

Complete 3D Chocolate Printing Guide [FAQ]

By *Choc Edge Ltd*

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Choc Edge is a UK and China-based technology company that provides chocolate printing solutions for individuals and businesses who wish to design and produce creative chocolates.

The latest 3D chocolate printer from **Choc Edge** is the **Choc Creator V2.0 Plus**, which improves greatly on all previous models. The **Choc Creator V2.0 Plus** is an incredibly versatile machine that is designed to print a wide range of designs, shapes and objects from 2D to full miniature 3D.

As the pioneers of 3D chocolate printing, we have been faced with the challenge of conveying our unique technology to the world in a way that can be understood not only by the 3D printing community but also chocolatiers, bakers, confectioners, marketing companies and anyone endeavouring on a brand new business venture.

It is therefore important for us to provide potential users with as much information as possible about the 3D chocolate printing process.

This **3D Chocolate Printing Guide** is presented as an **FAQ (Frequently Asked Questions)**, and is intended to provide an overview of all the information users need to get started with chocolate printing, and the potential challenges they may face. Every possible scenario is accounted for, and we hope that this information will (1) prove useful as an accompaniment to the **Choc Creator V2.0 Plus User Manual**, and (2) help newcomers to determine whether the **Choc Creator V2.0 Plus** is the right solution for their business.

All the questions in this **FAQ** are real questions delivered to the **Choc Edge** team regarding **Choc Creator V2.0 Plus**.

For convenience, the questions have been categorized:

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All about: **Chocolate**

What type of chocolate can be used in the *Choc Creator V2.0 Plus*?

We highly recommend the use of high-quality, machine-tempered, dark Belgian chocolate as it has consistently shown better printing results compared to other types of chocolate, due to its high level of cocoa solids. However, it is possible to print with different kinds of chocolate including milk chocolate and white chocolate.

What kind of tempering machine would you recommend?

Choc Edge uses a Rev 2 automatic chocolate tempering machine from **Chocovision**.

Does the chocolate need to be tempered for printing?

For reliable results it is essential that the chocolate is properly tempered. If the chocolate is not tempered results may be unpredictable or unsatisfactory.

Does the machine keep the chocolate warm during the whole process of printing?

Yes. The **Choc Creator V2.0 Plus** has a heating system. The barrel which houses the syringe while printing keeps a constant temperature. For example: If you set the temperature to 31°C, you will see "Temp: 31°C" on the LCD touch screen. Sometimes this bursts up to 33°C or maybe even 34°C momentarily while printing - the heating system is compensating for a slight drop in room temperature and is smartly keeping an even 31°C.

What are your cartridges made of?

The **Choc Creator V2.0 Plus** does not use cartridges – it has a syringe loading system. In simple terms, tempered chocolate is loaded into the printer via a syringe (meaning that the chocolate is sucked up into the syringe by hand) and the syringe is then loaded into the printer.

This process was chosen because it is food-safe, clean, efficient, enables the use of different chocolates, and the chocolate you load will always be fresh.

Could the chocolate dry up in the syringe?

When recommended operating temperatures are followed, the chocolate should not dry inside the syringe. As soon as you load the syringe with chocolate (which will be approximately 30~32°C from a tempering machine), it should be inserted into the printer's barrel and the cover closed. If the printer's heating system has been set to 31°C, the barrel will already be at that temperature, so it will be a smooth transition from tempering machine to the printer (with perhaps half a degree of fluctuation at most). When using a 0.8mm nozzle, the longest we usually print a single 3D model for is 40-50 minutes, with 50~60 minutes being the absolute maximum we would recommend. For 2.5D designs which are much quicker to print, the chocolate should not dry out while printing.

As mentioned above, the 0.8mm standard nozzle has proven itself suitable for extended print times. However, we also occasionally utilise a 0.4mm nozzle. The 0.4mm nozzle has an ultra-fine hole that the chocolate come out of, so naturally it is susceptible to blocking if the chocolate has rogue particles or if the room temperate is very low. When using a 0.4mm nozzle we usually print for no longer than 20 minutes, it's at this point that the nozzle may start to block. **Please note: The 0.4mm nozzle has been retired.**

How do you get the chocolate out from the machine at the end of the day?

For ease of use, we chose a syringe system for our printer. After you finish printing, you remove the syringe from the printer's barrel, and squeeze out any remaining chocolate into a cup (since it can be re-tempered and re-used if needed). Then simply clean the syringe and nozzle with warm water and dish soap. We supply a little brush for this. After the syringe is dry, you can reload it with freshly tempered chocolate and start the printing process again.

Can it also print using other foods or different mixtures of chocolate?

The **Choc Creator V2.0 Plus** was designed specifically for use with chocolate, dark chocolate being the best type for 3D printing.

Chocolate from the same family of couverture chocolate could theoretically be mixed together and printed with, but this will not create the desired marble texture due to the size of the nozzle.

Two-tone prints are achievable but require a little more effort than regular printing - the printer has a pause function, so if you have two syringes, you can experiment with changing syringes during a single print. For example: You could print the first half of a 3D object in dark chocolate, and the second half in white chocolate.

Most importantly the printer's warranty does not cover other materials than chocolate.

Can I use a coolant to cool the chocolate faster?

Cooling the chocolate should not be necessary to achieve 3D printing when tempered chocolate is used. (Please note that all the prints in our gallery have been produced without the use of a cooling system.) If your room temperature is very difficult to control, it may be helpful to place a small cooling appliance such as a USB-powered refrigerator in front of the printbed. Cooling the chocolate too quickly can also negatively affect the quality of the chocolate and cause it to become brittle.

What chemicals or additives do you use to make your chocolate suitable for 3D printing?

Absolutely none. We use chocolate straight out of the bag and place it into our tempering machine. We recommend Callebaut's Dark Belgian Chocolate for best results.

How do I keep the chocolate I've printed in a good condition?

Chocolate will keep well for months if stored in a cool, dry place, away from direct sunlight at 21°C or below. The humidity should be 50% or under. Airtight packaging will help to preserve the chocolate.

Why do you prefer couverture chocolate to compound chocolate?

Our extensive tests have shown that compound chocolate is not as reliable as other types of chocolate for the 3D printing process. Without specific tailoring, compound chocolate is not as workable or as stable as couverture chocolate.

Compound chocolate's basic contents can change the chocolate very quickly from a wet and loose state to a mousse-like viscosity, which makes it a slightly more difficult medium to print layers accurately with.

Although many of our experiments with compound chocolate have been successful, our customers naturally expect repeatability, reliability and consistency, and we prefer to recommend couverture chocolate in order to meet these expectations.

The dark chocolate you say you use has a 3 out of 5 viscosity and approximately 54% cocoa solids. If I would like to work with milk and white chocolate should I look for same viscosity and 54% cocoa solids?

Theoretically, this would seem like the best way to ensure similar results to dark chocolate. However, the percentage of cocoa solids in milk and white chocolate will usually differ substantially to that of dark chocolate. This is simply due to the mixtures used to create milk and white chocolate.

In comparison to dark chocolate, the cocoa solids percentage of milk and white chocolate is much lower, and there is also a milk solids percentage for milk and white chocolate. The viscosity of 3 out of 5 can be matched, but milk and white chocolate will always behave slightly differently to dark chocolate. Dark chocolate is slightly better for 3D printing because the milk content in other types of chocolate can cause the chocolate to be soft, moist or even greasy depending on the quality of the chocolate used.

My country is very hot for most of the year, with my room temperature ranging from 55°C during the day and 40°C during the night. Will this be an issue?

Yes. Unless you employ a temperature control system (air-conditioning) in your room, studio or factory, a temperature of 40~55°C will make printing impossible.

Chocolate behaves differently according to ambient temperatures. Chocolate is considered a 'cool temperature medium', meaning that it behaves well in a cool and non-humid environment, and becomes difficult to control in warm and humid conditions.

We recommended using a **Choc Creator V2.0 Plus** in an environment with an average 20~22°C ambient temperature, as our research has shown that most chocolatiers who sculpt their work (similar to 3D printing) do so in an environment that is monitored to an average temperature of 19~22°C.

For example: Tempered dark chocolate at 31.5°C will lose its tempering when it is exposed to heat greater than 34°C. If your room temperature is 40~50°C, you will find it near impossible to work with chocolate on any level. For 3D objects in particular, the room temperature (21°C) is absolutely crucial in achieving the results you see in our website gallery.

If you install an air conditioner, you simply need to set the temperature to 21°C and the **Choc Creator V2.0 Plus** to 31°C to create optimum printing conditions.

I need an idea of the capacity. For example: What could I get from a 1kg bag of chocolate?

The **Choc Creator V2.0 Plus** has a 30ml syringe loading system. In simple terms, tempered chocolate is loaded into the printer via a syringe (meaning that the chocolate is slowly drawn up into the syringe by hand) and the syringe is then loaded into the printer. This manual process was chosen because it is simple, food-safe, clean, efficient, and the chocolate you load will always be fresh.

A 30ml syringe can hold approximately 60 chocolate callets in melted form, which weighs 25~30g. A 1kg (1000g) bag of chocolate callets could therefore theoretically fill up 33~40 syringes, but this would only be the case if there was absolutely no waste or residue, so a maximum of 25~30 syringes would be a more realistic estimate in our experience.

If a design is a simple 2.5D design, you may be able to create 2 or 3 prints with one 30ml syringe. If your design is a 3D object, the full 30ml syringe will likely be required for a single print. For multiple refills throughout a working day, a constantly running tempering machine is recommended.

Can you give me any real life examples of productivity?

As demonstrated by our videos *Choc Creators* are desktop printers for chefs, chocolatiers and food innovators to utilize - they are not large portable chocolate factories as some people have assumed. During a production run our *Choc Creators* are working for approximately 6~8 hours a day, though the amount a single **Choc Creator V2.0 Plus** can produce depends entirely on the design.

We would suggest that potential **Choc Creator V2.0 Plus** users enter the world of 3D chocolate printing with the understanding that it is a desktop printer which is more suitable for smaller batches of regular 2D, 2.5D or 3D designs, and medium-sized batches of *simple* 2D or 2.5D designs.

For example: We once used our *Choc Creators* to produce 600 pieces for a customer in the USA. The designs made and printed for this customer were very simple 2.5D designs. The design took 7 minutes to print and was 6 layers high. A very simple design was necessary to meet the customer's deadline and quantity of 600. To make the 600 pieces, we worked in a team

of 3~4 people, and aimed to produce 30 pieces per day. Over 3 weeks (20 days), we produced 650 prints, so we had 50 extra pieces in case some broke during the journey from the UK to the USA. Likewise, in the past, a customer working to a very strict deadline of just one week asked us for a very large production run of a very detailed 3D design which took 45 minutes to print. After calculating the required printing time and manpower, we decided to decline their commission, as there is an obvious limit to the amount of prints a single desktop **Choc Creator V2.0 Plus** unit can produce in a single day. Fortunately, we find that most customers want their company logo, name or motif printed in chocolate, which is usually a simple design and can be printed relatively quickly.

Have you ever experimented with the brightly colored chocolate that some chocolate companies produce?

Yes, we have experimented - take a look at our colourful Easter Basket in our Gallery.

However, we must state that we do not recommend coloured chocolate as it produces very poor quality results due to the colourants used, which affect the behaviour of the chocolate. Some coloured chocolates (such as orange and green) have proven to be both soft and greasy even after correct tempering. We have therefore classified coloured chocolate as an unsuitable medium for quality and reliable 3D chocolate printing.

Precisely controlled room temperature is not an option for me. Could I still build objects at 23-25°C? This is the absolute lowest I can get my room temperature in my hot country.

The answer to this question will depend on the design. It is certainly possible to print 2D and 2.5D in a room with an ambient temperature of 23~25°C, but that is approaching the breaking point for tempered chocolate. We would advise keeping your room temperature closer to 23°C rather than 25°C if possible, but even at this temperature it is unlikely that complicated 3D objects with severe angular ascension will print correctly - they will most likely semi-collapse. Simple 3D models will more than likely build to completion. Keep in mind that thermometers are not always 100% accurate, and the chocolate may experience a "fat bloom" if your thermometer states 23~25°C but your actual room temperature is 24~26°C. We advise a room temperature of 21°C maximum for precision printing. As previously stated in this FAQ the **Choc Creator V2.0 Plus** works best at chocolatier studio temperatures, which typically range from 19~22°C in Europe.

I want to start a 3D face scanning and printing business from my home, but my rooms are 40°C. I never bought an air conditioner because I catch cold, and I prefer to keep my costs down. Will this be a problem for 3D printing chocolate? What about working underground?

Since tempered dark chocolate is finalized at the 31.5°C mark and works most comfortably in an ambient room temperature of 19-23°C, your house temperature of 40°C is simply too hot to work with chocolate. As a test, try to stack up drops of chocolate using a small spoon. You'll see that the chocolate doesn't stack up but instead melts into a pool. You will also notice that the chocolate never dries. If you have access to another location with a cooler ambient temperature, try the same test there.

Does this replace traditional moulding and chocolate screen printing?

No. Our technology and methodology does not replace moulding or chocolate screen printing. Instead, it is another highly useful tool in the arsenal of a chocolatier. Every chocolate-making method has 'pros and cons', and it makes sense to use the most suitable tool for the task in hand, and that may even be traditional hand piping or hand sculpting if it is the most efficient way to complete a task.

Moulding is tried and tested. However, bespoke moulding for short runs or one-off items of chocolate has also proven to be very expensive - This is one of the major 'cons' of moulding for chocolatiers who regularly receive commissions for designs that require more control than hand piping. We do not believe in 3D printing chocolate just for the sake of it, as we ourselves realize that time and effort is all monetized in the world of business.

All about: ***The Choc Creator V2.0 Plus***

What room temperature/humidity does the Choc Creator need to be operated in?

For reliable and accurate printing we recommend the printer is operated, and the chocolate prepared, in room temperatures between 20~22°C - ideally around 21.5°C. The humidity of the room should be 50%.

What is the size of the Choc Creator's print bed?

For printing purposes, the build space for the **Choc Creator V2.0 Plus** is 18cm (X-axis) x 18cm (Y-axis) x 4cm (Z-axis). The actual size is slightly larger.

If the chocolate is tempered and all other conditions are perfect, what is the longest the Choc Creator can print a single model for?

60 minutes is the absolute maximum. After this point, the chocolate loses its properties and printing loses its quality. We recommend keeping your print time to no longer than 55 minutes for a single highly-complex 3D print.

Scaling down models and increasing the print speed will help to reduce printing times. However, speeding up a print may negatively affect the print quality on 3D models as there is less time for each layer to dry.

What is max speed of the printer in “mm per second” and also “grams per minute”?

The maximum speed for 2D printing is *Speed 22* which is 22 mm per second.

Calculation for approximate minimum amount of grams per minute:
30ml syringe @ 22mms = 1200~1500 seconds (20~25 minutes) depending on the Gcode's route algorithm, resulting in 40~50 seconds per 1ml.

So 1ml (1gram) takes 40~50 seconds at most using the setting of *Speed 22*.

This calculation shows the minimum amount of grams at the absolute longest time rather than the maximum amount of grams in the shortest time - Put simply, the absolute longest time would be approximately three-quarters of a minute. Speedier results are therefore entirely possible.

The maximum speed for 3D printing is *Speed 7* which is 7 mm per second.

Calculation for approximate minimum amount of grams per minute:
30ml @ 7mms = 2400~3000 seconds (40~50 minutes) depending on the Gcode's route algorithm, resulting in 80~100 seconds per 1ml.

So 1ml (1gram) takes 80~100 seconds at most using the setting of *Speed 7*.

This calculation shows the minimum amount of grams at the absolute longest time rather than the maximum amount of grams in the shortest time - Put simply, the absolute longest time would be approximately a minute and a half. Speedier results are therefore entirely possible.

What is the minimum and maximum size for printing quality reliability?

For the maximum and minimum printing sizes, it is important for us to list the sizes that will guide users to create quality results with reliable printing.

Resolution is an important factor which needs to be considered for each design. Although very small and very large prints are not impossible, there may be factors that make it difficult to achieve perfect prints each time.

Maximum

For 3D objects, the maximum printing height (or "Z-axis height") of the **Choc Creator V2.0 Plus** is 4cm, with most of our 3D objects ranging from 2.5cm to 3.75cm in Z-height. The widest XY (width/length) point on any of our models is 5.5cm.

For 2D prints (such as a drawing or portrait), 15x15cm (XY) has been a default size we have used a number of times for printing 2D portraits onto icing sheets. Our largest 2D prints have been no more than 17x17cm (XY) and printed onto large icing sheets.

For 2.5D prints, we recommend 6~8cm (XY), increasing size to 9~12cm if necessary. Any print larger than 10cm is susceptible to the "bowing" or "curling" of tempered chocolate, which reduces the print success rate.

Minimum

For 3D objects, the minimum printing height (or "Z-axis height") of the **Choc Creator V2.0 Plus** is based around resolution - It is important to keep in mind that every layer is 0.8mm (almost 1mm) in height, so "miniature models" will have very little resolution or will not print to a satisfactory level of quality. This is why most of our 3D designs ranging from 2.5cm to 3.75cm in Z-height.

For 2D prints (such as a simple icon or logo, no text), we would rarely print anything smaller than 5x5cm as there will simply be no room for any detail.

For 2.5D prints (no text), anything from 4~6cm could be considered the minimum size for accurate printing, depending on the design.

If the maximum printing height is just under 4cm, how did you print those giant Albert Einstein and Paul McCartney heads?

The printed heads on our website are miniatures. Depending on the camera lens and settings, photographs of miniatures can make the object look larger than it actually is. For the designs in our gallery, any subjectivity regarding

scale is unintentional, as we only aim to take photographs that are clear and sharp with accurate colouring. As you can see by the thickness of the 0.8mm lines in the Albert Einstein and Paul McCartney photos, both these heads are approximately 3.75cm in height.

I want to print onto huge wedding cakes that are approximately 14" (35cm) in diameter. Is this possible?

No. Please see: [What is the minimum and maximum size for printing quality reliability?](#) (above)

I want put a 15cm high cake onto the platform and print onto it, but you say that this isn't possible. Can't I just take a screwdriver and fix this?

No. As you can tell from the photos, videos and information on our website, the **Choc Creator V2.0 Plus** works to a maximum printing height (Z-axis height) of just under 4cm, meaning that the print-head (with an attached nozzle) cannot be lifted any higher than this. 4cm is plenty for miniature 3D printing, but it means that a 15cm high ready-made cake will simply not fit under the printhead. The maximum height a cake could be is approximately 3.5~3.75cm for a 2D image to be printed onto it (with a little clearance to stop it getting messy). There is of course the possibility of printing onto icing paper or similar edible sheets and then transferring them to the top tier of the cake. This process is sometimes more comfortable due to the allowance for any possible printing errors that may be experienced while getting used to operating the printer. The platform of the printer moves along the Y-axis so it is fixed in place and cannot be lowered. For more information, please see: [What is the minimum and maximum size for printing quality reliability?](#) (Above)

How long does something the size of a lunch box take to print?

The maximum printing height (or Z-axis height) of the **Choc Creator V2.0 Plus** is 4cm, with most of our 3D designs ranging from 2.5~3.75cm in Z-height, and approximately 4~5cm in width/length.

The 3D designs in our gallery were printed on a slow setting to ensure accuracy, and took between 20 and 55 minutes per print.

The **Choc Creator V2.0 Plus** uses a 30ml syringe system, and each of our 3D designs requires 60~90% of the syringe's content, which is basically one print per 30ml syringe with some excess chocolate remaining. The **Choc Creator V2.0 Plus** is considered a desktop tool and most our designs are actually quite petite, with none of our 3D designs close in scale to a lunch box.

I noticed that the layers of the 3d objects are very noticeable, kinda "stripy" and sometimes "messy". Is it possible to solve this problem?

This is technically not considered a "problem". 3D printing is an ALM (Additive Layer Manufacturing) process, so what you see is the result of the ALM layer-upon-layer methodology.

If the individual 0.8mm chocolate layers are visible, it is a good sign that the chocolate used is high quality and has been correctly tempered. When you are 3D printing in chocolate, you should be aiming to have the layers as visible as possible, and you should be able to count the layers and match the exact amount to the value given by your slicing software.

(For example; When a 3D model that is 3.5cm in Z-height is sliced at 0.8mm, the slicing software will tell you it has sliced 43 layers, and you should be able to count all 43 layers of the finished chocolate print.)

By using a 0.4mm (high resolution) nozzle instead of a 0.8mm (low resolution) nozzle, you could print 0.4mm layers of chocolate that create a much finer resolution, but a nozzle of this size has a susceptibility to blocking unless conditions are absolutely perfect. Please note: The 0.4mm nozzle has now been retired due to the aforementioned reason.

As mentioned, tempered chocolate has the viscosity of toothpaste (very thick) so any "messy" areas of a print are largely due to the material being used. We consider none of the prints in our gallery to be "messy" despite the small scale of every design - this is simply what 3D printed chocolate looks like, and we feel these prints show the best chocolate can look when printed at 0.8mm.

Of course, we respect and understand people's opinions regarding the "stripy" look of 3D printed chocolate, and sometimes a moulding method is better suited to these people's tastes.

I've found some 3D models on the internet. Can they be printed in chocolate?

It is difficult to say without seeing the models. If the models are very large, have areas of fine detail, unsupported overhang or very steep angles, it is likely that the models will need to be edited to meet the requirements of chocolate printing. However, many models print perfectly as they are without any editing. It is a matter of trial and error.

Can the Choc Creator print with other materials?

No. The **Choc Creator V2.0 Plus** has been designed and tested for use with chocolate only - Specifically couverture chocolate.

Can the Choc Creator print onto a cake or other surface?

It is possible for the **Choc Creator V2.0 Plus** to print onto shallow surfaces like biscuits, but not deeper objects like cakes. However, prints can be lifted off the print bed and placed onto different surfaces when dry.

Is any assembly required?

No, the **Choc Creator V2.0 Plus** is fully assembled and tested before delivery.

Does the Choc Creator require much maintenance?

The only maintenance the machine requires regularly is cleaning the nozzles and syringe after use to prevent clogging. It is not necessary to use the machine every day to ensure that it runs well.

What consumables does the Choc Creator require?

The reusable syringe and nozzle required for printing is included with the printer. The rubber bung may wear down after time but replacements are available.

What is the capacity of the Choc Creator?

The **Choc Creator V2.0 Plus** uses a reusable syringe that holds up to 30ml of chocolate.

What's that faint sound I can hear every time I turn on my Choc Creator from cold?

This faint sound is generated by the heating system. The system starts heating when the printer is switched on - depending on your default temperature setting (e.g. 31°C), the printer aims to heat from its cold state to 31°C as quickly as possible. After the initial burst of heat, it takes a short while to balance itself out to 31°C.

While the printer is switched on, the heating system will always give out short bursts of heat to maintain the user's desired temperature. If you have your temperature at a high setting, you will likely notice more noise. Likewise, when the temperature is lower than 30°C, you may not even hear any sound at all.

Does the Choc Creator require human control, or is it like a robot? Is there a way to run a Choc Creator unattended for long hours during marketing events?

The *Choc Creator V2.0 Plus* is a desktop printer that has been designed as a tool for chocolatiers, confectioners, chefs, and food experimenters to work with in their studios. The size of the printer, its subsequent chocolate capacity, and reusable syringe system has been tailored to what fits best within the average chocolatier studio environment. As a result the printer's syringe and nozzle need to be cleaned, refilled, and reset after each print. However, the use of multiple syringes and nozzles throughout the day helps to speed up the reset process, with chocolatiers washing up all their syringes and nozzles together at the end of a working day.

To leave a printer unmanned for as long as possible at events, printing times of 3D objects could be tailored to a very slow speed, so that 3D objects take longer to print, noting that the maximum longest print time would still be 45~50 minutes before the tempered chocolate naturally starts to solidify - this is simply the science of chocolate and not a flaw in our methodology.

For marketing events that show 3D objects being printed, it is important to note that the room temperature must be suitable for tempered chocolate. If the room temperature is too warm, the 3D object may not build correctly - once again, this is simply the nature of chocolate.

I have heard that anything can be made because it's like a Star Trek replicator that turns everything into chocolate in seconds.

This is not true. If you study our literature, photographs, and videos you will find that the 3D ALM chocolate printing process has a number of limitations, the majority of which are related to the medium of chocolate itself and not flaws in our methodology. These limitations are explained in detail elsewhere within this FAQ.

So what is exactly is the deal with the inability to use chocolate scaffolding? And how do you defy gravity?

As mentioned elsewhere in this FAQ, no exterior support structures (known as "scaffolds" or "rafts") are used when 3D printing in chocolate. It cannot be done to any reliable effect for the following reasons:

(1) We slice at 0.8mm, so we print chocolate lines that are 0.8mm thick - not like plastic which can go as fine as 0.02mm - which means the chocolate deposited for any kind of exterior structural support will also be 0.8mm thick and will interconnect and "adhere" itself to the rest of the model. Tempered chocolate is like cement which cannot be cleanly detached from itself - You cannot simply break away unwanted areas without snapping parts of the model and destroying its beauty.

(2) A single 3D print without any support can use close to an entire syringe of chocolate, so the printing of any structural support would require approximately 30% more chocolate than can be loaded into a syringe.

(3) A single 3D print uses the maximum print time possible with tempered chocolate - So any structural support would add 15+ minutes to the print time and cause it to pass the "breaking point" of tempered chocolate.

3D chocolate designs therefore need to be carefully considered and have very little in terms of overhang and points of severe angular ascension. Chocolate has to be deposited onto a base for the first layer, and then all subsequent layer deposits must be directly on top of a prior deposit - In simple terms, any areas that are floating in the air will obviously not print correctly as we do not use supports and cannot defy gravity.

I've seen some of your amazing videos. However, one video has a single but admittedly complex print take 20 minutes. Are these print times practical? I still don't understand why you can't turn 20 minutes into 20 seconds.

I will address this question with two points:

(1) The time it takes to print a single 3D model in chocolate is largely determined by the properties and behavior of chocolate, which can only be controlled up to a certain point; we temper our chocolate like any other chocolatier, add absolutely no chemicals, no agents, no artificial ingredients or anything else to the mixture, and control both our room temperature and the heating system on our *Choc Creator* as precisely as we can. This is the most any chocolatier can do to control their chocolate.

When a 3D model is printed in chocolate at high speed, the layers of chocolate simply have no time to semi-harden before the next layer is deposited on top. After printing the first few layers of a 50-layer model at high speed, it would be obvious that the layers were all collapsing into one,

and that the model will unlikely build up in height. At a slow speed, each layer of chocolate would have time to semi-harden before the next layer. A complex 50-layer model will therefore need at least 20 minutes (but more likely closer to 30 minutes) to print accurately. As chocolatiers will know, this is the nature of chocolate and how it works. Freezing the chocolate from wet to dry while printing would be detrimental to the quality of the tempered chocolate, as the wet to dry process of chocolate is actually part of a crystallization process that is best left to happen naturally. Freezing chocolate takes away its shine, makes it brittle and, from a practical point of view, the icy air would likely cause blockage in the printer's nozzle. Spot cooling with jets of cold air from a spray can of freeze agent would either knock the 3D model over or again adversely affect the chocolate.

(2) The 3D models we produce for promoting our technology are purposely over-complex with overhanging areas that need time to semi-harden before a subsequent layer can be built on top. This is because we want to show our customers the full capabilities, mechanical prowess and infinite potential of our technology.

For more practical chocolatiering, users can choose to make any kind of model they wish and tailor it to their output needs. We suggest using 2D artwork if a very fast output rate is required for a medium-sized production run, and suitably designed 3D models for small runs of bespoke items, such as designs that use an internal infill structure that stops any collapsing and allows the model to build quickly.

Is the machine easy to use for someone with minimal 3D printing and computer experience?

We have found this depends largely on the user and how determined they are to use 3D chocolate printing technology. Some new users have learned how to operate the printer within a few hours, while others have taken longer. Similarly, for producing their own designs, some chocolatiers spend time playing with 3D modelling software and start producing bespoke work very quickly, whereas others never truly dedicate themselves - it all depends on the person.

The ***Choc Creator V2.0 Plus*** has been designed as user-friendly as we could make it, and it is wise to note that there will always be a limitation to how user-friendly such an articulate piece of technology can be. In short, we have aimed to achieve the best possible balance of ease-of-operation and functionality, and our users from all kinds of backgrounds certainly seem to agree that we have done our best.

Does the printer have a built-in tempering machine? If not, how can you get chocolate inside?

No. The **Choc Creator V2.0 Plus** is a desktop printer and does not have a built-in tempering machine. Tempered chocolate must be prepared by either an automatic tempering machine (not supplied) or by hand, known as 'hand-tempering'. **The Choc Creator V2.0 Plus** has a heating system that keeps chocolate warm during printing. Please see other sections of this FAQ for more details.

The **Choc Creator V2.0 Plus** does not use cartridges or any kind of pre-made chocolate substance - Users are required to prepare their own chocolate, which must be tempered couverture chocolate (not compound chocolate). The **Choc Creator V2.0 Plus** comes with a bespoke 30ml Stainless Steel Food-Grade Syringe. Tempered chocolate in its thick liquid state is loaded into the syringe, and then the syringe is loaded into the printer.

To explain the whole process in simple terms; to fill a syringe with chocolate, users must first prepare chocolate in their automatic tempering machine or by hand using a melting pot set ('hand-tempering'). When the chocolate is ready in its thick liquid tempered state, users are required to take their empty syringe and lower the hub into the Automatic Tempering Machine or pan of warm tempered thick liquid chocolate so that the syringe's exit-hole is submerged, and then pull up on the syringe's plunger so that chocolate is drawn up into the syringe. Tempered chocolate is thick (like toothpaste) so the chocolate must be drawn up slowly and steadily - Rushing the process may result in unwanted air bubbles in the syringe. Once the syringe has been filled, it can be loaded into the printer's barrel and locked into position. This process was chosen because it is food-safe, clean, efficient, enables the use of different couverture chocolates, and the chocolate loaded will always be fresh and familiar to the user.

What about printing onto non-flat surfaces, like a cookie that is shaped like a dome?

Any surface you print choose to print onto must be as flat as possible. For cookies or other baked goods, the baking process naturally results in items that will not be 100% flat or smooth, but the ability to articulately adjust the printer's nozzle means the printing process has a slight tolerance for non-flat surfaces, but not to the extent of a dome. When printing onto chocolate bars and cookies, the **Choc Creator V2.0 Plus** does not compensate for non-flat surfaces and the Z-axis does not travel in a curve or arch to deposit the chocolate.

If your cookies are at least 80% flat, the result will hopefully be acceptable. If your cookies are curved or shaped like a dome, the result will likely be unacceptable. For baked goods, it may be possible for bakery staff to pay special care and attention to the preparation and baking process so that the items produced are flatter than usual.

What is the voltage of the printer? Does it heavily drain power?

The **Choc Creator V2.0 Plus** has a range of **100~240 Volts**, and it is **50~60 Hertz** compatible.

The power consumption of the **Choc Creator V2.0 Plus** is much less than most people would expect. The oldest 3D plastic printers needed to heat their extruders to extremely high temperatures in order to melt the plastic filaments, which required a constant flow of power, and this temperature remained the same throughout the duration of the print, which could be up to 8 hours for a large complicated model. The **Choc Creator V2.0 Plus** has a heating system that only needs to be set to 31°C for tempered chocolate. Although the **Choc Creator V2.0 Plus** does have a bright LCD touch-screen, any kind of fancy flashing lights, music boxes or typical light-up logos have purposely been avoided to keep power consumption down.

Is the printer food safe / food grade / electrically safe?

Unlike many people have assumed, the **Choc Creator V2.0 Plus** is not an "adapted 3D plastic printer". Like our previous models, it has been designed from scratch by a team of scientists and engineers as a "Chocolate=FoodStuff Printer" which meets all food safety requirements.

FOOD SAFETY: All the moving and static parts of the **Choc Creator V2.0 Plus** that have direct contact with chocolate are made of food grade coded stainless steel. The bespoke Printing Syringe is also made of food grade coded stainless steel, and the accompanying Metal Nozzles used with the syringe are FDA certified.

MACHINE SAFETY: The **Choc Creator V2.0 Plus** has a CE mark to indicate it conforms to relevant EU directives regarding health and safety.

The chocolate produced by our technology is designed to be consumed. Naturally, the cleaning and washing of utensils is just as important as in any chocolatier's studio.

There are two documents that can be provided upon request:

#1 Certificate of Conformity: Confirming the product has been approved by an independent organization and a CE mark applied.

#2 FDA Certificate for Food Grade Compliance: Certificate for Nozzles that are USA FDA approved for use with edibles.

I don't want to use any kind of labour or workforce - I want to set your printer to run fully automatically, take customer's orders for chocolate fully automatically, and leave everything to print fully automatically.

This is not possible. It is important to fully understand that the **Choc Creator V2.0 Plus** is a manually operated printer for 2D/3D miniature chocolate printing - It cannot run automatically like a robot. The process of creating 2D/3D designs, converting them into a G-code, and printing them with a **Choc Creator V2.0 Plus** is a manual process. Currently, without true artificial intelligence, automation has too many variables and a lack of tolerance related to the suitability of the 2D/3D designs made by customers, the suitability of the G-codes, the correct loading of accurately tempered chocolate in optimum active+ambient temperatures, and the resetting+cleaning of the syringe and nozzle after each print.

It will not be a simple task to create an online ordering and printing system that is fully automated, as trained staff (possibly a designer, technician, and chocolatier) will need to be on hand to prepare or judge the suitability of design files, prepare and load chocolate, and operate the **Choc Creator V2.0 Plus** for each and every order. If you feel you are able to adhere to (or work around) these requirements and make compromises to reduce the element of automation, there will be far more possibilities open to you. For example; Utilizing our 2D drawing android application would allow customers to order their own 2D drawings to be printed onto a plain flat pre-made chocolate bar - This would help to remove the need for a designer and the need for generating G-codes, but the entire printing process would still be a manual one (involving the positioning of the chocolate bar, loading the syringe, setting the printer, monitoring the printing action, re-printing if necessary, and possibly contacting the customer if the drawing is not suitable for chocolate printing, etc.) The more that is left to chance, the higher the risk of failure of such a concept.

For customers who wish to discuss, co-develop or fund the design of a system that is as close to automated as possible, a meeting with the directors of Choc Edge can be arranged. Please contact: info@chocedge.com

All about: **Software**

What software is required for printing?

The software used to operate the machine is called **ChocPrint**, which will convert **STL** files into **G-code** files. It is provided free with the printer.

Will **ChocPrint** run on my computer?

ChocPrint will run on Windows XP, Vista, 7, 8 and 10. For Windows 10, the hard-wire connection has been removed as it is now an obsolete function due to customer preference. **ChocPrint** will not run on Mac iOS X, including iMacs and MacBooks.

If the printer cannot connect with a hard-wire to a Windows 10 computer, how do you send G-codes to the printer?

Due to customer preference, users who are running Windows 10 no longer require a hard-wire from their computer to the **Choc Creator V2.0 Plus**. We are aware that users much prefer to treat their **Choc Creator V2.0 Plus** as a stand-alone unit, without any archaic hard-wire connection that is considered impractical in a chocolatier's studio kitchen.

All users now place their G-codes onto a USB FlashDrive and insert it into the USB port on the side of the **Choc Creator V2.0 Plus**. The G-codes can then be instantly accessed using *YOUR DESIGN* on the LCD Home Screen.

Is **ChocPrint** or **ChocDraw** compatible with Apple iOS iMac, iBook, iPad, iPhone?

No, they are not compatible. For our **ChocPrint** *slicing program*, you will need to use a computer running a true Windows operating system, such as Windows XP, Vista, 7, 8 or 10. For **ChocDraw**, you will need an Android OS device such as a smartphone or tablet (not iPhone or iPad).

Is there any free software available that will help me to create simple designs?

Yes. **Google SketchUp**, **Autodesk's 123D collection**, **Blender** and many more free applications will allow you to create simple designs and save them as

STL or OBJ files. As with any piece of software, you may need to dedicate some learning time.

What software is your *Choc Creator V2.0 Plus* compatible with for 3D?

The *Choc Creator V2.0 Plus* follows the same principles as any 3D printer, so like all 3D printers, laser cutters and milling machines, the *Choc Creator V2.0 Plus* reads G-code files. G-code files contain movement and action instructions for the printer's X, Y, Z and E-axis.

To create a G-code, users usually need to start by creating an STL (the actual 3D model file).

As a printer, the *Choc Creator V2.0 Plus* is just the hardware, but we do, of course, supply you with a piece of software, too.

ChocPrint is the software that we supply to our users.

ChocPrint is used in the following way: Users open *ChocPrint* on their computer, import an STL (3D model file) into the software, and press the "generate G-code" button. The software will slice up the STL into layers that are suitable for chocolate printing. When it has finished slicing up the STL, you will have a G-code that you can directly port into the *Choc Creator V2.0 Plus*.

"Where do the STLs come from to begin with?" you may ask.

To create your own STL, there is a lot of free software available on the internet. **Google SketchUp**, **Autodesk's 123D collection**, **Blender** and many more free applications will allow you to create simple designs and save them as STL files. As with any piece of software, you may need to dedicate some learning time. For dedicated users, purchasing a monthly license for some of the more popular 3D modelling software, as well as **Photoshop-CC**, will provide you with a very useful piece of software.

We also have two online apps which feature ready-made STLs - The designs are all simple, but it is a good starting point for many of our users.

What type of files are required for printing?

The *Choc Creator V2.0 Plus* uses *ChocPrint* software which accepts STL files, a standard 3D printing file.

What type of files cannot be used for printing?

The **Choc Creator V2.0 Plus** reads only G-code files.

Raster Graphic files such as JPEG, PNG, TIFF and PSD cannot be used.

Vector Graphic files such as AI, SVG, DXF, DWG, EPS and PDF cannot be used.

G-code files contain movement and action instructions for the **Choc Creator V2.0 Plus** to follow. G-code is a programming language that is very similar to binary code and works in a similar way. To create a G-code, you need to start by creating an STL (the actual 3D model file). To create your own STLs, there is a great deal of software available. For example; *Autodesk's 123design* is free, and although *PhotoshopCC* is not free it is very useful for creating 2.5D and 3D STLs. These applications will allow you to create simple designs and export them as STL files. Once you have designed your own 3D models and exported them as an STL, you can use the slicing program called **ChocPrint** we provide to generate a printable G-code from your STL.

You mention a "slicing software" called **ChocPrint** you provide to users, but no mention of a 3D modelling software.

We do not currently provide users with any 3D modelling software. We have found the development of any propriety software (other than our slicer, **ChocPrint**) to be unnecessary due to the amount of highly capable freeware already available on the internet. **Choc Edge** can also advise users on the best software to use for designing their own models depending on their level of experience.

Can I slice unusual 3D models that are abstract and artistic? Will they work?

This will largely depend on the design. Unconventional 3D models can be designed and sliced using a careful choice of parameters to create a chocolate print with noticeably unique properties. For example: Printing a 3D object without infill, a 3D object with separate parts that join due to the chocolate adhering to itself in certain strategic places, etc. The aim is to work around any slicing issues by experimenting with parameters and re-designing the 3D model.

Why doesn't my STL slice correctly?

The automatic slicing program is very smart in that the algorithm works strictly to what is possible with the 3D model (STL) being used, the nozzle being used, and the user's choice of parameters - Any unsuitable 3D model (STL) or questionable choice of parameters may or may not cause the program to refuse to generate a G-code, foreseeing that there may be errors

related to size, speed, areas of overcram, areas of overhang, areas of gravity defiance, etc. It is often difficult to diagnose the reason when the G-code generation process fails, but sometimes the cause is very obvious when taking a closer look at both the 3D model (STL) and the parameters. For example: Although the orientation of a 3D model may have been correct in the software it was rendered in, the orientation may change when exporting it as an STL and importing it into ChocPrint, so the model may need re-orienting using the controls in ChocPrint in order to slice correctly.

I tried working with some of the 3D software you suggest, but I just can't get to grips with it. I'm simply no good at this kind of stuff. What are my options if I still want to work with a Choc Creator?

Some of your options are:

- *Use designs from Choc Edge's library.
- *Use our CHOC TEXT and MIX & MATCH apps.
- *Commission designs from a local designer.
- *Commission designs from students at a local design college,
- *Search for free STLs online that appear suitable for chocolate printing.
- *Work with a colleague who is more capable in 3D design.
- *Employ a 3D designer.

Are your apps CHOCTEXT, MIX & MATCH and CHOCDRAW designed to replace the need for 3D software?

No. CHOCTEXT is a very basic web-based app that has been designed as a quickfire tool for users who want to create simple TEXT and save it as an STL. MIX&MATCH is an enhanced version of CHOCTEXT which combines it with a library of simple 2D designs. CHOCDRAW is a doodling app for on-the-spot drawings and manual photo tracing (which is very useful for entertainment at events). For users who wish to create their own unique 2D or 3D designs, there is still a need for modelling software such as **Autodesk**, **Blender** and **Google SketchUp** (all of which happen to be free to download and use).

All about: **Design**

What can a Choc Creator create?

The **Choc Creator V2.0 Plus** is capable of producing 2D art, 2.5D designs and simple miniature 3D models in chocolate. Examples of prints can be found in our Gallery.

What is the picture format used for the machine?

The **Choc Creator V2.0 Plus** uses G-code, which is a programming language - **not** a picture format. G-code is best described as the instruction code 3D printers use. Although there are various ways to create a G-code, the most popular way is to create one automatically by 'slicing up' a 3D model.

How can I upload a photo to the program?

You cannot directly upload a photo to the **ChocPrint** software. Our **ChocPrint** software cannot accept Raster Graphics (such as JPEG, PNG, TIFF, etc) or Vector Graphics (AI, SVG, DXF, etc). Only STL and OBJ files can be used to generate a G-code with **ChocPrint**. It is therefore necessary to convert all photos and drawings to an STL or OBJ file, and then convert the STL or OBJ file to a G-code.

The quickest way to convert a photo without the need of an STL or OBJ file is to trace it using our CHOCDRAW Android App (not compatible with iPhone/iPad). Simply set your photo as a background image and trace over it. A ready-to-use G-code file will be immediately created which can be sent directly to the printer.

What's the difference between 2.5D and 2D relief?

Although they both belong in the same category of printmaking, there are slight differences between them. 2.5D is a shallow extrusion that is basically the same image repeatedly printed in layers. When printed with four or more layers, 2.5D prints are often presented as stand-alone pieces, whereas 2D relief usually refers to a shallow extrusion rising up out of a substrate.

Can solid 2D relief be achieved with a Choc Creator?

A semi-solid or solid 2D relief could be achieved but only on a very small scale due to the printing time and amount of chocolate required, with the maximum capacity being 30ml before needing to pause and refill. Due to the time and effort required to produce a quality semi-solid or solid print, we advise users to print a 1~3 layer extrusion onto a substrate (e.g. a flat chocolate bar) to achieve the same effect.

I still don't understand 2.5D and 2D relief. Can you please elaborate on these terms?

2.5D: 2D designs are only 1 layer, which is nearly flat at only 0.8mm in height. If that 1 layer is repeated 4 times, you have a design that is 4 layers high. It is not true 3D, but it has more depth than 2D, so we call it 2.5D

2D Relief: A chocolate bar from a mould sometimes has letters or images rising up out of the bar - this is relief. Depending on the design and if we have a similar flat chocolate bar, we can sometimes mimic this process with a **Choc Creator V2.0 Plus** by printing onto the bar.

When printing 3D models, how is the exterior support structure (or raft) formed?

No exterior support structures or rafts are used when 3D printing in chocolate. Designs therefore need to have very little in terms of overhang and any steep angles need to be considered.

Can more complex models be printed when the printing speed is reduced?

Yes. By reducing the printing speed the chocolate has more time to dry, creating hardened layers to build the next layers onto. This helps with areas of slight overhang and steep angles.

I have a very small (2cm) and detailed 2.5D model that was created for plastic printing. Can the Choc Creator print it?

It is difficult to say without seeing the model, but due to the nature of chocolate itself, the **Choc Creator V2.0 Plus** has a limited resolution. Although more detail can be achieved by reducing the nozzle size, there will always be a limited to what is achievable in terms of size and clarity. It is worth noting that our smallest prints have been approximately 4cm square and only very simple designs to put onto biscuits.

I want to make my own designs but I know absolutely nothing about 3D software. I only have some pens and paper. How easy is it to make my own designs, and what software would I need?

Although **Choc Edge** can provide customers with some pre-made printable designs, we realize that most customers want to create their own unique designs. When non-artists, non-designers or non-3D people think about

"design", they usually imagine a sketch on paper since that is their level of familiarity. Although a sketch of an idea is a great place to start, the creation of a printable 2D, 2.5D or 3D design involves a number of processes which use 3D modelling software.

To put things simply, every 3D printer follows a set of instructions - to print something, the printer needs a code that tells it such things as "move left", "move right", "squeeze out chocolate", etc. Since the **Choc Creator V2.0 Plus** has been designed to use a standard kind of 3D printing instruction code, known as G-code, every design method needs to result in a G-code. So if you start with an idea in your head and make a quick sketch on paper, you need to somehow transform your sketch into a G-code.

In the case of **Choc Edge** and our **Choc Creator V2.0 Plus**, our G-codes are usually created by slicing up STLs using our own software called **ChocPrint**. STLs, G-codes and **ChocPrint** are linked in the following way:

STL: A 2D, 2.5D or 3D model. STLs have no instructions embedded into them, so the **Choc Creator V2.0 Plus** cannot read these files - instead, it needs a G-code that is created from the STL.

G-code: An instruction code that tells the **Choc Creator V2.0 Plus** what to do (such as move left/right, move up/down, extrude, etc). The Choc Creator reads these files and they can be created by "slicing up" an STL.

ChocPrint: is a "slicing software" specifically tailored for chocolate. It is not a model-making or sculpting software. To create a G-code, import an STL into **ChocPrint** and use the "STL-to-Gcode" function.

The three main types of print are as follows, and an STL must be made accordingly:

2D: When you make a design (such as a company logo which is flat, not 3D), it is usually a flat design that has been slightly extruded on the Z-axis. We consider these STLs to be 2D, because they only have 1~2 layers, and they result in a print that looks like a flat drawing.

2.5D : When you make a design (such as a company logo which is flat, not 3D), the Z-axis height can be extruded so that it is 3~6 layers (or even more layers) in height. We consider these STLs as 2.5D, because they have 3-6 layers in Z-axis height, and they result in a print that looks like a flat drawing that has been 'raised up'.

3D: True 3D prints from 3D models. Of course, not every 3D model is suitable for printing in chocolate. Unlike 3D plastic printing there is no support structure when printing in chocolate, so it is best to avoid 3D models that have severe angles and lots of overhang. For example: It would be impossible to print an open umbrella that is standing upright because of the

severe overhang. However, it is possible to print 3D models with a reasonable amount of angular ascension that almost overhangs, such as the 3D LOVE print in our website gallery.

If you are able to create an STL, you will be able to "slice up" the model into a G-code using our **ChocPrint** software. But we often meet novices who are concerned as to whether or not they will be able to get as far as creating an STL. The **Choc Edge** team uses a great deal of freely available software and some that is only available via monthly subscription. We try to use free software as much as possible as we need to be able to introduce it to our users and sometimes instruct them on its use. If you are concerned that you may not be able to get the hang of creating STLs yourself after you purchase a **Choc Creator V2.0 Plus**, why not try downloading some free software and spend some time experimenting?

I'm a chocolatier that is actually studying very basic 3D design. I can only make simple shapes at the moment. I originally thought this skill would be useful for ordering custom moulds, but then I discovered your machine. Do you think I could use my basic STLs with your machine?

Simple designs work very well for chocolate printing, since you don't need to concern yourself with any heavy design factors such as severe angles or areas that are approaching a stage of overhang. If you extrude ("vertically stretch") your simple designs, you could create something like a 2.5D heart or star with 10 layers, which would look very impressive when printed in chocolate despite its simplicity. Remember that chocolate printing is a brand new technology, so everything from a simple 2D logo to a full 3D object looks unique and impressive to chocolate-lovers.

Following your advice, I downloaded Autodesk and have been playing around with it - pretty addictive! Can you just clarify what I do to get an STL once I've made a cool shape, please?

Once you have made a shape, use the scale function to double-check that your model is no taller on the Z-axis than 37.5mm. If needed, you can change your choice of measurement in the settings menu from inches to centimeters or millimeters. If your model is too tall, use the scale function to decrease the Z-axis height. Now select "Export as 3D..." and choose STL. After you name your STL and the export process has finished, you can use our **ChocPrint** software to slice up your model into an STL.

I'd like a Choc Creator but I have no interest whatsoever in making any artwork. I refuse to do it. I am a baker, not an artist.

That's fine, as long as you understand that you will be limited to a small selection of pre-made generic 2D and 3D designs from either our 2D apps or our 3D library, some which may need to be sliced into a G-code by yourself using our **ChocPrint** slicing program. You may also try searching for free pre-made STLs that may be suitable for chocolate printing on the internet, noting that they will also need to be sliced into a G-code by yourself.

Why can't I just talk to the printer and ask it to make my old house or my old car in chocolate, and then have the printer make it for me?

The **Choc Creator V2.0 Plus** is a desktop printer - It is not a robot with artificial intelligence. In order to operate, it must receive instructions in the form of a G-code instruction file, which must be generated by the user from a 2D or 3D STL model of the user's own artwork. Users must therefore create their own 2D or 3D STL models in order to print the kind of bespoke design they desire. If a user desires to print (for example) a representation of the house they lived in as a child or the car they drove when they were 17 years old, there is no way to instruct the **Choc Creator V2.0 Plus** to print such things without inputting a G-code instruction file made to the user's specifications. Only the user can make that kind of specific artwork, as neither the **Choc Edge** designers nor the machine itself know what those specific things look like. Although there may be a pre-made STL model of a house and a car in our library, it will naturally not be YOUR house or YOUR car, so users must make the effort to create their own artwork if they do not want to use anything generic.

Perhaps the most important question for some people: Can I take a figurine, scan it, and print an identical version in chocolate? What about a print from a full-body scan of a real person?

No - An identical print is not possible. Due to the maximum printing height of the **Choc Creator V2.0 Plus** and the 0.8mm resolution we have selected as the most reliable resolution for the medium of chocolate, a direct replica of a figurine (of a person) that contains all of the detail is not possible. It is wise to note that not only the detail but also the 'color information' will not be present to help represent the subject. Likewise, a full-body scan cannot be printed at a resolution that will accurately represent the subject, even when printed at the maximum size of 4cm.

Can I print a full-body figurine of a person using 0.4mm instead of 0.8mm?

No - The resolution would need to be closer to 0.04mm, not 0.4mm, and that is simply not possible. This is because chocolate cannot be used with ultra-fine nozzles - plastic can, but not chocolate because chocolate is made of crystals that compact under high pressure (such as the squeezing pressure of travelling through a nozzle that is smaller than 0.8mm). Plastic is an organic polymer of high molecular mass, so it behaves very differently.

We previously offered a 0.4mm nozzle for slightly finer printing but, when comparing the 0.4mm and 0.8mm nozzles, the results differed only slightly whereas the reliability differed greatly – The 0.4mm nozzle would only print reliably when all the necessary conditions were perfect, which is difficult to achieve for every print. We therefore retired the 0.4mm nozzle. Even using a resolution of 0.4mm, you cannot achieve a full-body 3D print of a person/figurine.

Can the Z-axis be extended for more height to print a figurine of a full-body person?"

No - The **Choc Creator V2.0 Plus** is a miniature 3D printer. The Z-axis cannot currently be extended. The maximum Z-height is 4cm, and there is good reason for this: The time it takes to print a 4cm model is the absolute maximum time that tempered chocolate will last. A complex 4cm print can take up to 60 minutes, so a print at double this size will take up to 120 minutes to complete, which is longer than tempered chocolate will keep its properties. The record for the longest 3D chocolate print is 70 minutes, but we recommend users to remain within the 60 minute limit.

Chocolate is not like plastic - There are far more rules to follow. The time it takes to print a single 3D model in chocolate is largely determined by the properties and behavior of chocolate, which can only be controlled up to a certain point; we temper our chocolate like any other chocolatier, add absolutely no chemicals, no agents, no artificial ingredients or anything else to the mixture, and control both our room temperature and the heating system on our Choc Creator as precisely as we can. This is the most any chocolatier can do to control their chocolate.

Even if the Z-axis could be extended, the printing times would be far too lengthy, and most users would still print smaller objects. Building a high-speed 3D chocolate printer would not resolve this situation: When a 3D model is printed in chocolate at high speed, the layers of chocolate simply have no time to semi-harden before the next layer is deposited on top. After printing the first few layers of a 50-layer model at high speed, it would be obvious that the layers were collapsing. At a slow speed, each layer of

chocolate has time to semi-harden before the next layer is deposited. A complex 50-layer model will therefore need 30~45 minutes to print accurately. As chocolatiers will know, this is the nature of chocolate and how it behaves.

Actively cooling the chocolate will not resolve this situation: Cooling or freezing the chocolate from wet to dry while printing would be detrimental to the quality of the tempered chocolate, as the wet to dry process of chocolate is actually part of a crystallization process that is best left to happen naturally. This demonstrates just how different the mediums of chocolate and plastic are. Freezing chocolate takes away its shine, makes it brittle and, from a practical point of view, the icy air could cause blockage in the printer's nozzle. Foodsafe coolant causes chocolate to become moist (colloquially referred to a 'sweating'), and spot cooling with jets of cold air from a spray can of freeze agent would either knock the 3D model over or again adversely affect the chocolate. Chocolatiers work in a studio of 19°C because active cooling is detrimental to chocolate - Only ambient cooling is suitable. That is why we recommend using the **Choc Creator V2.0 Plus** in a studio with an ambient temperature of 19°C~21°C.

All about: **Ordering, Delivery and Warranty**

Does the machine have a warranty?

Yes, the **Choc Creator V2.0 Plus** is covered by a 6 month warranty. During this period, any mechanical issues which cannot be resolved by the customer under the guidance of a technician via SKYPE (or similar videophone) will need to be looked at by our manufacturing team.

[Depending on the circumstances, you may be required to pay or contribute to the shipping cost for sending the machine back to our manufacturing plant.]

We will then resolve the issue or replace the unit depending on its condition. After 6 months, you will still have access to our technical support team, and if the machine experienced any post-warranty issues, you can request a repair. We will then diagnose the issue and provide you with a quote. We only charge for the cost of the repair and do not aim to make any profit.

What is the expected life of the printer?

The **Choc Creator V2.0 Plus** should be mechanically sound for at least 5 years.

What about a Melting Pot? What spare accessories do you have available?

We offer a Melting Pot (£50) as a standard accessory which is automatically attached to every basic package order. The Melting Pot can be removed upon request if chefs and chocolatiers have their own melting or tempering system. This item is not covered by the warranty scheme.

Spare Stainless Steel Food-Grade Printing Syringes (£70 per unit) and spare Metal FDA-Approved 0.8mm Nozzles (£22 per unit) are available.

What are your delivery times?

Choc Creator V2.0 Plus can be delivered worldwide. International delivery typically takes 10~14 days.

How much does delivery cost?

Shipping costs range from £140~£300 GBP depending on your location.

Is the machine manufactured in UK?

The **Choc Creator V2.0 Plus** was designed by both a UK and Chinese team, and is manufactured in China. The manufacturing process is governed by the same UK and Chinese team, upholding quality standards to meet all necessary safety and CE regulations.

Will I have to pay import duties on my Choc Creator?

The machines are shipped from **Choc Edge**'s manufacturer in China and import duties will vary from country to country. It is the buyer's responsibility to pay for these import duties.

Why do I have to pay an import duty, and how much is it?

Import duty is a tax that every importer has to pay to bring foreign goods into their country - It is not specific to **Choc Edge**. Import duty is also known as customs duty, tariff, or import tariff. Import duty can be "ad valorem" and based on the value of the goods, or it can be specific and based on weight, dimensions, or other units of measure.

What about shipping? Where do your products ship from?

Choc Edge now ships all its products from a manufacturing plant in China. All orders are shipped via DHL and a World Zone system is used for calculating shipping costs.

Depending on your country and region, you may or may not be subjected to an import duty. Customers requiring an import duty estimate should contact their local DHL office.

Other

I have seen other chocolate companies using online shopping programs to enable customers to create their own chocolates. Does Choc Edge do this?

As **Choc Edge** designs and manufactures 3D chocolate printing technology, we do not offer such an online service. The nearest we offer is our Mix&Match app, which is for users to download pre-rendered STLs and combine them with personalized text. There are a number of websites and companies that have an ordering system in place, but they almost always use a form of what is colloquially referred to as "chocolate screen printing". Although the methodology behind this way of transferring images onto chocolate is nothing new, it has more recently been digitized which has caught people's attention. For example: White chocolate is screened with a high-density silk mesh onto a pre-made dark chocolate bar, whereas the **Choc Creator V2.0 Plus** is an ALM (Additive Layer Manufacturing) printer, so the chocolate is extruded in lines of chocolate with a thickness of 0.8mm. The type of chocolate art we produce is therefore going to have a very different look and feel to other methods. The "Choc Edge style" of chocolate printed art can be seen in our gallery. If you compare our style to both "chocolate screen printing" and traditional moulding, you will see the difference is due to the methods used. The process of "chocolate screen printing" can produce some very fine details (such as miniature text) that can only be achieved reliably with this process. Similarly, photos can be converted into silhouettes and transferred like a screen printing stencil. However, the process is only for flat 2D work, with 2.5D and 3D printing simply not possible with screen printing. The **Choc Creator V2.0 Plus** is for 2D ALM (both Graphic Design and Drawing), 2.5D ALM, Chocolate Constructions using 2.5D ALM parts, and true 3D ALM. Any custom-made 3D works of chocolate art that online companies offer will come from a mould, and will therefore be costly, with the process involving the creation of a 'positive'

model from which a 'negative' mould is struck - In the modern world, a 3D master model will be designed by a professional in a CAD program, then a physical 'positive' will be created in plastic, and finally the 'positive' will be vacuum-formed into a 'negative', which is sold to the customer. This is why costs add up when ordering multiple custom-made moulds despite how simple they may be.

Can a Choc Creator save me money, and if so, how much?

The answer to this question depends entirely on your individual situation. Please contact us for a consultation.

I'm a chocolatier. How can purchasing a Choc Creator make me more money?

As a chocolatier, you will be familiar with generic moulds for chocolate and the fact that customized moulds can be expensive and not cost-effective when making a bespoke item for a single customer. Similarly, you will be familiar with the limitations of moulding and the struggle to produce crisp, clean, and accurate graphics using traditional handpiping techniques. The **Choc Creator V2.0 Plus** will enable you to produce bespoke and personalized chocolate in ways that moulding, handpiping and sculpting cannot.

The key to making money with a **Choc Creator V2.0 Plus** is what we call "added value", which means that regular plain chocolate plaques, cookies, cakes and other confectionery staples can be transformed into unique items and priced accordingly. An example would be a chocolatier producing a batch of flat chocolate plaques or flat cookies to act as a base for printing 2D artwork onto.

Without the attraction of being "personalized and 3D printed", even the most attractive regular chocolate plaques need to be priced in competition with the abundance of affordable chocolate items that are now on offer. Marketed as an item produced using a state-of-the-art 3D chocolate printer, personalized plaques (with sometimes nothing more than a simple 3D printed name) can easily be priced at two or three times the standard price of a plaque.

Contrary to popular belief, printing names, drawing and logos in 2D is more profitable than 3D objects, with 2D designs taking just a fraction of the time it takes to print a 3D object. The speed in which 2D designs can be printed onto a flat chocolate plaque enables chocolatiers to offer this service within a matter of hours, whereas 3D objects are best reserved for highly-specialized gifts, gourmet dessert garnishes and luxury wedding cake

decorations. Every chocolatier has their own creative ideas - Some are happier working in more traditional ways, others want to experiment a little.

I'd like to reduce manpower. Will a Choc Creator run unassisted all day long?

No. The **Choc Creator V2.0 Plus** is essentially a desktop printer for one-off bespoke items and small production runs. It is therefore necessary to refill and reset the printer after each print, as well as to intermittently monitor the printer.

How do I make and where do I get customised models for chocolate (not plastic) printing?

Even with very little experience you can create your own by simply taking into consideration the following: Unlike 3D plastic printers, there is no structural support when using chocolate, so make sure the model you make does not have overhang or very steep angles. Make sure the model is no more than 4cm in height and that 30ml of chocolate will be enough to print the model. Very tiny areas of detail don't print well - remember the resolution is 0.8mm lines with our standard nozzle - so try not to create too much detail. It is always best to start with very simple shapes and work your way up to more complicated models.

I work near Piccadilly Circus. Can I pop in to see you guys during my lunch break?

Unfortunately, this is not possible. Although we have an office in the UK, we are not based in London. Our UK team is based in Devon in the Southwest region, approximately three hours from London by train. However, we are no longer able to accept visitors to the UK office.

Didn't I see you guys in (country name) last month? Your machine was cheaper and looked different.

No, you did not see us – We have never exhibited in that country. Copycat companies may be trying to sell low-quality reproductions of our unique technology.

Please note that only **Choc Edge**, **Qiaoyi3d**, and our team of official distributors sell **Choc Edge/Choc Creator** technology. If you are ever unsure that an item is genuine, please contact us.

What's the best piece of friendly advice (not business advice) you can give me when purchasing the Choc Creator?

We would say that it pays to be open-minded, forgiving and patient with this new method of producing chocolate, and to appreciate the fact that 3D chocolate printing is still in its infancy with full artificial intelligence and automation of both the software and hardware is still many years away. What you see in our gallery is a record of all the 2D and 3D prints we have made under optimum conditions using the printers we design and manufacture, and that similar works of art can be achieved by users who are dedicated and willing to practice.

All the limitations we openly discuss in our FAQ are largely related to chocolate itself, which is a medium that only behaves under precise conditions - just ask any chocolatier - and we have always been completely honest about the fact that our printers are not the magic duplicating machines from sci-fi cinema, that they cannot be used blindly, and that not every print will be successful when the limitations are not adhered to. Most importantly, we want users to approach their new project as something fun, creative and exciting, and not expect immediate changes to their life or business overnight.

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