Retailer’s Guide to
3D FOOT SCANING
Introduction

This guide gives all relevant information on the application of 3D foot scanning to online and offline footwear retailers.

It includes a brief explanation of the technology behind 3D body scanning and outlines its benefits. Next, it explains the changes in retail processes after the implementation of the technology, contains consumer research on online shopping behaviour and attitudes towards 3D scanning and describes the market potential of 3D scanning technology. Finally, it compares several providers of mobile and in-store scanners and gives recommendations for the application in different business models.

The attached online test gives additional advice on the most suitable technologies:


Target group: online, offline and cross-channel footwear retailers
Keywords: 3D foot scanning, virtual fitting, shoe sizing
3D Body Scanning

3D scanners are ideal for measuring complex shapes which otherwise would require a large number of measurements to accurately depict them. With the help of different techniques, they are able to scan parts of the human body and to create a digital 3D model (Ebrahim, 2013). The market currently offers different technologies including in-store scanners and smartphone applications to enable 3D scanning in all kinds of retail concepts.

In-store scanning

Depending on the technology and the provider, in-store foot scanners consist of both a platform and one or more cameras which take photos around the feet within a few seconds. 3D body scanners capture the human body and create a virtual 3D model of it. Some scanners are also able to detect and recreate colours and measurements. For 3D body scanning, the most suitable techniques are structured light scanning and photogrammetry, or a combination of both (The best 3D Body Scanners in 2017, 2017).
Smartphone Scanning

There are several apps and programmes available for foot scanning based on the technique of stereo photogrammetry (image-based modelling). A processing software creates a 3D model out of photos taken with a conventional smartphone or digital camera. Therefore, the foot usually has to be placed on a blanc sheet of paper or a special mat. Afterwards, three or more photos are taken from different angles in order to assemble a 3D model of the foot. The smartphone applications are usually free for consumers, easily accessible in app stores and do not require any expensive equipment or complicated explanation (Lansard, 2016).

Image 3: Photogrammetry app, user manual, Findmeashoe
Virtual Fitting

Virtual fitting (or virtual try-on) is a technique of digitally aligning a 3D model of the scanned foot with the model of a shoe. The fitting software accesses data from inside-scans of available shoes or prototyping models. The technology is able to detect fit problems by calculating the distance between the inside of the shoe and the foot (Piperi, Galantucci, Kaçani, Shehi, Spahiu, 2014). The 3D foot scans can derive from scanning apps or scans created with a store-integrated 3D scanner. As a result, the program can display a heat map, exact measurements or gives size recommendations for preselected shoe models.

The application of virtual fitting tools in online shops gives more confidence in size decisions to prospective customers and makes size guides redundant, as the scans function as a universal sizing system (Kartsounis, Magnenat-Thalmann, Rodrian, 2003). Further, 3D scanning takes irregularities of the bone structure and different foot shapes into account and therefore guarantees a more precise measurement than traditional measuring methods (Lee, Lin, Wang, 2014).
**Shoe Sizing**

In a time of globalization, customers are able to purchase shoes from online shops all over the world. Therefore, they are confronted with a number of different sizing systems (EU, US, UK) and size guides in different metric systems (inch, cm). The fact that sizing systems and fit differ among brands, and sometimes even within brands, makes it even more complicated to find well-fitting shoes.

Traditional shoe sizes are based on the total length of the foot and do not take additional measurements, such as width, height and ball girth, into account. With 26 bones, deformations, irregularities and asymmetries, the foot is one of the most complex structures of the human body and changes throughout a person’s life time. Therefore, ill-fitted shoes can lead to pain, foot damage and changes in posture (Miller, Withcome, Lieberman, Norton, Dyer, 2014).

The pictures on the right show examples of feet that are of the same length but are different in height and width, and show different foot shapes, that are all of the same shoe size.
Consumer Research

As part of this research, a consumer study was conducted to evaluate the consumer’s online footwear shopping behaviour and the attitude towards 3D body scanning technology. 129 participants, mostly from Germany and the Netherlands, throughout all different age groups and occupations took part in the survey.

Key findings:

- 83% prefer to buy shoes in-store.
- Only 5% claim that all their purchased shoes fit perfectly.
- 47% notice differences in sizing among brands.
- Only 18% are entirely sure about their shoe size.
- 51% do not know their size in a US sizing system.
- 48% do not know their size in a UK sizing system.
- 49% decide on the shoe size online based on experiences with brands.
- 61% had their feet measured the last time as a child.

- Only 3% ever tried a body scanner.
- 57% are willing to try a 3D scanner immediately.
How do you know which size to buy online?

- experiences with brands: 63
- size guides + size charts: 61
- I do not buy online: 23
- order multiple sizes and send others back: 16

Have you ever tried 3D body scanning before?

- Yes: 96.9%
- No, never: 3.1%

Is there a reason why you are sceptical about 3D scanning?

- No, I would like to try 3D scanning immediately: 73
- I would be willing to scan my feet but rather not the rest of my body: 24
- Data privacy: 23
- I don't want to know every measurement of my body: 13
- Must be difficult to use: 13
Change of Process

Online

Insecurity among customers regarding fit and sizing is a major reason for returns (Apparel & Footwear Retail Survey Report, 2016) and caused return rates up to 40% for online retailers in 2016 (Dennis, 2017). These unsustainable, inefficient and expensive processes can be avoided if the customer is able to try on footwear virtually. 3D scanning tools do not only save time for the consumer but simplify the whole retail process and allow for a more direct connection. The virtual fitting tool is integrated on the website and helps to select the right shoe size. With the help of analysis functions about consumer behaviour provided by 3D scanning companies, the retailer is able to generate additional data for buying and manufacturing purposes.

Cross-channel

For retailers with online shops and local stores, 3D scanners have the impact to build a perfect bridge between both channels (Volumental, n.s.). The in-store scanners support retail staff and function as a USP. Customers scan their feet in-store, get the scan and measurements via email and are able to select shoes in-store and online afterwards. This increases loyalty and engagement and gives additional incentives to visit local stores.
## Benefits of Virtual Fitting Technology

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return rate</td>
<td>If customers can be sure that they will be able to fit their shoes already before they purchase online, the phenomenon of ordering multiple sizes for home try-on can be prevented. Although, the exact effect on the return rates for online shoe purchases has not been determined, different 3D scanning providers advertise a decrease by 25-31% (3Dlook.me, 2017 &amp; Volumental, n.s.).</td>
</tr>
<tr>
<td>Automatic size advice</td>
<td>3D scanning technology makes size guides redundant. Different foot shapes and variations in sizing of shoes are taken into account (Lee, Lin, Wang, 2014). Therefore, additional customer service and internal fitting departments become unnecessary for retailers and manufacturers.</td>
</tr>
<tr>
<td>Gain knowledge about customer</td>
<td>Most providers of 3D scanning technology offer evaluation tools. Due to that, retailers are able to get to know their customers better and use their valuable data for buying, internal size charts and prototyping (3Dabout.me, n.s.).</td>
</tr>
<tr>
<td>Extra service</td>
<td>Offering the new technology means offering an extra service for customers, which can be seen as a USP against competitors.</td>
</tr>
<tr>
<td>Omni-channel concept</td>
<td>In-store 3D foot scanning functions as a perfect connection between online and offline experiences. Customers are able to have their feet scanned and try on shoes in store or with the help of the scans and virtual fitting tools in the online shop (Volumental, n.s.).</td>
</tr>
<tr>
<td>Conversion rate</td>
<td>Customers using in-store scanners are more likely to purchase shoes after getting scanned. According to Volumental, the conversion rate is between 85% and 90% (Volumental, n.s.).</td>
</tr>
<tr>
<td>Topic</td>
<td>Description</td>
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<tr>
<td>Brand loyalty</td>
<td>Using 3D scanning technology tools in-store or online indicates high expertise and leads to a higher confidence in size decisions and trust (Kartsounis, Magnenat-Thalmann, Rodrian, 2003).</td>
</tr>
<tr>
<td>Exposure via scanning service</td>
<td>Being connected with 3D scanning services enables additional marketing exposure for retailers and brands through the provider’s apps and websites (3Dabout.me, n.s.).</td>
</tr>
<tr>
<td>3D data about collections</td>
<td>The providers of 3D scanning technology take care of the scanning of all shoe-insides, so that manufacturers and retailers can get interesting 3D information on collections and virtual fitting can be enabled.</td>
</tr>
<tr>
<td>User friendliness</td>
<td>Apps using 3D scanning technology based on photogrammetry are user-friendly, easily accessible and usually free for customers.</td>
</tr>
<tr>
<td>Better orientation</td>
<td>Some 3D scanning tools offer the possibility to show the best fitting shoe from the selected online shop. Therefore, the tool creates a preselection and allows the possibility to give the customer a more personalised offer.</td>
</tr>
</tbody>
</table>
Market potential

Virtual fitting and 3D scanning technologies are developing at a fast speed within several different areas which are of relevance to the fashion industry. 3D scanners are currently improving in accuracy, user friendliness, application possibilities and accessibility. An important development for the fashion industry is the advancement of home and mobile scanners due to their improvement in virtual fitting. According to the research of marketsandmarkets.com, “the 3D scanner market is expected to grow from USD 3.76 Billion in 2017 to USD 5.90 Billion by 2023, at a CAGR of 7.8% during the forecast period” (3D Scanner Market by Offering, 2017).

A range of body scanners in the form of full-body scanners, partial-body scanners, mobile scanners and hand-held scanners is available on the market. Looking at the developments of 3D scanning hardware, it becomes obvious that due to competition, scanners have improved in precision and are simultaneously becoming more affordable (Daanen, Ter Haar, 2013).

Initially, 3D foot scanners were used predominantly for orthopaedic purposes. However, the technology has become more relevant for the customisation of business and sports shoes and skiing boots (Jans, 2017). 3D foot scanners are important in the mass market of footwear and enable well-fitted shoes without a physical try-on. Applying this technology to the general online footwear retail industry could entirely change today’s retail processes and lead to decreased costs with a simultaneous increase in customer satisfaction.
Providers

3Dabout.me
The Dutch app gives shoe size recommendations for consumers in connected online shops. The technology is based on photogrammetry. After taking three photos of each foot, the 3Dabout.me app compares the measurements to a database of 10,000 shoes. It is currently connected to seven online shops, with 450 brands and 1,200 shoe measurements. The app is free for consumers and the retailer pays on a commission basis.

3Dlook.me
3D Look offers a variety of software. Their app Starlook detects the full human body based on two photos and gives size advice for the biggest apparel retailers. The widget SAIA can be integrated in the web shop and provides the customer with exact measurements, also based on two photos, which are then compared to the brand’s size chart. The company is based in the USA and the service is available globally.

3D-a-porter
3D-a-porter is a London-based company offering different services: in-store scanners, such as 3D mirrors and scanning booths, home scanning systems, 3D garment visualisation programmes and 3D virtual try-on tools.

Corpus.e
Corpus.e is a 3D foot scanning company from Germany, offering the in-store scanner lightbeam and a connected fitting software. The company specialises in the customisation of running shoes and skiing boots.
DOMEScan
The Spanish Instituto Biomecanica de Valencia has developed the in-store scanner DOMEScan and the mobile App 3D Avatar Feet, which are both based on photogrammetry and can be used for shoe fitting, personalisation and paediatric purposes.

Findmeashoe.com
After taking 3 photos of each foot, the Indian App findmeashoe gives size recommendations according to 30 measure points and aligns them with the inner cavities of measured shoes. The service is not available in the European app store yet.

Fitfully
The Tel Aviv based company developed a photogrammetry app which provides size recommendation for connected shoe brands.

mPort
mPort is an Australian provider offering 3D scanning booths in shopping malls. Infrared in-depth cameras scan the full body and allow customers to track their size and health and gives shopping recommendations. The consumer is charged for the service which is currently only available in the USA and Australia.

Right Shoes
The Swiss company Right Shoes offers different scanning possibilities: 3D foot scans on a specially designed mat with their smartphone app or with their own 3D laser scanners for stores and gyms. In addition, they offer instructions for manual foot measurement on their app and website.

Shoe Master
The UK company specialises in the improvement of shoe fitting and offers a variety of technologies ranging from shoe and foot scanners to CAD systems.
[TC]²
The provider offers a wide range of products, such as 3D body scanners, mobile 3D scanners, fitting engines, smart mirrors and CAD systems for retailers and producers. It is globally represented with offices in the USA, India and China.

vFit
vFit is an app using photogrammetry to fit shoes and connects the customer to a variety of online retailers. The company is based in USA and the service is not available to the European App store.

Volumental
Volumental offers in-store 3D foot scanners and an AI-driven fitting software. The scanning process takes 5 seconds with an accuracy of ± 1mm. The company is based in Sweden, runs its own research on 3D scanning technology and has five major shoe manufacturers and retailers as partners.

Voxelcare
The Spanish company Voxelcare offers 3D foot scanners, foam scanners and software solutions for the footwear industry.

In addition to these, there are different online sizing tools on the apparel market which offer sizing advice without the technique of 3D scanning:

Virtusize helps to compare the measurements of purchased clothes with items in online shops.
Fits.me is a fitting tool for online retailers giving size advice for garments according to a number of manual body measurements.
Bold Metrics creates a model of the body by asking their customers a number of questions.
Fit Analytics is a service which asks for the size the customer had in a specific model and calculates the size of the desired product.
The following table summarises all previously listed 3D scanning companies (providers and manufacturers):

<table>
<thead>
<tr>
<th>Company</th>
<th>Foot / Body Scanner</th>
<th>Online Program / In-store Scanner</th>
<th>App?</th>
<th>Available in EU?</th>
<th>Scanning Method</th>
<th>Price</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corpus.e</td>
<td>Foot</td>
<td>In-store</td>
<td>No</td>
<td>Yes</td>
<td>Based on laser scanning</td>
<td>Buy hardware and software</td>
<td><a href="http://www.corpus-e.com/en/home.html">http://www.corpus-e.com/en/home.html</a></td>
</tr>
<tr>
<td>ShoeMaster</td>
<td>Foot</td>
<td>In-Store</td>
<td>No</td>
<td>Yes</td>
<td>Laser, photogrammetry</td>
<td>Pricing depends on the service and product</td>
<td><a href="http://www.shoemaster.co.uk/equipment/foot-scanners/">http://www.shoemaster.co.uk/equipment/foot-scanners/</a></td>
</tr>
<tr>
<td>Volumental</td>
<td>Foot</td>
<td>In-Store</td>
<td>No</td>
<td>Yes</td>
<td>Laser Scanning</td>
<td>n/s</td>
<td><a href="https://www.volumental.com">https://www.volumental.com</a></td>
</tr>
<tr>
<td>Voxelcare</td>
<td>Foot</td>
<td>In-Store</td>
<td>No</td>
<td>Yes</td>
<td>Laser Scanning</td>
<td>n/s</td>
<td><a href="http://www.voxelcare.com/#!/content/3D-Laser-Foot-Scanner">http://www.voxelcare.com/#!/content/3D-Laser-Foot-Scanner</a></td>
</tr>
<tr>
<td>mPort</td>
<td>Body</td>
<td>In-Store and Online</td>
<td>Yes</td>
<td>No</td>
<td>Infrared depth scanning booths</td>
<td>Consumer pays for service 4.95€ per month</td>
<td><a href="https://mport.com">https://mport.com</a></td>
</tr>
<tr>
<td>Right Shoe</td>
<td>Foot</td>
<td>In-Store and Online</td>
<td>Yes</td>
<td>Yes</td>
<td>Photogrammetry and laser scanner</td>
<td>n/s</td>
<td><a href="http://www.rightshoes.ch/businessPage/business.php">http://www.rightshoes.ch/businessPage/business.php</a></td>
</tr>
<tr>
<td>[TC]2</td>
<td>Body</td>
<td>In-Store and Online</td>
<td>Yes</td>
<td>Yes</td>
<td>Different kinds of scanners</td>
<td>Pricing depends on the service and product</td>
<td><a href="https://www.tc2.com/home.html">https://www.tc2.com/home.html</a></td>
</tr>
<tr>
<td>3D-a-porter</td>
<td>Body</td>
<td>In-store and Online</td>
<td>Yes</td>
<td>Yes</td>
<td>Laser based, photogrammetry</td>
<td>n/s</td>
<td><a href="http://3d-a-porter.com/services/3d-garment-visualization-software/">http://3d-a-porter.com/services/3d-garment-visualization-software/</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Provider</th>
<th>Type</th>
<th>Online</th>
<th>Free</th>
<th>Technology</th>
<th>Commission</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fitfully</td>
<td>Foot</td>
<td>Online</td>
<td>Yes</td>
<td>Yes</td>
<td>Photogrammetry</td>
<td>n/s</td>
</tr>
<tr>
<td>vFit</td>
<td>Foot</td>
<td>Online</td>
<td>Yes</td>
<td>No</td>
<td>Photogrammetry</td>
<td>n/s</td>
</tr>
<tr>
<td>3Dabout.me</td>
<td>Foot</td>
<td>Online</td>
<td>Yes</td>
<td>Yes</td>
<td>Photogrammetry, based on 3 photos per foot</td>
<td>Commission based, pay per click, free for customer</td>
</tr>
<tr>
<td>3Dlook.me</td>
<td>Body</td>
<td>Online</td>
<td>Yes, Widget</td>
<td>Yes</td>
<td>Photogrammetry, based, full body scanner</td>
<td>n/s</td>
</tr>
<tr>
<td>Findmeashoe.com</td>
<td>Foot</td>
<td>Online</td>
<td>Yes</td>
<td>No</td>
<td>Photogrammetry</td>
<td>n/s</td>
</tr>
</tbody>
</table>

(No guarantee for completeness of the list can be given.)
Online Retail Implementation

Requirements
- Selection of best-fitting provider
- Providing 3D scanning companies with current and future article numbers for in-shoe scans

Web integration
- Often offered as widget / code to add in online shop
- Take the traffic flow on the website into account
- Place virtual fitting tool next to size selection, in the size guide section and in the final step (if customer is about to order multiple sizes of the same item)

Analytics
- Use of analysis tools offered by 3D scan companies helps to better understand consumer behaviour.

Image 10: Size advice from virtual fitting software
The integration of 3D scanning tools into footwear retail entails monetary and logistical benefits for retailers and manufacturers. Depending on the business model, different fitting tools will be most suitable.

For cross-channel retailers, the 3D scanning technology connects online and offline channels, supports retail staff and offers incentives to visit local stores. For online retailers, it has a positive impact on the return rate, offers an extra service to customers and provides additional analytical data in order to gain valuable knowledge of customers’ measurements.

3D foot scanning technology offers new possibilities and will likely shape the future of online shoe shopping. Therefore, it is recommended that retailers and manufacturers start to gather information and evaluate the 3D scanning tools available to prepare for the upcoming technological developments.

Take the quiz by opening the link below, in order to find out what shoe fitting tool suits your business model:

Methodology

This paper is part of a graduation project from Paulina Henrich-Bandis, student at Amsterdam Fashion Institute. The independent results are based on five months of research on the Implementation of 3D Scanning in the Online Footwear Industry in 2017.

The data was gathered through online literature research focussing on technology platforms, product information from retailers, research studies, user manuals and consumer reviews. Additionally, a survey was conducted on the consumer acceptance of fitting technology. As 3D scanning technology is developing at a fast speed, up-to-date sources written after 2013, were used as much as possible.

Contact: henricp001@hva.nl
References:


Volumental (n.s.). Volumental Home. [online] Available at: https://www.volumental.com [Accessed 13 December 2017].


3Dabout.me (n.s.). 3Dabout.me Home [online] Available at: https://www.3dabout.me [Accessed 13 December 2017].


Image sources: All tables, graphs and figures are based on own research, the survey and own configuration.

Titel page:

Image 1:

Image 2:
Volumental (n.s.) Volumental Home [image] Available at: https://www.volumental.com [Accessed 13 December 2017].

Image 3:

Image 4:
3Dabout.me (n.s.) 3Dabout.me Home [image] Available at: https://www.3dabout.me [Accessed 13 December 2017].

Image 5:
From internal 3Dabout.me PDF for retailers

Image 6, 7 & 10:
Volumental (n.s.), Volumental Home. [image] Available at: https://www.volumental.com [Accessed 13 December 2017].

Image 8 & 9: