Maths

T-shirts made by robots

RecyCOOL Lessons

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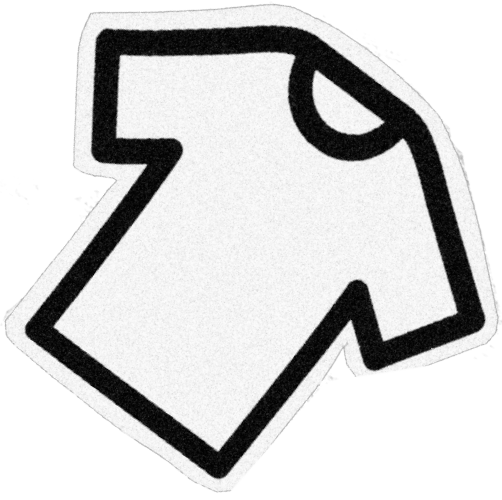
T-shirts made by robots

Description of the lesson
First we are going to see how many T-shirts we own, then think about their production. After that, we are going to learn about modern sewing robots, how they work and what their output is compared to a human workforce.
Then we will see how this in turn affects the pricing and the jobs of garment workers. After that we will do some calculations to see some exact numbers. And finally get some tips on how to reduce T-shirt consumption.

Objective
Objective of this lesson is to identify how robots are used to speed up the production of garments worldwide compared to the human workforce.

After this lesson you will be able to
- get to know how sewing robots work
- understand the robotic garment process
- see how production is affected in comparison with a human workforce

Tools and materials
calculator, pencil/pen, paper



SEWING ROBOTS:
Robots that are programmed to sew T-shirts/clothes.

OUTPUT:
The result of a process, like production.

STIFFENER:
Added solution/chemicals to make textiles harder.

ANALYSE:
To examine something closely.

SENSOR:
A special part of a machine that detects/measures a physical property and records it.

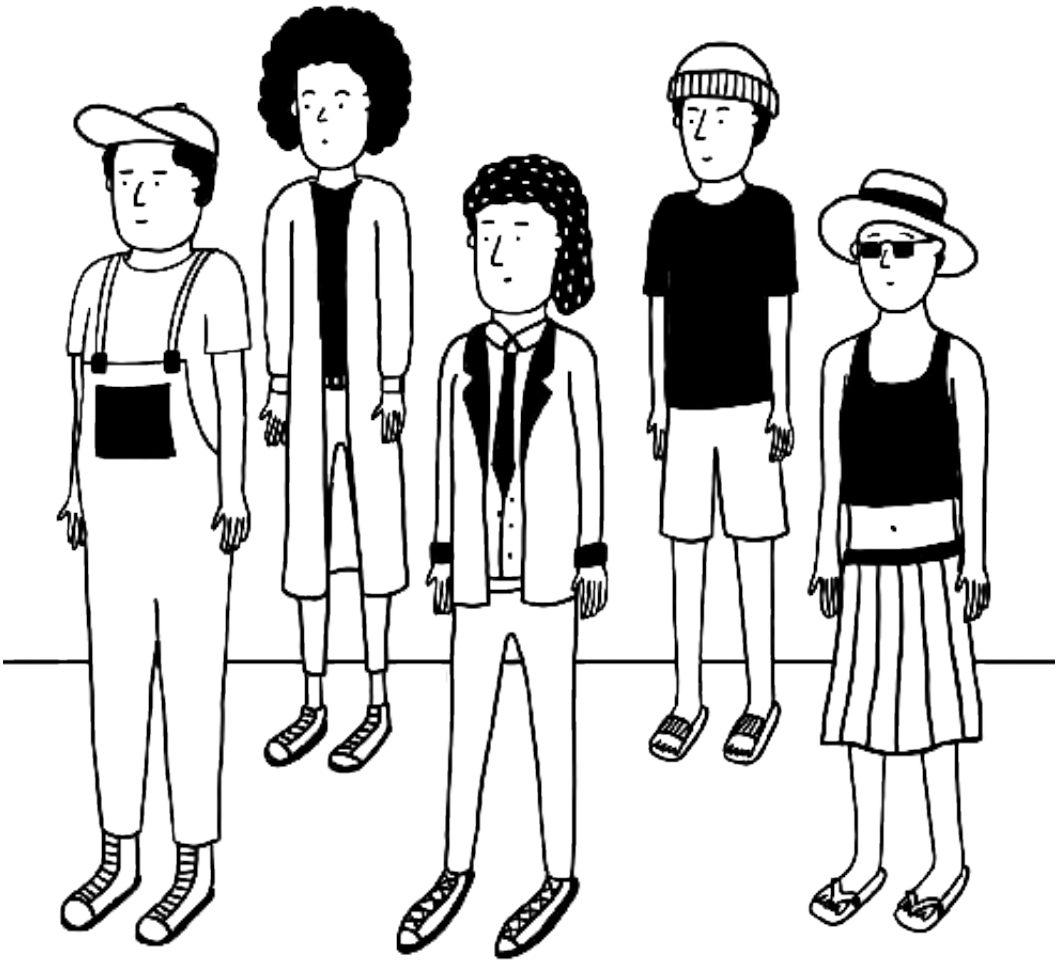
How many T-shirts do you own?
Can you estimate how many T-shirts an average teenager has?
How do you think the high demand of T-shirts is affecting the amount manufacturers produce?

We generally tend to have more T-shirts than we need. Brands and retailers are offering us new pieces every day. However, do you know that the making of a T-shirt needs intensive work?

The human workforce can only do a limited amount, so manufacturers want intelligent robots that can work non-stop for maximum output to meet the demand for more. Even sewing machines need humans to operate them, but some robots require little intervention.

Automation has long been in the textile industry and in 2015, LOWRY, a sewing robot or "Sewbot" was invented. Lowry was a sewing robot line with different robots. As the T-shirts were originally created for the military, so were the Sewbots.

The US military is required to only buy clothing that has been made in the U.S. Because of this, the Defence Department has been funding research for sewing robots for a long time. The first products of the sewing robots were bath mats, but later the technology advanced to make T-shirts and also jeans.



What is the output of a Sewbot?

A Sewbot work line can make a T-shirt in just 50 seconds. The way they are built is similar to sewing machines, mixed with complex sensors. The ideal output of a Sewbot is 1142 T-shirts in an 8 hour work time, which in theory is replacing 10 employees. The human workforce produces 669 T-shirts in this same time period. To help you calculate, it means that a Sewbot can make as many T-shirts in an hour as 17 employees. This is 71% more output! This can result in 1.2 million T-shirts per year.

This can mean that the low-paid garment workers in the Asia region may be replaced by robots. **Some calculations show that around 64-88% of textile workers could lose their jobs.** However, if garment workers were taught or educated on how Sewbots are operated, this would create opportunity for new, better paid jobs for them. **For those, who won't be needed or can't learn these new high-tech skills, the consequences can be unemployment or change of jobs.**

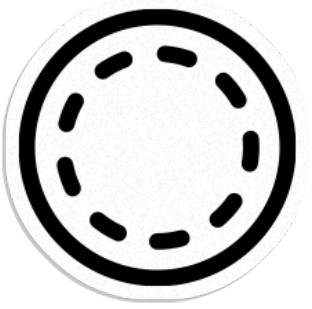


Photo credit: ISAIC

• If you would like to learn more about how to upskill garment workers to enable a just transition to a circular economy, you could check out this report from BSR's (Business for Social Responsibility) report Keeping Workers in the Loop. This report explores the impact of automation on garment workers and offers recommendations to industry and policymakers on creating a just, fair and inclusive circular fashion system. In a just transition, it is also important to consider the communities that deal with our clothing waste. To find out more, explore the work of the OR Foundation and their research report, Stop Waste Colonialism. You can also watch this short documentary and read the related research report by the Changing Markets Foundation to find out more about these topics.

How exactly does a Sewbot work?

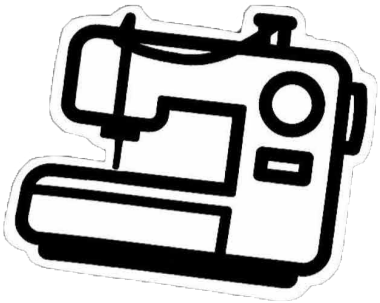
The sewing robots use a highly calibrated machine vision to watch and analyse fabric.

The automated production starts with the programming.
The data from the designers goes into the robot and then it performs accordingly.

Fabric is cut into pieces that will become parts of the shirt: the front, the back, and the sleeves. Those pieces are loaded into a work line where, instead of a person pushing the fabric through a sewing machine, a complicated vacuum system stretches and moves the material.

Cameras track the threads in each panel, allowing the system to make adjustments while the garment is being constructed.
In short, a 70-foot long production line for T-shirts are fully performed by the robots, who do the cutting, sewing a seam, adding a sleeve, and also do the quality inspection. And the computer vision guides the fabric along each step.

Does this lower the cost of T-shirts?
The cost of a robot-produced T-shirt can be cheaper or comparable than buying one from overseas. Let's say, in Bangladesh it costs $0.22, and in the U.S. it can be as much as $7.47 to pay a garment maker. Now the robots can make the same product for a cost of around only $0,05-$0.33 per T-shirt.



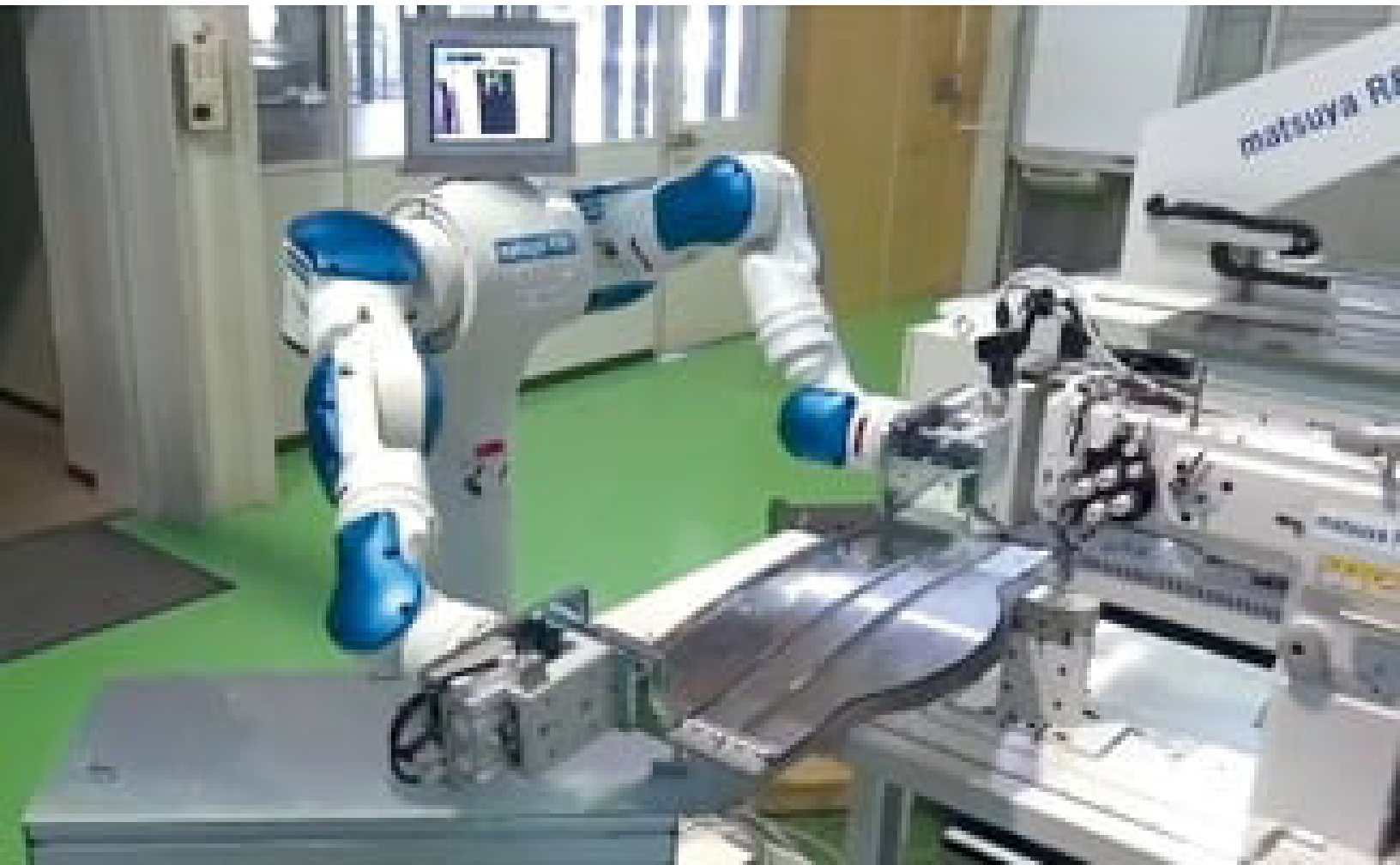
How can robots handle soft textiles?

I am sure you were wondering how these Sewbots can handle the gentle fabrics. Well, there is a way. Manufacturers add stiffener to the fabrics. A research study took place in Seattle by Sewbo to discover this. The robots need firm things to be able to work with. These robots handle the stiff textiles like metal sheets and when the production is over, the T-shirts are washed to retain their natural softer texture.

The stiffener could potentially contaminate the environment, if it's not from an organic substance.

Although the invention itself is genius!

Photo credit: Matsuya



Task

Watch the video on how Sewbot works.

Now let's do some maths to see exactly what we were talking about.

The task is to calculate a clothing factory's output if they only produce T-shirts size M(38). Imagine that you are the owner of a factory and you need to calculate the amount of T-shirts you make. Plan your output for 10 000 T-shirts per day (8 hour shift).

How many Sewbots do you need to produce that much amount?

The ideal output of a Sewbot is 1142 T-shirts in an 8 hour work time. And if you work 6 days a week with the same production, what is your output in one month/4 weeks?

What is the percentage of a Sewbot output compared to a human output? The human workforce produces 669 T-shirts in the same time period.

Answers:

1 Sewbot makes 1142 T-shirts in 8 hours, that means 8,75 (let's round it up to 9) **Sewbots are needed to make 10 000 T-shirts in an 8-hour shift.**

If all 9 Sewbots work in the same shift for 6 days a week for a month, then they will produce **246 672 T-shirts in total**.
The percentage for human workforce compared to Sewbots is 58%.

Reflection

In this lesson we have learned about sewing robots, how they can speed up the production compared to human workforce, how they work and comparing it to human workforce.

Robotic forces will surely take over some jobs in the future, textile production will be one of them. It is on us to consider the pros and cons of robots replacing humans in production.
Can you think of them?

Pros +

- saving money on wages of textile workers
- saving time and energy of the production
- less human intervention needed for the supervision of robots
- more identical garment pieces due to precise robotic movements
- the design/pattern can be changed quickly without explaining it to the workers

Cons –

- (possibly fossil) energy needed to make the sewing robots
- more energy needed to operate robots only
- need of high-tech staff who are able to program the robots
- garment workers could lose their jobs
- stiffener might harm the environment

Resources

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Sewbo
https://www.sewbo.com/

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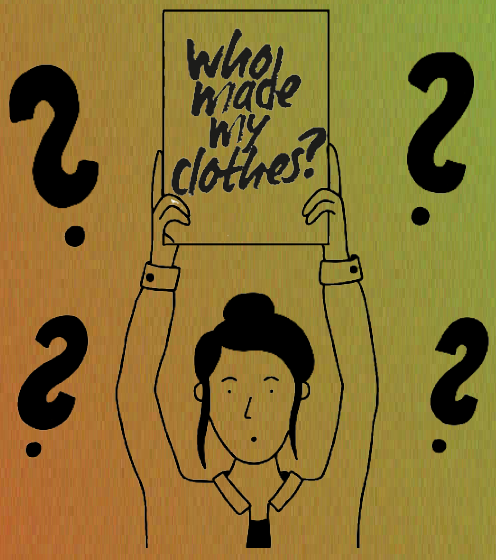

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