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Life & death

A VERY INTIMATE PORTRAIT

PART 2: A CENTURY OF LIFE CASTING

In this issue we consider the development of life casting techniques and materials over the past 100 years.

BY **MARY LOVEDAY**
WITH **WILLIAM FORSCHE**

From the beginning of filmmaking in the 1900s through to the mid-1920s, actors were expected to do their own makeup. Most early film makeup was based on techniques for the theatre, but this didn't always read well on cinema screens. If characters required some form of special FX makeup it would mostly have been achieved using a direct applied technique whereby materials such as wax, latex, cotton and collodion would be applied in layers and the desired look modelled directly on to the actor's face. Probably the most famous character realised thus was Boris Karloff as Frankenstein's Monster, created by legendary Universal Studios makeup artist Jack Pierce.

As the film industry progressed, the demands of realism, time, and – crucially – continuity, meant that the need for replicable makeup effects grew. And that meant sculpting and moulding prosthetics. And that meant life casting.

A life cast is a reproduction of a person's face, or body part, made by taking a negative impression, or mould, directly from a living person. This mould is most commonly filled with plaster to produce a hard duplicate of the subject's features. This enables the makeup artist to work on the life cast rather than the actor themselves and to make more detailed prosthetic appliances that could be custom-fitted to the wearer's features.

The first life casting medium was just plaster of Paris. The skin and exposed hair on the subject would be covered with a lubricant such as petroleum jelly, and the fast-setting plaster applied directly to the skin. The life cast however is now a hard mould, and to create a plaster positive – also a hard material – requires that the plaster negative be well-released; and the positive cast can only be removed by carefully breaking the plaster positive off in pieces. This is known as a waste mould, and there's always a significant risk of damaging the positive cast in the process. This is a technique of its time and should be avoided at all costs, as it comes with risks to the subject - including the plaster becoming bonded to hair and eyelashes that haven't been adequately lubricated

Above: *William Forsche (centre) life casts Vincent Price with alginate for* ***Dead Heat*** *(1988)*

Right: *Life cast of another horror legend, Boris Karloff*

Far Right: *The life cast of Vincent Price being taken above*

Images from the life mask collection of William Forsche

MOST EARLY FILM MAKEUP WAS BASED ON TECHNIQUES FOR THE THEATRE, BUT THIS DIDN'T ALWAYS READ WELL ON CINEMA SCREENS.

and, even worse, the cast becoming locked on to the face if it's applied too far back beyond the jawline or going on to the ears. In 2007 a schoolgirl in England lost eight fingers by trying to cast her hands in a bucket of plaster in an art lesson. Plaster heats as it sets, and the thicker the layer of plaster the hotter it can get. In the case of the schoolgirl the solid block of plaster could not be removed fast enough to save her fingers from damage by the heat that was generated by the plaster as it set.

There was a clear demand then for some sort of flexible impression material with which to produce life casts that would be more comfortable - and frankly less risky - for the subject, and during the 1920s and 30s many of the improvements in casting materials would come from innovations developed after the First World War. One of these was Negocoll, which had been used to make casts of injured servicemen in order to create prosthetics, including facial prosthetics for those afflicted with severe deformities caused by their injuries. Negocoll was invented by Alphous Poller of Vienna in 1925 when he was trying to develop a material that could be sterilised and applied without pressure. It was non-irritating and could be applied directly to sensitive parts of the body – "even the cocainized eyeball" – and was prized for its elasticity.

NEGOCOLL REMAINED A POPULAR LIFE CASTING MEDIUM FOR A NUMBER OF YEARS BUT WAS EVENTUALLY DISCONTINUED IN THE 1960S DUE TO ITS ASBESTOS CONTENT.

The basic ingredient of Negocoll, Dentocoll (for dentistry), Moulage, and other similar patented compositions was agar. Derived from seaweed, agar was discovered in Japan in 1658 and was then, and still is, used predominantly as a gelling agent for food and as a substitute for gelatine in vegetarian cooking.

These rubbery impression materials were far safer and more comfortable to use than applying plaster directly to the face, but a little fiddly to work with. The material had to first be heated to quite a high temperature in a double boiler to make it liquid, then cooled down to a temperature safe for applying to the skin by placing it in a cold water bath, before finally moving it to a third double boiler of warm water that kept it fluid while it was being used. The material was applied by brush, spatula, syringe, or by hand to the subject, to a depth of about an inch. (Although the hair might need to be gelled back, no other lubricant was required.) Then this flexible rubbery layer was reinforced with a plaster support.

Image: Wakefield Council

Negocoll remained a popular life casting medium for a number of years but was eventually discontinued in the 1960s due to its asbestos content.

The Second World War would drive the development of the next generation of impression materials. Japan was the centre

Three angles of a life cast of Grace Kelly. This cast is likely to have been made in the early 1950s; it included Kelly's hair in the cast so this suggests the impression was taken in Negocoll. Image from the life mask collection of William Forsche

for agar production, but supplies soon became more restricted during and after WWII due to the USA's conflict with Japan, so an alternative was needed.

Alginate was first described by the Scottish chemist ECC Stanford in 1881. Alginate and agar are both hydrocolloids; both derive from seaweeds. While Negacoll and other agar-based products could be sterilised and melted down and reused, alginate couldn't. Once the alginate powder has been mixed with water and gelled into a solid the process is irreversible. However, this made it far easier to use as it could simply be mixed with room temperature water and applied directly to the skin, with the gelation occurring soon afterwards via a chemical reaction rather than through cooling.

Charlton Heston being life cast in 1959 using what appears to be Negocoll for his role in ***Ben-Hurr***

Photo: Bettmann Collection/Getty Images

A life cast being taken with a modern slow-setting alginate specifically formulated for life casting

Alginate for dental impressions was introduced in the US in 1947. Negacoll was still in use until the 1960s so it can be assumed that it was some time during the 1950s that dental alginates first began being used for life casts. The world of prosthetic makeup frequently cross-pollinates with the processes and materials used in the medical and dental fields. John Chambers, for example, had worked as a dental technician with the US army as well as doing reconstructive prosthetic work on disfigured veterans before moving to Hollywood and joining the makeup department at NBC in 1953. It wouldn't be a surprise, then, if artists like Chambers were already familiar with alginates and, soon after their introduction, were finding a use for them in creating life casts.

By the 1960s alginates had become the dominant life casting impression material. The go-to alginate for many years in Hollywood was Prosthetic Grade Cream, a very pure white slower-setting alginate produced by the Teledyne-Getz alginate company. This had a 5-minute setting time at 70 degrees. However it never found distribution in Europe, where the best option available for life casting was a dental alginate - Cavex Superior Pink - with a 3-minute setting time. This could be extended to around four minutes by mixing it with very cold water.

By the late 1990s brands like Accu-Cast and ArtMolds emerged, developing ranges of alginates with slower setting speeds and low slump

BY THE 1960S ALGINATES HAD BECOME THE DOMINANT LIFE CASTING IMPRESSION MATERIAL.

formulas designed specifically for the life casting market, but there was an interest forming in the potential for silicone as a life casting medium.

The obvious advantages of silicone are that cure times can be elongated and varied, and that it doesn't shrink or distort. Life casts in alginate always required that the cast be filled as soon as possible after the impression was taken, as the volume of the alginate was made up of about 50% water and very quickly evaporation would cause it to shrink and distort. This could be retarded by placing wet towels in the cast and wrapping it in plastic for a time, but ultimately an accurate cast would require it to be filled with plaster pronto. This was okay when taking a cast in an FX shop with all the materials and facilities to hand, but frequently life casts would have to be taken at actors' convenience - meaning setting up in their homes or in hotel rooms and often travelling abroad to take the casts. This would then require the artist taking the plaster with them. Many FX artists know the difficulties encountered with trying to cast plaster into a full head cast in a hotel bathroom and then trying to pack the heavy cast as carefully as possible for an international flight.

Alginate's second Achilles heel was the fact it could only be used to produce a single cast. The alginate - having poor tear strength - would break apart easily when it came to de-moulding the plaster cast. This was fine if the cast came out well, but sometimes the alginate would shift in its plaster bandage mother mould, or an air bubble would get lodged on the tip of a nose, with no chance to recast the failed part due to the destruction of the alginate.

Silicone offered the possibility of a life cast that would be tougher, reusable, and would not shrink, alleviating the urgency to fill it with plaster immediately. Casts could be done in remote locations and wait to be returned to base before casting plaster into them - sometimes days or even weeks after the initial cast was taken.

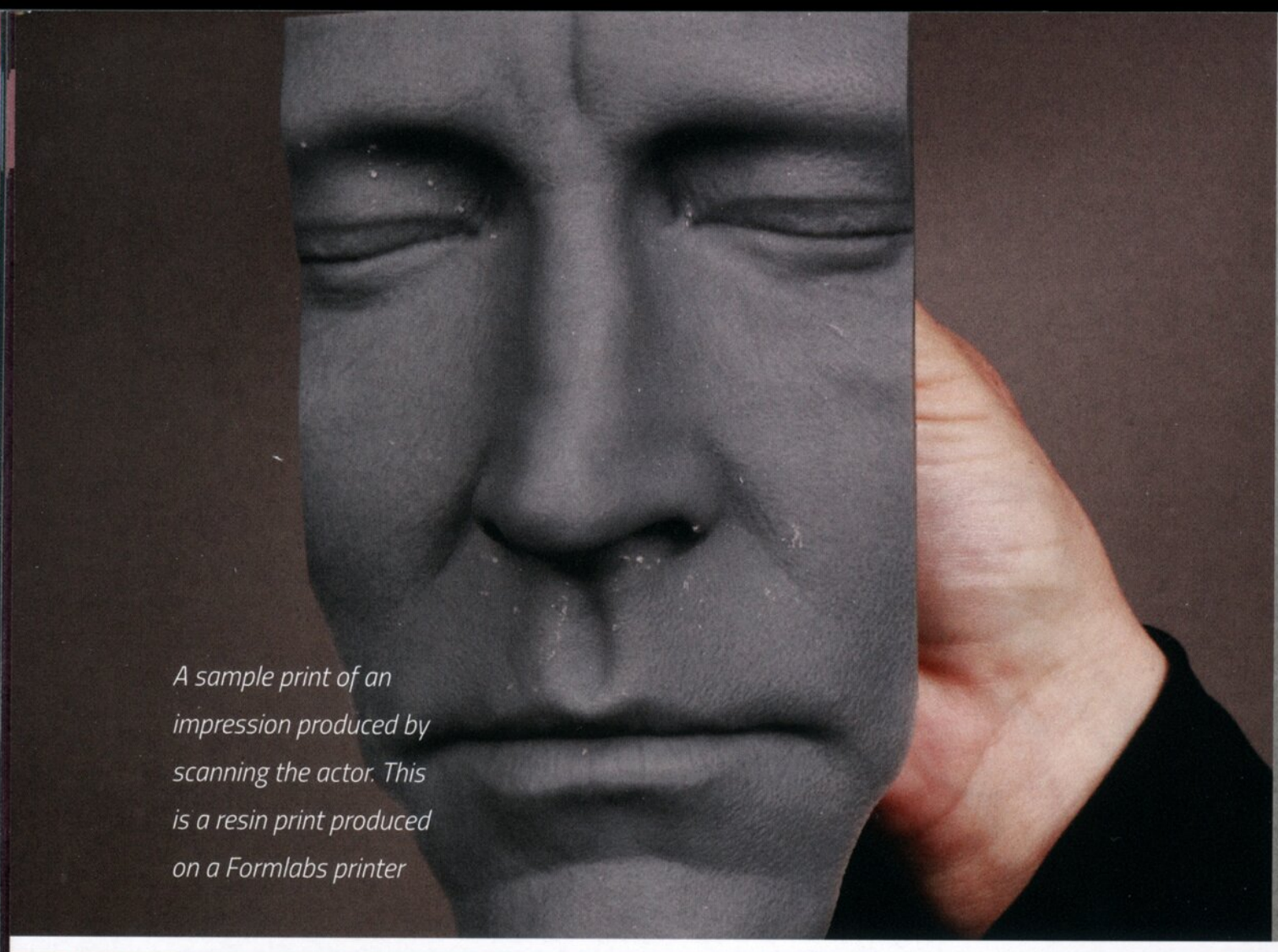
In the 80s and 90s tin (condensation) cure silicones were still the most commonly used silicone for mould making. Platinum (addition) cure silicones still suffered from being oversensitive and prone to cure inhibition through contamination, as well as being far more expensive. Tin cure silicones could be accelerated to be fast enough to do a life cast with, but the catalysts were unsafe for skin contact. Condensation cure silicone catalyst contains tin salts, an accumulative poison similar to lead that the body cannot get rid of, so prolonged skin exposure should be avoided. However, some Hyperrealist artists and maxillofacial technicians did experiment with casting using accelerated tin systems, the idea being that if a barrier cream was used on the skin first and only one cast was to be taken, then the exposure level for the subject would be extremely low.

In the 1980s Hyperrealist artist Duane Hanson would create silicone life casts of his subjects that would then be cast in a vinyl wax product called Elvax. Hanson worked very successfully with tin cure silicones backed with plaster. His process however required that the subject shave all their body hair and that copious amounts of Vaseline be used on the facial hair. While the process was slow and a little uncomfortable for the subject, Hanson's life casts did deliver terrific results and paved the way for modern silicone life casting.

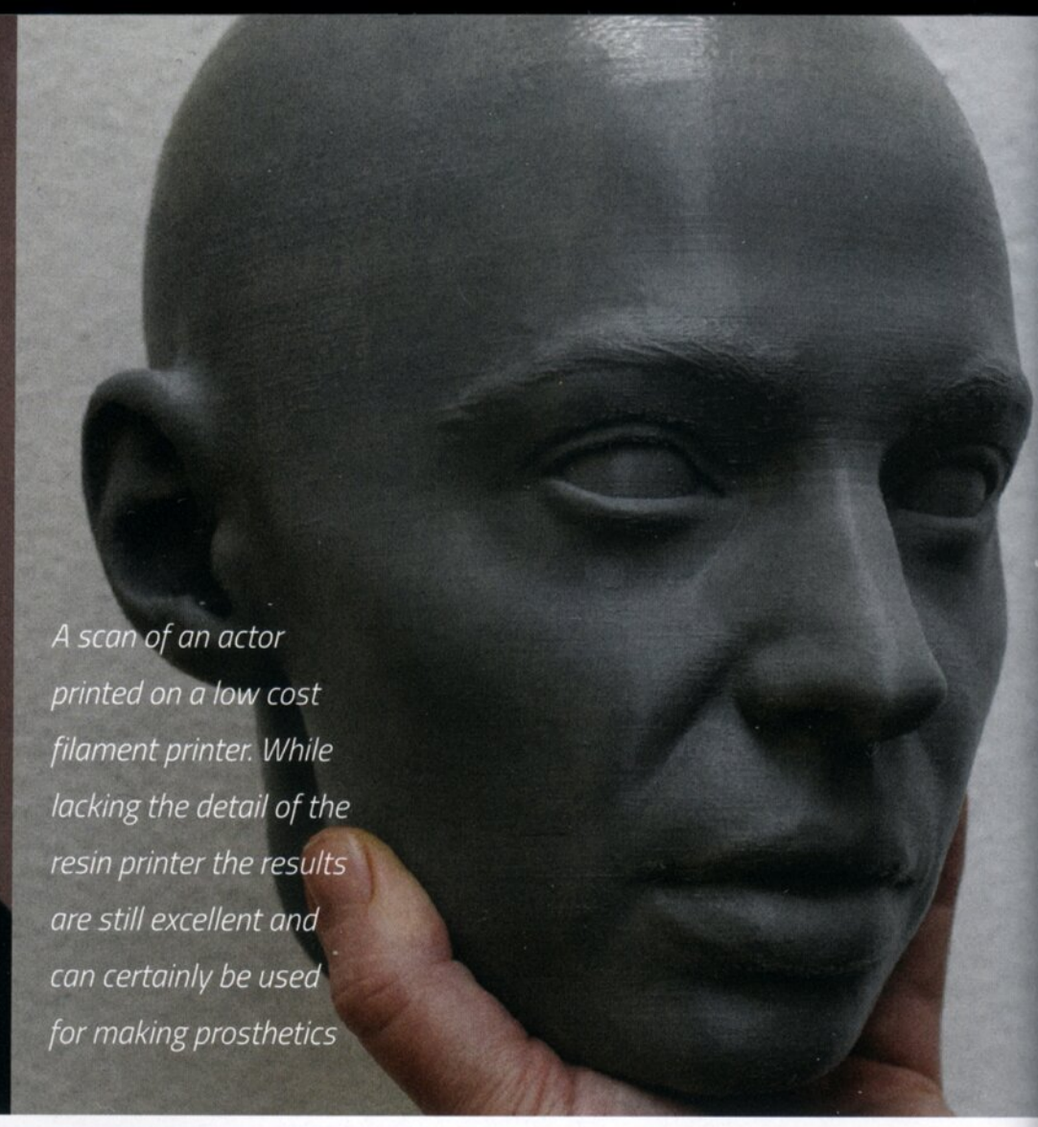
Above: *Key-Form is a life casting silicone designed not to stick to hair. Here it's peeling away easily from arm hair*

Below: *A life cast being taken in silicone*

Right: *Body Double is a popular brand of life casting silicone from Smooth-On*



A sample print of an impression produced by scanning the actor. This is a resin print produced on a Formlabs printer



A scan of an actor printed on a low cost filament printer. While lacking the detail of the resin printer the results are still excellent and can certainly be used for making prosthetics

What is the importance of having this source material? Forsche says, in one word: "History!"

The key to silicone life casting becoming more viable was advancements in addition cure silicones. Addition cure silicones are generally considered skin safe - although there are exceptions - being used in the manufacture of medical devices and even in kitchenware.

As they became more reliable and better priced, the first purpose-made life casting silicones began to appear. LifeRite from ArtMolds and Body Double from Smooth-On were the first serious contenders in the marketplace. Body Double was formulated in 2002 and is believed to be the first of these products to have become commercially available, with shipping having started in 2003. It was also the first life casting silicone to have a skin safety rating. With its reliability, quick cure, great tear strength and ease of use, Body Double silicone quickly gained popularity amongst FX artists and remains one of the market leaders today.

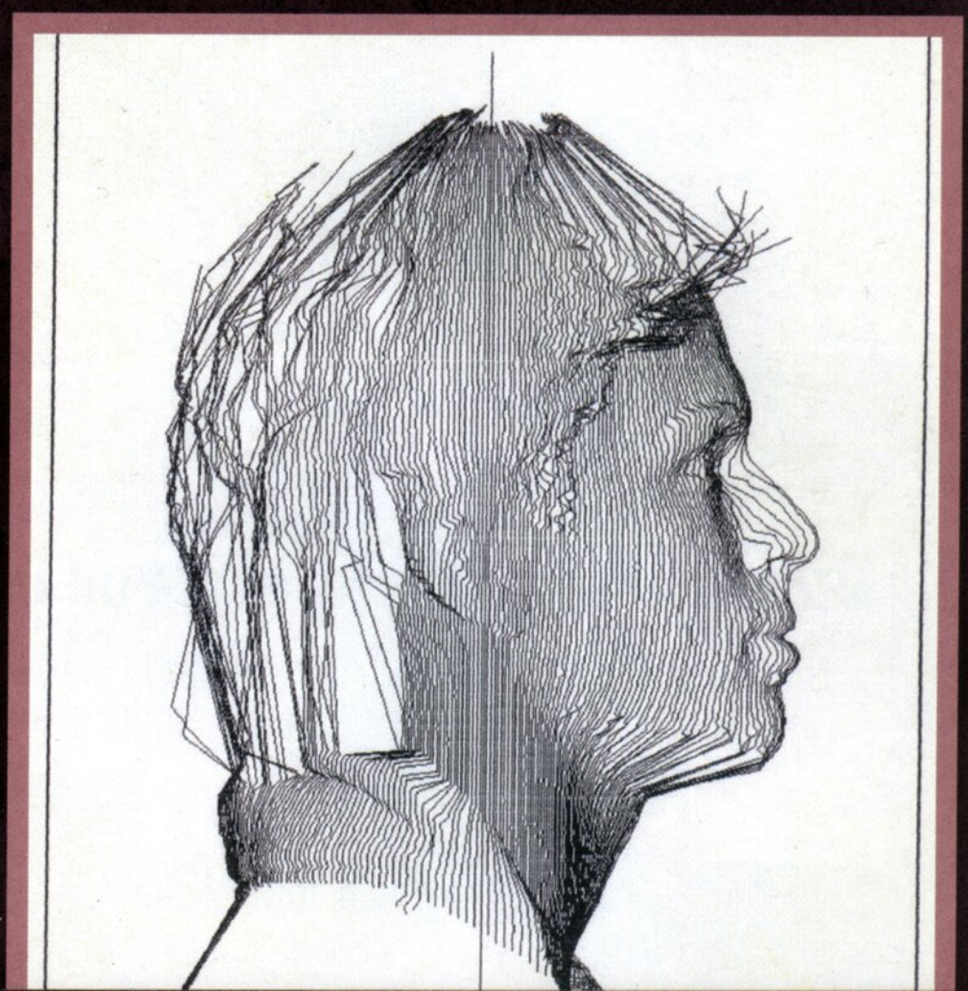
Of course, no system is perfect, and the one issue that came with silicone as a life casting medium was the fact that it sticks to hair. Alginates don't stick to short hair such as eyebrows and lashes, although longer hair and curly body hair could certainly get embedded in alginate. However a good coat of Nivea créme or Vaseline would address any issues there: in the worst case scenarios the alginate could simply be broken up and crumbled off any hair it became entangled in. Silicone, however, would easily rip out eyebrows, eyelashes and any other hair it came in to contact with that wasn't adequately released. Many artists learned the hard way just how, once hair was stuck in the silicone, the only way it was coming off was either being cut out or ripped out by the follicles. In an effort to avoid any problem Vaseline or collagen would be applied liberally, but this often led to loss of detail on the cast surface.

Neill Gorton shied away from life casting with silicones for this reason and would only use Body Double or PlatSil Gel-10 for life casting when it was absolutely necessary. This ultimately led him to try and develop a product himself.

Gorton: Back around 2001 a maxillofacial prosthetist called Robert Whitehead had shown me how he'd created a hand cast using an accelerated tin silicone that he'd mixed petroleum jelly into. I tried it myself and the silicone became very brittle but the detail in the cast was fantastic, and better still, the hairs on the back of my hand didn't stick in the silicone - so I'd known for some time the principle worked. I challenged my friend Justin Neill, who was CEO of Mouldlife at the time, to develop a product. This must have been around 2006 or 2007...

Justin formulated a number of samples for Gorton to test, eventually hitting on one that didn't stick to hair - even long hair - and required no release creams!

Below: *A digital scan of William Forsche from 1987. Image courtesy of William Forsche*



Gorton: I'd mix these samples up and put them on my arm and the ones that stuck I'd have a painful waxing when removing. One day Justin brought one over and my arm hairs just slid straight out leaving all the skin detail underneath. I don't think Justin quite grasped how important it was. I was saying, "This is going to change the industry!"

The product was named Lifeform and Gorton and Neill took early samples of it to IMATS L.A. It quickly acquired a buzz at the show after Gorton demonstrated it during one of his talks.

Gorton: I asked for a volunteer with hairy arms and when this guy came on stage I smothered his arm in silicone - to a gasp from the audience. While it cured, I spoke about how the biggest problem with life casting silicone was how it stuck to hair. All the time this guy is staring at his arm hair smothered in silicone! When I asked him to pull it off he looked terrified, but then it just peeled off really easily. His face was a picture and the audience were astonished.

Eventually Lifeform would hit the market around 2009. A few years later Smooth-On developed an additive for their Body Double system called Hyper-Folic, and several other products have since appeared. Gorton and Neill, who had since sold Mouldlife and established a new material supply company, Neill's Materials, put their heads together again to refine and advance their formula. Called Key-Form, this new product has now been available for the past few years.

While differing products and techniques have been used over the years to capture these likenesses, the finished casts themselves have a life outside of the world of makeup FX. William Forsche's career started in the 1980s, considered the golden era of makeup FX in Hollywood. Forsche was multiskilled and worked across many departments on films such as *The Lost Boys* and *Ghostbusters II* but frequently headed up the life casting on projects he worked on. Forsche maintains an extensive collection of life masks of famous actors and musicians, which he sells through his website. What is the importance of having this source material? Forsche says, in one word: "History!" It's one thing having photographic images of actors and performers, but cast likenesses literally add another dimension to our ability to see and know a character through their face and features.

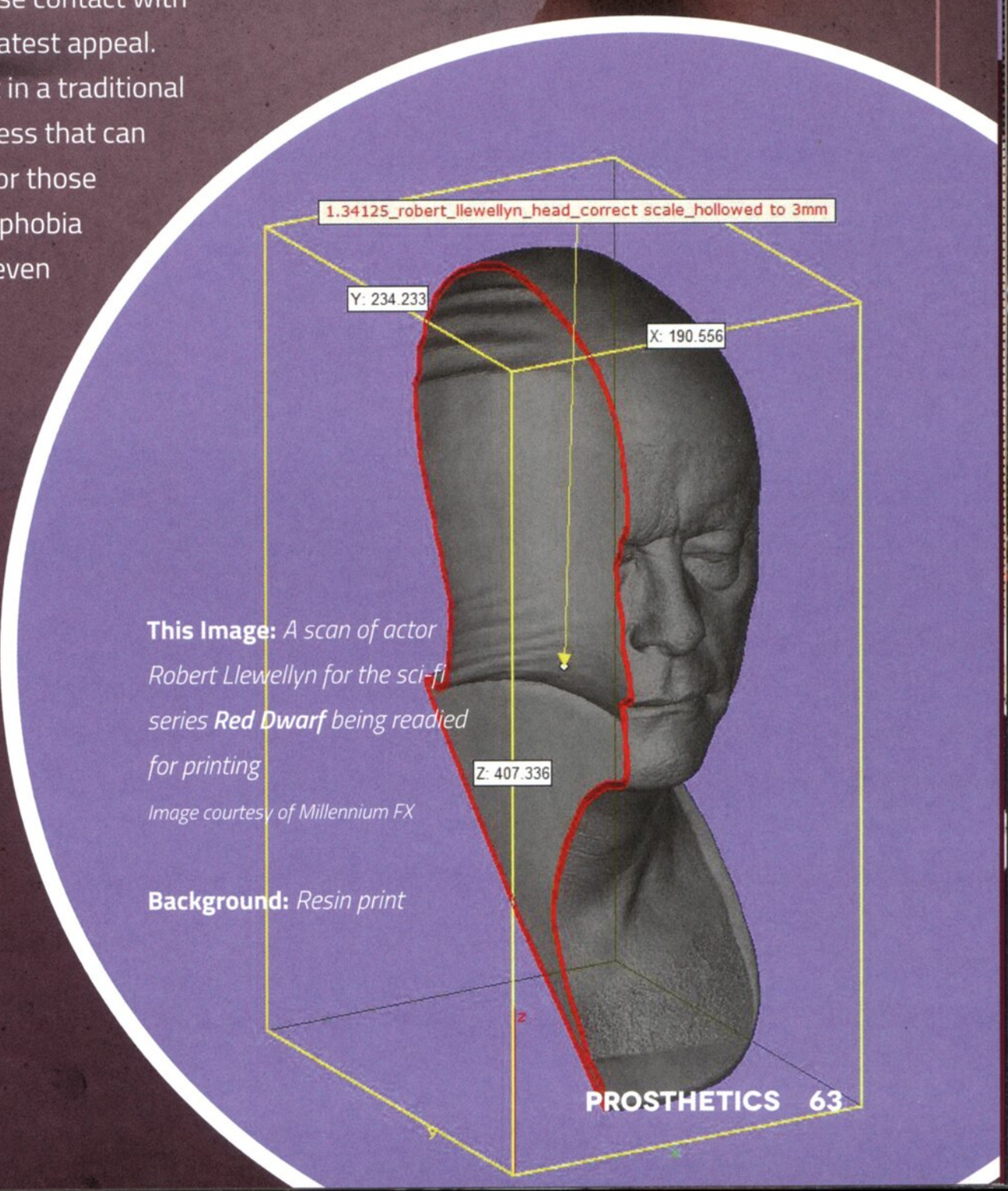
> "I don't think Justin quite grasped how important it was. I was saying, "This is going to change the industry!"

One of the attractions of the life cast to the movie memorabilia collector is the fact this is an impression taken directly from the actor. There's an intimacy about the process that gives the life cast a unique and unrivalled quality. But that intimate connection is under threat from the next iteration in the story of life casting.

It's the fact that 3D scanning and printing does not require the same sort of invasive intimacy and close contact with the subject that is its greatest appeal. When an actor is life cast in a traditional fashion it's a messy process that can take several hours, and for those who suffer from claustrophobia it can be a stressful and even traumatic experience if poorly executed.

A 3D scan, by comparison, involves no physical contact. The subject sits perfectly still while a scan is taken with a laser or structured light system. Alternately they may sit or stand in a multicamera rig that takes dozens of simultaneous photographs in a process called photogrammetry. Whichever way the scan is done the results are the same: a three-dimensional digital model of their face is produced and recorded on a computer. As with the plaster life cast there's always a certain amount of cleaning up that needs doing (called re-topologizing of the data) but the results can be spectacular. The traditional life casting materials have a burden of weight which, depending on the age of the subject and the firmness of their skin, results in distortions of the features. The 3D scan however is contactless and the version of the face it captures is distortion-free.

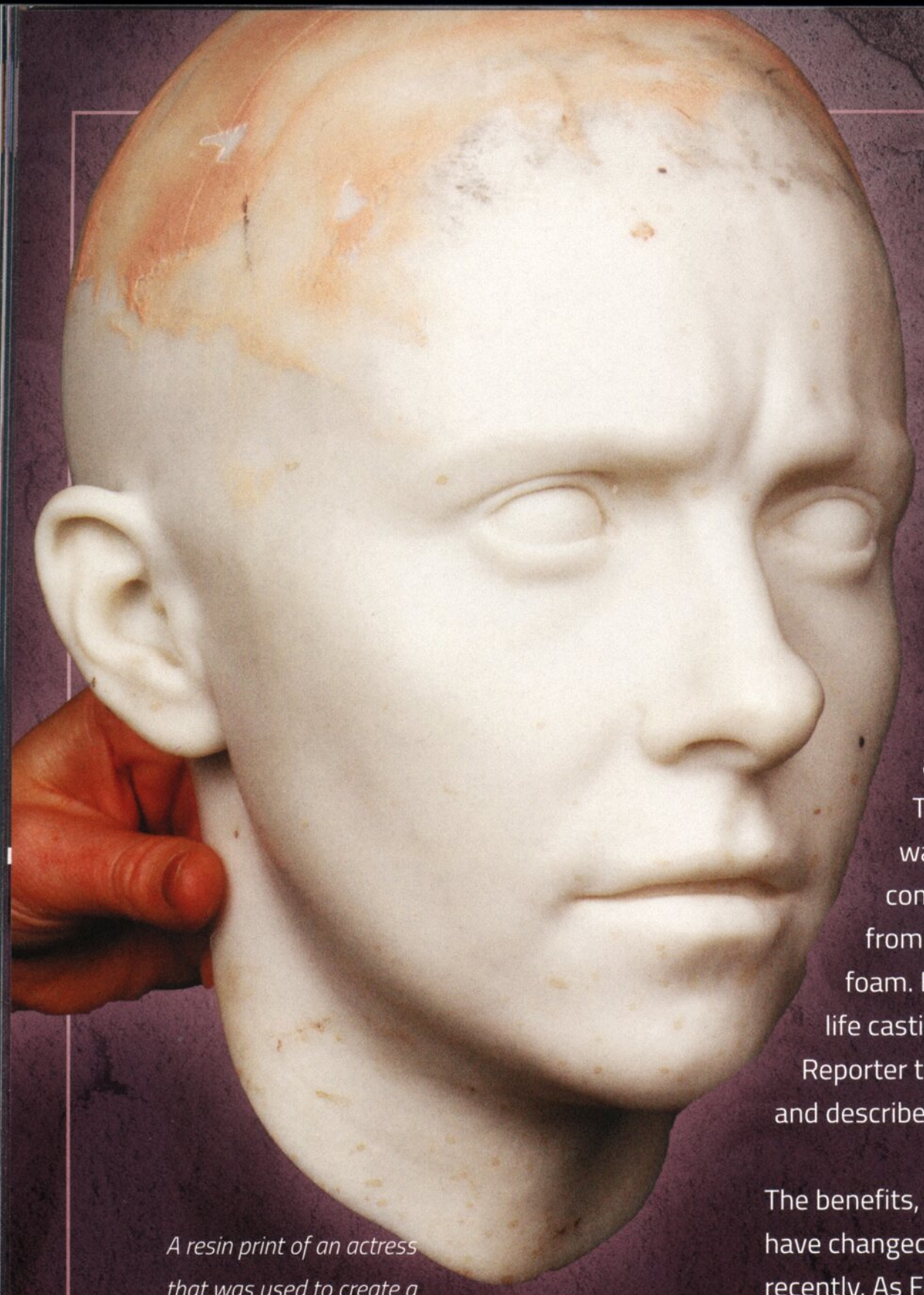
Although considered a very modern approach, the ability to scan a face has been around for some time and William Forsche was there at its birth.



This Image: *A scan of actor Robert Llewellyn for the sci-fi series* ***Red Dwarf*** *being readied for printing*

Image courtesy of Millennium FX

Background: *Resin print*



A resin print of an actress that was used to create a dummy head

In 1987 The Hollywood Reporter profiled a company, Image Masters, in California, who were offering 'The Echo Computerized 3-Dimensional Reproduction Process'. In 15 seconds, 250,000 measurements and 512 different views of the face were captured using a low-intensity laser beam. The data, captured on disc, was then sent to a lab where a computer lathe milled the mask from high-density polyurethane foam. Forsche, known for his life casting skills, was sent by The Reporter to have his image captured and describe what he thought.

The benefits, as well as the problems, have changed little from then until recently. As Forsche noted at the time, the ability to capture a face with open eyes and the lack of weight on the face meant that there was no distortion in the data. Because of this, the masks that were created didn't look dead!

However, while a scan can capture incredible detail, one of the key problems with this technology has always been with the output. Though the laser even then was capable of capturing every detail of the face, the milled outputs were not able to reproduce that detail and were also much slower at making a cast.

From the 1980s till now, the process of scanning technology has been far ahead of our ability to 3D print at a high enough quality of detail to make the process useful for prosthetics. The equipment costs have been too prohibitive and the process too time-consuming to be viable, making a traditional life cast more desirable. But we're now at the tipping point with consumer machines able to deliver almost comparable results to the traditional life cast.