University of Economics, Prague
Faculty of Business Administration
Master's Field: International Management

Master's Thesis

The influence of smartphone colour palettes on consumers' attitudes and purchase intentions

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Declaration of authenticity

I hereby declare that the Master's Thesis presented herein is my own work, or fully and specifically acknowledged wherever adapted from other sources. This work has not been published or submitted elsewhere for the requirement of a degree program.

Prague, 15 May 2019 Signature

Abstract

Despite its importance, the concept of colour is not widely understood in marketing. This thesis establishes conventionally, and unconventionally coloured smartphone lines based on desk research. The influence of these smartphone colour palettes on consumers's attitudes to the visual appeal of the product line, the brand personality with regards to originality, the brand itself, and purchase intention were then researched. Four hypotheses were tested on a sample of 101 subjects. The results demonstrated that smartphone colour palettes have significant impacts on consumers' attitudes and on their purchase intentions. Finally, colour strategies for incumbent and new market players based on the results are presented.

Keywords

Smartphones, colour, product marketing

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1. Introduction

Colour is an intangible concept whose power has been acknowledged widely and prominently. According to the artist Wassily Kandinsky, "colour is a power which directly influences the soul" (Düchting, 2007, p.17). Claude Monet admitted that "colour is [his] day-long obsession, joy and torment" (Clemenceau, 2015, Ch. 2). In fact, colour affects not only prominent artists such as Kandinsky or Monet, but every individual on Planet Earth.

Colour enables most people in today's world to see and distinguish objects and navigate the world through eye sight. However, colour does not only aid in wayfinding but serves many functions. Colour gives structure, shows emphasis, conveys mood, symbolises ideas, invokes meaning, transmits messages, holds cultural relevancy and establishes ambience (Eiseman, 2017; Sherin, 2011). As Eiseman (2017) states, "the influence colour has on our feelings, our well-being and our perceptions cannot be underestimated" (p. 6).

Colour fulfils many purposes in life in general and consequently also in commercial marketplaces. As Eiseman (2017) suggests, at every level of the marketplace, colour establishes a brand image and testifies to qualities of the company it represents. Part of a company's brand equity is built around their use of colour and suggests an emotional response (Eiseman, 2017). What is more, colour can catch the viewer's attention and communicate information that helps potential buyers to associate a mood or message or have the right reaction to a product, brand or service (Sherin, 2011). In fact, the brain first registers shape, second notices colour and third, reads content (Wheeler, 2017).

Figuring out which colour is appropriate for which product, which colour conveys the right qualities and mood, and which colour transmits the right message is a challenge itself. The involvement of multiple people and points of view in creating and deciding the colour of a product adds another layer of complication. As described by Sherin (2011), designers might be reluctant to using bold and risky combinations. Clients might have different preferences. Cultural associations might lead to misinterpretation of information. Technical issues might pose difficulties in representing colours differently on screen or in print (Sherin, 2011). Understanding the fundamentals of colour and combinations of colours can help determine the right choice for a given product. By employing known principles and rules, it is easier to create work that is visually pleasing and conveys an intended message. While the importance of colour in marketing is recognised, the effects of colours are not entirely understood.

To contribute to the academic research of the effects of colours in marketing, this master's thesis aims to gain understanding about the influence of smartphone colour palettes on consumers' attitudes and purchase intentions.

This master's thesis will begin with a literature review that introduces the reader to some fundamental colour theory, including basic terminology, the colour wheel and the creation of harmonious combinations. Next, the downstream effects of colour will be discussed, including an explanation of the physical and psychological impact of colours followed by the importance of colour in the cultural context. The upstream effects of colour examine the impact of colour in the bigger picture of marketing and go into detail regarding the relationship between colour and product. The literature review will close with a summary of the findings.

An experiment will be conducted to gain further understanding of the effects of smartphone colour palettes on consumers' attitudes and purchase intentions. The section following the literature review will explain the research methodology of the experiment. First, the chapter on research strategy will introduce the research question and the four hypotheses. Second, the chapter on research design will go into detail about the experimental and instrumental design as well as the pilot test and final questionnaire. Third, the measurement section will speak about the manipulation check as well as the independent, dependent and control variables. Finally, the data collection and sampling procedure will be explained.

The subsequent section will present the results of the research experiment, divided into two parts. The prerequisites for hypothesis testing make up the first part. A principal components analysis was conducted to combine each scale item into the correct scale. The scale reliability and data normality were measured, and the composite variables were calculated. The second part details the individual testing of all four hypotheses using the Wilcoxon signed-rank test, followed by additional data analysis using frequency distributions. This section will conclude with a summary of the findings.

The results and their managerial implications will then be discussed and divided into recommendations for established market players and for market entrants. The limitations of the study and possibilities for further research will be explored before the conclusion to the thesis, the references and the appendix.

2. Literature review

The literature review aims to provide a preliminary understanding of colour in general and with regards to product marketing. First, the fundamentals of colours are explored, including colour terminology, colour systems, the colour wheel, relating and contrasting harmonies on the colour wheel, and beyond the colour wheel. Second, the upstream effects of colour will be discussed, including physical and psychological effects as well as the importance of colour within a cultural context. Third, the downstream effects of colour will be explored in order to clarify the significance of colour in the bigger picture of marketing. Finally, the relationship between product and colour will be examined.

2.1. The fundamentals of colour

Humans might perceive colour as concrete in the physical environment. But in fact, colour is not tangible. Colour is light. Colour is created by varying wavelengths of light, and humans only perceive colour because of light. Every colour has its wavelength, and between every one of these colours, there are gradations of it. When these wavelengths are reflected off a surface, the eye interprets different colours. The rods and cones of the human eye can distinguish rays of light from each other based on their respective frequency. To see details precisely, the eye contains a lens that can focus light onto the sensitive cells within the retina, triggering nerve impulses connected to the brain, where a visual image is formed (Eiseman, 2017). If there were no light in our environment it would be impossible to see anything and as a consequence humans would have to live by means of other senses.

2.1.1. Colour terminology

To better understand the concept of colour, this section introduces some fundamentals of colour theory such as colour terminology, popular colour systems, the colour wheel and some common ways to create colour combinations. First, the following terms are useful when talking about colour.

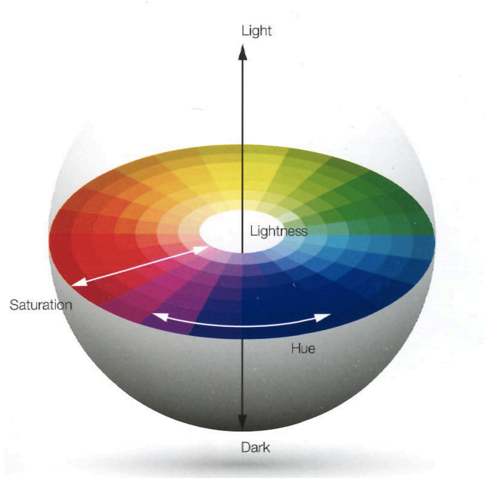

Figure 1: Colour terminology (Eiseman, 2017, p. 15).

Hue is a synonym for *colour*, and these two terms can be used interchangeably.

Saturation (or chroma) describes the intensity of a colour. Saturated colours are stronger, more vivid and brighter than desaturated, dull colours. The perception of whether a colour is saturated or not depends on the colours it is surrounded by.

Temperature refers to the perceived warmth or coolness of a colour, which is strongly dependent on the source of light. Lower colour temperatures imply warmer light (for example, yellow, orange, and red) and higher colour temperatures indicate cooler tones (for example, green and blue). Designers must pay close attention to the colour temperature on their screen, as this can distort the perception of the colour intended. Calibration adjusts colours to match the screen temperature so that the colour perception is not distorted anymore (Sherin, 2011). More on the separation between warm and cool colours can be found in section 2.1.3. The colour wheel.

Value describes the gradation of lightness or darkness of a colour. It can add emphasis, achieve contrasts and establish a visual hierarchy within a composition. The effect of value depends on the lightness and darkness of all elements in the layout; it is stronger if the differences between the values of colours in a composition are more significant (Sherin, 2011).

There are numerous other concepts of colour but addressing all of them would go beyond the scope of this thesis. Such terms include, but are not limited to, tone, shade, tint or undertone.

2.1.2. Colour systems

To create and replicate colours, conventional colour systems are used. There are numerous colour systems, but this paper will introduce the three that are most commonly used: CMYK, RGB and Pantone.

CMYK

The letters in the colour system named CMYK stand for cyan, magenta, yellow, and key (black). This four-colour subtractive process uses these four colours exclusively. In the process, the four colours mask the background, which is traditionally a white piece of paper. It is called subtractive because the ink on the paper reduces the light that would otherwise be reflected to create individual hues.

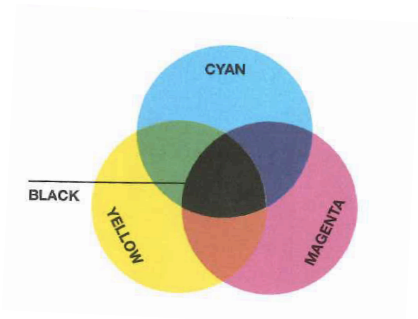

Figure 2: The CYMK colour system (Sherin, 2011, p. 38).

Using a halftone dot pattern, small points of the four colours are arranged so tightly next to each other that the human eye perceives solid colours of the entire colour spectrum. CMYK is most commonly used in printing (Sherin, 2011).

RGB

In contrast to CMYK, RGB is an additive colour system. RGB is an abbreviation for red, green and blue, its three base colours. By mixing these three base colours, all other colours on the visible spectrum can be produced. If the three base colours are combined in equal amounts, white is produced. In the absence of light, black is produced.

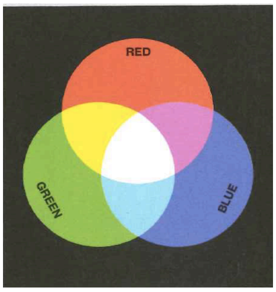

Figure 3: The RGB colour system (Sherin, 2011, p. 41).

RGB is used less for printing, but instead is the universal colour system for screen-based devices such as televisions, monitors, or smartphones (Sherin, 2011). RGB can be translated into CMYK, or vice versa. If something is created digitally utilising the RGB colour system, it can be converted to and printed in CMYK, and the human eye should not be able to see a difference.

Pantone

The proprietary colour system Pantone provides a universal language of colour that enables specific colour choices and consistency throughout any process, from inspiration to realisation of a project, and across various materials and finishes (Sherin, 2011). Pantone has multiple offerings, including the Pantone Matching System ©, which revolutionised the printing industry in 1963 by providing an innovative tool to select, articulate and reproduce accurate and consistent colour internationally ("About Pantone | store.pantone.com," n.d., para. 2). Designers, creatives and producers use the guide to specify certain colours, and then printers can replicate these. Today, apart from the guide, Pantone has also become a provider of services such as colour consulting or colour trend forecasting. Especially in the fields of graphic design, fashion, architectural, industrial and product design, Pantone has proved to be a popular choice ("About Pantone | store.pantone.com," n.d., para. 1).

The colour systems CMYK, RGB and Pantone are essentially languages of colour. They enable users to create and replicate specific isolated colours. To go a step further from separated colours and to be able to understand the compositions of colours, the next section will introduce the colour wheel.

2.1.3. The colour wheel

The colour wheel provides a basic understanding of isolated colours and colour relationships. The picture below shows the classic colour wheel, which encompasses twelve isolated hues. Conventionally, the colour wheel is divided into two halves: warm and cool colours.

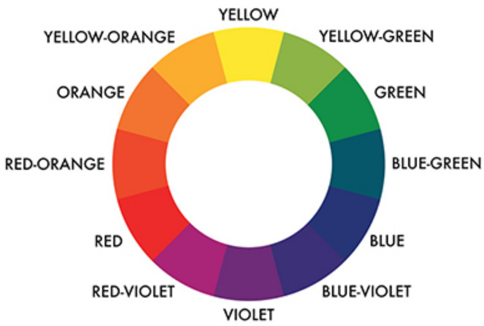

Figure 4: The colour wheel (McKinley, 2018).

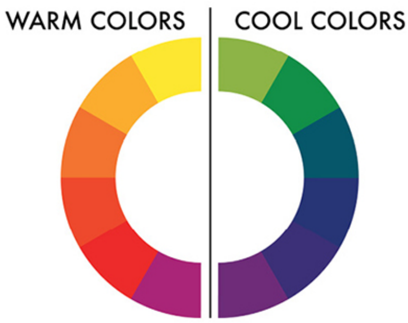

Figure 5: The colour wheel divided into warm and cool colours (McKinley, 2018).

Besides the division of warm and cool colours, all the colours in the colour wheel are based on three colours.

Primary colours

Yellow	Red	Blue

Figure 6: The primary colours.

The colour wheel is based on three original colours, also called the primary colours: yellow, red and blue. These colours are independent of each other and cannot be mixed using any different colours. In contrast, all colours on the colour wheel can be created by combining some combination of the primary colours (Sherin, 2011).

Secondary colours

Figure 7: The secondary colours.

Orange, green and violet are secondary colours. These are made by combining equal amounts of two primary colours (violet = ½ red + ½ blue; orange = ½ red + ½ yellow; green = ½ blue + ½ yellow).

Tertiary colours

Figure 8: The tertiary colours.

Tertiary colours are located between primary and secondary colours on the colour wheel, and – while they are still a mix of two primary colours – the split is not equal but has more of one primary colour. The hue of the colour depends on which primary colour is dominant (Sherin, 2011).

The next section will introduce how to utilise both the colour wheel and the concept of primary, secondary and tertiary colours to create colour harmonies. Sherin (2011) states that the underlying goal when dealing with colour is to produce pleasing colour combinations in an overall composition, which is referred to as harmony. The colour wheel is a tool with which colour combinations that form a unity can be created. By understanding the most common groupings of colours, it is possible to choose colour combinations with predictable visual results (Sherin, 2011).

2.1.4. Related harmonies on the colour wheel

Colour harmonies can be relating or contrasting depending on the location of the colours on the colour wheel. Relating harmonies are combinations of colours that lie next to each other on the colour wheel including monochromatic and analogous combinations (McKinley, 2018).

Monochromatic combinations

Monochromatic combinations are not made up of multiple hues, but a variation of a single colour which is altered by adding white – then referred to as a tint – or black – referred to as a shade. Sherin (2011) suggests that monochromatic combinations are often successful in design solutions and price-effective for printing. Additionally, in oversaturated markets, simple designs with limited colours tend to stand out (Sherin, 2011). Yet they are also at risk of being perceived as tedious or tiresome (McKinley, 2018).

Figure 9: Monochromatic colours (McKinley, 2018).

Analogous combinations

Analogous combinations are a set of colours that lie adjacent to each other on the colour wheel. These colour combinations also tend to be harmonious due to their similarity in wavelengths of light (Sherin, 2011).

Figure 10: Analogous colours (McKinley, 2018).

Relating harmonies can be a good starting point for creating harmonious colour combinations as they are easy to use but, similar to monochromatic combinations, run the risk of being perceived as boring or not standing out.

2.1.5. Contrasting harmonies on the colour wheel

In contrast to relating colour harmonies, contrasting colour harmonies are made up of hues that do not lie side by side on the colour wheel. According to McKinley (2018) contrasting harmonies are more challenging to use, but when they are correctly done, they can be richer and more satisfying to the human eye than relating harmonies. The colour combinations of contrasting harmonies are classified as complementary, split complementary, double complementary and triad colour combinations (McKinley, 2018).

Complementary colours

Any two colours directly opposite from each other on the colour wheel are called complementary colours. Altogether, there are six pairs of complementary colours. According to Sherin (2011), the relationship between complementary colours is contradictory because they are both attracted to and repelled by each other. This push-and pull effect can be a useful tool for attracting a viewer's attention (Sherin, 2011). McKinley (2018) suggests that "one of the complements used should be dull, light, or dark, or in small amounts" (para. 13).

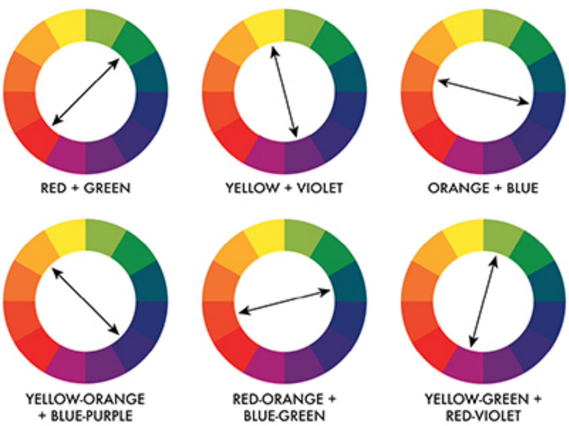

Figure 11: Complementary colours (McKinley, 2018)

According to Sherin (2011), one central idea of colour theory is that humans' eyes are always trying to create balance; theorists suggest that one's perception of colour can be influenced by a phenomenon in which the brain always creates an afterimage of the complementary colour in one's mind. Several experiments have been done that demonstrate that when a person is shown one colour and then quickly looks away, the colour he or she sees in that second is the complementary colour. This theory implies that the eye always tries to find balance, which happens if a colour is combined with its opposite, the complementary colour (Sherin, 2011). Knowing that the eyes' natural balance will be met, a designer can predict more precisely how a viewer will experience a visual colour composition when using complementary as opposed to non-complementary colours (Sherin, 2011).

Split complementary colours

Split complementary colours are a set of three colours consisting of one primary colour and two secondary colours that lie adjacent to the primary colour's complement on the colour wheel. Split complementary colours cannot start with a secondary colour because its complement, which is a primary colour, cannot be split into two (McKinley, 2018).

Figure 12: Split complementary colours (McKinley, 2018).

Double complementary colours

A double complementary colour combination uses two adjacent colours and their complements. To make this combination harmonious, McKinley (2018) suggests picking one outstanding hue and varying the intensities and values as well as the amounts of the other hues in the combination (McKinley, 2018).

Figure 13: Double complementary colours (McKinley, 2018).

Triad harmonies

As the name implies, triad harmonies are any set of three colours that have the same distance from each other on the colour wheel. Since the three primary colours blue, red, and yellow conform to this rule, they also constitute a triad harmony (Sherin, 2011). The following combinations do so as well: green, orange, purple; yellow-purple, blue-green, red-purple; and yellow-green, blue-purple, red-orange. McKinley (2018) suggests that this type of combination forms the richest harmony when used well.

Figure 14: Triad harmonies (McKinley, 2018).

When selecting colours, harmony is often the goal. An excellent place to start achieving harmony is the colour wheel and the combinations introduced above. Even though the perception of harmony will always be subjective, classic colour theory offers some solutions that might work better than others and some reasons why. Although the goal is often to create harmonious colour combinations, there are cases in which displeasing or non-harmonious colour combinations may lead to the desired result or convey the right message (Sherin, 2011), and the theory of the colour wheel can also help achieve that.

This section introduced the classic colour wheel and colour combinations that can be formed using it. Depending on the purpose of a colour combination, relating or contrasting harmonies can be a starting point. The colour wheel itself is still widely taught and utilised, and it forms the basis of classic colour theory. It can serve as an excellent reference tool (Sherin, 2011), although it is not the only source for creating colour combinations.

2.1.6. Colour combinations beyond the colour wheel

Besides the colour wheel, there is an endless number of established colour themes to choose from that suggest particular messages or themes. Sherin (2011) indicates that these existing pairings can impact a design positively or negatively. Depending on the specifications of a project, it may be appropriate to create a palette by choosing known colour combinations, while under different circumstances creating groupings based on research or on the attributes of the target group will produce the best results (Sherin, 2011). Below three examples from Eiseman (2017) that show Pantone colour combinations in relation to themes. These can be a helpful guide to marketers and designers.

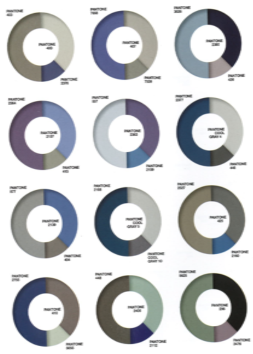

Figure 15: Colour combinations representing urbanism (Eiseman, 2017, p. 89).

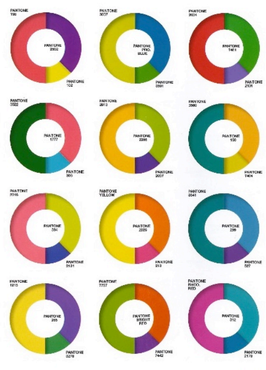

Figure 16: Colour combinations representing playfulness (Eiseman, 2017, p. 109).

Figure 17: Colour combinations representing romance (Eiseman, 2017, p. 125).

The combinations above show that there are colour combination guides and known combinations that might convey an intended mood or message. Choosing successful colour combinations can have a significant impact on business success (Sherin, 2011) and thus the importance of selecting the right combination of colours should not be underestimated. Colour choices are an integral part of any design process and should be considered as one of the first steps of a project (Sherin, 2011).

The perception of colour combinations depends on all of the other colours present in a composition. How a colour is perceived is altered by which different colours it comes in contact with. When creating colour combinations, designers must pay close attention to which colours are part of the composition and how the interaction of all colours may influence human perception (Sherin, 2011). In addition, it is important to remember that colour combinations are always affected by all other elements of a composition, such as images, format, font, background, texture or even the content that is communicated (Sherin, 2011).

Creating compelling colour combinations can be based on solid theory such as the colour wheel or other pre-existing colour themes, but the composition as a whole also needs to be considered, including the effects of different colours within and outside the composition as well as the other properties of a composition besides colour.

2.2. The upstream effects of colour

According to Kiehelä (2014), upstream effects of colour – in contrast to downstream effects – are effects that alter viewers' colour perceptions and describe influences on a person's perception of colour. These effects are dependent on a person's physical condition, psychological experiences and cultural origin and cannot be changed by designers or companies. However, they must still be acknowledged as they influence and trigger downstream effects, which are directly related to and influenced by a product or company (Kiehelä, 2014).

2.2.1. Physical effects of colour

It has already been established above that colour does not exist as a tangible object in the physical environment but rather consists of varying wavelengths of light, which are caught by the eye and translated into different colours in our brain. Most people can see a specific spectrum of colours, but there are two extremes of colour perception: colour blindness and super sight.

Colour blindness is the inability to differentiate among colours. It is genetic, usually occurs in men, and affects about ten per cent of the population worldwide (Sherin, 2011). There are different levels of colour blindness; some people are not able to see any colours, while others can see some colours, but not the whole spectrum. The most common type of colour blindness is red-green colour blindness. According to the US-American National Eye Institute, eight per cent of men and 0.5 per cent of women of Northern European ancestry are red-green colour blind (National Eye Institue, 2015). Other forms of colour blindness are extremely rare.

The opposite extreme to colour blindness is super sight, which can only occur in women for genetic reasons. These women, who are called tetrachromats, make up two to three per cent of the female population worldwide and can see approximately one hundred times more colours than average people (Sherin, 2011). Since colour signals are transmitted from the eye to the brain, colours do not only have physical but also psychological effects on humans

2.2.2. Psychological effects of colour

Colours do not only interact with the human eye; the eye sends colour signals to the human brain. Thus, colour conveys meaning and evokes emotions in humans. The relationship between colour and a person's conscious and subconscious perception has been a popular research subject. In particular, there are numerous studies on the effects of individual colours on people's emotions (e.g. red provokes arousal, blue is calming, et cetera). While these studies can be a starting point to understanding colour and how to use colour to communicate a particular message, the psychological effects of colour on people depend on individual preferences based on associative learning.

Associative learning is the process of developing colour preferences based on associations gained through experience or learning. While understanding general colour preferences among consumers is desirable, it may be preferable for marketers and designers to learn consumers' colour associations to better understand the emotional aspects of colour (Priluck Grossman & Wisenblit, 1999). Associative learning can happen both subconsciously – through experiences – and consciously – by learning meanings of colour.

Subconscious associative learning

Personal experiences can lead to individual preferences for specific colours. A positive or negative experience can lead to the preference or dislike of a particular colour (Priluck Grossman & Wisenblit, 1999). This type of associative learning happens subconsciously and personal colour preferences develop, additionally affected by colour trends (Singh, 2006). Colour preferences change not only over time, but also when specific colours are placed in relation to objects; a person's favourite colour might not be the preferred colour for every object. The meaning of a colour can change when associated with different objects.

Conscious associative learning

Another form of associative learning is learning the meaning of colour over time. People can develop preferred colours because they learn where, when and why which colours are appropriate (Priluck Grossman & Wisenblit, 1999). A simple example of conscious associative learning is a traffic light. For example, it is commonly and internationally known and taught from an early age that green means go, yellow means wait, and red means stop.

The understanding of people's associations to colours can help designers create colour combinations that produce an intended response. Unfortunately, the knowledge of how colour can affect our conscious and subconscious mind is still in its infancy. There is little doubt that colour influences our mood and evokes emotion, but there is still a long way to go to determining a reliable recipe for selling products or making viewers uniformly pay attention to a message based on colour (Sherin, 2011).

The research on the effects of particular colours on people's emotion has been omitted from this thesis on purpose, as the focus is not to understand the effects of specific colours, but rather of colour palettes.

2.2.3. Colour in cultural context

Associative learning through experience and learned meanings of colours can strongly affect personal preferences. So can cultural values, which are divided in this chapter into demographic factors as well as subjective norms. As Wheeler (2017) states a "family of colors needs to work across real and digital applications, and for global companies, the colours need to have positive associations in different cultures" (p. 149). There are three different approaches in marketing: global, local and "glocal". With global strategies, companies do not adapt to local cultures and have one consistent global identity. With local strategies, companies do not have a global brand but uniquely adapt to every market; companies might only be present in one or a small number of markets. "Glocal" strategies are companies that operate globally but adapt their global brand to every market individually in order to adhere to cultural differences. Generally, companies that follow a "glocal" approach are the most successful, as they take demographic factors and subjective norms into consideration in their marketing and colour choices.

Demographic factors

Demographic factors include but are not limited to age, place of birth, gender, native language, religion, income level and educational level. These factors usually cannot be changed by a person, but they do influence his or her personality and values, and also how he or she views colour and what he or she associates with it.

Culture and geographic location can affect how people perceive and understand colour. First of all, colours are communicated differently in different languages. Although the differences in how colours are communicated verbally in prominent modern languages are not very pronounced, there are distinctions in the number of words that refer to different colours. For example, the German and French languages offer more words to describe orange tones than English or Japanese (Sherin, 2011). An extreme example is the language Kekchi, a Mayan language used by indigenous people in Guatemala and Belize, that only uses five different terms to describe all colours (Sherin, 2011).

Colours can have different meanings and associations in different cultures. For instance, while in Western cultures white is associated with weddings, purity and innocence, in Eastern cultures white is the colour of funerals. The perception of what is considered beautiful, festive, and appropriate changes depending on culture and geographic location. Some colour associations are apparent, but others are subtle (Sherin, 2011). Colours are even more loaded with meaning in religions. In Christianity, for example, there are so-called liturgical colours that are used for vestments and textile hangings inside the church. The colours are supposed to underline the mood of the season or a special occasion. The colour of Palm Sunday (the Sunday before Easter) is red, for example, while the colour for Easter is white. Depending on cultural values and religion, these colours can be connected to definite meanings, and thus marketers ought to be careful and considerate with their colour choices.

The challenge when operating internationally is to create compelling designs that appeal to a broad audience and are also culturally relevant and understood. Although cultural differences can make marketing more complex, incorporating cultural nuances can improve the marketing process and make it more efficient. Adjusting colours to local markets, after understanding their cultural context and their underlying associations, can be an exciting and effective way to create a compelling message and refer to an imbedded meaning (Sherin, 2011). What is more, it can help products or brands stand out and gain a competitive advantage.

Subjective norms

While demographic factors are often inherent in a person and cannot be changed; subjective norms depend more on people's surroundings. They can, for example, come from the society and community someone grows up in, their role models, their career path, their group of friends and their lifestyle, among others.

In addition to colours having inherent cultural meanings, there are also subjective norms related to colour. An example is gender. In the United States of America, for example, pink is considered a female colour and associated with baby girls, while blue is regarded as a male colour and associated with baby boys (Priluck Grossman & Wisenblit, 1999). Another example are dress codes in different companies. While conservative companies tend to require a dark blue or black suit, a white shirt, a slightly colourful tie and black or brown leather shoes, less traditional companies allow their employees to come to work in more colourful garments. It can be beneficial for marketers to understand societal norms and to keep the target audience in mind in order to create colour campaigns that adhere to or break societal norms, depending on the intended message.

Choosing the right colour and colour combination for a brand or product is essential for its success. Many factors must be considered, such as understanding colour associations or the cost of production. Colour trends also play an important role. Since the colour of a product is usually determined long before it can be seen by the public, knowing which colour will be popular at the point of the introduction into the market can lead to a competitive advantage. For this purpose, colour research can either done by a company itself or purchased from external research companies. Colour forecasts are reports on which colours, textures and trends are expected to be popular in future seasons. While in most cases, colours are determined by the message to be communicated and the target audience, colour forecasts about future trends can help produce current and timely colour choices (Sherin, 2011). Some industries and products are inherently more prone to colour trends than others; while in the fashion industry, for example, it is of great advantage to know what will be popular in the future, in the auto industry colour trends are generally more stable.

When considering the upstream effects of colours, marketers should focus first on colours in a cultural and societal context, as this information can be found easily, and culturally inappropriate colour choices can be detrimental for a product or brand. Secondly, marketers should take the psychological effects of colour into consideration and understand that some associations to colours are learned and can differ from person to person depending on their experience. Lastly, a note should be taken that the physical effects of colour enable most people to see a particular spectrum of colours, but there are people whose visible spectrum is smaller or wider. After understanding the upstream effects of colour which marketers cannot change, it is important to examine the downstream effects of colour.

2.3. The downstream effects of colour

According to Kiehelä (2014), knowing the upstream effects of colours can be helpful but is not necessarily sufficient to understand the effects colours have on consumers. Upstream effects cannot be influenced by marketers at all, while downstream effects can to some extent (Kiehelä, 2014). Marketers can decide the colour of their logo, products and advertisements, among others, even though they cannot fully control how these colours are perceived by consumers (Kiehelä, 2014). Downstream effects of colour influence many areas of marketing. The emphasis in this paper will be the relationship between colour and products, but first the concepts of colour will be established in the big picture of marketing.

2.3.1. Colour in the big picture of marketing

Colour plays a vital role in marketing at any stage. The American Marketing Association (2013) defines marketing as “the activity, set of institutions and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners and society at large" (para. 1). When products or services are marketed, they must be merchandised, publicised, advertised and promoted. According to Eiseman (2017), colour plays a vital part in the entire marketing process as colour encourages sales in many instances "by attracting attention, whether in packaging, at point-of-purchase, online or in printed matter" (Eiseman, 2017, p. 204). This section will touch upon three downstream effects for which colour has been identified as a major influencer in purchasing decisions, namely retail, advertising and branding, before going into more detail about another downstream effect, the relationship of colour and product.

Retail

As illustrated in detail by Kiehelä (2014), several studies have examined the effect of colours in the retail environment. These investigations have found differences in purchase intentions and excitement between cool and warm colours, or among different cultures. Confirmed by several individual studies, colours in the retail environment are acknowledged to be capable of influencing the consumer, while a conclusive understanding of colours in the retail environment has yet to be reached (Kiehelä, 2014).

Advertising

In comparison to retail, the role of colour in advertising has been addressed more extensively in academic research (Kiehelä, 2014). However, the conclusion is similar. While there is definitive proof that colours in advertising have an impact on consumers, it is impossible today to reach a general conclusion about their effects as they are still deemed highly context-dependent (Kiehelä, 2014).

Branding

In addition to retail and advertising, colour also plays an essential role in branding. Colours help consumers identify brands (Abril, Olazábal, & Cava, 2009) and influence the perceptions consumers have about brands (Labrecque & Milne, 2012). What is more, through colour, a brand can establish a compelling visual identity, form strong relationships with a targeted segment, and position itself among competition (Labrecque & Milne, 2012).

It has been established that colour plays an important role and has downstream effects in retail, advertising and branding. While a general understanding of the importance of colours and their impact exists, their effects cannot be generalised and are still highly dependent on context and the upstream effects of colour. The downstream effect that is considered the most applicable to this paper and the research question is product colour, which will be discussed in depth in the following section.

2.3.2. The relationship between colour and product

Colour is a complex construct for which people can develop preferences or aversions. Every object has to have a colour for humans to be able to see it. What is more, differences in colour enable the human eye to distinguish colours and thus objects, which ensures survival. Therefore, the essence of colour is different if it is a concept per se or if it is put in relation to an object, which can completely change the meaning. For example, red can mean "danger" or "stop" when it is on a sign, but if it is on a can people will most likely associate it with Coca Cola or another soft drink (Caivano, 1998; Priluck Grossman & Wisenblit, 1999).

According to Priluck Grossman & Wisenblit (1999), when comparing somebody's favourite colour in general and preferred colour in relation to an object, they are likely not to be the same. People have favourite colours, which have probably been determined through positive stimuli. But that does not imply that people still choose those products that are in their favourite colour, or – given a choice of a range of colours – always choose their favourite colour. On the contrary, studies have found that people's colour preferences for objects and their favourite colour are independent from each other (Priluck Grossman & Wisenblit, 1999).

What is more, through experience and conscious associative learning, people are likely to have a wide range of colour associations and preferences, which makes it more complicated for marketers to understand which colour is appropriate and liked by consumers (Priluck Grossman & Wisenblit, 1999).

Product colour and packaging

For many types of products, the colour of the product itself cannot be changed or used as a differentiator. This holds true especially for low-involvement products or commodities. The main differentiator when the product itself is unchangeable is the packaging, which is what the marketer can influence and how the product is presented to the consumer before purchase. According to Eiseman (2017), the critical thing to note is that the packaging holds a promise about the product that lies inside it, a phenomenon called sensation transference. The impressions and impact produced by the colours of the packaging are transferred to the product inside (Eiseman, 2017). In the following, the examples will not focus solely on product colour per se – as it cannot be changed – but on the colour of the packaging that contains the product and performs sensation transference. As a result, product colour and packaging colour are treated equally in this paper.

Determining product colour or packaging colour through associations

To know which colour to give a product or its packaging is a crucial decision and can influence the success of any given product. As Priluck Grossman & Wisenblit (1999) suggest, colour meanings can be created by combining colours with images that represent the qualities of the brand. When particular to a brand, colour can act as a cue with strong associations. However, it is likely that consumers will develop unique associations based on the product because the colour is context-specific and not generalizable. To ensure that a particular colour association is not copied by another firm, a trademark can be useful to maintain a brand's proprietary colour and its related associations (Priluck Grossman & Wisenblit, 1999). The companies *Tiffany* or *Kodak*, for example, have trademarked their brand colours (Wheeler, 2017).

The aim is to pair the right colour with the product in question; the colour should serve a specific purpose and convey the right meaning. This could include differentiating the product in question from other products, imitating other products or creating awareness of a particular product attribute. As a marketer or product designer, it is a useful exercise do some research around the associations people have of the product in question and link these associations to colours (Priluck Grossman & Wisenblit, 1999).

After identifying the product and its associations, marketers can decide whether to work with colours that enforce these associations or break these associations intentionally, which will consequently create new associations. Especially when introducing a completely new product to the market which has not existed before, marketers have more freedom to create new associations that will specifically relate to their product. However, most products introduced to the marketplace are not new inventions but already exist in one form or another.

Following is an examination of the packaging of coffee beans, which are a commodity and highly indistinguishable without packaging. The upscale coffee brand *illy* uses silver tins as their packaging, which look similar to Italian espresso machines and can appeal to customers who are looking to enjoying upscale, Italian coffee.

Figure 18: Illy packaging (Illy, n.d.).

Figure 19: Italian espresso machine (Nisbets, n.d.).

By contrast, typically organic or fair-trade coffee brands pack their product into brown paper bags, which look similar to the coffee sacks in which the farmers store fresh coffee beans after harvesting them. Additionally, the brown bags are more environmentally friendly and appeal to those consumers who are more concerned about reducing their environmental footprint.

Figure 20: Agricultural coffee sacks (illuminechicago.com, n.d.).

Figure 21: Brown coffee bags (Fresh Roasted Coffee LLC, n.d.).

This anecdotal evidence shows that marketers ought to decide on colours that enforce the story they want to tell about their product and identify which target audience they want to appeal to. In addition to the importance of colour associations, these examples also touch upon the importance of packaging materials in conjunction with colour, which goes beyond the scope of this thesis but would be an interesting area for further research.

Determining product colour or packaging colour through competition

Another way to work with colours and products is to position a product among competitive products. Again, the packaging of the product can become a critical differentiator. There are two options: either copying the product or packaging design from a competitor and take advantage of previously created associations or differentiating the product design or packaging from the competition.

An anecdotal example showcasing the copy strategy in the shampoo industry in Germany is *L'Oréal Elvive Dream lengths* shampoo and *Balea Professional Beautiful Long* shampoo. *L'Oréal Elvive* entered the market for long hair in March 2018 with an orange and pink packaging for their *Dream lengths* shampoo at € 2,45 per bottle (dm.de, n.d.). Balea, the economically priced store brand of the German retailer *dm,* introduced a similar-looking product with an almost identical promise named *Beautiful long* later in 2018 using very similar colours, which they offered at a lower price, € 1,35 per bottle (dm.de, n.d.).

Figure 22: L'Oréal Elvive Dream lengths Shampoo (L'Oréal, n.d.)

Figure 23: Balea Beautiful Long Shampoo (dm.de, n.d.)

In contrast to the copy strategy, Eiseman (2017) identifies another significant function of colour, which is to make the product stand out in a display and a presentation or to help distinguish it from the competition. An example of a successful differentiation strategy through colour was pursued by the Australian wine company *[yellow tail].* As Chan Kim & Mauborgne (2005) show, *[yellow tail]* understood that wine shelves in supermarkets are often overwhelming for customers since wine bottles typically have a similar appearance and contain a lot of information that many people do not understand or consider relevant. Labels usually look similar, incorporating such tones as white, black, silver or gold. As a consequence, consumers are overwhelmed and do not know which wine to pick. *[yellow tail]* wines made this their advantage and created packaging with simplistic labels that only include the most relevant information for consumers; they also displayed this information on colourful, vibrant labels that stood out from the rest of the shelf (Chan Kim & Mauborgne, 2005).

Figure 24: Traditional-looking wine shelf (Tse, n.d.).

Figure 25: *[yellow tail]* wine assortment (McConville / Alamy Stock Photo, 2016).

Colour can serve both as an imitator of or a differentiator to competitive products, depending on the goal the marketers are pursuing. Both strategies have proven a success, although differentiation – when successfully implemented – is likely to lead to more long-term results and new imitators.

Determining product colour or packaging colour through brand equity

Many products are introduced by companies as an extension to the already existing product portfolio of an already existing brand. New products are introduced by both new and existing firms, but product creation by already existing firms makes up the more significant part of the two (Bilbiie, Ghironi, & Melitz, 2012). Thus, when a company introduces a new product that already has established products in a market under one or several brands, the new product must fit into the brand portfolio and build on the existing brand equity.

There are several ways companies might decide to extend their portfolio. First, a product can be in the same product category and just represent an extension to a product line under the same brand. An example is the *Procter & Gamble* shampoo brand *Head & Shoulders*. The shampoos traditionally use a white base and a blue cap as their packaging across the line, which helps consumers recognise the brand immediately. These colours can also evoke associations with pharmacy products, which are traditionally blue and white. Additionally, the shape of the bottle and the placement and font of the copy contribute to the recognition and equity of the brand. When adding new products to their shampoo portfolio, *Head & Shoulders* uses the white base and blue cap as a basis and combines a unique design with varying colours at the same spot on every bottle. That way, consumers can immediately recognise the brand *Head & Shoulders* while finding the product that meets their individual hair needs or desires.

Figure 26: *Head & Shoulders* shampoo product line (Head & Shoulders, n.d.-a).

Apart from adding more versions of a product to an already existing range, additional products can also be included, such as adding a line of conditioners to a line of shampoos. In the case of *Head & Shoulders*, the bottles of conditioner maintain the signature white base colour and a blue cap; the copy placement, fonts and individual design placement are almost identical to that of the shampoo bottles. This ensures that customers can still quickly identify the brand. But by turning the bottle around 180 degrees, the customer can also spot the difference to the regular shampoo and identify the container as a conditioner.

Figure 27: *Head & Shoulders* shampoo and conditioner product lines (Head & Shoulders, n.d.-b).

In 2017, *Head & Shoulders* launched a product line extension with a shampoo that was packaged in a recyclable bottle including 25 per cent beach plastic. The bottle still has the same shape and the blue cap as well as the same copy placements and fonts, but the base colour of the bottle is no longer white but dark grey. This bottle stands out from all the other bottles of the line, and *Head & Shoulders* does not highlight the hair benefit or ingredient of the shampoo. Rather, the bottle solely highlights one product attribute: that the container is made up of 25 per cent beach plastic. This is a differentiator from their other products, and while building on their existing brand equity with the blue cap and shape of the bottle, the grey colour invokes a more revolutionary approach to shampoo packaging and highlights the ecological awareness and progressive thinking of the brand.

Figure 28: *Head & Shoulders* recyclable shampoo bottle (Head & Shoulders, n.d.-c).

Apart from a product line extension, a company might also pursue a brand extension. *Head & Shoulders'* parent company *Procter & Gamble* is a suitable example. Apart from *Head & Shoulders*, the company owns a wide range of brands including *Pampers*, *Pantene*, *blend-a-med* and *Ariel*, among many others. Each of these brands has its own brand equity. Colours play an essential role within each brand, but less across the brands, unless the products are in direct competition to each other, as are the two hair care brands *Head & Shoulders* and *Pantene*, for example.

Figure 29: *Procter & Gamble's* product lines across brands and categories (P&G, n.d.).

All the products used as examples above are low-involvement products. Another approach to tackle the complexity in colour choice is to determine whether the product for which the colour is to be chosen is a high- or low-involvement product and to learn how important of a factor colour is compared to other product features (Priluck Grossman & Wisenblit, 1999).

Determining packaging or product colour through category: high- versus low-involvement products

High-involvement products are usually more expensive, valuable and long-lasting than low-involvement products. Moreover, high-involvement products may be associated with an increased economic or social risk or have some emotional appeal or functional importance (Priluck Grossman & Wisenblit, 1999). Examples of high-involvement products are cars, smartphones and jewellery, while low-involvement products include but are not limited to laundry detergent or pasta. Thus, the purchasing decision for high-involvement products is more significant than for low-involvement products, for which the decision-making may be done more automatically (Priluck Grossman & Wisenblit, 1999).

Based on Martindale & Moore's (1988) research, people generally prefer typical over atypical colours for objects. Additionally, Lee & Barnes (1990) suggest that typical colours are more likely to be learned for high-involvement products than low-involvement products due to the frequent use of standard colours for high-involvement products in advertising. Kardes (1988) suggests that for low-involvement products, critical or risky decision-making criteria might not be present, such as a high price. Consequently, simple factors might influence the purchasing decision much more and consumers can establish attitudes based on a small amount of information. Therefore, Priluck Grossman & Wisenblit (1999) suggest that colour – in their opinion an unimportant product attribute – may play a more important role in low-involvement products compared to high-involvement products, especially when the products are seen as relatively similar.

What is more, Priluck Grossman & Wisenblit (1999) propose in their research that consumers often conform to norms in their colour choices for specific product categories, in particular high-risk purchases. Although the colour of a high-involvement product is an important decision-making factor, a person's choice of colour may not be based on colour preference. Instead, a more complex formulation of associations occurs that leads to an emotional response when a consumer considers a high involvement product for purchase (Priluck Grossman & Wisenblit, 1999). For consumers, conforming to learned associations might often be more important than personal preference due to reducing the risk of not fitting in, not liking a colour at some future time, or a change of colour trends. As a consequence, understanding the factors that influence the purchasing decision – especially the choice of colour – may help prevent marketers from wasting their time, energy and money by utilising colours that are trendy instead of timeless (Priluck Grossman & Wisenblit, 1999).

2.4. Summary of the literature review

Colour is a complex construct that has a considerable impact on humans, yet only a fraction of its impact is understood.

The fundamentals can be found in classic colour theory. Colour terminology aids in understanding different levels and dimensions of colour. Colour systems explain how colours are produced and visualised in print and digitally and identifies associated risks. The colour wheel has existed for centuries but can still aid in making colour choices and creating relating or contrasting harmonies. There are numerous other resources beyond the colour wheel that can be of help when choosing appropriate colour combinations.

The upstream effects of colour comprise physical, psychological and cultural dimensions. Colour has physical effects on the human eye, which enables the visibility of a certain spectrum of colours. The psychological effects of colour depend on the relationship between colour and the human brain; subconscious and conscious associated learning also influences colour preferences. Colour should be seen in a cultural context because of demographic factors and subjective norms.

The downstream effects of colour can be viewed within the big picture of marketing including retail, advertising and branding, but an emphasis is placed on the relationship between colour and product. Subsequently, different ways of determining product or packaging colour were explored, including associations, competition, brand equity and the distinction between high- versus low-involvement products. As Ricks (1983) stated, sometimes companies fail simply because of inappropriate choices of product or packaging colours.

Despite widespread acknowledgement of the importance of colour in the field of marketing, "little academic research has investigated the ways in which colour can shape consumer perceptions such as brand personality, familiarity, likability, and purchase intent" (Labrecque & Milne, 2012, p. 1). In an attempt to fill this academic gap, the research experiment conducted for this master's thesis will explore the effects of smartphone colour palettes on consumers' attitudes and purchase intentions.

3. Research methodology

To provide an overview of the scientific approach used in the research which was conducted in order to find out how smartphone colours influence consumers' attitudes and purchase intentions, the research strategy and research design are explained in detail below.

3.1. Research strategy

Before laying the groundwork for the research question and derived hypotheses, it should be noted that this research was conducted using a positivistic approach. A positivistic approach implies that only observable phenomena can lead to the credible production of data (Saunders, Lewis, & Thornhill, 2009). Another aspect of the positivistic approach is that the research was conducted value-free, meaning that the personal opinions and feelings of the researcher were excluded. All explanations and predictions made in this paper underlie the positivistic approach, meaning that human interests are not relevant and the independence of the researcher is ensured (Saunders et al., 2009).

A research question and several hypotheses were developed in the course of this master's thesis. These were tested using common statistical methods to get reliable data that either confirm or refute the hypotheses and thus answer the research question.

This thesis aims to determine to what extent smartphone colour palettes affect consumers' attitudes and purchase intentions.

The research question entails that the concept of smartphone colours be defined. The term 'smartphone colour' refers to the shell of the smartphone, not the packaging or the colour of the screen. The smartphone colour can best be identified as the back of the phone. The term 'smartphone colour palette' designates a range of smartphones of different colours that are placed next to each other in retail displays or promotional materials. For the thesis, two levels of smartphone colour palettes were tested: conventional colours and unconventional colours. The definition and choice of colours for each product line will be explained in detail in section 3.2.1. Experimental design. Smartphone colour palettes can also be identified as the independent variable.

The first part of the research question was aimed at consumers' attitudes. This is an umbrella term for three measurable concepts that were tested, namely the visual appeal of the product line, brand personality appeal with regards to originality, and attitude towards the brand. It is important to note that the term 'consumers' attitudes' is generally not limited to the three variables above but could include several other variables.

The second part of the research question was aimed at understanding consumers' purchase intentions, about which two questions were asked. The purchase intention was measured as a dependent variable. Second, the perceived purchasing decision of one of the smartphones based on colour was evaluated.

The aim of the research question and thus, this thesis, is to determine a significant effect between the independent variable, namely the smartphone colour palette, and the dependent variables mentioned above. The table below shows the relationship between the dependent variables and the research question.

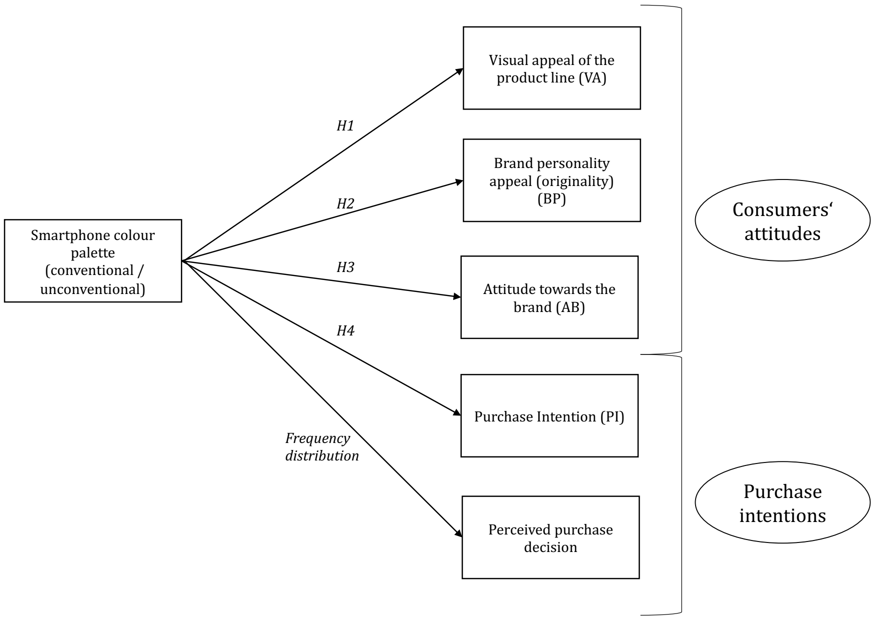

Figure 30: Conceptual model of the research question.

As can be seen in the table above, four out of the five variables are subject to hypothesis testing, which is the topic of the next section.

3.1.1. Hypotheses

Since a positivistic approach was applied and the aim was to find a significant difference between the two levels of the independent variable, several hypotheses were established. The hypotheses were formulated in a two-tailed or non-directional way to avoid missing an effect that is present but could not be detected due to a one-tailed or directional hypothesis formulation. For all variables, this thesis aims to find a significant difference between the unconventionally coloured smartphone line versus the conventionally coloured smartphone line.

To better understand consumers attitudes' towards conventionally and unconventionally coloured smartphone lines, three hypotheses were tested. The first hypothesis assesses the visual appeal of the product line, to determine whether there is a significant difference in the perception of the visual appeal between the conventionally and unconventionally coloured smartphone line. Thus, the first hypothesis is formulated as follows:

H1: The unconventional smartphone colour palette has a significant effect on the perceived visual appeal of the product line.

Going a step further from the visual appeal, the next hypothesis aims to understand whether there is a significant difference in the brand personality appeal with regards to its originality between the conventionally and unconventionally coloured smartphone line.

H2: The unconventional smartphone colour palette has a significant effect on the brand personality appeal (originality).

As will be shown in more detail later, the metrics of the brand personality's appeal aim at understanding the newness versus the commonness of the two smartphone lines. In comparison, the next hypothesis explores whether the differences in smartphone colour palettes affect the perception between value-for-money and luxury, labelled here as attitude towards the brand.

H3: The unconventional smartphone colour palette has a significant effect on the attitude towards the brand.

The final hypothesis aimed at understanding whether there is a significant difference in purchase intention between the conventionally and unconventionally coloured smartphone line. Thus, the following hypothesis was formed.

H4: The unconventional smartphone colour palette has a significant effect on the purchase intention.

In addition to the hypothesis test on purchase intention, a question was asked on the perceived purchasing decision, which was evaluated using a frequency distribution rather than a hypothesis test.

To conclude, the experiment aimed to evaluate whether there are significant differences between a conventionally and an unconventionally coloured smartphone line based on the dimensions of the visual appeal of the product line, brand personality appeal (originality), attitude towards the brand and purchase intention.

After establishing the research question and presenting the four hypotheses used to answer the research question, the next section of the paper will outline the research design.

3.2. Research design

This section of the paper will explain the experimental and instrumental design, the pilot test and the final questionnaire in more detail.

The research question determines the applicability of research methods and the data analysis procedure (Saunders et al., 2009). In general, three different types of research are the most prevalent: exploratory, descriptive and explanatory research. Exploratory research aims to gain a better understanding of a theoretical idea, rather than providing conclusive evidence. Descriptive research is usually the next step after exploratory research; having established the theoretical idea, data is collected to find more comprehensive information. Data from descriptive research is not used in order to be interpreted or to make predictions. This is only the case for explanatory or causal research, which aim to study "a situation or a problem to explain the relationships between variables" (Saunders et al., 2009, p. 140).

Since the aim of the thesis is to explain a relationship between an independent variable and four dependent variables, the explanatory research method was predominantly used. Nevertheless, the thesis will also include descriptive sections. Experiments are one way of doing causal research, including the research method pursued for this thesis.

3.2.1. Experimental design

Due to the characteristics of the research question, an explanatory research design was conducted in an attempt to answer the research question. As it is a reasonable choice for explanatory research methods, a quantitative study in the form of an experiment was performed. According to Dudovskiy (2018a), "experiments are the most popular primary data collection methods in studies with causal research design" (para. 2).

Experiments involve the manipulation of an independent variable to assess the effect on the dependent variables (Dudovskiy, 2018b). According to Saunders et al. (2009), conducting an experiment typically involves six steps: First, the definition of a theoretical hypothesis or several hypotheses. Second, the selection of samples of individuals from known populations. Third, the random allocation of samples to different experimental conditions. Fourth, the manipulation of the independent variable. Fifth, the measurement of a small number of dependent variables. And finally, the control of all other variables (Saunders et al., 2009).

Experimental designs are referred to as the *golden standard* of research designs as they ensure the strongest level of internal validity compared to other research designs (Trochim, 2006). This is because experiments try to minimise the number of explanations between two experimental conditions – first, the effect of the treatment and second, chance (Haslam, 2018). While there is never complete certainty regarding which of the two explanations holds, the probability of chance can be estimated as a plausible explanation and brought to a minimum threshold.

Types of experimental designs

While there are many types of experimental designs, the two primary methods in which project designs are carried out are independent-measures (also called between-groups or between-subject) and repeated-measures (or within-groups or within-subject) experimental designs (Draeger, 2017). In independent-group research designs, subjects are randomly assigned to a control or treatment group and are exposed to one of the two conditions. In comparison, in repeated-measures experimental research designs, all subjects are exposed to all conditions. Both the independent-group and the repeated-measures experimental design method come with advantages and disadvantages. For the most part, the disadvantages of one design are the advantages of the other. The next section will first describe the benefits of the repeated-measures design, followed by its risks and how these were tackled in the experiment conducted for this paper.

Repeated-measures designs have some substantial benefits compared to independent-group designs. First, the number of subjects necessary for obtaining an accurate, statistically significant estimation is less than for independent-group designs. This is because the analysis of change is measured not across groups but within one person. And "the change within a person between two measurements carries greater statistical accuracy than reliance on between-group changes" (Draeger, 2017, para. 1). Because of the increased accuracy, the repeated-measures design provides higher statistical power in analyses with fewer participants. Second, as no comparison between groups is required but comparisons are made within individual responses, no equivalency among groups is necessary to provide an accurate measure of change. While random assignment in between-groups measures is supposed to minimise variance within conditions, it does still exist and can decrease the clarity of the effects of the experimental factor (Draeger, 2017; Oeldorf-Hirsch, 2017).

The experiment presented in this paper was done using a repeated-measures design. It was determined to be beneficial for the study to learn the opinions and preferences on both treatments from all individuals, as the questions are based on personal taste. According to Draeger (2017), "a well-constructed within-subjects design provides a valid, reliable, and repeatable method that can serve the ends sought by the investigator" (para. 2). Nevertheless, the repeated-measures design comes with some risks, which will be explained next.

Confounding effects in repeated-measures designs

In experiments that examine a relationship between two variables, it is possible that – even though the two variables are correlated – a third confounding variable influences their relationship. Two variables can be considered confounded by a third variable if the treatment systematically changes with some other variable. Sources of confounding effects include but are not limited to the history, maturation, instrumentation and selection of participants (Kovera, 2010).

Even though experiments can contain confounds, the point of experimenting is to control the effects of potential confounding variables. In experimental repeated-measures designs, three types of common confounding effects can be identified and thus statistically controlled (Kovera, 2010).

Sequence effects refer to the potential influences of the treatments on each other, depending on the sequence in which the treatments are presented to the subjects.

Order effects differ from sequence effects, as they do not refer to the influence the order of treatments has on the treatments themselves, but instead refer to the influence the order of treatments has on the outcome.

Carryover effects are effects that change the subjects permanently (Acheson, 2010).

The following quote illustrates the differences between sequence, order, and carryover effects:

> *"Imagine an experiment where subjects are asked to pick up and guess the weight of different objects on multiple daily sessions. A sequence effect would be the perceived weight of a given object being influenced by whether light or heavy object was handled just before. In contrast, an order effect would be the perceived weight of objects increasing as the experimental session progresses and subjects grow fatigued. Finally, a carryover effect would be the perceived weight of objects decreasing across sessions as subjects grow stronger from all the excessive lifting" (Acheson, 2010, p. 2).*

There are two common strategies for minimising the three above-mentioned confounding effects. First, sufficient time can be allowed to pass between the treatment phases so that the subject returns to a pre-treatment state before the next treatment is administered. However, in reality it is hard to know what amount of time is sufficient and attrition can arise as a problem if the participant needs to return to the study. For practical reasons, this method has not been employed in the experiment conducted for this research paper and can thus be identified as a limitation to the study. The second strategy used in order to statistically manage sequence, order and carryover effects is counterbalancing, which balances out and thereby eliminates the effects (Foley, 2004). To learn whether counterbalancing can be employed as a statistical method in order to minimise sequence, order and carryover effects, one must first identify whether any asymmetrical confounding effects should be expected.

Confounding effects can be classified into *symmetrical* and *asymmetrical* residual effects from previous treatments. This distinction is essential when choosing the right method for analysing the data generated from the experiment. Symmetrical residual effects occur if the sequence, order and carryover effects are the same, regardless of the order of treatments. In contrast, asymmetrical residual effects occur if the sequence, order and carryover effects differ depending on the order of treatments. If asymmetrical carryover effects are expected, the within-subject design should be discarded, and instead, a between-subject design should be employed (Alferes, 2012).

In the experiment conducted for this research paper, asymmetrical carryover effects should not be considered a concern as the treatments should not permanently affect the subjects. Also, the experiment is relatively short – to avoid fatigue and boredom – and not cognitively, emotionally or physically challenging. The experiment asks for preferences rather than performance, thus learning effects should not be considered a problem. The assumption of symmetrical confounding effects lays the foundation for employing the counterbalancing method (Corriero, 2017).

Counterbalancing

In repeated-measures designs, counterbalancing allows researchers to control the symmetrical residual effects of previous treatments. In general, the method of counterbalancing refers to the systematic modification of the order of treatments in studies to enhance the study's internal validity. More specifically, in experimental designs most factors to be counterbalanced are procedural variables that can create confounding effects. While counterbalancing does not eliminate sequence, order and carryover effects, it does distribute them evenly across all experimental conditions, so their influence is balanced and does not confound the direct effect caused by changes of the independent variable (Corriero, 2017).

Counterbalancing can be divided into complete and incomplete types. Complete counterbalancing is achieved when all possible permutations of conditions are employed, and each sequence is assigned to an equal number of subjects. The number of permutations is calculated by employing the factorial to the number of treatments. Complete counterbalancing is considered the most desirable option for within-subject designs and should be used whenever enough participants are available. Since factorials rise quickly, though, the use of complete counterbalancing is only recommended for four or fewer treatment levels (Corriero, 2017). For the experiment conducted for this research paper, two treatment levels, A and B, were established. Thus, $2!=2$ permutations, AB and BA, were created and as a result the method of complete counterbalancing was applied. A select type of the counterbalancing method is the crossover design, which will be the topic of the following section.

Crossover design

As a counterbalancing method in this repeated-measures experiment, a crossover design was implemented. In this type of design, the sequence of treatments varies depending on the group. Group 1 is first exposed to Treatment A and then to Treatment B. By contrast, Group 2 is first exposed to Treatment B and then to Treatment A. Figure 23 depicts the 2×2 crossover design of the experimental study with two treatment sequences: AB and BA.

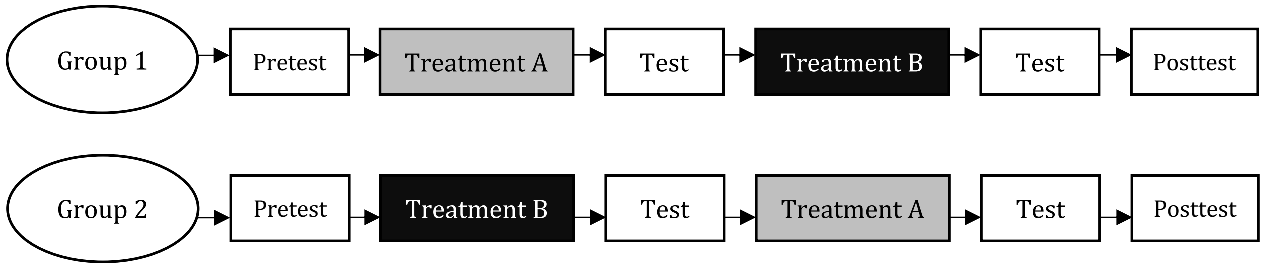

Figure 31: Crossover design.

A crossover design is denoted by CO(t, n, p): t stands for the amount of treatment levels, n is the number of subjects that receives the treatment levels and p is the number of periods. Thus, the experimental design done for this research paper is denoted as follows:

CO(2, 104, 2)

Crossover designs have two basic structural properties: *uniformity* and *balance*.

Uniformity describes the amount of treatment levels within subjects and periods. A crossover design is considered *uniform on rows* when for every subject (row) the same number of periods (columns) is assigned to each treatment level. In the case of the experiment for this research paper, one period is assigned to each of the two treatment levels for every subject. These periods are only a few seconds apart. Likewise, a crossover design is considered *uniform on columns* when, for every period (column), the same number of subjects (rows) is assigned to each treatment level. In the experiment, 104 subjects were assigned to each treatment level for both periods. As the design of the experiment conducted is both uniform on rows and columns, it can be considered a uniform design (Alferes, 2012).

Balance denotes the sequence and repetition of treatment levels across rows. A crossover design is considered *balanced* if every treatment is not repeated, or in other words, not preceded by itself but by all remaining treatment levels the same number of times. If a treatment is preceded by all treatment levels including itself, a crossover design is said to be *strongly balanced*. As this is not the case in the experimental design used in this paper, it cannot be considered *strongly balanced*, but *balanced* (Alferes, 2012).

Experimental designs in which the number of periods (p) and the number of treatments (t) are identical and that are uniformly designed are called complete-sequence designs. As can be seen above from the denotation of the experimental design CO(2, 104, 2), both t=2 and p=2, thus p=t. Also, the design has already been identified as uniform, as the number of replications per subject (row) and per period (column) is the same for all treatments. Thus, the experimental design can be considered a complete-sequence design (Alferes, 2012).

As a result of choosing a repeated-measures experimental design, every participant was exposed to two treatment levels. The first treatment level was a conventionally coloured smartphone line and the second treatment was an unconventionally coloured smartphone line. The crossover design was done automatically in Qualtrics by applying a block randomiser that randomised Block 1: Conventional Smartphone Portfolio and Block 2: Unconventional Smartphone Portfolio, as can be seen in the survey flow below.

Standard: Intro (1 statement)
Standard: Color blindness check (4 questions)

Block Randomizer:

> **Block 1: Conventionally coloured smartphone line (4 questions)**
> **Block 2: Unconventionally coloured smartphone line (4 questions)**

Standard: Perceived purchasing decision (1 question)
Standard: Control variables (5 questions)

Figure 32: Randomizer in survey flow derived from Qualtrics.

3.2.2. Instrumental design

The instrumental design of the experiment was done in two steps. First, desk research was conducted to determine the product palettes of conventionally and unconventionally coloured smartphones. Second, the smartphone lines were created.

Desk study

To determine the two treatments of conventionally and unconventionally coloured smartphone lines, a desk study was conducted. The desk study aimed to determine the colours used for the respective smartphone lines and the number of smartphones per product line.

The desk study focused on the smartphone market in the United Kingdom. This decision was made for two reasons. First, as has been established in the literature review, colours vary dramatically among cultures and countries. The meanings and associations can be very different from one culture to another. Thus, the decision was made to focus on one country to establish a purer depiction of what constitutes conventional and unconventional colours. Second, the sample of the study consisted primarily of professionals working in the United Kingdom. Consequently, it seemed logical to focus on colours that are conventional and unconventional in the United Kingdom.

The desk study was conducted in several steps. First, the leading smartphone vendors by market share in the United Kingdom were determined for the year 2018. The table below shows the market share data of the mobile vendor market in the United Kingdom according to StatCounter Global Stats (2019), which uses data from page views across more than two million websites. The data was available on a monthly basis from which an average for the year of 2018 was calculated. The results show that the smartphone market in the United Kingdom is led by Apple with a market share of 50.81 per cent. Apple possesses just over half of the entire market, followed by Samsung with 28.42 per cent, which makes it about half the size of Apple but still a quarter of the United Kingdom's smartphone market. Thus together, Apple and Samsung account for more than three-quarters of the entire market. Huawei managed to grow from 3.56 per cent in January to close to twice that size, 6.17 per cent, in December. On average for 2018, that means it accounts for around five per cent of the United Kingdom's smartphone market. The last three listed here are Motorola, unknown vendors and Sony. Summed up, these are only marginally bigger than Huawei. Thus, all vendors beyond Sony were disregarded due to their small market share.

Date	Apple	Samsung	Huawei	Motorola	Unknown	Sony
Jan-18	50.40	29.79	3.56	1.77	2.00	2.41
Feb-18	51.49	29.03	3.74	1.73	2.01	2.29
Mar-18	52.85	27.74	3.86	1.77	2.11	2.12
Apr-18	49.85	28.85	4.46	1.93	2.17	2.16
May-18	49.37	29.19	4.77	1.87	2.07	1.97
Jun-18	45.66	31.19	5.44	1.97	2.14	1.97
Jul-18	46.34	30.87	5.63	2.07	1.86	1.87
Aug-18	48.48	29.53	5.54	2.07	1.46	1.74
Sep-18	49.24	28.54	5.83	2.01	1.39	1.61
Oct-18	53.63	26.08	5.36	1.94	1.24	1.29
Nov-18	60.36	22.35	3.91	2.15	1.39	0.79
Dec-18	52.06	27.82	6.17	1.95	1.44	1.01
Average (2018)	**50.81**	**28.42**	**4.86**	**1.94**	**1.77**	**1.77**

Table 1: Market shares by vendor in the UK smartphone market in 2018 (StatCounter Global Stats, 2019)

To be able to map out the colours, all major phone lines released by the vendors in the year 2018 in the United Kingdom were taken into consideration. To generate the purest data possible, the local United Kingdom websites of the vendors themselves were used as the primary source. This is important because the colours can vary not only depending on the country it is sold in but also depending on the seller. Third-party partners (such as retailers and carriers) were disregarded.

The next step was to establish a classification of colours. The challenge here was that there is an infinite number of colours, but to group them and make them distinguishable it was necessary to come up with a classification that was appropriate for this study. Starting with the traditional colour wheel, the three primary and three secondary colours created the basis for the classification: yellow, red, blue, orange, green and violet.

Yellow	Red	Blue
Orange	Green	Violet

Figure 33: The primary and secondary colours for the desk study's colour classification.

As the colour wheel excludes any shade of grey but these colours are deemed common for smartphones, a greyscale of three colours was added, namely white, grey and black.

White	Grey	Black

Figure 34: Greyscale colours for the desk study's colour classification.

These nine hues formed the foundation, but to make the analysis more precise, three more colours that simulate metal were added: gold, rose gold and silver.

Gold	Rose Gold	Silver

Figure 35: Metallic colours for the desk study's colour classification.

Once the smartphone vendors and the colour classification system were established, the local United Kingdom website of every vendor was visited, and the colour that most closely resembled the colours above was chosen. In this context it is essential to point out that the hues above include any tint, tone and shade of that colour. As the mapping was done by means of the researcher's eyesight using a personal computer, the way colours would be perceived by other individuals using other devices might vary.

During the desk study, a total of 38 phone lines from five different vendors in the United Kingdom, namely Apple, Samsung, Huawei, Motorola and Sony, were examined. The number of colour variants per smartphone line was noted as were the colours according to the twelve categories mentioned above. In total, of the 38 smartphone lines, 31 offered a black phone, which corresponds to approximately 82 per cent of all phone lines. Interestingly, all of Samsung's phone lines offered a black model. Black was by far the most conventional colour, followed by blue with a colour count of 21 and gold, which was represented 14 times. The colours violet, silver and grey were also well represented (eleven, ten and ten times, respectively). Silver and grey phones together made up about 20 per cent of all colour variants. Three colours – rose gold, green and red – were each represented three times. White only appeared in two smartphone lines, and the only yellow and orange phones that could be found across all researched models were part of the iPhone XR line. The full analysis can be found in Appendix A.

Rank	Colour(s)	Colour Count	The ratio of colour count to the total number of phone lines (%)	The ratio of colour count to the total number of colour variants (%)
1	Black	31	81,58	28,18
2	Blue	21	55,26	19,09
3	Gold	14	36,84	12,73
4	Violet	11	28,95	10,00
5	Silver	10	26,32	9,09
	Grey	10	26,32	9,09
6	Rose Gold	3	7,89	2,73
	Green	3	7,89	2,73
	Red	3	7,89	2,73
7	White	2	5,26	1,82
8	Yellow	1	2,63	0,91
	Orange	1	2,63	0,91

Table 2: Smartphone colour distribution data.

Another aspect researched in this desk study is the average number of colour variants per smartphone line. This data per phone line can be found in Table 4. To calculate the average, the sum of all colour variants was divided by the total number of smartphone lines, which leads to an average rounded colour variant offering per smartphone line of three. As a consequence of this result, the number of colour variants displayed in both experimental conditions, conventional and unconventionally coloured smartphone lines, was three.

Total number of smartphones	110
Total number of smartphone lines	38
Average	2.9

Table 3: Average number of smartphones per smartphone line.

As a result of the desk study, the two smartphone lines were established. The first smartphone line of conventional colours featured three phones which were black, blue and gold. The second smartphone line of unconventional colours consisted of three phones which were white, yellow and orange. The next section will go into detail in how the smartphone lines were created.

Creation of instruments

The instruments were created using an image of a non-branded smartphone with a sleek, modern design that resembles what is currently available and desirable in the real marketplace. The image was purchased on *VectorStock* and is subject to a standard license. Below is the original image that served as the basis for the creation of the smartphone lines.

Figure 36: Original image for the creation of coloured smartphone lines ("VectorStock - Vector Art, Images, Graphics & Clipart," n.d.).

The original image was then adapted in Adobe Photoshop, to reflect the conventional and unconventional colours that were established in the desk study. For the conventional colours, namely black, blue and gold, the following colours were used in RGB:

Figure 37: Conventionally coloured smartphone line.

	R	**G**	**B**	**Hue**	**Saturation**	**Lightness**
Black	0	0	0	0	0	-100
Blue	44	57	108	228	42	+30
Gold	184	136	81	33	42	+52

Table 4: Colour properties of conventional smartphone colour palette.

For the unconventional colours which were established in the desk study as white, yellow and orange, these RGB codes were used:

Figure 38: Unconventionally coloured smartphone line.

	R	G	B	Hue	Saturation	Lightness
White	255	255	255	0	0	+100
Yellow	234	217	0	57	100	+46
Orange	234	121	0	32	100	+46

Table 5: Colour properties of unconventional smartphone colour palette.

Additionally, the screen was coloured black as this is the standard for a phone that is turned off and the background was coloured light grey, to enable visibility of the white phone.

3.2.3. Pilot test

Before the questionnaire was distributed among the whole sample, a pilot-test with a fraction of the sample was done which intended to minimise the likelihood of misinterpretation of the questions, and thus increase validity and reliability (Saunders et al., 2009). After the pilot test was conducted, feedback was collected in individual interviews on the understandability of the questions, the flow of the questionnaire, the time it took to complete the survey as well as the design and any other comments. The pilot test was distributed to five people of the population.

Feedback on the pilot test was positive overall. As a result of the pilot test, the initial instructions were reformulated to be shorter and a question on whether the respondent owns a smartphone or not was added. The remaining items were kept the same.

3.2.4. Questionnaire

To assess the research question on how smartphone colours influence consumers' attitudes and purchase intention, a questionnaire was chosen as the method to collect data. According to Saunders et al. (2009), surveys are especially appropriate in explanatory research that aims to explain relationships between two variables.

According to the Marketing Research Society (2011), a proper questionnaire needs to fulfil several requirements. First, it must be ensured that the questionnaire is fit for purpose and the respondents get an introduction that informs them about the use of the research and ethical considerations. Second, the design and the content of the questionnaire need to be appropriate for the target audience. Third, the participants need to be enabled to provide information that reflects their opinions, which includes balanced Likert-scale questions and the ability not to answer a question if not wanted. Fourth, the survey participants should not be drawn to a particular point of view, which is done by formulating non-suggestive questions. Fifth, responses should be able to be answered unambiguously. Sixth, personal data collected should be relevant but not excessive (Marketing Research Society, 2011).

Altogether, the questionnaire consisted of six pages: the introduction, the pre-test, the first treatment and test, the second treatment and test, the perceived purchasing decision and the post-test. The questionnaire started with instructions that informed the participant that he or she would be presented with two differently coloured smartphone lines and that the only differentiator among the phones was their colour. All other tech specs and features (such as storage, battery life, camera, et cetera) should be considered equal. This statement was followed by the purpose of the thesis, a declaration that all answers would be treated anonymously and a statement of gratitude. After the first part, each survey participant was exposed to a pre-test that checked for colour blindness which will be further explored in section 3.3.1 Manipulation check. After the colour blindness test, the participant was exposed to the first treatment followed by the first test. The first test was immediately followed by the second treatment and the second (identical) test. After completion of both treatments and corresponding tests, the survey participants were asked to identify their perceived purchase decision. The survey concluded with a post-test that included some control variables.

The questionnaire was created and answered using the software Qualtrics. The complete survey can be found in Appendix B. The next section will clarify how the questions asked in the questionnaire were measured.

3.3. Measurement

To measure the presence of significant effects, different questions, also referred to as scale items, and scales were used. The survey started with a pre-test in which the participants were asked to answer a colour blindness test to control for manipulation. Respondents who did not answer the questions correctly were disregarded during the analysis. After the pre-test, every survey participant was exposed to both treatments followed by an identical test. The test included four scales that included several scale items. All of the scale items were measured on seven-point bipolar Likert scales (Likert, 1932). A consistent scale throughout the questionnaire is recommended to avoid confusion among survey respondents (Saunders et al., 2009).

For the survey conducted, seven-point Likert scales were utilised. There is no unilateral agreement on how many points per scale are best; it depends on the context and structure of the questions. Nevertheless, research suggests that having more points is generally better than having fewer, with a diminishing return at eleven points (Nunnally & Bernstein, 1994). According to Weijters, Cabooter, & Schillewaert (2010), seven-point Likert scales are recommended for two reasons. First, survey respondents have a propensity to respond positively to questions in order to please the researcher. With a neutral middle value, this bias can be accounted for. Second, previous research has shown that survey respondents can process up to seven pieces of information at once. Consecutively, survey participants should be able to discriminate between seven different options (Weijters et al., 2010). As a consequence, seven-point Likert scales were chosen for the questionnaire.

Even though Saunders et al. (2009) suggest using only the same type of questions, the questions in the pre-test and post-test were categorical. Categorical questions are designed in such a way as to give respondents a limited number of answers to choose from. These kinds of questions are especially useful when collecting background information of survey respondents (Saunders et al., 2009). In my estimation, the categorical questions added in the pre-test and post-test did not lead to any confusion among the respondents.

The questions were not mandatory, meaning that a respondent could omit items if he or she wanted to, as recommended by the Marketing Research Society (2011). Furthermore, the survey participants could not go back to a previous page after they left to prevent contaminated results.

3.3.1. Manipulation check

In line with Perdue & Summers (1986), the survey included a manipulation check. As the survey participants were asked to rate their attitudes towards differently coloured smartphone lines and colour was the only differentiator, it was necessary to ensure that the participants were not colour-blind but able to see and distinguish the colours. Based on the literature review, the most common form of colour blindness is red-green colour blindness, which affects approximately eight per cent of men and 0.5 per cent of women of Northern European ancestry (National Eye Institue, 2015). Other forms of colour blindness are sporadic and were therefore omitted.

To test for red-green colour blindness, two plates from the Ishihara Colour Test were incorporated (Ishihara, 1972). The first plate shows a red eight on a green background. According to Ishihara (1972), a person with red-green colour blindness sees a three instead of an eight and a person with complete colour blindness is not able to identify anything. Thus, the survey respondents were asked to look at the picture and determine if they saw an eight, a three, or nothing at all in a categoric question. The second plate shows a green 74 on a red background to people with normal colour vision. To people with a red-green colour deficiency, the 74 will appear as a 21, and to people with complete colour blindness, nothing will appear (Ishihara, 1972). Consequently, the survey participants were asked in a categoric question to identify whether they see a 74, a 21 or nothing at all. The responses that identified anything other than the eight or the 74, respective of the plate, were excluded from the analysis.

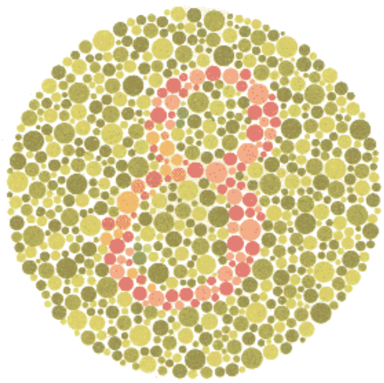

Figure 39: Ishihara Colour Blindness Test, Plate 2 ("Ishihara Color Test," 2009).

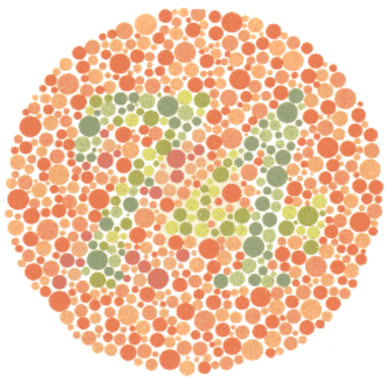

Figure 40: Ishihara Colour Blindness Test, Plate 7 ("Ishihara Color Test," 2009).

In all, three people did not pass the manipulation check and were excluded from the analysis.

3.3.2. Independent variable

The independent variable, and the one manipulated in the research conducted for this thesis, was smartphone colour palette. Every survey participant was exposed to a conventionally and unconventionally coloured smartphone line. The two experimental conditions are explained in detail in section 2.2.2. Instrumental design. The randomisation of the survey participants to the two treatment conditions was done through the survey software Qualtrics, to ensure even distribution and to avoid confounding effects. More information on randomisation is found in section 3.2.1. Experimental design. Next, the dependent variables will be explored.

3.3.3. Dependent variables

The survey conducted included four dependent variables: the visual appeal of the product line (VA), brand personality appeal (originality) (BP), attitude towards the brand (AB) and purchase intention (PI). These four variables were measured on bipolar seven-point Likert scales and tested using hypothesis testing. The survey participants were presented every dependent variable for each treatment condition, twice in total. Furthermore, the respondents were asked to rate the scale-items for every variable rather than every scale item individually in order to simplify the answering of the survey and make it less copy-heavy. Additionally, after being exposed to the two treatment conditions, a question on the perceived purchase decision was added, which was a categorical question and analysed using frequency distribution.

The visual appeal of the product line

The visual appeal of the product line variable was based on a scale with five bipolar, seven-point Likert scale items that measure the attractiveness and appeal of a product. The scale was introduced by White et al. (2016) with a reported alpha of .97. In their study, White et al. (2016) used the scale to measure the visual appeal of a product. As the interest in the survey for this thesis lies in the product line as a whole rather than an individual product, the question was amended to ask for the visual appeal of the product line rather than the product.

Brand personality appeal (originality)

As mentioned above, the image of the smartphone chosen for the treatment was a non-branded smartphone to avoid preconceptions. Thus, based on brand neutrality, the question of brand personality appeal with regards to originality was asked. The scale measured each survey participant's opinion about the novelty of the brand and its distinctiveness from another brand with four bipolar, seven-point Likert scale items. The scale was created by Freling, Crosno, & Henard (2011) with a reported alpha of .788.

Attitude towards the brand

This scale measures the extent to which a consumer believes a product to be either a luxury or a "value-for-money" brand with three seven-point bipolar Likert scale items. The scale originates from Hagtvedt & Patrick (2016), who reported an alpha of .97.

Purchase intention

The scale measuring the dependent variable purchase intention was based on a three-item, a seven-point Likert scale introduced by Burton, Garretson, & Velliquette (1999); it measures the likelihood that a consumer will purchase a product. The authors reported the scale's alpha as being 0.89. As mentioned above, the respondents were asked to rate the scale items for every variable rather than for every scale item individually. Consequently, the original scale used by Burton, Garretson, & Velliquette (1999) was amended from three individual scale item questions to one question followed by the three scale items.

After the completion of both treatments and the above four dependent variables, the survey participants were presented an image that combined both the conventionally and the unconventionally coloured smartphone lines to determine the perceived purchase decision.

Perceived purchase decision

At the end of the two treatment tests, the survey participants were presented with an image of all six smartphones combined and asked to choose which one of them they would be the most likely to purchase. To answer this question, a categoric question format was used giving the respondents six choices, of which they were able to choose one. Contrary to the other four dependent variables, this variable was not tested using a hypothesis test but instead was analysed using frequency distribution.

While the dependent variables constitute the core of the thesis and the empirical research, it is common practice to add control variables to the survey.

3.3.4. Control variables

At the end of the survey, four control variables were added to ensure that the dependent variable measured were caused by the change in the independent variables rather than extraneous variables (Saunders et al., 2009). The four control variables included in the survey asked for smartphone ownership, gender, age, country of origin and country of residence. All four control variables were in a categoric question format.

3.4. Data collection and sampling

After the survey was created with the manipulation check mentioned above, the independent variable, dependent variables, and control variables, the questionnaire had to be administered to a group of respondents.

Churchill & Iacobucci (2010) describe six steps which should be followed when drawing a population. First, the target population is identified and second, the sampling frame is set. Third, the sampling procedure is chosen, and fourth, the sample size is determined. Fifth, the sample needs to be accessed by the researcher and sixth, the data is collected.

The following paragraph will clarify how the steps were applied to this research (Churchill & Iacobucci, 2010).

First, a sample should be generalizable to the public. Nevertheless, researchers need to distinguish between theoretical and accessible populations. The theoretical population is the one that ideally inferences can be drawn for, while the accessible population is the one that is reachable by the researcher. Since the research in this thesis focused on the smartphone market in the United Kingdom, the theoretical population would be indistinguishable to the target population: all current and potential smartphone users living in the United Kingdom. However, because it was neither practical nor possible to reach the entire target population, the accessible population consisted of the personal and professional network of the researcher, most of whom live in the United Kingdom. Thus, there is reason to believe that the accessible population will predominantly be in the age range of 18-25 and 26-35 years old, due to the researcher's age of 25 years. Another limitation is that not all respondents were from or still live in the United Kingdom.

Second is the setting of the sampling frame, or the listing of the accessible population (Trochim, 2006). Altogether, the accessible population was a mix of professional and personal connections that amounted to a total of 142 people.

Third, the sampling procedure is described. The researcher first needs to determine the sampling method. In the case of this thesis and due to limited resources, convenience sampling was used. The researcher reached out to her professional and personal network personally. The network is limited and prone to bias, but to increase response rates, the researcher asked every person individually via email or electronic message to take part in the survey.

Fourth, a sampling size needs to be chosen; in order to choose sampling size, four different factors need to be determined: population size, the margin of error or confidence interval, the confidence level and the standard deviation ("How to Determine the Correct Survey Sample Size," n.d.). Since this study focuses on people living in the United Kingdom, the population size is estimated to be at 66 million ("Overview of the UK population - Office for National Statistics," 2018). The margin of error was chosen to be five per cent, with a confidence level of 95 per cent. Lastly, the standard deviation was determined to be .5 ("How to Determine the Correct Survey Sample Size," n.d.). As a result of these factors, the recommended sample size is 385 people. Please note that it was taken into consideration yet disregarded that the distribution of smartphones among age groups might not be linear. Assumedly, very young or very old people might not own a single smartphone while some people in the population own multiple smartphones. To facilitate the sampling size choice, this aspect was disregarded, and the population size of the United Kingdome was used as a measure.

Fifth, the sample needs to be reached. As the research done for this thesis aimed to collect data on colour preferences, the researcher utilised her professional and personal network and reached out to a total of 142 people via email and direct personal messages. As a result of reaching out to every person individually, the response rate was assumed to be high even though the response of the individuals still depended on willingness-to-participate. As a result, a total of 104 responses was collected.

Sixth, the data is collected. The questionnaire was created and distributed online using the software Qualtrics. The data was also collected on the platform before it was transferred to the software SPSS for the data analysis.

It is important to note that, as was already mentioned in section 2.2.1. Experimental design, the research conducted in this survey was designed as within-group or repeated-measures. Compared to between-group or independent measures designs, repeated-measures tests two treatments within one person, which allow for a lower sample size to achieve significance (Draeger, 2017). Thus, the sample size of 104 was deemed to be sufficient.

4. Results

The results of the experiment are presented in this section. Some prerequisite measures for hypothesis testing were taken. A principal components analysis was conducted to summarise several scale items into corresponding scales. Each scale's reliability and the data's normality were measured, and the composite variables were calculated. After finalising the prerequisites, the four hypotheses were tested, and the control variables, as well as other data, were analysed using frequency distributions.

4.1. Prerequisites for hypothesis testing

Before conducting the actual significance test to determine whether to accept or reject the hypotheses, the individual scale items were combined into composite variables. However, before actually computing the composite variables, a principal components analysis was conducted to test if the given scale items corresponded together, even though the scales had already been used in previous studies. Also, the reliability of each scale was measured using Cronbach's alpha.

4.1.1. Principal components analysis

To reduce the number of scale items and combine them into relevant components a principal components analysis (PCA) was run. The purpose of the PCA is to explain as much of the variance as possible using as few components as possible (Laerd Statistics, 2015a, page 1). The PCA was run separately for the scales used in Treatment 1, the conventionally coloured smartphone line, and Treatment 2, the unconventionally coloured smartphone line, as responses and thus variance vary depending on exposure. Both PCAs encompass fifteen scale items each.

Before the PCA was administered, its suitability was assessed. According to Laerd Statistics (2015), four assumptions have to be met. First, the variables have to be either continuous or ordinal. Ordinal variables include Likert scale items, and thus, the first prerequisite was met. Second, all variables have to have at least one correlation that is bigger than 0.3. This was tested using a correlation matrix. As can be seen in Appendix C and Appendix D, this prerequisite was also met for both treatment conditions. Third, the sampling adequacy was investigated with the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy. The KMO is a measure that can be used as an index on the existence of linear relationships between variables and can thus determine whether it is appropriate or not to run a PCA. According to Kaiser (1974) a measure below 0.5 is unacceptable. In the dataset, the KMO value for Treatment 1 is .904, which Kaiser (1974) classifies as “marvellous” (p. 35) and for Treatment 2 is .891, which is classified as “meritorious” (p. 35). Additionally, Bartlett’s test of sphericity was statistically significant ($p < .0005$) for both treatments, indicating that the data was likely factorizable (Laerd Statistics, 2015a). Thus, these prerequisites for conducting a PCA were also met.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.904
Bartlett's Test of Sphericity	Approx. Chi-Square	1878.591
	df	105
	Sig.	.000

Table 6: KMO and Bartlett’s Test for the conventionally coloured smartphone line.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.891
Bartlett's Test of Sphericity	Approx. Chi-Square	1700.476
	df	105
	Sig.	.000

Table 7: KMO and Bartlett’s Test for the unconventionally coloured smartphone line.

Next, the PCA was run for Treatment 1, revealing two components that had eigenvalues higher than one and which explained 60.0 per cent and 17.2 per cent of the total variance, respectively. Four components were retained, two of which had eigenvalues lower than 1. As such, the four components explained 88.3 per cent of the total variance. The full table can be found in Appendix E.

For Treatment 2, three components had eigenvalues greater than one, which respectively explained 52.0 per cent, 20.8 per cent and 8.9 per cent. Again, four components were needed to make the study comparable. Thus, one component with an

eigenvalue smaller than one remained. In total, all four components explained 87.1 per cent of the total variance. The full table can be found in Appendix F.
A Varimax orthogonal rotation was employed to facilitate the interpretability of the results. For both Treatment 1 and Treatment 2, the interpretation of the data was consistent with scales and respective scale items of the questionnaire. As a result, component scores were used for the analysis. Component scores are “scores calculated by SPSS Statistics that are the linear composite of the optimally-weighted original variables” (Laerd Statistics, 2015a, p. 12). Thus, the PCA resulted in having four component scores for each treatment condition. For the conventional colours, the components were visual appeal (va_con), brand personality (bp_con), attitude towards the brand (ab_con) and purchase intention (pi_con). The components of the unconventional colours are visual appeal (va_uncon), brand personality (bp_uncon), attitude towards the brand (ab_uncon) and purchase intention (pi_uncon). In total, this adds up to eight component scores. The next section will elaborate on the internal consistency of the components using Cronbach’s alpha.

	Component			
	1	2	3	4
Q3_1	**.853**	.206	.214	.247
Q3_5	**.790**	.190	.344	.326
Q3_4	**.787**	.182	.445	.257
Q3_3	**.772**	.172	.404	.332
Q3_2	**.699**	.235	.333	.259
Q4_3	.124	**.925**	.057	.074
Q4_4	.118	**.899**	.170	.115
Q4_2	.130	**.898**	.053	.269
Q4_1	.269	**.858**	.059	.113
Q6_2	.401	.071	**.850**	.277
Q6_1	.385	.126	**.829**	.289
Q6_3	.436	.124	**.818**	.283
Q5_1	.320	.161	.341	**.813**
Q5_2	.372	.167	.304	**.806**
Q5_3	.292	.262	.195	**.786**

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Table 8: Rotated Component Matrix for conventionally coloured smartphone line.

	Component			
	1	2	3	4
Q7_3	**.839**	.062	.419	.151
Q7_2	**.835**	.007	.041	.267
Q7_1	**.828**	.078	.402	.142
Q7_4	**.828**	.054	.416	.171
Q7_5	**.799**	.128	.407	.250
Q8_3	-.025	**.934**	.043	.088
Q8_1	.038	**.898**	.012	.002
Q8_2	.102	**.889**	.024	.201
Q8_4	.096	**.851**	.123	.184
Q10_3	.435	.044	**.836**	.257
Q10_1	.453	.079	**.810**	.248
Q10_2	.465	.094	**.801**	.264
Q9_3	.204	.251	.051	**.853**
Q9_1	.199	.127	.343	**.846**
Q9_2	.319	.112	.311	**.816**

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Table 9: Rotated Component Matrix for unconventionally coloured smartphone line.

4.1.2. Scale reliability

To measure the reliability of the eight components va_con, bp_con, ab_con, pi_con, va_uncon, bp_uncon, ab_uncon and pi_uncon, Cronbach's alpha was measured for each scale individually. The exact numbers can be found in the table below, but no scale had an alpha lower than .9, which speaks for high reliability of each scale.

The component number generated by SPSS (see Rotated Component Matrices above)	**Scale items**	**Scale**	**Cronbach's alpha**
1	Q3_1, Q3_2, Q3_3, Q3_4, Q3_5	va_con	.955
1	Q7_1, Q7_2, Q7_3, Q7_4, Q7_5	va_uncon	.953
2	Q4_1, Q4_2, Q4_3, Q4_4	bp_con	.937
2	Q8_1, Q8_2, Q8_3, Q8_4	bp_uncon	.925
4	Q5_1, Q5_2, Q5_3	ab_con	.918
4	Q9_1, Q9_2, Q9_3	ab_uncon	.904
3	Q6_1, Q6_2, Q6_3	pi_con	.973
3	Q10_1, Q10_2, Q10_3	pi_uncon	.976

Table 10: Summary of components, corresponding questions, and Cronbach's alpha.

After confirming the scale items belonging to the scales and the reliability of the scales, the data was checked for normality.

4.1.3. Data normality

Before being able to create the composite variables, the data needs to be checked for normality as this determines whether the mean or the median will be the appropriate measure. Normality can be assessed using numerical or graphical methods (Laerd Statistics, 2015b). For this paper, the numerical option was chosen using the Shapiro-Wilk test. The normality test was run for all eight composite variables individually. In the Shapiro-Wilk test – if the assumption of normality has been met – the significance value will be greater than .05 (i.e. $p > .05$). If the significance value is lower than .05 (i.e. $p < .05$), the data is not normally distributed (Laerd Statistics, 2015b).

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Q3_1	.225	98	.000	.925	98	.000
Q3_2	.175	98	.000	.934	98	.000
Q3_3	.156	98	.000	.936	98	.000
Q3_4	.163	98	.000	.939	98	.000
Q3_5	.176	98	.000	.935	98	.000
Q4_1	.153	98	.000	.923	98	.000
Q4_2	.152	98	.000	.939	98	.000
Q4_3	.146	98	.000	.938	98	.000
Q4_4	.163	98	.000	.929	98	.000
Q5_1	.167	98	.000	.926	98	.000
Q5_2	.174	98	.000	.931	98	.000
Q5_3	.173	98	.000	.943	98	.000
Q6_1	.210	98	.000	.926	98	.000
Q6_2	.171	98	.000	.941	98	.000
Q6_3	.145	98	.000	.943	98	.000
Q7_1	.175	98	.000	.926	98	.000
Q7_2	.220	98	.000	.932	98	.000
Q7_3	.176	98	.000	.918	98	.000
Q7_4	.201	98	.000	.909	98	.000
Q7_5	.139	98	.000	.942	98	.000
Q8_1	.216	98	.000	.899	98	.000
Q8_2	.180	98	.000	.930	98	.000
Q8_3	.180	98	.000	.918	98	.000
Q8_4	.187	98	.000	.916	98	.000
Q9_1	.134	98	.000	.931	98	.000
Q9_2	.135	98	.000	.935	98	.000
Q9_3	.165	98	.000	.932	98	.000
Q10_1	.191	98	.000	.874	98	.000
Q10_2	.196	98	.000	.901	98	.000
Q10_3	.176	98	.000	.898	98	.000

a. Lilliefors Significance Correction

Table 11: Shapiro-Wilk normality test.

The Shapiro-Wilk test was run for all individual dependent scale items and the significance level for all scale items was lower than .05. Thus, all variables are not normally distributed, which implies that the median is a better measure than the mean.

4.1.4. Composite variable computation

The PCA showed which scale items could be summarised into each scale, Cronbach's alpha proved strong reliability for each scale and the data was detected as not normally distributed. Next, the individual scale items were combined into composite variables that allow for significance testing. Please note that components are denoted by lower case letters while composite variables are denoted by upper-case letters. This was done by computing the median score for the corresponding scale items. As a result, eight composite variables were created that corresponded to the median scores of the relevant scale items and were utilised to perform the hypothesis testing. The table below shows which scale items were included for which composite variable. This confirms the originally intended items of the scales that were used.

Conventional		Unconventional	
Visual appeal (VA_CON)	Q3_1	Visual appeal (VA_UNCON)	Q7_1
	Q3_2		Q7_2
	Q3_3		Q7_3
	Q3_4		Q7_4
	Q3_5		Q7_5
Brand personality (BP_CON)	Q4_1	Brand personality (BP_UNCON)	Q8_1
	Q4_2		Q8_2
	Q4_3		Q8_3
	Q4_4		Q8_4
Attitude toward the brand (AB_CON)	Q5_1	Attitude toward the brand (AB_UNCON)	Q9_1
	Q5_2		Q9_2
	Q5_3		Q9_3
Purchase intention (PI_CON)	Q6_1	Purchase intention (PI_UNCON)	Q10_1
	Q6_2		Q10_2
	Q6_3		Q10_3

Table 12: Summary of composite variables and corresponding scale items.

4.2. Hypothesis testing

After running the principal components analysis, which confirmed which questions relate to each other to confirm each scale, consecutively checking each scale's reliability, and determining the normality of the data as a basis for computing the composite variables, the next step was to test the hypotheses to answer the research question. This paper aims to research the effect of smartphone colour palettes on consumers' attitudes – more specifically visual appeal, brand personality appeal (originality) and attitude towards the brand – and purchase intention.

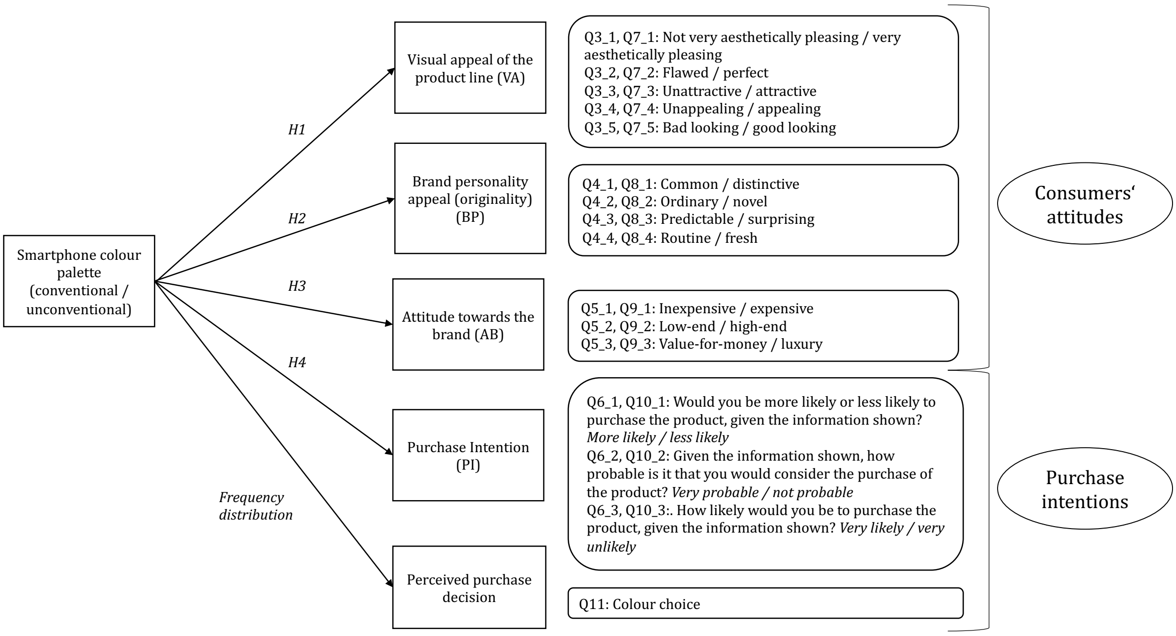

Figure 41: Conceptual model of the research question and corresponding scale items.

As was previously determined, the data collected was not normally distributed. Consequently, the significance test used was non-parametric, meaning it worked with the median instead of the mean. The test that was chosen to perform the hypothesis testing on all four hypotheses is the Wilcoxon-signed rank test. This test was chosen for several reasons. The experiment was set up as a repeated measures design, in which the same individuals were tested twice under two different conditions, but on the same dependent variables. The data was not normally distributed, and as a consequence, a non-parametric test was recommended over a parametric test, which means testing the hypotheses using the median instead of the mean.

Additionally, three assumptions need to be met to justify the Wilcoxon-signed rank test according to Laerd Statistics (2015c). First, there needs to be one dependent variable that is measured on an ordinal or continuous scale. The research in this paper has four dependent, composite variables, and the Wilcoxon signed-rank test was conducted for every variable individually. The variables are ordinal, but since the median was worked with, the scale increased from 7 points to 13 points. This is because of the possibility of the median being exactly between two adjacent Likert points, which are then divided by two to lead to the final median. The second assumption that needs to be met to run a Wilcoxon-signed rank test is to have one independent variable that exists for two related groups, i.e. the same participants were under two different conditions where only one variable was changed (Laerd Statistics, 2015c). In the case of this research experiment, the independent variable was the smartphone colour palette that was measured for two related groups. The two assumptions above were met in the research experiment. The third assumption for the Wilcoxon signed-rank test requires the distribution of the differences between the two related groups to be symmetrical in shape (Laerd Statistics, 2015c). Whether this third assumption was met was tested for every one of the four variables individually in the next section using the software SPSS Statistics.

After confirming the first and second assumption of the Wilcoxon signed-rank test, the four hypotheses were tested for significance if the third assumption was also met. The significance level is set at .05.

4.2.1. Hypothesis 1

Once again, the research experiment aimed to gain insight into the influence of smartphone colour palettes on consumers' attitudes and purchase intention. The first consumer attitude that was measured was the visual appeal of the product line, which led to the first hypothesis.

H1: The unconventional smartphone colour palette has a significant effect on the perceived visual appeal of the product line.

The Wilcoxon signed-rank test was conducted to determine whether there is a significant effect between the conventionally and unconventionally coloured smartphone line with regards to visual appeal. Both groups were exposed to both smartphone lines, with a counterbalanced and randomised order of both treatments. Before conducting the actual test, the third assumption of symmetrical distribution had to be met. As was assessed using a histogram, the distribution was approximately symmetrical. Thus, we were able to move forward with the Wilcoxon signed-rank test.

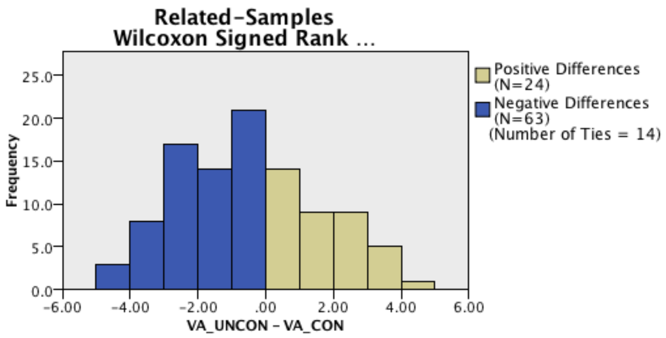

Figure 42: Distribution of positive and negative differences (H1).

Total N	101
Test Statistic	920.000
Standard Error	234.037
Standardized Test Statistic	-4.247
Asymptotic Sig. (2-sided test)	.000

Table 13: Significance testing results (H1).

A total of 101 eligible participants recruited for the study assessed the visual appeal of both the conventionally coloured and the unconventionally coloured smartphone lines. Of the 101 respondents, 24 perceived the unconventionally coloured smartphone line as being more visually appealing. In contrast, 63 evaluated the conventionally coloured smartphone line as more visually appealing. Fourteen people found both smartphone lines equally visually appealing. A Wilcoxon signed-rank test determined that there was a statistically significant decrease in visual appeal of the product line (*Median* = -1.0) when subjects assessed the unconventionally coloured smartphone line (*Median* = 3.0) compared to the conventionally coloured smartphone line (*Median* = 5.0), $z = -4.25$, $p < .001$.

Median

VA_CON	VA_UNCON	VA_Difference
5.0000	3.0000	-1.0000

Table 14: Median report (H1).

As a result, the null hypothesis *H0* was rejected, and the alternative hypothesis *H1* was accepted.

	Null Hypothesis	Test	Sig.	Decision
1	The median of differences between VA_CON and VA_UNCON equals 0.	Related-Samples Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Table 15: Hypothesis Test Summary (H1)

The result of all hypotheses will be summarized at the end of this section. Next, hypothesis two was tested for significance.

4.2.2. Hypothesis 2

The second hypothesis assessed the brand personality with regards to originality of unconventionally and conventionally coloured smartphone lines. The hypothesis reads as follows:

H2: The unconventional smartphone colour palette has a significant effect on the brand personality appeal (originality).

Before performing the actual hypothesis test, the third assumption of the symmetrical distribution of the Wilcoxon signed-rank test was assessed. Using a histogram, the distribution was considered approximately symmetrical, and the Wilcoxon signed-rank test was thus appropriate. One value was missing. Therefore only 100 responses were taken into consideration for this test.

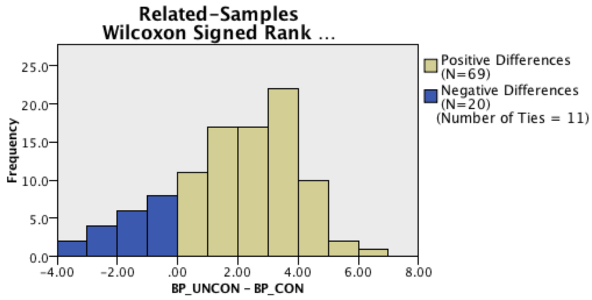

Figure 43: Distribution of positive and negative differences (H2).

Total N	100
Test Statistic	3,425.000
Standard Error	243.948
Standardized Test Statistic	5.831
Asymptotic Sig. (2-sided test)	.000

Table 16: Significance testing results (H2).

Of the 100 survey respondents, 69 evaluated the brand personality of the unconventionally coloured smartphone line as more original. Twenty people perceived the conventionally coloured smartphone line as being more original than the unconventional one. In addition, eleven respondents did not consider the smartphone lines different with regards to their originality in brand personality. Through the Wilcoxon signed-rank test, the unconventionally coloured smartphone line (*Median* = 5.0) elicited a statistically significantly median increase (*Median* = 2.0) in brand personality appeal (originality) compared to the conventionally coloured line (*Median* = 3.0), z = 5.83, p < 0.001.

Median

BP_CON	BP_UNCON	BP_Difference
3.0000	5.0000	2.0000

Table 17: Median reporting (H2).

Consequently, the alternative hypothesis *H2* was accepted, and the null hypothesis *H0* rejected.

	Null Hypothesis	Test	Sig.	Decision
1	The median of differences between BP_CON and BP_UNCON equals 0.	Related-Samples Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Table 18: Hypothesis test summary (H2).

4.2.3. Hypothesis 3

After getting statistically significant results for both the visual appeal of the product line and the brand personality (originality) of the smartphone line, the attitude towards the brand of the two smartphone lines was assessed next.

H3: The unconventional smartphone colour palette has a significant effect on the attitude towards the brand.

To ensure the Wilcoxon signed-rank test was appropriate, the third assumption of symmetrical distribution was checked and confirmed. 101 survey respondents evaluated their attitude towards the brand for both the conventionally and unconventionally coloured smartphone line.

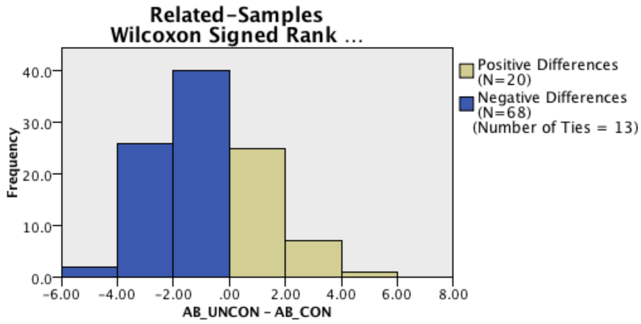

Figure 44: Distribution of positive and negative differences (H3).

Total N	101
Test Statistic	553.000
Standard Error	237.738
Standardized Test Statistic	-5.910
Asymptotic Sig. (2-sided test)	.000

Table 19: Significance testing results (H3).

The Wilcoxon signed-rank test elicited the following results. Of all the survey participants, 68 evaluated the conventionally coloured line as more premium, while 20 considered gave the opposite opinion and 13 people were neutral. The conventionally coloured smartphone line (*Median* = 5.0) caused a statistically significant median decrease (*Median* = -2.0) in attitude towards the brand compared to the unconventionally coloured smartphone line (*Median* = 3.0), $z = -5.91$, $p < 0.001$.

Median		
AB_CON	AB_UNCON	AB_Difference
5.0000	3.0000	-2.0000

Table 20: Median report (H3).

As such, *H3* was also accepted, and *H0* was rejected.

	Null Hypothesis	Test	Sig.	Decision
1	The median of differences between AB_CON and AB_UNCON equals 0.	Related-Samples Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Table 21: Hypothesis Test Summary (H3).

All three variables measuring consumers' attitudes – visual appeal, brand personality (originality) and attitude towards the brand – yielded statistically significant results.

4.2.4. Hypothesis 4

The final hypothesis that was tested investigated the perceived purchase intention of the smartphones.

H4: The unconventional smartphone colour palette has a significant effect on the perceived purchase intention.

As required, the symmetrical distribution was assessed and again confirmed using a histogram. This allowed for the Wilcoxon signed-rank test to be used as the appropriate hypothesis test.

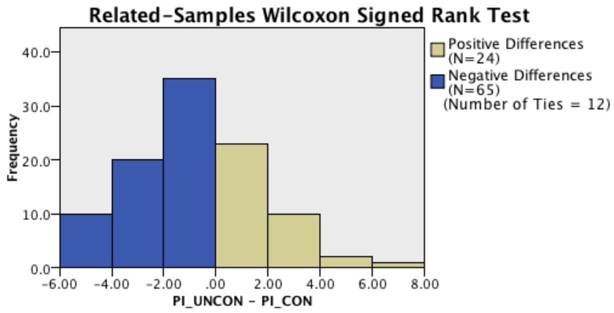

Figure 45: Distribution of positive and negative differences (H4).

Total N	101
Test Statistic	884.000
Standard Error	242.617
Standardized Test Statistic	-4.610
Asymptotic Sig. (2-sided test)	.000

Table 22: Significance testing results (H4).

A total of 101 survey respondents rated their perceived purchase intention. In the Wilcoxon signed-rank test, 65 people rated their perceived purchase intention higher for the conventionally coloured smartphone line, while 24 viewed the purchase intention higher for the unconventionally coloured line. Twelve people had equivalent responses for both smartphone lines.

The hypothesis test confirmed a significant median difference between the unconventionally and conventionally coloured smartphone line. In particular, the perceived purchase intention of the conventionally coloured smartphone line (*Median = 4.0*) generated a statistically significant median decrease (*Median = -1.0*) towards the perceived purchase intention of the unconventionally coloured smartphone line (*Median = 3.0*), $z = -4.61$, $p < 0.001$.

Median		
PI_CON	PI_UNCON	PI_Difference
4.0000	3.0000	-1.0000

Table 23: Median report (H4).

Consecutively, the fourth hypothesis *H4* was also accepted, and the null hypothesis *H0* was rejected.

	Null Hypothesis	Test	Sig.	Decision
1	The median of differences between PI_CON and PI_UNCON equals 0.	Related-Samples Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Table 24: Hypothesis test summary (H4).

After analysing the purchase intention using a scale, one question was asked about the perceived purchasing decision, which will be discussed in the following section.

4.2.5. Frequency distribution

After going through both treatments and answering all corresponding questions, the survey participants were shown all six different colour variants of the smartphones at once and asked to select which smartphone colour they would be most likely to choose, were they to purchase one of them.

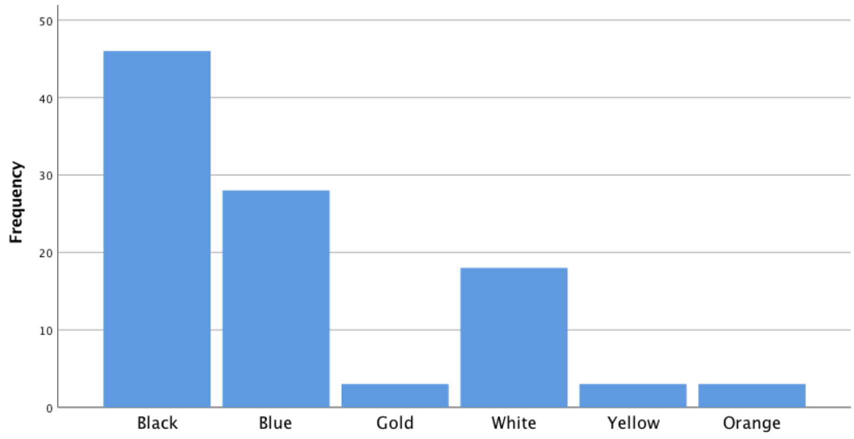

Figure 46: Frequency distribution of perceived purchase decision.

A total of 45.5 per cent of the respondents chose the black phone over any other colour. The popularity of the black phone is followed by the blue phone, which makes up 27.7 per cent of the total choices. Together, the black and the blue phone made up 73.3 per cent of the total perceived purchase decision. The white smartphone was the third most popular, with 17.8 per cent. The gold, orange and yellow phones each made up just 3 per cent of the total, respectively.

Out of interest, it was also determined whether there was a difference in the frequency distribution for female and male survey participants. A total of 57 female and 44 males made up the 101 respondents.

The same number of male and female survey participants – 23 – selected the black smartphone, which amounts to 40.4 per cent of all females and 52.3 per cent of all males. The blue smartphone elicited a similar percentage of 28.1 per cent among the female respondents and 27.3 per cent among the male respondents. The white phones were twice as popular with the female respondents compared to the males as measured by the frequency. The gold, orange and yellow phones were slightly more popular with the female survey respondents compared to the males, but the amount is marginal.

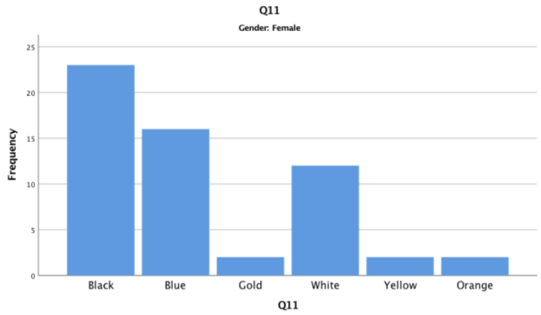

Figure 47: Frequency distribution of perceived purchase decision (female respondents).

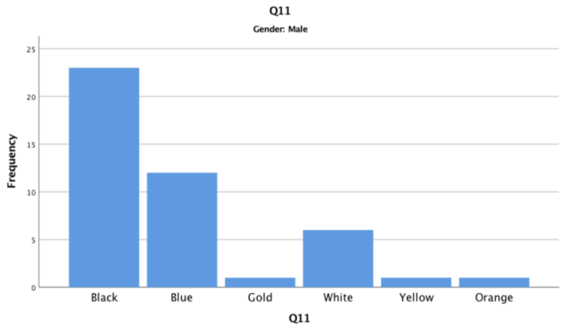

Figure 48: Frequency distribution of perceived purchase decision (male respondents).

The other control variables were omitted for this frequency distribution as no significant insight was expected; they are discussed in the following section.

4.2.6. Control variables

At the end of the questionnaire, the survey participants were asked to answer five questions that served as control variables. These questions assessed the smartphone ownership, gender, age, country of origin and country of residence.

Current smartphone ownership was confirmed by 100 per cent of the respondents. If survey participants had not owned a smartphone, this might have influenced the votes. But since every survey participant owns a smartphone, this variable was controlled for.

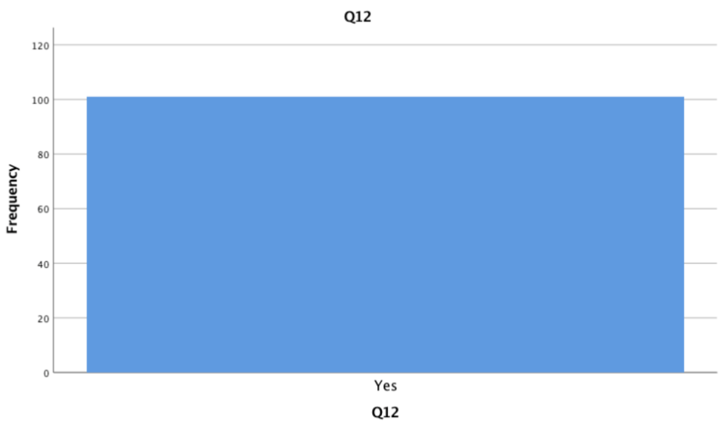

Figure 49: Frequency distribution of respondents' smartphone ownership.

The question on gender revealed that out of the 101 survey respondents, 57 were female and 44 were male. Despite the frequency distribution showing the perceived purchase decision, the female and male control question was omitted from the analysis as gender discrepancies are not the emphasis of the research question.

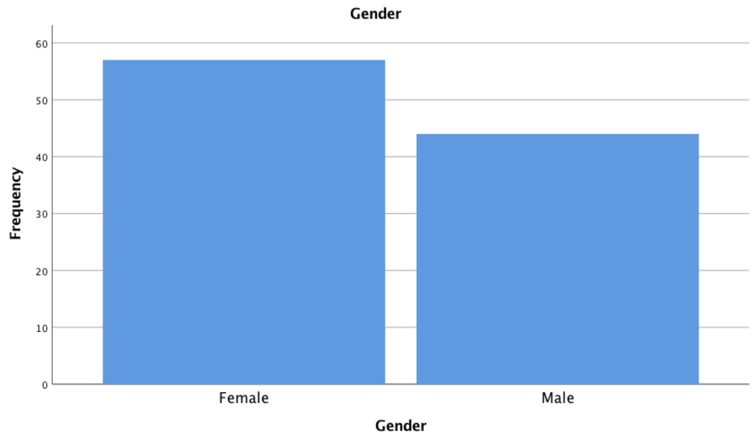

Figure 50: Frequency distribution of respondents' gender.

Because of the age of the researcher and her utilising her professional and personal network in the United Kingdom, skewed age distribution was expected. And indeed, 90.1 per cent of the respondents were 35 years or younger, with 30.7 per cent between 18 and 25 years old and 57.4 per cent between 26 and 35 years old. This will further be discussed in the limitations section, but this result may not be generalizable for the whole population based on age. As such, the hypothesis testing was not controlled for age as – similarly to gender – differences among age groups were not the main focus of this research experiment, and the sample was not distributed well enough nor was large enough to make significant inferences based on the age group.

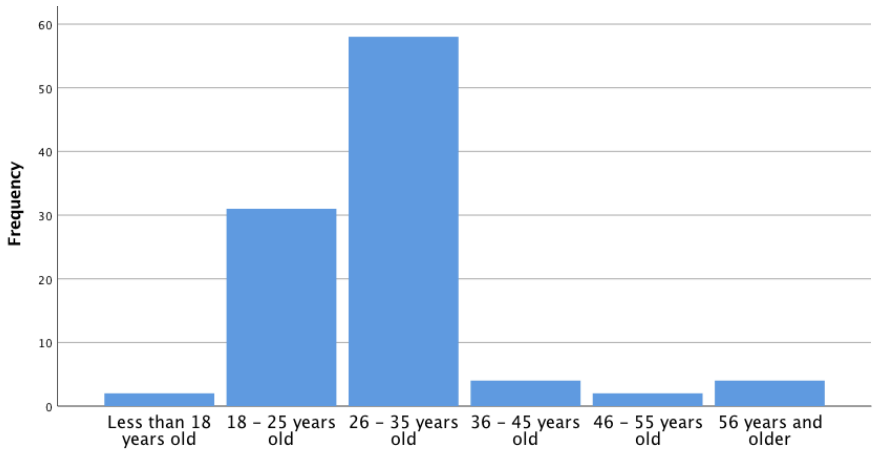

Figure 51: Frequency distribution of respondents' age.

The question regarding the survey respondents' country of residence revealed that the majority currently live in the United Kingdom of Great Britain and Northern Ireland, followed by Germany, the United States of America and Ireland. As was discussed before, colour can have a different meaning in different cultures and countries, which might lead to the argument that it would have been ideal only to include people living in the United Kingdom in this survey. Due to the limited resources of the researcher, this was not possible.

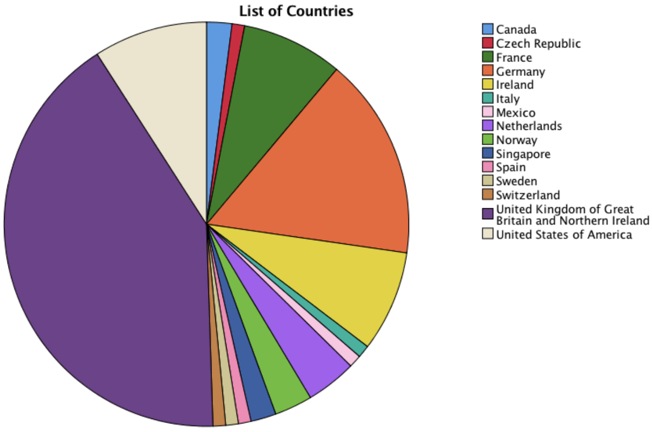

Figure 52: Frequency distribution of respondents' country of residence.

Secondly, in response to the question on the country of origin, the majority of respondents stated that they were German or US-American, which can be attributed to the dual citizenship of the researcher. The third most highly represented country of origin is the United Kingdom of Great Britain and Northern Ireland, the current country of residence of the researcher herself.

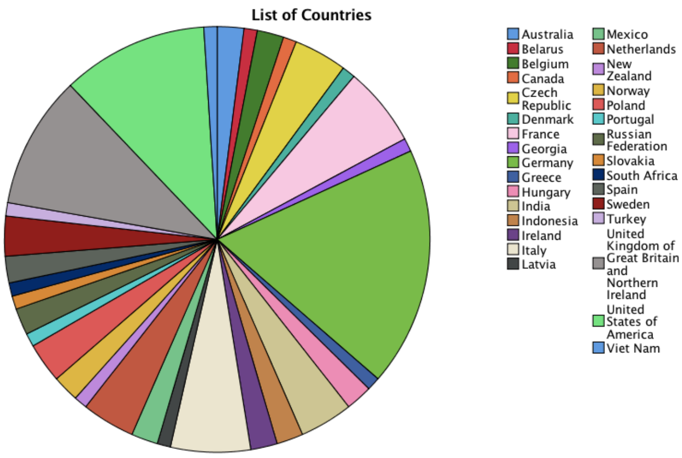

Figure 53: Frequency distribution of respondents' country of origin.

The next section summarises the testing results.

4.2.7. Summary of the testing results

The testing of the four hypotheses through four separate Wilcoxon signed-rank tests resulted in all four hypotheses being accepted. There were significant differences between the unconventionally and the conventionally coloured smartphone lines regarding their visual appeal, brand personality appeal (originality), attitude towards the brand and purchase intention.

The hypotheses were intentionally formulated in a non-directional way. If they were written directionally but the effect had been in the opposite direction to which the hypothesis was formulated, the effect would have been missed even though it was present. Thus, it is interesting to look at the direction of the effects. The perceived visual appeal, the attitude towards the brand and the purchase intention were evaluated significantly higher for the conventionally coloured compared to the unconventionally coloured smartphone line. In contrast, the median score was significantly higher for brand personality appeal (originality) for the unconventionally coloured smartphone line compared to the conventionally coloured one. The results of the hypothesis tests are summarised in the table below.

Hypothesis	**z**	**p**	**Testing Outcome**
H1: The unconventional smartphone colour palette has a significant effect on the perceived visual appeal of the product line.	-4.25	< 0.001	Accept *H1*
H2: The unconventional smartphone colour palette has a significant effect on the brand personality appeal (originality).	5.83	< 0.001	Accept *H2*
H3: The unconventional smartphone colour palette has a significant effect on the attitude towards the brand.	-5.91	< 0.001	Accept *H3*
H4: The unconventional smartphone colour palette has a significant effect on purchase intention.	-4.61	< 0.001	Accept *H4*

Table 24: Summary of the hypothesis testing results (H1 to H4).

What is more, a frequency distribution revealed the black phone was the most popular choice for the perceived purchase decision, followed by the blue and the white phone for both male and female survey participants. The interpretation of these results will be discussed in the following section.

5. Discussion and managerial implications

Colours have a significant impact on all of the hypotheses tested, and thus a significant impact on consumers' attitudes and purchase intentions. The conventionally coloured smartphone line was considered more visually appealing and more luxurious than the unconventionally coloured smartphone line, and the intention to purchase was higher as well. Consequently, there is a preference to buy visually appealing and expensive-looking phones, mostly black, followed by blue – the two colours that are already most prevalent on the United Kingdom's smartphone market.

The smartphone market in the United Kingdom is dominated by a few market players, namely Apple, Samsung, Huawei, Motorola and Sony, with Apple and Samsung holding more than three quarters of the market between them. Based on the results of this study, I would recommend that leading market players continue producing smartphones that are primarily black and blue in colour.

One action the established players could consider would be finding out how important other colours are to their palette besides black and blue. Potentially these colours could make their brand more interesting, but if these extra colours neither improve the brand metrics and nor serve as a purchase driver, they could be cut from the portfolio to save production and distribution costs.

By continuing to do what they are already doing, established players also face risks. A common saying recommends doing something that works until it does not. In other words, while established market players follow established patterns and practices, smaller companies may be engaging in their own activities. In many cases, big players are targeted by smaller companies who copy their products and strategies but differentiate on other factors, such as price. Another risk to be aware of as an established market player is that tastes change, trends arise, and there is always the possibility of a disruption of the smartphone market. As such, it is recommended that big market players look closely at their direct competition and new market entrants. What is more, market leaders should also pay extremely close attention to indirect competitors (such as camera or digital wearables companies) and digital trends that are on the rise which could soon become integrated into day-to-day activities (5G, internet of things). While it is hard to predict what influence new trends will have on smartphone colour palette choices, this upheaval may change which colours are practical or socially acceptable. It could change the way smartphones are designed altogether or even make smartphones obsolete someday.

For small players that aim to enter or grow in the smartphone market, there are two main strategies: copy or differentiate from incumbent players. When a brand copies brands from established companies, it runs the risk of not being viewed as innovative, perhaps even facing legal charges if patents or trademarks are violated. If this is not the case, an essential aspect of following a copy strategy is to find some distinguishing element. With copy strategies, this could be and, in many cases, ends up being price, as people agree to pay significantly less for something that looks similar or even the same, but might be of less quality or not the original brand. But to be successful over the long term, it is probably preferable to follow a differentiation strategy.

When looking at colour research, smaller players might want to position themselves uniquely and differently from incumbent players and target a different segment. For example, a company could find a target segment that prefers unique-looking phones in unconventional colours offered by an underground brand and could make the phones limited and thus desirable. Alternatively, phones could be created for children in unconventional and playful colours. Another idea would be to make the colour of the phone individualizable and offer this as a new feature to consumers. The options are endless, and there are countless opportunities for experimenting with unconventional colours.

Apart from colours, there are several other ways new smartphone players could attempt to enter the highly concentrated market successfully, especially in the ever-changing tech industry. At the same time, it might not be advantageous for new players to pursue the same strategies that the incumbent companies do. Perhaps smaller companies can offer product features or services that the big players cannot, such as a lower price, smart financing plans, innovative usage conditions, or beneficial and unique partnerships.

6. Limitations and further research

The findings of the research in this thesis have to be seen in light of several limitations. First, a classical experiment requires that there be control in the test situation. However, respondents answered the study under different conditions on their private devices, in varying surroundings and at different times. Especially critical for colour research is that there was no control over what the colours looked like on the personal devices, which might have appeared differently depending on the screen. One could fulfil the limitation of control by having all participants use the same equipment, at the same or similar time and under the same conditions. However, that was not feasible in the framework of this experiment.

Second, since the colours were chosen based on averages and frequencies of several brands, the smartphone lines shown might not reflect the colour palettes of an actual smartphone line. There are limitless options for doing colour testing and changing the smartphone lines. One could research different hues compared to the ones investigated in this paper as well as various combinations of those hues. Apart from checking individual hues, one could also examine the shades and tints of different hues. Another intriguing approach would be to research the number of colours per smartphone line. In this research experiment, the number of colour variants was three, but there is potential to gain an understanding of how much choice is ideal for consumers, and what the benefits are and where the breakeven point is of having more choice versus increased production costs. Additionally, it would be interesting to understand the use and impact of smartphone cases, which are widely available and also offered in various colours.

Third, there are several limitations regarding the sample. The sample size was quite low and the sample itself biased, and thus the results cannot be considered to be representative of the general population. As discussed in section 3.4 Data collection and sampling, a sample size of 385 people was recommended, but the sample included in the analysis was only made up of 101 people. Also, the sample was biased regarding age since most respondents are part of the professional and personal network of the researcher. Due to the limited resources of the author, a number of respondents have countries of origin and residence other than the United Kingdom. It is worth noting that the distribution might also be skewed for other demographic items that were not measured, such as income. Increasing the sample size and ensuring it is not biased would provide interesting opportunities for further research. The experiment could also be conducted in another country, or even across countries.

Fourth, this study only features quantitative research. Following it up with a qualitative study could provide greater insight into why consumers made their choices. This could also lead to a more detailed understanding of whether these personal preferences are caused by personality, conscious or unconscious associated learning, demographic factors or societal norms, or perhaps a combination of the above.

The author designed and conducted this research to the best of her ability and with awareness of several limitations. Colour has a proven to have significant impact on consumers' attitudes and decisions. The aim of the experiment conducted and presented in this research paper is to contribute some understanding of the inherently complex concept of colour.

7. Conclusion

This thesis aimed to answer a research question regarding the influence of smartphone colours on consumers' attitudes – visual appeal, brand personality in terms of originality and attitude towards the brand – as well as the purchase intention for smartphones.

When choosing a colour for a product, basic colour theory can provide a preliminary understanding of colours and colour terminology. The colour wheel can serve as a good starting point for creating compelling combinations of colour. In addition, when selecting colours, it is important to remember that colour does not only have the physical effect of being visible, but it also influences humans psychologically as a transmitter of mood and meaning, both symbolically and culturally. The colour of a product will also affect its advertising, branding and retail environment. To choose an effective product colour, several methods can be used, such as using existing or creating new associations, copying or distinguishing from the competition, building on brand equity or distinguishing between high- versus low-involvement products. Even though the colour is said to have a significant influence on the success of a product, its use and effects are still not completely understood. This thesis aimed to reduce this gap by means of an empirical experiment.

Based on an analysis of the smartphone market in the United Kingdom in 2018, a conventionally and an unconventionally coloured smartphone line were created and used as treatments. Upon testing four hypotheses, a significant difference was found for each one of them. The conventionally coloured smartphone line was perceived as more visually appealing and more premium looking, and it is more likely to be purchased than the unconventionally coloured smartphone line. Conversely, the unconventionally coloured smartphone line is perceived as having a more original brand personality. When it came to the perceived purchasing decision, the majority chose the black phone.

These results can have interesting implications for players in the smartphone industries as well as other industries. The smartphone market in the United Kingdom is very concentrated, which means that there is a small number of players that hold a significant market share. These existing players will likely do best by continuing to offer conventional colours, as they appear to be most appealing crowd pleasers. Nevertheless, these players might consider reducing their portfolio in order to save production and distribution costs. Also, these players would be well advised to pay close attention to new market entrants who might outplay them on a feature such as price, as well as to players in similar industries, such as the smartwatch industry, which could perhaps disrupt the smartphone industry as a whole. New market players might copy the successful colours of incumbent players, but then distinguish themselves by offering a lower price, for example. Alternatively, as a long-term strategy they could devise a new product positioning such as a limited edition and target a new segment that is searching for something original that could perhaps become a crowd pleaser in the future.

Smartphone marketing and purchase drivers comprise many more elements than simply the colour of the smartphone. A smartphone consists of two basic components: hardware and software. Colour is part of the hardware component, but so are the material, size, screen size, notch, weight, et cetera. The software component includes but is not limited to camera, battery life, software, capacity and processor. Additionally, price, a salesperson, word-of-mouth, brand reputation, habit and more can influence a purchase decision. What the experiment in this thesis has proven is that colour has a significant influence on consumers' attitudes and purchase intentions. Thus, its effect should not be underestimated. Investing in colour research and understanding the psychological and cultural implications colour has might be well-invested money. All mechanical and technological advancements as well as brand reputation and sales strategies aside, colour will always be a major aspect of any product, of how consumers perceive it, and of their decision whether or not to purchase it.

There are many possibilities for further research. The quantitative experiment undertaken in this experiment could be followed up with a qualitative study in order to better understand the reasons for respondents' colour preferences. Within the smartphone product category, it would be interesting to determine how important a role colour plays compared to other features and aspects of smartphones. In addition, similar experiments could be conducted using different colours, a different number of phones in the product line, different markets and different segments. The effects of conventionally and unconventionally coloured lines in a different product category would be another way to explore colour.

Understanding colour and its perception requires a combination of knowledge, judgement and intuition. This thesis aims to contribute to the knowledge about colour by demonstrating that colour affects consumers' attitudes and purchase intentions. The art of mastering colour is not only applicable for famous artists, such as Kandinsky and Monet, but also for marketers who want to create successful products that are desirable to consumers.

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