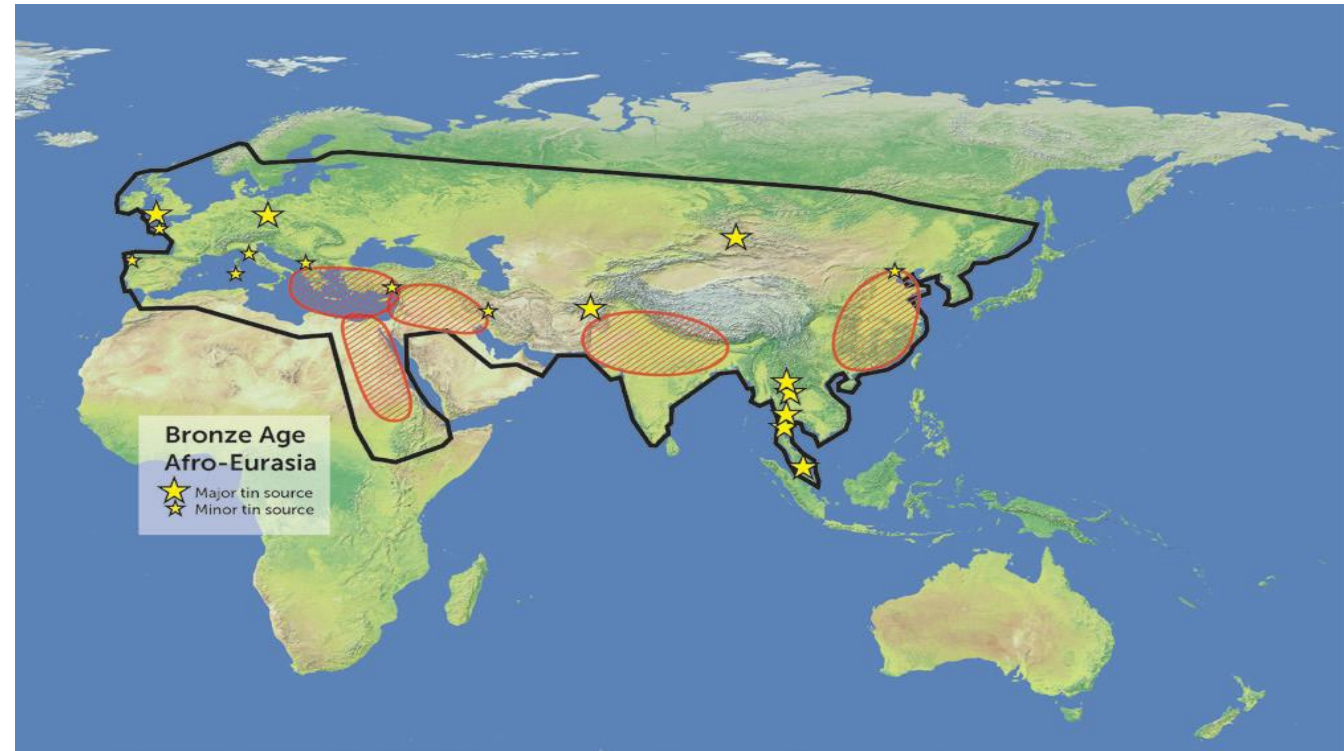
The first Iron Age



The world of Bronze
VS
The world of Iron

Bronze (copper & tin)

“Bronzization” (Vandkilde 2016)



Created unprecedented connectivity and relations of dependency between regions and people

Iron



“a democratic material”





Main central places 6th-5th century BCE



The bronze Vix Krater: 1.64 m tall, 208 kilos, 1,100 litres.

The legacy of Iron



[k/FeaturesEurope/Barbarian_Map52BC_max.htm](http://www.k/FeaturesEurope/Barbarian_Map52BC_max.htm)

Observations:

- A fundamental transition in materials does not happen easily.
- It is potentially very disruptive: economically and socially.

18th century England

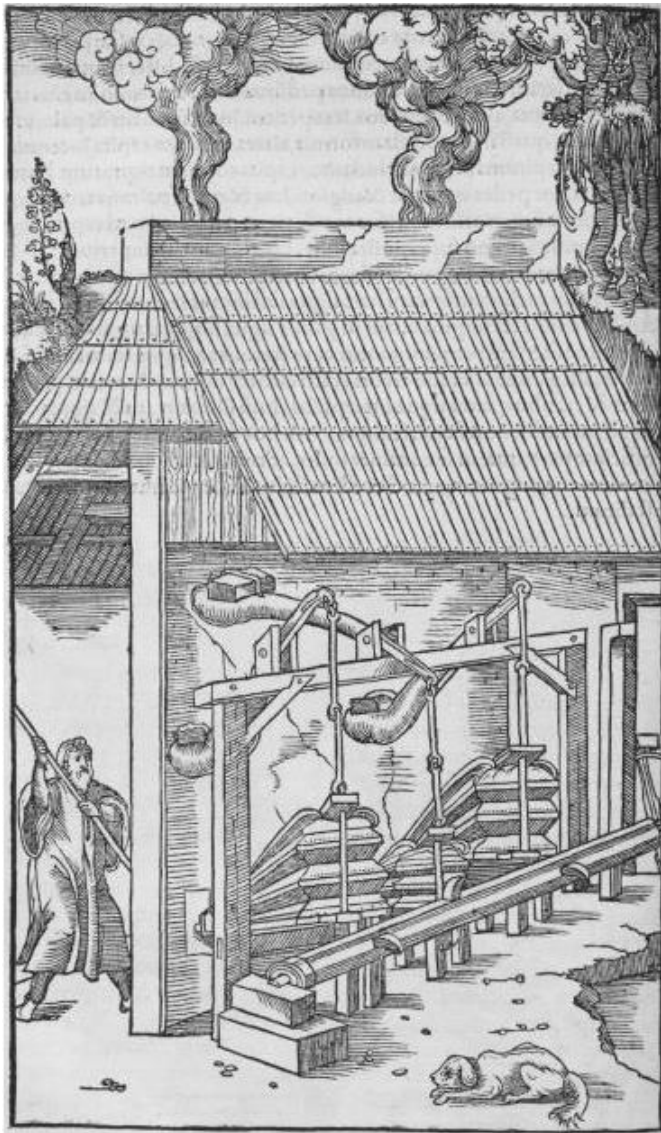


The second Iron Age



The Iron Bridge, Shropshire, UK - 1781

https://www.designingbuildings.co.uk/wiki/The_Iron_Bridge



Blast furnace 16th century (from Agricola *de re metallica*)



Charcoal production

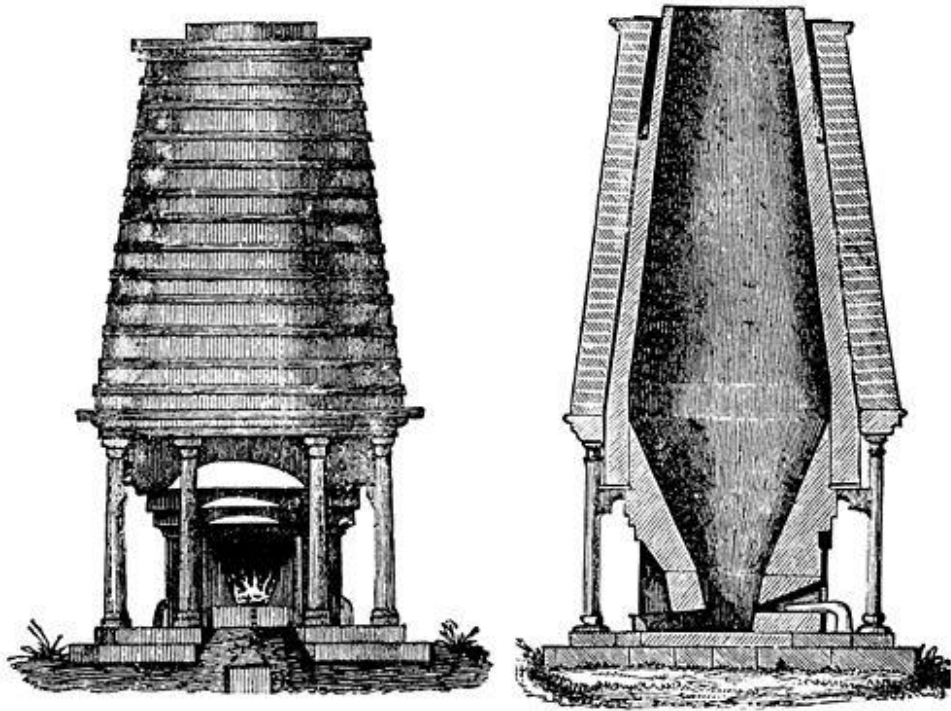


In the UK:

In 1700:

~12.000 ton of iron

~830.000 ton of wood



Coke fired furnace
Abraham Darby 1709



Coke production



In the UK:

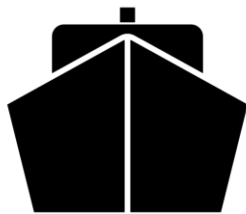
In 1850:

~2.000.000 ton of iron

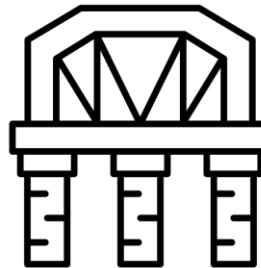
1830 – 56 km

Liverpool  Manchester

1860 – 100.000 km



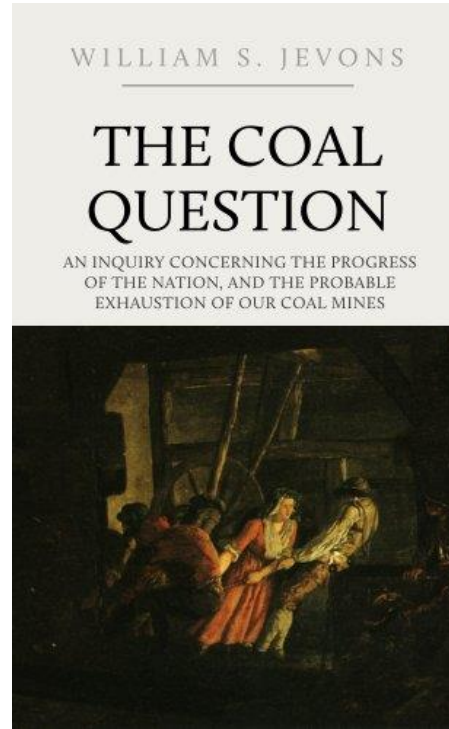
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Created by Ivana Milchanska
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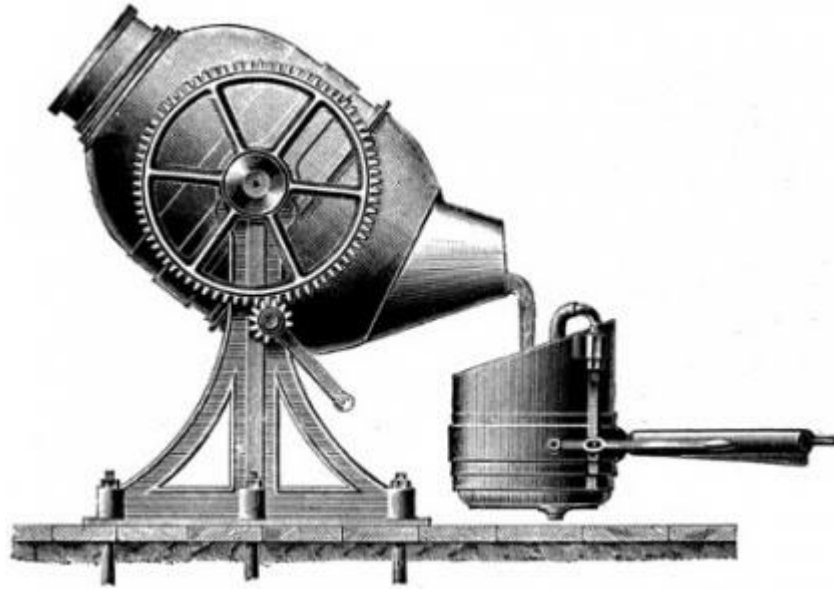
Jevons-paradox

“It is wholly a confusion of ideas to suppose that the economical use of fuel is equivalent to a diminished consumption. The very contrary is the truth.”

Observations:

- Efficiency is not a straightforward route to sustainability
- More efficient production and use of inherently polluting materials are no solution in the long-term

19th century



The third Iron Age



Henry Bessemer (1813 - 1898)

1867:
1 ton of steel: 2500 euro



1884:
1 ton of steel: 750 euro

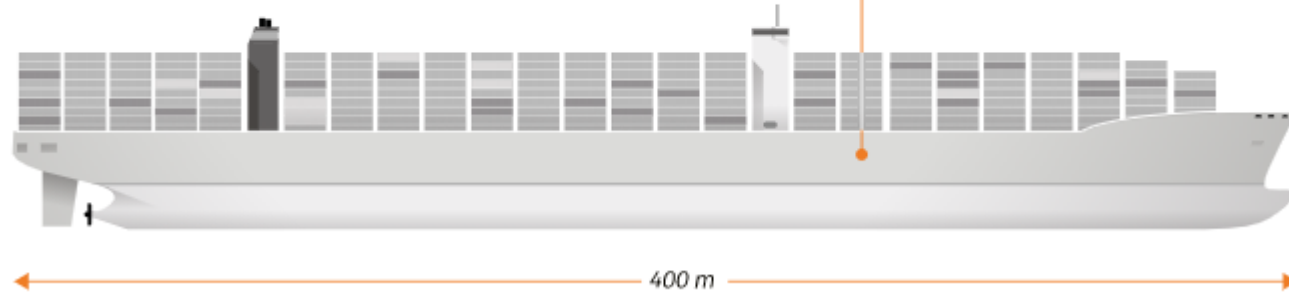
1856: the Bessemer converter



2013 Triple-E container ship
Sails worldwide



With the used steel of the Triple-E, you could build eight Eiffel towers



The coin is made of steel with a layer of copper

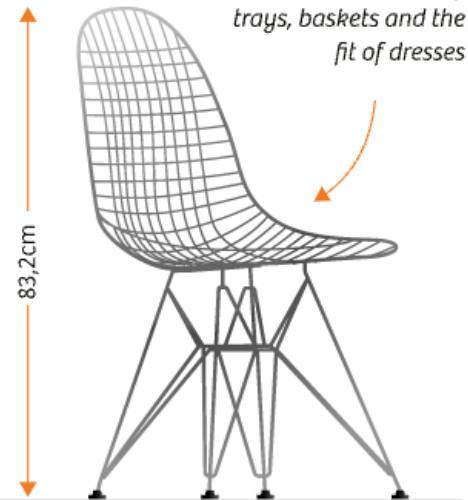


21,25 mm

1999-NOW 5 euro cent
Europe



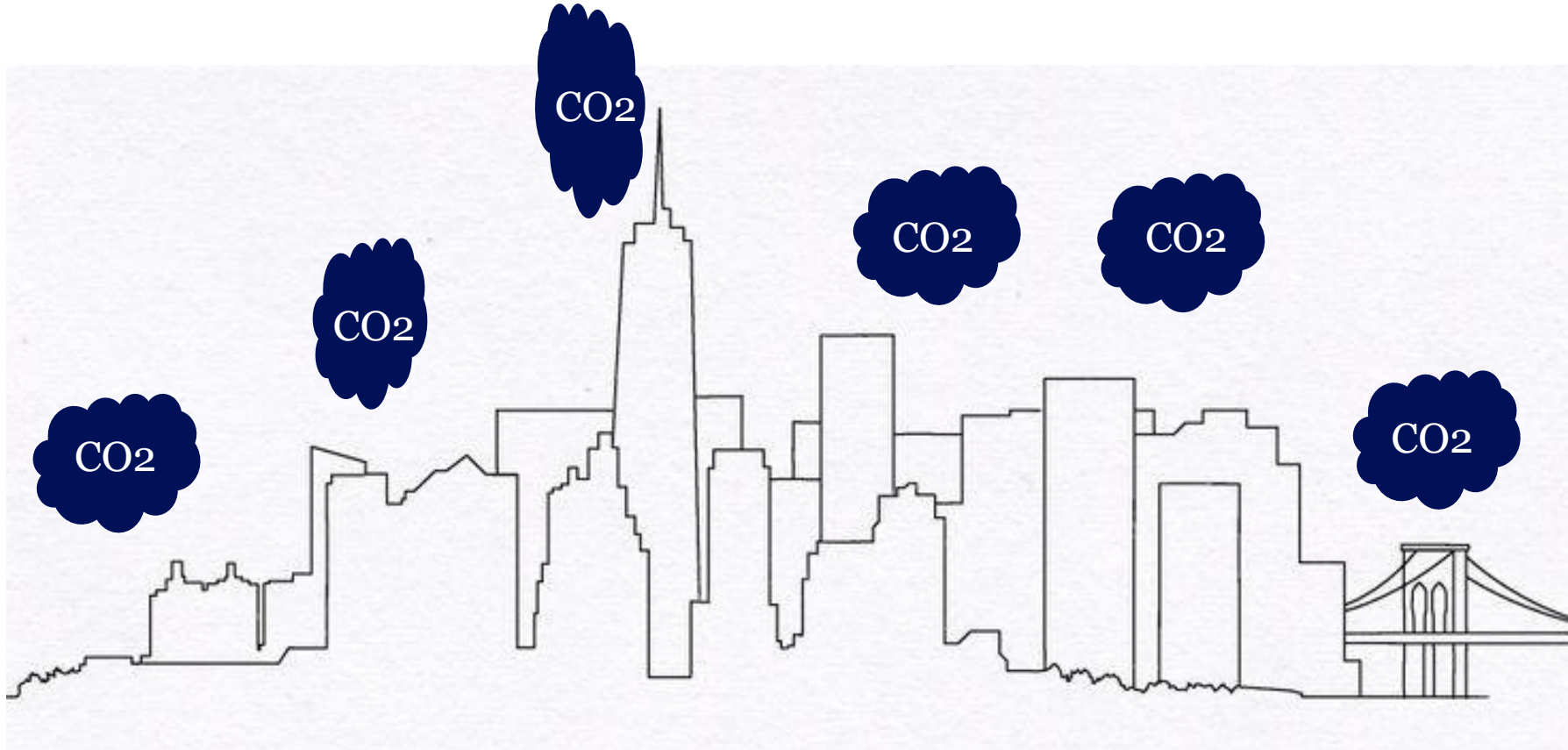
The design of the chair is inspired by trays, baskets and the fit of dresses



83,2cm

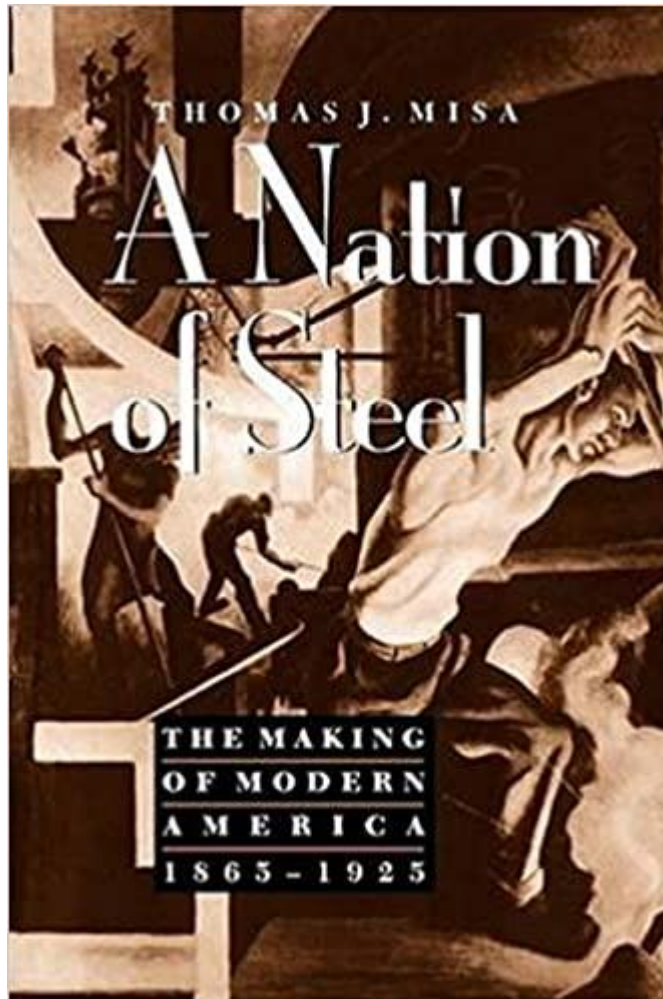
1951 Eames wire chair
California, USA

1000 kg of steel = 500 euro *and* 1850 kg of CO₂

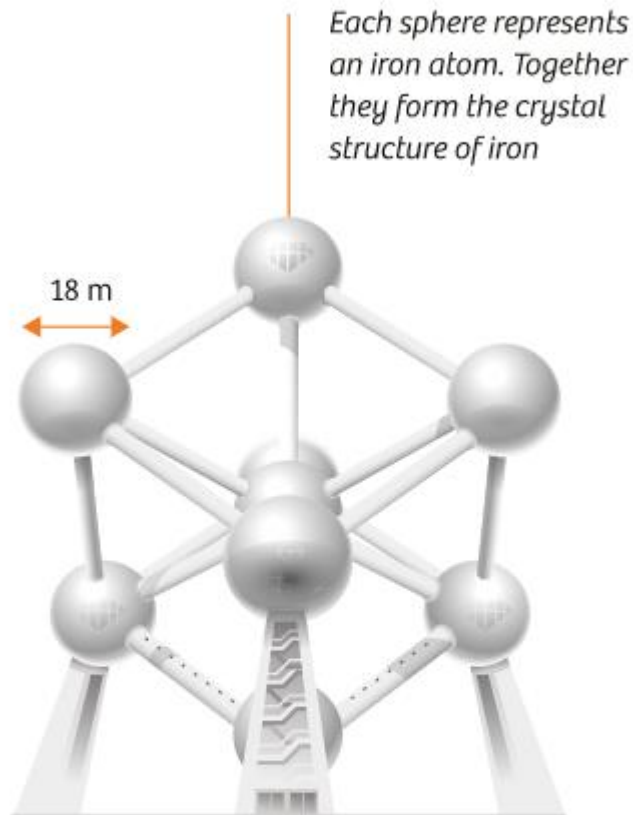


responsible for 7-9% of the global CO₂ emissions

Source: worldsteel.org

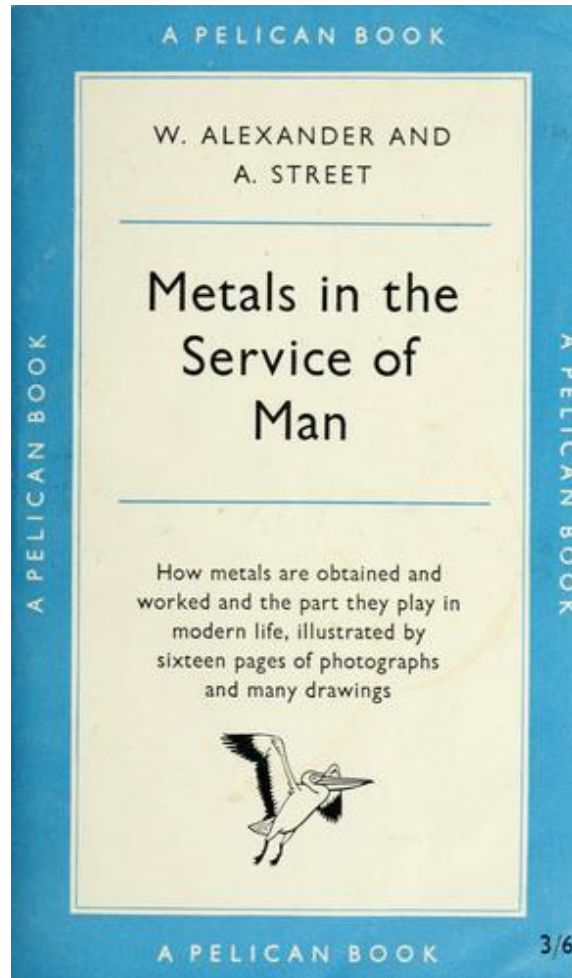


Lunch atop a Skyscraper, published in the New York Herald-Tribune, Oct. 2 1932



1958 Atomium
Brussels, Belgium

Europe's bones are steel. It holds the continent together – literally, in the form of thousands of kilometres of railway lines, and figuratively, in the economic sense.







Gender balance

Gender equality in steel and mining

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Sustainability



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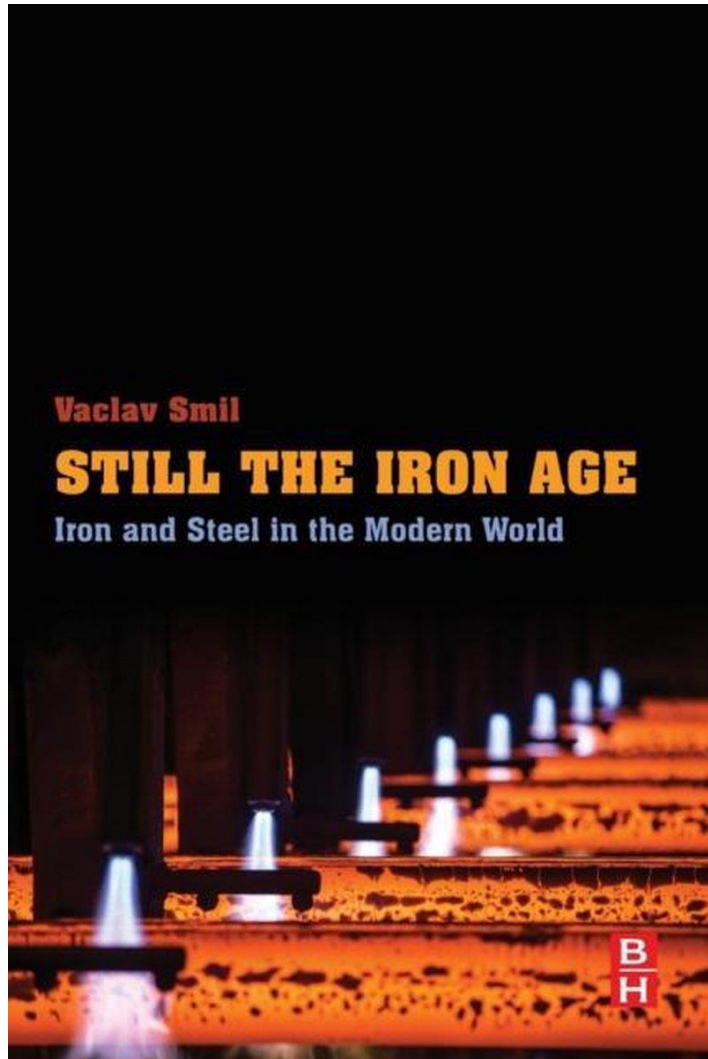
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Observations:

- Iron and steel are intimately connected to nationalism and a male-dominated view of the world
- The traditional identity of the iron and steel industry is one of macho-masculinity

Six observations to think about:

- A fundamental transition in materials does not happen easily.
- It is potentially very disruptive: economically and socially.
- Efficiency is not a straightforward route to sustainability
- More efficient production and use of inherently polluting materials are no solution in the long-term
- Iron and steel are intimately connected to nationalism and a male-dominated view of the world
- The traditional identity of the iron and steel industry is one of macho-masculinity



Let's make the fourth Iron Age
– a sustainable one –
happen