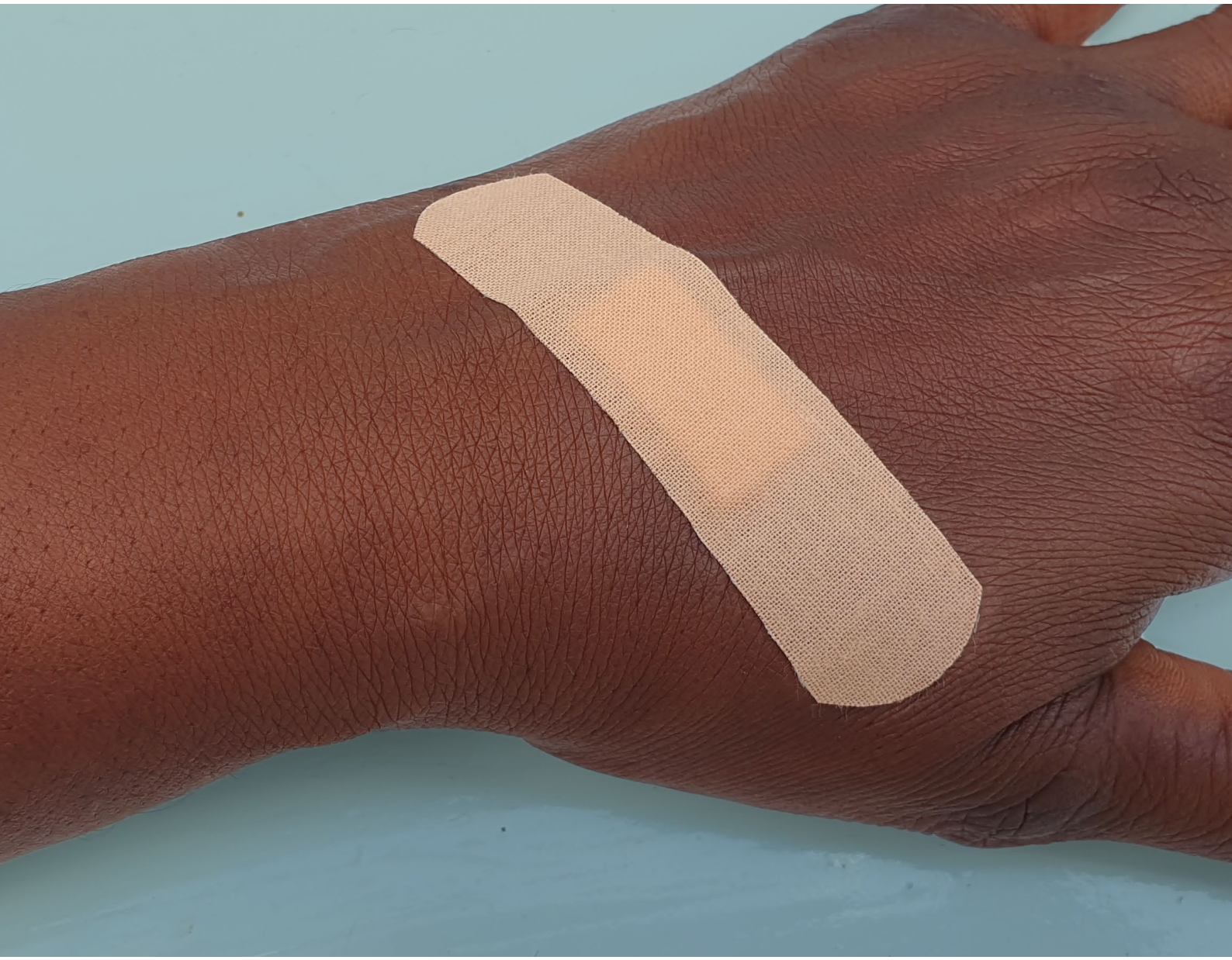
BEIGE BY DEFAULT

The issue of skin tone inclusivity in product design
and a proposal for resolving it
in design education and professional practices.



MASTER THESIS

CINDY JANTJI

BEIGE BY DEFAULT
The issue of skin tone inclusivity in product design an a proposal for resolving it in design education and professional practices

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Delft, The Netherlands
October 2021

PREFACE

Growing up as a brown-skinned girl in the Caribbean, I had several experiences where I encountered products that seemed to have not been made for me. With some of them, I was fully aware that (what it felt like to me) my skin tone was an obstacle for me to use the product. For example, as a little girl, the toy store was one of my favorite places to go. Particularly the aisle that had all the Barbie makeup, even though I knew that those light colors would not look good on me. Other times I was completely unaware of it. For example, when I was having problems with my knees in elementary school, I used to wrap my knees with a beige knee bandage before every gym class. At the moment, it did not occur to me what that color meant. But through many subtle and more apparent occurrences, I realized in my early twenties that this was a bigger issue. I knew then that my skin color was not the obstacle; the product's design was.

I also noticed that it was not a topic that was discussed at the Industrial Design Engineering faculty (IDE). By then, I had just started my Master Integrated Product Design at IDE (2018). I was asked to think of a topic for my graduation project during a 'Manage your Master' workshop. That was the first time I shared this idea with other people. Their surprised reaction to learning about the beige adhesive bandage confirmed that this was the project for me. The beige adhesive bandage also became my most used example when talking about my project. There are still many inequalities that Black and Brown people face in society. I knew that I had to do what I could within my field, especially since some non-inclusive products can cause scary incidents. So hopefully, as the awareness for inclusive design in general, and skin tone inclusive design in particular grows, people will no longer be made to feel like what they are is an obstacle.

I want to give a special thanks to my supervisors, Annemiek van Boeijen and Aadjan van der Helm, for your expertise and guidance. Thank you for supporting me during this project and for being so enthusiastic about this topic.

I also want to thank everyone else who contributed to this project. Thank you to the teachers I interviewed about their teaching experience and the students who shared how they experienced the bachelor program. And lastly, and perhaps most importantly, thank you to all those who personally experience exclusion who shared their feelings, frustrations, and concerns.

Finally, I want to thank my friends and family who supported me during this project. The contact I had with other students working together through Zoom meetings as I was working on my graduation project from Curaçao helped me immensely. Thank you for encouraging me to keep going when I had some setbacks. Thank you to my parents for supporting me and encouraging me to move halfway across the world to pursue my dreams of becoming an industrial designer.

EXECUTIVE SUMMARY

Past and current product design practices have not been and are not skin tone inclusive. People with darker skin tones are regularly excluded from the design process and the final product. Examples of this are the simple adhesive bandage and the more advanced facial recognition software. This project aimed to change this through an exploration of this type of exclusion, generally caused by designer bias.

Products that are not skin tone inclusive can be clustered into four different categories; Inadequate Color Selection, Failing Technology & Software, Undereducated Service Providers, and Unequal Communication & Representation. The products in these four categories have recurring issues, i.e., things that are consistently faulty. These issues led to thirteen Skin Tone Inclusive Design Guidelines to aid the designer in the design process.

The current Industrial Design Engineering curriculum does not pay any attention to the issue of skin tone inclusivity. The first-year bachelor course Understanding Humans is the ideal place to introduce this topic with the Skin Tone Inclusivity Lesson Plan, to be used during the Wonder Assignment. With four subgoals; Raise Awareness, Trigger Self-Reflection, Trigger Self-Awareness, and finally, Trigger Inclusive Design Behavior, the students are led through a session that leads to an understanding of the skin tone inclusive design guidelines. This is done incrementally, with the guidelines being introduced during the last activity of the Assignment. Using the three designed components, the Beige by Default website, the Card Set, and the Skin Tone Inclusive Design Guidelines, the students complete different activities to ultimately reach a more inclusive design behavior.

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DEVELOPMENT

EVALUATION

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In 2012 Brazilian photographer Angélica Dass created the project Humanæ to document humanity's true colors. This project demonstrates that each person is unique and illustrates the diversity of humanity. The background of each image is tinted with a Pantone® color that matches the nose of the subject. The project is still ongoing with new photographs being added from around the world (Angélica Dass, n.d.).

1 INTRODUCTION

1.1 INTRODUCTION TO THE TOPIC

This project was done as a graduation project for the master Integrated Product Design at the faculty of Industrial Design Engineering at TU Delft. The topic chosen for this project is skin tone inclusion (or lack thereof) in product design.

Human skin comes in a variety of colors. Sadly this is not always considered in product design, resulting in products that do not include groups of people. The exclusion of darker skin tones causes marginalized groups to feel invisible and unappreciated. And in turn, this makes product designers appear to lack empathy and be indifferent to the presence of non-white people in their community. Many products are designed in Western countries, which are becoming more and more racially diverse (World Population Review, 2021). Products designed in these countries should be designed with all ethnic groups in mind, especially since the products will not only be sold in the country where it was designed but also in other countries where the majority is not white. For example, I grew up in Curaçao, where the majority of the people are black. But still, I only saw bandages with a beige color at the drugstores. This is because Curaçao imports products from the most readily available brands, and these corporations are not designing with dark skin in mind. Recently, I saw brown bandages in different shades for the first time at one drugstore. But most drugstores still only have beige bandages.

Products that are not skin tone inclusive don't just have an emotional effect on the excluded groups. This project also explores instances where the products were entirely unusable for the user and occasions where the product created dangerous situations.

Within this issue, the excluded groups are almost always the same group; darker-skinned people. Because of this, we can refer to this problem as a systemic[1] exclusion. Exclusion at a systemic level repeatedly causes harm, both emotionally and physically. The root cause of this exclusion needs to be addressed so that this exclusion no longer occurs. It is especially fascinating to address the root cause since exclusion in product design is mostly unintentional. Whether the exclusion is intentional or unintentional, the hurt it can cause people is the same. That is why the impact of the design is more important than the designer's intent.

1 Systemic = Fundamental to a predominant social, economic, or political practice. Rooted in the system that holds sway (Merriam-Webster, 2021).

Nowadays, inclusive design has become a well-established subfield in product design, and designers often advocate for overlooked people in society. This inclusion, however, is almost always about topics like physical or mental disabilities and rarely about skin color or race.
As per my experience, the current TU Delft Industrial Design Engineering (IDE) education lacks knowledge on how people with dark skin are excluded from design processes and the final product. Because of this, previous, present, and future product designers will remain unaware of this phenomenon. This means that with the current curriculum, the issue at hand will not be solved in the near future.

1.2 APPROACH

There are many ways to approach a design project, depending on several factors such as the time, stakeholders involved, and the available tools. This paragraph explains how the project was shaped. It explains the areas that needed to be addressed to understand the topic, the related questions, and the methods to find answers. It also describes how activities were executed with intermediate results in distinctive phases (from the exploration phase to the final results).

Image 1: three search areas used in the initial exploration to better understand the subject

This project started with several search areas to explore and better understand the subject, namely:

1. The existing issue of skin tone inclusivity in product design
2. The topic of skin tone inclusion in design education
3. The topic of skin tone inclusion in professional design practices

Research questions were formulated for each area to understand each area better (see image 1).

To answer the research questions from search area 1, experts such as inclusive design teachers from IDE were interviewed, and people with personal experience with this type of exclusion were approached through a questionnaire. Furthermore, online literature research was done to find more examples of non-inclusive products (starting from the industrial revolution to keep it relevant for current product design practices) and to learn about the causes behind this issue.

For search area 2, the IDE education was analyzed to investigate the education designers have received and continue to receive. The analysis was done through interviews with teachers and course coordinators as well as through questionnaires sent to students who have completed their bachelor's at IDE. This research indicated how teachers at IDE tackle the topic of inclusion in general and skin tone inclusion in particular. It also resulted in an understanding of the level of knowledge on skin tone inclusion with which designers start their careers.

For search area 3, the intention was to collaborate with Philips to analyze one of their non-inclusive products and the design process that led to that product. This would have resulted in an understanding of which design decisions can result in a non-inclusive product and which barriers a designer deals with, such as finances, time, and technology limitations. Unfortunately, due to diminished interest in the topic from the approached company, this potential collaboration was abandoned to avoid further delays to the project. However, the initial meetings, as well as their diminished interest, did lead to some insights. These are discussed in the exploration.

The knowledge gathered from these three search areas led to an understanding of the issue and the writing of the skin tone inclusive design guidelines. This was done by analyzing the non-inclusive product examples and clustering them to reveal patterns of recurring issues. These issues were then translated into design guidelines.

The gap in design education discovered during the research was deemed an intriguing place to focus on entirely instead of collaborating with Philips. After identifying the bachelor course Understanding Humans, which contains the Wonder Assignments, a lesson plan was developed to be incorporated in the Wonder Assignment. The content of the lesson was determined in a way that would lead to the understanding of the skin tone inclusive design guidelines. This lesson plan was tested with IDE Master students who have completed their bachelor's at IDE and was finally evaluated by IDE teachers.

This project was tackled using the double diamond for problem-solving. In the following image (image 2), the different activities can be seen within the phases of the double diamond.

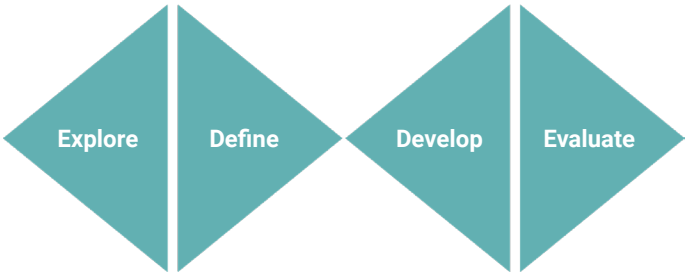

Image 2: double diamond with the phases of this project

Phase 1:
- Three search areas

Phase 2:
- Skin tone inclusive design guidelines

Phase 3:
- Design context
- Concept & testing
- Final concept

Phase 4:
- Evaluation
- Recommedations

1.3 STAKEHOLDERS

This project has several direct and indirect stakeholders. The direct stakeholders include IDE students who will need to be taught about this topic as they are the future designers and IDE teachers who are tasked with teaching the students about this topic. An indirect stakeholder is people with dark skin who are affected by the lack of inclusion. While they will most likely not be actively involved in IDE education, the products that these future designers will design will be used by them. Another possible stakeholder is professional designers; while they are not the main focus, they might still benefit from the results of this project.

1.4 PROJECT FRAMING

This project tackles the subject of inclusion, specifically the lack of inclusion of non-white people in product design (more specifically, people with dark skin). There are many ways non-white people can experience exclusion in a society where the majority is white. One way of exclusion by design is when products represent mainly the habits and lifestyles of the dominant culture. For example, according to Lyongo Juliana, Architect in Resident at the Amsterdam Centre for Architecture (ARCAM), in social housing in The Netherlands, solutions for kitchens, bathrooms, and other culture-sensitive aspects of housing are designed with a typical traditional European Dutch family in mind. This is in contrast with the reality that most users of social housing are of non-Dutch origin (de Koff, 2020). Another way of exclusion by design is when products represent mainly the dominant group's physical attributes, such as anthropometrics. An example is the design of Western bicycle helmets that generally do not match the proportions of Chinese anthropometric sizes, and therefore do not provide the necessary safety that a helmet should provide (Ball, 2011).

However, during this project, the focus on topics such as culture and physical attributes other than skin tone was kept to a minimum. While these are fascinating topics, unfortunately, there is not enough time to allow multiple large issues in a graduation project. Because of this, the focus was on the subject of skin tone regardless of race. This means that, in this project, the term "person with dark skin" refers to anyone who doesn't have a skin color that matches the traditional beige bandage.

Another critical topic is racism; while there have been instances of racism in design and products can allow for racist actions to take place, this is also a large topic in and of itself (this is further discussed in the recommendations in chapter 7.2). This project focuses on implicit bias, and while implicit bias does play a role in racism, a biased person isn't necessarily racist. For this reason, the focus of this project was on unintentional exclusion that comes from implicit bias that still causes harm and thus needs to be addressed. It is essential to make a distinction between intentional exclusion and unintentional exclusion; intentional exclusion is if an explicit (perhaps malicious) decision has been made to exclude a specific group. Unintentional inclusion occurs when a designer forgets about the presence of a particular group in society and therefore forgets to take them into account while designing. It is important to make this distinction because while they can both have the same results, the causes are different, and the approach must also be different.

CAN YOU EVEN IMAGINE THIS SCENARIO?

Photographer Chris Buck released a photo series called “Let’s talk about race” with O, The Oprah Magazine. In this photo series he challenges representation, power dynamics and stereotypes. In this particular image, a young white girl is seen in a toy store in front of a wall filled with black dolls, a reverse view of reality, to show the lack of representation black children face (Battle, 2017).

PHASE 1
EXPLORATION

2 THE ISSUE OF SKIN TONE INCLUSIVITY IN PRODUCT DESIGN

This chapter tackles search area 1 (see page 10) and gives a broad view of the principles of inclusive design in general and how unintentional exclusion can occur. Then the topic of skin tone inclusion, in particular, is explored by collecting examples of non-inclusive products and analyzing them to find patterns of recurring problems. These examples of non-inclusive products were found over the course of the project through personal and shared experiences of people with dark skin (they were approached on Facebook in different groups), and by searching online for articles describing experiences that users have had and, if applicable, papers describing causes of the faults within these products. This exploration resulted in a better understanding of those problems and their causes and how they manifest in products. It also resulted in an extensive collection of product examples. A selection of solutions for skin tone inclusive products is also presented to provide an overview of what has been done and can be done to correct non-inclusive products. Lastly, an analysis of designer bias and designers' assessment of their designs wraps up the chapter.

This chapter would have also tackled search 3 and included insights from the collaboration with Philips. However, this collaboration did not take place. While the company seemed interested initially, they were not willing to share information about their design process. Even though this collaboration didn't continue, from initial meetings, I was told that there weren't any inclusive design protocols set in place to ensure skin tone inclusive results, at least for the team that I spoke to. Instead, they were expected to use their judgment which seems like a rather thoughtless strategy. The research presented in this chapter illustrates why the assumption that designers will design inclusively by intuition is inaccurate.

2.1 UNDERSTANDING INCLUSIVE DESIGN

This project has inclusive design as its main focus. To be able to understand the principles of inclusive design, several inclusive design experts such as Microsoft, University of Cambridge, and Johan Molenbroek, professor of anthropometrics at IDE were consulted. These experts all have different aspects that they find important and these aspects, when put together, can illustrate what is necessary to accomplish skin tone inclusive design.

The mindset of inclusive design was introduced in the 1950s with attention to people with physical disabilities. Since then, global strategies and standards have been formulated to make design more accessible to a broader spectrum of users (Institute for Human Centered Design, n.d.). The British Standards Institute defines inclusive design as "the design of mainstream products and services that are accessible to, and usable by, as many people as reasonably possible" (British Standards Institution, 2005). To be able to do this, the designer must be able to embrace diversity. Diversity refers to all the differences we have as humans. The more diversity is embraced and implemented in the design process, the richer the product becomes and the more accessible it is to different people. During an interview with Johan Molenbroek, associate professor of Anthropometrics with a specialty in inclusive design at the Faculty of Industrial Design Engineering in Delft, he stated that inclusive design offers designers an opportunity to design for and reach more people, effectively extending the audience for their product by also including forgotten markets.
According to Jutta Treviranus, Founder of Inclusive Design Research Centre at the OCAD University, "diversity is our world's greatest asset, and inclusion is our biggest challenge" (Microsoft, 2016).

Designing one product that meets the entire population's needs is not always possible, and inclusive design also doesn't demand this. With inclusive design, a designer creates diverse ways for everyone to use a product without feeling left out (Microsoft, 2016, 11). A form of doing this is with a family of products (University of Cambridge, 2017). For example, for males and females, a family of products can be seen in daily vitamins. Because of the differences between the male and female body and the difference in needs, a brand will make vitamins pills with the correct dosages for men and different ones for women (Bayer, 2021). In skin tone inclusive design, this approach is best seen in products like adhesive bandages, ballet shoes, and underwear that are made in a variety of skin colors instead of just beige.

2.2 UNDERSTANDING EXCLUSION IN DESIGN AND ITS CAUSES

In product design, designers try to include as many people as possible. Still, sometimes it is inevitable and even necessary to narrow down the target group. This could be due to wants and needs from a specific group, financial capacity, and competition with other brands, among other things. As long as these factors are well thought out, and explicit decisions are made that can be justified, it should not be a problem. But sometimes, exclusion happens unintentionally due to factors that the designers have not considered. And sometimes, the designers only find out about the shortcomings of their products after they hit the market, and they receive complaints from consumers. According to inclusive design experts at Microsoft, exclusion occurs when designers design according to their own biases (Microsoft, 2016, 16). Every person has biases because we all have circumstances that we are used to and consider to be typical circumstances. Because of this, we believe that what is normal to us is the standard for everyone else. When a designer fails to look beyond their abilities and biases, they risk excluding certain groups. This can happen in many forms: When a designer is able-bodied and unconsciously assumes that all users will be able-bodied, they might design something that isn't usable for a physically disabled person. For example, most public restrooms are unusable for people in wheelchairs because they are too small and don't have handlebars on the walls (see image 3) (Flores, 2018). Or, when a designer unconsciously assumes that all users' literacy levels will align with their own, they might design something that isn't understandable for someone with low literacy. An example of this is the switch from the strip card to the OV chip card for public transportation in the Netherlands. This new design caused many people with low literacy to receive fines simply because they didn't understand the new system and didn't know how to load their cards (see image 4) (Stichting Lezen en Schrijven, 2020). When a designer unconsciously assumes that male body measurements are the standard measurements, they risk creating products that could even be dangerous for females. For example, seatbelts are made and tested with male body measurements in mind. Because of this, females are 47% more likely to be seriously injured during a car crash (see image 5) (Criado-Perez, 2019).

Image 3: A spacious restroom accessible for people in wheelchairs with handle bars on the walls (Frey Architekten, 2016)

Image 4: An OV chip card used for public transportation in the Netherlands being loaded with additional funds (Treinreiziger.nl, 2021)

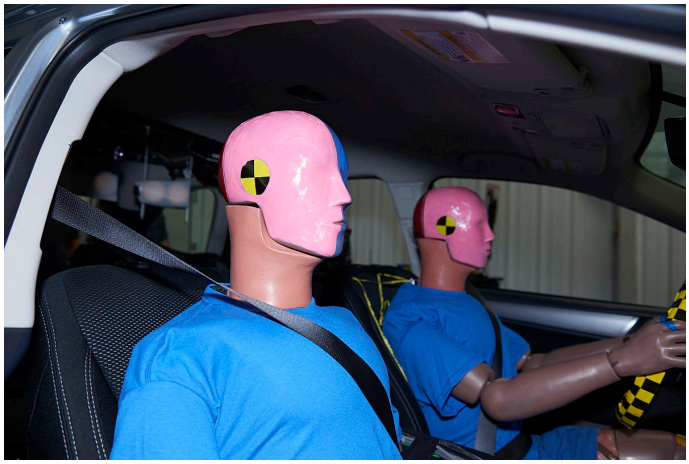

Image 5: A crash dummy used for testing safety of the passengers during a car crash (Tomy, 2020)

These are just a few examples of forms of exclusion. This project focuses on exclusion based on skin tone. When designers unconsciously assume that all users will have a light skin tone, they might exclude everyone who doesn't. Products might look odd on someone with dark skin, they might not work properly on someone with dark skin, or they might not work at all. Some examples of skin tone exclusion in products are discussed in chapter 2.3.

Exclusion is often unintentional and caused by designer bias. But sometimes, the reasoning behind excluding people with dark skin is a supposed lack of interest in that specific product from the groups that are being excluded. But blaming exclusion on a presumed lack of interest doesn't focus on the real problem. At this point, minority groups are "used" to being excluded; this means that they expect it. So often, when companies make some small attempts to be more diverse, these people don't even know about it. And they can't be interested in something that they don't even know exists. This is proven over and over when newer brands that are diverse from the start are instantly successful. A good example of this is Fenty Beauty by Rihanna, the first cosmetics company to have 40 foundation shades at the time of its launch (Greenwald, 2020). In the case of presumed lack of interest, the exclusion is caused deliberately by inaccurate assumptions by the designers. These assumptions are also based on unintentional preconceptions and biases. For these reasons, this project focuses primarily on unintentional exclusion.

2.3 AN ANALYSIS OF EXISTING NON-INCLUSIVE PRODUCTS

In this subchapter, some examples of non-inclusive products are shown, along with explanations of what makes them non-inclusive. Each section features a few examples to provide the information needed. The rest of the products can be found in Appendix A.
These examples were found by doing online research, speaking to experts such as inclusive design teachers at IDE, and sending questions to people with dark skin in different Facebook groups. The latter was the most informative, considering that they provided their personal experience (see Appendix B for questionnaire). The questions were answered by eighteen people.
These product examples were collected for three reasons:

1. To answer the research question of which products are not inclusive.
2. An analysis of these products would reveal patterns of what makes them non-inclusive. As per the assignment, these patterns would then be used as inspiration for the skin tone inclusive design guidelines.
3. Presenting a collection of examples is an excellent way of introducing people to the topic.

After collecting the products, they were clustered into four different categories to facilitate pattern-finding. The categories were formed by identifying the main issue with each product or service. The following categories were identified:

- Inadequate Color Selection
- Failing Technology & Software
- Undereducated Service Providers
- Unequal Communication & Representation

Furthermore, each category was further clustered in subcategories. These subcategories were found by identifying the reason that caused the main issue and compiling the ones most similar together.
These four clusters are presented on the next pages, along with information about each cluster to provide insight into these products. At the end of this chapter, the patterns that were found are presented.

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The first category of products explored is the category 'Inadequate Color Selection'; this category features wearable products made to blend into the skin. Many wearables are made in a few different colors and one "skin color." This "skin color" (in Dutch: huidskleur) is always a beige color that matches the skin tone of people with light skin. The products shown are also referred to as "skin color" on the packaging and through word of mouth. This name creates the illusion that the standard skin color is beige. Since the product is only available in beige (and sometimes extra colors unrelated to skin tone), it creates the idea that this is the only skin tone. In the following section, the product examples are shown with some explanation.

A few examples of Inadequate Color Selection can be seen below (images 6 to 8), along with an explanation. The rest of the examples can be found in Appendix A .

Image 6: Elastic bandages, used for compression to treat muscle sprains and strains, are made to match the skin tone to reduce the social stigma associated with medical products. Beige is often the only skin color that is available.

Image 7: Prostheses are artificial body parts used to replace a body part that was lost due to birth defect, injury or disease. It is made in a skin tone matching color to increase the intrinsic acceptance of the wearer. Beige is often the only skin color that is available.

Insights Inadequate Color Selection

The products shown here and in appendix A give an overview of which products in the category of Inadequate Color Selection are not inclusive. The analysis of these products also included assessing the reasoning behind the color matching. These reasons show the importance of color matching for each product and how necessary color matching is for the success of the product. Three reasons were identified by contemplating why the designer designed the product in that way and contemplating the product's purpose and meaning for consumers. Suppose these reasons are not exclusive to a specific skin tone. In that case, it means that anyone with any skin tone can benefit from these products. And this, in turn, means that the products could be made for any skin tone.

1. The designer wants to reduce the social stigma associated with the product. Good examples of this are compression stockings to combat varicose veins or underwear and shapewear for women which are not desirable to have on display (see pages 89 and 91).
2. The designer wants to increase intrinsic acceptance for the wearer due to familiarity. This is done when the wearer must accept the product as part of the body. For example, with a prosthetic leg that replaces the wearer's leg. Or an orthosis for toes which becomes an addition to the foot (see page 90).
3. The designer wants to create an enhancement through illusion. For example, in fashion, skin tone matching pantyhose is worn to create the illusion of smooth, clear skin. Or in sports & culture, in ballet, the pointe shoes match the color of the skin to create the illusion of long, elegant legs (see page 93).

Image 8: Pantyhose that matches the skin tone is worn to create the illusion of smooth and blemish free skin. Beige is often the only skin color that is available.

As we can see from the list of reasons for color matching, none of these is related explicitly to light skin tones. The list also shows that color matching is vital to the acceptance of the product for specific products. These products would serve society best if they were made in multiple skin tones. This would enable every person to find a (close) match. This is already being done for some products. Examples of this can be seen in chapter 2.5. Another benefit to knowing the reasoning is that it can not only indicate whether products for more skin tones should be available but also if it could be possible to stray away from skin color altogether. For example, color matching is critical with prostheses, especially facial ones (Adby, 2016). But for an adhesive bandage, the reasoning of social stigma can easily be ignored, especially for children. This shows that knowing the reason for color matching is essential. Still, it is also important to consider the target group, as the reasoning might not be relevant for all target groups. These examples are also discussed further in chapter 2.5.

FAILING TECHNOLOGY & SOFTWARE

The second category of products that was explored is the category of 'Failing Technology & Software.' The following products are examples of different technologies and software that are not skin tone inclusive, whether a simple sensor-actuator system like a soap dispenser or a complicated AI facial recognition software. As can be seen in a few examples, this is the area of skin tone exclusive design where non-inclusive designs can put people's lives in danger.

A few examples of Failing Technology & Software can be seen below (Images 9 to 11), along with an explanation. The rest of the examples can be found in Appendix A
.

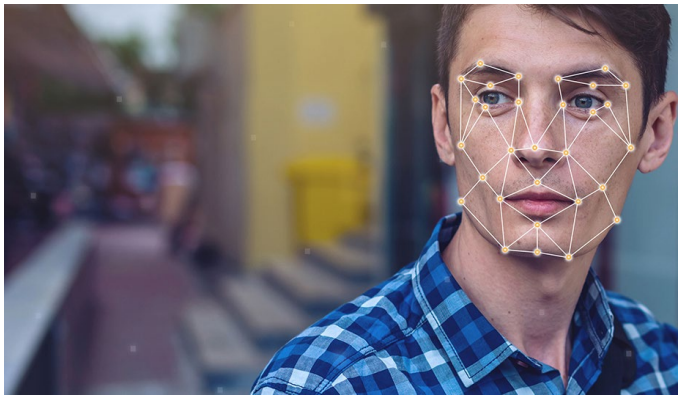


Image 9: Facial recognition software is an AI technology that can identify individuals through an image or video of the face. Some can even identify the person in real-time. It is able to do this through a dataset that is used to train the software to recognize faces. This dataset consists of images of faces and other images to teach the software what a face looks like. The issue is that the datasets that are used for machine learning consist mostly of pictures of white men (77% male and 83% white), which means that the software does not learn to properly recognize women and people with dark skin. According to a study by MIT researchers, the error rates for gender classification are 0.8% for light-skinned men, generally 34.7% for dark-skinned women (for some systems even 46.8%) (Hardesty, 2018). Since the police are also considering using facial recognition software to identify suspects, this creates a huge problem on top of the racial profiling already present in policing.

Image 10: Automatic soap dispensers are made to provide the user with soap without physical contact as this is a more hygienic and sanitary solution, especially for public restrooms.
There have been several reports of soap dispensers not recognizing hands with dark skin. Some reports show the user having a white friend get soap for them (Plenke, 2015), others show how they get soap from the dispenser by placing a piece of toilet paper on their hand (IFLScience, 2017).
Automatic faucets and soap dispensers work by sending an infrared light which has to be reflected off of the surface of the hand. The sensor then detects the light that was reflected to dispense the soap. If the surface of the hand is dark, it absorbs the light instead of reflecting it, in this case the device will not react (Hankerson et al., 2016, 476).

Image 11: The FaceApp beautification filter is meant to make people hotter, as the flame emoji suggests. Users with dark skin have noticed that the filter makes their skin tone lighter, reconstructs the nose to make it look more European and makes Asian eyes look more European (Emerson, 2017). The default settings in this filter are set to Eurocentric beauty standards regardless of the race and facial features of the user.

Insights Failing Technology & Software

The products shown here and in Appendix A give an overview of which products in the category of Failing Technology & Software are not inclusive. When it comes to technology & software, an introduction of inequalities in society to 'modern' digital products can be seen, sometimes even creating dangerous situations. This can be seen, for example, in AI in healthcare, where biased data from hospitals yields biased results (see page 98).

An analysis was done to determine what makes these products non-inclusive. During this analysis, several issues were found, namely:

1. The data set is not inclusive or biased. An example of a non-inclusive dataset can be found in facial recognition software. This software requires a dataset from the designer to be able to work properly, and the designer may fail to make the dataset (in this case, pictures of people's faces) diverse. The software can therefore not recognize what it has not been taught. According to a study by MIT, datasets consist primarily of pictures of white males (77% of the dataset is male and 83% of the dataset is white) (Hardesty, 2018). An example of a biased dataset can be found in AI in healthcare, where an incomplete data set and wrong use of parameters resulted in only about half of high-risk black patients receiving the enhanced medical attention they need (see page 98). This is a valuable example of inequalities in societies being introduced to 'modern' digital products (Obermeyer et al., 2019, 448).
2. The sensing technology is not inclusive. An example of a non-inclusive sensor can be found in automatic soap dispensers. This soap dispenser works by emitting and re-absorbing infrared light when it gets bounced back by an object (a hand). This does not happen when the hand is a dark color as the skin absorbs the light instead of reflecting it to the sensor, making the product unusable for someone with dark skin (Hankerson et al., 2016, 476).
3. The default setting is not inclusive. An example of a non-inclusive default setting is film development, which uses the 'Shirley card,' a photo of a woman with light skin, for calibrating the perfect lighting conditions. This ensures that only people with light skin are well lit in photographs (see page 95). Another example is the beautification filter used on apps like FaceApp and Snapchat. These filters are supposed to make the user appear more beautiful, but, in reality, it only gives the user more Eurocentric facial features by lightening the skin and narrowing the nose.
4.

Blind trust in AI

Subsequently, there is also a blind trust in AI that causes products not to be criticized; this is called automation bias (Goddard et al., 2012, 121). People tend to assume that computers and software cannot make mistakes because they are not human and are therefore objective; thus, they cannot discriminate. But AI software is as biased as the designers who create it and the input data. If the input data is biased, the output will also be biased. Biased AI can further perpetuate inequalities that, if left unchecked, can cause considerable damage (Kantayya, 2020).

In the case of color matching wearables, the effects were much smaller; most of the time, it just causes inconvenience. This is not to say that the effects are negligible, because the constant exclusion from many different products still has an emotional impact on people with dark skin.

But when it comes to products in the Technology & Software area, as was described in the examples, it can very easily result in people being placed in dangerous situations where they could potentially die, for example due to the non-inclusive software in self-driving cars.

The third category that was explored is the category of 'Undereducated Service Providers'. An Undereducated Service Provider is a service provider that has not been educated to provide the service (properly) for all skin tones. This category was analyzed to find points of attention for when designing a product to be used by a service provider instead of a consumer.
People with dark skin often receive sub-par service from these providers or are refused the service altogether. The services were found in various fields, such as medicine and cosmetics; some examples can be seen below.

A few examples of Undereducated Service Providers can be seen below (images 12 to 14) along with an explanation, the rest of the examples can be found in Appendix A.

Image 12: Laser hair removal is a procedure for permanent hair reduction of unwanted hair. It uses a concentrated beam of light that is absorbed by the pigment of the hair. This light energy is converted to heat which effectively damages the hair follicle and reduces its ability to produce hairs. Because the light is absorbed by pigment, it could also be absorbed by the pigment in the skin if the skin contains a lot of pigment which could burn the skin. This makes laser hair removal tricky for darker skin tones, but not impossible. Clients with the darkest skin color (Fitzpatrick Skin Type VI) can still undergo laser hair removal treatment as long as the proper settings are used on the machines (Nouri et al., 2002, 15-16) (Chan & Dover, 2013, 366-367).

Image 13: Tattooing is a permanent form of body modification that is done by inserting ink into the dermis layer of the skin to create a design. The top layer of the skin, the epidermis, forms a translucent layer over the ink. This means that the color of the epidermis influences how we see the color of the ink; lighter skin tones will experience little to no modification to the color of the ink, and darker skin tone experience a bigger alteration to the color of the ink as the translucent layer is dark. While the tattooing machine used for light and dark skin tones is the same, the tattoo artist must have knowledge on how different colors show up differently on dark skin or else the tattoo will not come out as desired. Many tattoo artists who are used to tattooing people with light skin do not have this knowledge. Another issue with tattooing is that tattoo artists tend to believe that dark skin is tougher and they need to be rougher when tattooing, but this is false and causes unnecessary scarring (Santibañez, 2019).

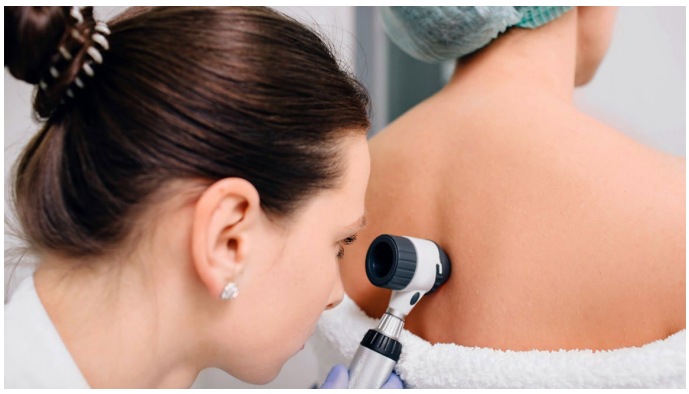


Image 14: Dermatology is a medical specialty that deals with the diagnosis and treatment of skin diseases and conditions. According to The New York Times and The Chicago Tribune, people with dark skin are often misdiagnosed because dermatologists are trained to diagnose conditions on light skin and do not know how to recognise the same condition in darker skin (Rabin, 2020)(Bowen, 2021). This can also be seen in the lack of representation of people with dark skin in medical textbooks, therefore dermatologists do not acquire the knowledge of how different conditions look like on dark skin (McFarling, 2020).

Insights Undereducated Service Provider

The products shown here and in Appendix A give an overview of which products in the category of Undereducated Service Provider are not inclusive.

The analysis has shown that the cause of non-inclusive services is often that the service provider has had a non-inclusive education, resulting in a lack of knowledge on how to provide the service for people with dark skin. Furthermore, they sometimes also don't have the right product to provide the service, resulting in two issues. In other situations, the cause is only non-inclusive education.

The following is an explanation of the two situations:

1. The first situation is non-inclusive education combined with non-inclusive products. An example of this is laser hair removal. Laser hair removal is possible for dark skin, but only with adjusted settings on the machine. This adjustment is only possible on specific devices, not all of them, and often the laser hair removal technician might not even know about it. Another example is a makeup artist that has not been educated on how to do makeup on dark skin, and they might not even have products in their toolkits that match dark skin (see image 100).
2. The second situation is non-inclusive education. An example of a non-inclusive service that isn't linked to a non-inclusive product is the cosmetic practice of tattooing. The tattoo artist might not be educated on how different colors show up on dark skin and therefore fails to get the desired results, but the machine used on people with light skin and dark skin is the same. Another example of a service provider with a non-inclusive education comes from the medical practice of dermatology.

Since there is an increasing involvement of designers (as educated in Delft) in the development of services it is useful to know this problem. This category can be tricky considering that a designer cannot influence a service provider's previous education, which has implications for how a designer designs a product for them. The design could incorporate the need to educate the stakeholders of a particular service, and even develop training material.

The fourth category of products that was explored is the category 'Unequal Communication & Representation'. This refers to non-inclusive or even anti-dark skin visuals and language associated with products, either used in marketing and commercials, or on the packaging of the product.

A few examples of Unequal Communication & Representation can be seen below (images 15 to 17) along with an explanation, the rest of the examples can be found in Appendix A.

Image 15: Crayons are often used by children to create drawings. Crayola's peach colored crayon was named "flesh" at the time of the invention. Since this is a product used most by children, it teaches them to start naming beige/peach objects "skin colored" at a very young age, effectively distorting their views of what skin color is; a variety of colors, and not just one color (Vargas, 2020). It also creates a confusing experience for children with dark skin as they do not recognize themselves in this color.

Image 16: This Dove advertisement promotes their skin care products. It is a gif. that shows a dark skinned woman taking off her brown shirt and turning into a light skinned woman. Critics find that the ad resembles old racist soap ads, like the Pears' soap ad (see image 19). with illustrations of dark skin becoming lighter after using soap (AD, 2017). Although the intention was not to mimic these old ads, as the light skinned woman does turn into a darker skinned woman in the second part of the gif[1].

Image 17: Children's books are used to entertain children, introduce them to new things, and help them develop their vocabulary and sense of imagination. Especially with the drawings, children can imagine themselves being in different situations. It can help them to aspire to do great things. According to a study done in the UK, there is a lack of representation for children with dark skin in children's books (BookTrust, 2020), in images and the way they are described (for example; long soft hair, fair skin) (Nakiyemba, 2017). As a result, children with dark skin find it difficult to recognize themselves in these stories because the characters don't look like them.

1 "Gif. = a series of images or soundless video that will loop continuously and doesn't require anyone to press play" (Wix, 2017)

Insights Unequal Communication & Representation
The products shown here and in Appendix A give an overview of which products in the category of Unequal Communication & Representation are not inclusive.

The examples were analyzed to determine the issues that made them non-inclusive. These issues are:

1. The product uses non-inclusive language. An example of this is the baby cream for red bum (see page 109), as a baby with dark skin will most likely not experience red skin. This means that the parents have to determine for themselves when they can use that product for their baby, instead of it being clear on the packaging. Other examples are whenever words are used to describe the color beige by referring to skin like with the 'flesh" crayon. This topic is also discussed in chapter 2.4.
2. The product uses anti-dark skin language. An example of this is the concealer line (makeup), where the darkest colors received names with negative connotations (see page 110). An example of a visual anti-dark skin language is the Dove commercial where a woman with dark skin transforms into a woman with light skin. A breakdown of anti-dark skin language can be seen below.
3. There is a lack of representation. This is best seen when dolls/figurines are modeled after a specific group while other groups are unable to find something that resembles them (see pages 103 and 104). Or when pictures in children's books are photographs and drawings of people with light skin. The importance of representation is discussed on the next page.

Dissecting anti-dark skin language
When analysing examples of anti-dark skin language two different types of languages can be identified:

1. Explicitly racist
2. Racially insensitive

Two advertisements were used to indicate the differences between the two.
Explicitly racist ads and racially insensitive ads are different in the sense that the first is a result of very obvious racism, and a deliberate execution to convey a racist message. This is best seen in the Chinese detergent where the man with dark skin becomes a man with light skin after being washed in the washing machine (see image 18).
A racially insensitive ad is usually an ad where the designers of the ad unintentionally created a racist image because they were not knowledgeable enough to know how the image could be interpreted and what it could represent (see image 19). For example, throughout history, there have been many soap ads where black people were depicted as dirty. This narrative is still perpetuated, as was seen in the laundry detergent commercial. The Dove ad where the advertisers put a darker skinned woman in the before-section and a lighter skinned woman in the after-section is reminiscent of the old racist ads and could be interpreted in the same way regardless of the advertiser's intent. Whether it was intentional or not, advertisers must have sufficient cultural and historical knowledge to not continue creating harmful content.

Image 18: This Chinese advertisement promotes laundry detergent. In this ad, a man with dark skin is pushed into a washing machine with the laundry detergent, and a Chinese man comes out after a wash cycle. This is a clear example of anti-dark skin messaging even though the makers refuse to admit that this was the message (Graham-Harrison, 2016).

Image 19: This Dove advertisement promotes their skin care products. While at first glance there doesn't seem to be anything wrong with it, as Dove explains that all three women are intended to show the "after" product benefits. According to Huffington Post, critics find that the ad resembles old racist soap ads (like the Pears Soap), as the ad places a woman with dark skin in the "before" section and a woman with light skin in the "after" section (Moss, 2017). This is another example of how a lack of cultural and historical knowledge can cause designers and marketers to (unintentionally) continue creating harmful content.

The importance of representation

Representation in this context refers to images and people that are used in a certain situation that either look like the people who are observing the situation, or they are in similar circumstances. For example, if a person watching a movie sees people who they look like, who are living in similar circumstances, who they can recognize themselves in, that person is being represented in that movie.

Laura Thomas, researcher in various Critical Skills programs for education, states; "Our children's early experiences -- including the hours spent consuming media -- shape what they imagine to be possible for people who look like them, live where they live, or come from where they came from. Simply put, kids determine what they can be based on the examples around them" (Thomas, 2016).

Representation shapes how people see the world, and what their role in the world could possibly be. When that representation is not present, when people cannot recognize themselves in movies, in books and even in products, it is a subtle message that people who look like them don't matter. When a child with dark skin doesn't see dolls with dark skin, it is a subtle message to them that a doll that looks like them isn't something that people want. When a child watches movies where all the princesses are said to be beautiful because they have fair skin and silky soft long hair, it is a subtle message that only people who look like that are important. Or when a child reads books where the heroes, always depicted as people with light skin, go on adventures and do great things, it is a subtle message that only people who look like that can do these things.

Just as representation is crucial for children's development, it is also important to adults. These subtle messages of who matters in society and who doesn't are present in, for example, every movie that doesn't have a diverse cast, or, for example, every non-diverse administration that makes decisions that negatively affect the people who are not represented. It is also present in every product that isn't inclusive. Some of these products we use from early childhood all the way through our adulthood, and others we are confronted with only as we get older.

In closing, representation matters. It is an important subject that should be taken into account in all aspects of life, including product design.

2.4 THE TERM "SKIN COLOR" IN PRODUCTS

In the previous subchapter, many products were presented that are beige in color. This color matches light skin color, and these products are given names that refer to skin. So when a product is beige, people automatically say, for example, 'nude'. This incorrectly relates those names to a light skin color when their definition does not necessarily do so (see image 20). In this subchapter, several terms used to describe beige products are listed, along with their definition (Dictionary, 2021). Learning the meaning of these terms can help us understand why they are unfit to define a specific skin color.

flesh [flesh]
noun: 1. the soft substance of a human or other animal body, consisting of muscle and fat.
2. the surface of the human body; skin

natural [nach-er-uhl, nach-ruhl]
adjective: 1. existing in or formed by nature (opposed to artificial)
2. in conformity with the ordinary course of nature, not unusual or exceptional
3. not tinted or colored, undyed

nude [nood, nyood]
adjective: nud•er, nud•est: naked or unclothed, as a person or the body.
noun: a color that falls within the spectrum of human skin colors.

skin tone [skin tohn]
noun: the color of a person's skin

From the definitions, we can see that none of these words refer to a specific color and are therefore unsuitable to describe any particular skin color.
While colors that match light skin are referred to as nude and natural, colors that match darker skin tones would just be referred to as brown. This creates the idea that brown skin is a deviation from the norm i.e., what is natural.

What is interesting to note is that the word "natural" doesn't refer to the skin at all. It refers to something that is considered normal or something that doesn't have a color. This can also be seen in the way Dutch people refer to white people as (Dutch word:) "blank," which also means "without color." This is, of course, false, considering that beige/peach/pink are also colors.
As cultural historians Maayke Botman and Nancy Jouwe stated: "As long as whiteness isn't considered an ethnic group, it will remain an invisible norm which perpetuates its dominant position" (Botman & Jouwe, 2001, 16).

This means that as long as beige skin is seen as the standard and brown skin is seen as a deviation from that standard, white people will continue being the priority in product design.
The products presented in this report are designed in Western countries, but they are sold worldwide. So the products can be bought in Western Europe and North America, where the majority of the people are white, but they are also sold in other countries where this is not the case.
As an example, pharmacies in Curaçao, Nigeria, and India all carry the same beige bandages as pharmacies in Western countries. In these countries, the majority of the inhabitants have brown skin. However, this is not reflected in the product. To further illustrate the example, the bandages in these countries were analyzed. In the following pictures (image 21 to 24), an inventory of a pharmacy in Curacao can be seen and screenshots from the first row of results after searching "bandage" on online pharmacies in Nigeria and India.

Image 20: Using skin-related terms to describe beige products that match a light skin tone incorrectly relates those words to a light skin tone.

Image 21: Bandage inventory in pharmacy in Curaçao shows a variety of beige products in a country where the majority of the inhabitants, and the majority of the consumers in this pharmacy, have dark skin.

Image 22: Bandage inventory in pharmacy in Curaçao shows a variety of beige products in a country where the majority of the inhabitants, and the majority of the consumers in this pharmacy, have dark skin.

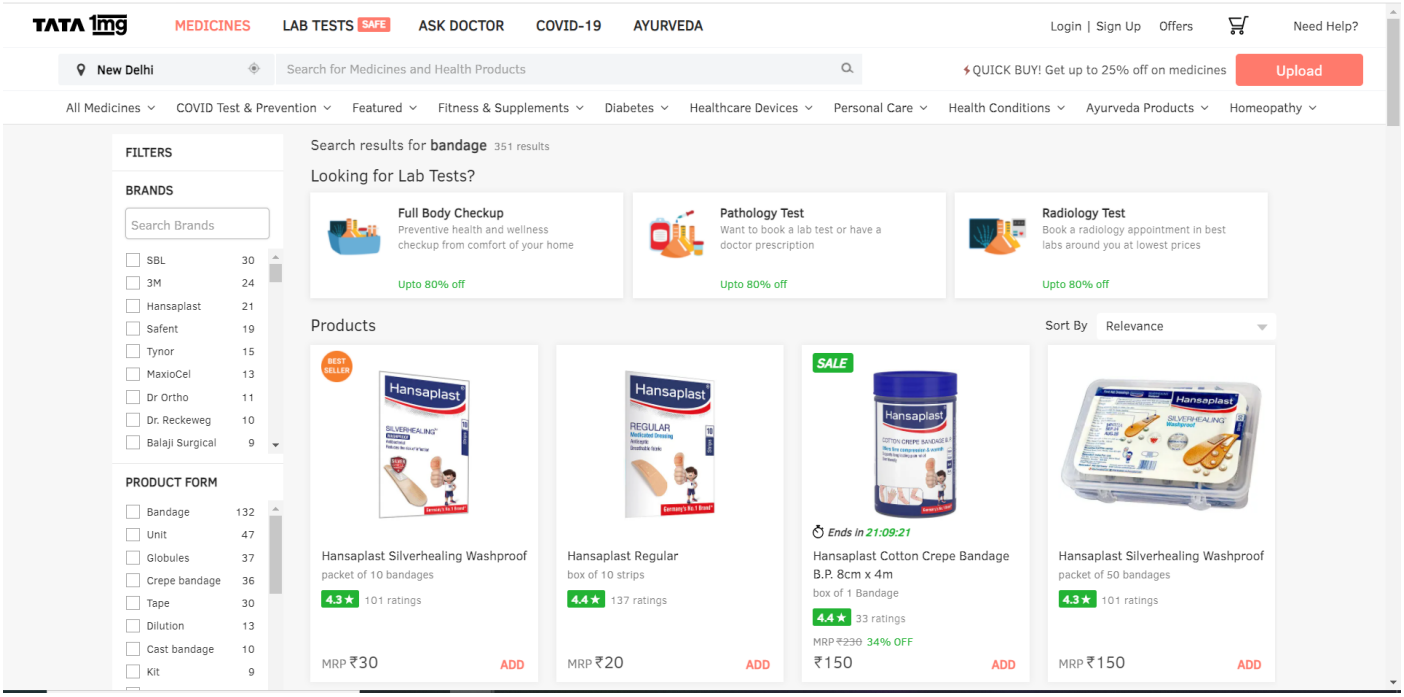


Image 23: Bandage inventory from an online pharmacy in India, a country where most of the inhabitants have brown skin. This image shows only the first row of results when looking for bandages, and these bandages are all beige. There were no other bandages available except for colorful children's bandages. No search filters were used to portray these results.

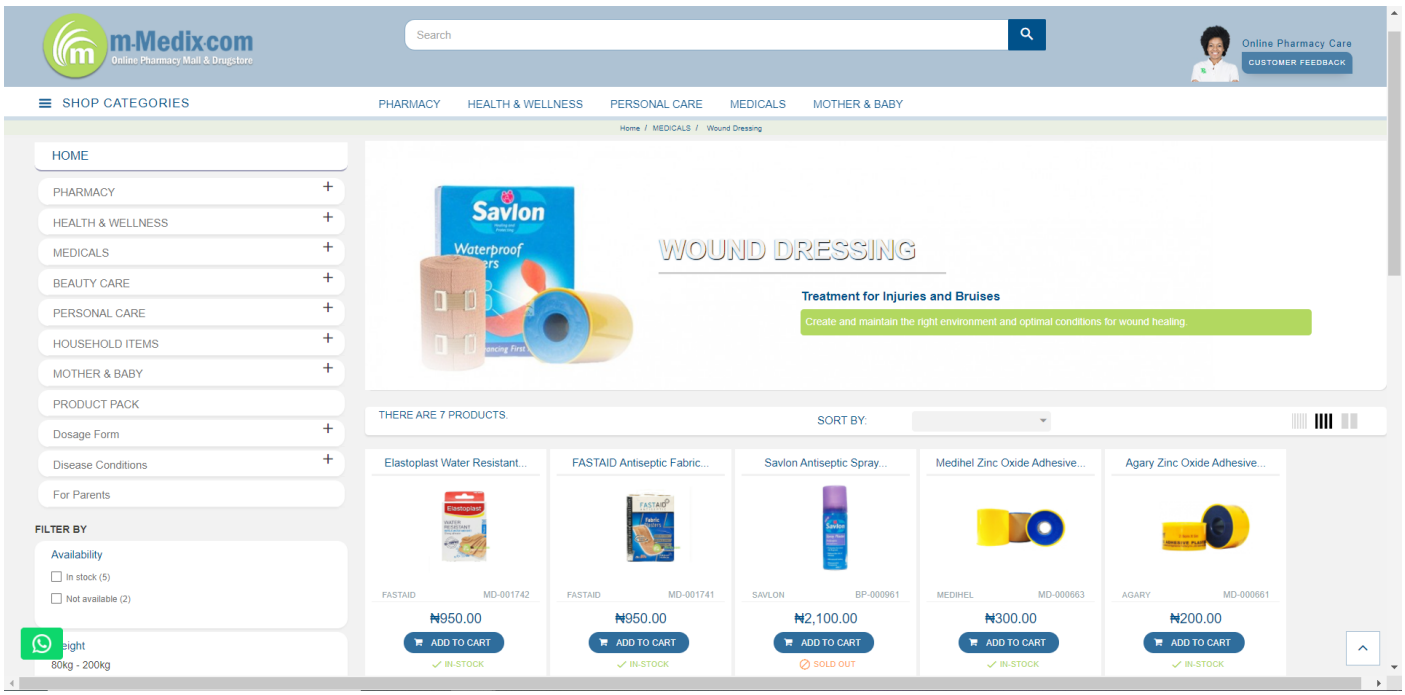


Image 24: Bandage inventory from an online pharmacy in Nigeria, a country where most of the inhabitants have brown skin. This image shows only the first row of results when looking for bandages, and these bandages are all beige. There were no other bandages available except for colorful children's bandages. No search filters were used to portray these results.

2.5 EXPLORING CURRENT SOLUTIONS FOR SKIN TONE INCLUSIVE DESIGN

In the previous subchapter, many examples were shown of products that are not skin tone inclusive. In this subchapter, examples of skin tone inclusive products are shown. These examples were found by doing online research aimed at finding existing solutions for non-inclusive products. The solutions could serve as inspiration for design students and professional designers and could therefore be incorporated into skin tone inclusive guidelines. The solutions are formulated as strategies as they can be used to achieve the goal of skin tone inclusivity.

Image 27: Underwear in a range of skin tones (see page 91)

STRATEGIES FOR COLOR SELECTION

The first category is Color Selection. Currently, there are a few strategies for wearable products to be made in a skin tone inclusive way.

Shade range for color matching

One strategy for making skin tone inclusive wearables is to make a range of products that are available in multiple skin tones to ensure that every user can find a (close) match. In images 25 to 27, several product ranges can be seen that are available in skin tones from light to dark.

Image 25: Ballet shoes in a range of skin tones (see page 93)

Image 26: Adhesive bandages in a range of skin tones (see page 88)

The reasoning behind the color matching can be used to assess how many shades a product range requires (see page 20) since this reasoning determines whether a truly accurate match is critical. Generally, the Fitzpatrick Skin Types can be used as a starting point (see image 28). This is a system of classification for human skin color based on the skin's response to UV light which depends on the amount of melanin pigment in the skin. Although this system has racial limitations, namely that it is not interchangeable with ethnicity and race (Ware et al., 2020, 77-80), this is not an issue with skin tone matching wearables. This category of products only looks at skin color and not ethnicity and race.

Typically, this classification is used for health reasons, for example, to help people determine how much protection from sun exposure they need to avoid sun damage and cancer (Healthline, 2019). According to the Fitzpatrick Skin Type classification, there are six skin types, and this also seems reasonable for a range of skin tone matching wearables.

Image 28: The 6 Fitzpatrick Skin Types

Custom products

Facial prostheses are a sensitive matter for the wearer, and for the best aesthetic outcomes, an absolute accurate match is critical (Ranabhatt et al., 2017). The Spectromatch e-Skin spectrocolorimeter can scan the patient's skin and retrieve an exact match by comparing the skin against a database of more than 22000 skin tones (Adby, 2016) (see image 29).

Whether this digital library is inclusive determines if

people with dark skin can find an exact match, which can make this method suitable as an inclusive option for skin tone matching wearables. Unfortunately this database is not available to be viewed and it was therefore not possible to verify whether it was inclusive.

Image 29: Spectromatch e-Skin Spectrocolorimeter scans the skin for an accurate match for facial prostheses

Nigerian artist John Amanam makes hyper-realistic prostheses for patients with dark skin because he found that he rarely saw people with dark skin with matching prostheses (see image 30) (Refined NG, 2021).

Image 30: John Amanam hyper-realistic prostheses for patients with dark skin

Straying away from skin color

To be able to stray away from skin tone matching, the reasoning behind the color matching must be known (see chapter 2.3). If this reasoning can be ignored for the specific product or for the specific target group, there are several other options for skin tone inclusivity. For example, the orthotics company Manometric aims to make beautiful orthoses for the fingers and wrist. A few of their products can be seen in image 31. These orthoses come in a range of bright colors and also in a clear version.

Image 31: Manometric ortheses are not made in the standard beige color but in different colors like blue, and one completely clear.

Another example of skin tone inclusion by straying away from skin color can be seen especially in products for children. Young children are more attracted to vibrant colors (Pancare, 2018), especially in combination with their favorite tv show/movie characters. Adhesive bandages for children can be found in an array of bright colors and cartoon characters (see image 32). This is an example of ignoring the reasoning behind the skin tone matching because of the wants and needs of a specific target group.

Image 32: adhesive bandages with Marvel characters are skin tone inclusive because they stray away from skin color

STRATEGIES FOR TECHNOLOGY & SOFTWARE

There have been several changes in the Technology & Software field to make products more inclusive. Some examples are discussed below.

Including more skin tones in photograph development

The previous Shirley card (see page 95) was swapped out in the mid-1990's for a multiracial Shirley card (see image 33) intending to help photographers calibrate different skin tones (Lewis, 2019).

Image 33:: multiracial Shirley card intending to help photographers calibrate different skin tones

Adobe Photoshop Lightroom has acknowledged that darker skin tones are not as easily translated to photographs as lighter skin tones (Zhang, 2015). They now offer different filters for different skin tones to ensure that each skin tone has a filter that enhances the skin tone instead of having one default setting (see page 98).

Photographer Dario Calmese argues that "having presets for black and brown skin tackles the erasive trope, 'I don't see color or race' and acknowledges and embraces the inherent, unique beauty of all people." (Lusina, 2021).

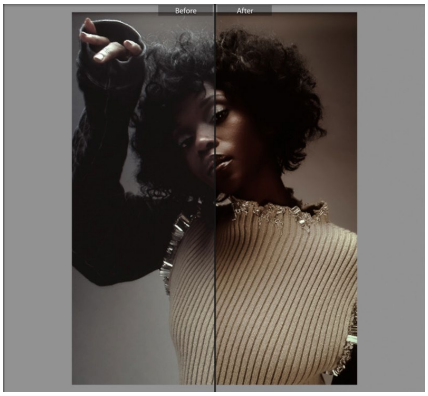


Image 34: Adobe Photoshop Lightroom filters for darker skin tone

STRATEGIES FOR SERVICE PROVIDERS

Including more skin tones in medical textbooks for better-educated service providers

Malone Mukwende, a medical student at the St George's University of London, wrote a book (Mind the Gap) with pictures of what different conditions look like on dark skin (see image 35) to ensure that people with dark skin can get proper treatment when they visit a physician or dermatologist, as this has not been the case (see page 99 and 102).

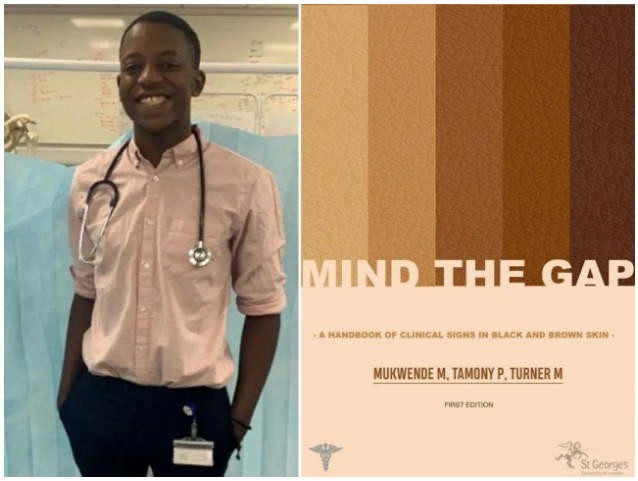


Image 35: Malone Mukwende and his book 'Mind the Gap'

STRATEGIES FOR COMMUNICATION & REPRESENTATION

Personalization

The company Wonderbly makes personalized children's books, the name and character can be customized to fit the child that will be reading the book. This "turns the child into the hero of their own story" (Wonderbly, 2012) (see image 36). This provides the representation that kids need while developing (see pages 26 and 28).

Image 36: Personalized children's books from Wonderbly

While not answering a specific research question, the strategies mentioned in this subchapter can be used as inspiration when designing. To see what has already been done and perhaps explore what more can be done makes this information valuable.

2.6 UNDERSTANDING DESIGNER BIAS

To resolve skin tone exclusion in product design, first, an understanding of its causes is needed. Chapters 2.1 and 2.2 tackled inclusive design and the causes of exclusion in design in general. This chapter deals with the causes of skin tone exclusion in particular. These causes were found by analyzing the environment that most designers in the West, and particularly the Netherlands, are in. The causes of designer bias in general were previously analyzed in chapter 2.2, and these were translated to fit this topic. Also, statements made by organizations such as the Inclusive Design Research Centre in Canada were also analyzed to further understand the necessary elements for inclusive design, which can indicate what is currently missing.
Additionally, the moment it is decided that a design is complete is questioned in order to raise the benchmark for successful design. Lastly, the relation between the designer's intent and the impact of a non-inclusive product is examined.

DESIGNER BIAS THAT CAUSES SKIN TONE EXCLUSION

What makes addressing bias difficult is that we are usually not aware that we have them. Because designers are unaware of their biases, the manner in which they are addressed is also important. It should not be done in a way that the designer feels attacked or scolded, because this will only cause defensive behavior and can even cause them to shut down if they feel that they are being accused of something they don't believe they are guilty of.

The research presented in the previous chapters, and conversations with teachers and students that will be presented in chapter 3, resulted in the the next diagram (image 37). This diagram displays the connections between three elements that were found to be essential when understanding designer bias regarding skin tone. These three elements are 'white environment', 'habituation by people with light skin' and 'lack of empathy for people with dark skin'. This diagram presents a phenomenon that happens unintentionally, this means that people have little to no control over it especially while growing up. Coincidentally, this is also when many ideas are formed regarding how they see the world. It will remain something that they are unaware of unless they are explicitly made aware of it.

Image 37: designer bias that causes skin tone exclusion

White environment

Even though there are no statistics available with this information, it is generally known that most designers in the Netherlands are white. Many white people have little to no people in their direct environment who aren't white, and this is also the case for white designers. They have mostly or only white people in their family, in their friend groups, and as colleagues at work or university. And because they have little to no exposure to people who aren't white, it becomes easier for them to only take the people that they see the most into account. In that case, they will only think of what they know the best while designing. This phenomenon was also discussed in chapter 3.2. Being exposed to a diverse group of people is not easy in the Netherlands, as many cities are not multicultural. A study done in 2018 by the Landelijk Kennisinstituut Cultuureducatie en Amateurkunst indicated that approximately 63% of elementary schools are more than 90% white. Only about 7% of elementary schools are less than 50% white (van den Bulk, 2018). This means that many kids will go to schools with little to no people of color, and they will only be exposed to other kids who look like them. And they will also start their IDE education never having been exposed to other people.

Habituation

This white environment can result in habituation. Habituation is a phenomenon that can occur in any situation that we are in for a prolonged period. It occurs when a response to stimuli is inhibited in the brain due to repeated occurrence of the stimuli (Rankin et al., 2008, 2). This can result in people getting used to certain aspects and even overlooking them. The traditional definition of habituation states that it is a decreased response to stimuli after repeated exposure. Considering that this analysis refers to a situation that the person has always been in, this project refers to habituation as no response

to repeated stimuli that have always been present. In terms of habitation in a white environment, white consumers don't question it when they see that a product is only available in beige. They are used to having products tailored to fit them and cannot imagine it any other way. And white designers will, in turn, also continue designing products based on what they know and what they are used to (see chapter 3.2). This means that the majority of consumers will stay quiet. And the people who get excluded often don't have a loud enough voice for their complaints to be heard.

Empathy

"Empathy is the ability to recognize, understand, and share the thoughts and feelings of another person, animal, or fictional character. Developing empathy is crucial for establishing relationships and behaving compassionately. It involves experiencing another person's point of view, rather than just one's own, and enables prosocial or helping behaviors that come from within, rather than being forced" (Psychology Today, 2011).

According to Jutta Treviranus, Founder of Inclusive Design Research Centre at the OCAD University, we should address the challenge of inclusivity by extending our empathy (Microsoft, 2016). Empathy is what can help designers understand the impact of their design; by being able to imagine how other people could experience the design. For a designer, it is incredibly important to work on developing empathy. Especially because humans typically feel greater empathy for people who are like them, and might feel less empathy for people outside their family, community, race, or nation (Psychology Today, 2011). And when designers design products for a community without working on their empathy, they will continue being blinded by their own biases, and in turn, they will continue excluding groups of people. Especially for designers in the Netherlands, this means that people who are not white will be excluded.

But what can a designer do to develop empathy?

In this next section, some methods for developing empathy are described. These methods come from exploring ways for designers to gain insight into the experiences of their target group.

Experience prototyping

A method that designers use to gain empathy for a target group is experience prototyping. Experiencing something for yourself is one of the best ways to understand a situation and gain empathy for those in that situation. With this method, the designers put themselves in a situation where they can experience what it's like to be a person in their target group.
For example, if a designer wants to design a product for the elderly, she/he could wear the GERontologic Test suit "GERT". This is an age simulation suit that allows designers to experience what it is like to be an older person (Vaes, 2016, 62). The suit is heavy and limits movements and disables proper grip of the hands. It also comes with foggy glasses to simulate bad vision (see image 38). This shows the designer how older people experience daily life and makes it easier for the designer to design the right product for older people.
Another example of experience prototyping is; using a wheelchair for any amount of time to experience what it is like to be in a wheelchair. The designer can go to the supermarket, go to the city, and experience what it is like to do different tasks in a wheelchair. This allows the designers to identify struggles and opportunities on top of hearing about them from a disabled person.

Image 38: GERontologic Test suit "GERT" used by designers to simulate older age to gain sympathy for elderly users (Produkt + Projekt Wolfgang Moll, n.d.).

Is experience prototyping appropriate in skin color inclusive design?

When it comes to skin tone, the possibility for experience prototyping practically disappears. It is much easier to simulate disabilities, and skin color is not a disability. The experiences of someone with dark skin cannot be simulated just by, for example, painting the skin darker. Not only would this be unacceptable, as is it considered to be blackface[1], it also does not allow the designer to experience

1 dark makeup worn to mimic the appearance of a Black person and especially to mock or ridicule Black people (Merriam-Webster, n.d.).

discrimination in all its subtleties. Skin color is a much more complex characteristic that can not easily be simulated.

Exposure
According to research done by industrial designers Merlijn Kouprie and Froukje Sleeswijk Visser, empathy starts with the designer approaching the user. This first contact with the user, which can be done with provocative material, can raise the designer's curiosity, and results in the designer wanting to learn about the user's experiences (Kouprie & Sleeswijk Visser, 2009, 445).
As was already discussed, people tend to feel less empathy for those outside their family, community, race, or nation (Psychology Today, 2011). When there is a lack of exposure to a group of people, we can easily forget that they exist and not take them into account. And when they are taken into account, it's sometimes in terms of stereotypes that are not always accurate.
As was stated earlier, being exposed to a diverse group of people is not easy in the Netherlands. This means that many kids will go to schools with little to no people of color, and they will only be exposed to other kids who look like them. And they will also start their IDE education never having been exposed to other people.
Since these kids will not see people of color at school, in their family, or in their community, they need to be exposed to them in other ways.

A way of exposing people to other people outside of their communities is by incorporating diversity in teaching materials at school, in shows, and advertisements on television/magazines/billboards. Not only does this provide representation for people of color, which helps them to imagine themselves in positions where they've previously only seen white people, it also sensitizes white people to diversity and helps them see that there are other people out there who don't look like them.
A challenge to creating this kind of exposure in a mostly white classroom is that the teacher has to do this actively. It is easier to use the first pictures you find after a Google search of, for example, 'kids playing', which will most likely be of white people, instead of looking further to ensure a racially diverse teaching material.

DESIGNERS' CRITERIA FOR A SUCCESFUL DESIGN

As designers, we can design forever and ever. At some point, we just have to stop. At this moment perhaps the time or budget is running out and the design is considered to be satisfactory. But when is a design considered to be satisfactory? At what point does a designer say: yes, it works!

Designers must think critically about this point because many designers are not even aware that skin color is something that they need to consider when designing.
They should be able to ask themselves: am I really satisfied with a product designed with mostly data from people with light skin and tested primarily on people with light skin?
Because no one knows what problems could arise when the product is tested on a diverse group. Taking the soap dispenser (see page 22) as an example: the designers maybe couldn't have known while designing that the technology doesn't work properly on people with dark skin. But testing the product with a diverse test group could have revealed these issues.

Joy Buolamwini is a researcher in the MIT Media Lab's Civic Media group and founder of the Algorithmic Justice League. This is an organization that looks to challenge bias in decision-making software. She asks software developers "would those failure rates have been permitted in a different subgroup?" (Hardesty, 2018). She also states that "The other big lesson ... is that our benchmarks, the standards by which we measure success, themselves can give us a false sense of progress" (Hardesty, 2018). This means that with low benchmarks for specific subgroups, in this case, people with dark skin, it is easy to believe that the product's design is satisfactory when it is, in fact, not.
This is the case not just for AI software but for all products. If a disadvantage would not be accepted in one subgroup, perhaps even one the designer belongs to, it should not be accepted in any other subgroup. And raising our benchmark, the point when we are satisfied, the moment when we feel that the design is successful, is essential to resolving exclusion in design.

To conclude, when designers are interested in a missing element in the product, they will invest time and money into more research and development. Currently, having products that work for people with dark skin does not seem to be essential in product design. To get designers to see this as essential, they must care about it. A way to get designers to care about this issue is through exposure, which was discussed erlier. As was explained previously, they need to have contact with the users (Kouprie & Sleeswijk Visser, 2009, 445). This project will further evolve on this concept of exposure.

IMPACT OUTWEIGHS INTENT

While collecting the examples of non-inclusive products, one thing remained consistent; the introduction of a non-inclusive product or insensitive advertisement on the market was often followed by an apology by the company. This apology always featured the same claim: “we never intended to hurt anyone”.

From Nivea:
"Thank you for caring enough to give us your feedback about the recent "Re-civilized" NIVEA FOR MEN ad. This ad was inappropriate and offensive. ***It was never our intention to offend anyone***, and for this we are deeply sorry. This ad will never be used again. Diversity and equal opportunity are crucial values of our company" (Sharp, 2011).

From Gucci:
"The fact that, ***contrary to my intentions***, that turtle-neck jumper evoked a racist imagery causes me the greatest grief" (Griffith, 2019).

From Intel:
"Unfortunately, our execution did not deliver ***our intended message*** and in fact proved to be insensitive and insulting" (Karanovic, 2014).

Most of the time, exclusion in design does not happen on purpose. As was discussed in chapter 2.2, exclusion occurs when designers design using their own biases, especially biases they are not aware of. This means that they are unintentionally excluding people because they overlook things. In these cases the product’s impact and the designer’s (supposed) intent are not aligned. This exclusion can cause a lot of damage, see chapter 2.3.

So, one must wonder; does it matter that it was unintentional?

When designers unintentionally cause someone harm or even cause someone to lose their life, it does not matter to that person (or their family) that it was unintentional.Exclusion in design can have emotional effects, an example of this is the woman with dark skin who faced the additional struggle of getting her prosthesis to match her skin tone on top of dealing with the loss of her leg (see page 90). Exclusion in design can also cause injury and even death, for example, in the case of people with dark skin being more likely to get hit by self-driving cars (see page 97), or the case of AI software in hospitals that are biased towards people with dark skin (see page 98).

When designers put an entire group of people in danger, the impact outweighs the intent.

It is easy for someone else to analyze a product in retrospect and point out its shortcomings. It is more difficult for a designer to point them out while designing, so a designer must take the necessary precautions to ensure that these issues are caught early on.

What is important for designers to do, is to understand the impact that their design choices have. Reflect on this impact and empathize with those they might hurt. The subject of empathy was discussed earlier in this subchapter.
Then they can align the impact that they make with their intentions. A retrospective: “I never meant to exclude anyone” or “I never meant to hurt anyone” can then be replaced with a prospective; “I intend to include everyone to the best of my ability”. This then includes taking active steps to ensure that exclusion does not happen. This project also focuses on active steps that can be taken for designers to become aware of their biases and work on an inclusive way of designing.

2.7 CONCLUSIONS

This chapter revealed the answers to the first two questions of the first research area, namely: which products are not skin tone inclusive and what causes products to be non-inclusive. The answer to the third question is not discussed in this chapter, but is used later in this report.
One of the most significant limitations of the research is very few scientific papers have been written about this topic. The ones that exist are usually about specific technologies like AI and sensors. This research was therefore done mainly by reading online articles and using tools for general inclusive design and translating them to this particular topic.

Chapter 2.3 and Appendix A show an extensive collection of examples of products that are not skin tone inclusive. While analyzing the products from these different categories (Inadequate Color Selection, Failing Technology & Software, Undereducated Service Provider, and Unequal Communication & Representation), it becomes clear that there are several aspects regarding the products (and services) and how they are communicated to the public that frequently go wrong and therefore can give give some indication as to what went wrong in the design process. Knowing these aspects can give a better understanding of the issue of skin tone inclusivity in product design and gives an idea of what needs to be taken into account during the design process.
In Appendix E, a table can be seen (first two columns) that explains which research area each insight came from.

The following insights were taken from the exploration:

1. The group that is able to use the product the way it was intended is not diverse, this can be because the description of the target group was not defined properly during the exploration phase, and different skin tones are not explicitly mentioned.
2. Not all stakeholders are taken into account during the design process and therefore indirect users of the product are excluded from the design process
3. Data gathering during research is not inclusive resulting in an incomplete dataset based mostly on data from people with light skin
4. There is little regard for different skin colors in when choosing the colors for color matching wearables, resulting in wearables that do not match all skin colors
5. Service providers are not educated in an inclusive way due to learning materials not being inclusive, and therefore cannot deliver the service in an inclusive way
6. Light-dependent products do not function for all skin colors due to different lighting conditions needed for dark skin and reflection of light not being taken into account
7. Products are not tested with a diverse group representing the intended users
8. Word choice on product or used for marketing is not inclusive
9. Designers/marketers lack cultural and historical knowledge regarding race and therefore create racially insensitive content

Keeping in mind all the different aspects that play a role in designer bias, it becomes clear that an approach to influence this must not be aggressive to avoid defensive behavior. It must also primarily be focused on opening eyes and planting seeds in people's minds. This is because it might take a while for people to recognize an issue in a situation that they are accustomed to.
Exposure is an important tool in design and designers must come into contact with their target group, in this case, people with dark skin, one way or another.

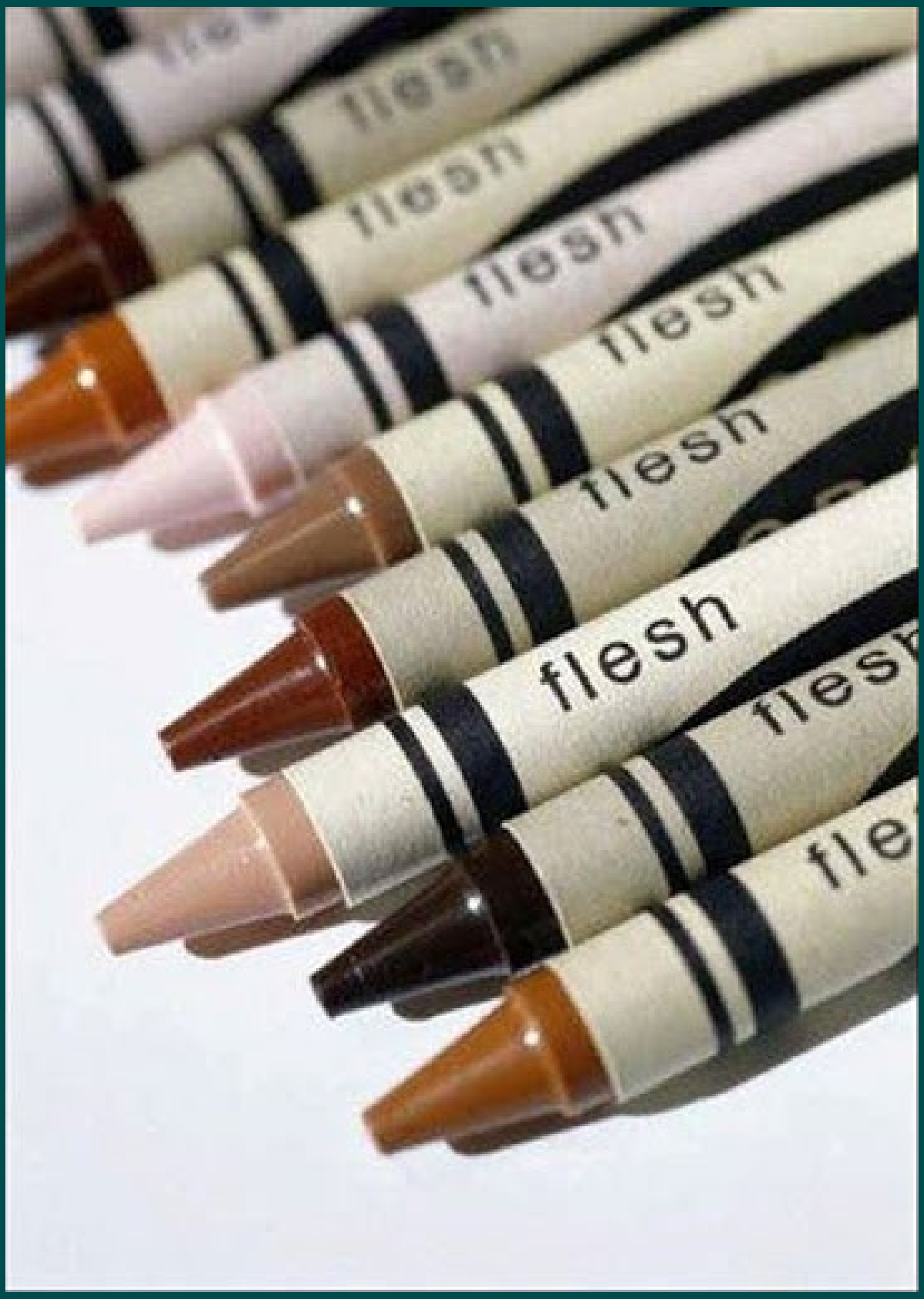


*Image source unknown

3 THE ISSUE OF SKIN TONE INCLUSIVITY IN DESIGN EDUCATION

During my studies at IDE it stood out to me that not much attention was paid to the topic of skin tone inclusivity. In this chapter, search area 1 (see page 10) is tackled to get a better idea of to what extent inclusive design in general, and skin tone inclusive design in particular, plays a role in education.
This would reveal potential gaps and opportunities for an intervention. The evaluation was done by interviewing teachers about their knowledge of inclusion in general and skin tone inclusion in particular. They were also asked whether they address these topics in class and when designing.

Six teachers/course coordinators involved in several bachelor courses such as the PO courses, Design Drawing, and the Bachelor Final Project were interviewed (see Appendix C) via Zoom for approximately an hour each. These teachers have all done their Master's at IDE, graduating between 1989 and 2012. They also have experience with professional design practices. They could therefore give some insight into what professional designers need to be able to learn about this topic. One of these teachers has a dark skin tone, and he is one of the few at IDE. He was interviewed as he was expected to have personal experience, which could give him a better view of what IDE is missing.

Before each interview, they could scroll through a document with some of the collected product examples to get acquainted with the topic and project.
Students who have finished their bachelor's at IDE were also approached with a questionnaire (see Appendix D) to ascertain the level of knowledge they had acquired during their studies. Ten students filled in this questionnaire.

3.1 TEACHERS' PERSPECTIVE

After the interviews with the six IDE teachers, all their comments were compiled and then clustered according to theme. From these interviews, seven themes were identified that came forward in (almost) all interviews. In this subchapter, the points brought forward by the teachers are presented and analyzed based on research and personal experiences of people with dark skin. The insights from these interviews indicate how the IDE bachelor education is set up.

INSIGHTS

Awareness of issue
Initially, most teachers expressed shock at the examples, asking if some of them were really true. Most of them indicated having heard of the adhesive bandage example, as it is quite a popular example, but they admitted to not having thought about the issue as a whole that much.
After seeing the example of the self-driving car (page 97), one teacher stated that he could not imagine that an error like this wouldn't be fixed as soon as the company knew about it.
One teacher explained that this is something that he regularly thinks about because he has a friend with dark skin who tells him about his experiences.

Focussing on skin tone
A few teachers expressed concern about a range of choices as a solution for skin tone matching wearables. They argued that this would put more emphasis on and sustain differences between people. They argued that a different solution would be better, for example, moving away from skin color altogether by making blue/purple/green bandages.
They also expressed concern for production logistics becoming an issue when expanding a product range to include more skin tones.

Teaching
Several teachers focused on inclusive design in general (for example, physical limitations and cognitive ergonomics). They stated that it was only discussed in class if the topic comes up naturally, for example, when they think that student overlooked something or made an incorrect assumption.
Most of them did find the topic of inclusion necessary, saying that it is important to be aware of who you are designing for. One also stated that it is especially crucial to teach students about inclusion at the beginning of their education because they don't have experience in design and are not aware

how important it is to talk to real people to get a better idea of who the target group is. But once they have that experience, they will understand how much value it adds.

Most teachers indicated that they have never taught skin tone inclusive design to students simply because they have never really thought about it. One teacher did say that he tries to make his presentations as diverse as possible and incorporate pictures of people with different skin tones. Another teacher (one of the few teachers with dark skin at IDE) stated that he tries to use underlayments[1] of people with varying skin tones during his Design Drawing classes. Even though these stock photos of people with dark skin are hard to find online, he believes that showing his students diversity will plant a seed in their minds to make them consider that not all users will look like them.
One teacher believed that skin color would never receive a place in the curriculum because there are so many different topics that can influence design, and they cannot all be considered during education. But he believes that it is better if the student can be taught to have empathy for things that they don't know, and for other people's perspectives, skin color will also be a part of that. A student must be taught to assess how important a topic is in the context of their project and how inclusive they have to be. If you don't have empathy for your target group, you cannot make that assessment.

Design practices
One teacher stated that physical ergonomics plays a significant role in his work. He, therefore, pays a lot of attention to who is going to be using his product and how he can make the product comfortable for people of different sizes.
Another teacher stated that he thinks about inclusion while designing but in a nuanced way. This means that he tries not to focus on it so much that it becomes positive discrimination because that can also be harmful. He stated that we think and react foremost using our routines and what we are used to. And this routine does not always include inclusive thinking, so he tries to train himself to do so.

Most of the teachers indicated that they haven't come across moments where skin tone was an important factor in their design practices. One did admit that there may have been moments, but he may have been too naive to realize it at that moment.

Moments of inclusive thinking during the design process
According to the teachers, if inclusive thinking were to be applied to the design process, it should be done at the very beginning of the project and at several other moments during the continuation of the project. For example, when setting a goal and when the criteria for this goal are formulated. And also, when form-giving, this can also determine if the product is inclusive or not.
Another teacher stated that skin tone inclusivity should be something that is always considered, just like all other differences between people are considered in inclusive design. Furthermore, one teacher stated that testing with a diverse group is necessary because then you don't have to foresee every single issue present in the product (which also isn't possible). The testing sessions will reveal them to you.

Added value of topic to design education
All teachers believed that this topic is important and that the idea of a collection of product examples is an excellent way to raise awareness and open the students' eyes. One teacher stated that it could even be used as part of a peer assessment, not for students to criticize each other but as a means to start a conversation. It can be used as a starting point for a more extensive conversation about morals, ethics, and inequality in general. Another said that it is something that could be introduced at the beginning of a project but that sometimes it would only be relevant once a student has encountered an issue, and this isn't necessarily in the first week.

Added value of project to design practices
One teacher stated that students and professionals often develop design tools and because they are in the form of guidelines or templates, they are easy to use. It becomes part of the 'toolbox' that a designer has and can pull inspiration from during the design process.

Additional insights
- Topics like these are sensitive and can cause friction in class, whether it be teachers or students who are afraid to say the wrong thing, or students feeling uncomfortable with the way the topic is handled. There needs to be careful consideration to ensure that people feel comfortable and safe to participate in discussions and communicate with each other. Several teachers indicated being nervous or knowing other teachers who are nervous about sensitive topics in the classroom because they are worried they might say the wrong thing. A safe space is needed in order for

1 stock photos used for tracing when drawing, usually to portray how a product is used by a person

the students to learn, but teachers also need a safe space in order to teach.
- In the first year the students are bombarded with new information and it is not always possible to make a specific topic stand out.
- Because the students are inexperienced it might take a longer time to make them aware of a certain issue than say, a professional designer.

DISCUSSION & CONCLUSION

Six teachers were interviewed to understand to what extent they included skin tone inclusion in their design considerations and teachings. This effectively answered the first research question from search area 2.. The stories make clear that while there is focus on inclusive design at IDE, skin color is not a part of it mainly because the teachers don't know about it and it's not a part of the curriculum. It is also apparent that not all teachers teach in the same way, which isn't necessarily a problem, but it does mean that depending on the day one class might acquire knowledge that another class doesn't, especially some teachers only handle a subject if it naturally comes up. This seems like a logical approach, but if the teacher's awareness of a topic is low, they might not realize it when it comes up. To ensure that all students learn something it would have to be part of the curriculum.

Most of the teachers were doubtful about introducing wearables in multiple skin tones as they believed that this would place too much attention on people's differences. However, I do not believe that addressing differences between people is a negative thing as long as the differences are not used to prioritize one person over another. Ignoring differences between people is one of the main causes of exclusion in design. Different racial characteristics means different needs and this can have an impact on how the product functions, therefore equality is not achieved by pretending that we are all the same. Additionally, as was explained in chapter 2.5, with certain products it is easier to stray from skin color than others. This depends on the reason why color matching was done. A user might accept a blue bandage, but can an amputee accept a blue prosthetic?

In their design practices, mostly involving products involving physical ergonomics and (public) spaces, the teachers seem self confident that their designs to date have been inclusive, almost as if completing an education at IDE (and having design experience) ensures that this comes naturally to them. Some of them also admitted not consciously thinking about it, but trusting that everything is being done in a proper way.

While self-confidence is important in design, it is also crucial to recognize that every person has blind spots that they are not aware of.

Because the students learn so much in the first year, and everything is new to them, not all of this information is going to stick. This means that there might not be space for the topic at all, and even if it is discussed it might be so small that it disappears in a sea of information.

Recommendations stemming from the interviews for to-be-designed concept:

- Intervention must be done in a way that a teacher with a lack of knowledge on the subject can teach students.
- Intervention must be done in such a way that the teachers feel comfortable talking about the topic.
- The intervention should, if possible, fit into the current curriculum as it might not be desirable to adapt the curriculum to fit this topic as an individual, standalone topic.
- The intervention should expose the students to people with dark skin since they will not likely be exposed to them in their daily lives.
- Any introduction of this topic to the students (no matter how small) must be done in a memorable way or else they might not be able to properly absorb it.
- The intervention should be done in a way that is challenging but not unpleasantly so.
- The intervention should be obvious and concrete to avoid an intuitive approach as this does not allow a designer to challenge their biases.
- The intervention should encourage students to consciously incorporate inclusive design into their process.
- In the future, research could be done to determine how introducing more colors to a range of skin tone matching wearables impacts the logistical side of production on an industrial scale.

3.2 STUDENTS' PERSPECTIVE

A questionnaire was sent to students that have done their bachelor's at IDE. This was done to get a better idea of how much they learned about inclusive design in general, and skin tone inclusive design in particular during their studies. This is then also an indication of the level of knowledge with which they start their careers. In the questionnaire, the students were shown a mock database with examples of non-inclusive products to get their opinions on them. This questionnaire was filled in by ten students that had all graduated from the bachelor program in the last five years. While the skin colors of the students who filled in the questionnaire were not known, it can be assumed that the majority, if not all, were Dutch with light skin as they are the majority at IDE. Below, the most important insights can be seen.

INSIGHTS

Awareness of issue
When asked if the students know that products exist that were designed with only people with light skin in mind, most students indicated that they did know. These students all indicated learning about it on social media platforms such as Instagram and from their friends.
Most of them mentioned bandages, as this is quite a popular example. Other products mentioned were, for example, ballet shoes, underwear, makeup, automatic soap dispensers and water taps, facial recognition, and medical practices.

Impression of the products
After seeing more examples of non-inclusive products, some students indicated that it seems self-explanatory when you see it all together. Still, they wouldn't necessarily think about it or notice it otherwise. Some also stated that a few products seem so easy to correct that they don't understand why it hasn't happened yet or why it was done wrong in the first place.
One mentioned understanding that the topic is quite complicated due to history. Still, they all agreed that a change should be made, as they labeled the products and their effects as problematic, ignorant, and even dangerous and scary.

Designer biases and inclusive design
When asked whether they were aware of designer bias that results in the unintentional exclusion of certain groups, all students expressed knowing this. They also seem to be aware of which kinds of biases exist that result in exclusion, such as gender, disability, education level, socio-economic status, among other things. One student stated that designers are taught to design for a target group, often simplified with a persona. Characteristics are assigned to personas based partly on gut feeling while researching. A lot of the time less common characteristics are left out. One student indicated that, especially with more awareness around a topic, a designer has the responsibility to at least try to design as inclusively as possible.

Inclusive design in education
They were asked if they had received in-depth knowledge about inclusive design during their bachelor's, for example, examples of non-inclusive products, how to design inclusively, how to look past biases, the effects of non-inclusive products on people and society, and how to incorporate inclusion in the design process. All the students stated that they did not learn about this during their bachelor's. Some of them pointed out that during the course Mens & Product, where the topics of ergonomics and anthropometrics are tackled, they did learn about physical differences. But that was the full extent of classes on inclusion. Two students indicated that they did receive more knowledge on this during their master's. But one said that this only happened during a project about Africa, where they then studied cultural differences.

All the students stated they believe that knowing about inclusive design influences the designer and the final product in the sense that designing is complex and people (designers) don't think about certain issues enough. They also believe that the design is based partly on the designer's assumptions, and that knowing about inclusive design can help the designer look at the design from different perspectives. According to some students, it is essential that the designer knows who they are excluding and why, since a lack of knowledge on inclusive design leads to exclusion that not only has emotional effects but can also cause injuries and even death. Lastly, they all stated that they would have liked to learn more about inclusive design during their studies. If a database had been available with examples of non-inclusive products, they would have consulted it to know what to avoid.

DISCUSSION & CONCLUSION
Ten students were asked to fill in a questionnaire to indicate how much they learned about inclusive design in general and skin tone inclusive design in particular during their bachelor's and thus illustrates the knowledge that they start their careers with. The goal of this was to reveal whether there were any gaps in the current IDE education and if there is enough attention paid to skin tone inclusive design at IDE. This effectively answered the second research

question from search area 2.
Even though the students might not have in-depth knowledge about this topic, they have heard about it. One teacher stated during the interviews (chapter 3.1) that since students don't have much experience it requires more effort to make them aware of something. The fact that they have at least heard about this before can facilitate the process of raising awareness of this topic.
The students' experiences aligned with my own in the sense that Mens & Product was the only course in which inclusive design is explicitly tackled, but only in the form of ergonomics and anthropometrics. Skin tone inclusion is not discussed during the bachelor studies so students either go into their careers or their master's without much awareness of the issue of skin tone inclusivity. And also that it is never shown at IDE how biases manifest in products and how to look past our biases. In fact, a little stereotyping is even encouraged in the form of creating personas. These personas can be valuable in the design process, but without sufficient knowledge, the personas can also result in an extremely narrow view of the otherwise diverse target group.
These results show that an intervention in the current IDE curriculum is needed. Students would also be interested in being taught about inclusive design. It also showed that the students found the examples to be a valuable way to teach about this topic. The message truly comes across when the examples are put together. It can help them think about something they might have seen on social media but never given much thought.

Recommendations for to-be-designed concept:

- A database with examples is valuable because viewing the non-inclusive products together gives the students a better idea of what the topic is about.
- Social media platforms seem to be the way that most students find out about this topic. Creating a database that is online and is thus sharable could be a great strategy.
- A lesson about biases and how it manifests in a product is necessary.
- An intervention in the current curriculum at IDE is necessary.
- The intervention could expand their views of what their target group is.

PHASE 2
DEFINITION

4 SKIN TONE INCLUSIVE DESIGN GUIDELINES

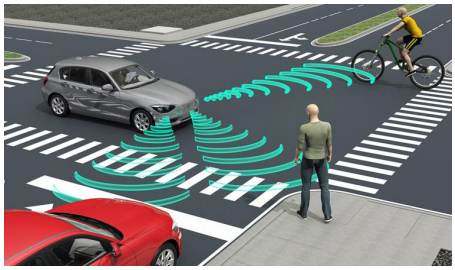
Much research was done to understand the issue of skin tone inclusivity in product design. After a thorough comprehension of the issue was achieved, the exploration phase was summarized by identifying the most frequently occurring issues in non-inclusive products. This summary can be found on page 39.
The issues and insights mentioned in the summary were used to formulate 13 skin tone inclusive design guidelines meant to help designers design more inclusively by prompting them to consider different matters during their process. Some of these guidelines come from insight directly relating to the four categories presented in chapter 2.3, and other guidelines came from other areas of the research, for example, the research about designer bias. In Appendix E, a table can be seen that explains where each insight from the summary came from, and also which insights led to which guidelines. These guidelines were formulated by thinking of solutions for each issue.
These 13 guidelines allow the designers to consider matters that they may not have thought about otherwise due to their implicit biases. These guidelines are formulated in the form of questions to help the designer explore different topics and can be added to the toolbox of inspiration.
The guidelines were also placed in a Basic Design Cycle to indicate at which moments during the process each guideline can be used.

4.1 SKIN TONE INCLUSIVE DESIGN GUIDELINES

1 Who is your target group?
Have you considered the diversity of the community and the country of your intended users? Consider looking for data about the population and exploring outside what you are used to seeing every day. What do people in the country look like?
Also, keep in mind that the product might be sold worldwide, and the people might not look like what you are used to seeing. For example, beige wearables are sold worldwide, even in countries where the majority of the people do not have light skin.

2 Is your knowledge of your target group based on facts?
Are they people that you interact with regularly? Is the knowledge that you have about them reliable? Is this knowledge based on facts or assumptions? Is it something that people always say, or is it actually true? Are you using stereotypes[1] to define the people in the target group or certain people in the target group?

3 Are all stakeholders identified, even the ones not directly using the product?
Who else is impacted by the product? Are there people outside of your focus area that the product can harm?
For example, pedestrians are not actively using self-driving cars, but they are stakeholders in traffic. Failing to consider people with dark skin as pedestrians results in self-driving cars being more likely to hit pedestrians with dark skin. The diversity of indirect users must be taken into account as much as the diversity of the direct users.



1 a standardized mental picture that is held in common by members of a group and that represents an oversimplified opinion, prejudiced attitude, or uncritical judgment (Merriam-Webster, 2021).

4 **Is the description of the purpose of the product inclusive when doing research?**

When describing the purpose of the product for research, are you using words that only a part of the community can relate to?

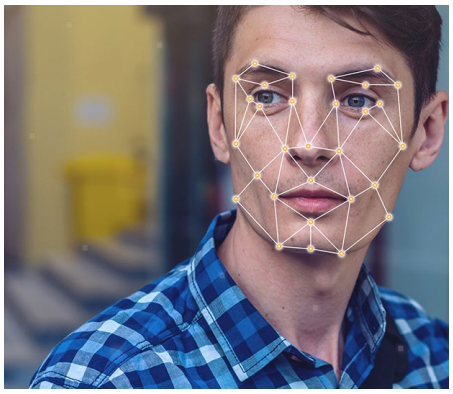
A simplified example, if you were researching diaper rashes and interviewing parents, and you asked the parents if their dark-skinned baby experiences red skin, the answer will most likely be no. Is the next step to exclude them from the product because you don't believe they need it? Or were the questions asked in a way that doesn't include other symptoms of diaper rashes that a dark-skinned baby does experience?

During the research, inclusive thinking and question-asking are important to ensure that you find the right insights to serve every user in your target group.

5 **When getting insights/data from your test group, did that group represent your established target group?**

How much data do you have from each sub-group? The efficacy of the final product depends on the data you have about your users (among other things). If you have more data about one group than another, the product might work better for the one group.

For example, facial recognition software is trained to recognize faces by using pictures of people's faces. These pictures make up the dataset. Currently, these datasets consist of 80% pictures of white men. As a result, facial recognition software is better at recognizing white men and often misidentifies women and people with dark skin. A much larger dataset is needed with a fairer distribution of different races and sexes for the software to identify everyone accurately.



6 **Are you keeping in mind that human skin comes in an array of colors?**

When designing a skin color matching wearable, consider how many skin tones there are instead of sticking with only beige.

Are you familiar with the Fitzpatrick Skin Type? This was developed to assess the propensity of the skin to burn during phototherapy, but it also is commonly used by providers as means of describing constitutive skin color and ethnicity". It is used to categorize skin tones into 6 different categories. Depending on the product, 5-6 could be a good number of variations in color for skin color matching wearables if there is an even distribution of light to dark colors. However, this is not enough if an accurate match is crucial, for example, with foundation (makeup) and facial prostheses.

7 **Are the people delivering the service educated in an inclusive way?**

Service providers don't always know how to provide that service for people with dark skin. For example, people with dark skin have a higher chance of being misdiagnosed when visiting dermatologists. So if you are designing something for a dermatologist, are you keeping in mind that their education might not be inclusive? Therefore the product might still not be used inclusively even if that was the intention.

8 Does the technology discern every skin color?

Are there sensors in the product that depend on light or the reflection of light? How do different skin tones affect the efficacy of the product? If light must be reflected, consider that dark skin absorbs more light than light skin. For example, some soap dispensers do not work with users with dark skin because not enough light is reflected to trigger the sensor. Consider using sensors that are not light-dependent, like buttons. Or if the product must 'see' people (for example, with a camera), what are the lighting conditions? Is a person with dark skin illuminated enough to be clearly 'seen' by the product?

9 Are you making a true effort to be inclusive?

Is your product truly diverse, or does it resort to a symbolic gesture that still results in an inconvenient and non-inclusive product? Are people with dark skin truly represented or are you resorting to tokenism[1]? For example, a makeup company came out with a line of foundations. There were 13 light shades and only 2 medium to dark shades.

10 Is everyone in your target group able to use the product the way it was intended?

When testing the product, does the test group represent the user group? Many non-inclusive products would have gone through another design iteration if problems had emerged during testing. But since the test group was most likely not diverse, the designers were not aware of the problem.

11 Is the description (of the purpose) of the product inclusive?

When describing the product, are you using words that only a part of the community can relate to? Is the product described in a way that people of every color can recognize themselves? An example is beige products being called "skin tone" or the beige Crayola crayon called "flesh."

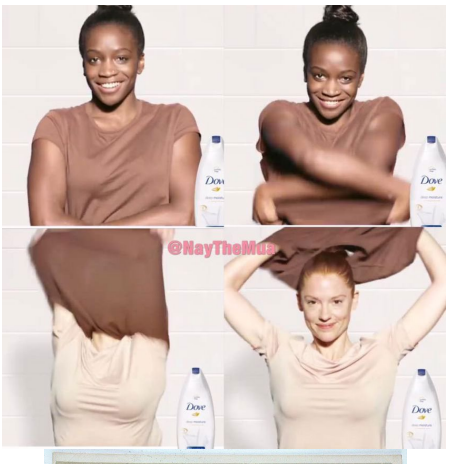
Another point of attention is where people of every color can recognize themselves in the way the purpose of the product is described. Using the previously mentioned example, the baby cream seems to be specifically for when a baby's bum is red. A baby with dark skin will not experience redness in the skin. So when does a parent know when to use the cream for a baby with dark skin? Can the purpose of products also be described in a way that people of every color can recognize when they can use them?

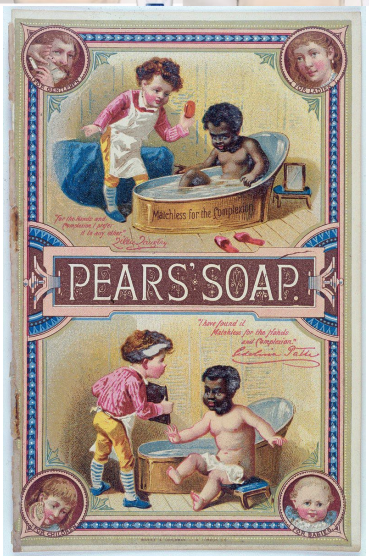
1 tokenism= "The practice of making only a perfunctory or symbolic effort to do a particular thing, especially by recruiting a small number of people from underrepresented groups in order to give the appearance of sexual or racial equality within a workforce" (Oxford English Dictionary, 2021). This act is merely performative and does not have any actual impact.

12 Are you using stereotypes/racially insensitive images or words to advertise/market the product?

For designers and marketing experts, cultural and historical knowledge is essential. Suppose there have been similar products in the past that used racist content in their advertising. In that case, this new product must not repeat this.

For example, soaps have a long history of racist advertising tied to them (see image Pears soap). This advertising from Dove probably wasn't intentionally recreating this. Still, with the proper knowledge, they could have anticipated how it could be interpreted.



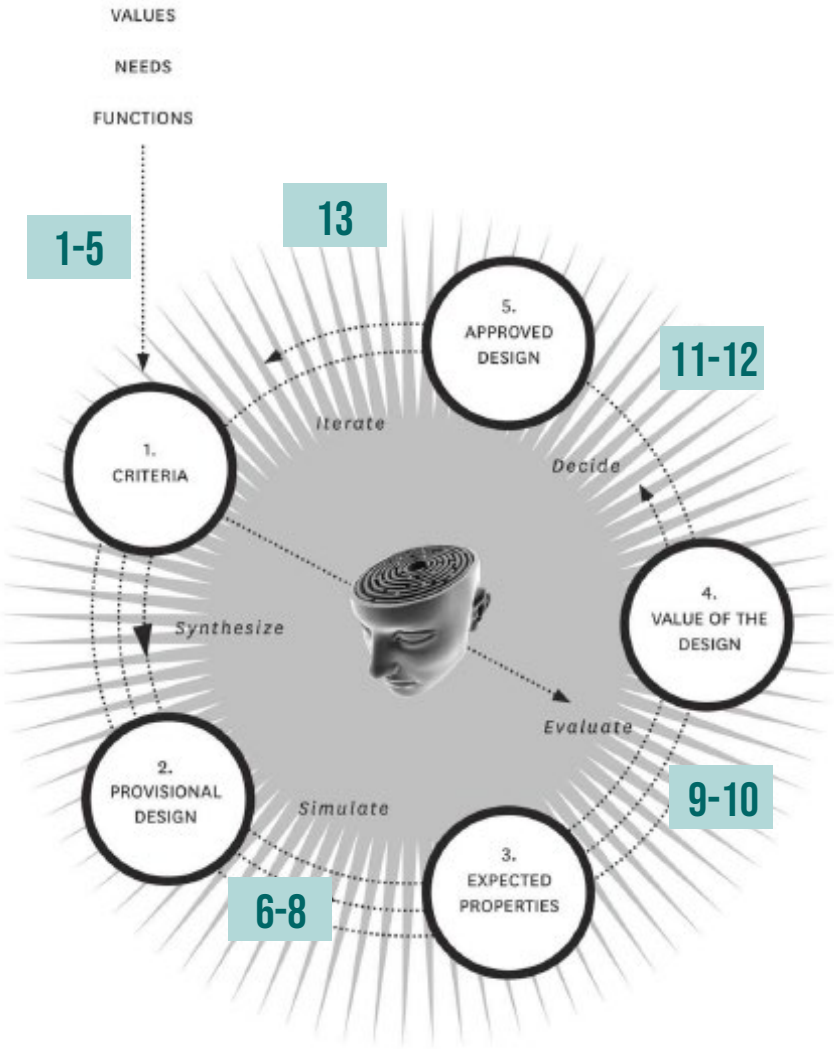


13 Is there a correction process built into the design of the product?

Some faults can always slip through and end up in the final product, even with careful testing. What can you do in advance to minimize the damage in case this happens? Is there a recall procedure in place? How do you show that you empathize with those that got hurt?

4.2 GUIDELINES IN THE DESIGN PROCESS

To create a better idea of when each guideline is relevant when solving a design problem, the Basic Design Cycle (see image 39), as explained in the Delft Design Guide, was used. In this case the Basic Design Cycle, which is usually used as an iterative thinking model, represents the different steps in a design cycle. The black numbers indicate the steps in the design cycle and the green are the design guidelines. The steps of the design cycle are explained below.



"The model describes five stages, each with a related outcome/ result.

ANALYSE:
In this stage you analyse aspects related to your design goal or a design problem. The processed information will yield the design criteria.

SYNTHESISE:
In this stage you generate possible solutions. This ideation will result in
ideas or designs.

SIMULATE:
In this stage you draw and model your ideas so that you can estimate and define the expected properties of your design.

EVALUATION:
In this stage you bring in your design criteria to evaluate your design.

DECISION:
In this stage you decide whether your design is acceptable or not. If it is not, you go back to one of the earlier stages" (van Boeijen et al., 2013, 18-19).

Image 39: Basic Design Cycle (Roozenburg & Eekels, 1995) in (van Boeijen et al., 2013, 18-19)

The guidelines numbered 1-5 can be used during the analysis stage, 6-8 during the simulate stage, 9-10 during the evaluation, and 11-12 during the decision stage. And lastly, number 13 can be used to iterate. The synthesize phase does not have any guidelines, this is because the ideation is supposed to be free of constraints. After the ideation, the ideas can be filtered using the guidelines.

This cycle could be done repeatedly during the design process until the design problem is solved. For this demonstration, marketing and market introduction are presumed to be part of the approved design during the final cycle. The consumer feedback can then be used for an iteration and to set up new criteria for a new design.

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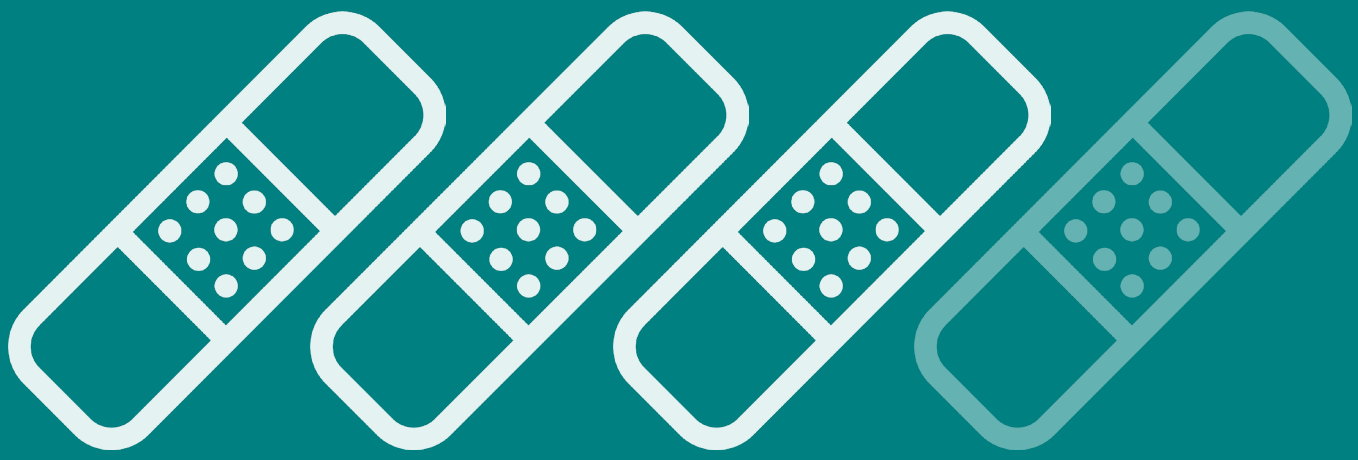


PHASE 3
DEVELOPMENT

5 DESIGN DIRECTION: EDUCATION

In this chapter, the primary design goal within the chosen design direction is discussed as well as the sub-goals for the final project results. Following an exploration of the design context, an updated, more specific design goal is presented.

5.1 INITIAL DESIGN GOAL

During the research phase, a gap was detected in the IDE curriculum. This seems like an appropriate place to focus on to resolve the issue of skin tone inclusivity as this is where many designers get their education. From this, the initial design goal is as follows:

Help TU Delft design students design inclusively to break the cycle of exclusion of people with dark skin in product design.

Design students: This project is done foremost with design students in mind, and the final design solution should be easy to implement for TU Delft IDE students. It could also be possible to scale up in the future also to include students from other technical universities. Including professional designers could also positively impact the design world. However, this is not a priority during this project.

The design goal was further dissected, resulting in four sub-goals (four steps) that ultimately complete the primary design goal.

1. The first goal of the concept is to raise awareness for the current issue of skin tone exclusion in product design. This is a problem that many people, including designers, are not aware of. So this concept should introduce them to the issue.
2. The second goal of the concept is to trigger self-reflection. After learning about the issue, the reader must be triggered to reflect on it. They must reflect on why they never knew about this problem, making them analyze their position.
3. The third goal of the concept is to trigger self-awareness. After reflecting on the issue and the designer's position, they must be aware of their design process and their own biases. They must also look at the products around them with a new level of awareness and recognize this problem in existing products.
4. The fourth goal of the concept is to trigger inclusive design behavior. Once the designer is self-aware, they will be able to consciously design diversely and inclusively (using the guidelines provided with the product).

5.2 COMPARISON TO A DIDACTIC MODEL

The Johari window model taught in the IDE bachelor elective course 'Design Didactics' has similarities with the four goals previously mentioned. This model was developed by psychologists Joseph Luft and Harrington Ingham to help people acquire knowledge about themselves (De Steven, n.d.). Nowadays, it is also used a lot for personnel management in companies for the development of self-awareness. This model can be seen in image 40.

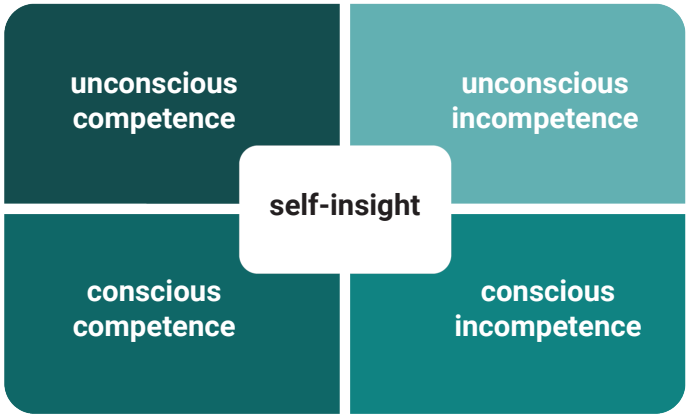


Image 40: the Johari window model

This model describes four different states of self-awareness and competency. The first three states (starting in the upper right corner and going clockwise) are similar to my first three goals. The fourth one is different, and the differences are also explained.
The first state is unconscious incompetence. This refers to when a person is not aware of their shortcomings. This matches the first goal: raise awareness; during this step, the designer is introduced to the issue.
The second state of the model is conscious incompetence. This refers to when a person becomes aware of what they still have to learn and reflect on it. This matches the second goal: trigger self-reflection; during this step the designer reflects on themselves and the issue presented in the first goal.
The third state is conscious competence. This refers to when a person is aware of their skills or qualities. This matches the third goal: trigger self-awareness. During this step, the designer is aware of their design process and can recognize the presented issue in other products.

There are also some differences next to the similarities between my four goals and the Johari window model. The Johari window model is a tool that places a person in one of the windows to determine their current state of competence, whereas the four goals describe a process where a person starts at the first

goal and must go through some development to end up at the fourth goal.
Another difference is that the fourth quadrant of the Johari window model and my fourth goal differ in the level of consciousness required. The Johari window model describes a state in which the person is unconsciously competent, meaning they are unaware of their skill, perhaps because it comes naturally to them. In contrast, my fourth goal; trigger inclusive design behavior, still calls for conscious competence. This is because the designed concept is a design tool that a designer consciously uses, and therefore complete unconscious competence is not required.

The similarities between the four goals and the Johari window model were considered to be a validation. Therefore, the four goals were used going forward with the project.

5.3 DESIGN CONTEXT: IDE BACHELOR

The current IDE bachelor courses were explored to find a good fit for this topic, and the course Understanding Humans can be used to teach skin tone inclusive design to students. This course aims to teach students to understand people in all aspects, for example; ergonomics, emotions, behavior, cultural and social context and many more. There are weekly Wonder Assignments where different topics are introduced. The topic of skin color can also be introduced, for example during Cultural & Social Context week of the course.

The setup of the Wonder Assignment is as follows:

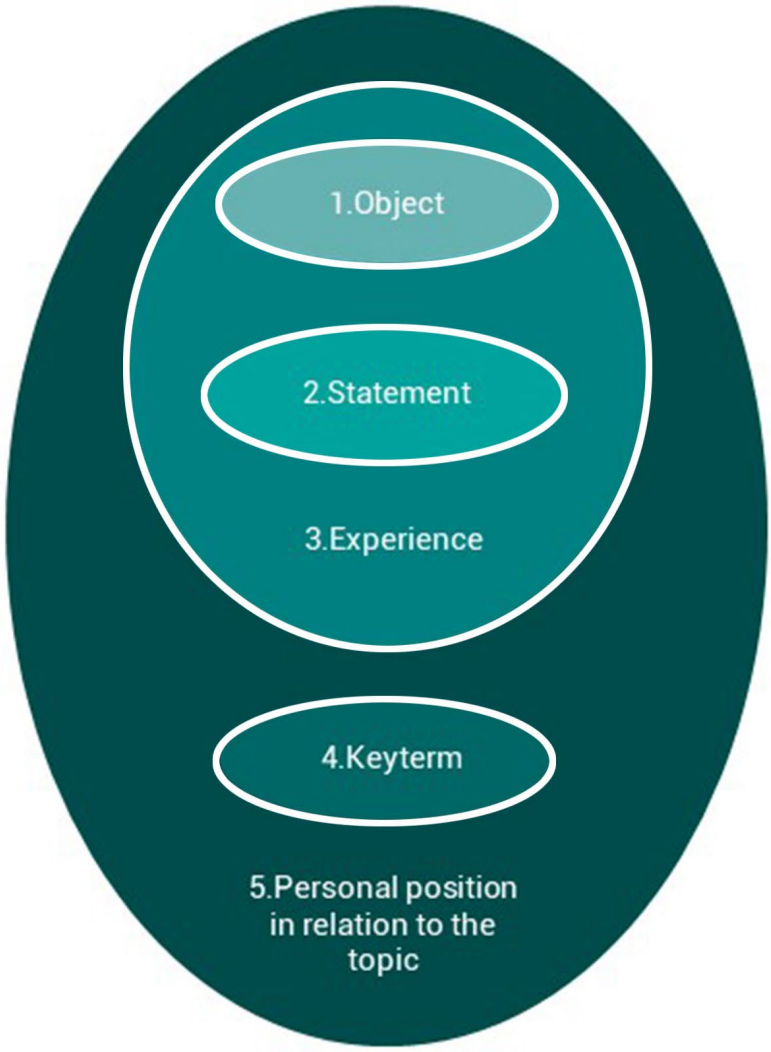


Image 41: Setup of the Wonder Assignment

The students will attend a lecture during which a topic is introduced, during this lecture several key terms that they must use during the assignment are also introduced by the teacher. These key terms are words that are relevant to the topic and can spark reflection and a discussion.

After the lecture, each student must complete an assignment. A diagram of this assignment can be seen in image 41. The assignment is as follows:

1. Choose an object (a product) that is relevant to the topic and think of a statement relating to the object.
2. Use the object and the statement to formulate an experience that a user of the product might have.
3. Choose one of the key terms presented in the lecture to formulate your opinion on the topic by relating the key term to the experience.

To further explain this assignment, an example is shown below. This example is a completed assignment that was done by one of the test subjects who participated in the to-be-discussed test (chapter 6.3). This participant chose her own object and completed the assignment using the object:

Object: Beige/peach crayon named “flesh”.

Statement: This product is often used by children.

Experience: In kindergarten all the kids were waiting for the ‘skin colored’ crayon to become available, because all the dolls were the same color.

Key term: Dominant group.

Personal position relative to the topic: Because most people in the Netherlands have a light skin tone, most kids don’t realize that ‘skin color’ does not belong on a crayon. That can even be the case with kids with other skin tones! I think that they are influenced by the dominant group in the Netherlands because they are not that aware of themselves at that age.They might unconsciously feel less important because they don’t receive recognition.
‘Skin color’ crayons can cause people with dark skin to not recognize themselves in drawings. The majority of dolls are beige. By naming this color ‘skin color’ I can imagine that people would think that this is the only skin color. I think that this name needs to be removed, or there should be a variety of different skin colors. Like with foundations (makeup).

This assignment is then presented in class after which discussions take place in groups of three where they will discuss the topic using their point of view.

Structure of the Understanding Humans course:

- This course is given in the first year when everything is new to the students and they will be confronted with many new ideas. This topic given within this course will then have to compete for space in their heads, therefore it is difficult to say how much of it will stick.
- During this course a new topic will be presented every week, and they will also have another course at the same time. This means that there are 2.5 days for this topic. This isn’t a lot of time for in-depth exploration, so there needs to be a clear plan of which elements in the topic are a priority.
- A typical in-person lecture at IDE is about 45 minutes. Currently, lectures are given online due to the pandemic, these lectures have also been shortened to approximately 20-25 minutes. Assuming that skin tone inclusivity is incorporated into the course, it will not be in the coming year. This means that hopefully in-person lectures will be done again, allowing for 45 minute lectures.
- The current set-up of the course allocates 15 minutes for a discussion after each student has given their presentation. This also isn’t a lot of time. A possibility is that the discussion will come to an end before it has had time to properly start. For this part there must also be a clear plan to ensure that the students get the most out of the little time they are given so that they can learn something valuable.

Target group

The target group for the design consists of first year IDE students who are following the Understanding Humans course. They are approximately 17-19 years old, most likely most of them are Dutch with light skin, as most students in the IDE bachelor’s are Dutch with light skin.
The target group also consists of the teachers that will be guiding the course and educating the students during the Wonder Assignments. Most of these teachers will also be Dutch with light skin. Most of them have also completed their education at IDE.

RELATION OF ACTIVITIES TO THE FOUR GOALS

The four goals ultimately need to be achieved within the context of the Wonder Assignment of the Understanding Humans course.
The description of the Wonder Assignment can be found on page 56. Each activity in the assignment was assigned to one of the four sub-goals (see page 54) to relate the content of the Wonder assignment to the sub-goals. This relation can be seen in image 42.

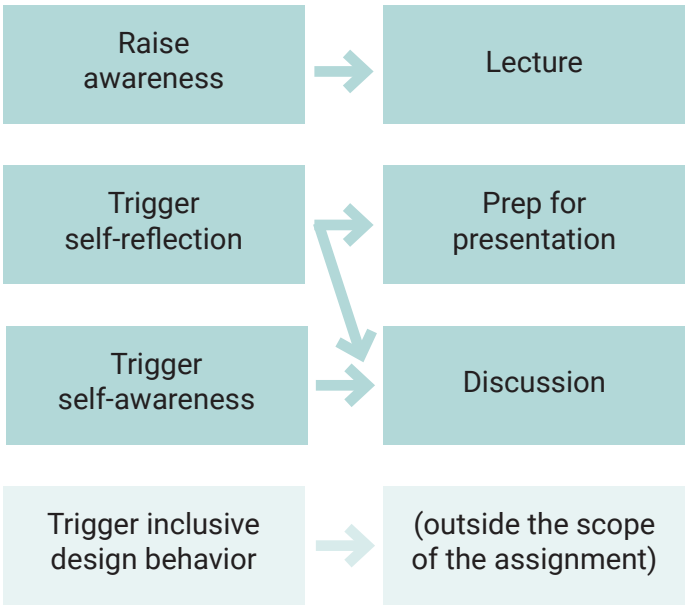


Image 42: Relation of the activities of the Wonder Assignment to the four subgoals

The lecture can be used to introduce the students to the topic, this would complete the first goal; raise awareness. The students have to complete an assignment, this gives them an opportunity to learn more about this topic and they will encounter many things for the first time. The goal is that this will trigger self-reflection as they are confronted with so many new things that they never knew about. The discussion after the presentations will allow for further reflection as they are able to hear other people's opinions on the matter. During this activity they will also start to become self aware as they form their own opinions. Since this course is a knowledge course and not a design course, the fourth goal, different design behavior, falls outside the scope of the Wonder Assignment. However, this last goal can be used in a different way. In order for the students to design in a skin tone inclusive way, they must understand the skin tone inclusive design guidelines. As they will not be designing with the guidelines in this assignment, the content of the assignment can be curated in such a way that the students are prepared to understand and use the guidelines in a different occasion. Perhaps a follow-up course that also tackles similar topics.

5.4 UPDATED DESIGN GOAL AND CONTENT OF THE WONDER ASSIGNMENT

Following the analysis of the Wonder Assignment within the Understanding Humans course, the design goal was updated:

Intervene in the existing setup of the Wonder Assignment, especially during the discussion, to allow the students to reflect and start to become self-aware on the topic of skin tone inclusion.

Existing setup > this concept must fit within the current setup and not change the lesson plan, especially because the Wonder Assignment is done every week with different topics. This will keep the assignments consistent.

Discussion > currently, the discussion part is the only part of the existing setup that doesn't have a planned structure. Because of this, the discussion part is an excellent area for an intervention. Especially because this is an area where the students are able to share their opinions and hear those of others.

Reflect and start to become self aware > as can be seen in image 42, the activity of the discussion has as goal is to self reflect, they will continue doing so in the discussion and during this discussion they will start to become self aware. It is not expected that they will become fully aware after one assignment.

KNOWLEDGE NEEDED TO UNDERSTAND GUIDELINES

As was described earlier, the content of the Understanding Humans course needs to be such that the students understand the guidelines later on. In the table on the next page (table 1) each guideline can be seen along with the knowledge that is necessary to understand them. This knowledge was found by indicating the different elements of each guideline. This is presented in the form of questions to allow for exploration. As per the description of the structure of the Understanding Humans course that was presented in chapter 5.3, a lecture is 45 minutes long. As can be seen in the table on the next pages, there are many sub-topics that are relevant to the main topic of skin tone inclusivity, and there might not be enough time in one lecture for all of them. Therefore these sub-topics are intended to be sub-topics that can, not should, be discussed during the lecture.

	Activity / Guidelines	Lecture (Raise awareness)	Preparation for presentation (Self-reflection) Discussion (Self-reflection + self-awareness)
1	**Who is your target group**	Show that there are people with many different skin tones Show how products designed in the West are sold worldwide	Who uses the products shown in the database? Does everyone in the target group look like the designer? Will the product be used worldwide?
2	**Is your knowledge of your target group based on facts**	Teach them about stereotypes and assumptions.	What are stereotypes? What are the wants and needs of the people in the target group? Is the knowledge that the designer has about the target group based on facts or assumptions? Does skin tone determine the wants and needs of a consumer?
3	**Are all stakeholders identified, even the ones not directly using the product**	Show what happens when all stakeholders are not considered	How can you ensure that you have taken all stakeholders into account? Can someone get hurt when (indirectly) using this product?
4	**Is the description of the purpose of the product inclusive when doing research**	Show examples of words that are not skin tone inclusive	Are words being used that only describe one skin tone or something that only happens to one skin tone? Which words can you use to ensure that everyone can recognize themselves in the product or know when they can/should use it?
5	**When getting insights/ data from your test group, did that group represent your established target group?**	Show what happens when data isn't gathered from everyone in the user group	How could you get data from all sub-groups in your target group? Does the data come from a group of people representing the people who will ultimately use the product?
6	**Are you keeping in mind that human skin comes in an array of colors?**	Show examples of products with shade ranges	Can you think of other solutions for skin tone matching wearables? Is "skin tone" beige? Is the designer used to going to the store and always finding wearables in their skin tone?
7	**Are the people delivering the service educated in an inclusive way?**	Show what happens when service providers are not inclusive	What can you do to ensure that your product will be used the way it was intended, even if the service provider does not have the necessary knowledge on inclusion? Is educating the service provider a solution? Is ensuring that the product results are always inclusive regardless of who is providing the service a solution? Is the designer responsible for how the service providers use the product?

	Activity / Guidelines	Lecture (Raise awareness)	Preparation for presentation (Self-reflection) Discussion (Self-reflection + self-awareness)
8	**Does the technology discern every skin color?**	Show what happens when datasets and sensors are not inclusive	Do different skin colors influence how well the product functions? Does the product need to recognize people> In that case, what should the dataset look like? Dark skin absorbs more light; will this be an issue for the product.
9	**Are you making a true effort to be inclusive?**	Show example of product that isn't truly inclusive	Can people with every skin tone use the product? Do you know about the Fitzpatrick Skin Types? Are people with dark skin genuinely represented in the product, or are they used as tokens?
10	**Is everyone in your target group able to use the product the way it was intended?**	Show, for example, how beige wearables don't work as intended on dark skin	What could have happened if the product was tested on a diverse group? Should the designer only test with the users that are in the majority?
11	**Is the description (of the purpose) of the product inclusive?**	Show examples of words that are not skin tone inclusive	Are words being used that only describe one skin tone or something that only happens to one skin tone? Which words can you use to ensure that everyone can recognize themselves in the product or know when they can/should use it?
12	**Are you using stereotypes/racially insensitive images or words to advertise/ market the product?**	Show what happens when attention isn't paid to old racist stereotypes	Which negative stereotypes have been used in similar products in the past? What is the role of cultural and historical knowledge in product design?
13	**Is there a correction process built into the design of the product?**	Show examples of apologies that were not received well	What do brands typically do after people complain about a product? (Especially a large-scale complaint on a social media platform). Do they handle it correctly? Do they do enough to make it right? If you could decide in advance what you would do to correct a possible future mistake, what would it be? Is a designer responsible for all negative outcomes related to the product?

Table 1: Overview of guidelines for skin tone inclusive design with the knowledge needed to understand each of them

6 DESIGN SOLUTION

This chapter shows the process of the ideation and concept testing to fulfill the design goal that was formulated in chapter 5.4. Lastly the final concept is presented along with the user scenario.

6.1 USE CONTEXT

The following user scenarios depict the activities during the Wonder Assignment of the Understanding Humans course as well as the desired experience for students with the intervention of the concept (see image 43).

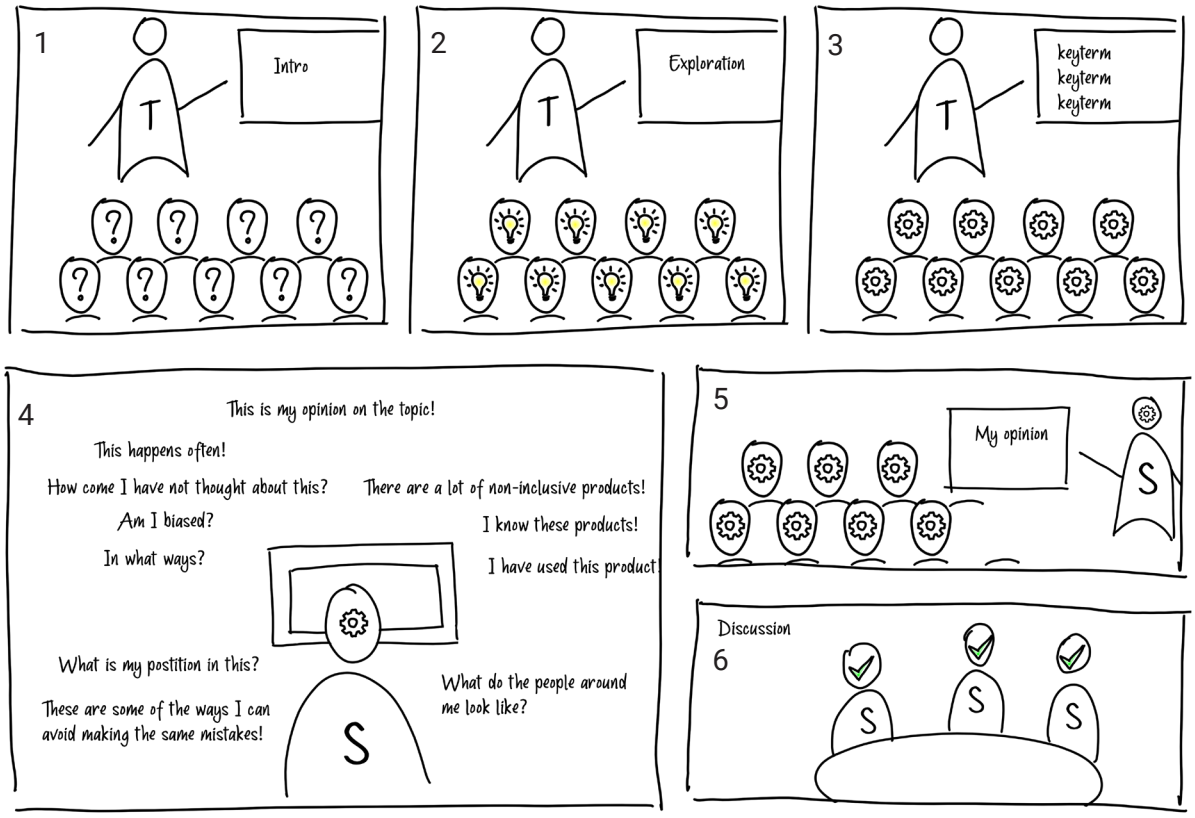


Image 43: User scenario during the Wonder Assignment with the desired qualities

1. Prior to the lecture, the students (S) are unaware of the issue and don't know much (or anything) about skin tone inclusion.
2. The information for the lecture is gathered by the teacher (T) using the concept. The teacher might not know much about the topic and is given support. Therefore, the students are given a better view of the topic because the information presented illustrates the full extent of the topic, and the students are thus better prepared for the assignment.
3. When the key terms are presented for the assignment, the students can start relating them to the topic already and forming their opinions.
4. When completing the assignment at home, they can ask critical questions about the topic and continue forming their opinion. If they didn't have the proper information they might wonder whether this type of exclusion is common and if the topic is even worth researching.
5. The presentation gives a clear view of their position as they were able to do the proper reflection.
6. During the discussion, each student is able to contribute as they have acquired the proper knowledge for this exercise[1].

The desired qualities presented in the second scenario were used during ideation and development of the concept to realize the desired results.

1 The expectation isn't that they are able to be fully aware of the entirety of the topic as it is quite extensive, but the students must be able to accomplish as much as possible during the limited time that they have for the assignment.

6.2 IDEATION

After the analysis of the design context, possible solutions for the design goal can be generated. The starting point of the development phase was the context of the Understanding Humans course, in particular the Wonder Assignment. This assignment already has a setup, as was discussed in chapter 5.3. The concept must fit within this context for it to be helpful during the course. In this subchapter, the creative sessions that led to insights for the concepts are discussed.

CREATIVE SESSIONS

Since the design goal requires an intervention in the current Wonder Assignment, there needed to be a new lesson plan for the assignment. In order for this lesson plan to be offered as best as possible, several components need to be present:

1. The students need to be introduced to the topic, and this is best done with examples as was determined in chapter 3. The product examples collected in chapter 2.3 could be used for this. This collection of product examples can then also be used by the students to pick out an object while they are completing the Wonder Assignment (see page 56).
2. There also needs to be a discussion probe. As was discussed earlier, the discussion part of the Wonder Assignment is the only area of the assignment that does not have a planned structure. Therefore this is an excellent area for an intervention. A discussion probe will provide the students with topics to discuss as they might not know much about skin tone inclusivity.

To come up with ideas for the different components of the lesson plan, a solo brainstorming session was done to get some initial ideas. After this, the main design goal was split into several smaller design questions for a better overview of the main goal as this helps with the ideation. These questions were compiled by reflecting on what would be necessary for the lesson plan to be implemented as best as possible as well as addressing my own concerns. These concerns include the mental wellbeing of the students while discussing this sensitive topic. This entails, for example, students with light skin being afraid to say the wrong things, or potentially, the few students with dark skin feeling vulnerable.

The How-To's that were used in the brainstorming session are the following:

State of mind
- How to create a safe space for someone in the dominant group?
- How to create a safe space for someone in the marginalized group?
- How to raise empathy for those negatively affected by an issue?

Reflection
- How to get a student to reflect on a topic?
- How to get a student to reflect on themselves?
- How to use a topic to get a student to reflect on themselves?
- How to get students to think critically about their assumptions?

Discussion
- How to start a discussion between students?
- How to keep a discussion going between students?
- How to make a discussion between students interactive?
- How to discuss a difficult/delicate topic in the classroom?

General
- How to ensure that the students will remember the lecture and discussion?
- How to lead students to an online digital database that contains product examples?

These questions were answered during a group brainstorm session with three IDE Master students using a Miro Board (see Appendix F). This session was done online through Zoom. The following are the most important insights that were gathered:

State of mind
- Storytelling, audio, and visuals are powerful tools to raise empathy.

Reflection
- Reflection can be done with prompts in the form of a template, questions, a debate, and media such as photos, videos, and text.

Discussion
- A good discussion might need preparation, taking turns to initiate a topic, prompts such as (controversial) statements and questions, and perhaps small groups.

General
- Lectures and discussions can be remembered by making it controversial, confronting, by taking notes, and with assessments of knowledge after.
- The students can be led to the digital database by arousing their curiosity and by making the link available in the material that they use.

The following insight was also taken from the session, however, due to time constraints it was not incorporated into the concept as it required more research. Since this is an important aspect, recommendations were made for further research in the future (see chapter 7.2).

State of mind

- In order to create safe spaces, there needs to be a set of rules for the discussions and clarity over the division of roles (if there are any). There also needs to be an allowance for mistakes and a clear way for a person to indicate that they are unsure if what they are about to say is right/correct.

From these brainstorming sessions, it became clear that prompts would be necessary to start a discussion and to keep the discussion going. Prompts and examples would also be helpful during the discussion and would provide a feeling of safety, especially for students with dark skin, because the students would not need to use their personal experience for the discussion if they didn't want to. This was confirmed during an interview with Nadège Heyligar, teacher of Communication & Multimedia Design, researcher for the Inclusive Education Department at The Hague University of Applied Sciences and formed IDE student. She suggested that the examples would have to be as concrete as possible to create the possibility of using only the cards to fill in the discussion and not personal experience if the students are not willing to share anything too personal. From this, it was decided that the final concept would need to have concrete Statements and Questions incorporated into it to trigger reflection. This and the other important insights and requirements presented above were taken into account during the idea generation.

Next, a solo ideation session was done to generate ideas that fit the insights from the brainstorming session. From this, the ideas for the two components of the lesson plan that are presumed to have a higher chance of fulfilling the design goal were chosen. These ideas are presented in the next subchapter and Appendix G.

6.3 CONCEPTS

After the creative sessions and setting up the concept requirements, another solo brainstorm session was done to generate ideas for the concept. The insights from the creative sessions were used. The idea generation was done to find ideas that use prompts in the form of provocative statements that can guide the discussion. Regarding the preparation that is necessary for a good discussion; it is presumed that the Assignment that the students complete prior to the discussion sufficiently prepares them for this. In all three concepts, the students work in groups of three, as per the official description of the Wonder Assignment.
From the ideas that were generated, the following three ideas for the discussion
probe were chosen for further development. The ideas for the website can be found in Appendix G.

Concept 1: Decision tree
This decision tree is presented on a large sheet, each student gets one sheet. The tree has many branches that are prefilled with statements about the design process and the product etc. The students must start at the top and work their way down. At each point, there are statements that the students must agree or disagree with while discussing with each other and motivating their decision to each other. This brings them deeper and deeper into the topic. At each branch, they encounter a new statement based on their previous answer. As each student fills in the bullets of their own tree, the tree will illustrate their opinions and trigger critical thinking as they are confronted visually with different views from other students.

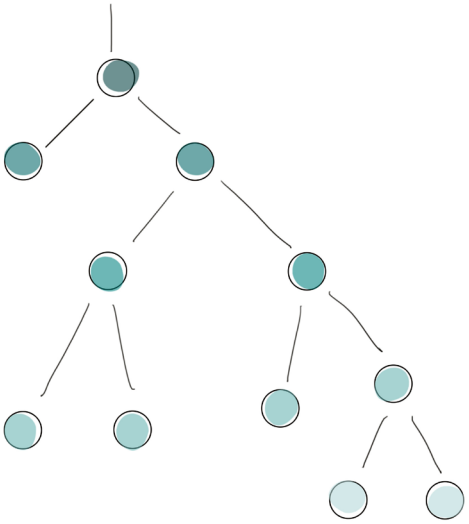


Image 44: Decision tree

Concept 2: Card set
This card set has two types of cards: Statement and Question cards. Each group of students gets a card deck. These cards will act as prompts during the discussion to ensure that the students have a topic to discuss. For the Statement card, they have to state whether they agree or disagree with a statement about how the product was designed, which will trigger them to formulate their own opinions. For the Question card, they have to answer a question about the product. The Questions trigger them to explore possible solutions to make the product inclusive.
There is also a QR code on each card to provide more information about the specific statement or question.

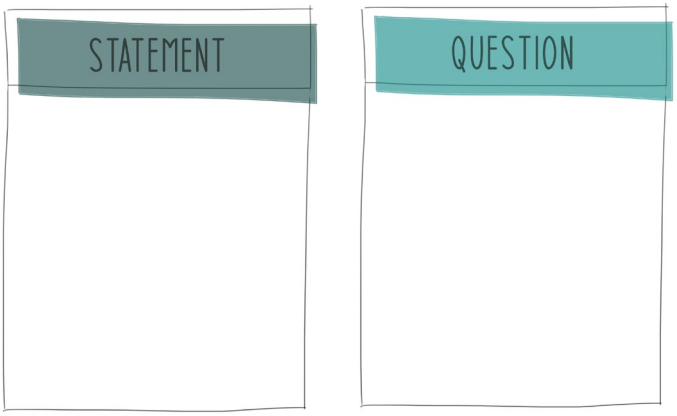


Image 45: Card set

Concept 3: Spin board

For this concept, the students must choose a product from a list that comes with the Spin board. The spin board contains general Statements and Questions that can be answered for most products; each compartment includes a new Statement or Question delving deeper into the topic each time they step outward through the different rings. Like the previous concept, the statements are about how the product was designed, and the questions are about possible solutions to make the product inclusive. After choosing a product, the students must spin the arrow to select a compartment on the board and discuss the Statement or Question concerning the selected product, after which they can go to the next ring and the next. For the next product, the students must spin again to select a different compartment with Statements and Questions. This way, each time, they can combine another product with a different set of Statements and Questions.

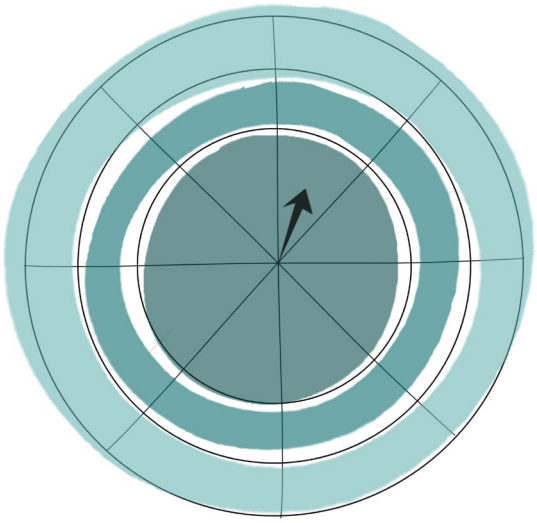


Image 46: Spin board

FINAL REQUIREMENTS FOR CONCEPT

To be able to select and further design a concept, requirements are necessary. They provide a framework to help to keep track of important elements to be fulfilled in the design. The insights gathered through the previous research (the Exploration phase) were translated to the final requirements for the concept. These requirements are also sorted according to the three pillars of innovation; Desirability, Viability, and Feasibility. This also gives some themesfor evaluation after the design is developed.

Desirability (D)

1. Intervention must be done in a way that even a teacher with a lack of knowledge on the subject can teach students.
2. Intervention must be done in such a way that the teachers feel comfortable talking about the topic.
3. The intervention should be done in a way that is challenging so it is memorable, but should not be unpleasant.

Viability (V)

1. The intervention should, if possible, fit into the current curriculum as it might not be possible to adapt the curriculum to fit this topic as an individual, standalone topic.
2. Any introduction of this topic to the students (no matter how small) must be done in a memorable way or else they might not be able to properly absorb it.
3. The intervention should be obvious and concrete to avoid an intuitive approach as this does not allow a designer to challenge their biases.

4. The intervention should encourage students to consciously incorporate inclusive design into their process.
5. The concept must facilitate the discussion part of the Wonder Assignment to result in the students' self-awareness within the topic.
6. The intervention should expose the students to people with dark skin since they will not likely be exposed to them in their daily lives.
7. The concept must provide content and topics in the form of Statements and Questions for the discussion.
8. The concept must be a physical product (as opposed to a digital product) to allow the students to work together away from screens.

Feasibility (F)

1. The concept must be easily adaptable to allow for new information to be added.
2. The concept must need little to no setup because of time constraints in class.

Requirements D1, V1, V3-V8, F1, and F2 were consulted to choose a concept. The other requirements could not be assessed at this time as they depend on further development of the designs and were finally consulted during the evaluation of the final concept. All three concepts seem to satisfy the rest of the requirements except for the requirement F1 that refers to the adaptability of the concept, as only Concept 2 met this requirement. Skin tone inclusivity is a topic that continues evolving as more products are designed, making this requirement essential. To keep the concept relevant, its adaptability is vital. The decision tree and spin board are fixed and are therefore not adaptable. To be able to update them, an entirely new one needs to be made. A card set allows for the addition of extra cards to an existing card deck, with new Statements and Questions about new products. Therefore the chosen concept is Concept 2: Card Set.

TESTING AND ITERATION

After reviewing the research material and the insights from the creative sessions, the missing element of storytelling was spotted. The card set was modified to a triple card (see Appendix H) to allow for an additional element: the User Experience. This ensures that the topic of exposure, that was discussed in chapter 2.6 and 3.1, is also incorporated into the design, as the students would be learning about people's experiences. The cards were also attached to each other so the three elements that are related to each other can stay together and can be discussed together.

Two user tests, the first with four IDE Master students and the second with three IDE Master students, resulted in the final insights that led to the final concept. The setup of these tests can be found in Appendix H and J as well as the objectives of each test.

Most important insights from the tests

The tests, where the participants completed the full Wonder Assignment (see page 56), revealed many insights about the concept. The ones that further influenced the design are presented here.

These tests revealed elements of the card that were not desired, such as the QR code (see Appendix J), as well as elements that were desired, such as the round shape and the talking points on the card. The QR code was replaced by making the card bigger and adding a description of the product in the center. The talking points (User Experience, Designer Responsibilities, and Product Design) were the main focus of the cards and was also the most well liked element. It gave the participants a starting point for a discussion as they would otherwise not know what to talk about. The primitive database that they were given to choose an 'object' to complete the assignment was also appreciated as not all participants were able to think of a product for the assignment on their own. Therefore the website with the collections of product examples is seen as an essential part of the concept. The full results of the tests can be found in Appendix H and J.

The insights from the tests were used to further develop the concept and complete the final concept which is presented in chapter 6.5.

6.4 COMPONENTS OF THE FINAL CONCEPT

In order to complete a well-rounded concept that fits the design goal, several components were designed. In this subchapter, the components used in the final concept are explained.

Once again, the design goal was:
Intervene in the existing setup of the Wonder Assignment, especially during the discussion, to allow the students to reflect and start to become self-aware on the topic of skin tone inclusion.

As was explained earlier, the content of the Wonder Assignment is sorted in such a way that through each activity a deeper understanding of the guidelines is achieved, even though the students don't get to see them. At the end of the assignment the guidelines are presented and the student is introduced to them for the first time and they are able to work with them.

Three components were design for the concept:
1. Website
2. Card set (+ STARR Reflection)
3. Guidelines (this was already presented in chapter 4)

These components are meant to be used together to contribute to the fulfillment of the design goal.
These components were combined into a lesson plan to be used by the teacher during the Wonder Assignment of the Understanding Humans course. Each component is explained in the next subchapter where the final concept is presented.

6.5 FINAL CONCEPT

In this chapter, the final concept is presented. The final concept is a lesson plan for the first-year Understanding Humans course, specifically for the Wonder Assignment, to be used by the teacher in combination with the official manual of the course. The concept is also presented in the form of a lesson plan, with instructions to the teachers so they can prepare the lecture and guide the students during the Wonder Assignment. The concept is aimed at making the students aware of the topic of skin tone inclusivity and makes them reflect on the topic and become self aware, ultimately resulting in inclusive design behavior.
Within this lesson plan it will also become clear which moment during the Wonder Assignment each component is used (see images A and B). The images in the lesson plan are named with letters instead of numbers to avoid confusion with the rest of the report.

Additional information about the card set that is not available in the lesson plan is discussed on page 74.
A full overview of the regular setup of the Wonder Assignment can be found on page 56.

SKIN TONE INCLUSION LESSON PLAN

To be used during the Wonder Assignment of the first-year bachelor course Understanding Humans.

This week, the topic will be "Skin tone inclusivity in product design". Several components will be added to the regular lesson plan. This particular plan is to be used as a supplement to the official lesson plan in the Manual of the course as this plan only explains the components that are added to the assignment.
In image A, a description of the different activities of the Assignment can be seen, as well as the components that were added specifically for this topic. These components are highlighted in the text.

In the second image (image B), a zoomed-in view of the Discussion part can be seen to explain the different steps to using the cards.

Goals for this session
The lecture serves to raise awareness for the topic.
The assignment and presentation helps the students to start reflecting on the topic.
The discussion helps the students to continue reflecting and start to become self-aware.

*please consult the Showcase for a video presentation of the lesson plan.

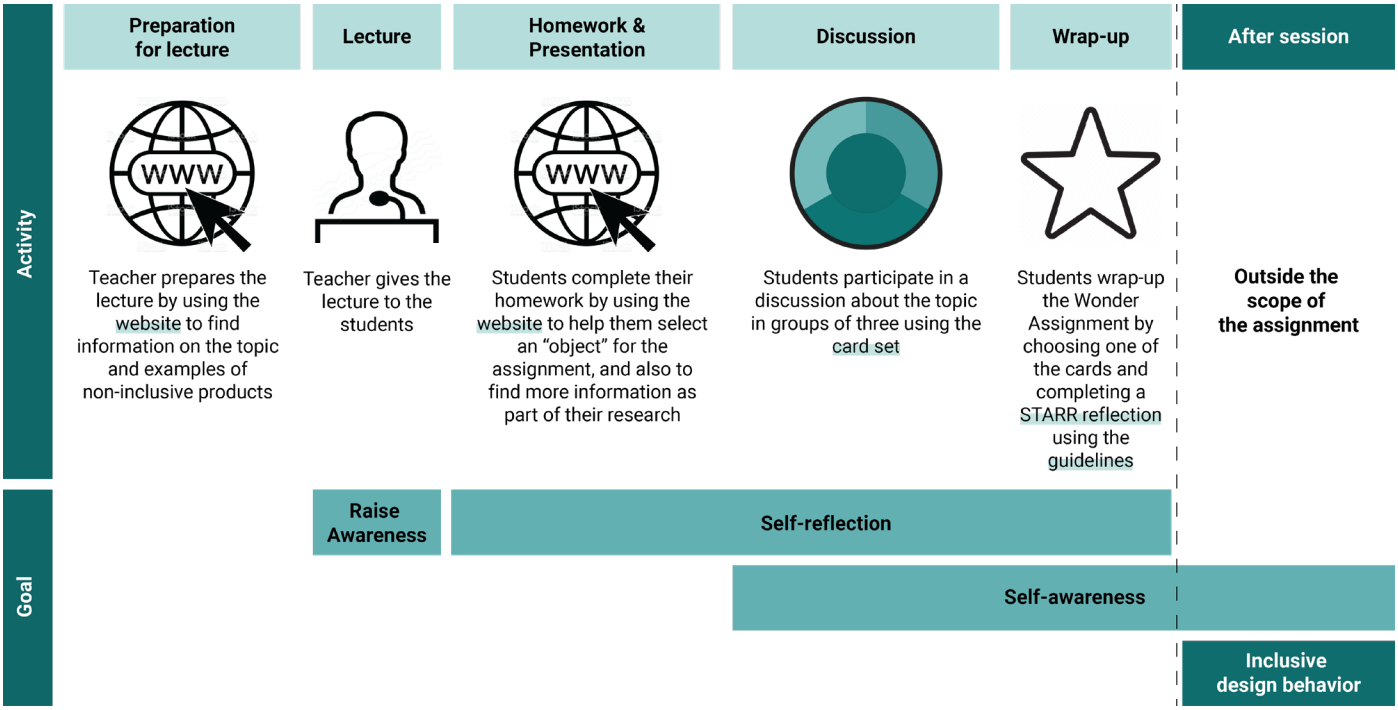


Image A: The activities of the Wonder Assignment with their corresponding added components

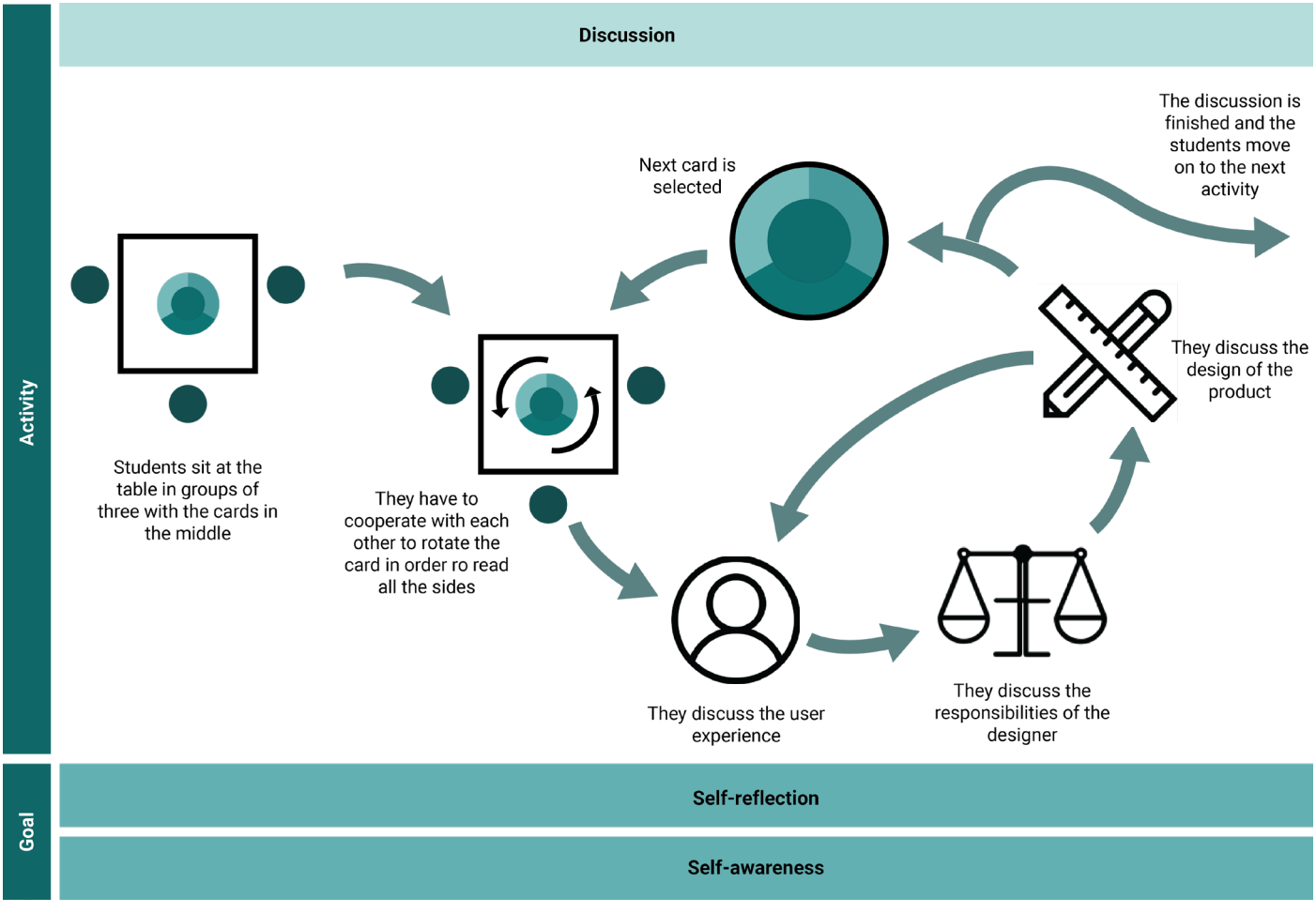


Image B: A zoomed-in view of the Discussion part of the Assignment

1. PREP FOR LECTURE

Prepare the content of the lecture. The website (see images C to J) can be used to find examples of non-inclusive products to show to students by using the tab 'Non-Inclusive Products'. Other information that can be found is, for example, a breakdown of designer bias that results in skin tone exclusion which can be found under the tab 'Designer Bias'. For additional information of which aspects of this topic could be integrated into the lecture, please consult page 60 of this report (This part was left in its original chapter to not have double text). Use the website and create a well-balanced lecture using a bit of information from each section.

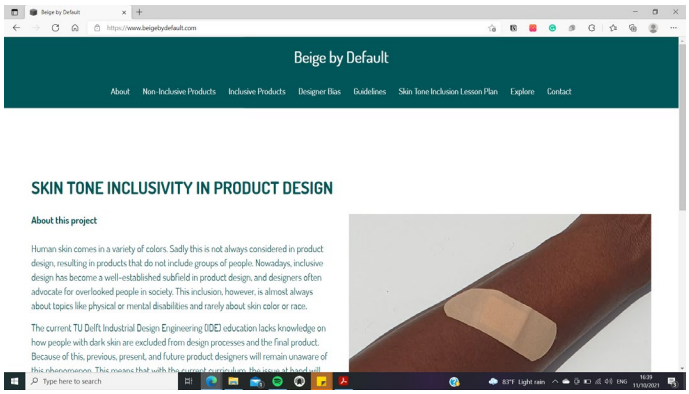


Image C: Main page of website

Non-Inclusive Products
The main purpose of the website is to display all the different non-inclusive product examples that were collected during the project. The products are displayed within their cluster (Inadequate Color Selection, Failing Technology & Software, Undereducated Service Provider, Unequal Communication & Representation). Within these clusters, it is also possible to choose a specific domain. So, for example, when choosing Inadequate Color Selection, and the domain medical; the medical products within that cluster will be visible. This makes it easier for a student to find relevant examples while doing a project. Tags are also added to each product example so the student will also be able to search keywords to find the relevant examples. The teacher can also use this page to collect examples that can be used during the lecture.

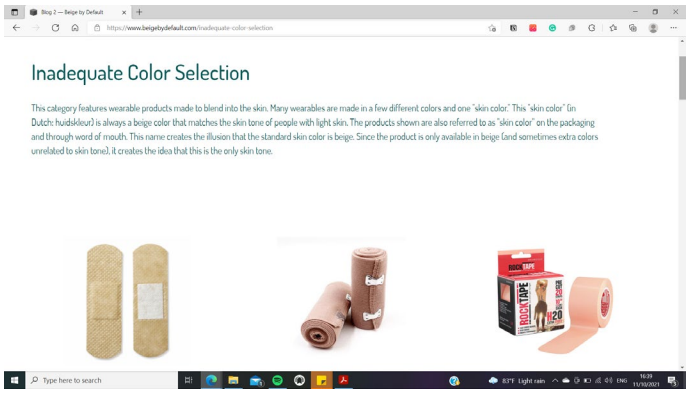


Image D: Category 1 Inadequate Color Selection

Inclusive Products
Next, the existing solutions for creating skin tone inclusive products can be found. These can be used as inspiration. These examples are also divided into their respective clusters; Color Selection, Technology & Software, Service Providers, Communication & Representation.

Image E: Explanation of a product

Designer Bias
A page about designer bias informs the reader why biases exist and makes them aware of how designer biases manifest themselves in products.

Guidelines
To accompany the non-inclusive products, there are also the skin tone inclusive design guidelines that the student can use for inspiration when designing, depending on where they are in the design process.

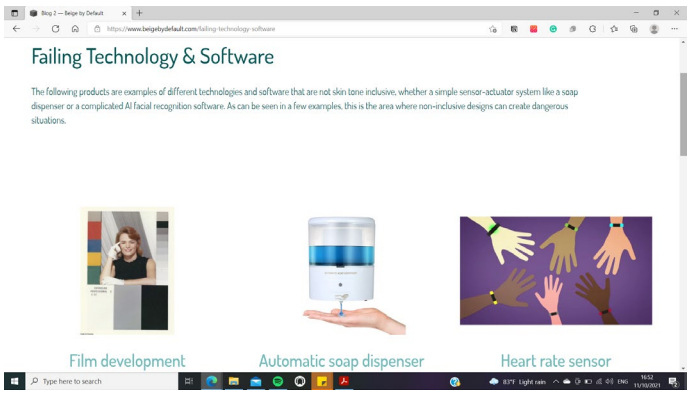


Image F: Category 2 Failing Technology & Software

Skin Tone Inclusion Lesson Plan
The next page shows the lesson plan that was

developed in this project. This page isn't necessarily for the students, as they will already come into contact with the lesson in person. However, it is nice to display the results of the project.

Explore
Lastly, there is a page with links to relevant articles, papers and documentaries that the students can use to learn more about the topic.

Contact
Lastly, there is also a contact page. Anyone with questions or suggestions for more examples to be added to the database can fill out the contact form to get into contact with me. I will then be able to answer their question or add the products they suggested to the collection if it fits.

2. LECTURE

Give a lecture of approximately 45 minutes to the students, with information from the website, to make them aware of the issue of skin tone inclusivity.

3. ASSIGNMENT + PRESENTATION

During the assignment, instruct the students to select an 'object'. Consult the official Manual of the Understanding Humans course for an explanation of the assignment. The website can be used by the student for the selection of an object. Either they choose an object that is on the website, or they use the website to get an idea of which products are relevant to the topic to propose their own object.
The website has a search function that allows them to use tags to find specific products that match their interests.
*The tags that are given to each product can be found in Appendix G.

4. DISCUSSION

The discussion is led by the card set. Give each group, consisting of three students, their own set. The students have to collaborate with each other to rotate the card and read the different sides. In the center of the card the product and its shortcomings are explained. The students will discuss the User Experience, Designer Responsibilities, and Product Design. The students are able to use a card until they are ready to move on to the next card, which will be about a different product, User Experience, Designer Responsibility and Product Design.
When they have discussed all the cards, or the time has run out, instruct the students to move on to the Wrap-up.

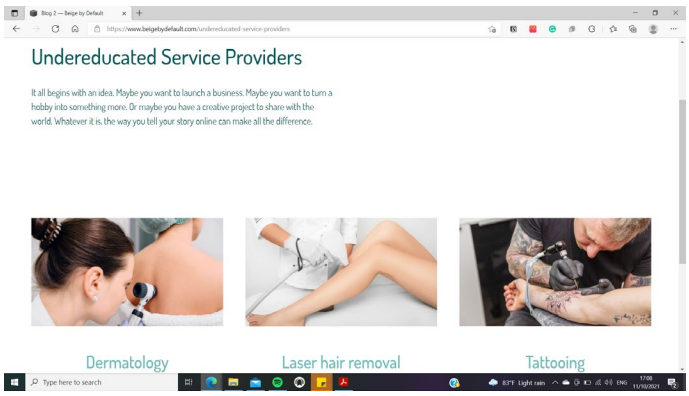


Image G: Category 3 Undereducated Service Providers

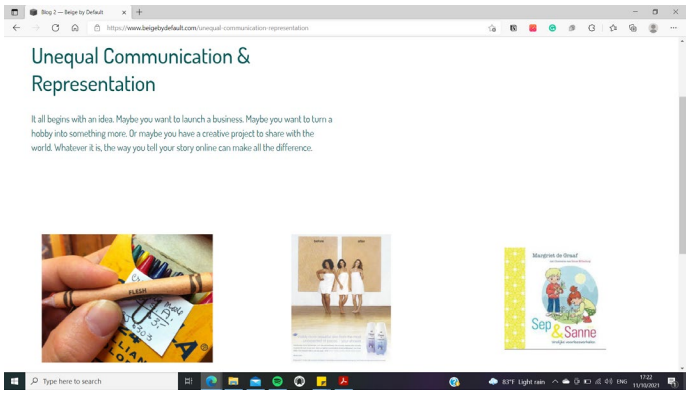


Image H: Category 4 Unequal Communication & Representation

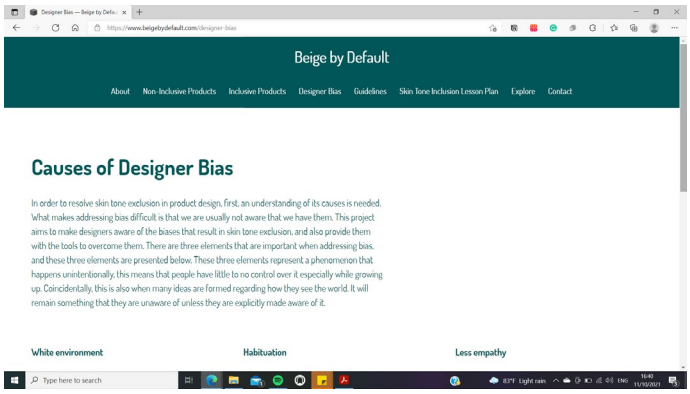


Image I: Explanation of designer bias

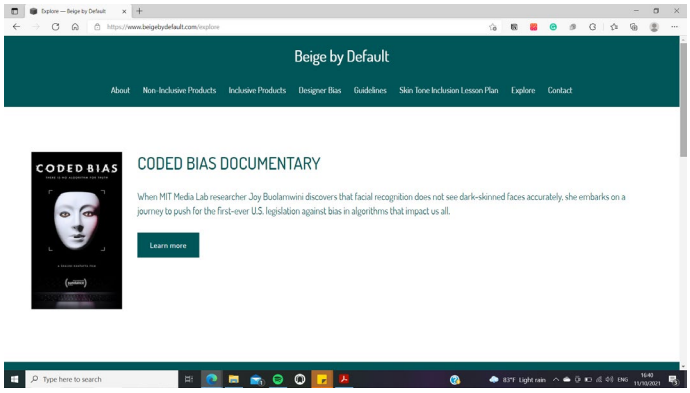


Image J: Other sources for research

Explanation of the card

*A larger picture of the card can be found in Appendix M of this report.

The center circle describes the product and what makes it non-inclusive.
Below this, in the outside ring, the User Experience is described (see image K). It allows the students to learn about an experience that a person with dark skin has had with the product. This user experience is the starting point of the discussion as it sets the scene.

Image K: Product and User Experience of the card

The second part of the outside ring has a statement about the Designer Responsibilities (see image L), this allows the students to talk about what the responsibilities of a designer are from a moral/ ethical standpoint.

Image L: Designer Responsibilities of the card

The third part of the outside ring has a question about Product Design (see image M), this allows the students to explore the faults of the product regarding the design process, the technology and its limitations, solutions for skin tone inclusivity etc.

Image M: Whole card

5. WRAP UP

For this wrap-up, each group chooses one card that they discussed during the Discussion. The students must complete a STARR analysis while pretending that they are the designers that designed that specific product. They must go through each step of the STARR analysis to describe the Situation, Task, Action, Result and Reflecting concerning this product. The Guidelines can be used to provide tips and advice on how to tackle the design process of such a product. The form for the STARR analysis can be found in Appendix N of this report.The full guidelines can be found in chapter 4 of this report.

Below, images of the guidelines pages and the STARR reflection forms can be seen (N and O).

WWW.BEIGEBYDEFAULT.COM

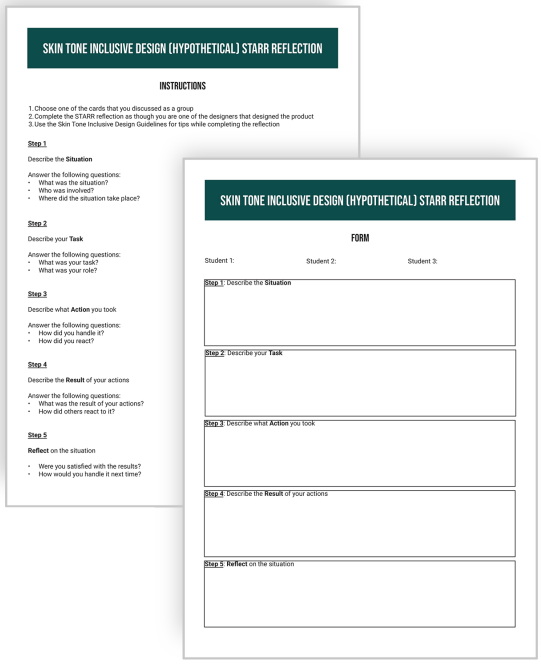


Image N: STARR reflection explanation and form

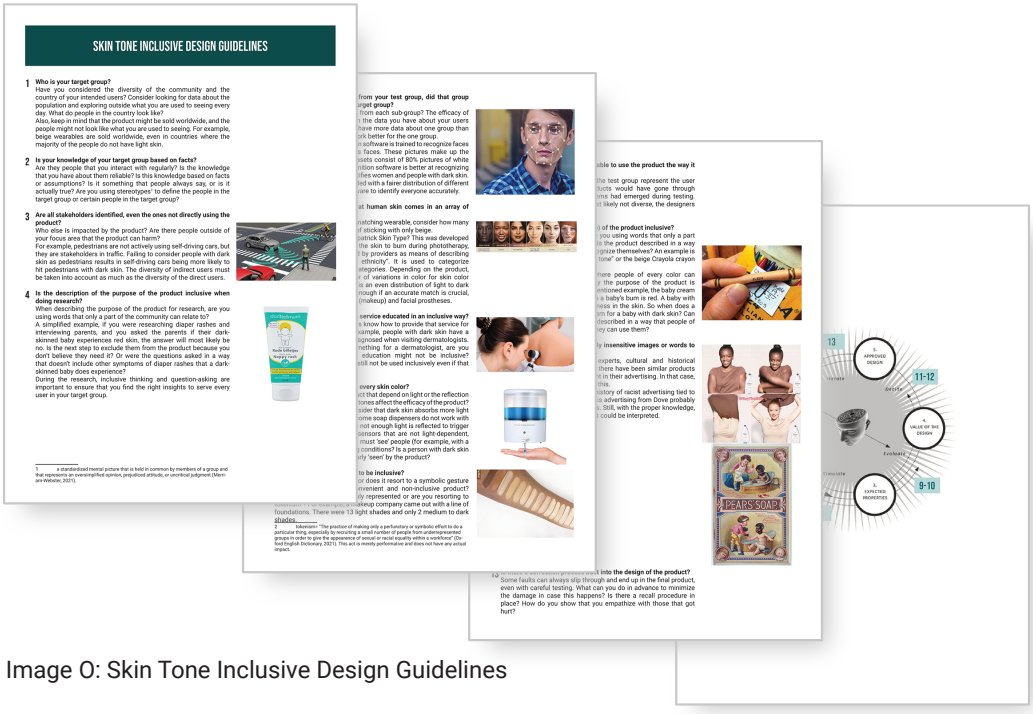


Image O: Skin Tone Inclusive Design Guidelines

6.6 ADDITIONAL INFORMATION ABOUT THE CARDS

The card (see image 48) is based on the user and their experience with a specific product. The main part of the card, the dark green, therefore also resembles a ‘user icon’ (see image 47). The orientation of the text in the center circle also emphasizes that the dark green parts of the card belong together. The User Experience allows them to have the exposure to people with dark skin that was mentioned several times in this report. The experiences on the cards were given by people with dark skin that filled in the questionnaire (Appendix B), and some were found by reading articles online. This results from this questionnaire effectively answer the third research question from search area 1.

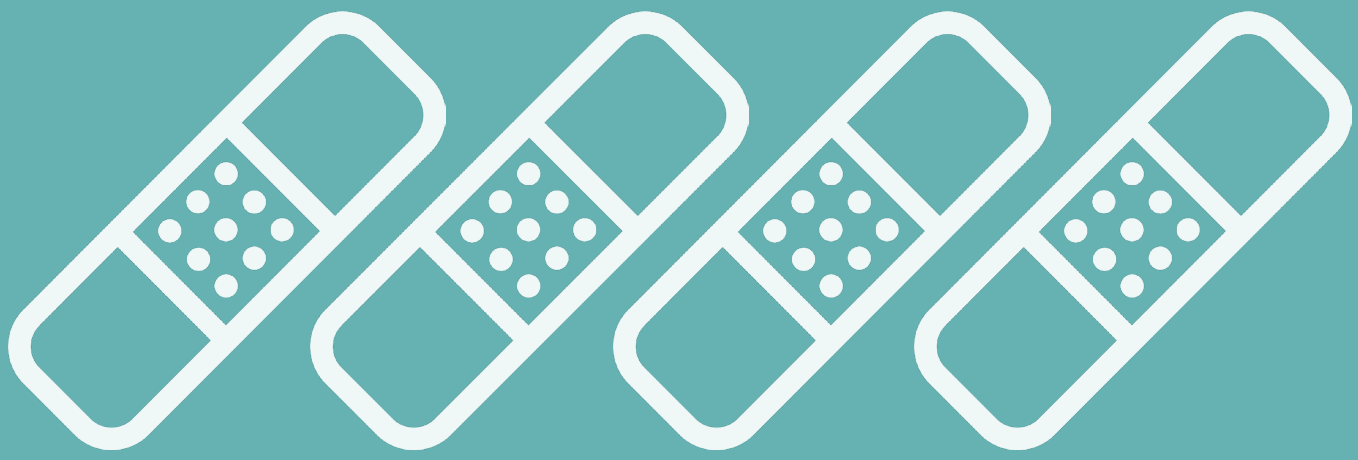
Image 47: User icon in de card

The round shape of the card invites closeness between the students and invites them to collaborate as they need to continuously coordinate with each other to be able to rotate the card to read all three sides of the card and the center circle. The card is approximately 30 cm in diameter. The gradient of the colors show that there is an order but at the same time a discussion is allowed to be organic, therefore the discussion can go from one side to another. This is the reason why there is only a gradient to indicate somewhat of an order but there are, for example, no arrows or numbers demanding a specific sequence. The gradient goes counter clockwise to allow for an intuitive clockwise turning to see all the sides.

Image 48: Whole card

At IDE, this card set can ensure that certain topics are discussed that are vital to a designer’s education. If used in a professional setting, it can ensure that designers are actually designing according to the company’s standards of inclusivity rather than assuming or hoping that they will do so on their own

Consult Appendix M for a larger version of the card..



PHASE 4
EVALUATION

7 EVALUATION

At the end of a design process, the designed concept must be evaluated to assess its current state and potentially improve it. The concept presented in chapter 6.5 was made to fulfill the design goal (see page 59). In this chapter, it is evaluated whether this has been done successfully. This was done by evaluating the concept with two IDE teachers and by evaluating the concept based on the three pillars of innovation. Lastly, recommendations for improvement and further research and development were formulated.

7.1 CONCEPT EVALUATION

This was done by interviewing two IDE teachers for approximately one hour each via Zoom. One was a teacher with light skin, involved in many design courses such as the PO courses and BEP, and the other was a teacher with dark skin involved in Design Drawing courses. The teacher with light skin has experience teaching and experience with professional design practices and could therefore give some insight into whether the concept is appropriate for professional designers. Even though the current concept is not designed specifically for designers, but for design students, it is part of the design goal and an evaluation of whether it can be used by designers was necessary. The teacher with dark skin was interviewed as he also had experience teaching and was expected to have personal experience which could give him a better view of what is missing at IDE. The intention was to evaluate the concept with three IDE teachers, but it was only done with two due to arrangement misunderstandings. This, however, is not an issue as the first two evaluations generated many insights that can be used for further iterations. This means that the evaluation can still be considered to be successful.
The goal of these interviews was to get the opinions of people with a teaching background on the lesson plan that was developed. Each component was discussed separately during the interviews, as well as the lesson plan as a whole. The guidelines were sent a few days before the interviews so the teachers could get acquainted with them. The website and card set were shown with a presentation during the interviews. The two scenarios from the lesson plan were used to explain the steps of the different activities of the assignment. This gave the most accurate depiction of what the lesson plan would look like in practice to ensure that proper feedback from the teachers would be obtained. The full list of interview questions can be found in Appendix O.

INSIGHTS

Guidelines
When asked about the comprehensibility of the guidelines, both teachers found the guidelines to be understandable. However, one teacher found that the title did not accurately describe the explanation for some guidelines, which could be an obstacle for students. For example, guideline 8 used to be: 'Is the product light-sensitive/dependent?'. But he felt that the explanation was about the technology and whether it perceived people with dark skin, which is accurate. This guideline was then changed to: 'Does the technology discern every skin color?'
There were two other guidelines that had a similar issue, and they have been updated.

One teacher commented about the structure of the guidelines; he saw a pattern of the guidelines building on each other. This was only magnified when he was shown the Basic Design Cycle with the phases and their assigned guidelines. Both teachers found this helpful, especially since they both felt that it was hard to know what to do with the guidelines without the diagram. One said that 13 guidelines would be too much to think about simultaneously, and the other said he didn't know where to place them. This, of course, wouldn't be an issue if each guideline is used in the correct phase of the design process.

One teacher also mentioned that he liked that some of the guidelines are more general and can be used for inclusive design in general. Others are more specific to skin tone inclusive design, which reminds you of its purpose.

After receiving the explanation of the Basic Design Cycle, both teachers mentioned appreciating that there are no guidelines for the ideation process; this keeps the ideation free of constraints.

When asked if the guidelines could have added value to IDE, both teachers agreed that this is a topic that is not discussed at IDE and that it should be discussed. The guidelines are a great way to do that, so in that sense, it is valuable. However, the actual added value can only be measured once you see the impact that it has had and notice a change in design behavior.
They believed that students could use the guidelines after the session and that reading them could remind them of the discussion and what they have learned. Professional designers could also find the guidelines useful as they most likely do not already have any material relating to skin tone.

Card Set

When asked about the design of the card (the round shape and rotating to see the sides), both teachers mentioned that the shape was a nice element. They both said that it would, whether subconsciously or consciously, communicate to the students that they need to work together whether they agree with each other or not. If this interaction would be pleasant or not in practice would only become apparent with testing. They do believe that there could be less text on the cards so the students can see with a glance what the card is about.

They were asked about the three themes (User Experience, Designer Responsibilities, Product Design and whether they are enough for a well-rounded discussion. Both teachers found that the three themes covered the bases for a complete discussion. However, one teacher did mention that he could only make that assessment for the one card that he was shown and that he didn't know whether it would be the case for all cards.

One important aspect that they found that the cards missed was how the students would be triggered to start the conversation. One teacher said that it might not be enough to place a card set in front of students and tell them to talk about it, and that this is often an issue in teaching. This point is further discussed in the recommendations. This same teacher also said that the students might also need guidance in asking the right questions. For example, I mentioned budget and time constraints being important aspects that the students could talk about. This teacher believed that first-year students do not have enough knowledge about considerations made while designing due to constraints.

The other teacher stated that more attention could be paid to creating a safe space for students and teachers. In this concept, the examples given are as concrete as possible so that students don't have to use their personal experience if they don't want to. But the teacher would appreciate it if there was a manual for teachers as this is also new to them. This way, they could know how to handle different situations, such as a student not feeling at ease or settling a conflict.

When asked if they thought that professional designers could benefit from the card set, one teacher said he believed that designers would use the website more. He believed that professional designers have enough experience to look at the examples online and learn from them without needing a card set. He mentioned that there could be a workshop where 75% of it is showing and discussing examples of products from the website. The other teacher also mentioned a workshop. He said that he could imagine that designers working at a design agency or consultancy might want to do a workshop where they learn about the topic, and they would also use the cards in that scenario.

Website

Answering the question of whether a teacher would use the website to prepare the lecture, both teachers agreed that teachers would definitely use it. They said that having a specific place with many examples is valuable and comfortable for teachers. One of the teachers said that this is the case, especially if it is a topic that teachers don't know much about.

When asked whether students could use it to jumpstart their research, both teachers said that it is a great way to get an overall view of the topic. Afterward, they could delve into a specific aspect by searching more specifically (somewhere else). One teacher said that he would add the website to a list with links given to students, for example, during a BEP project. One teacher did mention that students would need the searching to be facilitated so that they are not just randomly clicking around. When told that there would be tags for each product example and a search function, he agreed this was a useful addition.

Lesson plan overall

After explaining how the lesson plan was designed (with each activity contributing to understanding the guidelines), both teachers mentioned that they liked it. One teacher mentioned liking that the activities build on each other in different steps; that way, the students gradually get into it before they start using the guidelines. And also that it is nice that they are given the guidelines at the end; that way, they have it for the next project.

When asked about the structure of the lesson plan and to describe it in a few words, one teacher characterized it as provocative and confronting but also dry. The latter is because he does not believe that it is finished in a way that he can implement it right away. He believes that the flow from one activity to another could still be finalized and detailed more and that he would need to fill in some blank areas himself, which would be a reason not to use it. The other teacher mentioned that he is enthusiastic about the lesson plan as it is a topic that isn't discussed at IDE but should be. He said that this is a great way to be introduced to the topic. He also noted that this topic is an excellent addition to inclusive design.

He called the concept valuable and balanced, in the sense that it is not too pedantic and intrusive but also not too discreet. He also saw some obstacles to using the lesson plan; namely, he would need more information about the classroom setup, but it does serve as a good point of departure for teachers.

Design goal

According to the teachers, this concept does help with self-reflection and could contribute to self-awareness, but similar to how it was described earlier, one session cannot lead to complete self-awareness. The amount of self-awareness that it can contribute to depends on how intense or superficial the session was.

One teacher mentioned that it has added value if it sticks and if the feeling of inclusive design remains after the session. That is when it has had an impact. This is also something that is not known until it is tested. But one teacher did mention that introducing it in the first year is a positive thing as they will have more time in the coming years to work with the guidelines and develop themselves as designers.

From this evaluation, it became clear that this lesson plan has the potential for being introduced at IDE as a valuable addition and that it also largely fulfills the design goal. But that for it to be introduced at IDE, certain elements need to be developed further. The recommendations for further development are discussed in the following subchapter.

7.2 RECOMMENDATIONS FOR FURTHER RESEARCH AND DEVELOPMENT

To assess and improve the concept an evaluation was done which resulted in many insights and points of improvement. In this subchapter, these insights and points of improvement are discussed, as well as my own idea of what needs to be improved based on things that I was not able to do due to time constraints.

RESEARCH

- The focus of this project was skin tone exclusion in product design. A topic that was not incorporated into the research was racism (except for a few examples for the product category 'Unequal Communication & Representation'). Research on racism in product design and how design can allow for racism could be interesting. For example, social media platforms implement rules or community guidelines to regulate content to ensure the safety of users. An example of this is: what do designers do and fail to do while developing online platforms that they promise to be racism-free? Platforms like Facebook have rules or "community guidelines" to ensure that people using the platform feel safe. They remove posts with racism, homophobia, antisemitism, etc. But they didn't have these rules initially, and not having them allows racism to occur. Many people argue that Facebook still isn't doing enough about this because they make more money from hateful content. Another topic that was not incorporated into the research was exclusion based on culture, on page 12, an example was given of this, namely social housing in the Netherlands. This could also be an intriguing research direction. It could include, for example, vacation parks, festivals, and other social events that are centered around Dutch habits and lifestyles. The book "Cultural Sensitive Design" by Annemiek van Boeijen would be a perfect starting point for this.
- During interviews with teachers (see chapter 3.1), several teachers mentioned concern for complications in terms of production logistics when more colors are introduced into a line of skin color matching wearables. Unfortunately, this topic, while interesting, was deemed outside of the scope of the project. This can be a topic for further research.

CONCEPT DEVELOPMENT

Facilitating the use of the concept overall

- First year students might not have enough knowledge and experience for an in-depth discussion about this topic as they may not know the different considerations that are made during a design process. There are several solutions for this:
  1. This intervention could be offered at a different moment in the bachelor, perhaps in the second or third year.
  2. The lecture could also include examples of constraints during the design process, such as time and budget.
  3. The card set could include a list of general considerations that the students can use for every card.
- The flow between certain activities, for example, the assignment/presentation and discussion could be better defined. There are two solutions for this:
  1. The chosen object could become part of the discussion.
  2. It could be made clear, prior to the assignment, that the assignment served only as research to get to know the topic better. This removes the assumption that the results of the assignment will be used in the discussion.
- The website is meant to have a search function to allow students and designers to search for a specific type of product. This is done by using tags for each product (see Appendix G). While this element is part of the design it has not been incorporated into the current prototype as it is a time-consuming element to prototype.

Facilitating the discussion

- There could be a form that can be used to document what they have learned after every card. This form can then be used for valuable insights or questions as several cards in one session can result in a lot of information that the students have to take in.
- There could be guidelines for the teachers to help them navigate different issues, for example, the discussion might not get into gear smoothly, or there could be students that might not feel at ease, or there could be a conflict. This experience could be tensive for the teachers as well because they might not know how it's going to go.
- The cards could be made in four different colors for the four different categories (Inadequate Color Selection, Failing Technology & Software, Undereducated Service Providers, and Unequal Communication & Representation. This would

make it easier for the students and teachers to keep track of whether they are using enough cards from each category.
- Another iteration could be done to make the cards even more minimal with as little text as possible This way the students don't have to read a lot of text and can understand what the card is about with a glance. This can make the discussion more fluid.

Additional testing
- Due to the fact that the tests were done via Zoom as I was working remotely, I was not able to test the round form of the card in detail. The evaluation with the teachers was also done based on the idea of a round card and what they thought about it. An additional test in the future could show how the round form works in practice.
- There could be testing to see how the collaboration (the round form and rotating of the card) works with different group compositions. For example, how does this work when a student of the group is more dominant.
- Some user tests could be done to verify the size of the cards since all tests for this project were done via Zoom. Although when filming the showcase the size did seem convenient.

Further research
- For this concept, the focus was on IDE students but with potential to expand to professional designers. The teachers that were interviewed had some thoughts about how professional designers could use the concept, but since no research or testing has been done on this, it is not certain. To further optimize the concept for designers additional research and testing would need to be done.
- Due to time constraints I was not able to interview a social worker at the Hague University of Applied Sciences, who is also a researcher for the Inclusive Education Department, about how to guide a discussion about a sensitive topic. This would have resulted in guidelines and 'rules' about how students can tackle this matter and also how teachers can guide them.
- Regarding the recommendations about the structure of the lesson plan and the flow between the activities, this can best be optimized along with an expert in the field of lesson plan development, perhaps a course coordinator. This expert can also indicate what can be done to initiate discussions between students, as one teacher pointed out that it might not be enough to place the cards in front of them and expect them to start discussing.

The four goals (see page 54) were: raise awareness, trigger self-reflection, trigger self-awareness, and trigger inclusive design behavior. It is concluded that this concept does the first two effectively. The teachers that were interviewed for the evaluation also agreed that the concept can potentially contribute to self-awareness, but as I described throughout this report, a complete self-awareness cannot be achieved after one session. Also, it is not possible to know whether an inclusive design behavior has been triggered without knowing what impact the session has had on the student, for this their progress would need to be followed after the session. This is another point that cannot be answered without a prolonged study.

7.3 THE THREE PILLARS OF INNOVATION

For further evaluation, the concept was assessed using the three disciplinary perspectives at IDE; the three pillars of innovation. This model allows the concept to be assessed from:

- a 'people' perspective, which indicates its desirability.
- an 'organization' perspective, which indicates its viability.
- a 'technology' perspective, which indicates its feasibility.

Using these three pillars ensures that the design is balanced and has the necessary elements to be successful.
Considering that this concept isn't meant to be sold and thus generate profit, but rather is a concept used for education, this analysis was approached quite differently than an analysis for a product that is meant to hit the market.

People
This concept was designed with an existing course in mind, Understanding Humans; in this case, there is a minimum amount of deviation from the course needed for the concept to be used. This makes it more likely for course coordinators and teachers to integrate it into the curriculum. This can be achieved with the necessary improvements mentioned in the recommendations.
Regarding the concept's desirability in terms of the students, I believe that younger people are more interested in learning about these topics and are open to their views of the world being changed. Especially since the Black Lives Matter protests last year, there seems to have been an increase in younger people wanting to learn more about topics that affect other people and society in ways that they were never aware of. In that case, this project, coincidentally, was timed perfectly.
This project has the potential to change certain things in the design world, which could have a positive impact on people and thus on society.

Organization
It is quite strange to think of the viability of a product that one hopes isn't needed in the future when the problem no longer exists. Nonetheless, awareness is always a good thing, even for issues that no longer exist, to ensure that they never become a problem again. So this concept can initially be used more intensively to raise awareness and teach students how to prevent issues regarding skin color in their designs. If one day these issues don't occur anymore, the concept can be used as a reminder.
As was mentioned, this concept was designed for the course Understanding Humans. The course already has a setup in place to explore different topics (the Wonder Assignments), and the current concept focuses mainly on the discussion part of the assignment. So, if the bachelor is overhauled in the future, the concept could still be used in any other course with space for research relating to people. The research portion would most likely have a different format, but the result remains the same; a student develops some knowledge on the topic to prepare them for a discussion with other students using the concept. This is also the case if the concept is used at a different university in a different course.

Technology
This concept consists of low-tech elements, namely the guidelines and the card set, and a high-tech element, namely the website. These different elements are all relatively simple to maintain; as was explained earlier, cards can be added to the card set as the topic develops, and the same counts for the website. This can also be updated to reflect current developments. Since the guidelines are on the websites, these can also be updated if necessary.
All media used is accessible and updatable and can therefore easily be revised to fit current events and advancements. The website is updated more quickly than the card set, considering that it might be impossible to know who the cards have been handed out to in order to give them additional cards. However, this problem might be minimized in the scenario that the cards are only used at IDE and are given back to the teachers at the end of each session.
This concept can also influence technology through the students that learn about this topic and learn inclusive design behavior. As more advanced digital and technological products are being designed, this concept could make a change and ensure that these products are skin tone inclusive.

To conclude, the concept seems to be quite simple in its design and implementation. Due to the design using uncomplicated media, it would also be easy and not cost a lot of money to update. In closing, the concept could be quite desirable, viable, and feasible with the proper adjustments.

7.4 REFLECTION ON THE PROJECT

Project topic

This topic was very personal to me, and at times it wasn't very pleasant, especially during the research phase when I was constantly finding examples of non-inclusive products. Throughout this project, I noticed a change in how I felt, and I was able to be more objective. Especially realizing that most people don't respond well when they feel attacked, I was able to be more neutral. Even though there is definitely a time and place for indignance, this needed to be tackled more delicately.

This topic is relatively new to the design world, and because of this, there is very little information available, and very few research papers have been written. My goal was to close this gap.

A strategy often used for research is finding different research that describes the same phenomenon or a similar phenomenon and finding overlap in these works. However, with this topic, as there wasn't much available, I used other works about inclusive design and translated and paraphrased them to fit this topic. This strategy required collecting small pieces from different research and piecing them together. While I did struggle with this, as I was unsure at times if the same descriptions and terms could be used, I believe that it was done successfully and provided a clear view of the issue and what is needed to solve it.

Project setup

Starting this project, I did not have a set assignment, but I was going back and forth with Philips for a potential collaboration. This meant that the first few weeks of my assignment, I did not know what my deliverables would be at the end of my project. When the collaboration fell through I had a big gap in my project and continued doing research without knowing what I was doing it for. The only element that I knew I wanted to deliver from the beginning was the guidelines. This resulted in an unclear planning and a lack of decision-making. This was only amplified combined with my hesitancy.

What I would have done differently is I would make sure that I had an assignment or at least a direction, either with a client or without, before starting the project. Or, if starting without an assignment was the only way, I would be more proactive and try out different things to get out the feeling of being stuck.

While it was difficult initially, ultimately, a proper direction for the project was found in time, which meant that I was able to get good results for the project.

Priotitizing

During the project, there were several things that I wanted to do that I later decided was outside the scope of the assignment. An example is the small side research I wanted to do involving DA Drogisterij in Curaçao. This is the only place where I have encountered brown bandages. I wanted to find out what people thought of them and if they even knew that they were sold there as the majority of the inhabitants of Curaçao have dark skin but use beige bandages. As the main research became more time consuming I realized that while this side research was interesting it wasn't completely necessary for the project overall. Another example is the side research about production logistics. During the interviews with the teachers, several of them expressed concern for possible difficulties in the production of wearables if more colors were to be introduced. I wanted to know exactly what difficulties would arise from this and I started approaching people. I first approached the company Band-Aid, as they have experience with producing only one color bandage and then introducing more. However they had a policy of not doing interviews with students so I approached Erik Tempelman, professor at IDE with expertise in materials and manufacturing. I was told by him that he was not able to help me and I decided to put this side research on hold. Later, I realized that I didn't need to do it, I could also write a recommendation for future research. I'm glad that this side step didn't take too much time but it would have definitely been better if I had realized sooner that it was not a step I needed to take. For future projects I need to have a more focused view of my projects and be more critical of whether a side step is valuable. This could be done by having a clear framework and explicit assignment.

Expectations

On two different occasions I felt that I was disappointed by companies; the failed collaboration with Philips and the interview with Manometric. I assumed that companies would be eager to work on or help with a project with this topic and approached them with this mindset. With both experiences I was able to realize how sensitive this topic is to companies, perhaps they are worried about their image. Even a company as big as Philips, who has many statements about inclusion and diversity, was not willing to share sensitive information. This also happened with Manometric as they were unwilling to share the realities of their practices and what issues they were encountering.

All in all, I am proud of the results of this project and am excited to see how it is used in the future, perhaps at IDE, to bring real change to the design world.

REFERENCES

AD. (2017, October 9). *Dove biedt excuses aan na kritiek over racisme in reclame.* AD. Retrieved September 7, 2021, from https://www.ad.nl/bizar/dove-biedt-excuses-aan-na-kritiek-over-racisme-in-reclame~af74c1c6/

Adby, M. (2016, June 24). *Importance of Color Management for Prosthetics.* X-Rite. Retrieved August 5, 2021, from https://www.xrite.com/blog/color-management-for-prosthetics

Anderson, R. (2021, February 15). *Ballerina's reaction to pointe shoes matching her skin tone goes viral.* Good Morning America. Retrieved May 21, 2021, from https://www.goodmorningamerica.com/living/story/ballerinas-reaction-pointe-shoes-matching-skin-tone-viral-75830211

Angélica Dass. (n.d.). *Humanae*. Angélica Dass. Retrieved May 8, 2021, from https://angelicadass.com/photography/humanae/

Apple. (2019, September 19). *Get the most accurate measurements using your Apple Watch*. Apple. Retrieved May 5, 2021, from https://support.apple.com/en-us/HT207941#heartrate

Ball, R. M. (2011, April 30). *SizeChina: A 3D Anthropometric Survey of the Chinese Head* [Doctoral Thesis Industrial Design Engineering Department of Ergonomics]. TU Delft Repository. Retrieved September 8, 2021, from http://resolver.tudelft.nl/uuid:2d038418-8923-4605-92e8-ca3df57ea731

Battle, M. (2017, May 18). *These Photos Flip The Script On Race And Power Dynamics Amongst Women.* Elite Daily. Retrieved September 2, 2021, from https://www.elitedaily.com/life/culture/lets-talk-about-race-photos-chris-buck-oprah-magazine/1954524

Bayer. (2021). *Why choose One A Day vitamins*. One A Day. Retrieved March 24, 2021, from https://www.oneaday.com/why-choose-one-a-day-vitamins

BBC. (2020, September 10). *TRESemmé: South African shops pull products after 'racist' hair adverts.* BBC News. Retrieved September 7, 2021, from https://www.bbc.com/news/world-africa-54102625

Boere, R. (2018, January 12). *Interne ophef over discriminerende klantprofielen.* AD. Retrieved September 7, 2018, from https://www.ad.nl/binnenland/interne-ophef-over-discriminerende-klantprofielen-albert-heijn~aeb110ac/

BookTrust. (2020, November 11). R*epresentation in children's books still not reflective of society, says BookTrust and CLPE.* BookTrust. Retrieved September 7, 2021, from https://www.booktrust.org.uk/news-and-features/news/news-2020/representation-in-childrens-books-still-not-reflective-of-society-says-booktrust-and-clpe/

Botman, M., & Jouwe, N. (2001). *Caleidoscopische visies: de zwarte, migranten- en vluchtelingenvrouwenbeweging in Nederland.* Koninklijk Instituut voor de Tropen. https://collectie.atria.nl/viewer/146299/?offset=&height_top=60&css-name=include&dir_ico=%2Fassets%2Fimages%2Fviewer%2Fblack%2F#page=6&viewer=picture&o=&n=0&q=

Bowen, A. (2021, May 5). *Black patients see skin issues misdiagnosed as dermatologists are often trained on lighter skin: 'It's a different treatment plan'.* The Chicago Tribune. Retrieved September 6, 2021, from https://www.chicagotribune.com/living/health/ct-health-life-dermatologist-color-skin-issues-tt-20210505-4hoblxo3dvezxmeeef7j3vc-7uu-story.html

British Beauty Council. (2020, June 4). *Supporting the Petition: Include Afro Hair Education in the Hairdressing NVQ*. British Beauty Council. Retrieved September 7, 2021, from https://britishbeautycouncil.com/supporting-the-petition-include-afro-hair-education-in-the-hairdressing-nvq/

British Standards Institution. (2005). *Design management systems. Managing inclusive design.* BSI. 0 580 44902 5

Caswell, E. (2015, September 18). *Color film was built for white people. Here's what it did to dark skin*. Vox. Retrieved August 10, 2021, from https://www.vox.com/2015/9/18/9348821/photography-race-bias

Chan, C. S., & Dover, J. S. (2013, March). Nd:YAG laser hair removal in Fitzpatrick skin types IV to VI. *Journal of drugs in dermatology* : JDD, 12(3), 366-367. https://pubmed.ncbi.nlm.nih.gov/23545924/

Criado-Perez, C. (2019, February 23). *The deadly truth about a world built for men – from stab vests to car crashes.* The Guardian. Retrieved March 8, 2021, from https://www.theguardian.com/lifeandstyle/2019/feb/23/truth-world-built-for-men-car-crashes

de Koff, A. (2020, June 15). *Over diversiteit en inclusiviteit in woningbouwarchitectuur, een interview met Lyongo Juliana.* ArchiNed. Retrieved September 8, 2021, from https://www.archined.nl/2020/06/over-diversiteit-en-inclusiviteit-in-woningbouwarchi-

tectuur-een-interview-met-lyongo-juliana/

De Steven. (n.d.). *Bewustwording is een leerproces. De Steven* één-op-één coaching. Retrieved May 6, 2021, from https://www.desteven.nl/leerdoelen/persoonlijke-leerdoelen/persoonlijke-effectiviteit-leerdoelen/bewustwording

Dickey, M. R. (2020, September 21). *Twitter and Zoom's algorithmic bias issues*. TechCrunch. Retrieved September 2, 2021, from https://techcrunch.com/2020/09/21/twitter-and-zoom-algorithmic-bias-issues/?guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAAAvLdLfSLAyD0_TVWSy1Pt9x3EfJo5_mviQ3gazFbMj7TUGd_7j8MdyVzXIw-W44jfAIs8HpmLFo2Oux16I2hZ59rFfMVPtFjCMuPRfcn22eoTF0

Dictionary. (2021, August 4). *Dictionary.* Dictionary. Retrieved August 4, 2021, from https://www.dictionary.com/

Emerson, S. (2017, April 25). *That Viral 'FaceApp' Is Making Everyone Look Whiter*. VICE. Retrieved September 4, 2021, from https://www.vice.com/en/article/qkqwxp/that-viral-faceapp-is-making-everyone-look-whiter

Flores, E. (2018, April 14). *Having a Disability Prevents Me From Using the Bathroom in Public*. Teen Vogue. Retrieved March 23, 2021, from https://www.teenvogue.com/story/having-a-disability-prevents-me-from-using-the-bathroom-in-public

Goddard, K., Roudsari, A., & Wyatt, J. C. (2012, January). Automation bias: a systematic review of frequency, effect mediators, and mitigators. *Journal of the American Medical Informatics Association, 19*(1), 121-127. https://doi.org/10.1136/amiajnl-2011-000089

Goldman, D. (2015, April 9). *Clorox apologizes, deletes tweet after racial uproar.* CNN Money. Retrieved September 10, 2021, from https://money.cnn.com/2015/04/09/technology/clorox-emoji-tweet/index.html

Goodwin, K. (2021, March 20). *Stop Ignoring My Skin Color: "Nude" Isn't One Size Fits All*. The Everygirl. Retrieved June 19, 2021, from https://theeverygirl.com/nude-isnt-one-size-fits-all/

Goodyear, S. (2020, December 10). *The Sims launches 100 new skin tones thanks to the advocacy of Black players.* Canadian Broadcasting Corporation. Retrieved September 6, 2021, from https://www.cbc.ca/radio/asithappens/as-it-happens-thursday-edition-1.5836193/the-sims-launches-100-new-skin-tones-thanks-to-the-advocacy-of-black-players-1.5836196

Graham-Harrison, E. (2016, May 28). *Black man is washed whiter in China's racist detergent advert*. The Guardian. Retrieved September 7, 2021, from https://www.theguardian.com/world/2016/may/28/china-racist-detergent-advert-outrage

Greenwald, M. (2020, June 1). *Why Inclusive Product Design And Messaging Matters: 20 Best Practices.* Forbes. Retrieved August 8, 2021, from https://www.forbes.com/sites/michellegreenwald/2020/06/01/meaningful-authentic-approaches-to-product-and-service-inclusivity/?sh=7d389ee0524e

Griffith, J. (2019, February 14). *Gucci creative director says unintended racist imagery of $890 sweater causes him 'grief'*. NBC News. Retrieved September 2, 2021, from https://www.nbcnews.com/news/us-news/gucci-creative-director-sa-ys-unintended-racist-imagery-890-sweater-causes-n971261

Hailu, R. (2019, July 24). *Fitbits and other wearables may not accurately track heart rates in people of color.* STAT. Retrieved May 5, 2021, from https://www.statnews.com/2019/07/24/fitbit-accuracy-dark-skin/

Hankerson, D., Marshall, A. R., Booker, J., El Mimouni, H., Walker, I., & Rode, J. A. (2016, May 7). *Does Technology Have Race? CHI EA '16: Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems,* 473–486. https://doi.org/10.1145/2851581.2892578

Hardesty, L. (2018, February 11). *Study finds gender and skin-type bias in commercial artificial-intelligence systems.* Massachusetts Institute of Technology. Retrieved August 30, 2021, from https://news.mit.edu/2018/study-finds-gender-skin-type-bias-artificial-intelligence-systems-0212#:~:text=artificial%2Dintelligence%20systems-,Study%20finds%20gender%20and%20skin%2Dtype%20bias%20in%20commercial%20artificial,percent%20for%20dark-%2Dskinned%20

Healthline. (2019, January 2). *What Are the Fitzpatrick Skin Types*? Healthline. Retrieved August 5, 2021, from https://www.healthline.com/health/beauty-skin-care/fitzpatrick-skin-types

Hern, A. (2020, September 21). *Twitter apologises for 'racist' image-cropping algorithm*. The Guardian. Retrieved September 2, 2021, from https://www.theguardian.com/technology/2020/sep/21/twitter-apologises-for-racist-image-cropping-algorithm

Hollander, J. (2013, August 28). *Why Are There No*

Black Emojis? Bustle. Retrieved September 10, 2021, from https://www.bustle.com/articles/4300-why-are-there-no-black-emojis

Houser, K. (2019, May 3). *Self-Driving Cars May Hit People With Darker Skin More Often*. The Byte. Retrieved September 7, 2021, from https://futurism.com/the-byte/biased-self-driving-cars-darker-skin

IFLScience. (2017, August 16). *This Viral Video Of A Racist Soap Dispenser Reveals A Much Bigger Problem In Tech*. IFLScience. Retrieved May 2, 2021, from https://www.iflscience.com/technology/this-racist-soap-dispenser-reveals-why-diversity-in-tech-is-muchneeded/

Institute for Human Centered Design. (n.d.). *History of Inclusive Design*. IHCD. Retrieved September 26, 2021, from https://www.humancentereddesign.org/inclusive-design/history

Joglar, A. (2017, April 25). *Racism in Advertising*. The A Magazine. Retrieved September 9, 2021, from https://theamag.com/racism-in-advertising/

Kantayya, S. (Director). (2020). *Coded Bias* [Film]. Netflix. https://www.netflix.com/cw/title/81328723

Karanovic. (2014, May 12). *Critical Race Analysis: Intel's 2007 Ad*. Karanovic. Retrieved September 9, 2021, from http://www.karanovic.org/courses/mca008/archives/1613

Kouprie, M., & Sleeswijk Visser, F. (2009, October). Merlijn Kouprie and Froukje Sleeswijk Visser. *Journal of Engineering Design, 20*(5), 437–448. https://studiolab.io.tudelft.nl/manila/gems/sleeswijkvisser/kouprieslеeswijkemp.pdf

Lewis, S. (2019, April 25). *The Racial Bias Built Into Photography*. The New York Times. https://www.nytimes.com/2019/04/25/lens/sarah-lewis-racial-bias-photography.html#:~:text=In%20the%20mid-1990s%2C%20Kodak%20created%20a%20multiracial%20Shirley,they%20coincided%20with%20the%20rise%20of%20digital%20photography.

Lusina, A. (2021, July 7). *Adobe Hopes its Darker Skin Presets Will Make Photos Look More Natural*. PetaPixel. Retrieved August 10, 2021, from https://petapixel.com/2021/07/07/adobe-hopes-its-darker-skin-presets-will-make-photos-look-more-natural/

Mari, F. (2021, June 16). *The Best Sunscreens For Dark Skin That Won't Leave A White Cast*. Huffington Post. Retrieved 10 10, 2021, from https://www.huffpost.com/entry/best-sunscreen-for-dark-skin_l_60c7a956e4b0292575a57f25

McEntegart, J. (2010, November 5). *Kinect May Have Issues with Dark-Skinned Users*. Tom's Guide. Retrieved May 6, 2021, from https://www.tomsguide.com/us/Microsoft-Kinect-Dark-Skin-Facial-Recognition,news-8638.html

McFarling, U. L. (2020, July 21). *Dermatology faces a reckoning: Lack of darker skin in textbooks and journals harms care for patients of color*. Stat. Retrieved September 6, 2021, from https://www.statnews.com/2020/07/21/dermatology-faces-reckoning-lack-of-darker-skin-in-textbooks-journals-harms-patients-of-color/

Merriam-Webster. (2021, August 4). *Merriam-Webster*. Merriam-Webster. Retrieved August 4, 2021, from https://www.merriam-webster.com/dictionary/systemic

Merriam-Webster. (2021, August 12). *Stereotype*. Merriam-Webster. Retrieved August 12, 2021, from https://www.merriam-webster.com/dictionary/stereotype

Microsoft. (2016). *Inclusive Toolkit Manual*. Microsoft. https://www.microsoft.com/design/inclusive/

Microsoft. (2016, June 28). *Inclusive: A film about innovative design*. Microsoft. Retrieved August 23, 2021, from https://news.microsoft.com/videos/inclusive/

Moss, H. (2017, December 6). *'Dove VisibleCare' Ad Called Out For Being Racist (PHOTO, POLL)*. The Huffington Post. Retrieved September 7, 2021, from https://www.huffpost.com/entry/dove-visible-care-ad-racist_n_865911

Nakiyemba, O. (2017, March 13). *How Representation in Children's Books is a Powerful Tool in Uganda*. Culture Trip. Retrieved September 7, 2021, from https://theculturetrip.com/africa/uganda/articles/how-representation-in-childrens-books-is-a-powerful-tool-in-uganda/

Nouri, K., G.P., J., & Trent, J. (2002, March 1). Laser hair removal in patients with Fitzpatrick skin type VI. *15*, 15-16. https://www.researchgate.net/publication/291106391_Laser_hair_removal_in_patients_with_Fitzpatrick_skin_type_VI

Obermeyer, Z., Powers, B., Vogeli, C., & Mullainatha, S. (2019). Dissecting racial bias in an algorithm used to manage the health of populations. *Science, 366*(6464), 447-453. https://www.science.org/doi/abs/10.1126/science.aax2342

Oxford English Dictionary. (2021, June 12). O*xford*

English Dictionary. Oxford English Dictionary. Retrieved June 13, 2021, from https://languages.oup.com/google-dictionary-en/

Pancare, R. (2018, April 23). *How Do Bright Colors Appeal to Kids?* Sciencing. Retrieved March 9, 2021, from https://sciencing.com/do-bright-colors-appeal-kids-5476948.html

Pelletiere, N. (2019, April 30). *Man's powerful tweet showing a bandage that matched his skin draws global support*. Good Morning America. Retrieved April 14, 2021, from https://www.goodmorningamerica.com/living/story/mans-powerful-tweet-showing-bandage-matched-skin-draws-62700365

Plenke, M. (2015, September 9). *The Reason This "Racist Soap Dispenser" Doesn't Work on Black Skin*. Mic. Retrieved May 2, 2021, from https://www.mic.com/articles/124899/the-reason-this-racist-soap-dispenser-doesn-t-work-on-black-skin

Produkt + Projekt Wolfgang Moll. (n.d.). *Age simulation suit GERT*. Produkt + Projekt Wolfgang Moll. Retrieved September 26, 2021, from http://www.age-simulation-suit.com/

Psychology Today. (2011, August 23). *Empathy*. Psychology Today. Retrieved March 9, 2021, from https://www.psychologytoday.com/intl/basics/empathy

Rabin, R. C. (2020, August 30). *Dermatology Has a Problem With Skin Color*. The New York Times. Retrieved September 6, 2021, from https://www.nytimes.com/2020/08/30/health/skin-diseases-black-hispanic.html

Ranabhatt, R., Singh, K., Siddharth, R., Tripathi, S., & Arya, D. (2017). Color matching in facial prosthetics: A systematic review. *The Journal of Indian Prosthodontic Society, 17*(3-7). 10.4103/0972-4052.197935

Rankin, C. H., Abrams, T. W., Barry, R., Bhatnagar, S., Clayton, D., Colombo, J., Coppola, G., Geyer, M. A., Glanzman, D., Marsland, S., Mcsweeny, F. K., Wilson, D. A., Wu, C.-F., & Thompson, R. F. (2008, October). Habituation Revisited: An Updated and Revised Description of the Behavioral Characteristics of Habituation. *Neurobiology of Learning and Memory, 92*(2), 135-8. 10.1016/j.nlm.2008.09.012

Redwood, S., & Gill, P. S. (2013). Under-representation of minority ethnic groups in research — call for action. *British Journal of General Practice 2013, 63*(612), 342-343. https://doi.org/10.3399/bjgp13X668456

Refined NG. (2021, May 3). *John Amanam*. Refined NG. Retrieved August 5, 2021, from https://refinedng.com/john-amanam/

Roozenburg, N. F.M., & Eekels, J. (1995). *Productontwerpen, structuur en methoden*. Boom Lemma Uitgevers.

Santibañez, T. (2019, November 5). *6 Black Tattoo Artists Unpack The Most Common Myths About Tattooing On Darker Skin*. Bustle. Retrieved September 7, 2021, from https://www.bustle.com/p/4-myths-about-tattooing-on-dark-skin-that-are-completely-untrue-19188832

Sentementes, G. (2009, December 23). *The case of the "racist" HP webcam*. The Baltimore Sun. Retrieved May 6, 2021, from https://www.baltimoresun.com/bs-mtblog-2009-12-hp_racist_web_cam_youtube-story.html

Sharp, G. (2011, August 24). *Nivea's "Re-Civilize Yourself" Ad*. The Society Pages. Retrieved September 9, 2021, from https://thesocietypages.org/socimages/2011/08/24/niveas-re-civilize-yourself-ad/

Soloducha, A. (2017, August 1). *Regina woman shocked to discover lack of colour options for prostheses*. CBC News. Retrieved September 14, 2021, from https://www.cbc.ca/news/canada/saskatchewan/regina-woman-shocked-to-discover-lack-of-colour-options-for-prostheses-1.4229804

Stern, C. (2020, June 8). B*lack dancer reveals how ballerinas of color have to 'pancake' their pointe shoes in makeup to match their skin - as thousands sign petitions calling for brands to offer more shade options*. Daily Mail. Retrieved May 14, 2021, from https://www.dailymail.co.uk/femail/article-8399337/How-ballerinas-color-pancake-pointe-shoes-brown-make-up-match-skin.html

Stichting Lezen en Schrijven. (2020, March 12). *Anita Witzier nieuwe ambassadeur Stichting Lezen en Schrijven*. Stichting Lezen en Schrijven. Retrieved March 8, 2021, from https://www.lezenenschrijven.nl/over-stichting-lezen-en-schrijven/actueel/antoinette-de-graaf-driesen-nieuwe-adjunct-directeur

Thomas, L. (2016, August 22). *Why Representation Matters*. Edutopia. Retrieved September 14, 2021, from https://www.edutopia.org/blog/why-representation-matters-laura-thomas

University of Cambridge. (2017). *What is inclusive* design? Inclusive Design Toolkit. Retrieved March 24, 2021, from http://www.inclusivedesigntoolkit.com/whatis/whatis.html

Vaes, K. (2016). *Product Stigmaticity Understanding,*

Measuring and Managing Product-related Stigma [PhD Conference Paper]. Institutional Repository. Retrieved May 12, 2021, from http://resolver.tudelft.nl/uuid:c79448dd-a362-4979-a566-06a616f14625

van Boeijen, A. G.C., Daalhuizen, J. J., Zijlstra, J. J., & van der Schoor, R. S.A. (2013). *Delft Design Guide*. Amsterdam: BIS Publishers.

van den Bulk, L. (2018). *Etnisch-culturele diversiteit in beleid en cultuureducatie: intercultureel onderwijs*. Landelijk Kennisinstituut Cultuureducatie en Amateurkunst. Retrieved March 25, 2021, from https://lkca.nl/wp-content/uploads/2020/01/ce49_etnisch_culturele_diversiteit_lenie_van_den_bulk.pdf

Vargas, T. (2020, February 22). *This Dove advertisement promotes their skin care products. It is a gif that shows a dark skinned woman taking off her brown shirt and turning into a light skinned woman. Critics find that the ad resembles old racist soap ads (like the one seen below) with.* The Washington Post. Retrieved 9 16, 2021, from https://www.washingtonpost.com/local/a-9-year-old-girl-got-people-to-finally-stop-thinking-of-the-peach-colored-crayon-as-the-skin-color-crayon/2020/02/22/89ab7590-5506-11ea-b1-19-4faabac6674f_story.html

Ware, O. R., Dawson, J. E., Shinohara, M. M., & Taylor, S. C. (2020, February). Racial Limitations of Fitzpatrick Skin Type. *Cutis, 105*(2), 77-80. https://www.mdedge.com/dermatology/article/216697/pigmentation-disorders/racial-limitations-fitzpatrick-skin-type?sso=true

Watson, W., & Marsh, C. (2021). *Artificial Intelligence Bias in Healthcare*. Booz Allen Hamilton. Retrieved September 14, 2021, from https://www.boozallen.com/c/insight/blog/ai-bias-in-healthcare.html

Winchester Hospital. (n.d.). *True or False: Dark-skinned People Don't Need Sunscreen*. Winchester Hospital. Retrieved October 17, 2021, from https://www.winchesterhospital.org/health-library/article?id=157004

Wix. (2017, November 16). *What are GIFs and How to Effectively Use Them on Social Media*. Wix. Retrieved September 24, 2021, from https://www.wix.com/blog/2017/11/gifs-in-social-media/

Wonderbly. (2012). *Wonderbly*. Wonderbly. Retrieved September 21, 2021, from https://www.wonderbly.com/personalized-products?gclid=3dd9596e4c6814f0af88382444ea41f2&gclsrc=3p.ds&utm_source=bing&utm_medium=cpc&utm_campaign=BI-SEA-ROW-En-Brand-Exact&utm_term=wonderbly&utm_content=Brand_Core_Exact

World Population Review. (2021, August 4). *Most Racially Diverse Countries 2021*. World Population Review. Retrieved August 4, 2021, from https://worldpopulationreview.com/country-rankings/most-racially-diverse-countries

Yarbrough, J. L. (2019, July 25). *Something Went Seriously Wrong With Tarte's New Shape Tape Foundation*. Ranker. Retrieved September 6, 2021, from https://www.ranker.com/list/tarte-shape-tape-foundation-controversy/jessica-defino

Zhang, M. (2015, September 19). *Here's a Look at How Color Film was Originally Biased Toward White People*. PetaPixel. Retrieved August 10, 2021, from https://petapixel.com/2015/09/19/heres-a-look-at-how-color-film-was-originally-biased-toward-white-people/

APPENDIX A: NON-INCLUSIVE PRODUCTS

INADEQUATE COLOR SELECTION

Adhesive bandage
Adhesive bandages, used to cover small wounds, are made to match the skin tone to reduce the social stigma associated with medical products. Beige is often the only skin color that is available.

Elastic bandage
Elastic bandages, used for compression to treat muscle sprains and strains, are made to match the skin tone to reduce the social stigma associated with medical products. Beige is often the only skin color that is available.

Kinesiology tape
Kinesiology tape is a therapeutic tape used to support joints and muscles and therefore reduce pain. It is made in many bright colors and also a skin tone matching color to reduce the social stigma associated with medical products. Beige is often the only skin color that is available.

Birth control patch
Birth control patches release hormones into the body and effectively prevents pregnancy. It is made in a skin tone matching color to reduce the social stigma associated with medical products. Beige is often the only skin color that is available.

Nicotine patch
Nicotine patches release nicotine into the body to reduce nicotine withdrawal symptoms. It is made in a skin tone matching color to reduce the social stigma associated with medical products. Beige is often the only skin color that is available.

Occlusion eye patch
Occlusion eye patches are used to treat Amblyopia or lazy eye by covering the good eye. It is made in a skin tone matching color to reduce the social stigma associated with medical products. Beige is often the only skin color that is available.

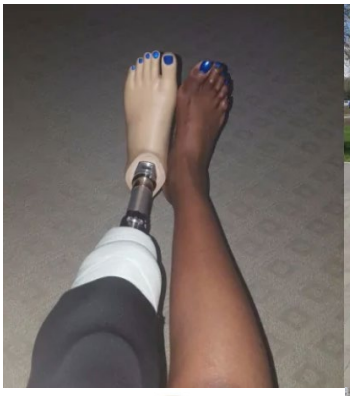
Compression stocking
Compression stockings help to increase blood flow in the legs and reduce pain and swelling. It is made in a skin tone matching color to reduce the social stigma associated with medical products. Beige is often the only skin color that is available.

Knee band
Knee bands are used to support the knee area to treat or prevent injuries. It is made in a skin tone matching color to reduce the social stigma associated with medical products. Beige is often the only skin color that is available.

Elbow band
Elbow bands are used to provide pressure in the elbow area to reduce pain. It is made in a skin tone matching color to reduce the social stigma associated with medical products. Beige is often the only skin color that is available.

Orthotic insole
Orthotic insoles go inside the shoes to treat foot problems to reduce pain in the feet, legs, knees, hips, and back. It is made in a skin tone matching color to reduce the social stigma associated with medical products. Beige is often the only skin color that is available.

Orthosis
Orthoses are used to brace and correct different body parts. It is made in a skin tone matching color to increase the intrinsic acceptance of the wearer. Beige is often the only skin color that is available.



Prosthesis
Prostheses are artificial body parts used to replace a body part that was lost due to birth defect, injury or disease. It is made in a skin tone matching color to increase the intrinsic acceptance of the wearer. Beige is often the only skin color that is available.

In 2017, a black woman documented her process of (unsuccessfully) trying to dye her prosthesis to match her skin tone (Soloducha, 2017)

Hearing aid
Hearing aids are electronic devices used to improve hearing in both noisy and quiet environments. It is made in a skin tone matching color to reduce the social stigma associated with medical products. Beige is often the only skin color that is available.

Arthritis glove
Arthritis gloves are used to provide compression to treat arthritis and reduce pain and swelling, and increase mobility. It is made in a skin tone matching color to reduce the social stigma associated with medical products. Beige is often the only skin color that is available.

Shapewear
Skin tone matching shapewear is worn so it does not stand out under light colored clothing or sheer clothing to reduce the social stigma associated with showing shapewear. Beige is often the only skin color that is available.

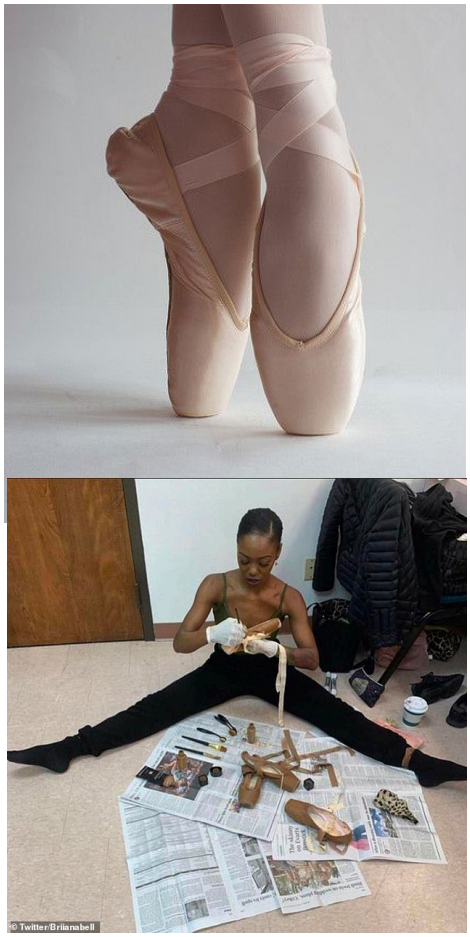
Underwear
Skin tone matching underwear is worn so it does not stand out under light colored clothing or sheer clothing to reduce the social stigma associated with showing underwear. Beige is often the only skin color that is available.

Pantyhose
Pantyhose that matches the skin tone is worn to create the illusion of smooth and blemish free skin. Beige is often the only skin color that is available.

Sock
Socks that match the skin tone are worn to create the illusion that the wearer isn't wearing socks (when a certain pair of shoes looks better without socks). Beige is often the only skin color that is available.

Sheer clothing
Sheer clothing has a layer under the sheer fabric that matches the skin color to create the illusion that the skin is showing. Beige is often the only skin color that is available.

Ice skate
Ice skates match the skin tone to create the illusion of long, elegant legs. Beige is often the only skin tone that is available.



Ballet shoe
Ballet shoes match the skin tone to create the illusion of long, elegant legs. Beige/light pink are often the only skin tones that are available. The color of the shoes is referred to as European Pink which already suggests who the product is meant for, namely people of European descent. According to the Daily Mail, many ballerinas with darker skin are still having to paint their shoes with makeup in order for it to match their skin tone (Stern, 2020).

Microphone
Microphones are used when addressing a crowd. Some are made in a skin tone matching color to create the illusion that the wearer isn't wearing a microphone but is addressing the crowd directly. Beige is often the only skin color that is available.

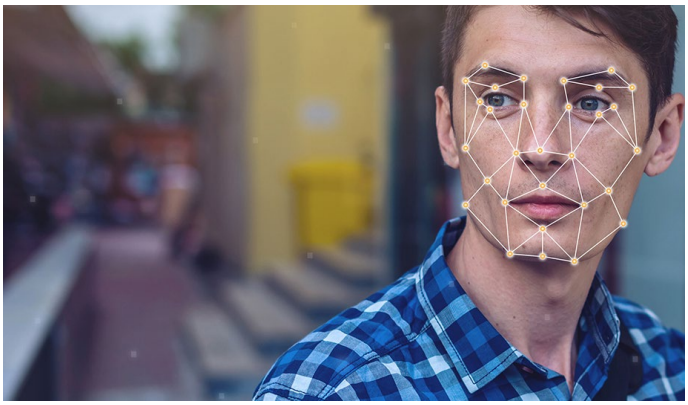
Halloween costume
Halloween costumes sometimes have beige areas to match the skin tone and create the illusion of exposed skin. Beige is often the only skin color that is available.

Halloween products
Halloween/prank products that are made to match the skin tone are often only made in the color beige.

Film Development
The first film development technology was made to capture people with light skin in a flattering light. The chemical coating on the film was specifically chosen to capture light skin and was therefore not able to capture a diversity of skin tones. This is confirmed by the picture of a light-skinned woman with optimal lighting (the Shirley card) that was used to calibrate the lighting conditions. The lighting conditions for the development of photos were set to these standards by default. Oftentimes people with dark skin became just a black silhouette with bright eyes and teeth (Caswell, 2015). Nowadays photographers still struggle to photograph people with dark skin because, despite advancements in digital photography, the default toward lighter skin is still present (Zhang, 2015).

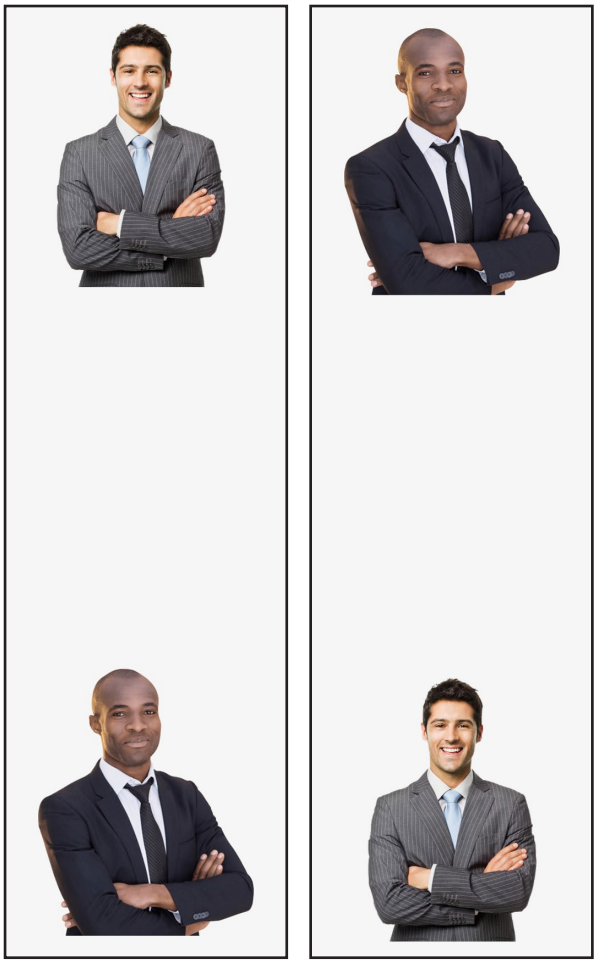
Smartwatch
Smartwatches are used for fitness, among other things. They can be used to track physical activities to reach fitness goals. One of the features of a smartwatch is the heart rate sensor. Most smartwatches on the market, like Fitbit and Apple Watch, use green light for this sensor because it is cheaper than the IR (infrared) lights that are used in hospitals. But because melanin, a natural skin pigment, absorbs green light due to its shorter wavelength, dark-skinned users, who have a lot of melanin in their skin, get a less accurate reading (Hailu, 2019)(Hankerson et al., 2016, 476). According to Apple, this has also been the case for people who have dark tattoos, although they have not acknowledged the effects of skin color on the accuracy of the monitor (Apple, 2019).

Automatic soap dispenser
Automatic soap dispensers are made to provide the user with soap without physical contact as this is a more hygienic and sanitary solution, especially for public restrooms. There have been several reports of soap dispensers not recognizing hands with dark skin. Some reports show the user having a white friend get soap for them (Plenke, 2015), others show how they get soap from the dispenser by placing a piece of toilet paper on their hand (IFLScience, 2017). Automatic faucets and soap dispensers work by sending an infrared light which has to be reflected off of the surface of the hand. The sensor then detects the light that was reflected to dispense the soap. If the surface of the hand is dark, it absorbs the light instead of reflecting it, in this case, the device will not react (Hankerson et al., 2016, 476).



Facial recognition

Facial recognition software is an AI technology that can identify individuals through an image or video of the face. Some can even identify the person in real-time. It is able to do this through a dataset that is used to train the software to recognize faces. This dataset consists of images of faces and other images to teach the software what a face looks like. The issue is that the datasets that are used for machine learning consist mostly of pictures of white men (77% male and 83% white), which means that the software does not learn to properly recognize women and people with dark skin. According to a study by MIT researchers, the error rates for gender classification are 0.8% for light-skinned men, generally 34.7% for dark-skinned women (for some systems even 46.8%) (Hardesty, 2018). Since the police are also considering using facial recognition software to identify suspects, this creates a huge problem on top of the racial profiling already present in policing.

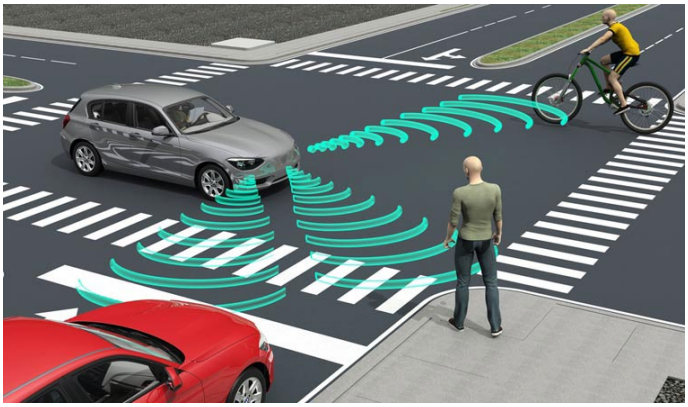


Twitter auto-cropping

Twitter's image-cropping algorithm automatically crops images to ensure that they don't take up too much space on the main feed, this also allows for multiple images to be shown in the same tweet. Twitter uses several algorithms to crop the image and zoom in on the most important part of the image to ensure that faces remain part of the cropped image. Whenever there are multiple faces in an image, the face with light skin will be considered the most important. This is the same issue as facial recognition software where the data sets are not inclusive and the algorithm, therefore, prioritizes what it knows best; light faces. According to The Guardian, a British daily newspaper, Twitter users are even testing this by tweeting two images, both containing a person with light skin and a person with dark skin, but in different orders. For both images, the person with dark skin is cropped out (Hern, 2020).

Zoom virtual background

Zoom's virtual background feature allows users to use any image or video as their background during Zoom calls to avoid showing their environment (like their home). In a reported incident, the algorithm was unable to identify the face of a man with dark skin, this meant that the algorithm removed his head along with his background to insert the virtual background (Dickey, 2020). This could be the same issue as facial recognition software where the data sets are not inclusive and it is, therefore, unable to recognize people with dark skin (see page 96).



Self-driving car

A self-driving car is a vehicle that uses a variety of sensors to effectively navigate traffic with little to no human input.

It uses AI recognition software to detect pedestrians. Self-driving cars are more likely to hit pedestrians with dark skin as they are not able to recognize them. This is the same issue as facial recognition software where the data sets are not inclusive and the algorithm is therefore not trained to recognize people with dark skin (see page 96) (Houser, 2019).

HP face tracking

HP's camera face tracking feature tracks the user's face to stay zoomed in on their face as the user moves around. There have been reports that the software has a difficult time recognizing people with dark skin and consequently the feature does not work for them (Sentementes, 2009). A similar problem has been reported by GameSpot, a video gaming website, about Microsoft's Kinect, a motion sensor add-on for the Xbox 360 gaming console. This sensor is supposed to identify individual players through facial recognition but has reportedly had difficulty doing so when it comes to players with dark skin (McEntegart, 2010). This could be the same issue as facial recognition software where the data sets are not inclusive and it is, therefore, unable to recognize people with dark skin (see page 96).

AI in healthcare

AI in healthcare is used to flag high-risk patients to aid doctors in determining who needs enhanced medical attention. It does this by determining the severity of the illness by predicting future healthcare costs based on past spending (Watson & Marsh, 2021). However, black people generally seek and receive medical attention at a much lower rate, and so the money spent on black people in healthcare is also a lot less. As a result, the AI model then learns less about them. Since the algorithm is not aware of other societal factors that result in racial inequities in healthcare, it then falsely assigns a "low-risk" label to a black person who is in fact, high-risk. According to a study, only about half of black people in need of enhanced medical attention actually receive it (Obermeyer et al., 2019, 448). The same study also shows that altering the algorithm to use clinical data, as opposed to spending data, greatly reduces this bias.

However, another pitfall is that women and people of color are underrepresented in clinical trials (Redwood & Gill, 2013, 342), resulting in AI data sets predominantly based on white men.

FaceApp beautification filter

The FaceApp beautification filter is meant to make people hotter, as the flame emoji suggests. Users with dark skin have noticed that the filter makes their skin tone lighter, reconstructs the nose to make it look more European, and makes Asian eyes look more European (Emerson, 2017). The default settings in this filter are set to Eurocentric beauty standards regardless of the race and facial features of the user.

Philips Lumea

The Philips Lumea device uses intense pulsed light (IPL) technology to remove hair from the user's body. This technology is suitable for Fitzpatrick Skin Types (FST) 1-5 but not FST 6 (Philips, n.d.). While this is a wide range, the technology is not completely inclusive, and Philips also doesn't offer alternatives for those who are excluded. There are other technologies that are suitable for FST 6 but these were not selected for the Philips Lumea. While the reason for this is unknown, one could speculate that it could be because of budget reasons or more research required to implement the other technology in an at-home device which was not deemed worth it.

Dermatology

Dermatology is a medical specialty that deals with the diagnosis and treatment of skin diseases and conditions. According to The New York Times and The Chicago Tribune, people with dark skin are often misdiagnosed because dermatologists are trained to diagnose conditions on light skin and do not know how to recognise the same condition in darker skin (Rabin, 2020)(Bowen, 2021). This can also be seen in the lack of representation of people with dark skin in medical textbooks, therefore dermatologists do not acquire the knowledge of how different conditions look like on dark skin (McFarling, 2020).

Laser hair removal

Laser hair removal is a procedure for permanent hair reduction of unwanted hair. It uses a concentrated beam of light that is absorbed by the pigment of the hair. This light energy is converted to heat which effectively damages the hair follicle and reduces its ability to produce hairs. Because the light is absorbed by pigment, it could also be absorbed by the pigment in the skin if the skin contains a lot of pigment which could burn the skin. This makes laser hair removal tricky for darker skin tones, but not impossible. Clients with the darkest skin color (Fitzpatrick Skin Type VI) can still undergo laser hair removal treatment as long as the proper settings are used on the machines (Nouri et al., 2002, 15-16) (Chan & Dover, 2013, 366-367).

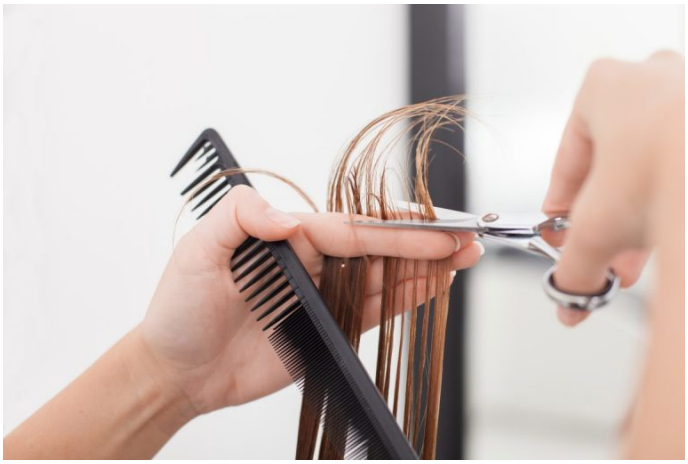
Tattooing

Tattooing is a permanent form of body modification that is done by inserting ink into the dermis layer of the skin to create a design. The top layer of the skin, the epidermis, forms a translucent layer over the ink. This means that the color of the epidermis influences how we see the color of the ink; lighter skin tones will experience little to no modification to the color of the ink, and darker skin tone experience a bigger alteration to the color of the ink as the translucent layer is dark. While the tattooing machine used for light and dark skin tones is the same, the tattoo artist must have knowledge on how different colors show up differently on dark skin or else the tattoo will not come out as desired. Many tattoo artists who are used to tattooing people with light skin do not have this knowledge. Another issue with tattooing is that tattoo artists tend to believe that dark skin is tougher and they need to be rougher when tattooing, but this is false and causes unnecessary scarring (Santibañez, 2019).

Makeup artistry

Makeup artists, either self-taught or professionally trained, do people's makeup for photoshoots or special occasions. They are typically not taught to do makeup on people with dark skin in cosmetology school.

They also often don't have makeup for dark skin in their kits so as a result models with dark skin have to bring their own makeup, and sometimes even do their own makeup.



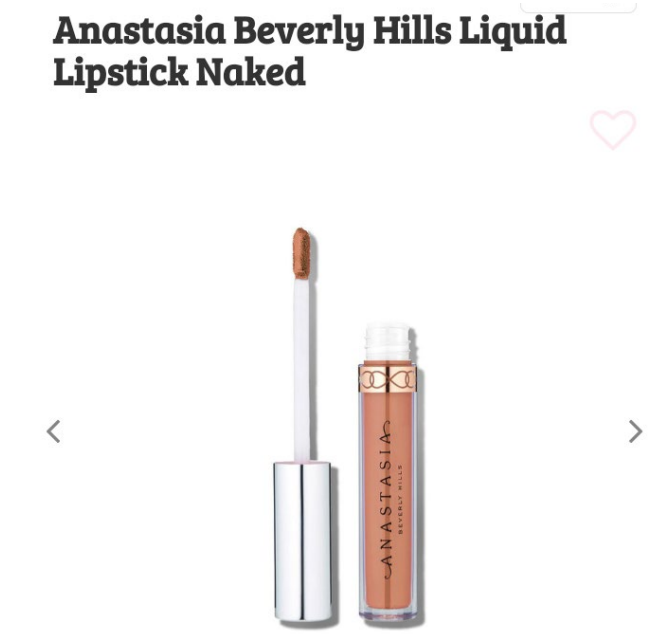
Hairdressing

Hairdressers are either self-taught or professionally trained to cut and style hair.

There is no attention to Afro hair in the current curriculum as it is targeted towards European hair, resulting in hairdressers that cannot style Afro hair (British Beauty Council, 2020). Being able to do Afro hair is then seen as a specialty rather than a common skill. A consequence is that clients with Afro hair are turned away from most hair salons and are left with no options if they live in a city where there aren't any hairdressers specialized in Afro hair. Another consequence is that when models with Afro hair are booked for a job, they either have to do their hair themselves for a show or photoshoot, or they have to get their hair done by a hairdresser who hasn't had any training. Oftentimes the results are not great but the models cannot complain for fear of being labeled as difficult. While not directly related to skin tone (as there are people with light skin with afro textured hair such as biracial people, and people with dark skin and straight hair such as South Asian people), this is still an interesting example.

Crayon
Crayons are often used by children to create drawings. Crayola's peach colored crayon was named "flesh" at the time of the invention. Since this is a product used most by children, it teaches them to start naming beige/peach objects "skin colored" at a very young age, effectively distorting their views of what skin color is; a variety of colors, and not just one color (Vargas, 2020). It also creates a confusing experience for children with dark skin as they do not recognize themselves in this color.

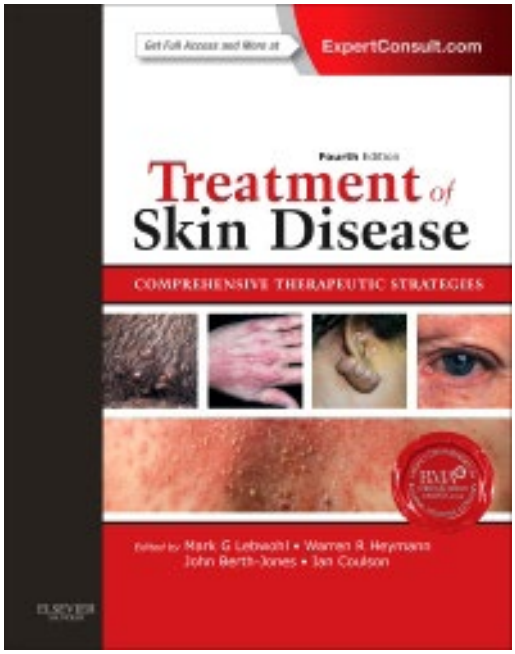
Pedicure congress advertisement
This poster is an invitation from a podiatry practice for a pedicure congress. The theme of the congress is Skin & Posture and the color beige/peach was chosen for the illustration of the poster. This shows the limited range of colors that the makers associate with the word 'skin'.



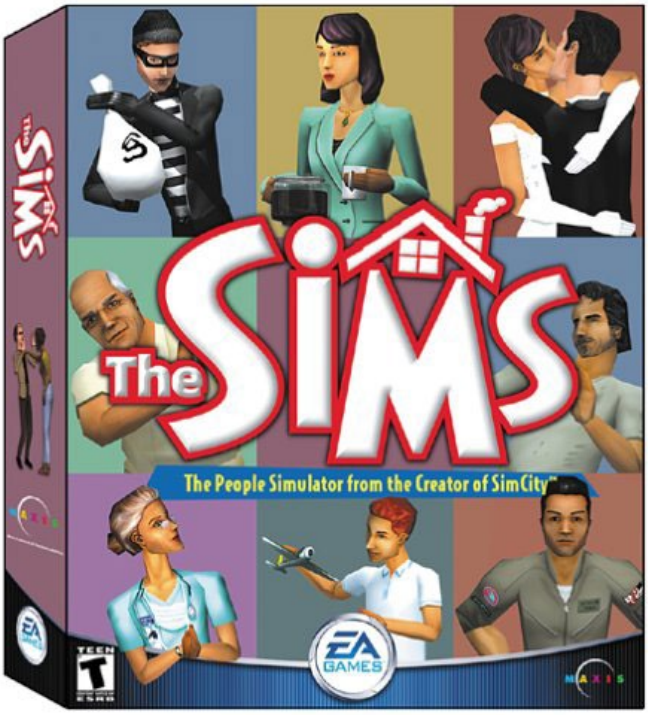
Cosmetic product
Cosmetic products, like the lipstick in the image, are often described using terms that refer to skin whenever the color of the product is beige or peach. This particular shade of lipstick is called "Naked" and is described on the website as a 'light peachy nude'. They also have a shade called "Stripped" that is described as 'neutral beige nude'.

Complexion product
Foundation is a cosmetic product used to cover flaws and create an even color to the complexion. To do this the foundation must match the skin tone of the wearer. Foundation and concealer lines often have many shades of beige to match lighter skin tones, while there is a lack of representation for darker skin tones. This particular line of foundation in the image was released by Tarte Cosmetics in 2018 (Yarbrough, 2019).

Melange paint
This paint is another example of products that are beige/peach color that get a name which refers to skin. This particular paint is named “Bare Naked Pink”.



Medical textbook
Medical textbooks are used in education to teach medical students what different diseases and conditions look like. There is a lack of representation in these books for people with dark skin (McFarling, 2020), resulting in doctors that are not properly educated to give diagnoses to people with dark skin as certain conditions look completely different on different skin tones (Rabin, 2020) (Bowen, 2021).



The Sims
The Sims is a life simulation game that centers around simulating daily activities. For many people, the appeal of The Sims is this customization; creating a digital version of yourself in a virtual world.
Until 2020, The Sims offered only limited options for customization when creating Sims with dark skin (Goodyear, 2020).

Mannequin
Store mannequins are used to display clothing that is sold in a store, to give shoppers an idea what the clothes will look like on the body and allow them to imagine what the clothes will look like on themselves. There is a lack of representation for people with dark skin as most stores use beige mannequins.

Doll
Children's dolls are modeled after humans and are used as toys. Many dolls have a light skin tone, and because of this parents struggle to find dolls with dark skin for their children. This results in children with dark skin playing with light dolls, but you will rarely see the opposite.
Due to lack of representation, children are subtly taught through dolls and many other products that dark skin is undesirable.

Children's book
Children's books are used to entertain children, introduce them to new things, and help them develop their vocabulary and sense of imagination. Especially with the drawings, children can imagine themselves being in different situations. It can help them to aspire to do great things. According to a study done in the UK, there is a lack of representation for children with dark skin in children's books (BookTrust, 2020), in images and the way they are described (for example; long soft hair, fair skin) (Nakiyemba, 2017). As a result, children with dark skin find it difficult to recognize themselves in these stories because the characters don't look like them.

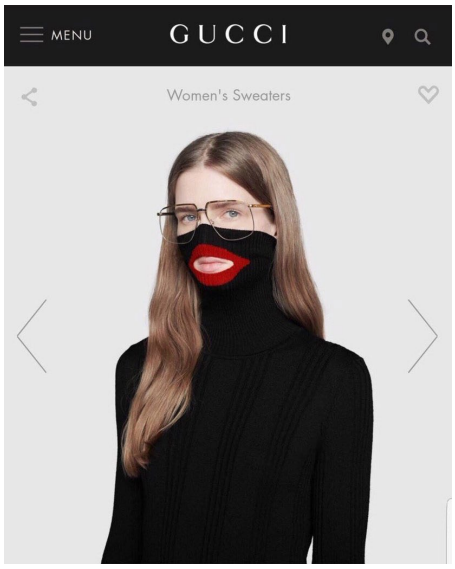
Figurine
Christmas villages are miniature villages used to decorate around Christmas time. The figurines that are used in these decorations often have light skin and people with dark skin struggle to find figures with dark skin so they can create families that look like their own.

Birth card
Birth cards are sent to friends and family to announce the birth of a child. Often, there is a drawing or photo of a baby on the cover. These babies often have a light skin tone, and parents, specifically in the Netherlands, are referred to adoption sites to find birth cards with darker skinned babies.

Dove advertisement 1
This Dove advertisement promotes their skincare products. It is a gif that shows a dark-skinned woman taking off her brown shirt and turning into a light-skinned woman. Critics find that the ad resembles old racist soap ads (like the one seen below) with illustrations of dark skin becoming lighter after using soap (AD, 2017). Although the intention was not to mimic these old ads, as the light-skinned woman does turn into a darker-skinned woman in the second part of the gif, it is a clear example of how a lack of cultural and historical knowledge can cause designers and marketers to (unintentionally) continue creating harmful content.

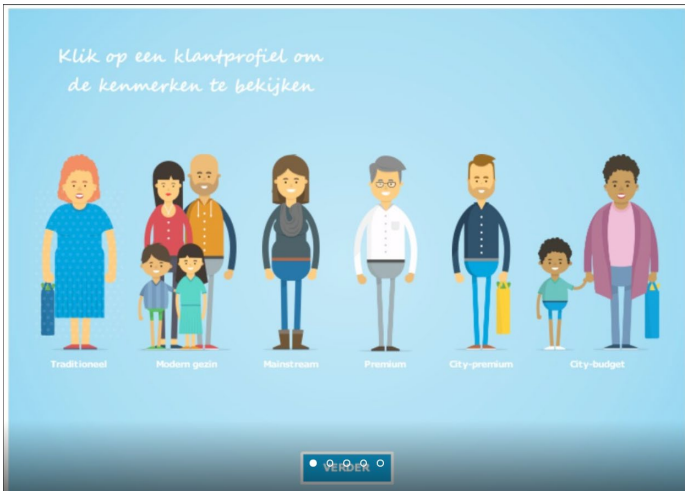
Dove advertisement 2
This Dove advertisement promotes their skin care products. While at first glance there doesn't seem to be anything wrong with it, as Dove explains that all three women are intended to show the "after" product benefits. According to Huffington Post, critics find that the ad resembles old racist soap ads (like the one seen below), as the ad places a woman with dark skin in the "before" section and a woman with light skin in the "after" section (Moss, 2017). This is a clear example of how a lack of cultural and historical knowledge can cause designers and marketers to (unintentionally) continue creating harmful content.

Laundry detergent advertisement
This Chinese advertisement promotes laundry detergent. In this ad, a man with dark skin is pushed into a washing machine with the laundry detergent, and a man with light skin comes out after a wash cycle. This is a clear example of anti-dark skin messaging even though the makers refuse to admit that this was the message (Graham-Harrison, 2016).



Gucci sweater
This sweater appeared on the Gucci website in 2019. Gucci received intense backlash as many critics found that the black balaclava sweater with red lips resembled blackface (Griffith, 2019).

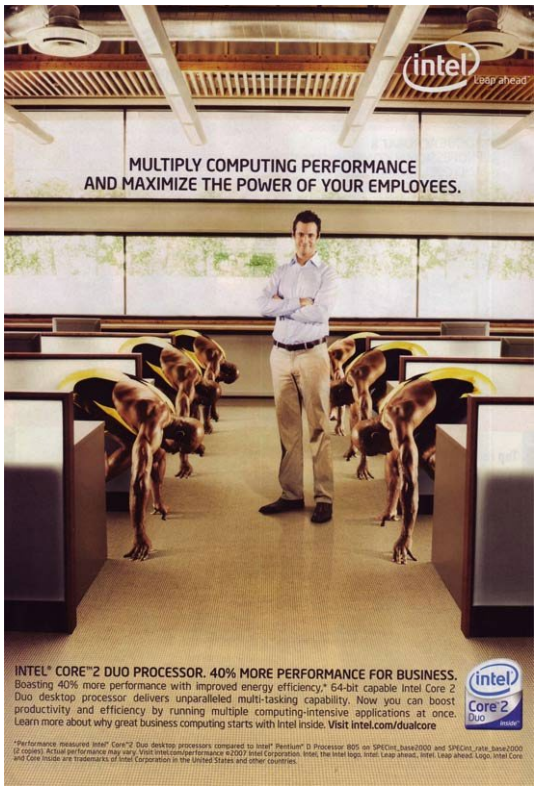
TRESemmé advertisement
This TRESemmé advertisement was used to promote hair products in South Africa. The ad describes straight hair as “normal” and “fine & flat”, while using negative works for afro textured hair such as “frizzy & dull” and “dry & damaged” (BBC, 2020). This creates a clear image of what type of hair they consider to be normal and which they consider to be a deviation from the norm. While not directly related to skin tone (as there are people with light skin with afro textured hair such as biracial people, and people with dark skin and straight hair such as South Asian people), this is still an interesting example.



Albert Heijn client profiles
The supermarket chain Albert Heijn developed client profiles that are used to train workers to identify different clients with different needs. According to Dutch daily newspaper AD, these profiles were perceived as ethnic profiling since the profile “premium” was accompanied by a drawing of a man with light skin, and the profile “city budget”, which was described as a person with a below average income, was accompanied by a drawing of a woman with dark skin (Boere, 2018).

Sony advertisement
This Sony advertisement promotes their Playstation White. This ad, which was displayed on billboards all over the Netherlands, features a light-skinned woman dressed in white, aggressively grabbing and overpowering a dark-skinned woman dressed in black. The imagery of the dominant posture of the white woman versus the submissive posture of the black woman is only amplified by the slogan (bottom left corner): White is coming (Joglar, 2017).

Nivea advertisement
This Nivea advertisement promotes their shaving products for men. The ad, which was part of their ‘Look like you give a damn’ campaign, features a freshly shaven dark-skinned man holding his ‘past’ head (big Afro and beard), ready to throw it away. The accompanying text says: Re-civilize yourself. Many felt that this ad played into the false stereotype that black people are uncivilized and savage (Sharp, 2011). There was another ad in the campaign featuring a freshly shaven man with light skin holding a head with long hair and beard with the text: 'Sin city isn’t an excuse to look like hell'. While both ads were part of the same campaign, only one of them suggested that the subject wasn’t civilized.



Intel advertisement

This Intel advertisement promotes their Core 2 Duo processor chips. It features a man with light skin standing in the middle with his arms crossed in a powerful posture, with six muscular dark-skinned men bowed down towards him in a starting position. The ad was interpreted by many as reminiscent of plantations and slavery, with a light-skinned man in a dominant position and dark-skinned men in a submissive position. This interpretation is further confirmed by the accompanying text: “maximize the power of your employees”. It also perpetuates the false stereotype that black people are only physically talented and white people are superior due to intelligence (Karanovic, 2014).

Clorox tweet

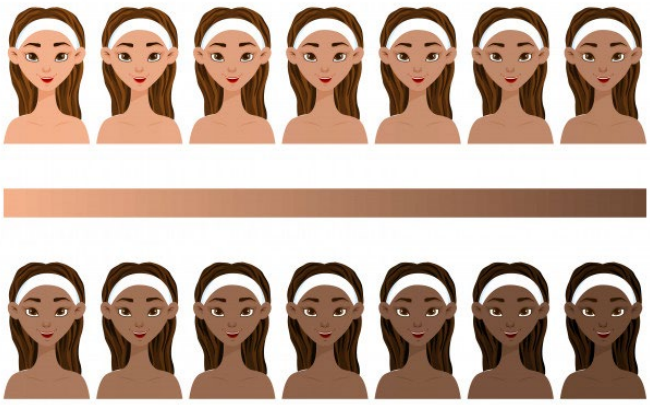
Clorox tweeted this image in 2015 with the text “New emojis are alright but where’s the bleach” when the new emojis including racially diverse emojis were announced for the first time. This tweet seemed to be aimed at the new racially diverse emojis, suggesting that the dark colors need to be bleached. According to CNN, they later claimed that “it was meant to be about all the [toilet, bathtub and red wine] emojis that could use a clean up" (Goldman, 2015).

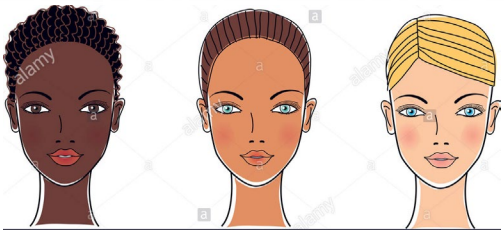
Emoji

Emojis are used in text messages to convey emotions. Many people like to choose the emoji that matches their skin tone the most to express themselves. Until the Apple iOS 8.3 update in 2015, there was no representation for other skin colors besides white. Before that, the only emoji with dark skin was a stereotypical Indian man with a turban. The new emoji colors were determined using the Fitzpatrick Skin Types (Hollander, 2013).

Baby cream

This cream, to be used for babies with diaper rashes, has “red bum” written on the front. This wording uses red skin as an indicator for when to use the product. However, people with dark skin don’t experience redness when the skin is irritated. This means parents of babies with dark skin have to figure out for themselves when it is appropriate to use this product. They have to search further to find other symptoms for diaper rash that apply to their child.



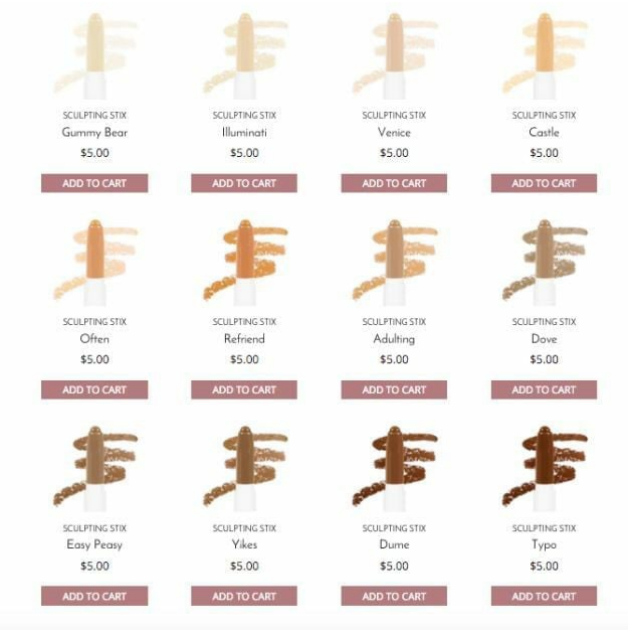


Skin color index illustrations

Drawings of people with different skin colors are typically sold as illustrations to be used in various projects. In these illustrations, typically, the same drawing is used repeatedly, and only the skin tone is changed. While this is technically skin tone inclusive (provided that the darkest skin tone is dark enough), this completely ignores the fact that skin tone is not the only difference between people from different races. Other characteristics such as hair textures and facial features (for example, nose shape) are ignored. This is best seen in the first image. The second image makes a good step towards inclusivity with the different hair textures. However, the facial features are still the same. Viewing this the other way around can help explain why it is not correct; imagine a range of images where every image has African facial features. The skin tone is made lighter until the image somewhat resembles a white person. Since this is not something that would be done, the other way is also not correct.

Sunscreen

Contrary to the popular belief that people with dark skin don’t need sunscreen, research has shown that the darkest skin tone has built-in sun protection of only SPF 13+. This is not enough as a minimum of SPF 30+ is recommended by dermatologists for daily use regardless of skin tone (Winchester Hospital, n.d.). It is, however, quite difficult for people with dark skin to find sunscreens that look good on their skin, as most sunscreens leave a grey/white/purple cast on the skin that is most visible on dark skin. This is due to pharmaceutical companies using the easiest ingredients when formulating sunscreen and these ingredients do not look good on all skin tones even if the companies advertise them as being suitable for all skin tones (Mari, 2021). Nowadays it is a bit easier to find a suitable, inclusive sunscreen but there is still much more improvement to be made.



Colourpop contour stick

Colourpop Cosmetics released a line of Sculpting Stix which are used to contour the face and are therefore made to be slightly darker than the wearer's own skin color. The darkest shade had negative names such as "Yikes" and "Typo" which illustrates anti-dark skin language.

APPENDIX B: QUESTIONNAIRE PERSONAL EXPERIENCE

Skin tone inclusion in design

Hi! Ik ben op dit moment bezig met mijn afstudeerproject voor mijn master Intergrated Product Design. Hierbij wil ik gaan kijken naar hoe mensen met een donkere huidskleur worden uitgesloten in product en service design.
Hiervoor heb ik een facebook post gemaakt en daar heb jij op gereageerd.
De volgende vragen gaan over de producten/services die je hebt benoemd. Hierbij wil ik ook graag dat je over je ervaringen verteld.
Alvast bedankt!

* Required

1. Welk product/service heb je benoemd? *

2. Hoe wist je dat het product/service niet voor jou geschikt was? *

3. Waren er alternatieven die je wel kon gebruiken? Zo ja, welke, en hoe heb je die alternatieven gevonden? *

4. Hoe voelde je je bij het feit dat je het product/service niet geschikt voor jou was door je huidskleur? (indien het geen gebruiksproduct is; hoe voel je je bij het feit dat het product niet inclusief is?) *

From Questionnaire:

"My little sister used to dance ballet and the translucent pink stockings always looked greyish on top of her skin."

"After I had my baby I was looking for baby cards to send to friends and family but I couldn't find one with a brown baby on it. I was told to visit an adoption website because they might have other cards."

"I never fully trust the diagnosis that my doctor gives me"

"I got diagnosed with vitiligo when in reality I had a fungal infection. I eventually diagnosed myself and started using antifungal cream from the drugstore. The spots are starting to go away."

"I have lupus, so I get butterfly shaped rashes. But because I have brown skin the doctors can't recognize it and they keep telling me that they don't know what it is."

"A doctor told me to get a second opinion after diagnosing me with shingles because she wasn't sure of her diagnosis. It's really bothersome, I can barely trust doctors to properly recognize my symptoms."

"It's annoying, mixed feelings but you are forced to accept it. It's disappointing that people of color experience these situations and that the medical world doesn't make enough effort to fix it."

"I didn't like my ballet stockings. On the other kids it looked really pretty and pink but on me it looked greyish. So I kept looking for thicker stockings that wouldn't show my skin through it so that my legs would also be pretty and pink. I had no idea that it wasn't possible."

"As a model I often deal with hair stylists who have no idea how to do curly hair. It doesn't come out nice and I have to pretend to like it so I don't get labeled as "difficult to work with"."

"My school pictures always came out horrible."

"I like to make towns with those little Christmas houses. Unfortunately I have only been able to find figurines with light skin. I was really disappointed."

"Back when I was involved in modeling I always had to bring my own makeup otherwise I would end up looking grey."

"I work at an after school care center and I can never find coloring pages of black people. I was really surprised."

"My orthopedist gave me an orthosis to correct my toe and I asked for a different color but they only had the color beige. I think it's shameful that to this day it's still not inclusive"

"Sometimes I see wedding reports where the person(s) with dark skin are barely recognizable."

"If you go to a random dermatologist they just stare at you with an astonished look on their face. I've experienced this too many times, even in the OLVG. I think the AMC is the only hospital in the Netherlands that has a department for special skin conditions. So if you have hyperpigmentation, something that is common among people with dark skin, it is apparently a "special skin condition".

"I feel like a second class citizen."

"I have been living in Belgium for 20 years, and I have never gotten my hair done at a European hair salon. When I did go, they told me that they couldn't do my hair. It makes me feel really sad. I can never say that I'll go to a hair salon to pamper myself."

Online:

"The inconsistencies were so glaring that for a while, I thought it was impossible to get a decent picture of me that captured my likeness. I began to retreat from situations involving group photos. And sure, many of us are fickle about what makes a good portrait. But it seemed the technology was stacked against me. I only knew, though I didn't understand why, that the lighter you were, the more likely it was that the camera — the film — got your likeness right" (Caswell, 2015).

"I tried all the soap dispensers in that restroom, there were maybe 10, and none of them worked.
Any time I went into that restroom, I had to have my friend get the soap for me" (Plenke, 2015).

"It's taken me 45 trips around the sun, but for the first time in my life I know what it feels like to have a band-aid in my own skin tone. You can barely even spot it in the first image. For real I'm holding back tears
When I saw the brown bandage, it was just beautiful. I felt a tad ridiculous feeling that way, but it really just felt like I belonged, like I was welcomed, like I was valued" (Pelletiere, 2019).

"I witnessed the update (the Sims) myself for the first time on stream with my community, and I did get so overwhelmed that I cried.
It was just such a feeling, because I was taken back to kind of an early adolescence, going to make a Sim, but couldn't make a Sim that looked like me because I didn't have the available resources" (Goodyear, 2020).

"I want to live in a world where I can walk into a store and easily, mindlessly even, purchase something that was designed with my body in mind the same way my white friends can" (Goodwin, 2021)

"Sometimes it's frustrating and annoying, but it's just how it is. The dance world is slow to accept POC (person of color) dancers, and I've just had to deal with it and do what I need to do to perform.
"I was ecstatic when I realized Suffolk was releasing new shoes. I've been wearing pink ones ever since I was a young girl, but when I heard they were creating brown ones, I couldn't believe it. I knew I had to grab a pair" (Anderson, 2021).

APPENDIX C: INTERVIEW TEACHERS

1. *Vertellen over project en stuur link MPV database.
2. Is er iets wat u heel erg opvalt of is er iets opmerkelijks?
3. Wat is uw mening over dit soort producten? Misschien kunt u een paar uitkiezen die het meest opvallen.
4. Wist u voor deze interview dat er producten bestonden die niet huidskleur inclusief zijn? Zo ja, hoe bent u er achter gekomen?
5. Nu een paar vragen over uzelf als ontwerper. Denkt u aan inclusiviteit als u zelf ontwerpt? (denk aan lichamelijke beperkingen, gender, geletterdheid)
6. Op welke momenten tijdens ontwerpen denkt u aan inclusiviteit en hoe verwerk u dat in uw ontwerpproces?
7. Wat voor effect heeft dat (of zou dat hebben) op het eindproduct?
8. Denkt u aan huidskleur inclusiviteit tijdens het ontwerpen?
9. Op welk moment denkt u er aan of op welke moment zou een u eraan moeten denken?
10. Wat voor effect zou dat hebben op het eindproduct?
11. Welke vakken geeft u en wat houden ze in?
12. Nu een paar vragen over lesgeven. Denkt u aan inclusiviteit tijdens het lesgeven (lichamelijke beperkingen, gender, geletterdheid).
13. Op welke momenten tijdens het lesgeven denkt u aan inclusiviteit en hoe verwerkt u dat in de lessen?
14. Wat voor effect heeft dat (of zou dat hebben) op de les?
15. Denkt u aan huidskleur inclusiviteit tijdens het lesgeven?
16. Op welke momenten doet u dat er zou het gedaan moeten worden?
17. Wat voor effect zou dat hebben op de lessen?
18. Ik heb een paar doelen opgesteld voor de database. Ten eerste raise awareness zodat mensen weten dat het probleem bestaat. Ten tweede Trigger self-reflection, zodat ze dan gaan nadenken over het probleem, waarom ze er niet van wisten, en kunnen ze reflecteren over hun eigen positie. Ten derde trigger self-awareness. Als ze eenmaal hebben gereflecteerd over hun eigen positie kunnen ze bewuster hun eigen ontwerpproces analyseren en hun eigen biases analyseren. Ook kunnen ze dan dit probleem herkennen in producten om hun heen. En als vierde en laatste, inspire different design behaviour. Nu kunnen ze bewuster op een diverse en inclusieve manier ontwerpen. Dus dat zijn de vier doelen. Naast de database zullen er ook guidelines zijn om ze te helpen om inclusiever te ontwerpen. Wat denkt u van de 4 doelen en aanvullende guidelines?
19. Gebaseerd op uw ervaring als ontwerper, zou zoiets u kunnen helpen?
20. Wat denkt u ervan als zoiets beschikbaar was voor professionele ontwerpers?
21. Is het iets dat u zelf zou willen gebruiken? Zo ja, op welke momenten en hoe?
22. Welke andere mogelijkheden ziet u hierin voor professionele ontwerpers?
23. Als we weer kijken naar de vier doelen en de guidelines. Gebaseerd op uw ervaring als docent, is dit iets wat studenten zou kunnen helpen?
24. Wat denkt u ervan als zoiets beschikbaar was voor studenten?
25. Is het iets dat zij zouden willen gebruiken? Zo ja, op welke momenten en hoe?
26. Welke andere mogelijkheden ziet u hierin voor studenten?

APPENDIX D: QUESTIONNAIRE STUDENTS

Questionnaire students

Thank you for taking the time to fill out my survey!
I am currently doing my IPD graduation project on inclusive design and would like to ask you a few questions about your bachelor education. This might help me to find some gaps and opportunities in the curriculum.

* Required

1. Did you do your Bachelor at TU Delft IDE? *

Mark only one oval.

- ◯ Yes
- ◯ No

Untitled Section

2. Were you aware of the fact that there are products on the market that were designed specifically with people with light skin (Caucasian) in mind? These products look odd on people with dark skin or the products don't work properly on users with dark skin. *

Mark only one oval.

- ◯ Yes
- ◯ No *Skip to question 5*
- ◯ Other: _____

Untitled Section

3. Did you learn about it in class during your bachelor's at IDE or somewhere else (please specify where if you remember)? *

4. Which product(s) did you learn about? *

Skip to question 6

Untitled Section

5. Can you imagine what such a product might be? *

Untitled Section

6. The following link will take you to a database with just a few product examples. Take a few minutes to read some of the examples.
https://docs.google.com/document/d/1rtZOFCslyS7F2Qv65m-LobkDjVAg7Ha8_9yZiqEPAgg/edit?usp=sharing *

Mark only one oval.

- ◯ Done

7. What jumps out at you the most when seeing these products? *

_____

_____

_____

_____

_____

8. What is your opinion on these products? *

_____

_____

_____

_____

_____

9. Did you know that all designers have certain biases that make them unintentionally exclude people/groups of people from their design? *

Mark only one oval.

- ◯ Yes
- ◯ No *Skip to question 11*
- ◯ Other: _____

Untitled Section

10. What kind of biases do you know about? *

Untitled Section

11. Some examples: People can be biased about skin tone, gender and physical/mental disabilities *

Mark only one oval.

- ◯ Got it

12. Did you receive in-depth knowledge about inclusive design during your bachelor? For example; examples of non-inclusive products, how to design inclusively, how to look past your biases, the effects of non-inclusive products on people and society, how to incorporate inclusion in your design process? *

13. If applicable, during which courses did you receive this information? *

14. Would you have liked to learn more about inclusive design as a whole during your bachelor? *

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Other: _____

15. Which bachelor courses would have been suitable for topics like these? *

16. Do you think that knowing about inclusive design has an effect on the designer and the final product? Please explain why yes or no *

17. If there had been a database with examples of non-inclusive products (any theme) along with guidelines on how to design inclusively and take a specific group into consideration, would you have used it during your studies? If yes, how? If no, why not? *

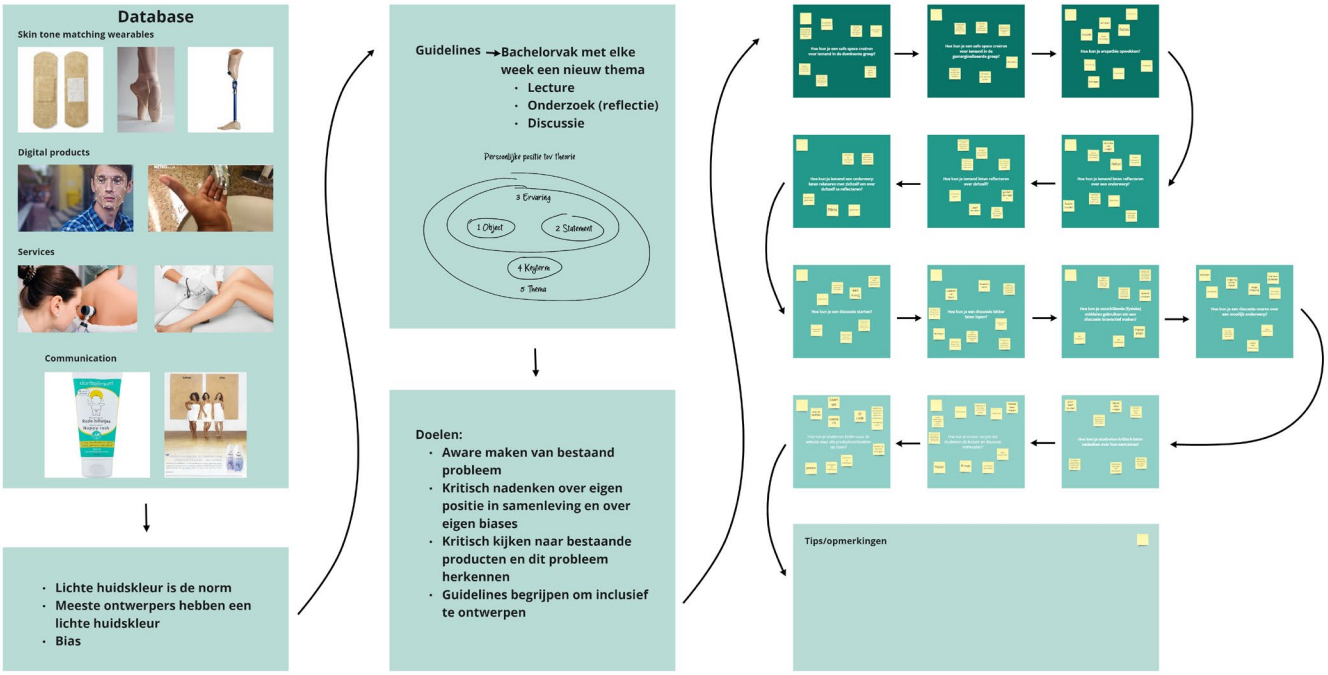
Thank you for your time!

18. Any comments or tips? Optional: Fill in email address to get an update when the project is finished

APPENDIX E: RESEARCH AREAS AND THEIR OUTCOMES

Area of research (see page 10)	**Insight (see page 39)**	**Guideline (see page 47)**
All 4 clusters and also other research areas like designer bias	1	1-2
Cluster Technology & Software, mainly from products like self driving cars that impact pedestrians who are not directly using the product	2	3
All 4 clusters but mainly cluster like technology & software with products like facial recognition	3	4-5
Mainly the cluster inadequate color selection but also unequal communication & representation with products like the “flesh” crayon	4	6
Cluster Undereducated service providers	5	7
Cluster technology and software	6	8
All four clusters	7	9-10
Cluster Communication & representation	8	11
Cluster communication and representation	9	12
Interviews with teachers	X	13

APPENDIX F: BRAINSTORM SESSIONS



APPENDIX G: IDEAS

Component 1:
As was discovered during the research and interviews with IDE teachers, examples are a great teaching tool, especially if there are many examples as this helps them to get a better idea of what the topic is about. For this, the products that were found and analyzed during the Exploration phase of this project can serve as the examples. The examples can best be shown in the form of an online digital database as it allows for more product examples to easily be added since this is a current and evolving topic. Anything other than an online digital database, like a book(let), would not allow for the database to stay current, and for everyone to have access to the latest content. An online digital database can also be made easily accessible for students and other people. As some of the product examples are marketing related, it could potentially also be consulted by a marketer or anyone else who can benefit from it. Tags can be added for easy searching if a person is looking for a specific product. Another element that can aid in easy searching is dividing the examples in different domains. The student (or someone else) can then search for product examples in the domain that matches with their project.
The product examples were divided into these different domains by determining the context in which and the reason why the product is used. The division of the products in different domains can be found in the tables below. This feature allows the student to go to a specific product issue (Inadequate Color Selection, Failing Technology & Software, Undereducated Service Providers, Unequal Communication & Representation) and choose a specific domain to find examples of what has gone wrong and what to avoid. What will not be a part of the Wonder Assignment, but can be used later on, is that the student can then go to the skin tone inclusive guidelines to get tips on what they could do to avoid these issues. Therefore the skin tone inclusive guidelines will also be on the website along with the collection of products.

Medical	Fashion	Sports & culture
(Flat on the skin) Adhesive bandage Elastic bandage Kinesiology tape Birth control sticker Nicotine bandaid Compression stockings Elastic knee support band Elastic elbow support band Orthotic insoles Occlusion patch Arthritis gloves (3d object) Prosthesis (replacement) Orthosis for toes (addition) Hearing aid (addition)	Underwear Shapewear Pantyhose Socks Sheer clothing	Ballet shoes Ice skates Microphone Halloween/prank products

Personal care/ health	Security/safety	Communication	Transportation
AI in healthcare Soap dispenser Smart watches Philips Lumea	Facial recognition	Twitter auto-zoom Zoom background HP user tracking 3D scanner Photo development FaceApp/Snapchat beautification filter HP face tracking FaceApp	Self driving cars

Medical	Cosmetic
Dermatology	Hairdressing Makeup artistry Laser hair removal Tattooing

Cosmetics	Personal care/health	Recreation	Miscellaneous
ABH lipstick Colourpop contour sticks Tarte foundation	Baby ointment Pedicure congress Dove advertisement Chinese laundry detergent ad Medical textbooks	Crayon Melange paint Dolls Children's books The Sims	Store mannequin Baby cards Christmas village figurines

Secondly, there needs to be a discussion probe as part of the lesson plan that is used in the classroom that the teacher can incorporate into the lesson.

Component 2:
As was explained in in this report, the discussion part of the assignment in the UH course does not have a specific structure. Because of this, the focus of the intervention will be the discussion part of the Wonder Assignment, as this still has free space where something new can be introduced. This discussion will have"trigger self-reflection" and "trigger self-awareness" as its goals.
To stimulate collaboration between the students so they learn from each other's perspectives as they become more comfortable with the topic, this discussion probe needs to be a physical product that is put on the table during the discussions.

APPENDIX H: TEST 1

This concept was further developed before the first test by reviewing the insights acquired from the creative sessions and ideation. Originally, the concept consisted of Question cards and Statement cards. Experience cards were also added to add the element of storytelling as this is a powerful tool to help raise empathy, especially empathy towards people that one might not typically meet in their daily lives. This brings back the topic of **exposure** that was discussed several times in this report.
After realizing that specific Experiences, Statement, and Question cards belong together, I decided to turn the concept into triple cards. Each folded card contains three cards added together, an Experience, Statement, and Question card.

The first card, the Experience card, contains a quote from a real person to allow the students to learn about other people's experiences and imagine themselves being in their positions.
The second card, the Statement card, contains a statement regarding a moral/ethical issue relating to the designer. This allows the students to discuss the designer's responsibility from an ethical standpoint.
The third and last card, the Question card, has a question regarding the product, its design, and its design process. With this card, the students are able to explore different solutions for skin tone inclusive design.
An example of a prototype of a triple card can be seen below. Three diffferent cards were used for the test.

EXPERIENCE	STATEMENT	QUESTION
"I tried all the soap dispensers in that restroom, there were maybe 10, and none of them worked. Any time I went into that restroom, I had to have my friend get the soap for me."	The designer only has to take the majority into account when determining the target group and selecting people for user research and tests. Agree/Disagree	How do different skin colors influence how well a product functions?

The first iteration was done prior to the testing phase. For the second iteration, the cards were tested with a group of students.

Test setup:
For this test, four students participated via Zoom as I was not in the Netherlands. This test also occurred during the summer vacation and because of this I could not get access to bachelor students as I did not know them personally. For this reason, the test was done with four IDE Master students who have all completed their Bachelor at IDE. The Wonder Assignment requires three students per group but another student was added to the test to gain more insights but still keep the group small.
The test was conducted over the course of two days. On the first day, the students were given a mock lecture and received their assignment the way it is described in the Wonder Assignment portion of the Understanding Humans course. On the second day, the participants gave their presentation, which was based on the results from their homework, and afterward, they had their discussion using the concept described above.
The first card was sent to a single participant to allow them to read the experience out loud. This was done to simulate a scenario where the students would sit around a table and one person would grab one card. It was also done this way to determine whether reading and hearing an experience out loud has a bigger impact

than just reading it silently. Following this action, the card was sent to the rest of the students and they were able to read it for themselves and start the discussion. The QR code was simulated by sending a link in the Zoom chat and the participants could click on it if they needed more information to continue the discussion. After they were done discussing a card, the next card was sent to a new participant and so forth until all three cards used for the test were discussed.

After the discussion, they were also asked to fill in a questionnaire to reveal how they experienced the test.

Several questions needed to be answered in this test:
- How do the students experience reading the “Experience” out loud?
- How does the concept function in the form of the triple card?
- How does the transition flow from the presentation to the discussion?
- How should the cards be presented during the discussion?
- At what moment and how will a new card be picked for a new discussion?

These Insights were gathered through observation during the test and with the help of the questionnaire that the participants filled out after the test. This questionnaire can be found in Appendix I.

Insights after the first test:
-

- The contents of the cards do not provide a structure for the discussion. The participants jumped fromone card to another in an organic manner (this isn’t a negative or positive insight).
- The ‘Question’ card is sometimes forgotten. The ‘Experience’ card gets the most attention, and after that they typically move on to the ‘Statement’ card, but by the end I had to prompt them to answer the question.
- A link that leads to an article provides interesting information but an article is too long to read during a discussion.
- Sometimes more context is necessary, for example when a student doesn’t know much about the inner workings of a product.
- The transition from the presentation to the discussion isn’t clear, the participants thought they would be discussing the presentations.
+ Reading the ‘Experience’ out loud is not necessary as it is not coming from a person who could have experienced it themselves.
+ The contents of the cards are able to provide subjects and topics for the discussion. Several participants mentioned that otherwise they wouldn’t know what to talk about.
+ One participant mentioned that they liked that the contents of the cards are very specific, this means that the discussion is about something different with each card, as opposed to general topics that have overlap.
+ The product examples provided on the “website” were helpful when choosing an object for the assignment.
+ The conversation could also become quite playful even though it is a sensitive topic, for example when the participants were thinking of solutions for color matching wearables.
+ All participants found the experience to be educational and they felt that they had learned a lot.
+ They felt quite comfortable with a small group, although this might also be because it was via Zoom and they were each in their own home.
+ Several participants mentioned that they appreciated that the lecture was neutral and they did not feel attacked or like they were being blamed.
  One participant mentioned that it was interesting that the lecture began quite broad, describing exclusion in design in general, and then zoomed in on skin tone exclusion.

APPENDIX I: QUESTIONNAIRE AFTER TEST 1

Skin Tone Inclusion in Product Design

* Required

1. Welke huidskleur heb je? *

Mark only one oval.

- ◯ 6
- ◯ 5
- ◯ 4
- ◯ 3
- ◯ 2
- ◯ 1

2. Had je al kennis over dit onderwerp voor de test?

Mark only one oval.

- ◯ Veel
- ◯ Meer dan gemiddeld
- ◯ Gemiddeld
- ◯ Een beetje
- ◯ Niks

3. Welke Master doe je of heb je gedaan?

Mark only one oval.

- DfI
- IPD
- SPD

4. Wat is het eerste dat bij je opkwam tijdens de lecture (dag 1)? *

5. Had je negatieve gevoelens/gedachtes tijdens de lecture (dag 1)? Zo ja, welke en waarom? *

6. Had je positieve gevoelens/gedachtes tijdens de lecture (dag 1)? Zo ja, welke en waarom? *

7. Wat is je het meest bijgebleven? *

8. Herken je jezelf in dit onderwerp? Zo ja, op welke manier? Zo nee, waarom niet? *

9. Begreep je de opdracht toen het werd uitgelegd? Zo nee, wat begreep je niet? En wat zou je nodig hebben om het beter te begrijpen? *

10. Had je de database met product nodig om een object uit te kiezen? *

11. Had je moeite met de opdracht terwijl je ermee bezig was? Zo ja, waar had je moeite mee? *

12. Wat vond je van de presentaties van anderen? *

13. Had je zin in de discussie of zag je ertegen op? Zo ja/nee, waarom? *

14. Had je zelf een onderwerp in gedachten waarover je wilde discussiëren (dus iets dat niet op de Cards stond)? Zo ja, welke? *

15. Wat vind je van het feit dat er onderwerpen werden aangeboden (de Cards)? *

16. Wat vond je van de onderwerpen? *

17. Had je negatieve of positieve gevoelens tijdens het lezen van de “Experiences”? Zo ja, welke en waarom? *

18. Hadden de “Experiences” toegevoegde waarde? Zo ja, hoe? Zo nee, waarom? *

19. Had het voorlezen van de "Experiences" teogevoegde waarde? Zo ja, hoe? Zo nee, waarom? *

20. Hadden de “Statements” toegevoegde waarde? Zo ja, hoe? Zo nee, waarom? *

21. Hadden de “Questions” toegevoegde waarde? Zo ja, hoe? Zo nee, waarom? *

22. Vond je de links handig? Zo ja, waarom? Zo nee, waarom niet? *

23. Liep de discussie vloeiend? Graag uitleggen *

24. Vond je dat er iets miste tijdens de discussie? Zo ja, wat? Zo nee, waarom? *

25. Hoe voelde je je tijdens de discussie? *

26. Hoe voelde je je na de discussie? *

27. Was deze ervaring leerzaam? Zo ja, hoe? Zo nee, waarom? *

28. Wat zou je persoonlijk nodig hebben om zo'n college/presentatie/discussie aangenaam (of aangenamer) te maken? *

29. Wat zou je persoonlijk nodig hebben zodat de ervaring leerzaam (of nog leerzamer) zou zijn? *

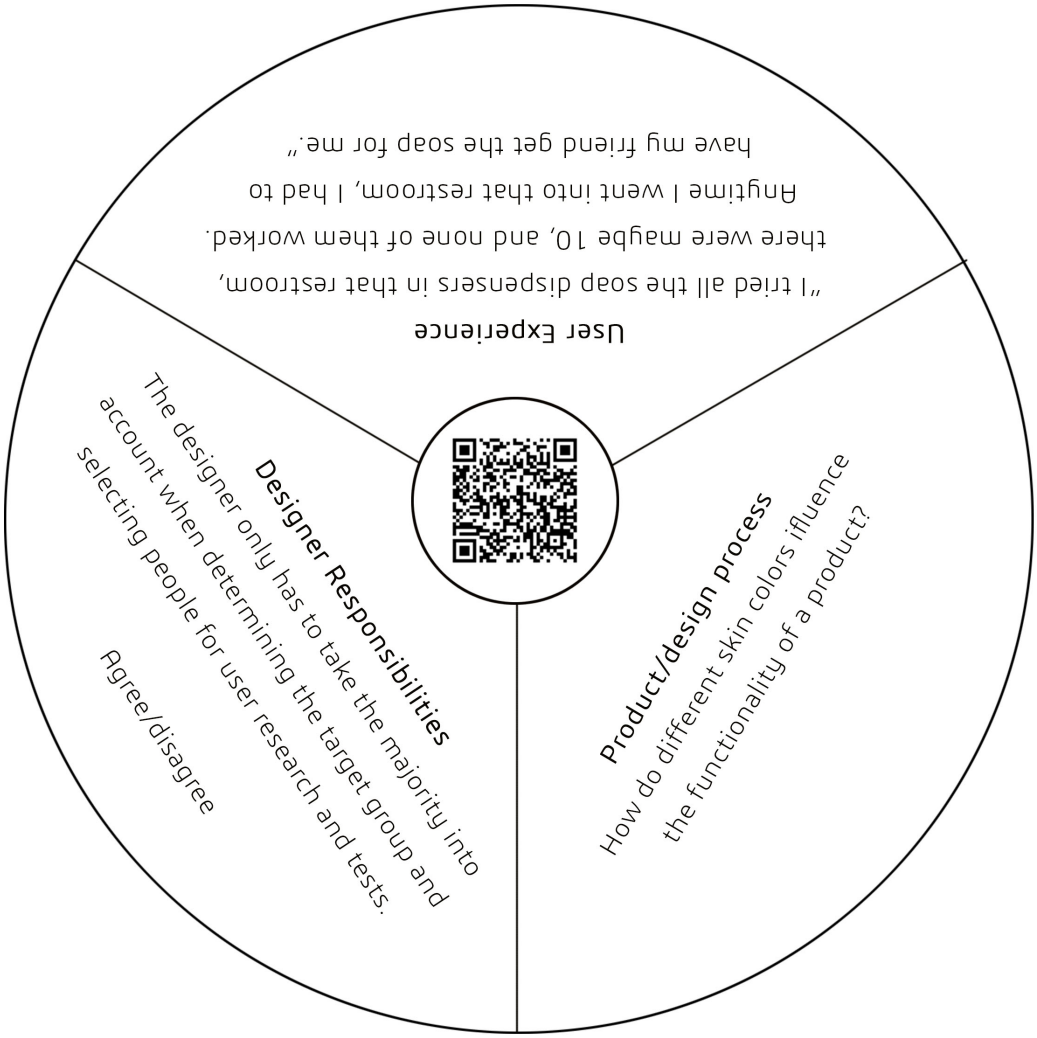
30. Extra tips en tops?

APPENDIX J: TEST 2

From theinsights from test 1 several points need to be taken into account for the next iteration:

- How can all cards be used during the discussion without the attention going to just one or two?
- The link should lead the student to a much shorter piece of text with additional information.

Using the insights from the first test, the second iteration resulted in the following concept:



This round card features three sides that each represents a role, each student is assigned one of the sides and is therefore also assigned a role. The card is placed in the middle of the table with each side facing a student.
The first side is 'User Experience'. The student that is assigned this role must participate in the discussion as a designer who represents the users. Which users the student decided to represent is up to them.
The second side is 'Designer Responsibilities'. The student that is assigned this role must participate in the discussion as a designer that acts from a viewpoint of morals and ethics regarding the designer's responsibilities.
The third side is 'Product/Design Process'. The student that is assigned this role must participate in the discussion as a designer that focuses on the product, the design process, the technology (and its limitations) etcetera.

After finishing a card, a new card is picked and the roles are switched so that all students are able to engage in all the roles. The students also receive an ID card that they must place in front of them so that everyone knows what their role is in case they want to rotate the card to read.

Second test:
To test this concept, three participants (IDE Master students) gathered in a conference room at the faculty of Industrial Design Engineering. This way the test could be done with physical cards (approximately 20 cm in diameter) that were placed on the table as this also provides the opportunity to test the form of the card.

Several questions needed to be answered in this test:
- How does the product function in the round form?
- How do the participants experience the different roles?
- How does the QR code contribute to the discussion?

Insights:
- The round form is pleasant in the context of three students sitting at a table together
- The QR code was not the best way to present additional information, the students would have preferred if this information was also on the card
- The different roles were quite limiting during the discussion and the students did not stick to them otherwise they would not have been able to say what they wanted to say.

These insights were used to iterate for the third time and resulted in the final concept. This concept is presented in chapter 6.5

APPENDIX K: QUESTIONNAIRE AFTER TEST 2

Skin Tone Inclusion in Product Design

* Required

1. Welke huidskleur heb je? *

Mark only one oval.

- 6
- 5
- 4
- 3
- 2
- 1

2. Had je al kennis over dit onderwerp voor de test?

Mark only one oval.

- Veel
- Meer dan gemiddeld
- Gemiddeld
- Een beetje
- Niks

3. Welke Master doe je of heb je gedaan?

Mark only one oval.

- DfI
- IPD
- SPD

4. Wat is het eerste dat bij je opkwam tijdens de lecture (dag 1)? *

5. Had je negatieve gevoelens/gedachtes tijdens de lecture (dag 1)? Zo ja, welke en waarom? *

6. Had je positieve gevoelens/gedachtes tijdens de lecture (dag 1)? Zo ja, welke en waarom? *

7. Wat is je het meest bijgebleven? *

8. Herken je jezelf in dit onderwerp? Zo ja, op welke manier? Zo nee, waarom niet? *

9. Had je de database met producten nodig om een object uit te kiezen voor de opdracht? *

10. Had je moeite met de opdracht terwijl je ermee bezig was? Zo ja, waar had je moeite mee? *

11. Wat vond je van de presentaties van anderen? *

12. Had je zin in de discussie of zag je ertegen op? Zo ja/nee, waarom? *

13. Had je zelf een onderwerp in gedachten waarover je wilde discussiëren (dus iets dat niet op de Cards stond)? Zo ja, welke? *

14. Wat vind je van het feit dat er onderwerpen werden aangeboden (de Cards)? *

15. Wat vond je van de ronde vorm van de Cards? *

16. Wat vond je van de 3 vakken met verschillende rollen? (denk aan leesgemak, verdelen van rollen etc) *

17. Had je de ID cards nodig om te onthouden welke rol je had? *

18. Wat vond je van de onderwerpen op de Cards? *

19. Wat vond je van de rol "user experiences"? *

20. Wat vond je van de rol "designer responsibilities"? *

21. Wat vond je van de rol "product/design process"? *

22. Had je de voorbeelden op de Cards nodig om te weten hoe je de discussie kon invullen in de verschillende rollen? *

23. Hoe had je het ervaren om in een rol te moeten blijven tijdens de discussie? *

24. Vond je de QR code handig? Zo ja, waarom? Zo nee, waarom niet? *

25. Liep de discussie vloeiend? Graag uitleggen *

26. Vond je dat er iets miste tijdens de discussie? Zo ja, wat? Zo nee, waarom? *

27. Hoe voelde je je tijdens de discussie? *

28. Hoe voelde je je na de discussie? *

29. Was deze ervaring leerzaam? Zo ja, hoe? Zo nee, waarom? *

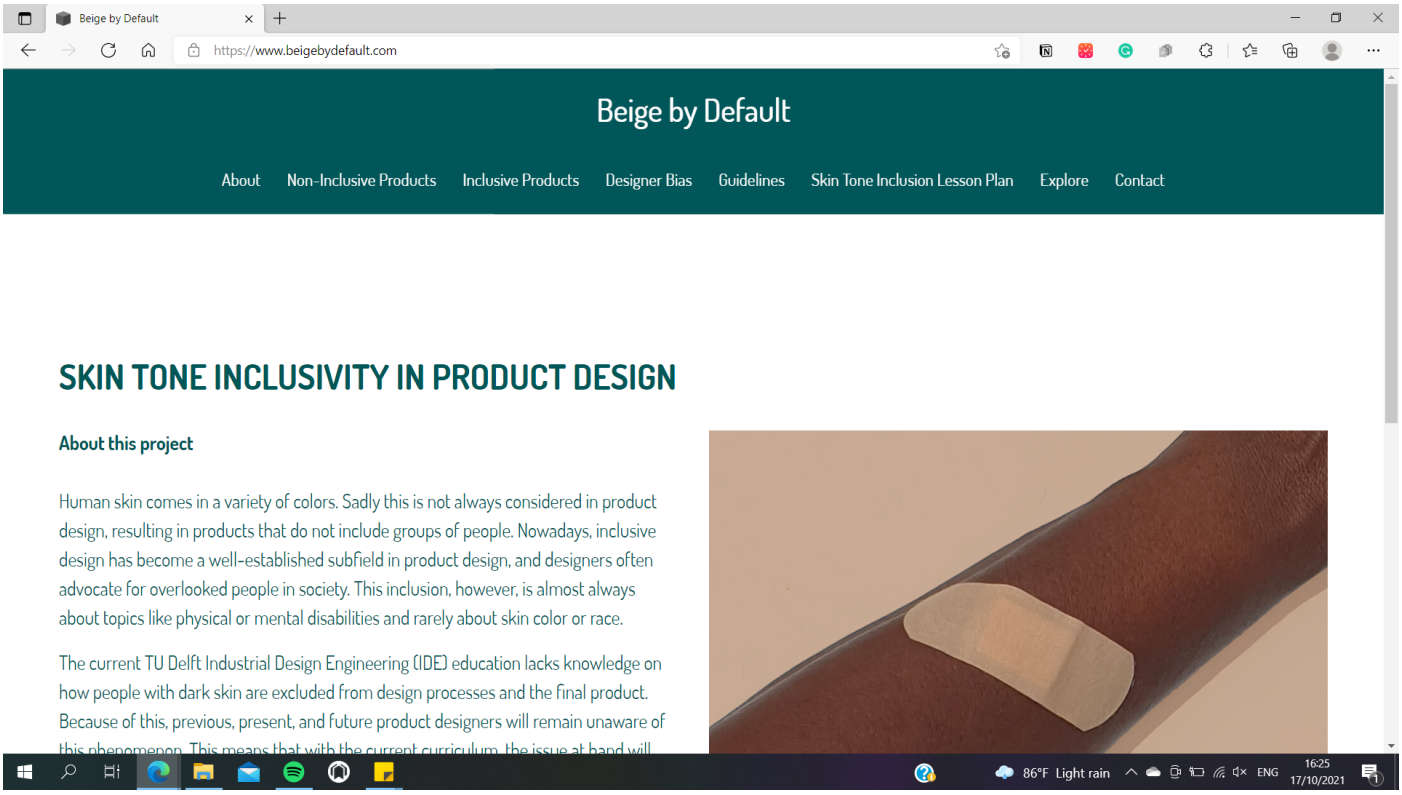
30. Wat zou je persoonlijk nodig hebben om zo'n college/presentatie/discussie aangenaam (of aangenamer) te maken? *

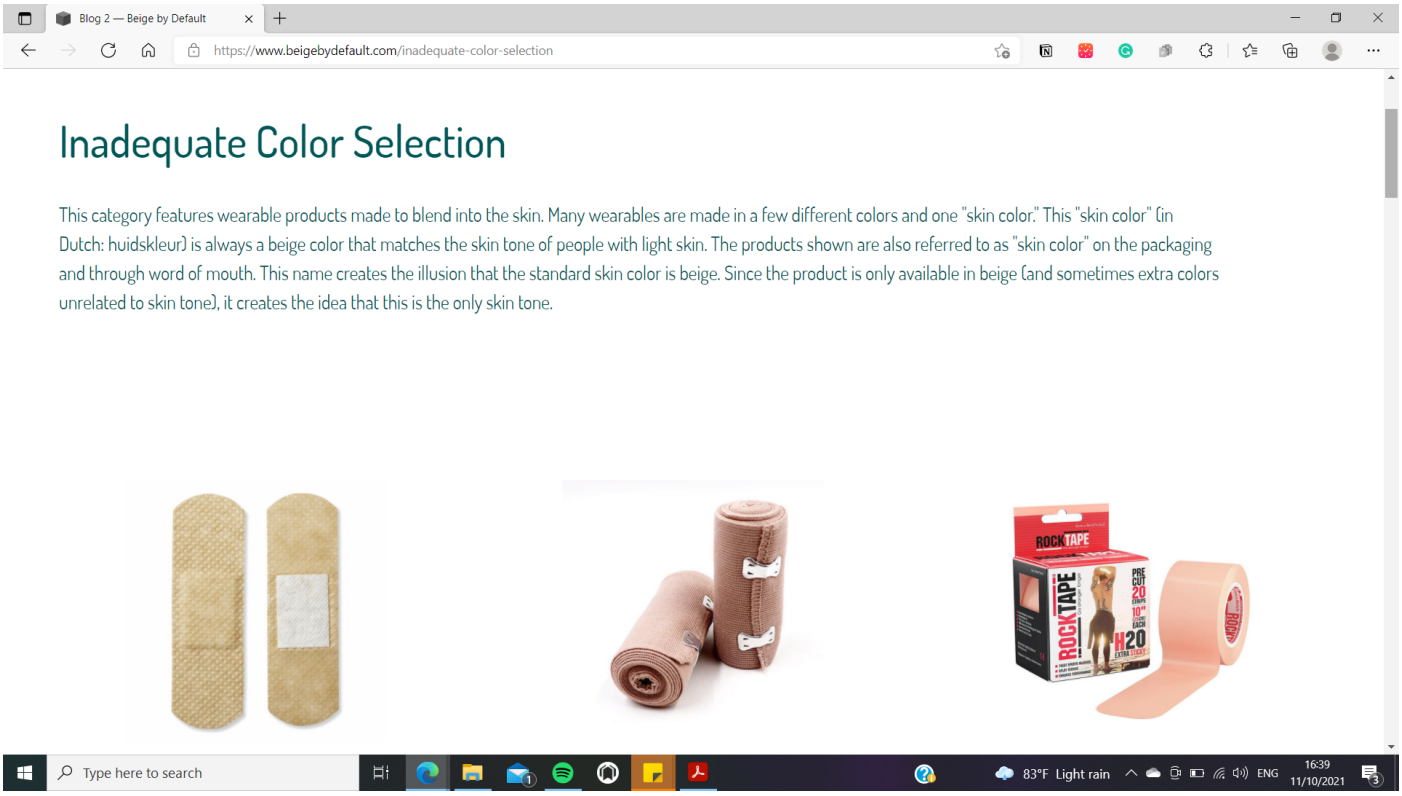
31. Wat zou je persoonlijk nodig hebben zodat de ervaring leerzaam (of nog leerzamer) zou zijn? *

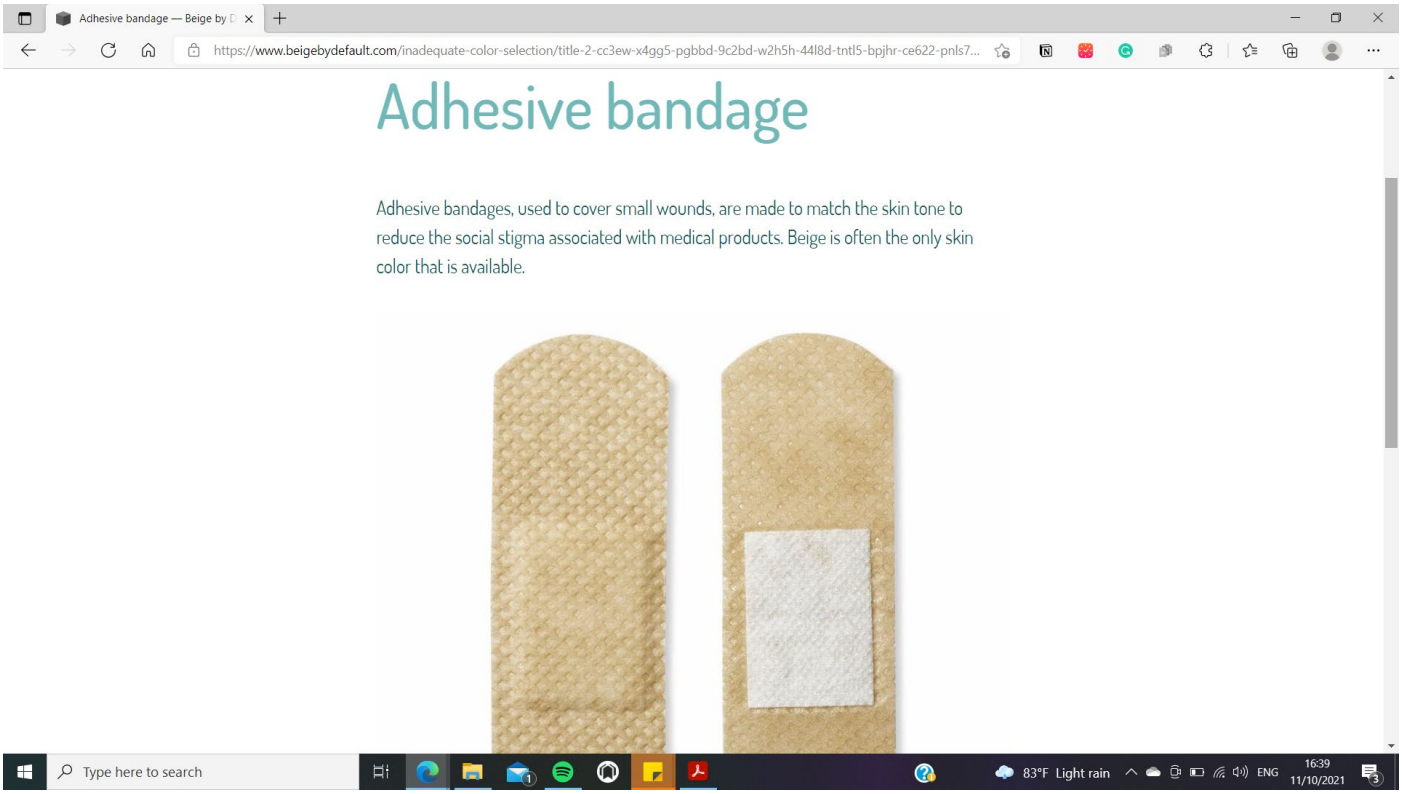
32. Extra tips en tops?

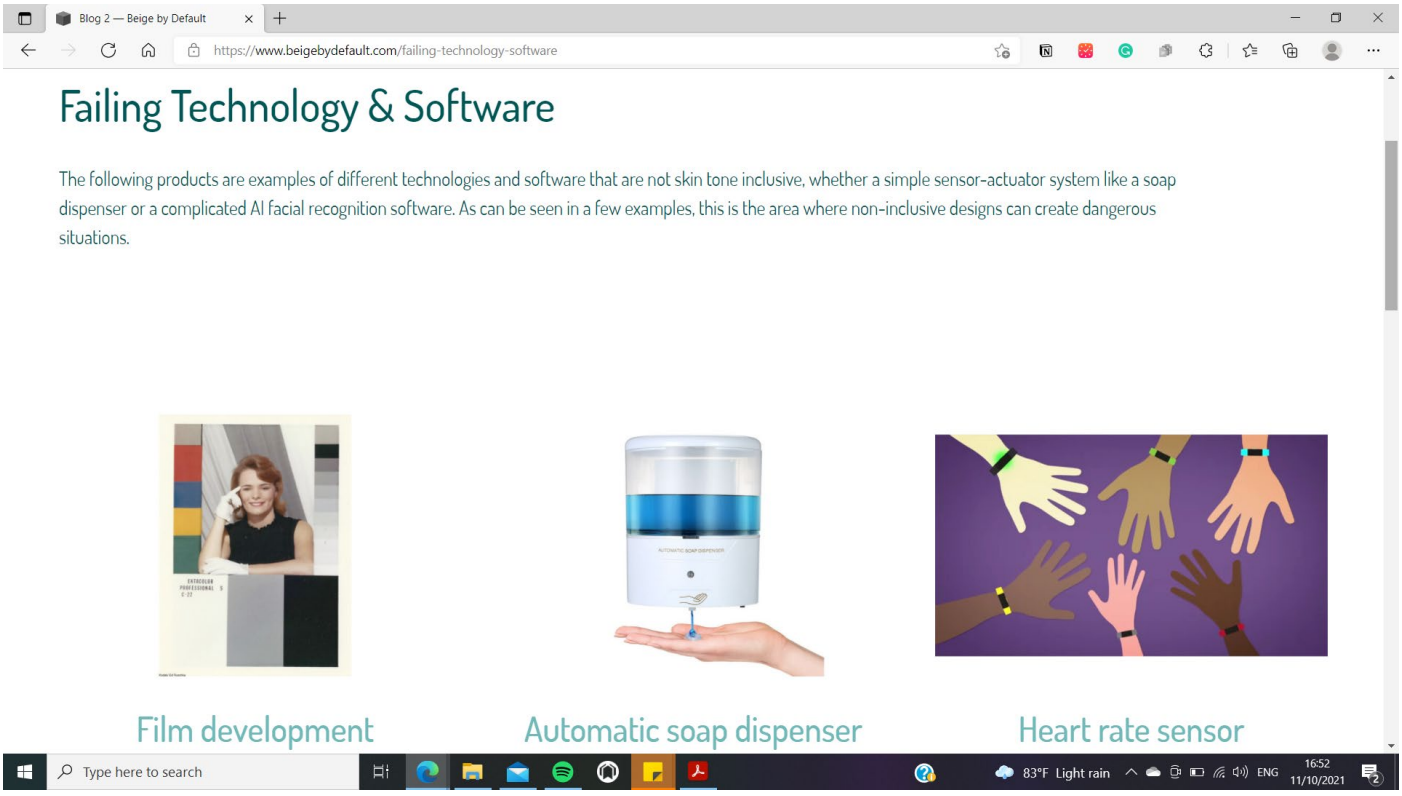
APPENDIX L: SCREENSHOTS WEBSITE

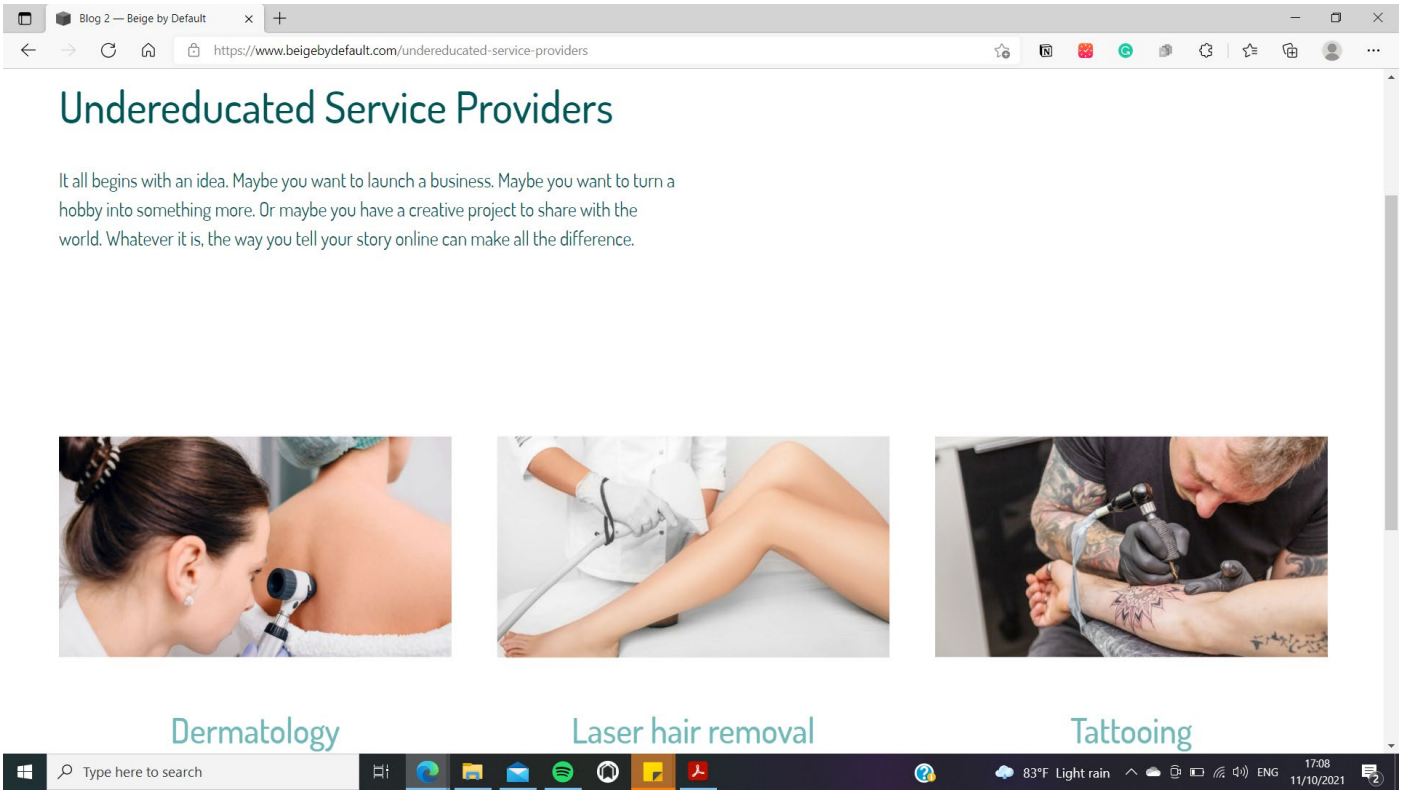
Consult chapter 6.5 for an explanation of each page

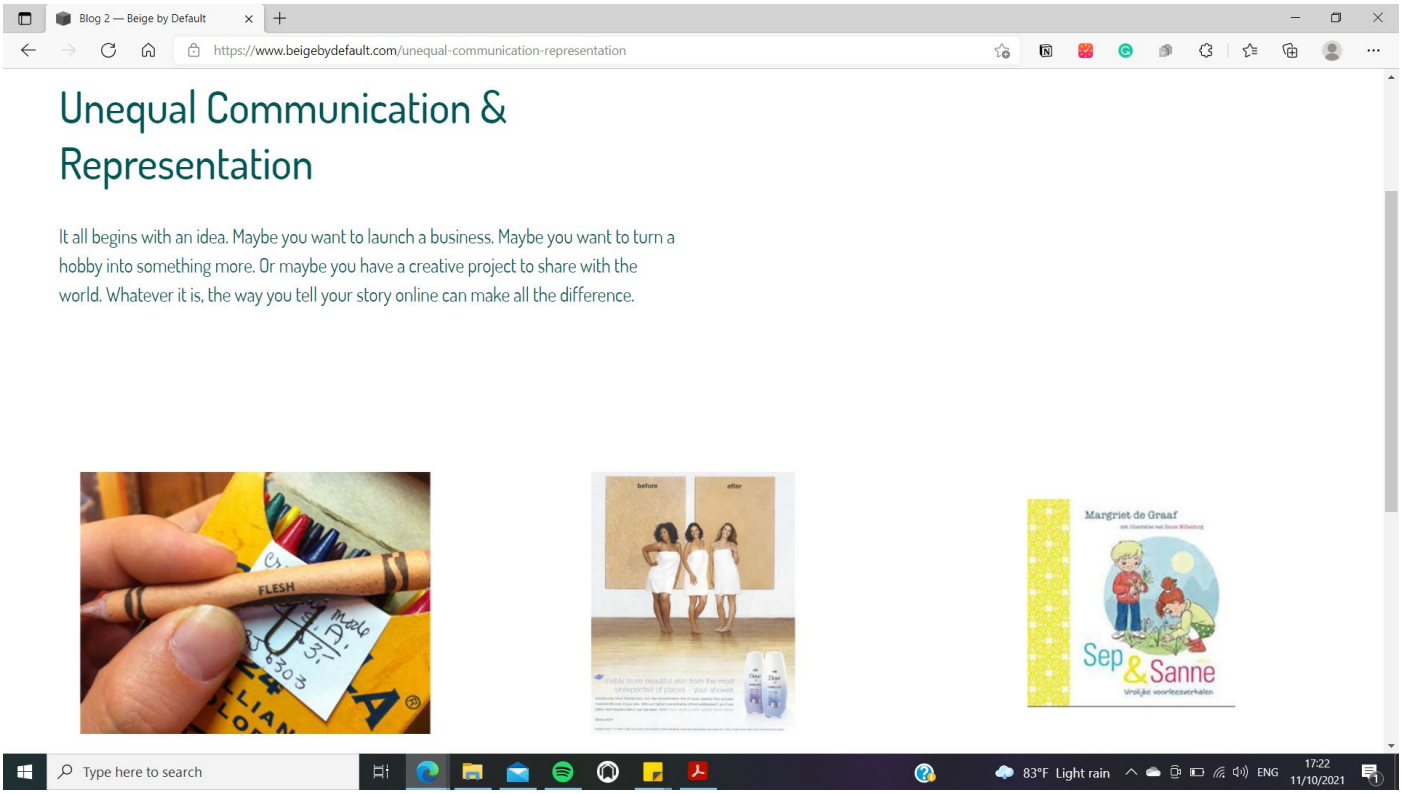


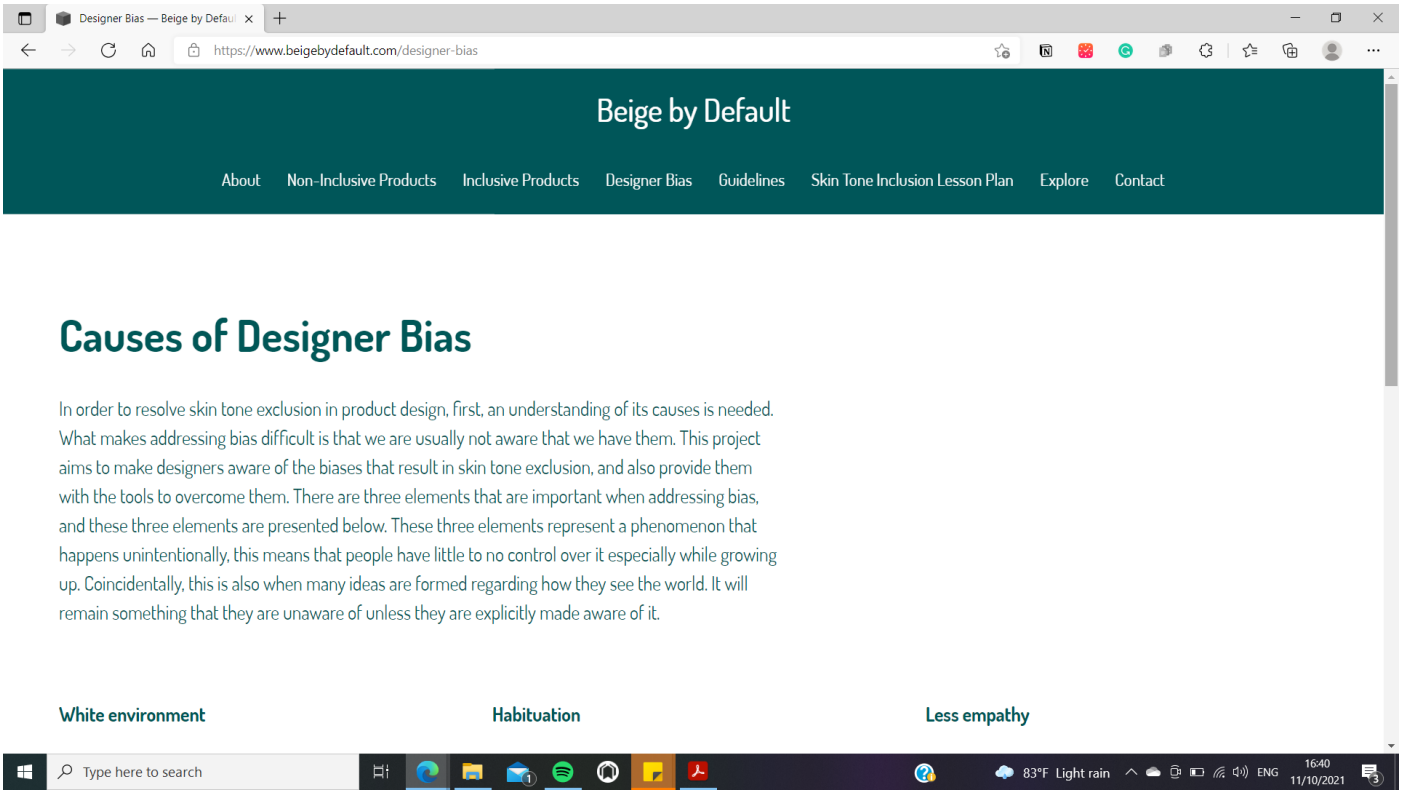


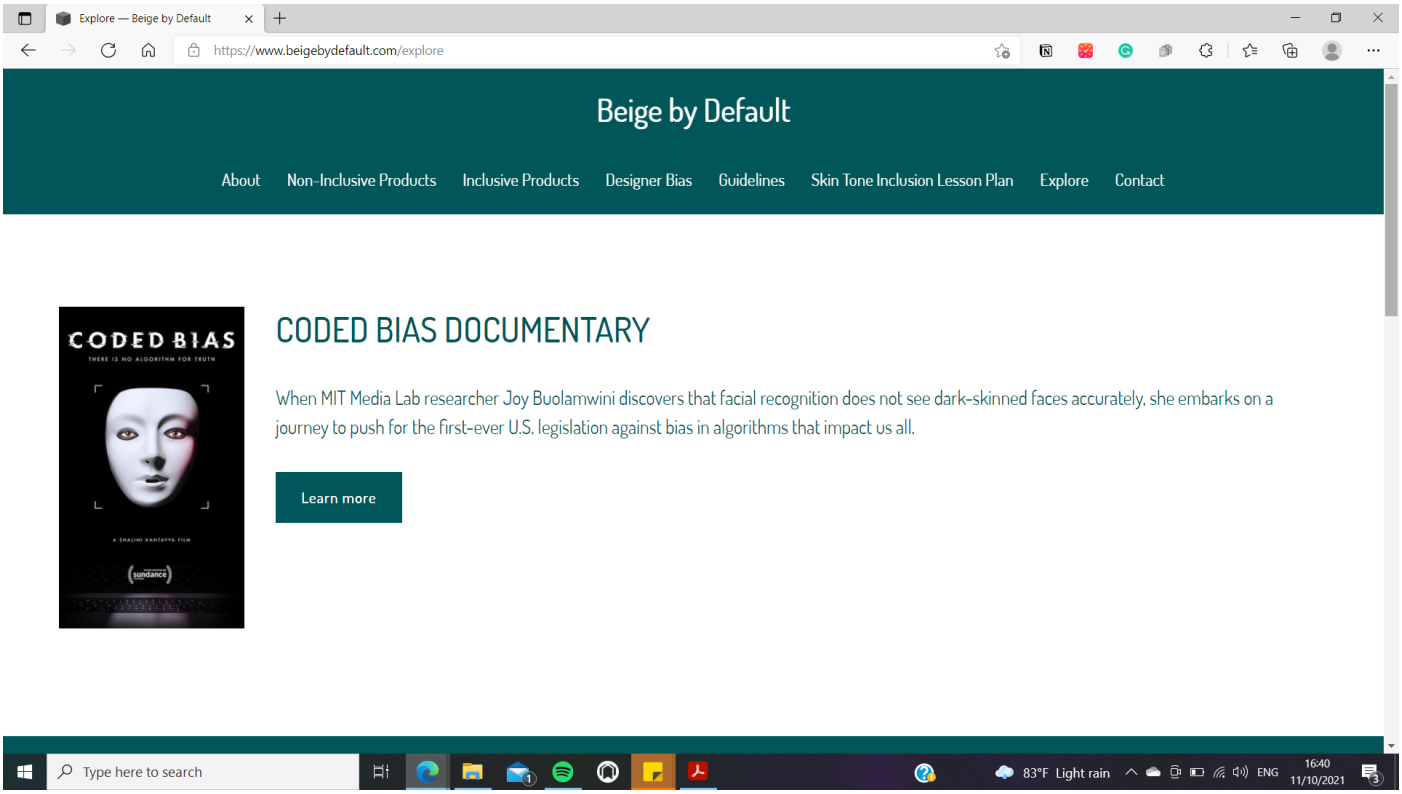

Adhesive bandage — Beige by D
https://www.beigebydefault.com/inadequate-color-selection/title-2-cc3ew-x4gg5-pgbbd-9c2bd-w2h5h-44l8d-tntl5-bpjhr-ce622-pnls7...
Adhesive bandage
Adhesive bandages, used to cover small wounds, are made to match the skin tone to reduce the social stigma associated with medical products. Beige is often the only skin color that is available.
Type here to search
83°F Light rain
ENG
16:39
11/10/2021


Blog 2 — Beige by Default
https://www.beigebydefault.com/failing-technology-software
Failing Technology & Software
The following products are examples of different technologies and software that are not skin tone inclusive, whether a simple sensor-actuator system like a soap dispenser or a complicated AI facial recognition software. As can be seen in a few examples, this is the area where non-inclusive designs can create dangerous situations.
Film development
Automatic soap dispenser
Heart rate sensor
Type here to search
83°F Light rain
ENG
16:52
11/10/2021


Blog 2 — Beige by Default
https://www.beigebydefault.com/undereducated-service-providers
Undereducated Service Providers
It all begins with an idea. Maybe you want to launch a business. Maybe you want to turn a hobby into something more. Or maybe you have a creative project to share with the world. Whatever it is, the way you tell your story online can make all the difference.
Dermatology
Laser hair removal
Tattooing
Type here to search
83°F Light rain
ENG
17:08
11/10/2021


Blog 2 — Beige by Default
https://www.beigebydefault.com/unequal-communication-representation
Unequal Communication & Representation
It all begins with an idea. Maybe you want to launch a business. Maybe you want to turn a hobby into something more. Or maybe you have a creative project to share with the world. Whatever it is, the way you tell your story online can make all the difference.
FLESH
before
after
Margriet de Graaf
Sep & Sanne
Vrolijke voorleesverhalen
Type here to search
83°F Light rain
ENG
17:22
11/10/2021


Designer Bias — Beige by Default
https://www.beigebydefault.com/designer-bias
Beige by Default
About
Non-Inclusive Products
Inclusive Products
Designer Bias
Guidelines
Skin Tone Inclusion Lesson Plan
Explore
Contact
Causes of Designer Bias
In order to resolve skin tone exclusion in product design, first, an understanding of its causes is needed. What makes addressing bias difficult is that we are usually not aware that we have them. This project aims to make designers aware of the biases that result in skin tone exclusion, and also provide them with the tools to overcome them. There are three elements that are important when addressing bias, and these three elements are presented below. These three elements represent a phenomenon that happens unintentionally, this means that people have little to no control over it especially while growing up. Coincidentally, this is also when many ideas are formed regarding how they see the world. It will remain something that they are unaware of unless they are explicitly made aware of it.
White environment
Habituation
Less empathy
Type here to search
83°F Light rain
ENG
16:40
11/10/2021


Explore — Beige by Default
https://www.beigebydefault.com/explore
Beige by Default
About
Non-Inclusive Products
Inclusive Products
Designer Bias
Guidelines
Skin Tone Inclusion Lesson Plan
Explore
Contact
CODED BIAS
CODED BIAS DOCUMENTARY
When MIT Media Lab researcher Joy Buolamwini discovers that facial recognition does not see dark-skinned faces accurately, she embarks on a journey to push for the first-ever U.S. legislation against bias in algorithms that impact us all.
Learn more
Type here to search
83°F Light rain
ENG
16:40
11/10/2021

APPENDIX M: CARD SET

These are just a few examples of possible cards

30cm

Product Design

How do different skin tones influence how well a product functions?

Designer Responsibilities

The designer only has to take the account when determining the majority into account when determining the target group and selecting people for user research and tests.

Agree/Disagree

Automatic soap dispensers emit IR light that reflects off of the surface of the hand back to the sensor. If the hand is dark, it absorbs the light instead of reflecting it and the device will not react.

User Experience

"I tried all the soap dispensers in that restroom, there were maybe 10, and none of them worked. Anytime I went into that restroom, I had to have my friend get the soap for me".

30cm


Agree/Disagree
When designing a product to be used for a service the designer must assess the service provider's previous education.
Designer Responsibilities
Product Design
How would you design a product for a user that lacks the necessary knowledge?
Dermatologists diagnose and treat skin conditions. People with dark skin are often misdiagnosed because dermatologists are trained to diagnose conditions on light skin and do not know how to recognize the same conditions in darker skin.
User Experience
"I got diagnosed with vitiligo when in reality I had a fungal infection. I eventually diagnosed myself and started using antifungal cream from the drugstore. The spots are starting to go away."

30cm


Product Design
Can you think of solutions for skin tone inclusive wearables?
Designer Responsibilities
The designer can choose to only make the product in one color to keep production simple and economical.
Agree/Disagree
Orthoses are used to brace and correct different body parts. They are made in a skin tone matching color to reduce the social stigma associated with medical products. Beige is often the only skin color that is available.
User Experience
"My orthopedist gave me an orthosis to correct my toe. I asked for a different color but they only had the color beige"

SKIN TONE INCLUSIVE DESIGN (HYPOTHETICAL) STARR REFLECTION

INSTRUCTIONS

1. Choose one of the cards that you discussed as a group
2. Complete the STARR reflection as though you are one of the designers that designed the product
3. Use the Skin Tone Inclusive Design Guidelines for tips while completing the reflection

Step 1

Describe the **Situation**

Answer the following questions:
- What was the situation?
- Who was involved?
- Where did the situation take place?

Step 2

Describe your **Task**

Answer the following questions:
- What was your task?
- What was your role?

Step 3

Describe what **Action** you took

Answer the following questions:
- How did you handle it?
- How did you react?

Step 4

Describe the **Result** of your actions

Answer the following questions:
- What was the result of your actions?
- How did others react to it?

Step 5

Reflect on the situation

- Were you satisfied with the results?
- How would you handle it next time?

SKIN TONE INCLUSIVE DESIGN (HYPOTHETICAL) STARR REFLECTION

FORM

Student 1: Student 2: Student 3:

Step 1: Describe the **Situation**

Step 2: Describe your **Task**

Step 3: Describe what **Action** you took

Step 4: Describe the **Result** of your actions

Step 5: **Reflect** on the situation

APPENDIX 0: EVALUATION QUESTION

Guidelines
- Had u zelf opmerkingen over de guidelines?
- Zijn ze begrijpelijk?
- Hier een foto van waar ze horen in een ontwerpproces, passen de guidelines binnen het ontwerpproces?
- Zijn er guidelines bij die overbodig zijn?
- Hebben deze guidelines een toegevoegde waarde voor in het onderwijs?
- Hebben deze guidelines een toegevoegde waarde voor professionele ontwerpers?
- Zouden studenten deze guidelines kunnen gebruiken tijdens het ontwerpen?
- Zouden studenten deze guidelines willen gebruiken tijdens het ontwerpen?
- Zouden professionele ontwerpers deze guidelines kunnen gebruiken?
- Zouden professionele ontwerpers deze guidelines kunnen gebruiken?

Card set
- Wat vind u van de 3 thema's?
- Hoe zou de kwaliteit van interactie tussen de studenten zijn, dus hoe zouden studenten het ervaren? (in
- Zou zo een discussie tot bewustwording kunnen leiden?
- Zouden professionele ontwerpers zo'n card set eventueel kunnen gebruiken?
- Zou het educatief zijn voor professionele ontwerpers?

Website
- Zou een docent zo een website gebruiken voor inhoud voor een lecture?
- Wat vind u ervan als een student naar zo een website zou gaan om een onderzoek te starten?

Overall
- Hoe denkt u over het lesplan als geheel?
- In hoeverre Is het educatief?
- Zou dit een waardevolle toevoeging zijn aan het curriculum van IO?
- Als u dit zou moeten beschrijven in 3 woorden, welke zouden dat zijn?
- Als u zelf zou moeten kiezen om dit te gebruiken in de klas, zou u het doen? Waarom wel of waarom niet? Qua inhoud of vormgeving.

DESIGN FOR our future

TU Delft

IDE Master Graduation

Project team, Procedural checks and personal Project brief

This document contains the agreements made between student and supervisory team about the student's IDE Master Graduation Project. This document can also include the involvement of an external organisation, however, it does not cover any legal employment relationship that the student and the client (might) agree upon. Next to that, this document facilitates the required procedural checks. In this document:

- The student defines the team, what he/she is going to do/deliver and how that will come about.
- SSC E&SA (Shared Service Center, Education & Student Affairs) reports on the student's registration and study progress.
- IDE's Board of Examiners confirms if the student is allowed to start the Graduation Project.

USE ADOBE ACROBAT READER TO OPEN, EDIT AND SAVE THIS DOCUMENT

Download again and reopen in case you tried other software, such as Preview (Mac) or a webbrowser.

STUDENT DATA & MASTER PROGRAMME

Save this form according the format "IDE Master Graduation Project Brief_familyname_firstname_studentnumber_dd-mm-yyyy".
Complete all blue parts of the form and include the approved Project Brief in your Graduation Report as Appendix 1 !

family name: Jantji
initials: C.A. given name: Cindy
student number:
street & no.:
zipcode & city:
country:
phone:
email:

Your master programme (only select the options that apply to you):

IDE master(s): ★ IPD ☐ DfI ☐ SPD
2nd non-IDE master:
individual programme: - - (give date of approval)
honours programme: ☐ Honours Programme Master
specialisation / annotation: ☐ Medisign ☐ Tech. in Sustainable Design ☐ Entrepeneurship

SUPERVISORY TEAM **

Fill in the required data for the supervisory team members. Please check the instructions on the right !

** chair: Dr. ir. Boeijen, A.G.C. van dept. / section: HCD/DA
** mentor: Ing. Helm, A.J.C. van der dept. / section: HCD/DCC
2nd mentor:
organisation:
city: country:

comments (optional)

Chair should request the IDE Board of Examiners for approval of a non-IDE mentor, including a motivation letter and c.v..

Second mentor only applies in case the assignment is hosted by an external organisation.

Ensure a heterogeneous team. In case you wish to include two team members from the same section, please explain why.

APPROVAL PROJECT BRIEF

To be filled in by the chair of the supervisory team.

chair Dr. ir. Boeijen, A.G.C. van date - - signature

CHECK STUDY PROGRESS

To be filled in by the SSC E&SA (Shared Service Center, Education & Student Affairs), after approval of the project brief by the Chair.
The study progress will be checked for a 2nd time just before the green light meeting.

Master electives no. of EC accumulated in total: _____ EC

Of which, taking the conditional requirements into account, can be part of the exam programme _____ EC

List of electives obtained before the third semester without approval of the BoE

YES all 1st year master courses passed

NO missing 1st year master courses are:

name date - - signature

FORMAL APPROVAL GRADUATION PROJECT

To be filled in by the Board of Examiners of IDE TU Delft. Please check the supervisory team and study the parts of the brief marked **.
Next, please assess, (dis)approve and sign this Project Brief, by using the criteria below.

- Does the project fit within the (MSc)-programme of the student (taking into account, if described, the activities done next to the obligatory MSc specific courses)?
- Is the level of the project challenging enough for a MSc IDE graduating student?
- Is the project expected to be doable within 100 working days/20 weeks ?
- Does the composition of the supervisory team comply with the regulations and fit the assignment ?

Content: APPROVED NOT APPROVED

Procedure: APPROVED NOT APPROVED

comments

name date - - signature

Skin tone inclusion in product design

project title

Please state the title of your graduation project (above) and the start date and end date (below). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

start date 01 - 03 - 2021 10 - 08 - 2021 end date

INTRODUCTION **

Please describe, the context of your project, and address the main stakeholders (interests) within this context in a concise yet complete manner. Who are involved, what do they value and how do they currently operate within the given context? What are the main opportunities and limitations you are currently aware of (cultural- and social norms, resources (time, money,...), technology, ...).

Throughout history, post-industrial revolution product design has focused on people with a light skin tone (Caucasian), and dark skin tones are often overlooked and ignored. This results in products that are unsuitable for people with dark skin. A simple example is the adhesive bandage, which until recently was only available in the color beige (FIXME bron). This color was meant to match people with light skin. Whether intentional or not, it is an issue that needs to be addressed.

The exclusion of darker skin tones causes marginalized groups to feel invisible and unappreciated. And in turn this makes product designers appear to lack empathy, and to be indifferent to the presence of non-white people in their community. A lot of products are designed in Western countries, which by now are all multi-cultural. Products that are designed in these countries should be designed with all ethnic groups in mind. Especially since the products will not only be sold in the country where it was designed, but also in other countries where the majority is non-white. For example; I grew up on an island, Curaçao, where the majority of the people is black. But still I only saw bandages with a beige color at the drugstores. This is because Curaçao imports products from the brands that are most readily available, and these corporations are not designing with dark skin in mind.

Often the reasoning behind excluding people with dark skin is a supposed lack of interest from certain groups. But blaming it on a lack of interest is a weak excuse that doesn't focus on the real problem. At this point, minority groups are "used" to being excluded, this means that they expect it. So oftentimes when these companies make some small attempts to be more diverse people don't even know about it. And you can't be interested in something that you don't even know exists. This is proven over and over again when newer brands who are diverse from the start are instantly successful.

Nowadays, inclusive design has become popular, and designers often advocate for people who are overlooked in society. This inclusion, however, is almost always about things like physical or mental disabilities, and rarely about skin color or race.
As per my own experience, the current TU Delft IDE education lacks knowledge on how people with dark skin are excluded in design processes and in the final product. Because of this, previous, current and future product designers will remain unaware of this phenomenon.

space available for images / figures on next page

introduction (continued): space for images

image / figure 1: Exclusive vs Inclusive Color Matching

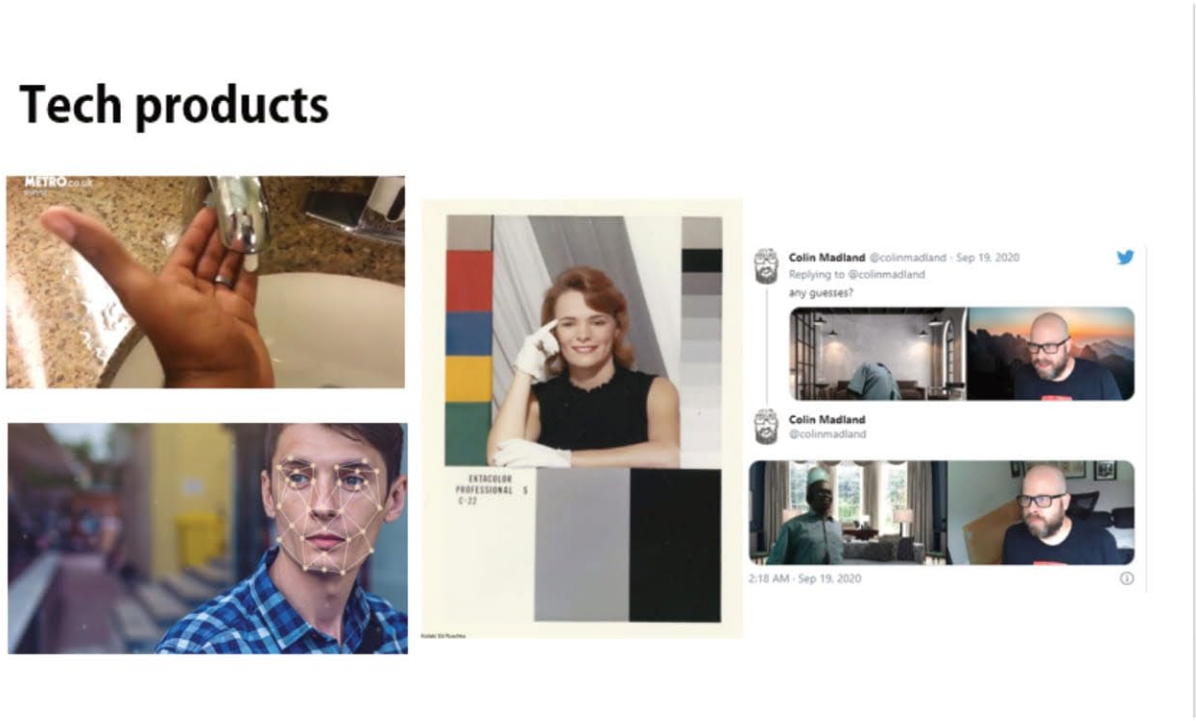


image / figure 2: Exclusive Technology

PROBLEM DEFINITION **

Limit and define the scope and solution space of your project to one that is manageable within one Master Graduation Project of 30 EC (= 20 full time weeks or 100 working days) and clearly indicate what issue(s) should be addressed in this project.

This project will focus on researching instances in which white skin was considered the norm when designing the product. There isn't much literature on this topic and not much attention paid to it. From personal experiences, and by talking to people, I know of many examples but it's hard to find material online that also explores this topic. This might be a reason why the TU Delft IDE - in which the majority of students and staff are white - also does not pay attention to it. Topics such as race exclusion will most likely not be something they will ever think about, at least not from a product design perspective. I want to design something that helps designers to understand the impact of race exclusion and to think and design in a more inclusive way.

ASSIGNMENT **

State in 2 or 3 sentences what you are going to research, design, create and / or generate, that will solve (part of) the issue(s) pointed out in "problem definition". Then illustrate this assignment by indicating what kind of solution you expect and / or aim to deliver, for instance: a product, a product-service combination, a strategy illustrated through product or product-service combination ideas, ... In case of a Specialisation and/or Annotation, make sure the assignment reflects this/these.

I will research which existing products are not compatible with dark skin to make designers aware of this phenomenon. And hopefully this will change designers' behaviour.

In this project I want to research the exclusion of dark skin in product design throughout history (starting from the industrial revolution) and currently, and illustrate this in a way that shows the severity of the issue (Glamour, 2018, "100 years of nude" section). This will also show the importance of this topic (Forbes, 2020) in general and in design education. Along with physical products I will also be analyzing services and modern technology and the impact of race exclusion in these areas. This analysis will aid in designing a demonstrator (an inclusive product concept) which shows how inclusion and exclusion impacts design thinking. Ultimately there will be a set of guidelines that helps designer to be more inclusive during the design process.

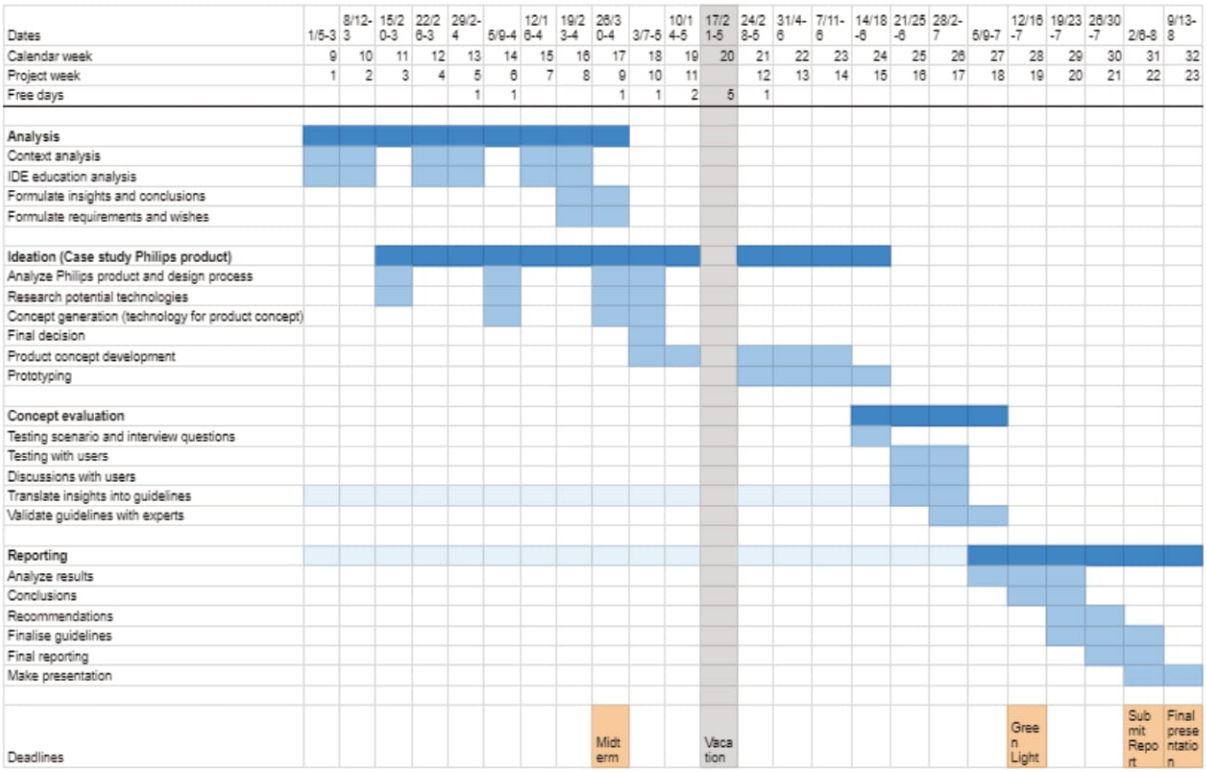
Cruel, J. (2018, March 21). 'Nude' is no longer one shade fits all. Glamour. Retrieved March 2, 2021, from https://www.glamour.com/story/nude-makeup-inclusive/amp?fbclid=IwAR1cKe3Mz_hbwXAsAdV4JP-a4oGsq2QDfPwG0bQ8ZsZ0bvthCayogr-unSY

Greenwald, M. (2020, June 1). Why Inclusive Product Design And Messaging Matters: 20 Best Practices. Forbes. Retrieved March 2, 2021, from https://www.forbes.com/sites/michellegreenwald/2020/06/01/meaningful-authentic-approaches-to-product-and-serv

PLANNING AND APPROACH **

Include a Gantt Chart (replace the example below - more examples can be found in Manual 2) that shows the different phases of your project, deliverables you have in mind, meetings, and how you plan to spend your time. Please note that all activities should fit within the given net time of 30 EC = 20 full time weeks or 100 working days, and your planning should include a kick-off meeting, mid-term meeting, green light meeting and graduation ceremony. Illustrate your Gantt Chart by, for instance, explaining your approach, and please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any, for instance because of holidays or parallel activities.

start date 1 - 3 - 2021 10 - 8 - 2021 end date



Taking holidays and my personal vacation into account this project will be done over 23 weeks to reach the 100 days requirement.

The analysis phase will consist of literature research as well as interviewing experts, IDE teachers (course coordinators) and students.

The research and ideation will be done in cycles for a more agile approach. The ideation phase is the longest as the quality of the design process concept will determine how well I am able to to formulate the guidelines.

With the involvement of a third party (Philips) I will design a product concept which will then be translated into a set of design guidelines.

MOTIVATION AND PERSONAL AMBITIONS

Explain why you set up this project, what competences you want to prove and learn. For example: acquired competences from your MSc programme, the elective semester, extra-curricular activities (etc.) and point out the competences you have yet developed. Optionally, describe which personal learning ambitions you explicitly want to address in this project, on top of the learning objectives of the Graduation Project, such as: in depth knowledge a on specific subject, broadening your competences or experimenting with a specific tool and/or methodology, ... Stick to no more than five ambitions.

Research topic and present findings in a clear structure, in a manner that effectively convinces the reader that there is a link between the findings which makes the issue relevant. In other words, if a person believes that these are all unrelated incidents which makes the issue insignificant, they should be able to see the bigger picture and its impact after learning about my research. This should be understandable for product designers and anyone else.

Bring change in a phenomenon that is seen as normal. This will be done by challenging what people believe is the norm, so they can critically analyze products around them. Ultimately this should change the position that currently marginalized groups have in society (how white people see these groups and how these groups experience their position).

Learn more about this topic beyond my personal experiences, and the experiences of those in my close proximity. While doing this project I want to be an advocate for marginalized groups.

FINAL COMMENTS

In case your project brief needs final comments, please add any information you think is relevant.