
ENGLISH LEARNING
FOR CURIOUS MINDS

Episode #174
3D Printing
9th Jul, 2021

[00:00:00] Hello, hello hello, and welcome to English Learning for Curious Minds, by Leonardo English.

[00:00:12] The show where you can listen to fascinating stories, and learn weird and wonderful things about the world at the same time as improving your English.

[00:00:22] I'm Alastair Budge and today we are going to be talking about 3D printing.

[00:00:29] It has been **hailed**[1] as the technology that will **usher in**[2] a Fourth Industrial Revolution, will help take humans to Mars, help us live longer, happier lives, and **revolutionise**[3] manufacturing.

[00:00:43] But people have been saying this for quite some time now, and the technology is actually a lot older than you might think.

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[1] approved for its importance

[2] cause the start of something new

[3] greatly change something into something better

[00:00:52] So, in today's episode we are going to talk about how 3D printing actually works, what people think it will allow us to do, some of the fears that people have about 3D printing, and discuss how, if at all, it will change the world we live in.

[00:01:10] I should say that this episode is a member request, it's from an awesome member of Leonardo English, a guy from the Czech Republic called Jachym.

[00:01:19] So, Jachym, I hope you enjoy this episode.

[00:01:23] And if you want to be a bit more like Jachym, and do things like request episodes, listen to all of our bonus episodes, plus follow along with the subtitles, transcript and key vocabulary, then I would love for you to check out becoming a member of Leonardo English.

[00:01:40] Membership of Leonardo English gives you access to all of our learning materials, and will help you improve your English in a faster, more enjoyable, and most importantly, more interesting way.

[00:01:53] So, if that sounds like fun then the place to go to is leonardoenglish.com.

[00:02:01] Right, 3D printing.

[00:02:05] One of the main differences between humans and animals is that we make things.

[00:02:10] We create tools from the natural world to help us do things.

[00:02:16] From a caveman making an **axe**[4] out of some wood and stone right through to the creation of the phone or computer that you are listening to this episode on, humans make things.

[00:02:27] An animal might make a **nest**[5], it might dig a hole to create a house, but the creation of objects is something that's relatively **unique**[6] to us, that's **unique** to human beings.

[00:02:41] To state the obvious, as time has gone on, and technology has developed, each generation has got better and better at producing objects.

[00:02:51] 3D printing, to its **proponents**[7], to its greatest fans, is the most advanced and important manufacturing technology that currently exists.

[00:03:02] It allows anyone, anywhere, with the right machine, to produce **custom-built**[8] objects, in a huge variety of different materials.

[00:03:13] So, how does it actually work, and why is this important?

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[4] a tool with a metal blade at the end of a wooden handle, used for cutting wood

[5] a place built by birds to lay their eggs and raise their young

[6] connected only

[7] supporters

[8] made according to the needs of a particular person

[00:03:19] One way of thinking about the actual 3D printing process is that it is the opposite of traditional or classic manufacturing.

[00:03:29] Think of traditional manufacturing like **sculpture**[9], **carving**[10] an object out of a piece of stone or **marble**[11].

[00:03:37] There is a block of material, and you cut pieces away until you are left with the object that you want.

[00:03:46] If we continue with the example of a **sculpture**, let's take Michelangelo's David, for example, this was **carved**[12] out of a large piece of **marble**, it was **smoothed**[13] and **sanded**[14] until what remained was the form of David that we see today.

[00:04:03] 3D printing is the opposite.

[00:04:05] You start with nothing, and **matter**[15] is added and added until the **desired**[16] shape, or object, is created.

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[9] the art of forming objects out of a material

[10] the art of forming a shape by cutting into wood or stone

[11] a type of very hard rock used in architecture and art

[12] cut to shape a piece of art

[13] made even and regular without areas that rise or fall

[14] cleaned and made even using a type of hard paper called sandpaper

[15] some kind of material or substance

[16] wanted

[00:04:14] To call it printing is actually a little bit **deceptive**[17].

[00:04:20] To the **uninitiated**[18], to those who don't know huge amounts about it, it makes you think of a printer.

[00:04:28] There are some shared concepts between 3D printing and traditional printing, but it's probably more useful to think about the "printing" in 3D printing as building, creating, or simply "making".

[00:04:46] Indeed the technical term for 3D printing is Additive Manufacturing - manufacturing by adding, rather than taking away.

[00:04:56] Although you might have seen headlines and news programmes in the last 10 years or so about the huge impact that 3D printing is going to have, the technology has actually been around since the 1980s.

[00:05:12] Early versions of 3D printing were similar to typical 2D printing at a **conceptual**[19] level.

[00:05:20] If you are printing a document or a photo, there is a computer record of the text or image to be printed, then the printer adds ink to the paper in the right places, and ta-da, you have a printed document.

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[17] not showing the truth

[18] not having knowledge of a particular subject

[19] relating to mental ideas and not actions

[00:05:35] Early 3D printing worked in a similar way.

[00:05:38] You would create your computer file in 3D of the object to be printed.

[00:05:45] But the 3D printer didn't just go across the page at one level, it added **matter** vertically, so that gradually an object could be created from nothing.

[00:05:58] Although this was **groundbreaking**[20] technology, in its early days it was too expensive and slow to be practical for **widespread**[21] use.

[00:06:08] As one might expect, the technology continued to be improved and improved, and new forms of 3D printing would be created, and **patented**[22], they would be protected by a **patent**[23], a legal device to prevent others from copying it.

[00:06:25] As you may know, and you are probably extra familiar with this if you have listened to the episode on **patents**[24], **patents** all have a fixed term, they don't last forever.

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[20] introducing new, very important methods or ideas

[21] happening among many people

[22] protected by a legal device to prevent others from copying it

[23] a legal device that protects the creator of a technology by preventing others from copying it

[24] legal devices that protect the creator of a technology by preventing others from copying it

[00:06:37] This gives the inventor the opportunity to benefit from a **time-limited**[25] monopoly on it, but they have to provide clear instructions for others on how to **replicate**[26] the technology.

[00:06:51] Now, coming back to 3D printing, having a **patent** meant that the inventor of a particularly **sophisticated**[27] 3D printing technique could charge higher prices for people to use their machines.

[00:07:06] In the 2000s, even though 3D printing objects could be very expensive, for some use cases it was still cheaper than traditional manufacturing.

[00:07:17] For example, one of the earliest obvious uses of 3D printing is for **prototyping**[28], for building a version one, a test version, of a product.

[00:07:30] With traditional manufacturing, you need to find a factory to build it. This factory needs to have expensive machinery, which needs to either be built or **calibrated**[29], and the entire process takes a long time and is expensive if you only want to build one **unit**[30], if you only want to make something once.

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[25] happening only for a certain period of time

[26] make it in exactly the same way

[27] developed and complicated

[28] building a first, test version of a product

[29] carefully set

[30] a single thing

[00:07:52] With 3D printing, you can do this very quickly, and even with what we would now consider to be very high costs of 3D printing, it could still be more cost effective than traditional manufacturing.

[00:08:06] But, in 2009 the **patent** for the most advanced 3D printing technique, called fused deposition modeling expired.

[00:08:16] These machines used to cost around $10,000 to buy, but almost **overnight**[31] the price dropped to around $1,000.

[00:08:27] Still, not cheap, and not the sort of thing that anyone would buy to use at home, but a significant **reduction**[32].

[00:08:36] This not only meant that using 3D printing technology became a lot cheaper, but it also opened up the market to **hobbyists**[33], to people who wanted to 3D print objects for fun or for personal curiosity.

[00:08:52] Suddenly, there was **renewed**[34] interest in the technology, and it became more accessible to companies of all sizes, across a huge variety of industries.

[00:09:04] Let's talk through some of the examples of how it was used.

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[31] during the time one nights lasts

[32] decrease

[33] people who do something as a hobby and not as a job

[34] happening again after a pause with more enthusiasm

[00:09:08] Firstly, let's continue with manufacturing, as this is the **sector**[35] for which 3D printing is most exciting.

[00:09:16] For **prototyping**, a company could now buy their own 3D printer, and rapidly **iterate**[36] on products, they could improve something continuously over a short period of time.

[00:09:30] An engineer could design a new product, and the next day a version of it could be produced, it could go from idea, to software, to physical product in a tiny amount of time compared to the **status quo**[37], to the normal way of doing it.

[00:09:48] It's also thought that 3D printing will completely **revolutionise** the global manufacturing **supply chain**[38].

[00:09:56] If we take the example of a British car manufacturer, it currently buys parts for its cars from different factories all over the world.

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[35] part, area

[36] do something again and again

[37] the present situation

[38] the system according to which products are distributed

[00:10:06] Perhaps a factory in China makes the windscreen[39] wipers[40], a factory in Brazil might make the seat belts, a factory in Germany might produce the electrical wires, an Italian factory might produce the brakes[41].

[00:10:21] Our economy has developed in this way, so that factories, or indeed entire companies, specialise[42] in making just one or two components[43], which they ship all over the world.

[00:10:34] There are even entire cities in China which specialise in producing only one product, there's cigarette lighter city, condom city, and so on.

[00:10:45] The economics of this currently make sense, and with our example of the British car company, it is cheaper for it to buy all of these parts from all over the world, and they are shipped to the factory where they are put together.

[00:11:01] For this car company to build its own factories to make all of the unique parts would be incredibly expensive, and so it doesn't make sense for it to do it.

[00:11:12] But, what if it could 3D print these parts closer to home?

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[39] the window at the front of the car

[40] devices that remove rain from a vehicle's windows

[41] mechanisms that makes a vehicle go slower or stop

[42] have special knowledge of and work on a particular subject

[43] parts

[00:11:17] What if the cost to 3D print the parts was so low that it made no sense to buy them from the other side of the world?

[00:11:27] 3D printing isn't quite there yet, but it is currently at the level where if a company needs only a few units, it can print them itself, rather than having to order hundreds of thousands of them from the other side of the world.

[00:11:43] Obviously, when 3D printing does become cheaper than buying a product from a factory on the other side of the world, this will have huge **implications**[44] for global trade.

[00:11:53] Producing goods closer to home means less transport, fewer **emissions**[45], and a complete **rethinking**[46] of the global trade system that we currently live with.

[00:12:04] 3D printing also means you can produce a much greater variety of products.

[00:12:11] There are some shapes and forms that are just very difficult to produce using traditional manufacturing processes, given that you have to cut, or **bend**[47], or fix things together.

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[44] consequences

[45] the acts of sending out gas

[46] thinking again about a system in order to change or improve it

[47] shape into a curve or angle

[00:12:24] Due to the fact that with 3D printing you are literally creating a shape from nothing, you can make practically anything.

[00:12:34] And when it comes to what you can make, 3D printing isn't only about making quicker **prototypes**[48] or a greater variety of products.

[00:12:44] It's also already meaning that we can "print", **in inverted commas**[49], print things that we couldn't previously do.

[00:12:53] It's now possible to print or make human body parts.

[00:12:58] Whether it's an ear or a part of an **organ**[50], the technology now allows us to take **cells**[51] and literally create new body parts.

[00:13:08] There is always a **mismatch**[52], a **disparity**[53], between the number of people who need new body parts and the number of available body parts, and **advocates**[54] of 3D printing suggest that the technology will allow us to close this gap.

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[48] the first examples or versions of something

[49] between punctuation marks that show that the word inside them is not used with its true meaning

[50] a part of the body that does a particular job

[51] the smallest basic units of the body

[52] an unequal amount

[53] a lack of equality

[54] supporters

[00:13:24] Need a new **tube**[55] going into your heart? No problem, we can print one for you.

[00:13:29] It would certainly **revolutionise** global healthcare.

[00:13:33] And, moving further afield, out of this world even, 3D printing is a technology that is already playing an important role in space exploration.

[00:13:44] At the moment, everything that is taken into space is manufactured on Earth and shot up into space.

[00:13:52] A spacecraft needs to take everything it needs with it, because there obviously isn't an easy way to get a new piece of equipment when you are circling the Earth.

[00:14:04] But, with a 3D printer, you can literally make any object you need, you can use that object, and when you no longer need it you can **melt**[56] the material down and create something else.

[00:14:17] Amazing, right?

[00:14:19] And it's not just for making **spare**[57] parts on spaceships.

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[55] an empty part of the body in the shape of a cylinder used for transferring liquids

[56] turn something solid into a liquid mass

[57] additional, extra

[00:14:23] It is thought that 3D printing will play a very important role in a human **settlement**[58] on Mars.

[00:14:31] These **settlements**[59] would have to be created somehow, and it isn't **feasible**[60] to shoot up an entire **pre-built**[61] **settlement** and fly it to Mars.

[00:14:42] Instead, so the theory goes, 3D printers would be used to create new **settlements** directly on Mars.

[00:14:51] So, how is 3D printing going to affect you and me, **assuming**[62] that we are unlikely to be personally **colonising**[63] Mars?

[00:15:00] Will we literally be able to print anything we want?

[00:15:04] Will we all have machines in our houses and we can press a button to create a cup, a new ear, or even a full English breakfast?

[00:15:13] Now, let's actually take these three examples first, because they are all important in their own different ways.

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[58] a new place where people create a community

[59] new places where people create a community

[60] able to be done

[61] made before it is transported to its destination

[62] accepting, knowing the fact

[63] going to live in a new place

[00:15:20] It is already possible to buy a 3D printer, the cheapest ones start at around €100 nowadays, so it is not completely **inconceivable**[64] that you could have one in your house.

[00:15:34] You could certainly print a cup, that's an easy one.

[00:15:37] It's also possible to print a new ear, although that obviously requires some pretty complex medical knowledge as well, and your €100 3D printer probably wouldn't be up to the challenge.

[00:15:51] And in terms of printing yourself a full English breakfast, or creating food out of nothing, this has been a theme that has interested science fiction writers for years.

[00:16:03] If you are a Star Trek fan you will be familiar with a device called The Replicator, which was similar to a microwave oven, but could create objects from nothing.

[00:16:14] There are several companies that are already working on 3D printing meat, and the first 3D printed steak is set to appear on dinner plates at certain European restaurants by the end of 2021.

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[64] impossible to think of

[00:16:28] The comparison might sound a little **disgusting**[65], but the process is similar to that of creating a human ear. You take a **sample**[66] of the **tissue**[67], and from that you can create a **replica**[68] of the original.

[00:16:43] I couldn't find an example of any company that is focussing on 3D printing full English breakfasts, but there is no reason that the technology shouldn't be possible in the future.

[00:16:55] Now, as with anything new, there are the usual fears about what this might lead to.

[00:17:01] If anyone can create anything for themselves, what sort of dangerous **implications** will there be?

[00:17:08] The most commonly **cited**[69] example of this with 3D printing is of people printing their own guns.

[00:17:16] It is very possible to 3D print a gun, and these guns can often be hard to **detect**[70].

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[65] extremely unpleasant

[66] a small amount or part of something

[67] material from which a body is made

[68] exact copy

[69] referred as evidence for the argument mentioned

[70] discover their existence

[00:17:24] Indeed, an Israeli journalist demonstrated this in 2013 by 3D printing a gun, going to a press conference with Benjamin Netanyahu, the Israeli Prime Minister, where he managed to take the gun through the metal detector without it **beeping**[71].

[00:17:43] In the video of the event you can see the journalist holding the gun and secretly pointing it at Netanhayu. It would have been very easy for him to stand up, fire the gun and kill him.

[00:17:57] Netanyahu criticised this as an "an **irresponsible**[72] act", but 3D printing certainly does **pose**[73] some security problems.

[00:18:06] In most countries in the world, apart from the one very obvious exception, gun ownership is very **tightly**[74] **regulated**[75], and the idea that anyone, anywhere could get their hands on a gun is something that most governments haven't had to properly **confront**[76] yet.

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[71] making a sound

[72] not thinking about the possible results of the action

[73] cause

[74] with very strict control

[75] controlled

[76] face, deal with

[00:18:24] But to think that people are going to start printing guns and shooting people just because they now have a 3D printer seems a little bit **unrealistic**[77].

[00:18:34] If you are **intent**[78] on killing someone then I'm sure you can find a way without a 3D printer.

[00:18:42] And there is the familiar **critique**[79] of any new technology, that it is going to take jobs from humans.

[00:18:50] If we no longer need large factories with humans **manning**[80] the equipment to produce the parts, or humans **assembling**[81] the parts, this will cause these people to lose their jobs, so the argument goes.

[00:19:03] Of course these machines will replace the jobs of humans, that's the entire point.

[00:19:08] The job of any machine is to reduce the work of a human, whether it's a fishing net or a 3D printer, the reason for creating machines is to reduce the amount of work a human needs to do.

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[77] not likely to happen

[78] determined to

[79] an act of showing the faults of something

[80] operating

[81] bringing together, joining

[00:19:23] But to criticise 3D printing, or to **legislate**[82] against it because it will lead to some job losses in the manufacturing **sector** is pretty **shortsighted**[83], and is comparable to regulating against driverless cars because they will put truck drivers out of work.

[00:19:41] This is such a familiar criticism of any new technology, and the economic system has a pretty good **track record**[84] of creating new jobs to replace the old ones.

[00:19:52] Now, even though 3D printing as a technology has been around for over 40 years now, it is just getting started. It was worth around $14 billion dollars in 2020, and is **predicted**[85] to grow at around 21% every year.

[00:20:10] Right now most of us probably don't see the impact that it is having, but **behind the scenes**[86], in healthcare, manufacturing, space travel, and multiple other industries, it is helping us build products more quickly, more cheaply, and more **efficiently**[87].

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[82] make laws

[83] showing not enough thought about how it can affect the future

[84] past achievements

[85] said that it will happen in the future

[86] without most people knowing about it

[87] in a way that provides results

[00:20:28] Only time will tell when the day will come when we can print our own full English breakfasts.

[00:20:36] OK then, that is it for the magical technology of 3D printing. It might have got off to a slow start, but it is playing an ever greater role in the world we live in.

[00:20:49] As always, I would love to know what you thought of this episode.

[00:20:53] Have you ever 3D printed anything? What would you think about eating a 3D printed steak, or having something that was 3D printed **transplanted**[88] into your body?

[00:21:04] I would love to know.

[00:21:06] For the members among you, you can head to our community forum, over at community.leonardoenglish.com and get chatting away to other curious minds.

[00:21:16] And as a final reminder, if you enjoyed this episode, and you are wondering where to get all of our bonus episodes, plus the transcripts, subtitles, and key vocabulary, then the place to go to for all of that is leonardoenglish.com.

[00:21:31] I am on a mission to make Leonardo English the most interesting way of improving your English, and I would love for you to join me, and curious minds from 50 different countries, on that journey.

[00:21:44] The place you can go to for all of that is leonardoenglish.com. You've been listening to English Learning for Curious Minds, by Leonardo English.

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[88] put (for a body part)

[00:21:54] I'm Alastair Budge, you stay safe, and I'll catch you in the next episode.

[END OF EPISODE]

Key vocabulary

Word	Definition
Hailed	approved for its importance
Usher in	cause the start of something new
Revolutionise	greatly change something into something better
Axe	a tool with a metal blade at the end of a wooden handle, used for cutting wood
Nest	a place built by birds to lay their eggs and raise their young
Unique	connected only
Proponents	supporters
Custom-built	made according to the needs of a particular person
Sculpture	the art of forming objects out of a material
Carving	the art of forming a shape by cutting into wood or stone
Marble	a type of very hard rock used in architecture and art
Carved	cut to shape a piece of art

Smoothed	made even and regular without areas that rise or fall
Sanded	cleaned and made even using a type of hard paper called sandpaper
Matter	some kind of material or substance
Desired	wanted
Deceptive	not showing the truth
Uninitiated	not having knowledge of a particular subject
Conceptual	relating to mental ideas and not actions
Groundbreaking	introducing new, very important methods or ideas
Widespread	happening among many people
Patented	protected by a legal device to prevent others from copying it
Patent	a legal device that protects the creator of a technology by preventing others from copying it
Patents	legal devices that protect the creator of a technology by preventing others from copying it
Time-limited	happening only for a certain period of time
Replicate	make it in exactly the same way

Sophisticated	developed and complicated
Prototyping	building a first, test version of a product
Calibrated	carefully set
Unit	a single thing
Overnight	during the time one nights lasts
Reduction	decrease
Hobbyists	people who do something as a hobby and not as a job
Renewed	happening again after a pause with more enthusiasm
Sector	part, area
Iterate	do something again and again
Status quo	the present situation
Supply chain	the system according to which products are distributed
Windscreen	the window at the front of the car
Wipers	devices that remove rain from a vehicle's windows
Brakes	mechanisms that makes a vehicle go slower or stop

Specialise	have special knowledge of and work on a particular subject
Components	parts
Implications	consequences
Emissions	the acts of sending out gas
Rethinking	thinking again about a system in order to change or improve it
Bend	shape into a curve or angle
Prototypes	the first examples or versions of something
In inverted commas	between punctuation marks that show that the word inside them is not used with its true meaning
Organ	a part of the body that does a particular job
Cells	the smallest basic units of the body
Mismatch	an unequal amount
Disparity	a lack of equality
Advocates	supporters
Tube	an empty part of the body in the shape of a cylinder used for transferring liquids

Melt	turn something solid into a liquid mass
Spare	additional, extra
Settlement	a new place where people create a community
Settlements	new places where people create a community
Feasible	able to be done
Pre-built	made before it is transported to its destination
Assuming	accepting, knowing the fact
Colonising	going to live in a new place
Inconceivable	impossible to think of
Disgusting	extremely unpleasant
Sample	a small amount or part of something
Tissue	material from which a body is made
Replica	exact copy
Cited	referred as evidence for the argument mentioned
Detect	discover their existence

Beeping	making a sound
Irresponsible	not thinking about the possible results of the action
Pose	cause
Tightly	with very strict control
Regulated	controlled
Confront	face, deal with
Unrealistic	not likely to happen
Intent	determined to
Critique	an act of showing the faults of something
Manning	operating
Assembling	bringing together, joining
Legislate	make laws
Shortsighted	showing not enough thought about how it can affect the future
Track record	past achievements
Predicted	said that it will happen in the future

Behind the scenes	without most people knowing about it
Efficiently	in a way that provides results
Transplanted	put (for a body part)

We'd love to get your feedback on this episode.

What did you like? What could we do better?

What did you struggle to understand?

Let us know in the forum community.leonardoenglish.com