



Personalization in Beauty Tech Using AI and AR

Investigating Consumer Behaviour and Benefits of Personalization in Beauty

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ABSTRACT

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Personalization has the potential to optimize a service for users by catering to unique needs and characteristics. The influx of artificial intelligence (AI) and augmented reality (AR) technology in the retail space has helped to re-define how customers engage with brands. Integration with brands work to improve the online and in-store engagement with consumers through a combination of data analysis and user generated responses. The purpose of this thesis was to explore the mutual benefits of personalization for the customer and the brand, what factors contribute to a successful implementation, dive deep into customer behaviour and explore the challenges associated with it. The research took a constructive approach on defining how an AI/AR online service can strategically place businesses as frontrunners in their industry. It specifically looked at which variables influence customer behaviour and how AI/AR can provide a personalized skin regime within minutes. The questions that were asked are: what are the drivers for consumer adoption of personalized solutions in the beauty industry? What is it about a personalized solution that drives a consumer to take action? The study included data sets from top beauty brands that revolved around consumer spend using the skin advisor tool, engagement rate, questionnaires, and data analytics. It investigated the technology associated with personalization and how it accommodates consumer uncertainty, preferences, and define goals. It looked at the business value gained from personalized recommendations.

The results from this study had 48 participants that spanned over six different companies. These company participants were Naos, Higher Education, Pierre Fabre, Nahdi, Shiseido, and Yon-ka. The study displayed a 64% positive response to the skincare advisor for personalized recommendations and a 30% lift in sales attributed to the Walgreens pilot experience.

Based on the results, it is clear that consumers are finicky and are prone to follow trends. Consumers proved to adopt personalized regimes based on the technology backing up the results and brand loyalty. Consumers as a whole are driven to products that promote health and wellness, so with the emergence of AI and AR platforms in Beauty Tech, there is high rate of consumer adoption. This thesis was able to conclude that consumers will adopt personalized regimes based on the fact that they are given fewer number of choices. Reviewe was able to gain insight into consumer adoption and business.

Key words: artificial Intelligence, augmented reality, beauty tech, computer vision, SDK

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ABBREVIATIONS AND TERMS

API

An API, short for application programming interface, is a tool used to share content and data between software applications. An API is a documented piece of software that enables anyone with access rights (an API key) to receive information from it.

Artificial Intelligence (AI)

Artificial Intelligence is the theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.

Augmented Reality (AR)

Augmented Reality (AR) as a real-time direct or indirect view of a physical real-world environment that has been enhanced/augmented by adding virtual computer-generated information to it.

Beauty Tech

Modern technologies that help and facilitate the growth of the beauty industry. Beauty tech is the mashup of the beauty sector with the technology field to produce technological advanced products and services for consumers.

Computer Vision

Computer vision is a field of artificial intelligence that trains computers to understand the visual world. Using digital images from cameras and videos and deep learning models, machines can accurately identify and classify objects — and then react to what they “see.”

SDK

A software development kit (SDK) is a collection of software development tools in one installable package. They ease creation of applications by having compiler, debugger, perhaps a software framework, and ready built visualizations. They are normally specific to a hardware platform and operating system combination.

KPI

A Key Performance Indicator (KPI) is a measurable value that demonstrates how effectively a company is achieving key business objectives. Organizations use KPIs at multiple levels to evaluate their success at reaching targets. High-level KPIs may focus on the overall performance of the business, while low-level KPIs may focus on processes in departments such as sales, marketing, HR, support and others.

1 INTRODUCTION

Personalization in the retail space has been growing over the recent years, specifically in the beauty and skincare field. With skincare being such a massive industry, there has been an influx of Beauty Tech implementations introduced to the global market. These solutions for the most part use AI (Artificial Intelligence) and AR (Augmented Reality) to provide the consumer with personalized skin regimes and beauty products specifically suited for that person. This thesis looks at how the data behind consumer behavior and what the driving factors are for adopting a personalized skincare and beauty solution.

1.1 Background and motivation

The use of beauty products and cosmetics can be traced back to about 4,000 BC and today the beauty industry as a whole is worth an estimated \$425 billion. Brick and mortar establishments have been offering skincare solutions as long as we can remember, but as technology advanced, so did online retail. Online skincare is a \$33 billion industry growing 10% p.a. With retail margins of 78% and a product-return rate of 1.8%, skincare is the most profitable product category for e-commerce (Revieve Oy 2018).

Throughout history, beauty and technology were separate from each other, but now they have merged into one lane. “Technology is quickly changing the relationship between consumers and brands, which is providing a massive shift in the beauty and personal care industry” (Beddoe 2019). With such an influx of information and products being shown to the consumer, personalized recommendations are something to relish in. The personalized assistance can provide ease to the shopping experience. Machine learning and computer vision can significantly help to make recommendations to benefit the user. As reported in Mintel’s 2018 Global BPC Trend ‘My Beauty, My Rules’ beauty is being redefined constantly by the consumers (Mintel 2018). They have the power to define what a consumer’s daily needs are based on age, skin, hair or body shape. Brands are forced to adapt if they want to keep up (Khanom 2019).

The motivation for this thesis is to better understand consumer behavior and the shift in purchase behavior to more personalized centered solutions for customers. With the beauty industry being as vast as it is, it is important to

understand why consumers would want to focus their buying power into personalized experiences.

1.2 Outline of thesis

This thesis begins with an overview of what mixed reality is and breaks down the different forms, so there is an understanding of what types are utilized in the beauty industry. The next segment is an explanation of the technology subset called Beauty Tech and what it brings to the beauty/skincare field. The thesis then explores the details of personalization, specifically what it can contribute to consumers and businesses. A case study is then performed where the thesis does a deep dive on a Helsinki based start-up called Revieve (www.revieve.com). Revieve is a software company that provides virtual skincare advisor, product recommendations, and make-up virtual try-on for brands to implement.

Throughout this investigative process, the goal is to answer the following questions regarding personalization in the beauty industry:

Q1: What are the drivers for consumer adoption of personalized solutions in the beauty industry?

Q2: What is it about the personalized solution that drives a consumer to take action?

To answer these questions, this thesis explores the inner workings of Revieve and the software utilized to provide personalized recommendations to the consumer via beauty brands. Through knowledge gained by studying Revieve, plus ability to research brands such as Walgreens and Naos made this experience possible. By researching Revieve, the thesis is able to discuss consumer behaviour, how age and demographic plays a role into the skincare market, and sustainability in the business.

The Research chapter explores the approach and methods for studying the number of companies involved, the data associated with that research, and how it helps to answer the research questions stated above. This chapter is crucial in explaining the data to drive us to the next chapter of drawing conclusions.

By deep diving into the company specifics and understanding how the beauty industry utilizes AI/AR personalization, the thesis is able to draw results and

discusses conclusive findings. Since the skincare and beauty industry is constantly changing, it is important to discuss validity and next steps as well.

1.3 Forms of mixed reality

The use of mixed realities has an extensive amount of influence in the world today, as their applications are visible at every turn in our media, education, and consumer products. Mixed realities have a long history and one of the most recognizable visualizations can be seen in Milgram (Milgram and Kishino 1994). As seen in Figure 1, Milgram and Kishino's reality virtuality continuum gives a visual look at the relationship between the mixed realities. Looking at it left to right, the real environment comes first, then augmented reality, then augmented virtuality, then finally virtual environment.

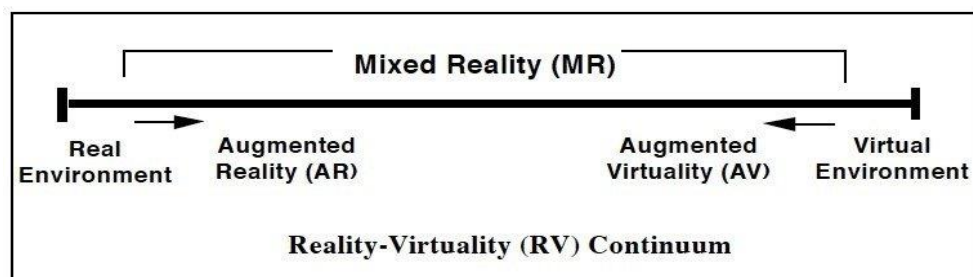


FIGURE 1. Milgram and Kishino's mixed reality on the reality-virtuality continuum. (Milgram and Kishino 1994)

AI and AR are very prominent in the skincare and beauty solutions, as they provide an extra layer of analysis and virtual try-on that allows the customer to make the best suited purchase possible. The broad term for “Artificial Intelligence (AI) is the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent being.” (Copeland 2020). It is the simulation of human intelligence processes by machines, especially computer systems. Specific applications of AI include expert systems, natural language processing and speech recognition.

Taking a deeper look at each of the of mixed reality is important in having a full understanding AI. In the context of this thesis, AI refers to:

Machine learning and algorithms used to analysis a consumers' selfie to either suggest makeup/beauty products for a user or determine what

skincare products are necessary in a person's regime based on their skin type, skin concerns, selfie and more.

This type of AI is beneficial in developing anti-aging regimes for the consumer.

Virtual Reality (VR) is a complete immersion in an experience that shuts out the physical world. Extended Reality (XR) is different still, as it is known to be the overarching term that includes AR, AV, and VR, which means AR is actually part of XR. These two technologies and terms are not discussed in depth further in this thesis.

Encyclopedia Britannica defines Augmented Reality as, "AR, in computer programming, a process of combining or "augmenting" video or photographic displays by overlaying the images with useful computer-generated data." (Hosch 2020). In the context of this thesis, we can define AR as:

Specifically holding the task of makeup and beauty product placement on the consumer's face digitally via desktop or mobile screen. AR differs than VR because AR adds digital elements to a live view as described earlier through methods of taking a selfie through desktop computer or mobile smartphone.

1.4 Beauty tech

It is clear that consumers as a whole are drawn to personalized solutions for their needs, so the purpose of this thesis is to dig deep into why adoption of personalized solutions in beauty is so strong. What consumer behaviour is the driving force behind these actions? Beauty Tech is the technology at hand that will allow us to answer those questions.

The beauty industry has performed steadfastly well throughout time and differs greatly from other consumer sectors. The beauty industry is able to engage consumers of all races, ages, and from beauty aficionados to new beauty product advocates. As more technology, such as skin scanning tools become it to the mainstream, it will make it much easier for brands to engage new consumers. As seen in Appendix 1 visualizations (Deloitte Research 2015), 10% of consumers are shown to purchase personalized beauty products in 2018.

Many companies are developing platforms that integrate technology into the beauty and skincare market in this current age. They are pursuing "a better

customer experience through the combination of data and personalization” (BeautyTech.jp 2018). Top companies such as L’Oreal, Unilever, Estee Lauder, P&G, COTY and Shiseido have all adopted new methods that incorporate AR, AI and even VR to be market leaders. With this need for Beauty Tech, there has been an increase in start-ups jumping to the challenge and providing the solution for these companies. The one company that this thesis explores on a deeper level is called Revieve.

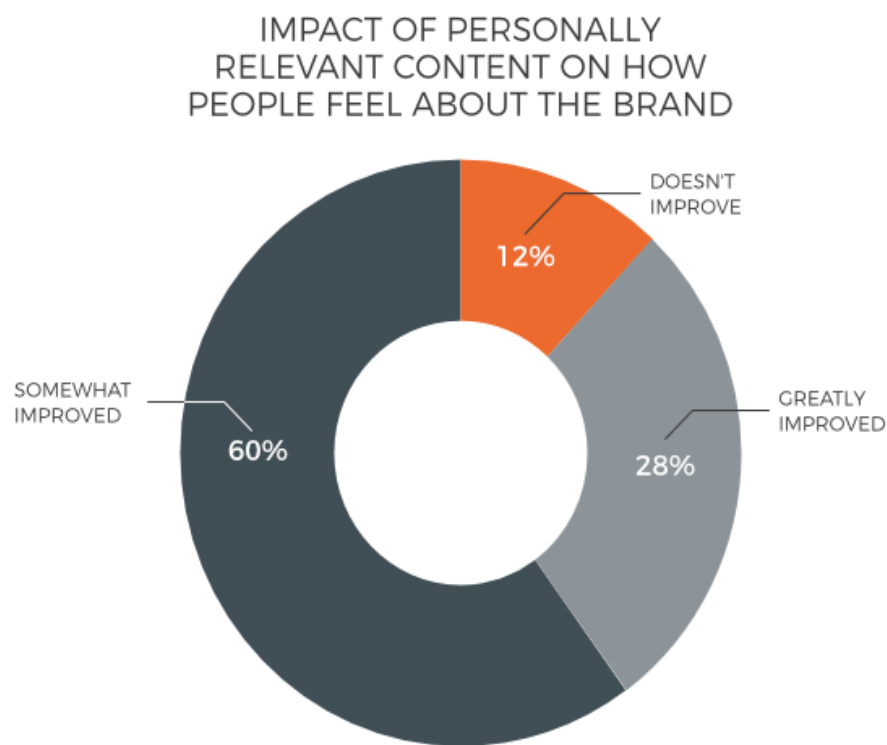
In the modern age, consumers are spending much of their time browsing online through smartphones and desktop. Since such enormous numbers of individuals are online, Beauty Tech is the perfect way for the skincare industry to stay relevant in a saturated consumer society. It allows users to experience and find new skincare and makeup products that they otherwise may have missed in their daily lives. Technology is now changing the definition of beauty and how the everyday consumer interacts with it since these new digital tech services are bringing solutions to our fingertips.

Beauty Tech is allowing data and AI to bring new types of personalisation and customization to the consumer. Companies are loading their websites, point of sale apps with these services and increasing the intimacy of their relationship with the consumer. The idea is for the consumer to feel that a certain company knows their needs and provides them with the perfect product. Data shows that online search demand for apps and new Beauty Tech has been consistent, which means it has opportunity to be explored further (Vanzella, Cynthia 2019).

2 PERSONALIZATION AS A SERVICE

This section describes what personalization is and how AI and AR play a role in that. Previous research has shown that with correct marketing techniques and new services offered, personalized recommendations in the beauty space has done well. Personalization within consumerism and retail, specifically beauty retail requires methods on filtering out the onslaught of information and deciphering what is right for that person. Personalization is key in that. According to Gartner, personalization is “a process that creates a relevant, individualized interaction between two parties designed to enhance the experience of the recipient” (George, Sharon 2017).

Humans have an innate nature for the need to be in control. This type of control is what draws the consumer to purchasing products specifically catered or made for them. This is the reason brands take steps to connect us and offer personalized “choices”. As seen in Figure 2 (One Spot 2017), studies have shown that consumers have an improved brand perception if the content is relevant to them and their interests.



Source: OneSpot

FIGURE 2. 2017 is the year of content personalization (One Spot 2017)

“It is clear that organizations and businesses choose personalization for a number of reasons” (Revee 2020). It has the potential to increase engagement, drive conversions, grow loyalty, and improve Key Performance Indicators (KPI). More importantly, customers have become dependent on personalization and even expect it in new businesses. For example, Spotify and Netflix have imposed seamless personalization techniques on watchers and listeners, so that a customer may feel they cannot live without it. The main takeaway is customers feel valued when tailor made experiences are available to them and given the option to participate.

2.1 Benefits of personalization

Studies conducted in the science and technology field have concluded the substantial benefit of personalization for the end-user and service provider on the basis of personalization (Zanker M. 2010). It is important to choose the right evaluation method for personalized web-based applications (including beauty), identifying the different techniques, target markets and dependencies. “Personalization has been shown to improve the large number of outcomes in services including satisfaction, loyalty, efficiency, purchase motivation, brand familiarity and others. Research has shown that there is a large consumer appetite for more personalization of products and services” (Revee 2019). Personalization provides opportunities for brands to differentiate themselves on the purchasing experience and efficiency when navigating the retail world.

This personalization gives an insight in the plethora of health, wellness and beauty in today's market. New platforms and experiences are always emerging to enhance the experience. A shift in brand focus has seen that a prioritization of health and wellness goals have shifted product sales worldwide (Schmidt 2020). Cosmetics that purely suit cosmetic purposes have fallen to the wayside as health focus has taken precedence, with more face masks, moisturizers and cleansers hitting the market. Since health is such a massive selling point, that means that personalization is key in businesses being profitable. Consumers are increasingly only interested in purchasing organic, cruelty free and paraben free products, so businesses need to adapt to meet needs.

2.2 Personalization technology

Although there are many forms of personalization technology, for the purpose of this thesis we will focus mainly on Augmented Reality and Artificial Intelligence. For discussion sake and relevant background, here is a list of recognized forms of technology that enable personalization (Baier, Matthew 2019):

1. Web Content Management Platforms are evolving as the need to engage customers on deeper level is increased.
2. Voice activated technology such as Amazon Alexa or Google Home are helpful in creating personalized playlists, daily schedules and so forth.
3. Smart cars such as Tesla can drive themselves and stay on the road with the help of GPS, AI and cameras.
4. Augmented reality can be found in e-commerce retail sites such as Lacoste, where the customer can virtually try-on clothing.
5. Artificial intelligence is most commonly seen in global powerhouses such as Amazon, where AI can take customer data and make recommendations that reportedly make up 35% of sales.
6. Blockchain to create personalized identities as found in the World Food Program building retina scans for refugees to create virtual identities.
7. Access to conversational bots such as the ones on booking.com helps the customer reach their needs without having to talk to an actual person.

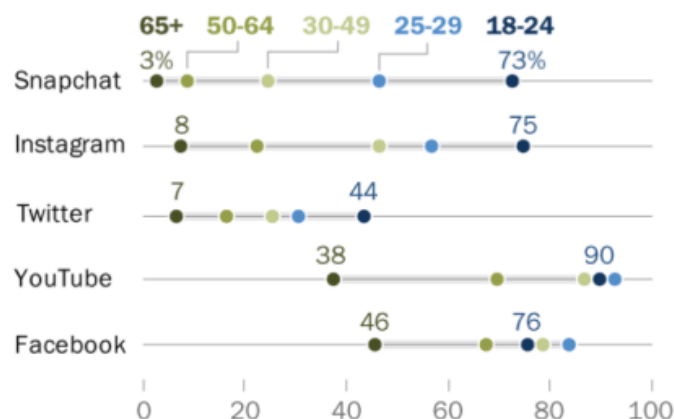
Selfie personalization technology that analyzes a user's face to suggest or implement some sort of alternate reality on that photo has taken over social media. A very recognizable example of AR can be attributed to Snapchat. Snapchat has a platform that allows a user to create multimedia messages, using a smartphone, referred to as "snaps". Then the user can then edit and write any message they desire before posting to their profile or sharing privately. In 2015, a new lens feature was introduced that allowed the user to add real-time effects into their snaps using face detection technology. Then a few years later, AR technology was integrated with 3D render elements that allowed the user to add elements into the scene they are filming. This also allowed the user to manipulate

their face using AR. It was outrageously popular, to the point that there were 158 million users by 2017 (mediakix.com 2016).

Over the past decade, technology that creates a sense of personalization has made its way into every form of content. The emergence of Snapchat is a prime example of personalized tech that utilizes AI and AR. Snapchat introduced filters that enables users to alter photos and visualize current location, speed, temperature, and even change your selfie completely with filters. The ‘face swap’ function and ability to apply filters to the face to appear like different animals and characters can all be classified as prime examples of personalized technology. The leading demographic using Snapchat was the younger generation, perhaps generation Z. As seen in FIGURE 3 (Kats, Rimma 2018), the largest user demographic for Snapchat and Instagram is ages 18-24.

Snapchat and Instagram are especially popular among 18- to 24-year-olds

% of U.S. adults in each age group who say they ever use ...



Note: Respondents who did not give an answer are not shown.
Source: Survey conducted Jan. 8-Feb. 7, 2019.

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FIGURE 3. Snapchat and Instagram are especially popular among 18-to-24-year-olds (Kats, Rimma 2018)

2.3 Personalization in retail

A significant shift in retail has evolved to showcase the social construct of interaction between retail and their customers to be a great bar-setter of customer satisfaction. Simply put, the customer's word is more valuable now and retail has adapted to meet consumer demand. A major focus for retail as a whole has been personalization, along with clean beauty and the growth of e-commerce (Fine 2019).

As seen in FIGURE 4, the personalization spectrum incorporates curated products for consumers, customized products and bespoke products.

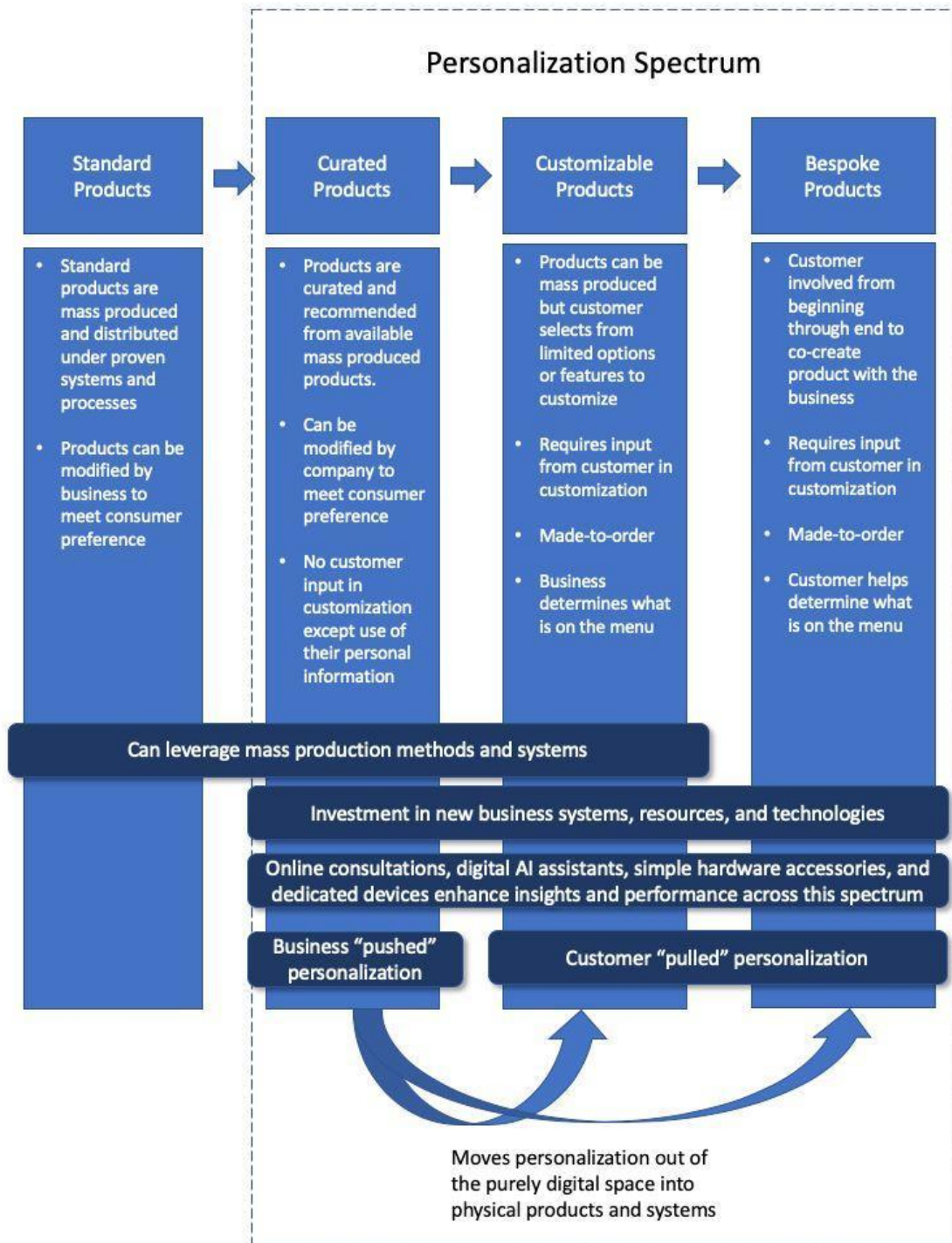


FIGURE 4. Personalization spectrum (Cambridge Consultants 2019)

Curated products are based around customer data and modifications to mass produced inventory. Customizable products can be mass produced as well, but the consumer has the option to pick options, usually limited. A great example of this type of personalization is Nike ID because the consumer is limited to only a number of shoes, colourways and overall options. The consumer is in a way “in charge” but restrained by the brand ultimately. Bespoke products are for the most

part custom ordered and require involvement from the customer from day one. These types of products are unique and one of one.

In regard to this thesis and skincare, we mostly focus on curated products. The company we are studying, Revieve, utilizes technology to curated products to the consumer that specifically suite their needs. Other companies do exist that focus more on the customizable and bespoke products through development of smart serums and lotions.

Personalization is great for retailers because it helps to provide product that the consumer wants and will purchase. If no tracking or personalization was done, certain retail establishments have the potential to fail or not meet quota. When we speak about retail, we are talking both e-commerce and brick and mortar. For the supplier, value gain can come in the form of knowledge enhancement and improved customer satisfaction. (Lee & Park, 2009). Knowledge enhancement can be done through surveys, email campaigns and even adding digital devices into the brick and mortar storefront. “Retailers are then able to better observe customer behaviour, to collect customer data, their need and provide personalized services. This personalization may provide additional value for customers but may also lead to privacy concerns” (Wetzlinger, Werner 2017).

Beauty commerce has evolved to become an experience focused on independent businesses. Consumers’ are looking for engagement, convenience and ease. Since the customer journey is non-linear, there needs to be some consistency across channels (Revieve 2019). Future success relies on the beauty experience following customers across channels and touchpoints. Since beauty is one of the most personal verticals of retail, customers expect to be served on a personalized level each time they interact with a brand.

2.4 Opportunities for the consumer in beauty tech

A skin care routine or regime is the process of taking care of ones’ skin. This process is important to the health of a person and to provide comfort in their daily life. The opportunity for the consumer lies in having a system or institution giving them suggestions on how to take care of their skin, plus the difference in routines and the needs of different skin types (Noorhuzaimi 2018). Potential value and opportunity can be measured by the time and money saved by using a personalized skincare solution instead of doing research and trial and error type purchase behaviour. Personalization gives the consumer a sense of control and

engagement that they would not normally see day-to-day. Assurance that this product is the best possible product for them and address their concerns is where personalization carries validity.

The average consumer is most likely targeted with ads for products and services on a daily basis if they use the internet and social media. Beauty Tech provides a solution to the consumers' needs that other services do not. Beauty Tech provides solutions based on data that only pertains to that one individual. The idea is that the consumer has the ability to have skincare products that work perfectly with their skin type and daily life. Instead of a targeted ad about a blouse that may look nice on that person, Beauty Tech can provide recommendations that will create the change and effect that individual is looking for.

2.5 Opportunities for beauty brands

Creating a successful service is one accomplishment but measuring that success and building on it is extremely valuable. A service provider or brand can measure success by with the following metrics: increase in time on site, increase in number of page views and increase in average basket size. The methods of measurement can be defined through monitoring a Google Analytics dashboard seen in Figure 5, where segments have been broken out to monitor:

- consumers time on website
- number of page views
- website conversion
- average shopping basket size

This helps to differentiate for people who use the personalization software vs people who visit the website but do not use the software. Being able to view this information is extremely important for brands in becoming or continuing to be successful.

Country branded beauty products very important for beauty brands are designing their marketing plan. Korean beauty has been a 'hotspot' for a long while now and have let the way in the 10-step regime. Analysts have also noted that other beauty hotspots include Scandinavia, Australia, and Japan (Schmidt 2020). There is a huge opportunity here for the brand because consumers will

merely purchase products based on the fact that they are from one of those countries. A very powerful quote on the key to brands understanding the consumer comes from L'Oreal CEO Jean-Paul Agon, "Consumers will be always looking for something extra in terms of performance and results. They will not compromise on quality, efficacy, security, and sincerity" (Tan 2017).

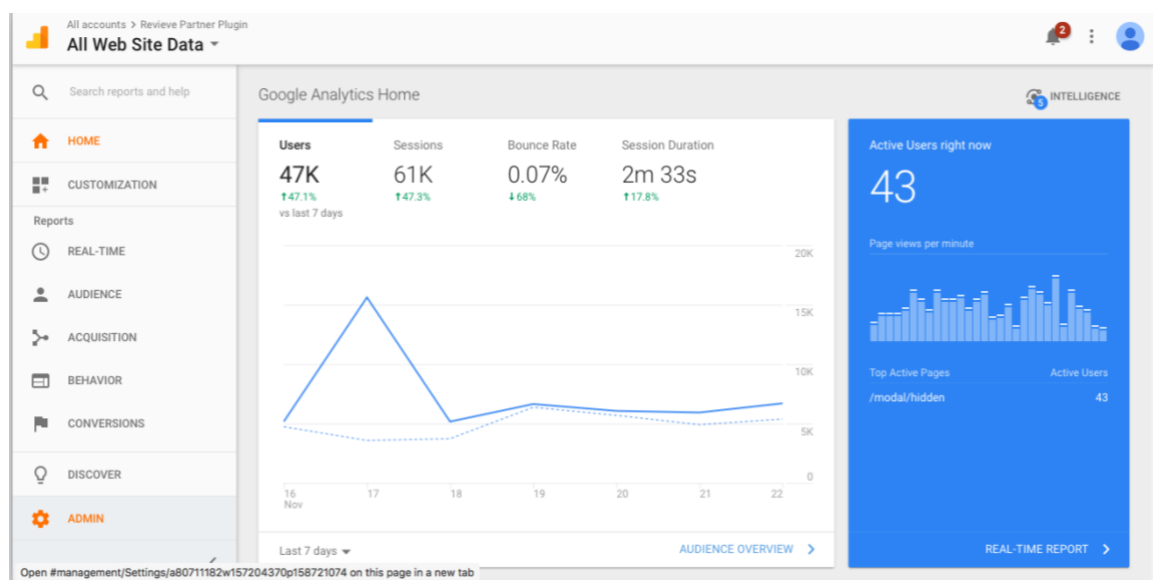


FIGURE 5. Example of Google Analytics dashboard (Reveie 2019)

2.6 Revolutionizing the Skincare Experience using AI/AR

The beauty industry has been revolutionized through technology, specifically AI and AR. It has brought ground-breaking innovation by allowing the consumer to have personalized formulas and leaving the generic products to the past. AI has given companies the ability to know their consumer on a deeper level and market in a way that was unattainable in the past. The ease of purchasing has also been increased.

AI and AR driven skin analysis platforms have taken the role of professional dermatologist and allowed consumers to receive recommendations in the comfort of their own home. Facial skin scans and virtual makeup try-on has revolutionized the consumer skincare purchasing experience. The ability to try-on make-up and find foundations that match a person's skin tone though AR technology. AI and AR have given consumers the ability to use thousands of data points and algorithms for assistance on making basic skincare purchases. Brands are continuously diversifying to stay relevant and must keep customers engaged by

utilizing new forms of technology. As Celine Pannuti, the Head of European Consumer Goods Research said, “At the heart of it, the beauty industry is a business of personal advice and technology is just enabling this. So, what you see from tutorials to targeted content, augmented reality, or even personalization of products – all enabled by digitalization – has really been an accelerator for the industry” (J.P. Morgan 2019). Pannuti touches an important aspect. The industry has been accelerated and reached new levels with the influx of technology.

2.7 Link between self-esteem and skincare

Cystic acne and other skin issues affects a large majority of the world's population, specifically affecting self-esteem and the way a person views themselves. Researches from Tagore Medical College and Hospital assessed the impact of acne on the various psychosocial domains of daily life and concluded that the impact of acne and its sequelae was shown on emotions, daily activities, social activities, study/work, and interpersonal relationships (Hazarika 2016). The result concluded that the location of the acne was also highly significant, specifically people with facial acne feeling more self-conscious, given that the face is what others usually see first.

With skin concerns having such a massive link to self-esteem and self-confidence, it is important to have a skincare regime that is suitable for that individual. Studies have even shown that skin conditions can even lead to avoidance of social interaction. Individuals will not attend events and gatherings based on their skin issues, such as breakouts and acne flare ups. It can even affect work, school and other day-to-day activities. Everyone's skincare routine is different, as is each person's skin and needs are different. That is why personalization in beauty tech and the skincare industry has gotten so massive, it has the support of information and data to provide accurate results in real time. This eliminates much of the trial and error techniques used in that past and helps to provide means to people having a better self-image and higher self-esteem. Along with a proper skincare routine, it is important for individuals to follow best life practices as well such as, staying hydrated, balanced diet, exercise, and sleep (Ahuja, Aashna 2018).

2.8 Anti-aging

The constant search for longevity is nothing new. Literature proves that people have been focused on the search for the fountain of youth for hundreds of years. From the 16th century to the 18th century, medical professionals and researchers worked to extend to the lives and vitality of the elderly, as they believed that the aging process could be slowed as people deteriorated. From the 19th to the 20th century, anti-aging obsessives regarded as old age as something to be feared (Haber, Carole 2004). They devised methods that morphed into anti-aging creams, hair dyes, sun creams, plastic surgery, and injections to marginalize the effects and outer appearance of growing old. The stigma of growing old has become to plague the consumer into perceiving that it's not right and should be avoided at all costs. Measures such as supplementing with human growth hormone (HGH) has even been known to be used by men in hope of reversing the aging effect.

The anti-aging movement is a social movement that focuses on reducing or eliminating the effects of aging. Beyond extreme medical measures, the consumer can adopt skincare regimes and methods to assist in finding the mythical fountain of youth. Antiaging effects is a major driver in the consumer adopting unique personalization regimes in skincare routines. The main focus around anti-aging in present day have revolved around skin health and preventing more or future damage. This skin damage can present itself in many forms, but the most important aspect to finding this so-called fountain of youth is lifestyle (Felton, Kathleen 2018). The key to looking younger can be attributed to using UV protection, diet, sleep, not smoking, exercise, reducing stress, skincare regimes, h20 consumption, and limited alcohol consumption. The anti-aging phenomenon plays greatly into consumer behaviour and personalization in the skincare industry.

2.9 Consumer behaviour

Consumer decision making and behavior has been a topic of interest for researchers, academics and brands for a very long time. About 300 years ago, early economist began doing research and examining the basics of consumer

behavior and building theories (Richarme 2007). The most prominent model that materialized out of this research is the 'Utility Theory', which put forth the idea that the consumer makes choices based off their own goals and what is best for them. The theory investigates people's preferences or values with assumptions about a person's preferences that allows them to be represented in numerical ways. It is a self-centered approach that shows people as a whole make decision on what they expect or want the outcome to be (Fishburn 1968).

An understanding of consumer behavior and overall need is important for businesses when setting up their marketing and sales plan, especially e-commerce. "How can consumer behaviour research help Internet marketers increase their chances of success? Marketers have long argued that the marketing concept is the appropriate philosophy for conducting business. Simply stated, the marketing concept suggests an organization should satisfy consumer needs and wants to make profits" (Peter & Olson 2010). Businesses and entrepreneurs have a need to understand the market in order to make profits. Consumer behavior follows trends, but with the emergence of consumer obsession with personalization, there is even a greater need to businesses to cater accordingly.

The model in Figure 6 represents the information flow which includes elements such as intention, attitudes, comprehension, and attention. This historic chart displaying the way in which consumers interact is important to understanding how consumer decisions may impact a business. It shows that factors such as importance of purchase, personality value, social class, time pressure, and financial status can all contribute to factors in the buying process, so it will ultimately control the output and end result. The Theory of Buying behavior is something that has been around for many years and still holds importance when studying the consumer.

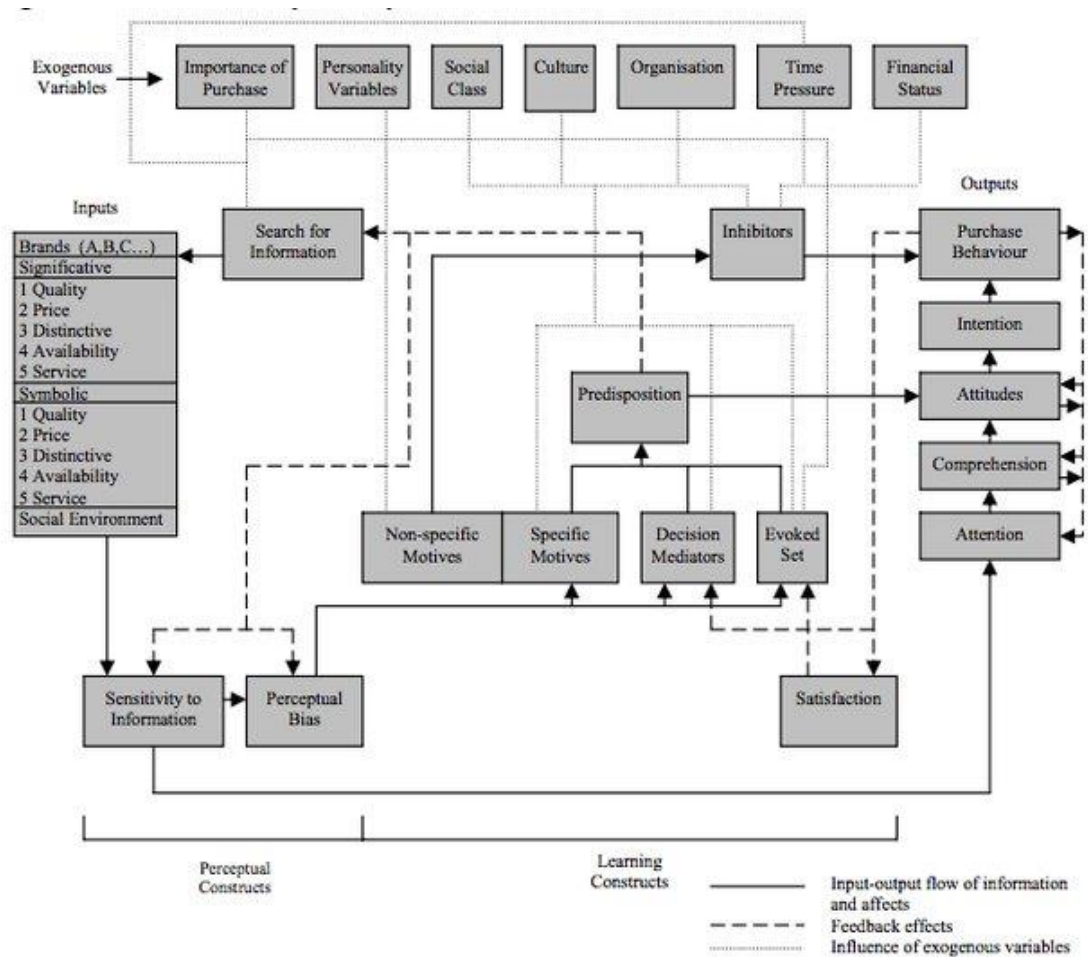


FIGURE 6. The theory of buyer behavior (Howard and Sheth 1969)

This area of discussion is extremely complex and intricate, though provides great insight into how to grow a successful business model. Consumer behavior involves the fields of economics, psychology, marketing, sociology, technology, and trends, but continuing to study and update theories will help to better understand consumer decision making. Being conscious of region and country is also very important. For example, consumer behavior differs in urban consumer than that of rural consumers because the rural consumer tends to be more conservative and more price sensitive, but the urban consumer tends to have more luxurious spending habits but can differ depending on upbringing. Personalization has an import role to play in consumer behavior, as it can cater to any price group and any accommodate demographic differences.

Though it's a globally limited representation of male consumers in Thailand, Figure 7 (Nuntasaree 2009) does an excellent job in displaying the different steps in consumer behavior process. It shows that the consumers beliefs in product

attributes and self-image both have a role to play when influenced into making the initiative to purchase products.

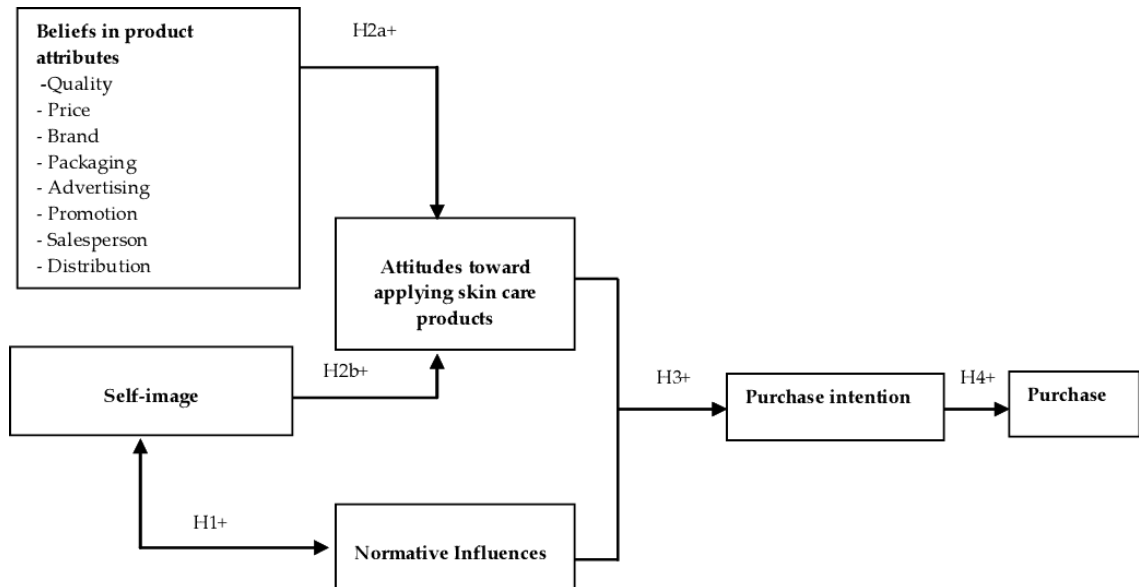


FIGURE 7. The conceptual model of male consumer behaviour in buying skin care products (Nuntasaree 2009)

Consumer research has shown that because skincare regimes and techniques require more research and development, customers will stay loyal to the larger brands rather than switching to a new, up and coming brands. Figure 8 portrays how the skincare is growing faster than the makeup industry year-over-year and that can be attributed to technology. From this information, it is easy to deduce that growth in skincare purchasing in the next few years is bound to happen. On top of that, consumers have been studied had shown to have an

overall 30% interest in personalized beauty products (Deloitte Research 2015, Appendix 1.)

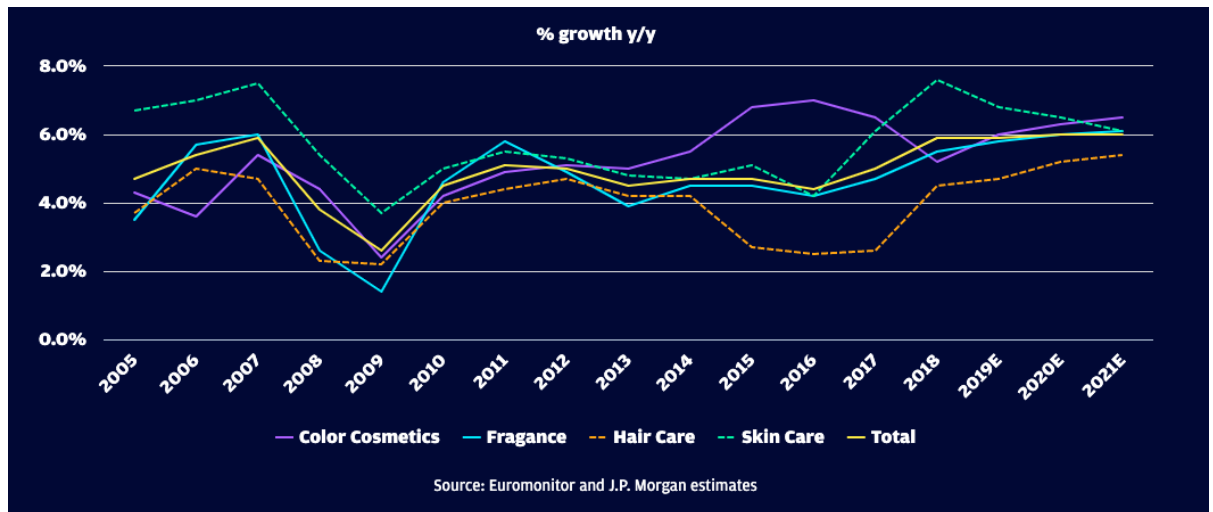


FIGURE 8. Skincare is now growing faster than makeup, as the selfie generation grows up (J. P. Morgan 2019)

2.10 Sustainability: personalization in the future

Sustainability is a very broad term in 2020 and can be associated with a number of definitions, but for research purposes we are looking at the sustainability surrounding personalization. As said in the Median article (Dand 2019), “In general, sustainability is thought to encompass well-being along three dimensions — environmental, social, and economic. But of course, there are a lot of conflicts of interest between those three dimensions and it’s naïve to expect simple ‘win-win-win’ situations. Moreover, you can criticize this definition as ‘anthropocentric’ — it centres on current and future generations of *humans*; the well-being of the environment has no intrinsic value-” (Baur 2019). We have come the assumption that personalization is sustainable because consumer spend on unnecessary products is minimized, travel to and from a brick and mortar store potentially is eliminated, and there is the possibility for businesses to cut back on marketing spend. All of this can cut down on carbon footprint and help contribute to more sustainable business methods.

There are other questions we may ask to gain a better understanding of sustainability. Will the personalization obsession last? Will retailers continue to cater to the consumer and their needs? This world is clearly not something out of a science fiction movie, so the answer is yes. Personalization will continue to

morph and grow, but it is not going anywhere. We are living in a society that allows us to be unique and have our own voice, so in a sense the concept of personalization in retail, specifically beauty is sustainable.

2.11 Waste and consumerism

The interesting aspect about the beauty industry, specifically skincare, is the amount of waste and consumerism at hand. “Globally, the packaging industry for beauty and personal care products, which primarily reflects plastic packaging, makes up nearly \$25 billion in sales” (Borunda, Alejandra 2019). Mass amounts of marketing informs the consumer that they need to purchase a vast amount of skincare products to have healthy skin, but the answer may lie in personalization with the help of AI/AR. A more sustainable future that reduces waste can provide the perfect high-end product for the consumer that is more sustainability oriented and limit the number of items needed. By reducing the number of products needed, it reduces the amount of plastic used.

3 CASE STUDY: REVIEVE

Revieve is a software start-up that originated out of Helsinki Finland and they have focused on creating an AI-driven beauty personalization platform that assists cosmetic brands and retailers. This AI driven software is helpful to the businesses in order to drive revenue and improve the customer experience. As physical retail stores specializing in cosmetics around the world shut down due to increase of e-commerce, Revieve's solution is increasingly important for driving sales online. Revieve is able to work with partners to closely track usage data and optimize their solution over time.

Revieve began with the goal of helping brands and retailers provide a hyper-personal customer experience for their beauty consumers (Parkkinen 2019). Working with the brand to provide a valuable customer experience in purchasing products, while providing tangible data is the goal. They currently only focus on digital beauty only, which includes skincare and makeup, work with customers across four continents and have offices in Finland, USA and Spain.

Revieve offers modular solutions where different specifics can be leveraged separately or together to build advanced beauty advisors for beauty personalization. The consumer must participate in a number of data driven questions and a selfie skin analysis to acquire the AI-powered recommendation. A number of Revieve's clients have also adopted an augmented reality virtual make-up try-on solution, which is currently under development.

Figure 9 (Revieve 2019) illustrates the process of using Revieve's tech in order to generate skincare recommendations and the ability to track your skin score. The user flow begins with the user answering a number of questions revolving around skin type, gender, age, skin concerns, and then taking a selfie that analyses the face to produce skincare product recommendations.

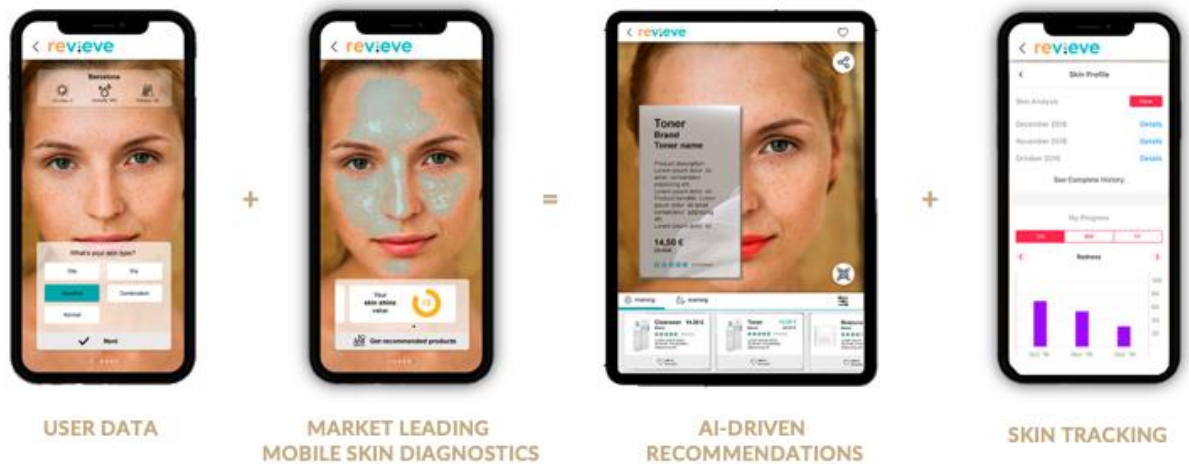


FIGURE 9. Reviewe user flow (Reviewe 2019)

Reviewe offers potential clients a Digital Skincare Advisor solution and Digital Makeup Advisor that rely on Computer-Vision Application Programming Interface (API). Product Recommendation API is based on logic and algorithms that was developed in order to provide the most accurate recommendation possible. The Digital Skincare Advisor plugin is a template that the client can change, but to have a fully customized solution, a Software Development Kit (SDK) must be purchased. This can be built for e-commerce, web, mobile, and in-store use, which is discussed in more detail in the next section.

3.1 Recommendation system

As discussed in the previous section, the user flow directly affects the product recommendation system on Reviewe's software. The system is based on the user choosing their gender, skin type, skin concerns and taking a selfie for analysis. This will result in a number of products being recommended to the user based on the criteria selected and found. Products are based on the product feed that the client specifies and provides, with the products being enriched to incorporate appropriate attributes so the recommendation is accurate as possible. For example, a product's attributes could be for sensitive skin, female, evening, and paraben free. With such precise attributes and questions, the user will have recommendations that suite their needs exactly. Figure 10 displays a visual representation of the information needed to be input into the system for the

recommendations to work correctly. For users to receive the most accurate recommendations possible, all data inputs should be accurate as possible as well.

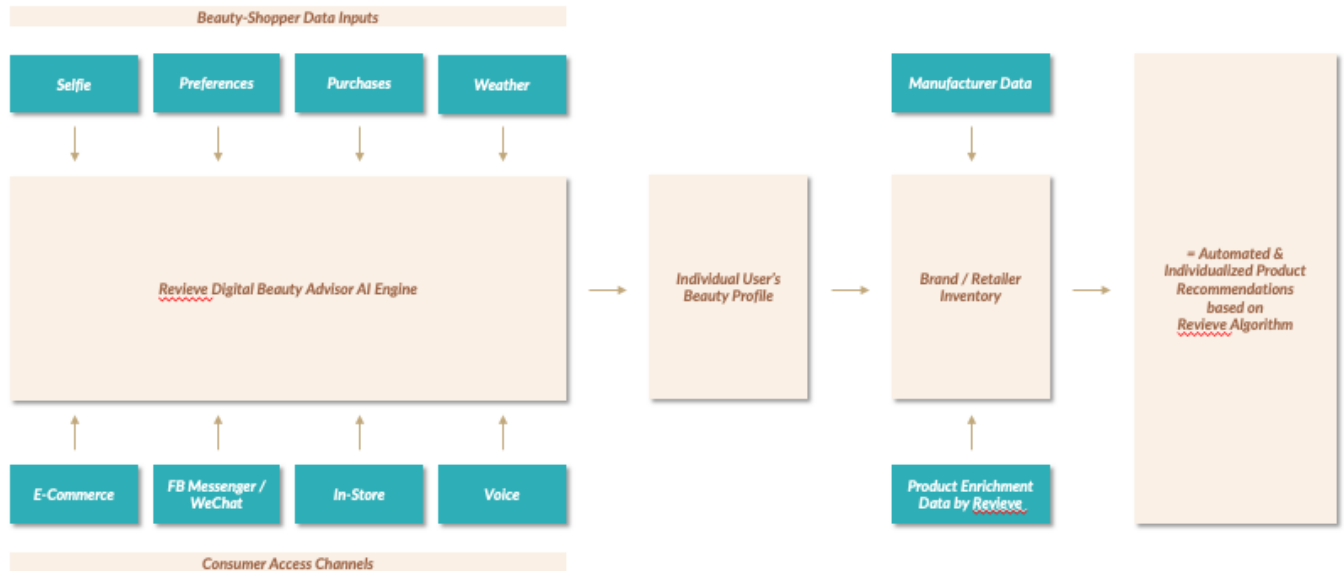


FIGURE 10. Revieve – single recommendation engine for all channels (Revieve 2019)

3.2 Computer vision

Revieve's Selfie Skin Analysis is an automated computer-vision system trained using an extensive data set of images to uncover and measure over 80 different metrics from the user's face. The proprietary computer-vision technology used by Revieve consists of several dozens of different algorithms specifically trained and designed to analyze distinct skincare and beauty-related facial features from specific areas of the user's face. In addition, Revieve's computer-vision solution is trained to provide real-time feedback to the user about the quality considerations present in their selfie, including information about inadequate lighting conditions, the presence of eyeglasses as well as the incorrect positioning of the users' face. The multi-step process used Revieve's computer-vision solution in preparation for analyze the users' selfie consists of the following steps:

- Landmark Point Extraction
- Colour and lighting balance normalization
- Face division into smaller, distinct facial areas

In order for Revieve to provide accurate recommendations and analysis, they developed in house tech that was able measure 80+ different metrics from a user's face. This was done by analyzing over 30,000 data set images. Dozens of different algorithms were developed, specifically trained and designed to analyze distinct skincare and beauty-related facial features from specific areas of the user's face (Revieve 2019).

This solution Revieve developed focuses on the capability for in-depth analysis of mobile quality selfies that the user takes, which in turn will deliver accurate results. Evaluation of this tech was done by a multitude of initial customers that helped to improve accuracy and analysis scores. These scores were compared with leading dermatologist solutions such as VISIA Complexion Analysis. This tech is compatible with any smartphone or tablet across any operating platform.

The CV capabilities are built on advanced machine and deep learning methods as well as statistical modelling. Measures are built and calibrated statistically based on a natural data sample. Meaning: "we set the system up to measure tens of thousands of photos and look at the outcome for a measure. This result is then further analyzing to result in the final sample-dependent relative score (Revieve 2019)." Simply put, 0.5 is close to the median or the middle normal value. "1.0 would be the maximum observed score in the sample. Validation of the measure algorithm itself is based on lower level technical characteristics of the algorithm" (Revieve 2019).

3.3 Software accuracy, capabilities and implementation

Revieve's selfie analysis solution is dependent on correct lighting, colour balance, face orientation and consumer guidance. The analysis is capable of putting a value to wrinkles/facial lines, eyebags, dark circles, hyperpigmentation, redness, skin texture, skin radiance, skin shininess, acne, skin tone and firmness. As we see in Figure 11 (Revieve 2020), a value is attached to each of these specific areas after the analysis is done. These values help to determine if that

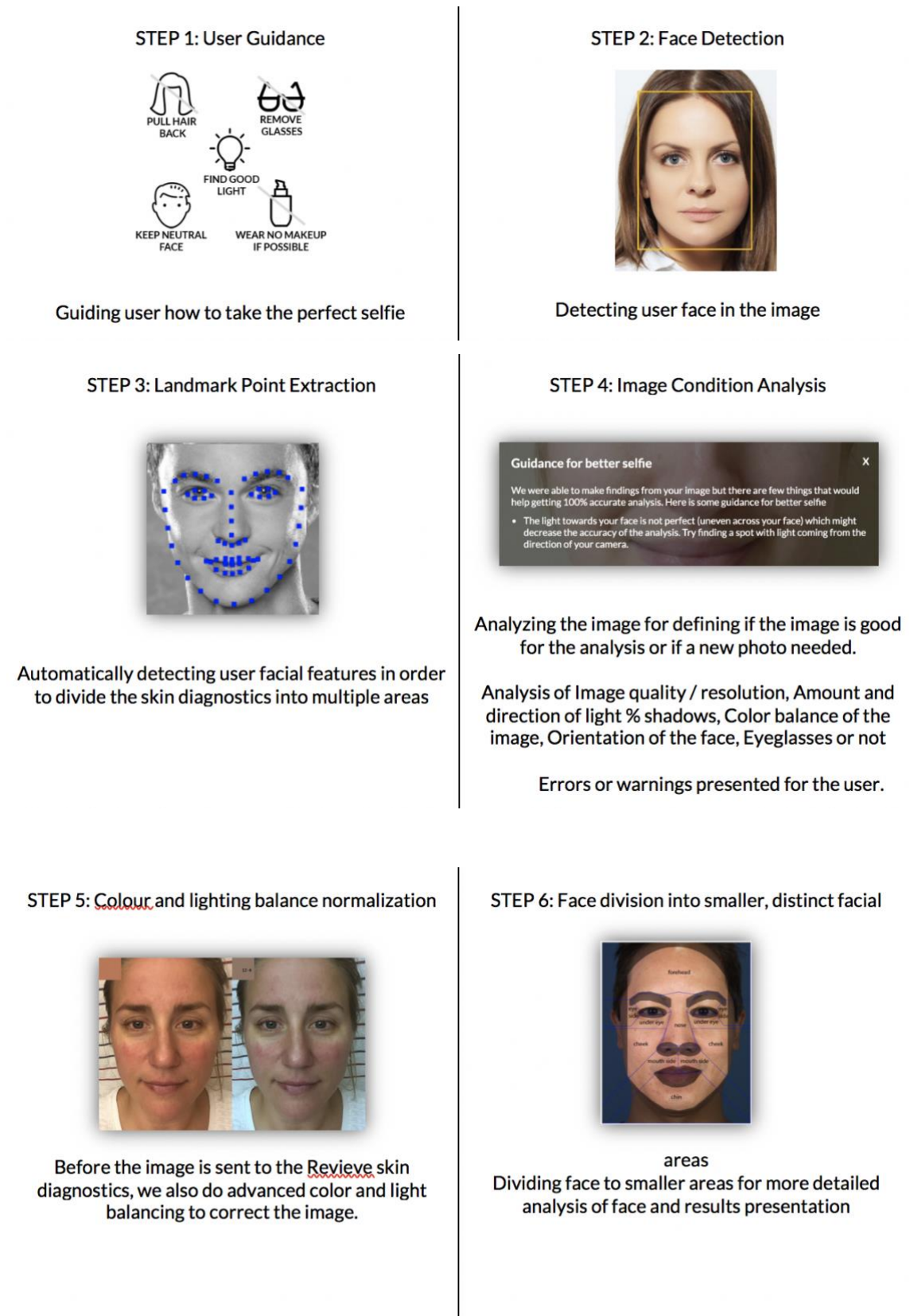


FIGURE 12. Selfie analysis process (Revieve 2020)

Most selfie analysis solutions use manually tagged images as a training-set of data for their algorithms. Revieve has decided to go a different route to combine computer-vision algorithms with statistical methods used in

mathematics to calculate the results of the CV-Analysis (Revieve 2020). See Figure 13 for a visualization on where the range of values per image land. As we can see, 95.44% of images have values between .25 and .75. This helps in creating an algorithm that has useful information included in the database. As a concrete example for wrinkles, most users don't have a completely wrinkle-free face and don't have their face entirely covered in wrinkles either. When there are a collection of images, they form a mathematical value as seen on the curve. The Y axis is the number of images and the x axis shows the value of measurement.

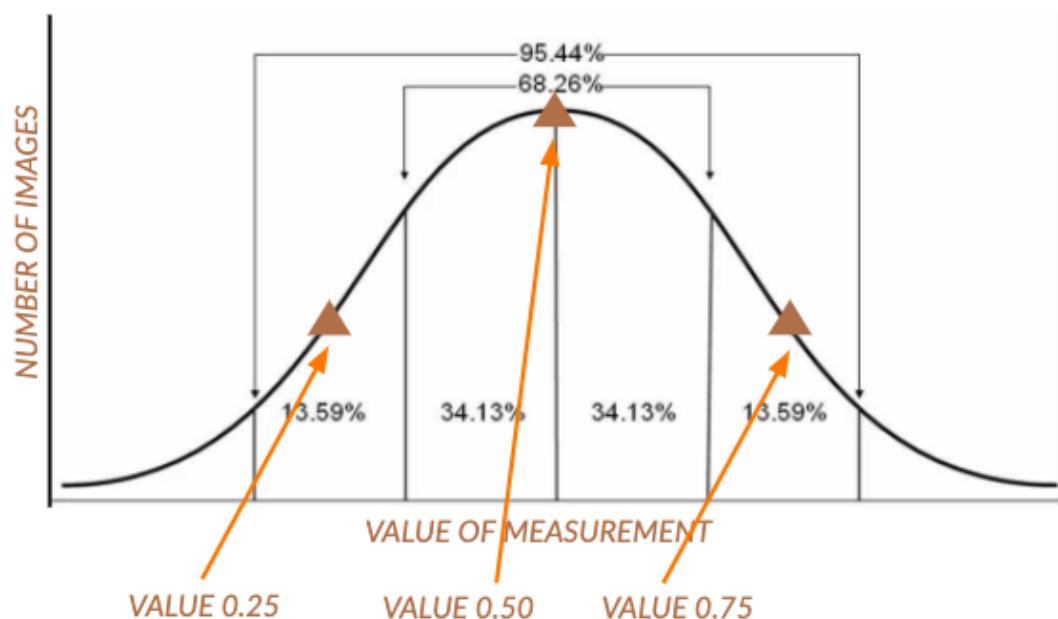


FIGURE 13. Image analysis visualization (Revieve 2020)

As the company progresses and continues to push boundaries, so does the tech. As of April 2020, Revieve is perfecting virtual makeup try-on capabilities. This will use AI and AR to scan the users face and apply lipstick, eyeliner, blush, and many other others. The virtual try-on experience will be web-based, Javascript based solutions, and the products / colours will be requested by the brand. The virtual try-on will have adaptive lighting technology, which focuses on mostly on eyes and lips. The goal is to provide spot on accuracy for consumers to view their skin health, receive personalized product recommendations and also try-on various make-up products.

3.4 Virtual try-on

Currently Revieve is in the final development phase of the makeup offering. There are five distinct makeup offerings they will focus on (Revieve 2020):

- Digital Makeup Advisor: A guided, personalized customer-experience combining a questionnaire, skin analysis (for makeup-related factors) and product recommendations. Leverages the same structure and features as Digital Skincare Advisor.
- Multi-Category Virtual Try-On (VTO): A Virtual Try-On solution to enable the live video try-on of multiple products at once, entire looks, or enabling the experience for products on a category-level.
- Managed Product Page Virtual Try-On: A Virtual Try-On solution for a single product on the product page with product data managed by Revieve
- Standalone Product Page Virtual Try-On: A Virtual Try-On solution for a single product on the product page with product data managed by customer.
- Foundation Matching: Questionnaire + skin analysis to match user to best recommended foundation (including try-on)

The Virtual Try-On gives the ability for the end consumer to experience the products virtually with any device, any channel, either for a single product or a full look. Revieve's goal is to provide customers with a VTO-offering that is good enough for many small, medium and some enterprise customers to accept as standalone or as part of overall personalization offering. Revieve's approach is an in-house live-video Virtual Try-On with third party facial feature tracking library complemented by specific non-core assets that may be sourced from outside. Sampo Parkkinen is quoted as saying "Our virtual try-on capabilities will not be competing to be the most realistic on the market, but a good enough. If you're looking for the world's best virtual try-on, go to Perfect Corp. But if you're looking to personalize the customer-experience for your beauty-consumers and provide them with value that produces results, we should talk" (Parkkinen 2020). This AR technology allows the consumer to purchase skincare and makeup products from anywhere they choose.

To give businesses a chance to see if Revieve is the right choice for them and their customer base, there are demos available to try:

Makeup Digital Skincare Advisor

- Effectively a makeup version of the skincare advisor
- [LINK](#)

Multi-Category Virtual Try-On

- All features available on the product recommendation page of the advisor–solution
- [LINK](#)

Product Page Virtual Try-On (Managed / Standalone)

- All features available on the product recommendation page of the advisor-solution
- [LINK](#)

Foundation Matching

- All features available in the Advisor –solution
- [LINK](#)

3.5 Tangible business results

Benefits of Revieve’s Digital Beauty Advisor can be categorized under “Improved effectiveness of marketing spend” and ‘drive customer life-time value” (Revieve 2019). The idea is to minimize the consumers use of third-party review sites, YouTube or social media after the solution has brought them to the company site. Leveraging individual insights shared by the consumer and drive post-purchase engagement, plus create brand loyalty is the goal. “The Digital Beauty Advisory has been attributed to a 3-4x conversion among customers using the solution and 20-30% basket size increase” (Parkkinen 2019). In Figure 14, a chart showcasing the Digital Skincare Advisor Analytics data is displayed. It portrays the percentages for completion rate, navigated to product page and add-to-cart for consumers. Completion rate means how many users completed

the entire experience from beginning to end and received skincare recommendations. Navigated to product page means how many users click through to the product page via the skincare recommendation and add-to-cart rate means how many users actually add the products to their cart via the skincare advisor.

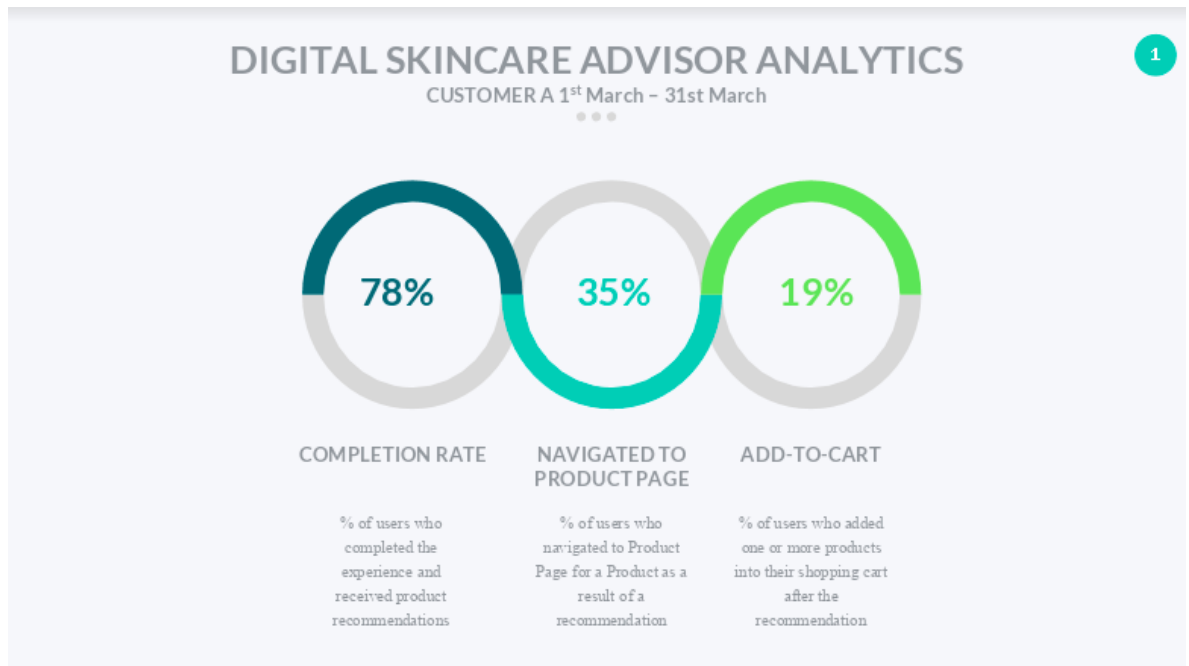


FIGURE 14. Digital skincare advisor analytics (Reveie 2019)

The goal of ensuring engagement to increase conversion is always top mind when implementing AI-driven personalization skincare solutions. The expected increase in e-commerce conversion, compared to regular e-commerce search and navigation, is 2-4x (Reveie 2019). The expected increase in average shopping basket size is 30%. In order to leverage the increase in conversion and transaction size to its fullest potential, proper marketing and implementation must be done on the company side.

3.6 Purchasing specifics

As discussed previously, Reveie's logic works accurately when the consumer selects their skin concerns, age, gender, location, and participates in a selfie analysis. The AI-driven selections are weighted and provide product results based on the logic implemented. The product feed provided by the brand will be input into the database and then regimes are built off category names. See

Figure 15 for an example of a skincare regime. This specific result regime will provide products for the user under 'Targeted Solutions', 'Daily Essentials', and recommended products. The user then has the choice to add-to-cart and purchase the products personalized for their regime.

```

3  [
4  {
5    name: 'targeted solutions',
6    configurations: {
7      skinType: {
8        dry: ['Cleanser', 'Toner', 'Serum', 'Moisturizer'],
9        oily: ['Exfoliator', 'Cleanser', 'Toner', 'Serum'],
10       combination: ['Exfoliator', 'Cleanser', 'Toner', 'Moisturizer'],
11       sensitive: ['Cleanser', 'Toner', 'Serum', 'Moisturizer']
12     },
13   },
14 },
15 {
16   name: 'daily essentials',
17   configurations: {
18     skinType: {
19       dry: ['Sunscreen', 'Cleanser', 'Toner', 'lotion', 'Night Cream'],
20       oily: ['Sunscreen', 'Cleanser', 'Toner', 'lotion', 'Moisturizer'],
21       combination: ['Sunscreen', 'Cleanser', 'Toner', 'lotion'],
22       sensitive: ['Sunscreen', 'Cleanser', 'Toner', 'lotion']
23     },
24   },
25 },
26 {
27   name: 'recommended products',
28   configurations: {
29     skinType: {
30       dry: ['Cleanser', 'Toner', 'Serum', 'Cream', 'Sunscreen'],
31       oily: ['Cleanser', 'Toner', 'Serum', 'Sunscreen'],
32       combination: ['Cleanser', 'Toner', 'Serum', 'Cream', 'Sunscreen'],
33       sensitive: ['Cleanser', 'Toner', 'Serum', 'Cream', 'Sunscreen']
34     },
35   },
36 }
37 ];

```

FIGURE 15. Revieve Skincare Recommendations Example (Revieve 2020)

Brands or retailers have the power to influence the recommendations in many ways. They can either provide Revieve with specific rules and regulations for recommending products based on what the consumer does in the experience or what we find from their selfie. They can also provide a list of brands or products

that they would like to have excluded or included in the experience. For example, if the brand or retailer was to provide preference to certain brands or products, there is a guarantee of those showing up before any others a potentially lift revenue under those products. This scenario could happen due to a sponsorship of some kind.

A customer may wonder if out-of-stock products may show up, but in order to make sure of that, a query is running every day on the product feed to make sure the list is up to date.

Best practices include having a banner or launch button on your landing page that ensures the customer is driven to the experience. It is also important for the brand to drive the consumer to the plugin through the category or product page.

Overall, Revieve provides a service that exceeds many of the competitors because it is holistic and covers all the bases. Next, this thesis goes into detail of the research conducted to answer the pending questions.

4 RESEARCH ON SKINCARE PERSONALIZATION

The research conducted within this thesis consisted of quantitative research, qualitative research, user experience, and testimonials. The idea was to explore different methods of research in order to get a conclusive understanding of personalization in the beauty industry using AI and AR.

The previous chapter went into detail on Revieve and the specifics revolving the technology. This chapter explains the research methods used to achieve findings in response to the posed questions:

Q1: What are the drivers for consumer adoption of personalized solutions in the beauty industry?

Q2: What is it about the personalized solution that drives a consumer to take action?

Clients associated with Revieve were leveraged in order to conduct appropriate research to answer these questions. These clients that agreed to be involved in the study are aware the information gained has the potential to assist Revieve in learning more about the consumer.

4.1 Approach and methods

The research approach began by implementing solutions for a number of customers, then having those clients track the success and metrics of user behaviour. The clients were also provided with a list of questions to answer, along with giving questionnaires to their customers. The purpose was to try and determine if the newly implemented plugin that provided the option to have a highly personalized skincare regime was successful and drove consumers to spend more than usual. The intention was to get closer to key information that displayed what key factors were driving consumers to adopt a new personalized regime.

Additional methods used to retrieve data and information on the subject matter included reviewing scholarly articles written on the subject, interviewing Revieve's CEO and COO on the specifics of the business and conducting consumer research with the assistance of Skincare Advisor clients.

4.2 Participants

Client participants in the thesis study included the Revieve team, anonymous consumer studies and members from the following businesses:

- Walgreens
 - Walgreens is an American company based in Chicago, Illinois. It is the second largest pharmacy store chain in the United States and specializes in prescriptions, health and wellness products, health information, and photo services.
- Naos (Bioderma and Esthederm)
 - Naos is a skincare company that originated out of France but is positioned itself all over the world. They own skincare brands such as Bioderma and Esthederm. This thesis only discusses results and data associated with Naos Japan.
- Higher Education Skincare
 - Higher Education is based out of Newport Beach, California and is geared to treat patients between the ages 15 to 35. It is a smaller skincare brand that aims to help correct various skin conditions that affect people from Generation Z and Millennials.
- Pierre Fabre
 - Pierre Fabre is the second largest private pharmaceutical company in France.
- Murad
 - Murad is a clinical skincare brand that located in El Segundo, California. It has been providing expert backed skincare solutions for over 50 years.
- Nahdi
 - Nahdi is a Saudi Arabian retail pharmacy operating out of 125 cities and villages across the Kingdom.
- Shiseido
 - Shiseido is a Japanese multinational personal care company that specialises in skin care, hair care, cosmetics, and fragrance.
- Yon-ka

- Yon-ka is a French skincare company that mainly focuses on products with the aroma of plants and essential oils.

The intention was to increase chances of varied results since these businesses are headquartered across the globe in the following countries: USA, Japan, France and Saudi Arabia. As stated before, regional factors contribute heavily to consumer behaviour, so the intention was to gain insight into as many regions as possible.

4.3 Walgreens case study

Before diving too deep into the data collection and analysis, this thesis takes a look at one of largest establishments in the United States that was utilized for this study, Walgreens. Walgreens is a client of Revieve and provides great insight into customer base and skincare personalization.

The Walgreens SDK case is an in-store implementation that involves an employee assisting the customer by walking them through the personalization pilot via a hand-held tablet. This experience was implemented with the goal of driving in store sales, skincare awareness and brand awareness. The campaign consists of in store signage, a Walgreens professional to walk customers through the advisor and then guide them to the product on the shelf once recommendations have been shown.

A/B testing resulted in developing this in store method for delivering the most potential to generate more revenue and target loyal customers. The target consumer is shoppers seeking mid-range products that are within budget and suit their skincare needs. The Walgreens business model caters to more of the everyday person and excludes the extremely high-end products that are unaffordable.

Once a consumer walks into the store, they are approached by a Walgreens representative and propositioned to participate in the skincare advisor experience. If they consent, the consumer then answers a series of questions, takes a selfie to acquire results and then receives skincare regime recommendations based on those questions and software logic. In this case the consumer receives product recommendations for Cleanse, Treat, Moisturize and Protect, but only products that are currently in stock at that store. The Walgreens

employee then walks the consumer over to the shelf to pick up the recommended products.

This case study is a great example of how software personalization paired with human expertise can create the best possible results for purchasing skincare products that suit the person's needs. The consumer is having the assistance of a person, but also the data to back up the results. In Figure 16, examples of the Walgreens experience are shown. They include intro slide, Skin Type and Recommendations.

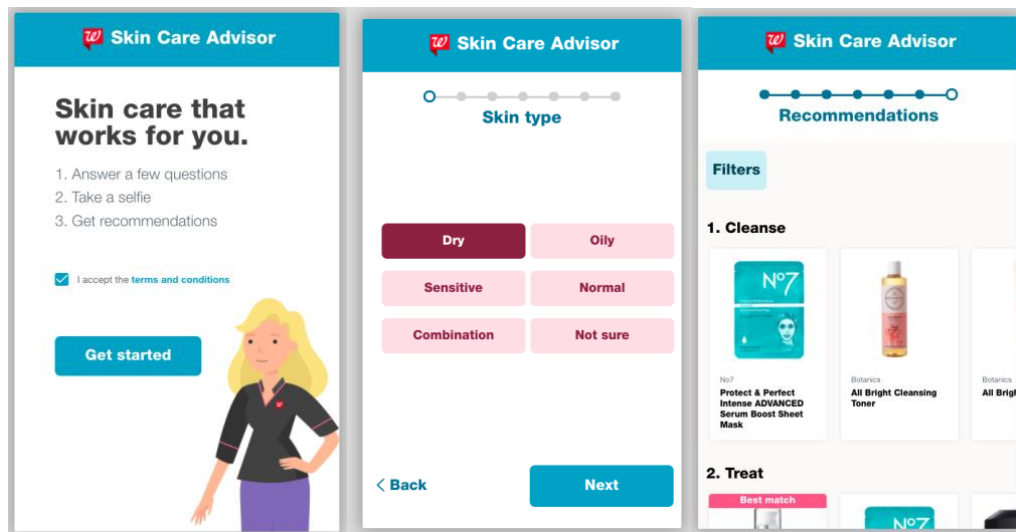


FIGURE 16. Walgreens skincare advisor (Revieve 2020)

This Walgreens Skincare Advisor was piloted at four locations to start in Chicago, Illinois, then plans to expand country wide in late 2020. Initial responses from consumers were positive, with one anonymous user stating that,

The skincare advisor was amazing! I simply loved taking a selfie and having an analysis within seconds that showed me my problem areas and recommending specific products. I was already concerned about the wrinkles on my forehead, but now I am confident that I can help improve them with the products I purchased today” (Walgreens Customer 2020).

The Walgreens staff was able to track the number of consumers that interacted with the Skincare Advisor over a thirty-day period and recorded that 30% (Approx. 40 people) of the persons using the Skincare Advisor made a purchase. Meaning that, after receiving the product recommendations they went

to the counter and purchased the products. As seen in Figure 17, each consumer is given a point on the graph and the number of products purchased on their visit is shown.

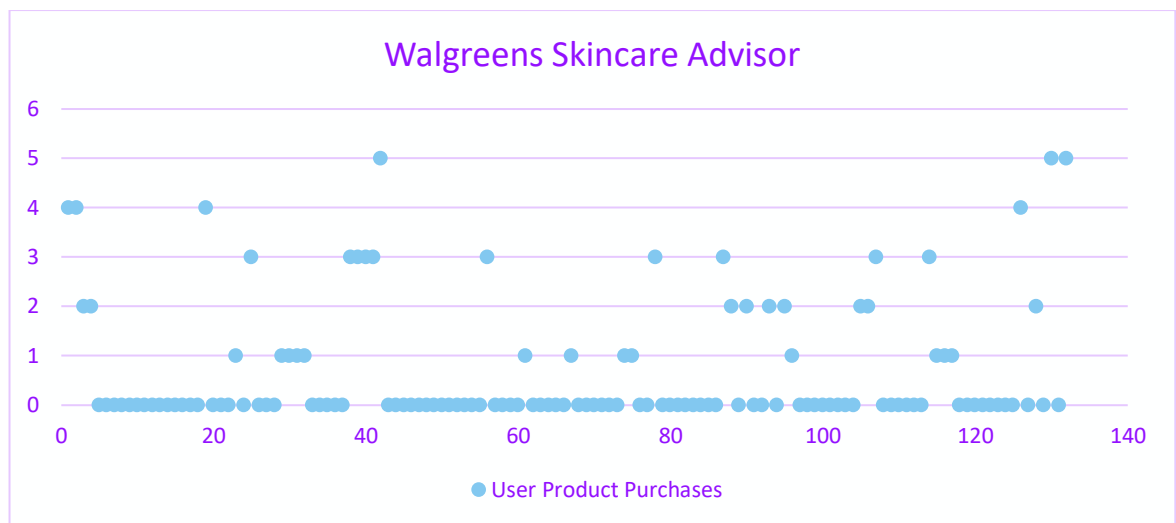


FIGURE 17. In-store Walgreens skincare advisor results (Walgreens 2020)

It is clear that through the success of the skincare advisor lies in users being able to visualize their skincare problem areas through the AI and AR based selfie analysis. The use of technology to bring a user personalized results is a massive selling point because then the consumer feels that they are 1 of 1 and this product will work for them perfectly. Some may disagree with this fact, but it is genius marketing and solves the problem of connecting with the consumer.

The terms and conditions tab that must be chosen to proceed in order to get past page one. These Ts&Cs state that the selfie you are taking is not stored in any data base and is completely safe. No personal data is collected and stored, which in theory will make the consumer feel much safer and agree to participate.

As of April 2020, the in-store skincare advisor is on hold due to a global health pandemic. Once the pandemic is over, the in-store AI based experience will resume normal operations.

4.4 Data collection: instruments & techniques used

The clients that participated in the thesis data collection were provided questions that would help determine if personalization was creating lift in their business. By linking the plugin or SDK experience to the clients Google Analytics ID, there was the possibility of viewing the consumer interaction. Through

research, questionnaires and Google Analytics, the study was able to collect sufficient data in ultimately studying consumers and try to answer the pending thesis questions.

4.5 Questions

The questions developed for said brands were focused on consumer engagement and to gain insight into the driving force behind why companies chose to use Revieve's software experience in the addition to their normal e-commerce experience. The majority of the studies focused on larger brands such as Walgreens, Esthederm, Bioderma and Pierre Fabre. These brands have larger consumer interaction and are more well known.

Customers surveys were supplied to the client contacts of the listed companies and then sent out by to be anonymously completed by customer test groups within their organizations. These questions were targeted at individuals that needed to purchase skincare products and were already associated with the brand. The results amounted to 48 users providing answers to the questions.

See below for a list of questions associated with the customer survey:

- Are you more likely to purchase a product or follow a regime that is specifically recommended to you after a using the skincare advisor? (Y/N)
- How likely are you to switch skincare brands based on the Skincare Advisor results? (Very/Not Likely)
- Do you feel that personalized regimes are important? (Y/N)
- Does the emergence of AI and AR based skincare product recommendations help your decision? (Y/N)
- Does personalization hold weight in your purchasing behaviour? (Y/N)
- Would you be willing to spend more money on skincare products based on the recommendations? (Y/N)
- Would you recommend this experience to friends and family? (Y/N)

One project manager associated with the Revieve account at each company was also given a series of questions to help track results and product use.

- Have you seen a lift in customer usage since implementation? (Y/N)

- Have you seen a lift in purchase behaviour since implementation? (Y/N)
- Was the goal of implementing the skincare advisor to drive more traffic or create more sales? (Traffic/Sales/Both)

These questions were specifically designed to give a holistic understanding into why consumers prefer a personalized shopping method and will go out of their way to understand what they are purchasing.

4.6 Google analytics

Businesses that choose to work with Revieve and implement a plugin or Custom experience are able to view analytics information in real time on their Google Analytics dashboard. The data delivered to the dashboard consist of two different types:

- Page-view data
- Event-data

The Page-view data is showing in Figure 18 below:

NAME OF PAGE VIEW	DESCRIPTION
/modal/skin_details	First questionnaire page of the Digital Beauty Advisor -experience
/modal/skin_details2	Second Questionnaire-page of the Digital Beauty Advisor -experience
/modal/skin_analysis	Selfie-upload page
/modal/cv_results	Facial analysis page after uploading a Selfie
/modal/conditions	Manual selection page for users who do not upload a selfie
/modal/results/standard	Product recommendations for products in the middle price bracket
/modal/results/economy	Product recommendations for products in the lowest price bracket

FIGURE 18. Page-view data (Revieve 2020)

Google Analytics Events for each act a user performs is tracked and categorized as well. There are four distinct categories of the skincare advisor events:

- System: System generated events created for example for the user opening up or closing the Digital Beauty Advisor –experience

- User Input: User generated events for each selection that the user makes in the Digital Beauty Advisor
- Recommendation: Events generated for products being displayed and recommended to the user
- Purchase: Events generated from the user performing an action based on receiving product recommendations, e.g. navigating to the product page for a particular product or adding the product to the shopping cart

Event-Actions mark the specific actions that have occurred in the experience. E.g. the user setting their age-range in the experience, the user uploading their selfie in the experience etc. Event-Labels mark the values of the specific actions occurred in the experience. If for example a user set their gender as 'female', the associated Event-Label would be "female" with the Event-Action would be "set gender". Events example can be seen in the Figure 19 below.

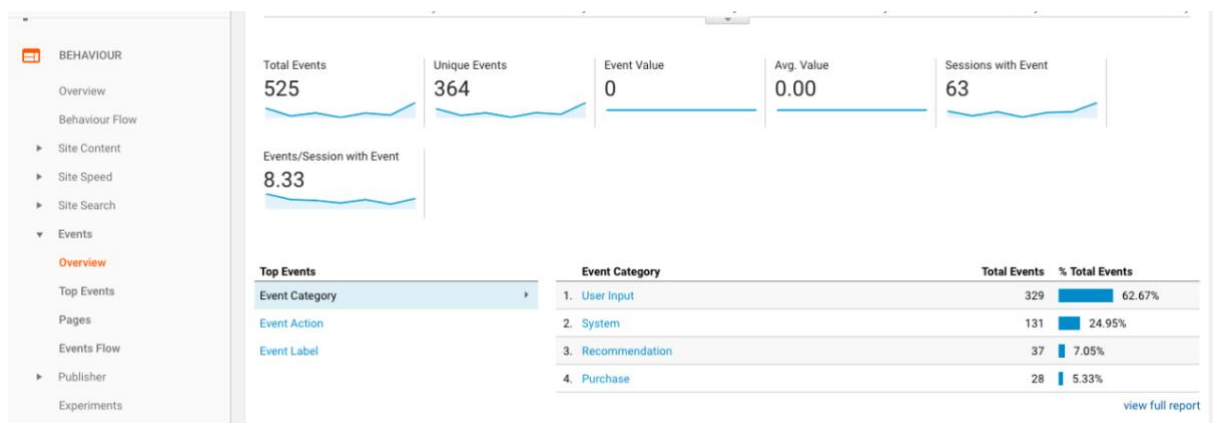


FIGURE 19. Review skincare advisor Google analytics (Reveive 2019)

Shiseido is a good example of one of Reveive's implantations of a skincare advisor Google Analytics report. In FIGURE, we can see that the bounce rate is very low considering the numbers of users and using the plugin on a one-week span. We can see that the methods used to produce personalized results is successful and the user completes the plugin journey, with an over bounce rate of 1.49%. Even though the Figure below may be very complex, it is important to show the bounce rate day over day.

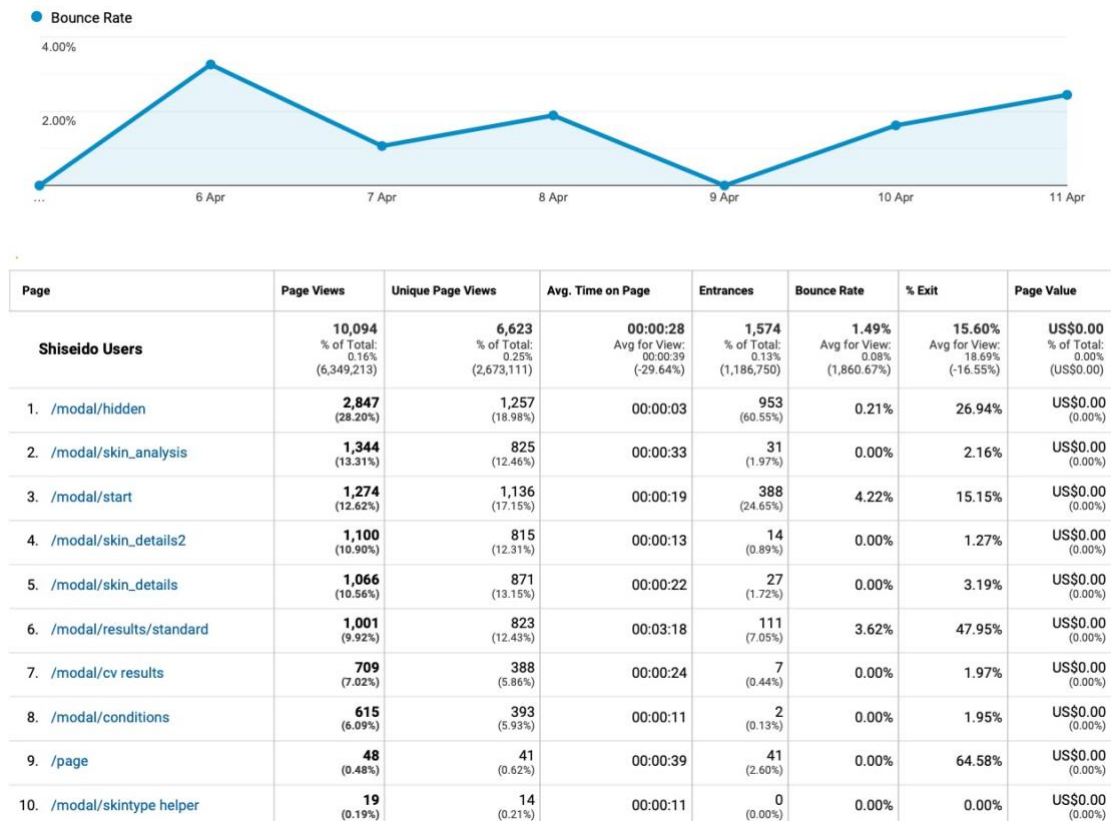


FIGURE 20. Google analytics – shiseido (GA 2020)

Unfortunately, the monetary value attributed to each user journey is not displayed nor should they be shown as businesses prefer to keep that information somewhat private. The data collection methods provide sufficient evidence that the plugin works in providing users with skincare results personalized for each user and then drives the user to make a purchase decision.

4.7 Results

The results of this study are complex and vary region by region, brand by brand, but it is clear that skincare advisors that produce personalized results create a lift in business. Consumers enjoy having personalized products and experiences. By viewing the analytics of different brands and speaking to brand managers, we were able to determine that Revieve's personalization platform is better suited for larger brands offering more selection. With the assistance of each project manager from the companies listed above, results of e-commerce customer survey interactions amounted to 48 participants. These participants spanned over

Naos, Higher Education, Pierre Fabre, Nahdi, Shiseido, and Yon-ka.

4.7.1 Customer survey

Conducting the customer survey was crucial in collecting data that pertained to actual use of the plugin by consumers. The questions and results are listed below:

- *Are you more likely to purchase a product or follow a regime that is specifically recommended to you after using the skincare advisor? (Y/N)*
 - 32 Yes, 16 No – Overall 66% positive
- *How likely are you to switch skincare brands based on the Skincare Advisor results? (Very/Not Likely)*
 - 25 Very, 23 Not Likely – Overall 52% positive
- *Do you feel that personalized regimes are important? (Y/N)*
 - 35 Yes, 13 No – Overall 73% positive
- *Does the emergence of AI and AR based skincare product recommendations help your decision? (Y/N)*
 - 29 Yes, 19 No – Overall 60% positive
- *Does personalization hold weight in your purchasing behaviour? (Y/N)*
 - 34 Yes, 14 No – Overall 71% positive
- *Would you be willing to spend more money on skincare products based on the recommendations? (Y/N)*
 - 23 Yes, 25 No – Overall 48% positive
- *Would you recommend this experience to friends and family? (Y/N)*
 - 40 Yes, 8 No – Overall 83% positive

Overall there was a 64% rate of positive customer reviews. These customers that participated in the survey were ages ranging from 18-55+, 72% women, and locations ranged from the United States, Japan, Saudi Arabia, and France. This shows that women have a major interest in personalized skincare routines.

An important fact to note is that the technology uses training data sets from a variety of ethnicities and ages to uncover and measure different metrics on the user's face. It does not analyse ethnicity by an individual image but the training data sets in the background contain all different ethnicities and age groups so that the results are inclusive.

Small brands that offer a small number of products, such as MZ Skin have gone on record to say,

This skincare advisor is not right for our brand. After the initial investment of 25k€, we can see that number of sales does not make of for the costs of the plugin. (MZ SKIN 2020)

Variables include product price point, region, and marketing, so there is no way to tell if this case is true with other brands until we examine case by case.

4.7.2 Brand manager survey

Now, the results from each brand of the seven brand managers that were contacted to participate in the customer survey:

- *Have you seen a lift in customer usage since implementation? (Y/N)*
 - 5 Yes, 2 No – Overall 71% positive
- *Have you seen a lift in purchase behaviour since implementation? (Y/N)*
 - 5 Yes, 2 No – Overall 71% positive
- *Was the goal of implementing the skincare advisor to drive more traffic or create more sales? (Traffic/Sales/Both)*
 - 7 Both, 0 Traffic, 0 Sales – Overall 100% positive

These simple results prove that there was a lift in customer purchase behaviour and usage with the assistance of the skincare advisor. Not all numbers associated with each brand was provided. Through the responses given, 71% or 5/7 of the brands reported lift in purchasing and usage. Reflecting and de-briefing with the different brand managers has gave insight into how they viewed the solution and how it helped them stay ahead of their competitors. Overall, the brand managers believed the solution was a great extra layer of education to the consumers and allowed them to reach a broader audience.

4.7.3 Brand deep dive

Taking a deeper dive into the brands this study is very important as well. This section will start by investigating the results associated with Shiseido. By viewing

the Google Analytics Report for Shiseido on Figure 20 (GA 2020), we can see a completion rate and low bounce rate on the plugin. The goal to view the personalized regime has helped users complete the skincare advisor. Below are some highlights regarding the Revieve Shiseido Skincare Consultation Tool data for YTD. The tool launched on 2/7/2020.

- Less than 1% of total site visitors viewed the skincare tool.
- Strong \$176 AOV with users that interacted with the tool and +56% compared to average site.
- The skincare tool generated \$39k in demand sales for YTD.
- Positive 73% engagement rate with users that interacted with the skincare tool.
- The skincare tool landing page accounted for less than one percent of total page views but had a strong average time spent of 3 mins and 4 sec, +142% to average site (1:16). (Shiseido 2020)

The pilot experience with Walgreens (Section 4.3) was most helpful because it was a way to track results face to face with users. By communicating with the project lead for Walgreens, we are able to determine the driving factors for consumer adoption in this sector of the beauty industry. It was determined consumers enjoy products and experiences more if personalization is catered to the users. When a product feels unique and fits within that person's daily life perfectly, there is more chance of consumer adoption. The personalized solution drives a consumer to take action because they are faced with a problem, whether it be mild or severe skincare needs, and then given a solution. Having a solution so accessible to something so important such so personal, is exactly what will drive consumers to take action – whether it is from the comfort of their own home or through and in-store experience. Delivering a new experience that consumer has never had before is exactly what it takes to drive action.

Working with Japanese brands Esthederm and Bioderma (Naos Brand) on a delivering a custom AI skincare advisor, was very insightful due to the fact cultural differences play a huge part in the skincare experience. The significance of whitening products and UV protection is very important in Asian cultures, so having the AI based analysis was important to consumers. Since implementing the plugin, Naos provided additional figures that attributed to an 8% lift in revenue

when using the online e-commerce skincare advisor over the last quarter in 2020. They did not provide access to the actual data sheets but provided the percentage. Figure 21 displays the design and experience of the Naos plugins. For Naos customers, having a technologically advanced AI recommendation system was key to participating in the experience and taking action to purchase products.



FIGURE 21. Esthederm – Naos (2020)

The questionnaire given to each brand was conclusive and helpful in determining how consumers function and think. The results were overwhelmingly geared toward consumers making more purchases if the recommendations were personalized. 64% of consumers in the study were more likely to purchase a product or follow a regime that was specifically recommended to them after using the skincare advisor. It was clear from consumer answers in the questionnaire that AI/AR played a huge role in their purchasing behaviour due to the blatant accuracy of the experience.

The questionnaire given to brand business contacts was also helpful in determining thesis results. There was an overall lift in purchase behaviour since software implementation and there was a direct correlation in sales / click through rate with the skincare advisor. One VP for a business unit was quoted saying,

My mother-in-law has been made so many more purchases since using the skincare advisor. She was able to find products she never knew existed, such as a new Micellar Water geared to her skin type. (Anonymous VP)

Findings of this study indicated that all variables are important and significantly affect consumers to adopt personalization methods when navigating the beauty industry. These variables include demographic, age, gender, skin concerns, and personal preference. AI and AR have a massive role to play in that, because new technologies translate to results being more accurate. The relationship between consumers and skincare has always been of interest, but when the addition of new Beauty Tech arises to provide results consistent dermatologist quality, it is clear that ease, accuracy, and cost all play an equal role of consumer adoption of personalized skincare solutions.

5 DISCUSSION

Throughout this thesis, the exploration of the history behind skincare and personalized routines has been discussed. The advances that have been made in Beauty Tech and what it means for the consumer are monumental. This thesis has explored the tech behind a start-up called Revieve and what their software offers the beauty industry. The personalization techniques discussed throughout the thesis have touched on the important role AI and AR plays in determining production and consumer needs.

5.1 Research reliability and validity

The reliability and validity of this study and the information gathered in it is accurate when it comes to analytics data and scholarly articles. This type of information gathered from scholarly articles has been validated, sourced, and authorized by given credit by an institution that holds weight. In terms of Google Analytics, these numbers are coming straight from consumer interaction with Revieve's plugin. Certain factors such as lighting and distance from the camera has the potential to skew results, but for the purpose of this study we are taking the analytics that Google has produced.

When interviewing and gathering information on a questionnaire basis, we must factor in room for error due to fact every consumer difference in their ideals, preferences, and shopping methods. These results have to be taken with a grain of salt, but also are very important because the consumers voice and decision causes the most direct change. Out of the eight businesses and brands that were sent questions to, six agreed and 48 consumers participated in providing answers. As stated, before these businesses were Naos, Higher Education, Pierre Fabre, Nahdi, Shiseido, and Yon-ka. Walgreens was in its own pilot study that provided different results. This sample size is not as large as preferred, but it did provide the insight and a deeper understanding of consumer behaviour. Having the participants encompass 72% of the sample size shows us that women are more interested in personalized skincare results than the male population.

By getting involved with the consumers and businesses, we are able to see a different side of the retail experience and determine what would potentially contribute to a more successful beauty business model. In this sense, the results are very valid.

Some short fallings in the study would potentially be failing to get statements and information from every business team that that was contacted. Certain individuals did not want to disclose any information or be included in any published work. No fault or blame can be attributed to the businesses that did not participate because it is understandable that businesses would not want to give out sensitive information.

5.2 Future of personalization

The industry is in moving in a way that benefits the consumer by providing personalized regimes, but what if it could provide even more? Tech companies are on the cusp of developing skin solutions for individuals in the lab based on their personal attributes. “Just as a saliva sample can trace your ancestry, it could also be used to predict how your skin will age — and how to reverse course — based on an evaluation of your genetic makeup, says cosmetic chemist Ni’Kita Wilson.” (Siegel 2019). Products such as smart sunscreens, smart serums, 3-D printed foundation are all in development now and being improved at every turn. This is where personalization is headed for the future of skincare. This is the beginning of hyper personalization, a world where your face creams are specifically tailored to you based on your DNA, diet and environmental circumstances (Siegel 2019).

The beauty industry has been making a noticeable transition over the recent years as well by stepping away from store to increase direct-to-consumer retail sales. All retail has been affected over the years and beauty is no different. By adopting these direct-to-consumer methods, there is the potential to make more revenue and accelerate business (Kestenbaum 2019). This means that newcomers to the industry will build their brand from the ground up on direct-to-consumer and forego retail stores altogether.

5.3 Future of AR in beauty

The future of AR in Beauty Tech revolves heavily on the basis of users’ being able to have real-time video with digital overlays of make-up and products on their face. This give the consumer the ability to see what products look like from virtually anywhere before purchasing. Revieve is currently working on

technology that does this exact action as well. This type of purchasing and consumer behaviour is shown to be popular globally across all markets (Revee 2020). This type of digital layer differs from the Snapchat example discussed early because the purpose is to fully integrate with the users' face and give a very realistic image that would mimic trying on make-up physically in person.

This year alone there has been a surge in make-up virtual try-ons by the consumer. From February to April, there was a report that it rose by 28%, says Perfect Corp (BW Confidential 2020). This shows that in this very internet driven society, virtual try-on that incorporate AR will be at the forefront of beauty consumerism.

6 CONCLUSION AND FUTURE WORK

Throughout this thesis, results of a study that investigated personalization in the beauty industry were presented and discussed what drivers were at hand for consumers to adopt those personalization methods. A major portion of the study revolved around a company called Revieve, that provides a beauty personalization service to brands, which in turn provides personalized skincare routines and products to consumers to who use the experience. They are also working on a cutting-edge virtual make-up try-on that utilizes data and Augmented Reality to let the consumer try-on make-up from anywhere in the world via their device. The findings were conclusive in determining that consumers react in a positive manor to personalized experiences, specifically using Beauty Tech in the skincare industry because of the accuracy and ability to get exactly the right product for their needs.

The ability to have this AI and AR based skincare advisor available and receive reliable results in real time is a huge technological advantage. Unfortunately, it was not possible to get data driven results attributed to the AR makeup try-on because the solution has not been finalized and launched yet. It will be part of the future work of this thesis in determining if virtual make-up try-on is something that consumers desire. It is possible to conclude that the consumer adoption is based on the humanistic need for the best and most suited product available, along with the ease and reliability that new technology provides in personalized routines using AI/AR.

A major factor that plays into these conclusions is the aspect of choice. Consumers are bombarded with thousands of products and choices every day, so having technology that pairs down those choices to three or four products is something to be relished in. Ronald Goldsmith, a consumer psychologist at Florida State University says that, "Choice overwhelms people, and studies have shown that people don't respond well to too much choice" (Mull, Amanda). Personalization is a way for consumers to get around all those choices.

Along with moving away from an excessive amount of choices, it is established that data collection is very lucrative from a business aspect. They are able to take customer buying patterns and develop products that will sell more. Companies are able to know exactly what the consumer wants and cater to that, which in turn will provide more customer adoption.

Future work in this field personally and professionally is very much the plan. Helping to take customer implementations from start to finish is crucial in future learnings. The findings in this study will help me to assist client needs and design their skincare advisor experience to fit their specific asks. It is important to be cautious of regional concerns and making the consumer feel comfortable. Sparking a positive emotion, whether it through copywriting or design is important in their overall interaction with the experience. A consumer is more likely to make purchases if they feel like the brand is in-tune with their morals. Beauty Tech is ever evolving, so learnings within this field we never cease to exist. Revieve was able to gain insight into consumer adoption and roadmap their business plan to accommodate.

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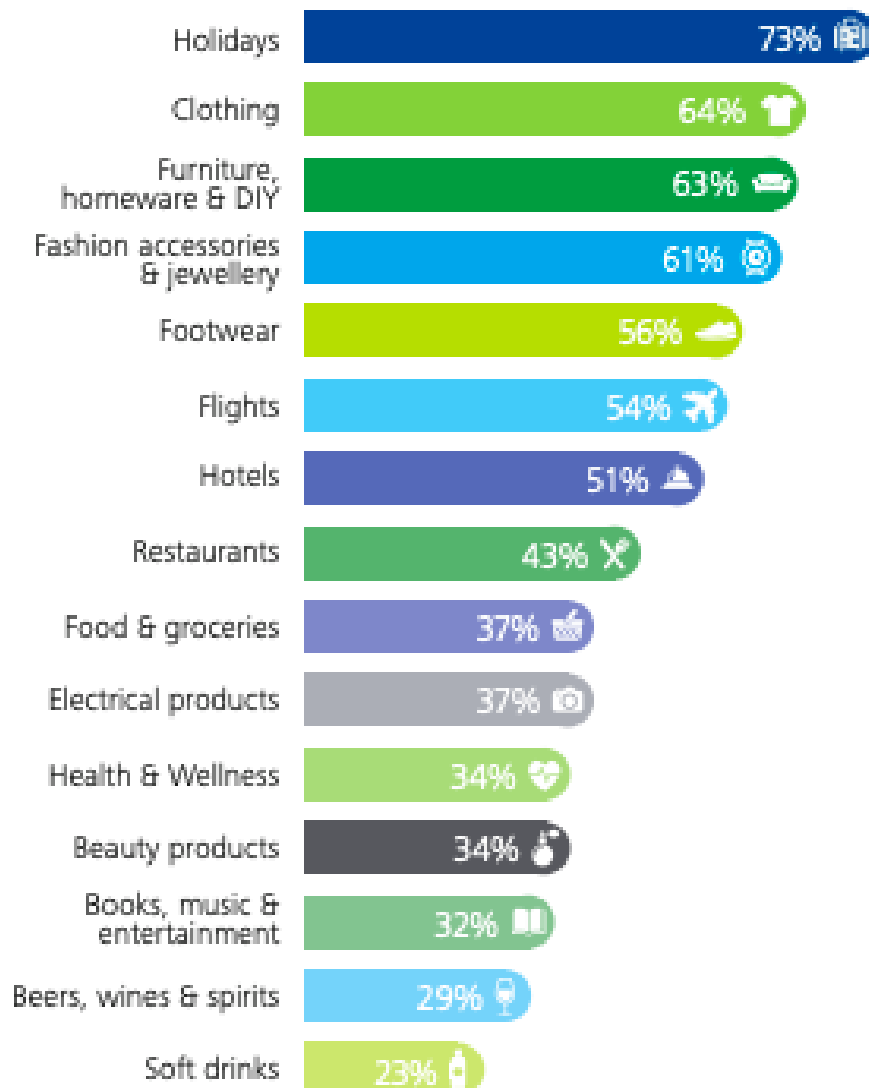
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APPENDICES

Appendix 1. Consumer Research Findings.....page 9, 23

Figure 22 (Deloitte Research 2015) visualizes consumers awareness of products or service customisation by category. The figure was created by Deloitte to display the focus of consumerism in 2018 and what items were prominent. The second part of the figure visualizes consumers who have purchased a customized product or service in past by category. Figure 23 displays consumers interest in personalised products or services by categories and age groups. These three charts all relate to each other and do a great job of portraying the relations between consumer and industry.



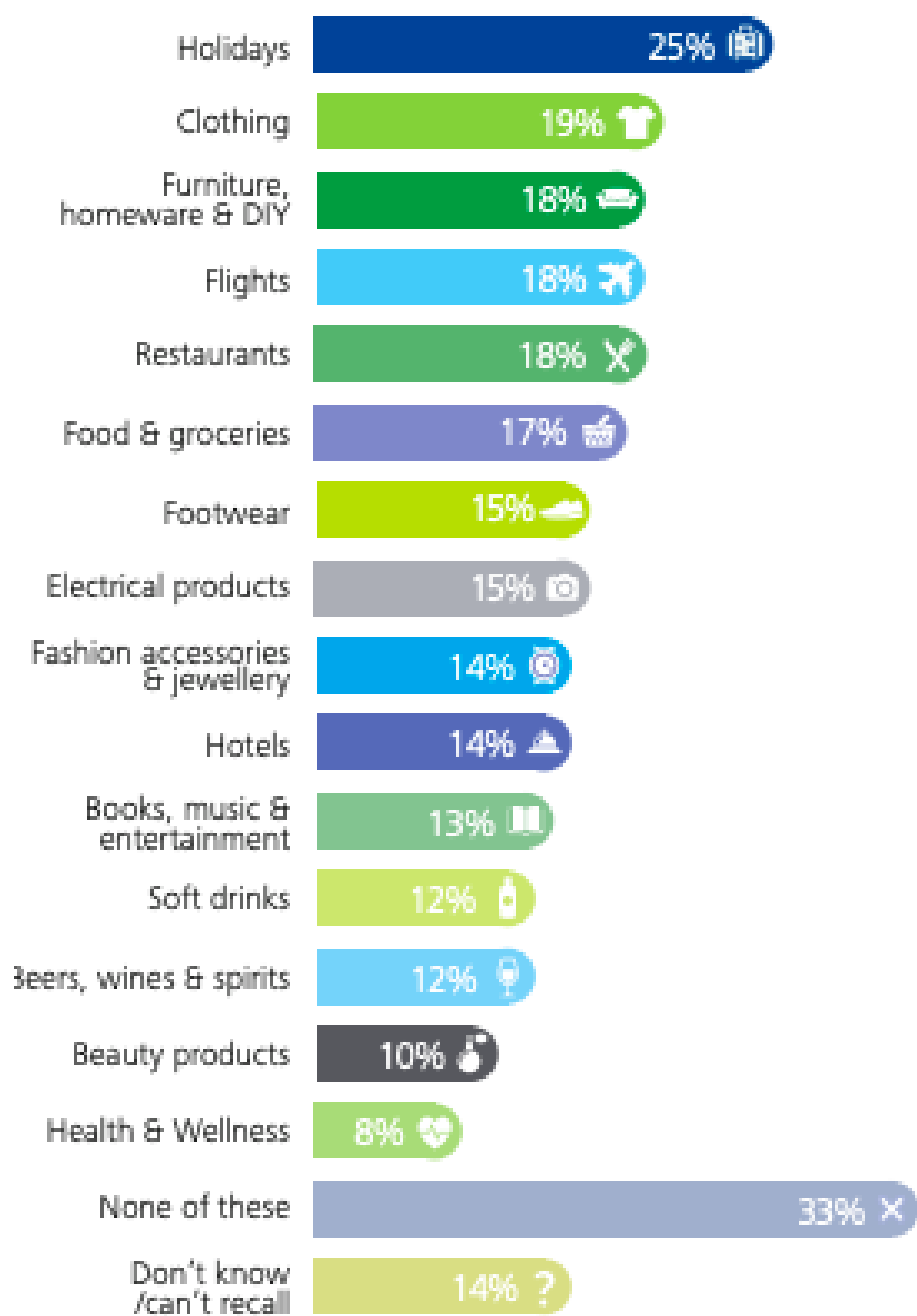


FIGURE 22. Consumer research findings

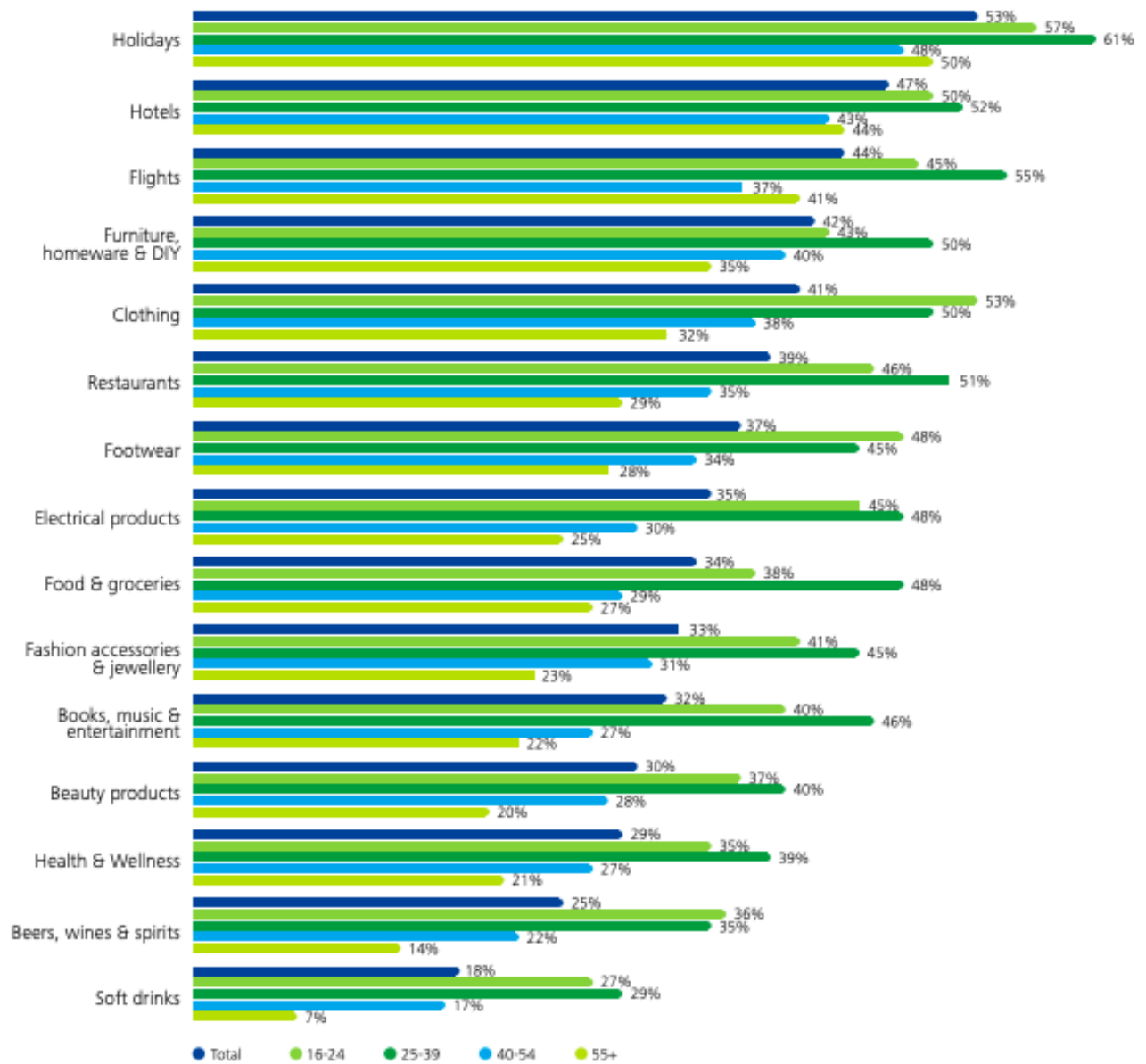


FIGURE 23. Consumer research findings