DePaul University

College of Computing
and Digital Media
243 South Wabash Avenue
Chicago, Illinois 60604-2302

UV Guardians
DePaul University
College of Computing and Digital Media
243 S. Wabash
Chicago, IL, 60604

June 6, 2023

We are submitting our report entitled “Skin Health in the Sun”. In this report we describe our methods, findings, and implications for design for a technology aimed to help users practice better skincare. Specifically, practices that help protect the user's skin from the sun’s damaging effects. The proposed name of our technology-based solution is “ShieldU”.

Major implications for the design of our technology are as follows:

- Our solution should educate users on the effects of being overexposed to the sun and how users can limit their amount of sun exposure – Based on our finding that participants that have little to no knowledge on the sun’s effects on the skin
- Our solution should notify users to apply or reapply sunscreen – Based on our finding that participants inconsistently or never wear sunscreen
- Our solution should utilize a database that presents users with results that align with search query keywords and filter out unrelated content – Based on our finding that participants used specific terms to narrow their skin health searches
- Our solution should use a recommendation algorithm to suggest products to the user – Based on our finding that participants buy products without conducting prior product research
- Our solution should enable filters and provide users with reliable products, websites, and reports on proper skin protection – Based on our finding that participants had multiple criteria when selecting a product or opening an article
- Our solution should provide means for users to customize a plan of action to combat their personal skincare needs including the amount of sun protection that they desire – Based on our finding that participants attempted to create plans to better serve themselves and their friends sun exposure concerns
- Our solution should alert the user of the current UV index, warn the user if they are overexposed to UV rays, and recommend sunscreens– Based on our finding that

participants would prefer a technological solution aimed at promoting awareness of possible overexposure.

In our next step, we will utilize the implications for design to conceptualize features of our technological solution “ShieldU”.

Thank you. If you have questions about this report, please contact us at:

Jaycee Helmer – jhelmer@depaul.edu
Tabitha Milon – tmilon@depaul.edu
Denise Sahaid – dsahaid@depaul.edu
Claudia Aguilera – caguile6@depaul.edu

# *Skin Health in the Sun*

**Final Report**

UV Guardians:

Tabitha Milon, Claudia Aguilera, Denise Sahaid, Jaycee Helmer

HCI 445

June 6, 2023

# Table of Contents

Executive Summary ..... 6
Introduction ..... 8
Research and Analysis Methods ..... 9
Observations ..... 9
Participants ..... 9
Data Collection ..... 10
Data Analysis ..... 10
Interviews ..... 11
Participants ..... 11
Data Collection ..... 11
Data Analysis ..... 12
Findings ..... 12
Knowledge and Habits ..... 12
A. Knowledge ..... 12
B. Habits ..... 13
Sun-Protection Products Search Queries and Research ..... 13
A. Search Queries ..... 13
B. Research ..... 14
Product and Source Criteria ..... 15
A. Product Criteria ..... 15
B. Source Criteria ..... 15
Problem-Solving Strategies and Technological Solutions ..... 16
A. Problem-Solving Strategies ..... 16
B. Technological Solutions ..... 16
Persona Spectrums ..... 17
Personas ..... 19
Scenarios ..... 20
Priority Matrix ..... 22
Customer Journeys ..... 23
**Discussion** ..... 25
Knowledge and Habits ..... 25

A. Knowledge ..... 25
B. Habits ..... 25
Sun-Protection Products Search Queries and Research ..... 25
A. Search Queries ..... 25
B. Research ..... 26
Product and Source Criteria ..... 26
A. Product Criteria ..... 26
B. Source Criteria ..... 26
Problem Solving Strategies and Technological Solutions ..... 26
A. Problem Solving Strategies ..... 26
B. Technological Solutions ..... 26
Limitations and Future Work ..... 27
References ..... 28
Appendices ..... 29
Appendix I: Observation Documents ..... 29
Observation Protocol ..... 29
Observation Informed Consent Blanks (In-Person and Online) ..... 32
In-Person Consent Blank ..... 32
Online Consent Blank ..... 34
Appendix II: Observation Affinity Diagram ..... 37
Appendix III: Observation Sequence Diagram ..... 38
Appendix IV: Interview Documents ..... 39
Interview Protocol ..... 39
Interview Informed Consent Blanks (In-Person and Remote) ..... 42
In-Person Consent Blank ..... 42
Online Consent Blank ..... 44
Appendix V: Interview Affinity Diagram ..... 47
Appendix VI: Interview Codebook ..... 48

# Executive Summary

The rate of skin cancer continues to rise; exposure to the sun is associated with the development of skin cancer [1]. According to the EPA (United States Environmental Protection Agency), excessive amounts of UV radiation exposure cause other risks such as premature aging, skin damage, immune system suppression, and eye damage [2]. People need to protect their skin every day to reduce the risk of sun overexposure. In this project, we asked: "How can a technology-based solution help individuals from being overexposed to the sun?"

We began with an observation study. In our observation study, we presented nine participants with a scenario of hiking in the sun with four friends that have different skin types/skin concerns. We then asked the participants to demonstrate how they would help themself and their friends to practice better skincare and avoid overexposure to the sun. Next, we interviewed eight participants and asked questions regarding their skin type/skin concerns, skincare routines, daily sun exposure, sunscreen use, their knowledge of sun protection, and their sun protection usage.

We identified four main themes gathered from the interviews and observations. From these findings, recommendations were chosen to address any concerns:

1. *Knowledge and Habits*

   a) All participants had minimal to basic knowledge of sun exposure risks. The other five interview participants were knowledgeable. Many participants understood that sun exposure can cause cancer but were unaware of other risks and how to protect their skin. Participants had a similar skincare routine, but only a few included sunscreen in their daily routine. Our solution should educate users on the effects of being overexposed to the sun and how users can limit their amount of sun exposure and notify users to apply or reapply sunscreen.

2. *Sun-Protection Product Search Queries and Research*

   b) Observation participants used a search engine to search for products using keywords such as "best" and "tips"; however, their results did not consistently match their search query criteria. Our solution should use a database that presents users with results that align with search query keywords and filter out unrelated content. Additionally, many participants did not conduct prior research when searching for or purchasing a sun-protection item. Our solution should use a recommendation algorithm to suggest products to the user.

3. *Product and Source Criteria*

c) Participants in both studies mentioned specific criteria they have for sun-protection products. Multiple participants mentioned the following criteria: affordability, customer reviews, and dermatologist-recommended products. Other criteria noted were clean ingredients, reef-safe ingredients, and reputable brands. Two participants had source criteria that influenced their decision to choose a source, such as credible medical institutions, and recognizable organizations. Our solution should enable filters and provide users with reliable products, websites, and reports on proper skin protection.

4. *Problem-Solving Strategies and Technological Solutions*

d) In the observation scenario, participants constructed methods to solve the problem-based scenario. Methods included sharing articles about the importance of sun protection, motivating their friends to practice better sun-protective habits, and to remind their friends to wear sunscreen every day. Our solution should provide means for users to customize a plan of action to combat their personal skincare needs including the amount of sun protection that they desire.

We asked interview participants what features a technological solution for preventing sun exposure should have. Some of the features included overexposure alerts, sunscreen recommendations, UV index data, and information on what UV radiation levels mean for their skin. Our solution should alert the user of the current UV index, warn the user if they are overexposed to UV rays, and recommend sunscreens based on their criteria.

With these findings and recommendations, we created two personas, their scenarios, and customer journeys. All these reflect a product that addresses the features mentioned above.

# Introduction

Sun exposure is beneficial in numerous ways. It aids individuals in forming healthy sleep patterns, boosts moods, reduces high blood pressure, and allows our skin to produce Vitamin D [7]. However, too much sun exposure can be detrimental to our health. The National Institutes of Health explains that "*when UV rays enter skin cells, they upset delicate processes that affect the skin's growth and appearance*" [5]. Furthermore, the more exposure an individual receives over time, the quicker their skin ages [5]. In addition to accelerated skin aging, excessive sun exposure can cause skin cancer. This is why overexposure to the sun and skin cancer have become major concerns in human health. According to the American Cancer Society (2023), "*Cancer of the skin is by far the most common of all cancers…(and) the rates of melanoma have been rapidly rising over the past few decades*" [1].

As a result, "*people are becoming more concerned about gauging their exposure to the ultraviolet (UV) radiation…* [4]." The fear of getting skin cancer can hinder many individuals from living their lives to the fullest by not allowing them to take part in the outdoor activities that they enjoy. We argue that this rising concern indicates there are needs for the development of means for people to track how to protect themselves from overexposure to the sun to minimize their risks of skin cancer. With the knowledge of how much Ultraviolet (sun) exposure one receives, individuals can better their health and decrease their chances of potentially getting skin cancer. This is because, "*UV exposure measurements can provide vital information for people with an elevated risk of sunburn, especially when caused by UV light accumulated over days of exposure. The ability to determine the degree of UV exposure received during the day has value in terms of comfort and convenience*" [4].

The goal of this study, Skin Health in the Sun, is to discover how a technology-based solution can help users from being overexposed to the sun. The research team used a pre-observation questionnaire and a problem-based scenario to gather important information about the subjects. Our targeted users for this project are individuals who are 18 years of age and older and who have used or are currently using sunscreen. In the following report, we summarized our methods, findings, themes, and implications for the design of our technology-based solution. While researching pre-existing solutions, we discovered two competitors:

- Shade (https://www.wearshade.com/technology)
  Shade is a Bluetooth device that connects to an app and enables individuals to better understand and manage their UV exposure. The device measures the total UV exposure of an individual and alerts the user when they are nearing overexposure. The product was funded by the National Cancer Institute and claims to provide accurate results 10x more often than other sensors. Their research is peer-reviewed. The device is available for purchase, but is expensive, selling for $249.00.

- Sola: Sun UV & Vitamin D Timer (https://apps.apple.com/us/app/sola-sun-uv-vitamin-d-timer/id1454332188)
  Sola is an IOS app that calculates and tracks how much sun exposure a user is getting based on current UV index forecast, your skin type, existing tan, sunscreen SPF, and whether the user changes sides regularly if sunbathing. The solution is lacking because it is only offered to Apple device users.

# Research and Analysis Methods

## *Observations*

### Participants

We recruited nine people: seven identified as female and two as male. All participants were adults between the ages of 23 and 55. We recruited participants through referrals of personal connections, and in public spaces such as gymnasiums and school libraries. See Table 1 for observation participant information.

**Table 1. Observation Participant Demographics**

| Participant ID | Age | Gender Identity | Skin Type |
|---|---|---|---|
| 1 | 24 | Woman | Dry |
| 2 | 26 | Man | Sensitive |
| 3 | 25 | Woman | Normal |
| 4 | 23 | Woman | Dry |
| 5 | 24 | Woman | Oily |

| | | | |
|---|---|---|---|
| 6 | 31 | Man | Dry |
| 7 | 55 | Woman | Normal |
| 8 | 31 | Woman | Oily |
| 9 | 42 | Woman | Combination |

**Data Collection**

Each group member interviewed two participants individually. All participants signed a consent form (see Appendix I: Observation Documents) to participate in the study and for the conversation to be recorded. We recorded participants over Zoom meeting software, using video footage, or voice memos. We transcribed all study recordings.

We first asked about their background, knowledge of skincare, and their sunscreen usage. We then gave participants a problem-based scenario asking them to imagine they went hiking with four friends in the summer and had a discussion on sunscreen and skincare. The friends in the scenario have varying skin types and skin concerns such as a history of skin cancer in the family, different skin types, and different skin tones. Participants shared their screen to demonstrate how they would help themselves and their friends practice better skincare in the sun. We added these findings to the scenario in the appendix.

**Data Analysis**

We used the Activities, Environments, Interactions, Observations, and Users (AEIOU) Method to scaffold our notes. We created an affinity diagram to consolidate main themes in the findings in Figma. The affinity diagram is in the appendix (see Appendix II: Observation Affinity Diagram).

We also created a sequence diagram showing the observation steps participants took to complete the problem-based scenario. The diagram shows the major tasks and subtasks performed by the participants divided into two task categories: Informational Search Query and Product-Related Search Query (see Appendix III: Observation Sequence Diagram).

## *Interviews*

### Participants

For our interview study, we recruited eight participants; five identified as male and three as female, ranging from the ages of 23 to 58. We recruited participants through referrals of personal connections, word of mouth, and Slack channels. All participants have used sunscreen in the past or currently use sunscreen. See Table 2 for interview participant information.

**Table 2. Interview Participant Demographics**

| Participant ID | Age | Gender Identity | Skin Type |
|---|---|---|---|
| 10 | 25 | Male | Normal |
| 11 | 58 | Female | Normal |
| 12 | 26 | Female | Oily |
| 13 | 23 | Male | Dry |
| 14 | 24 | Male | Dry |
| 15 | 26 | Female | Oily |
| 16 | 29 | Male | Sensitive |
| 17 | 23 | Male | Normal/Oily |

### Data Collection

All participants signed a consent form (see Appendix IV: Interview Documents) to participate in the interview and provided approval for the conversation to be recorded. We

recorded participants using Zoom meeting software, Google Meet, video footage or voice memos. We transcribed all the interview recordings using Microsoft Word.

We screened each participant to ensure they were an adult, have used sunscreen before, and were willing to discuss their skincare habits. We first asked the participants warm-up questions about their skincare and sunscreen habits and any skin problems they faced in the past. We then asked the participants deep focus questions about skin care usage and knowledge, sun-protection product purchases and research, and their sun technology usage. We also asked retrospective questions about features a technology-based solution should have, and their main concerns with sun overexposure.

**Data Analysis**

We each created and applied descriptive codes to our interview transcripts in the Atlas.ti program. Then, we assembled our codes into an affinity diagram in Figma to identify themes (see Appendix V: Interview Affinity Diagram). With the consolidated list of codes, we created an interview codebook (see Appendix VII: Interview Codebook). Using the saliency of each code from the interview codebook, we created personas, persona spectrums, scenarios, customer journeys, and a priority matrix.

# Findings

---

We identified the following four major themes from our findings from the observations and interviews:

1. Knowledge and Habits
2. Sun-Protection Products Search Queries and Research
3. Product and Source Criteria
4. Problem-Solving Strategies and Technological Solutions

## *Knowledge and Habits*

### A. Knowledge

All observation participants had minimal knowledge about damaging effects caused by sun exposure. When prompted to explain their knowledge on the subject, phrases such as “not a lot”, “a little”, and “only the basics” reoccurred. For example, P4 explained, “ *I know a little bit*

*about the sun's effects on the skin but not too much to the point where I'm educated on why I should wear sunscreen*." Interview participant's knowledge, however, evenly varied:

- Four interview participants had minimal knowledge. For example, P12 noted, "*I know it* [sun exposure] *eventually causes skin cancer and that it's not good for your skin. That's just the basic knowledge I have of it*."
- The other four interview participants were knowledgeable of the sun's damaging effects. P14 explained, "*I know the sun can definitely give you skin cancer…I also know that the sun ages your skin and causes wrinkles…The sun is dangerous, and sunscreen and skin protection are important*."

### B. Habits

Most participants reported similar skincare habits in the observations and interviews. All participants from both studies use a skincare routine that included cleanser and moisturizer. Eight observation and seven interview participants had experienced a sunburn. Both participant group's sunscreen usage and time spent outside during daylight hours varied:

- Four observation participants and six interview participants applied sunscreen every day.
- The other five observation participants and two interview participants occasionally or never apply sunscreen.
- Observation participant's time spent outside during the day ranged from less than an hour to approximately eight hours daily.
- Interview participant's time spent outside during the day ranged from less than an hour to more than six hours daily.

The amount of time spent outside during daylight hours was not related to whether the observation participant used sunscreen. P6 told us that he spends approximately eight hours a day outside and reported being inconsistent with his sunscreen application. Conversely, P9 applied sunscreen everyday despite being outside "very little on a daily basis" while the sun is out. This is also consistent with the interview findings. P15 mentioned that she spent approximately 6 hours daily in the last month but mentioned that she only has sunscreen in her makeup. Contrarily, P11 noted, "*I always make sure to wear it [sunscreen] outside*", despite only spending less than an hour daily outside during the day in the last month.

## *Sun-Protection Products Search Queries and Research*

### A. Search Queries

Observation participants attempted to solve the problem-based scenario using a search engine to find information they thought would be helpful. Observation participants used 18 different search queries; 13 included the term "sunscreen". Seven observational search queries included the descriptive term "best". One interview participant (P15) also used a search engine to locate a sun-protection product. We divided queries into two sub-categories: General Search Queries and Specific Search Queries.

- Specific: Four observation participants used the specific terms "fair skin", "olive skin", "skin cancer", and "dark skin tone" in their search query.
- General: Five observation participants and one interview participant included general SEO (Search Engine Optimization) keywords. Some of these keywords were "tips to good skincare", "sunscreen with makeup", and "natural sunscreen". Most participants arranged their search queries in the same way. 17 search queries were SEO keywords, including "best ways to protect yourself from the sun" and "protective sun gear to wear". The one search query that was not an SEO keyword was "sunscreen".

Two observation participants (P6 and P7) mentioned that despite the search query entered, the search engine provided the same products and sponsored advertisements at the top of the results. This made the search for information and products difficult. For example, P6 noted, "*it looks like the same products show up on the sponsored products of the search page, that can be confusing*", and P7 noted "*it looks like the same products pop up every time*."

**B. Research**

All observation participants searched for specific products that protect against the sun. Two observation participants (P2 and P3) performed prior research before looking for products. P2 opened an article from Johns Hopkins Medicine titled "Sunscreen and Your Morning Routine", looking for information on how often to reapply sunscreen, and P3 opened two separate articles during her search: "Skin Care: 5 Healthy Tips" from Mayo Clinic and "How to Protect Yourself from the Sun" from the CDC (Centers for Disease Control and Prevention). The other six observation participants did not conduct prior research. The observation participants searched for the following products: sunscreen, sunglasses, UPF (Ultraviolet Protection Factor) clothing, and hats.

All interview participants purchased a sun-protection product in the last month. The items purchased are similar to the observation participant's product search, and included sunglasses, sunscreen, and hats. Identical to the six observation participants, seven interview participants did not conduct prior research and simply went to the store to buy the product. For example, P11 said "*I went to Ulta and browsed their products*", and P12 explained, "*I did not use any resources. I just went to Target and went into the summer collection area and found sunglasses I really liked*."

## *Product and Source Criteria*

### A. Product Criteria

Five observation participants and all interview participants mentioned criteria when choosing a sun-protection product. We found that some of the observation and interview participants shared the same criteria:

- Two observation participants (P1 and P5) and one interview participant (P16) mentioned affordability as a part of their criteria. P1 and P5 mentioned they would look at the different prices and compare them, and P15 noted "*I usually just go for affordability to be honest*."
- One observation participant (P7) and one interview participant (P12) mentioned choosing a product based on the customer reviews. For example, P12 explained, "*...I look more into customer reviews than anything when looking for a product online*."
- Two observation participants (P1 and P2) and three interview participants (P12, P13, and P17) mentioned the importance of the brand being dermatologist recommended.
- One observation participant (P9) and four interview participants (P11, P17, P16, and P10) mentioned choosing sunscreen based on sunscreen's SPF. P9 noted, "*you should consider getting a sunscreen that has at least 30 SPF*", and P10 mentioned always using sunscreen that is "*at least 30 SPF*."

Furthermore, two interview participants (P11 and P13) had criteria for products with clean ingredients, mentioning they preferred sunscreens without ingredients such as Benzene and Oxybenzone. Additionally, two other interview participants (P14 and P15) were against products that involve animal-testing. The observation participants P3, P4, P6, P8, and P9 did not mention criteria for choosing a sun-protection product.

### B. Source Criteria

The two observation participants (P2 and P3) that conducted prior research, as mentioned in the Sun-Protection Products section, had criteria for their sources. P2 explained that after analyzing the results for the search query "how often to reapply sunscreen" he chose "Sunscreen and Your Morning Routine" from John Hopkins Medicine, as "*John Hopkins Medicine is a trustworthy source*". P3 chose articles "Skin Care: 5 Healthy Tips" from Mayo Clinic and "How to Protect Yourself from the Sun" from the CDC (Centers for Disease Control and Prevention). When prompted, she noted that she chose those articles because she "*recognized them as health organizations that are known to be reliable sources*."

## *Problem-Solving Strategies and Technological Solutions*

### A. Problem-Solving Strategies

We categorized how observation participants attempted to solve the problem-based scenario into two sub-categories: Creating a Plan of Action and Sharing Information. (Some used both)

- Sharing Information: Six participants noted they would share product information or an article relating to sun-protection with their friends. For example, P7 noted "*I would send products in our group chat*", and P6 said he would send his friends links to his choices of sun-protection gear. The six participants mentioned they would share the information; however, did not mention direct actions they would take.

- Plan of action: Five participants used a participatory strategy of creating a plan of action. They stated they would attempt to directly influence their friends to practice better skincare through actions. The participants' plans of action included (a) encouraging their friends to wear sunscreen every day, (b) practice good skincare, (c) bringing sunscreen for the friends, (d) reminding their friends to reapply, and (e) motivating their friends to wear protective UPF clothing. P2 noted his plan of action is to "*refer all of this* [article and product information] *to my friends and help them be responsible with applying their sunscreen, wearing protective clothing, and hats*."

- Both: Five participants used both problem-solving strategies. These participants said they would share the information they found and explained their proposed plan of action. For example, P3 described her solution as follows: "*The next time we go on a long hike I would make sure to pack some SPF 50 and that we reapply like every 40 minutes or every hour-ish*" and noted that she would share the article she found on sun-protection with her friends.

### B. Technological Solutions

We asked the interview participants what features a sun-protection technology-based solution should have. We categorized the findings into three main sub-categories: UV (Ultraviolet) Information, Sunscreen Recommendations, and Overexposure Warning:

- UV Information: Six interview participants noted that they would like a feature that provides (a) UV index information, (b) UV context (c) UV ray strength, and (d) recommended time outside based on the UV index. P10 explained that the technology should "*give a warning if the UV index is too high, or even a UV index forecast. I think it should also make it easy for people to understand what the UV index is and what each number means*."

- Sunscreen Recommendations: Five interview participants mentioned the technology should have a sunscreen recommendation feature. Participants said the feature should recommend (a) sunscreen brands and SPF, (b) when the user should reapply sunscreen, and (c) sunscreen brands based on the user's skin tone/type. For example, P13 noted that "*it could recommend different kinds of sunscreen specifically for your skin type*", and P14 said, "*I think it'd be cool if an app would tell you and recommend what type of sunscreen to use and how many times to reapply it*."
- Overexposure Warning: Four interview participants mentioned they would like an overexposure feature that would let the user know (a) how long the user can stay outside, (b) their level of sun exposure, and (c) if they are at risk for sunburn. P17 explained, "*I guess if it would let you know how much exposure you've had…that'd be good to know*." Moreover, P12 noted, "*if the app or something could tell me 'Hey you've spent too much time outside', I would probably use that tool a lot*."

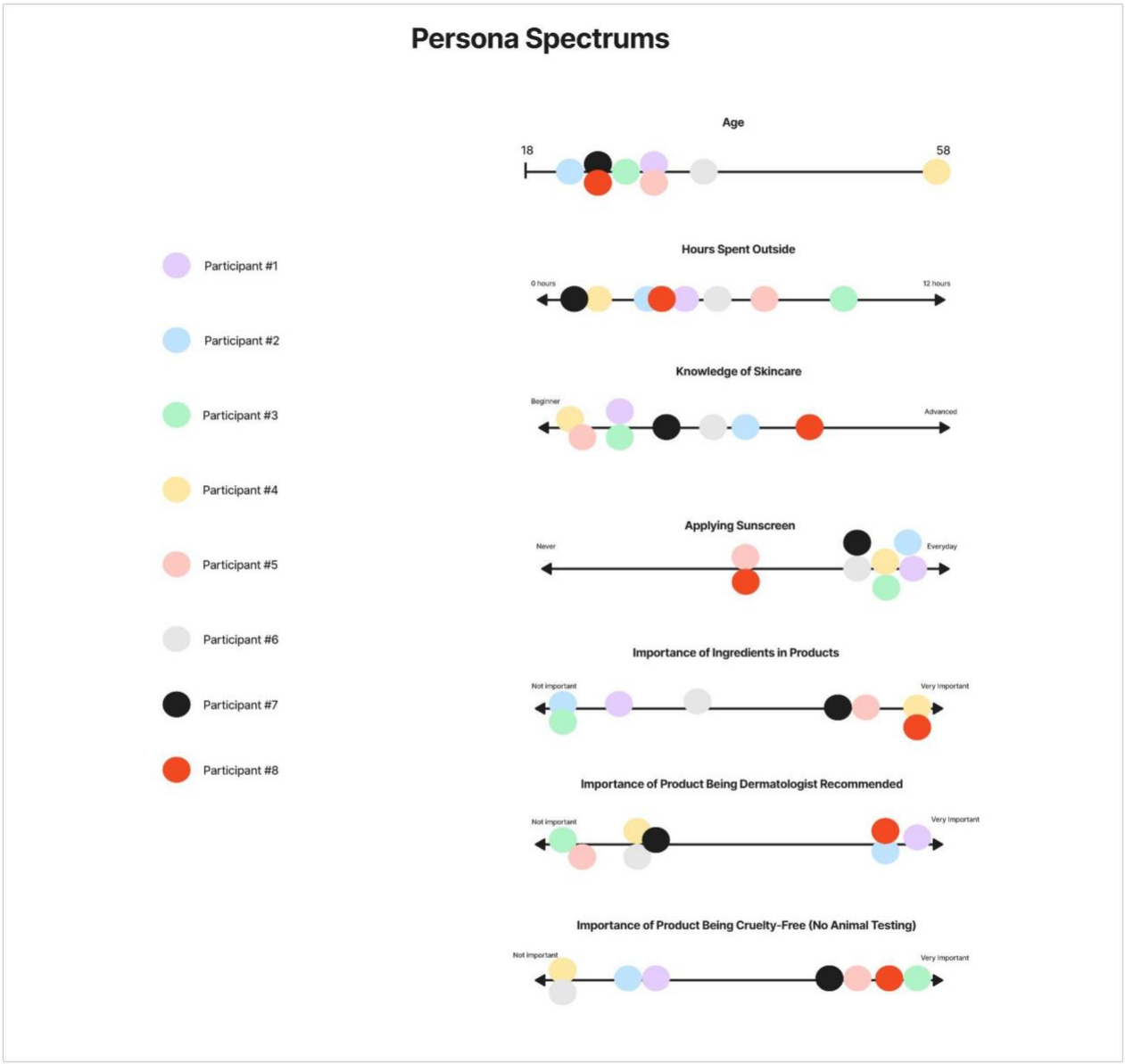
## *Persona Spectrums*

After reviewing data from our interviews, we identified seven persona spectrums that we felt best represented our participants and gave valuable insight to our target users. Age is a demographic that we included as a spectrum as we wanted to identify any potential patterns between the participant's age and their placement on the remaining six spectrums.

Knowledge of skincare is an important spectrum we explored as this is a recurring theme in our project. Similarly, frequency of sunscreen application is another spectrum we identified as skincare habits is another theme in our project. We also included the spectrum of time spent outside to understand the varying levels of sun exposure amongst our participants.

Lastly, there are different factors that influence our participants' decision to buy a sun-protective product, which we identified as three spectrums of importance: product ingredients, dermatologist recommendation, and no animal testing.

We were able to discover significant variations in the spectrums that allowed us to develop our two personas that represent our end users and their differing needs from our technological solution.


Persona Spectrums
Participant #1
Participant #2
Participant #3
Participant #4
Participant #5
Participant #6
Participant #7
Participant #8
Age
18
58
Hours Spent Outside
0 hours
12 hours
Knowledge of Skincare
Beginner
Advanced
Applying Sunscreen
Never
Everyday
Importance of Ingredients in Products
Not important
Very important
Importance of Product Being Dermatologist Recommended
Not important
Very important
Importance of Product Being Cruelty-Free (No Animal Testing)
Not important
Very important

## *Personas*

01



### Laura Adams - The Responsible

Age: 25
Location: San Diego, CA
Occupation: Product Manager
Skincare knowledge level: Intermediate

**Bio**

Laura loves living in San Diego, but has a busy work schedule and only gets to enjoy being outside in the sun for about 2 hours a day during her lunch break and after work. She is passionate about taking care of her skin and makes sure she follows her skincare regimen, including wearing sunscreen every single day.

**Personality Traits**

Dedicated | Overwhelmed | Analytical | Organized | Conscientious

***"I care a lot about my skincare routine, but there are so many sun protection products on the market that I don't feel confident in my choices."***

**Frustrations**

- Feeling overwhelmed by the amount of sun protection products on the market
- Difficulty finding a product that is effective and meets her criteria
- Unsure if she is protecting her skin enough from sun exposure

**Wants & Needs**

- A tool that notifies her of the current UV index
- A tool that recommends what SPF level to wear and any additional protection to use based on the current UV index
- A system that can detect how much exposure to the sun she is getting in real-time
- A platform that can suggest products without having to do extensive searching

**Motivations**

Product Ingredients
Dermatologist Recommendation
Cruelty-Free
Outdoor Activity

02



### Joseph Clark - Skincare Beginner

Age: 34
Location: Chicago, IL
Occupation: Teacher
Skincare knowledge level: Beginner

**Bio**

Joseph enjoys being a teacher and loves that he gets a few weeks off each summer to enjoy the weather and be outside. During the school year, he spends about 4 hours a day outside doing various activities with his students. Although he has a basic understanding of the sun's effects on the skin, he only wears sunscreen when he knows he is going to be outside for an extended period of time.

**Personality Traits**

Relaxed | Compassionate | Creative | Organized | Adventurous

***"I don't remember to wear sunscreen everyday, so I do accidentally expose my skin to sun without protection. I wish I could find something to incorporate into my daily routine."***

**Frustrations**

- Unsure of what product is best for his skin type
- Cost of sun protection items can be expensive
- Difficulty remembering to apply and/or reapply sunscreen on a daily basis

**Wants & Needs**

- A system that can determine his skin type and the best sun protection product for him
- A tool that reminds him to apply sunscreen based on the current UV index rating
- A tool that reminds him to reapply if it is detected that he is exposed to the sun

**Motivations**

Product Ingredients
Dermatologist Recommendation
Cruelty-Free
Outdoor Activity

## *Scenarios*

01

### Laura Scenario



Laura is a skincare enthusiast and loves taking care of herself and her skin. Although she is adamant about wearing sunscreen everyday all her sunscreens leave a whitecast on her darker skin. Due to her busy schedule she can only buy sunscreen during her lunch break.

Laura had been putting off buying a new sunscreen because she is overwhelmed by the amount of brands and features that they all have. She wants to find something that fits all her criteria but does not want to take hours to find it. Now that it is summer in San Diego, she wants to have the perfect sunscreen in her routine as soon as possible.

At work, Laura's coworker told her about this new app that helps you select sun protective items depending on your preferences. She downloads it and after a short survey of her likes and dislikes, she gets sunscreen recommendations that she can buy in-store or online.

She finds one that is to her liking and she picks it up at her nearest Target during her lunch break. When Laura heads back to work, the app notifies her that the UV rays are especially damaging at that hour. She uses this indicator to spray a layer of her new sunscreen before continuing her way back to work. Not only is it the perfect sunscreen, but she is happy that the app helps her take care of her skin.

02

## Joseph Scenario



Joseph enjoys being a teacher and treating his students to fun outdoor activities. He spends about 4 hours a day playing different games and running around with them. Although his knowledge of the sun's damaging effects on the skin are limited, he notices his skin is starting to burn and flare up more than usual.

As Joseph is planning tomorrow's outdoor activity for his students, he packs his sunscreen in his bag hoping he will remember to apply it. Throughout the day, Joseph realizes he has not applied his sunscreen once and his skin is burning red.

When he heads back home, his friend Jess, notices his irritated skin. Since she is a skincare enthusiast, she tells him about this app that reminds you to apply sunscreen throughout the day. Convinced, Joseph downloads this app and sets his schedule. The next day at school, the app notifies him to apply sunscreen in the morning, afternoon and evening. As the weeks go by, he notices his skin is less irritated and much healthier.

Joseph is excited to have a tool that can take care of his skin while he can stay focused on activities with his students.

## *Priority Matrix*

We identified several features for our technological solution based on the implications for design from the findings. The priority matrix (see Table 3) displays rankings of each feature and considers the importance of each feature for our two personas.

**Table 3: Priority Matrix**

| **No.** | **Feature** | **Priority** | **Impact** | **Feasibility** | **Priority for Personas** | |
|---|---|---|---|---|---|---|
| | | | | | ***Laura*** | ***Joseph*** |
| 1 | Alert system that notifies user of UV ray overexposure | High | High | High | Medium | High |
| 2 | Database of current sun-protective skincare products on the market | High | High | High | High | Medium |
| 3 | Alert system that notifies user of current UV index | High | High | Medium | High | High |
| 4 | Notifications to apply/reapply sunscreen | High | High | Medium | Medium | High |
| 5 | In-app search for skincare products | High | High | Medium | High | Medium |
| 6 | Filters that apply various criteria to search results | High | High | Low | High | Low |
| 7 | Personalized suggestions for products | Medium | Medium | Medium | High | High |
| 8 | Customizable skin care plan | Medium | Medium | High | Medium | Medium |
| 9 | Information on how sun overexposure impacts the skin | Low | Medium | Low | Low | Medium |
| 10 | Informing the user on what the UV index rating means | Low | Medium | Low | Low | Medium |

## *Customer Journeys*

**01** **Laura's Customer Journey**

| | | |
|---|---|---|
| Actions | | |
| • Laura downloads the app and creates a profile with her preferences.<br>• She creates a profile with all her preferences. | • She finds a sunscreen that is to her liking in the app<br>• She picks it up at her nearest Target during her lunch break. | • Laura gets notified that the UV rays are especially damaging at that hour.<br>• She reapplies sunscreen. |
| Thoughts | | |
| • Laura wants to find something that fits all her criteria but does not want to take hours to find it. | • Laura appreciates how the app narrows down the options for sunscreen and finds one perfect for her. | • Laura is grateful that she has a tool that helps her protect her skin. |
| Feelings | | |
| • Laura is overwhelmed by the amount of sunscreen options. | • Laura is satisfied with the sunscreen the app suggested she buys. | • She is happy to know that the app will help her take care of her skin. |

**02** **Joseph's Customer Journey**

| | | |
|---|---|---|
| Actions | | |
| • Joseph packs a sunscreen to his activities but forgets to apply it.<br>• His skin gets burned and irritated by excessive sun exposure. | • Joseph downloads the app to remind him to wear sunscreen.<br>• The app creates a schedule depending on his daytime activities. | • Joseph is notified a few times a day to reapply sunscreen.<br>• He reapplies sunscreen. |
| Thoughts | | |
| • Joseph knows he should apply sunscreen but he is too busy to remember. | • Joseph's appreciates that the app will remind him to wear sunscreen during his most active hours. | • Joseph appreciates that he can spend time with his students without worrying about his skin. |
| Feelings | | |
| • Joseph feels frustrated that his skin is burned and irritated<br>• Joseph feels disappointed that he keeps forgetting to apply sunscreen | • Joseph is relieved he no longer has to be aware of his time outdoors because the app does that for him. | • Joseph is enjoying his time outside knowing his skin is protected. |

# Discussion

We asked the question, "how can a technology-based solution help individuals from being overexposed to the sun?" We initially observed nine participants as they attempted to solve a problem-based scenario for their hypothetical friends with various skin types and/or skin concerns.

Following the observations, we conducted interviews with eight participants to gain a deeper understanding into their skincare knowledge and habits. We also wanted to discover an in-depth understanding of the factors that influence our participants to select (or not select) solutions to protecting their skin from sun overexposure.

The four key findings from both the observations and interviews have led us to identify several implications for design:

## *Knowledge and Habits*

### A. Knowledge

In our observations, we discovered that participants had minimal knowledge about the sun's effects on the skin. The data from our interviews also show that half of our participants had minimal knowledge about the risks from sun overexposure. Our solution should educate the user about the health risks associated with sun overexposure, and how to limit exposure, through informative and interactive content.

### B. Habits

Participants in our observations and interviews had varying frequency in sunscreen application. Seven participants either occasionally or never apply sunscreen. Our solution should implement a feature that notifies and reminds the user to apply and/or reapply sunscreen to create better skincare habits.

## *Sun-Protection Products Search Queries and Research*

### A. Search Queries

In our observations, participants used search engines to find helpful information to address their fictional friends' specific skin concerns. The participants used keywords such as "best", "tips", and the specific skin type/skin concern when looking for solutions to sun-protection but were presented with unrelated results. Our solution will have a database of sun-protection products that will provide users with results that align with their search query keywords and filter out unrelated content.

**B. Research**

Six participants in our observations and seven participants in our interviews did not search for information on sun-protective products prior to selecting one that met their criteria. While doing background research on products can be time-consuming, it reduces the risk of buying a product that does not work for the consumer. Therefore, our solution should utilize an algorithm that suggests products to the user based on their past purchase history, preferences, etc.

## *Product and Source Criteria*

**A. Product Criteria**

In our interviews, we asked participants about criteria that influence their product selection. Price, ingredients, and anti-animal testing have varying levels of importance amongst our participants. Our solution should provide the user with the ability to enable filters that display results based on their specific product criteria.

**B. Source Criteria**

Participants from our observations and interviews commonly relied on perceptions of credibility (i.e., a dermatologist-recommended product, an article from a reputable medical organization, or a product with positive reviews) when reviewing and determining what product or informative article to select. Our solution should provide rankings of reliable sources that highlight key criteria users look for when presented with search results.

## *Problem Solving Strategies and Technological Solutions*

**A. Problem Solving Strategies**

In the observations, our participants chose different methods when attempting to help their fictional friends with sun-protection. Plans included sharing links to products or articles, directly communicating information learned through search queries, and reminding friends to apply sunscreen. Our solution should provide a customizable plan of action for users to meet skin care needs for sun-protection.

**B. Technological Solutions**

Interview participants provided insight on features they would like in a technological solution to help prevent overexposure to the sun. Features included UV index information, overexposure alerts, and personalized sunscreen recommendations. Our

solution should implement an alert system that notifies the user of the current UV index, and if the user is exposed to UV rays for an extended period of time. This system will also recommend to the user the best skin protection practices for the current UV index, and sunscreen recommendations.

## *Limitations and Future Work*

Our observations included nine participants, with most participants being in the age range of 24-31. Seven interview participants were in the age range of 23-29. Our participants did not, therefore, accurately represent the general population. Additionally, some of our participants had more interest in their skincare routine and sun-protection than others. This may have created biases when demonstrating how they would help their friends practice better skincare and discussing their solutions to sun overexposure. Another limitation are the targeted ads that appeared in the results after a participant submitted their search query, which could influence their decision-making process.

Future work should expand the sample size and include a wider age range of participants. With a larger sample size, participants could be stratified based on interests and/or prior experience in skincare and sun protection to analyze potential differences in the observations and interviews. Furthermore, usability testing of the proposed design solutions could provide useful feedback on the ease of use and effectiveness of these features in preventing overexposure to the sun.

# References

[1] *Melanoma skin Cancer Statistics*. Melanoma Skin Cancer Statistics. (n.d.). https://www.cancer.org/cancer/melanoma-skin-cancer/about/key-statistics.html#:~:text=How%20common%20is%20melanoma%3F,5%2C420%20men%20and%202%2C570%20women

[2] Environmental Protection Agency. (2022, December 15). *Health Effects of UV Radiation*. EPA. https://www.epa.gov/sunsafety/health-effects-uv-radiation

[3] LLC, B. (2019, June 16). *Sola: Sun Uv & Vitamin D Timer*. App Store. https://apps.apple.com/us/app/sola-sun-uv-vitamin-d-timer/id1454332188

[4] Staff, E. (2014, February 23). *Building wearable UV index sensor devices for protection from harmful sun exposure*. Embedded.com. https://www.embedded.com/building-wearable-uv-index-sensor-devices-for-protection-from-harmful-sun-exposure/

[5] U.S. Department of Health and Human Services. (2020, January 6). *Sun and Skin*. National Institutes of Health. https://newsinhealth.nih.gov/2014/07/sun-skin

[6] Shade UV sensor technology. (n.d.). https://www.wearshade.com/technology

[7] *5 Ways the Sun Impacts Your Mental and Physical Health*. Tri. (2021, May 7). https://www.tricitymed.org/2018/08/5-ways-the-sun-impacts-your-mental-and-physical-health/

# Appendices

## *Appendix I: Observation Documents*

### Observation Protocol

**STEP 1: INTRODUCTION**

**Introduce yourself and the project:**

My name is _____. Thank you for taking the time to meet with us. I'm working on a school research project. My team is interested in learning how people are protecting themselves from being over-exposed to the sun.

**Explain the purpose of the project:**

The purpose of this study is to gather insights from people who are concerned about their skin health when spending a great time outside. With this information, we can better understand which aspects of these services need to be improved upon.

The data we collect today will be used for our school project and only our team will know your identity. Outside of our team, your identity will remain confidential.

**Explain what will happen:**

There are no right or wrong ways to carry out an activity, or right or wrong answers to my questions; I only want to watch what you do and hear what you have to say. As you perform the activity, your actions and comments will be noted, and you may be asked to describe what you are doing. You may be asked questions before, during, or after performing the activity.

**Informed consent:**

For your participation, we need your informed consent.

*[Give participant the informed consent form if in person or if sent ahead of time asked if they have read over.]*

*[Get a signature or verbal consent.]*

**STEP 2: WARM-UP**

[If needed:] I would like to ask you a couple of questions before we get started on the observation.

- Demographics: How old are you? What is your gender identity?
- Describe your skin type (e.g. normal, combination, dry, oily, sensitive).

- Describe any skin problems that you face (e.g. acne, eczema (atopic dermatitis), dry, itchy, psoriasis, rosacea).
- Do you practice any type of skin care?
    - If so, what?
    - If not, why?
- How much time do you spend outdoors during daylight hours weekly? Daily?
- Do you wear sunscreen?
    - If so, how often?
    - If not, why?
- Have you ever experienced a sunburn?
- How much do you know about the sun's effects on the skin?
- Do you have any conditions or medications that affect your skin when in the sun?
- Does skin cancer or any other skin conditions run in your family?

**STEP 3: OBSERVATION**

For our activity, please consider the following scenario. Imagine you are on a hike with four of your friends on a hot day in the summer. During the hike, you can't help but notice how long all of you have been exposed to the sun.

One of your friends has a history of skin cancer in their family, one has fair skin and burns easily, one has olive and oily skin, and one has a dark skin tone. On the drive home, after the hike, your friend brings up that they forgot to wear sunscreen, which strikes a discussion about skincare. You realize that you would like to help yourself and your friends.

In-person: Please demonstrate how you would help yourself and your friends practice good skincare habits in any way that you feel is best.

Online: Please share your screen and demonstrate how you would help yourself and your friends practice good skincare habits in any way that you feel is best.

*[Observe the participant: Let the participant perform the activity. Record the participant's activity using a screen recording tool. Only interrupt if necessary. Take note of your questions and save them for the wrap-up. Note: Take a picture of any notes they record during the task.]*

**STEP 4: WRAP-UP**

**Follow-up Questions:**

That is the end of the observation period. I now have some follow-up questions I'd like to ask:

- Has your perspective on skincare and sun exposure changed?
- Will you be making any changes to your current skincare and/or sun protection routine?
    - If so, what?
    - If not, why?
- Did you find anything surprising or obvious during the scenario?
- Did you encounter any challenges during your participation?
- How satisfied are you with your participation in the study?

Demographics

Adults 18-70, Male and/or Female, and skin types.

That concludes the activity. Thank you for your time and for meeting with me. Would it be okay to reach out to you for a follow-up sometime in the next few weeks?

**Observation Informed Consent Blanks (In-Person and Online)**

*In-Person Consent Blank*

## ADULT CONSENT TO PARTICIPATE IN RESEARCH

### Skincare Management: Protection from Sun Exposure

**Principal Investigators:** Tabitha Milon, Claudia Aguilera, Denise Sahaid, Jaycee Helmer

**Institution:** DePaul University, Chicago, Illinois, USA

**Department, School, College:** Jarvis College of Computing and Digital Media ("CDM")

**Faculty Advisor:** Cynthia Putnam, Ph.D. - CDM, DePaul University

**Key Information:**

***What is the purpose of this research?***

We are asking you to be in a research study because we are trying to learn how a technology-based solution can help individuals (with different skin types) from being overexposed to the sun.

This study is being conducted by Tabitha Milon, Claudia Aguilera, Denise Sahaid, and Jaycee Helmer. They are graduate students at DePaul University performing this research as a requirement to obtain their master's degree. This research is being supervised by their faculty advisor, Cynthia Putnam.

We hope to include 8-12 people in the research.

***Why are you being asked to be in the research?***

You are invited to participate in this study because you are open to discussing how you might search for options to protect your skin and others with different skin types and/or skin conditions against sun exposure. You are also over the age of 18 years old. You will not be asked to share personal information or the information of others. We will be working with a hypothetical scenario.

***What is involved in being in the research study?***

If you agree to be in this study, the research involves first answering questions about your experience with sun exposure. We will then observe you complete a task for a hypothetical scenario where you will search for sun protection ideas specific to your friends' skin concerns.

Video and audio recording will be used during the observation and will later be transcribed into written notes for documentation. In addition, you will be interviewed and asked a series of questions regarding your demographics (i.e., age, gender identity, skin type, skin tone, etc.), any prior experience or knowledge of the research topic, and your experience participating in the task for this study. The interview will be audio recorded and transcribed into written notes to get an accurate record of what you said.

***Are there any risks involved in participating in this study?***

There are no risks with participation in this study beyond those present in everyday living. You may feel uncomfortable about answering certain questions. You do not have to answer any question that you do not want to.

There is the possibility that others may find out what you have said, but we have measures in place to prevent this from happening. We will create an identification number in our records instead of using your name.

***Are there any benefits to participating in this study?***

You will not personally benefit from being in this study. We hope that what we learn will lead to improvements in management of skin protection from sun exposure.

***How much time will this take?***

This study will take about 30 minutes of your time.

**Other Important Information about Research Participation**

***Can you decide not to participate?***

Your participation is voluntary, which means you can choose not to participate. There will be no negative consequences, penalties, or loss of benefits if you decide not to participate or change your mind later and withdraw from the research after you begin participating.

***Who will see my study information and how will the confidentiality of the information collected for the research be protected?***

The research records will be kept and stored securely. Your information will be combined with information from other people taking part in the study. When we write about the study or publish a paper to share the research with other researchers, we will write about the combined information we have gathered. We will not include your name or any information that will directly identify you.

***You will be given a copy of this information to keep for your records.***

**Statement of Consent from the Subject:**

I have read the above information. I have had all my questions and concerns answered. By signing below, I indicate my consent to be in the research. Additionally, I authorize DePaul University to take and use video and audio recordings of me in connection with the research study. The video and audio recordings will be destroyed after the research study is completed.

Signature:_____

Printed name: _____

Date: _____

---

*Online Consent Blank*

**ADULT CONSENT TO PARTICIPATE IN RESEARCH**

**Skincare Management: Protection from Sun Exposure**

**Principal Investigators:** Tabitha Milon, Claudia Aguilera, Denise Sahaid, Jaycee Helmer

**Institution:** DePaul University, Chicago, Illinois, USA

**Department, School, College:** Jarvis College of Computing and Digital Media ("CDM")

**Faculty Advisor:** Cynthia Putnam, Ph.D. - CDM, DePaul University

**Key Information:**

***What is the purpose of this research?***

We are asking you to be in a research study because we are trying to learn how a technology-based solution can help individuals (with different skin types) from being overexposed to the sun.

This study is being conducted by Tabitha Milon, Claudia Aguilera, Denise Sahaid, and Jaycee Helmer. They are graduate students at DePaul University performing this research as a requirement to obtain their master's degree. This research is being supervised by their faculty advisor, Cynthia Putnam.

We hope to include 8-12 people in the research.

***Why are you being asked to be in the research?***

You are invited to participate in this study because you are open to discussing how you might search for options to protect your skin and others with different skin types and/or skin conditions against sun exposure. You are also over the age of 18 years old. You will not be asked to share personal information or the information of others. We will be working with a hypothetical scenario.

***What is involved in being in the research study?***

If you agree to be in this study, the research involves first answering questions about your experience with sun exposure. We will then observe you complete a task for a hypothetical scenario where you will search for sun protection ideas specific to your friends' skin concerns. Video and audio recording will be used during the observation and will later be transcribed into written notes for documentation. In addition, you will be interviewed and asked a series of questions regarding your demographics (i.e., age, gender identity, skin type, skin tone, etc.), any prior experience or knowledge of the research topic, and your experience participating in the task for this study. The interview will be audio recorded and transcribed into written notes to get an accurate record of what you said.

***Are there any risks involved in participating in this study?***

There are no risks with participation in this study beyond those present in everyday living. You may feel uncomfortable about answering certain questions. You do not have to answer any question that you do not want to.

There is the possibility that others may find out what you have said, but we have measures in place to prevent this from happening. We will create an identification number in our records instead of using your name.

***Are there any benefits to participating in this study?***

You will not personally benefit from being in this study. We hope that what we learn will lead to improvements in management of skin protection from sun exposure.

***How much time will this take?***

This study will take about 30 minutes of your time.

## Other Important Information about Research Participation

### *Can you decide not to participate?*

Your participation is voluntary, which means you can choose not to participate. There will be no negative consequences, penalties, or loss of benefits if you decide not to participate or change your mind later and withdraw from the research after you begin participating.

### *Who will see my study information and how will the confidentiality of the information collected for the research be protected?*

The research records will be kept and stored securely. Your information will be combined with information from other people taking part in the study. When we write about the study or publish a paper to share the research with other researchers, we will write about the combined information we have gathered. We will not include your name or any information that will directly identify you.

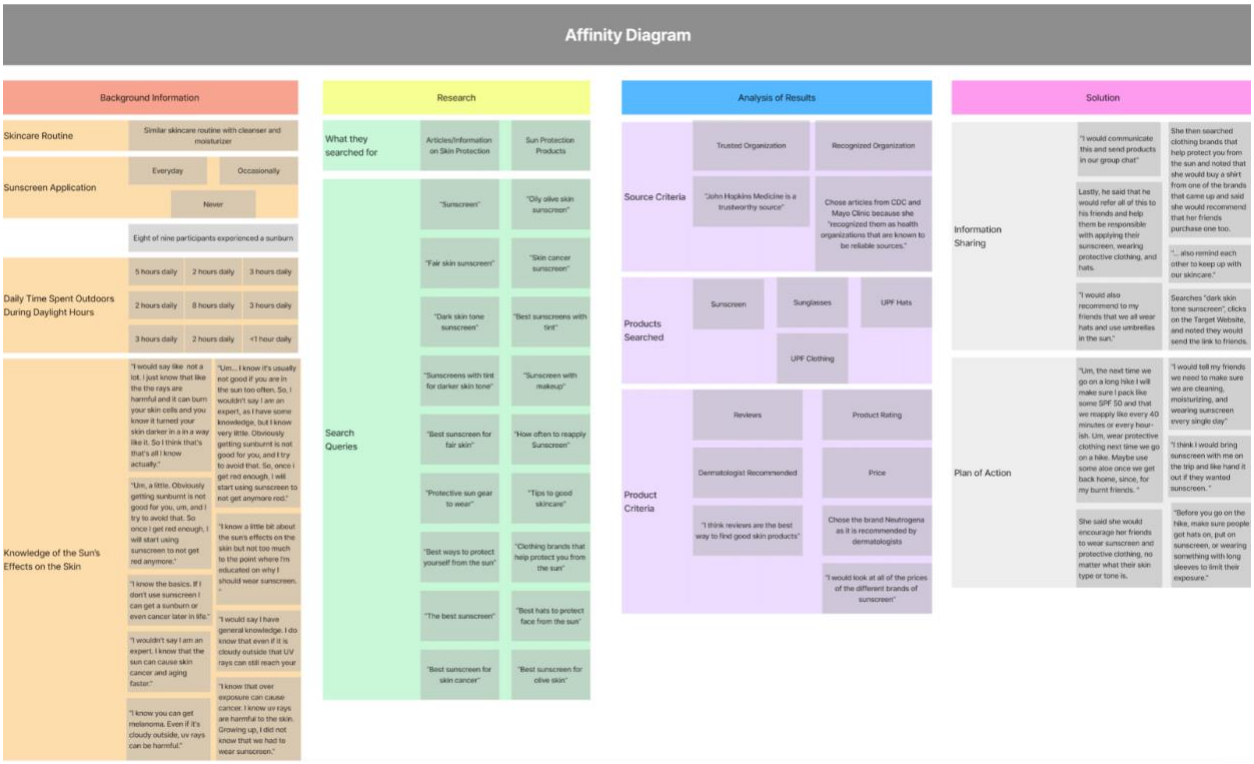
***You can print a copy of this information to keep for your records.***

## Statement of Consent from the Subject:

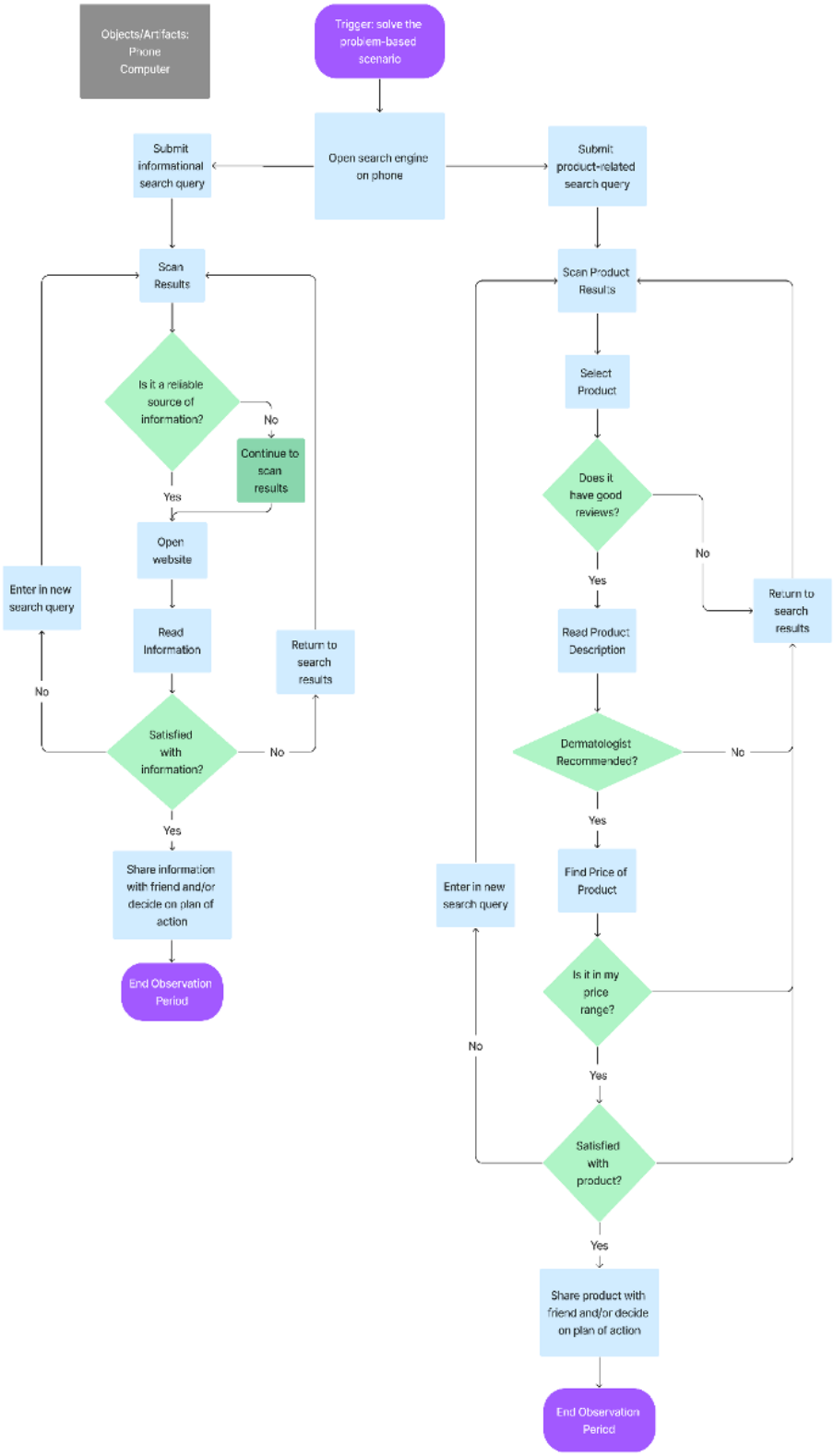
The consent form has been read to you. Have you had all your questions and concerns answered? If not, please ask us anything else you would like. If all your questions have been answered, do you provide your verbal consent to be in the research?

By giving verbal consent, you agree to the following statement: "I have read the above information. I have had all my questions and concerns answered. By giving verbal consent, I agree to be in the research. Additionally, I authorize DePaul University to take and use video and audio recordings of me in connection with the research study. The video and audio recordings will be destroyed after the research study is completed."

# *Appendix II: Observation Affinity Diagram*



## *Appendix III: Observation Sequence Diagram*



# *Appendix IV: Interview Documents*

**Interview Protocol**

***Interview Protocol: Skin Health in the Sun***

**Overarching Research Question:**
How can a technology-based solution help individuals from being overexposed to the sun?

**Screener Questions - Asked before scheduling the interview:**

1. Are you over 18 years of age?
2. Are you willing to discuss your skincare and sun protection habits?
3. You must have used or use sunscreen.

**Introduction**
Hello, my name is [____], and I am a graduate student at DePaul University. Thank you for agreeing to participate in this interview. I am working in a group to conduct research to gather insights from people who are concerned about their skin health when spending time outside.

There are no right or wrong answers. Your answers will be kept confidential.

Today's interview session should take approximately 30 minutes, without interruptions. Please refrain from using your cell phone during the interview.

[Read the consent]

Do you have any questions before we start?

**Warm Up Questions:**

1. Describe your skin type (e.g. normal, combination, dry, oily, sensitive).
2. Describe any skin problems that you currently face (e.g. acne, eczema (atopic dermatitis), dry, itchy, psoriasis, rosacea).
    a. Have you had any skin problems in the past that you do not have now?
        i. [If yes] tell me about that.
    b. Do you have any conditions or medications that affect your skin when in the sun?
3. Thinking about the last month, do you have a daily skincare routine?
    a. [If yes] Tell me about that.

4. Thinking about the last month (now that we are getting close to summer) about how much time do you spend outdoors?
    a. Was that pretty typical?
    b. What types of activities did you do when outdoors?
    c. Did you wear sunscreen when you spent time outdoors last month?
        i. Is that typical?
        ii. If so, how often did you reapply?
        iii. If not, why?
5. Have you ever experienced a sunburn?
    a. If yes, tell me about the last time.
6. Does skin cancer run in your family?

**Deep Focus**

**A. Skincare Usage and Knowledge**

1. Tell me about what you know about suncare.

2. Tell me about what you know about the risks/dangers of being over-exposed to the sun.

3. By agreeing to this interview, you stated that you use or have used sunscreen. Tell me about what you currently use. What have you used in the past?
    1. What criteria have you used when choosing a sunscreen?
        1. Have you ever chosen a sunscreen based on your skin type?
        2. Have you used a specific SPF?
        3. Are there any ingredients you look for when choosing a sunscreen?
            1. Are there any ingredients you look to avoid? (ex: reef safe sunscreens [can cause skin irritation], animal-based ingredients)
            2. How important is it to you whether a sunscreen is dermatologist recommended?
        4. Tell me what you know about differences between chemical and mineral sunscreen?
            1. Do you have a preference between the two?

    2. Does your choice of sunscreen vary based on what activity you have planned?
        1. If yes, tell me about that.
    3. Have you ever researched anything about product testing on animals?
        1. If yes, tell me about the last time.
        2. Have you ever chosen a product because it was advertised as not using animal testing?

1. IF yes, tell me about a recent time.

4. Do you use any other products to protect your skin and or eyes from sun exposure? Examples include UPF (Ultraviolet Protection Factor) hats, clothing, sunglasses, etc.?

**B. Product Research**

1. Can you tell me about the last time you bought a sun protective item?
    1. What did you buy?
    2. What resources did you use to find the product?
        1. If you used the internet to find the product, what keywords did you search for?
2. Have you ever found it challenging to search for or find a product that meets your criteria?
    1. If yes, tell me about a recent time.

**C. Technology Usage**

1. Have you ever used a technology to help prevent sun exposure?
    1. [If yes] tell me about the most recently used technology
        1. What do you like about it?
        2. What did you dislike about it?

**Retrospective**

1. In a perfect world, if there was a technology that minimizes the risk of overexposure to the sun, what kinds of features should that technology have?
2. What are your main concerns regarding sun protection?

**Demographics**

1. How old are you?
2. What is your gender identity?

**Closing**

That concludes all the questions I have for you today. Do you have any final thoughts you would like to share or any questions that you would like to ask at this time?

I really appreciate you taking the time to speak with me today. If there's anything further you need, please do not hesitate to contact me. I can be reached at [Email Address].

**Interview Informed Consent Blanks (In-Person and Remote)**

*In-Person Consent Blank*

**ADULT CONSENT TO PARTICIPATE IN RESEARCH**
**Skincare Management: Protection from Sun Exposure**

**Principal Investigators:** Tabitha Milon, Claudia Aguilera, Denise Sahaid, Jaycee Helmer
**Institution:** DePaul University, Chicago, Illinois, USA
**Department, School, College:** Jarvis College of Computing and Digital Media ("CDM")
**Faculty Advisor:** Cynthia Putnam, Ph.D. - CDM, DePaul University

**Key Information:**

***What is the purpose of this research?***

We are asking you to be in a research study because we are trying to learn how a technology-based solution can help individuals (with different skin types) avoid overexposure to the sun.

This study is being conducted by Tabitha Milon, Claudia Aguilera, Denise Sahaid, and Jaycee Helmer. We are graduate students at DePaul University performing this research as a requirement to obtain their master's degree. This research is being supervised by their faculty advisor, Cynthia Putnam.

We hope to include 8-12 people in the research.

***Why are you being asked to be in the research?***

You are invited to participate in this study because you are open to discussing topics about your skin and how you protect yourself from sun overexposure. You are also over the age of 18 years old. You will not be asked to share personal information or the information of others.

***What is involved in being in the research study?***

If you agree to be in this study, the research involves an interview where we will ask you a series of questions about your skin, your experience with sun exposure, and how you may choose products to protect your skin from sun exposure. The interview will be audio recorded and transcribed into written notes to get an accurate record of what you said.

***Are there any risks involved in participating in this study?***

There are no risks with participation in this study beyond those present in everyday living. You may feel uncomfortable about answering certain questions. You do not have to answer any question that you do not want to. There is the possibility that others may find out what you have

said, but we have measures in place to prevent this from happening. We will create an identification number in our records instead of using your name.

***Are there any benefits to participating in this study?***

You will not personally benefit from being in this study. We hope that what we learn will lead to improvements in management of skin protection from sun exposure.

***Is there any compensation to participating in this study?***

If you are a DePaul University student who signed up through the CDM/COMM Participant Pool for Research, you will receive 0.5 points of credit after completion of the research. You will only be given credit if you complete the study. If you withdraw before completing the study, you will not be given credit.

***How much time will this take?***

This study will take about 30 minutes of your time.

**Other Important Information about Research Participation**

***Can you decide not to participate?***

Your participation is voluntary, which means you can choose not to participate. There will be no negative consequences, penalties, or loss of benefits if you decide not to participate or change your mind later and withdraw from the research after you begin participating.

***Who will see my study information and how will the confidentiality of the information collected for the research be protected?***

The research records will be kept and stored securely. Your information will be combined with information from other people taking part in the study. When we write about the study or publish a paper to share the research with other researchers, we will write about the combined information we have gathered. We will not include your name or any information that will directly identify you.

***You will be given a copy of this information to keep for your records.***

**Statement of Consent from the Subject:**

I have read the above information. I have had all my questions and concerns answered. By signing below, I indicate my consent to be in the research. Additionally, I authorize DePaul University to take and use video and audio recordings of me in connection with the research study. The video and audio recordings will be destroyed after the research study is completed.

Signature:_____

Printed name: _____

Date: _____

---

*Online Consent Blank*

**ADULT CONSENT TO PARTICIPATE IN RESEARCH**
**Skincare Management: Protection from Sun Exposure**

**Principal Investigators:** Tabitha Milon, Claudia Aguilera, Denise Sahaid, Jaycee Helmer
**Institution:** DePaul University, Chicago, Illinois, USA
**Department, School, College:** Jarvis College of Computing and Digital Media ("CDM")
**Faculty Advisor:** Cynthia Putnam, Ph.D. - CDM, DePaul University

**Key Information:**
***What is the purpose of this research?***
We are asking you to be in a research study because we are trying to learn how a technology-based solution can help individuals (with different skin types) avoid overexposure to the sun.

This study is being conducted by Tabitha Milon, Claudia Aguilera, Denise Sahaid, and Jaycee Helmer. We are graduate students at DePaul University performing this research as a requirement to obtain their master's degree. This research is being supervised by their faculty advisor, Cynthia Putnam.

We hope to include 8-12 people in the research.

***Why are you being asked to be in the research?***
You are invited to participate in this study because you are open to discussing topics about your skin and how you protect yourself from sun overexposure. You are also over the age of 18 years old. You will not be asked to share personal information or the information of others.

***What is involved in being in the research study?***

If you agree to be in this study, the research involves an interview where we will ask you a series of questions about your skin, your experience with sun exposure, and how you may choose products to protect your skin from sun exposure. The interview will be audio recorded and transcribed into written notes to get an accurate record of what you said.

***Are there any risks involved in participating in this study?***

There are no risks with participation in this study beyond those present in everyday living. You may feel uncomfortable about answering certain questions. You do not have to answer any question that you do not want to. There is the possibility that others may find out what you have said, but we have measures in place to prevent this from happening. We will create an identification number in our records instead of using your name.

***Are there any benefits to participating in this study?***

You will not personally benefit from being in this study. We hope that what we learn will lead to improvements in management of skin protection from sun exposure.

***Is there any compensation to participating in this study?***

If you are a DePaul University student who signed up through the CDM/COMM Participant Pool for Research, you will receive 0.5 points of credit after completion of the research. You will only be given credit if you complete the study. If you withdraw before completing the study, you will not be given credit.

***How much time will this take?***

This study will take about 30 minutes of your time.

**Other Important Information about Research Participation**

***Can you decide not to participate?***

Your participation is voluntary, which means you can choose not to participate. There will be no negative consequences, penalties, or loss of benefits if you decide not to participate or change your mind later and withdraw from the research after you begin participating.

***Who will see my study information and how will the confidentiality of the information collected for the research be protected?***

The research records will be kept and stored securely. Your information will be combined with information from other people taking part in the study. When we write about the study or publish a paper to share the research with other researchers, we will write about the combined information we have gathered. We will not include your name or any information that will directly identify you.

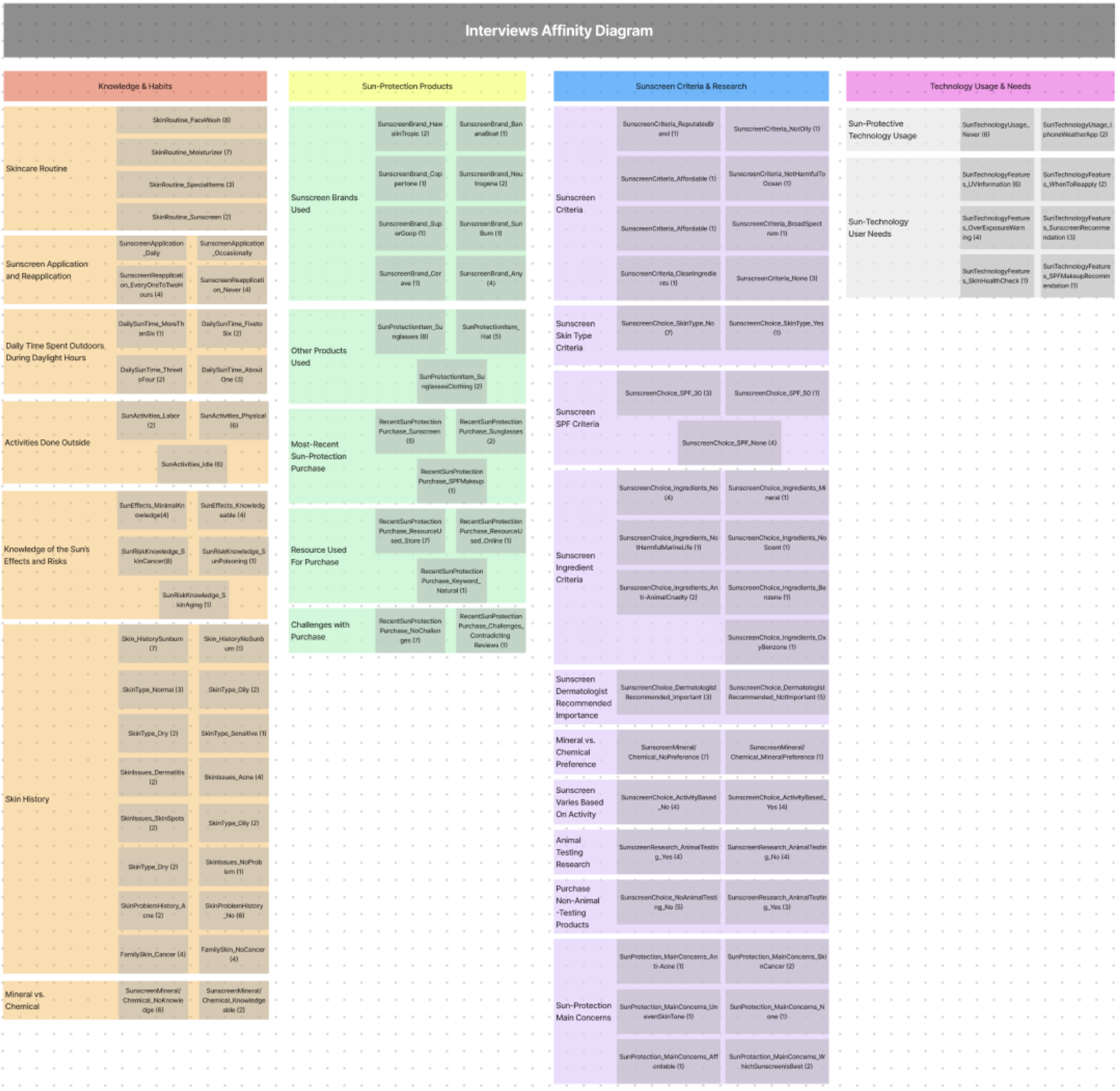
***We will send you a copy of this information to keep for your record if you request.***

**Statement of Consent from the Subject:**

The consent form has been read to you. Have you had all your questions and concerns answered? If not, please ask us anything else you would like. If all your questions have been answered, do you provide your verbal consent to be in the research?

By giving verbal consent, you agree to the following statement: "I have read the above information. I have had all my questions and concerns answered. By giving verbal consent, I agree to be in the research. Additionally, I authorize DePaul University to take and use video and audio recordings of me in connection with the research study. The video and audio recordings will be destroyed after the research study is completed."

# *Appendix V: Interview Affinity Diagram*



*Appendix VI: Interview Codebook*

## A. Knowledge & Habits

Code under **Knowledge&Habits_**

Code when participant mentions their knowledge on any skin-related topic, their skincare routine, or habits related to skin/being outside.

**A.1 Skincare Routine**
Code when participants mention skin products or their skin routine

Keywords: Face wash; moisturizer; retinol; cream; sunscreen; any brand name (E.g. Cerave)

**A.2 Sunscreen Application/Reapplication**
Code when participants mention their habits of applying or reapplying sunscreen

Keywords: sunscreen; apply; reapply; application; reapplication; sunscreen

**A.3 Time Spent Outdoors**
Code when participants mention the amount of time they spend outdoors during the day daily, weekly, or monthly

Keywords: daily; monthly; weekly; per month; hours; outside; time; spent

**A.4 Activities Done Outside**
Code when participant discusses the activities they do when they are outside

Keywords: Yard Work; labor; hiking; tanning; walking; running; working out; reading; beach; swimming; physical activity; hanging out

**A.5 Skin History**
Code when participant mentions skin-related family or personal history

Keywords: family; skin cancer; sunburn; oily; normal; dry; sensitive; problem; acne; dermatitis; skin spots

**A.6 Mineral vs. Chemical**
Code when participant discusses knowledge of mineral and chemical sunscreen

Keywords: Mineral; chemical

Note: Do NOT code if discussing preference, C.6, only code if discussing differences/knowledge

## B. Sun-Protection Products

Code under **SunProtectionProducts_**

Code when participant mentions any sun-protection product (e.g. sunscreen, clothing, hat, sunglasses), and any product purchase details

**B.1 Sunscreen Brands**
Code when participant mentions the brands of sunscreen they use, even if they do not have a preference

Keywords: sunscreen; brand(s); Hawaiian Tropic; Cerave; Banana Boat; Neutrogena; Super Goop; Sun Bum; Coppertone; anything; store brand

**B.2 Non-sunscreen Products**
Code when participant mentions a sun-protection item that is not sunscreen

Keywords: UPF; hat; sunglasses; clothing; shirt; pants; shorts

**B.3 Most Recent Sun Protection Purchase**
Code when participant mentions their most recent purchase of a sun-protection item

Keywords: most recent; purchase; sunglasses; hat; sunscreen

Note: Do NOT confuse with past purchases, only code if talking about most recent purchase

**B.4 Resource Used for Purchase**
Code when participant mentions what resource they used to buy the product

Keywords: Online; website; keyword(s); store

**B.5 Challenges with Purchase**
Code when participant discusses any challenges experienced while purchasing product, even if they did not experience any

Keywords: challenges; no challenges; purchase; problem; issue; no problem

## C. Sunscreen Criteria & Research

Code under **SunscreenCriteria/Research_**

Code when participant discusses product criteria, product research, or any product concerns

### C.1 Criteria

Code when participant discusses general criteria for purchasing sunscreen, even if they do not have any

Keywords: Reputable Brand; not oily; not harmful to ocean; affordable; broad spectrum; SPF; clean ingredients

### C.2 Skin Type Criteria

Code when participant mentions if they buy sunscreen based on their skin type or if they do not

Keywords: Skin Type; skin tone; acne

### C.3 SPF Criteria

Code when participant discusses if they buy sunscreen specifically based on SPF

Keywords: SPF; 30; 20; 15; 50

### C.4 Ingredient Criteria

Code when participant mentions if they buy sunscreen based on specific ingredients or how sunscreen is produced

Keywords: Animal cruelty; benzene; oxybenzone; scent; harmful to marine life; clean; mineral ingredients

### C.5 Dermatologist Recommended Importance

Code when participant mentions whether dermatologist recommended sunscreen is important to them or not important

Keywords: Important; not important; dermatologist recommended

### C.6 Mineral vs. Chemical Sunscreen

Code when participant discusses their preference (if any) of chemical or mineral sunscreen

Keywords: chemical; mineral; preference

Note: Do NOT confuse with A.6, knowledge about mineral and chemical sunscreen

**C.7 Sunscreen Varies Based on Activity**
Code when participant mentions if sunscreen use varies or does not vary based on the activity they are doing

Keywords: Varies; does not vary; activity

**C.8 Animal Testing Research**
Code when participant mentions if they research whether a product is tested on animals, or if they do not research

Keywords: animal; testing; cruelty; cruelty-free; research

**C.9 Purchase Non-Animal-Cruelty Products**
Code when participant discusses whether they consciously purchase animal-cruelty free products or if they do not

Keywords: Purchase; animal-cruelty; cruelty-free; sunscreen

**C.10 Sun Protection Main Concerns**
Code when participant mentions their main concerns about their skin and protecting it from the sun, even if they did not have any

Keywords: main concern; skin cancer; affordable; sunscreen

## D. Technology Usage and Needs

Code under **TechnologyUsage/Needs_**

Code when participant mentions past usage of sun-protection technology or features they would want included in a sun-protection technology

**D.1 Usage**
Code when participants discuss their usage of technology (if any) related to the sun protection and/or skincare

Keywords: Technology usage; never; app; weather

**D.2 User Needs**
Code when participant mentions features they want in a sun-protection technology

Keywords: features; recommendation; warning; information