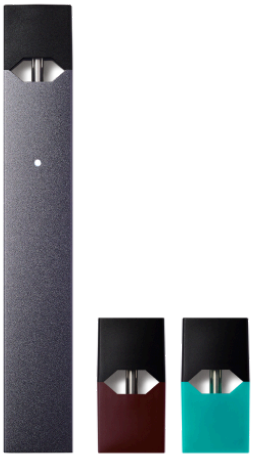
User Needs for E-Cigarettes



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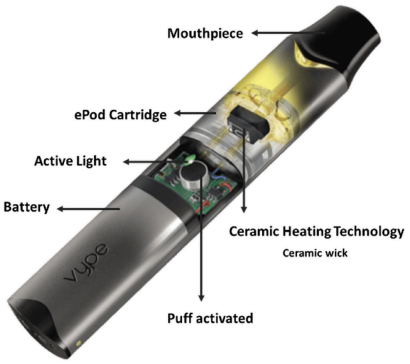
Topic

E-cigarettes are battery-powered devices that simulate the experience of smoking traditional cigarettes, but without burning tobacco. In the early 2000s, e-cigarettes began popping up in China and sparking international interest. In 2005, two product design students at Stanford invented the design concept for Juul which would become the most popular e-cigarette device in the United States quickly after its release.[1] Juul was famous for their e-liquid cartridges, which were available in a variety of flavors such as menthol, mint, mango, cinnamon, etc. During the 2010s, e-cigarettes became increasingly popular and were marketed to consumers as healthier alternatives to traditional cigarettes and as gateway devices to help adults quit smoking. The convenience and portability of e-cigarette devices gave rise to their popularity over traditional cigarettes, especially among younger generations.

Product Design

When creating Juul, the founders wanted to design a device that was sleek and compact to offer a more sophisticated smoking experience. The original device drew design inspiration from a flash drive, setting the precedent for the simple rectangular design of most e-cigarette devices. While there are different types of e-cigarettes, most devices share a similar design and internal components. E-cigarettes are powered by a rechargeable battery that heats up a coil inside the device. The coil (or atomizer) heats the e-liquid to the point of vaporization. Once heated, the coil vaporizes the e-liquid which produces the vapor that the user inhales while taking a hit from the device.[2] In disposable e-cigarettes, the e-liquid is stored in a cartridge. In reusable e-cigarettes, such as Juul, the e-liquid is stored in a tank that can be replaced with a new one once it has been used up. [3]For most e-cigarette devices, the user inhales to trigger the heating process while in other devices the user presses a button. Some e-cigarettes have an LED light at the bottom which lights up while the user is taking a hit, in order to visually mimic the experience of smoking a traditional cigarette.



[1] (Etter, 2021)
[2] (Pinto et al., 2022)
[3] (Pearse, 2018)

User Experience

Although the way to use an e-cigarette has remained largely unchanged, the design of these devices is constantly being iterated to improve the user experiences. Early versions of Juul devices were marked by the e-liquid leaking into users' mouths, not producing a satisfying nicotine hit, altering the pH balance of the cartridges, experimenting with different flavor profiles, preventing the device from overheating, etc. Product designers, chemists, and electrical engineers at Juul poured significant time and money into additional research and prototypes to address these early issues and improve the user experience of Juul to prevent barriers to adoption and improve customer retention.

With disposable e-cigarettes, the user purchases a device that has a specific flavor. The user will suck on the mouthpiece of the device in order to vaporize the e-liquid and take a hit. Once the e-liquid in the cartridge has run out, the user throws the device away. With reusable e-cigarettes, such as Juul, the user buys an e-cigarette device that comes with a charger and starter e-liquid tanks. Once the device is dead, there is a blinking light at the bottom to indicate to the user to recharge the device. Once the e-liquid in the tank has emptied, the user can replace it with another tank and keep using the device.

The user experience of using e-cigarettes is characterized by the immediate oral fixation of taking a hit and the convenience compared to smoking traditional e-cigarettes. The design of e-cigarette devices is intended to be very simple and user-friendly, often with no buttons or controls. There is no prior knowledge or set-up required to use an e-cigarette device. Compared to smoking traditional cigarettes where users need to carry a lighter, a pack of cigarettes, and be cognizant of both odor and ash, e-cigarettes require no set-up and offer a very discreet user experience as they product minimal, if any scent.The various e-liquid flavor options available allow users to experiment and offers a degree of user control and freedom. Nicotine strength is another aspect of the user experience, a single Juul e-liquid tank is roughly equivalent to smoking an entire pack of cigarettes. Since e-cigarettes are designed to be small, sleek and compact, they are very portable and easy to carry around. Additionally, the modern design of e-cigarettes is more reminiscent of an Apple product than a Marlboro, giving users the experience (and potentially illusion) of partaking in a healthier habit than traditional smoking.

User Plan

Objectives

The main goal of identifying and interpreting user needs for e-cigarettes is to understand pain points users currently experience and to gain insight into what features and qualities are important to e-cigarette users. Although incredibly common and popular, e-cigarettes are still relatively new products and have much room for improvement in terms of usability and applying

human factors principles to enhance the user experience of these devices. Objectives for developing a plan to create a list of user needs will help identify which human factors analysis methods are most appropriate to elicit more information, different types of user needs depending on the user group, and which user needs to prioritize for future development. I am interested in comparing the user needs for disposable vs. reusable e-cigarettes, and exploring how the user needs for older users differ, if at all, from younger users.

Procedure

For my research plan to gather and analyze user inputs and data, I will employ methods such as task analysis, questionnaires, structured interviews and focus groups. Participant inclusion criteria will require test participants to be over the age of 21 years old, the minimum age to purchase vaping products in the United States. To conduct task analysis, I will observe users using a Puff Bar (disposable e-cigarette) and a Juul (reusable e-cigarette). As of 2021, Puff Bar is the most popular e-cigarette brand after Juul. [4]Each task analysis session will ask participants to use a Puff Bar and Juul and to describe their feelings before and after taking a hit. I will take notes and observe how many hits a user takes during the task analysis session, how they interact with the device, how they hold onto the device, etc.

Using Qualtrics, I will create a questionnaire to administer to additional test participants. The questionnaire will contain optional questions about participant's demographic information such as age, location, race, gender, and occupation. Sample questions for the questionnaire will include:

- When did you first start using e-cigarettes?
- What compelled you to start using e-cigarettes?
- Do you prefer to use disposable or reusable e-cigarettes?
    - How often do you purchase a new disposable e-cigarette?
    - How often do you purchase new e-liquid pods?
- What is your favorite e-cigarette brand and why?
- What is your favorite flavor of e-liquid?
- How many hits of an e-cigarette do you take each day?
- How do you feel after taking a hit of an e-cigarette?
- What do you like about using e-cigarettes?
- What are the most important features of an e-cigarette?
- What would you change or improve about e-cigarettes?
- How would you rate your experience using e-cigarettes? (1-5)

Based on the responses to the questionnaire, I will identify gaps and tailor the questions to ask participants during interviews and focus group sessions. For conducting interviews, I will meet with participants one-on-one for thirty minutes. I am interested in learning more about each

[4] (Etter, 2021)

individual's preferences for certain e-cigarette brands, criteria they have for what makes a good e-cigarette, and how the physical design and aesthetic of different devices plays a role in customer loyalty and the user experience. For focus groups, I will conduct sessions with four participants lasting one hour. In order to identify differences among age groups, I will conduct a focus group with participants ages 21 to 30 years old, another with participants ages 31 to 40 years old, and an additional focus group with participants ages 41 to 60 years old. During each focus group, I am eager to learn more about each age group's experience with smoking and using e-cigarettes and their habits and preferences for e-cigarettes.

Expected Outcomes

After using several human factors methods to conduct research, I will analyze the data to identify a comprehensive set of user needs, identify different user groups, and further break down the main set of user needs based on type of user group. Based on the questionnaire results and interview and focus group responses, I will create affinity diagrams to identify patterns, develop journey maps and user personas to identify different user groups. Expected outcomes for the set of comprehensive user needs include:

- E-cigarette must deliver a satisfying and consistent nicotine hit
- E-cigarette must be customizable, with options for different colors, flavors and nicotine levels
- E-cigarette must not overheat during use, or during charging if device is reusable
- E-cigarette must not leak e-liquid, if device is reusable
- E-cigarette must be easy to use, and not require additional steps for set-up or use (such as pressing a button to activate device)
- E-cigarette must provide visibility of system status, if device is disposable in order to indicate to user how much longer the device will last for (since the amount of e-liquid is not visible to the user as with reusable devices)
- E-cigarette must be durable to withstand everyday wear and tear
- E-cigarette must be discreet in the smell and amount of vapor produced
- E-cigarette must be compact and easily portable
- E-cigarette must have an aesthetic and minimalist design

I expect to identify differences in test participant's user needs based on age, gender, frequency of use, and preference for disposable vs. reusable e-cigarettes. I predict that older users will be more concerned with the satisfaction of the nicotine hit while younger users will prioritize the design and appearance of the device more. I also predict that younger users will be more concerned with customization of e-cigarettes, especially with e-liquid flavors that are designed to make using e-cigarettes more appealing to new users within the younger generation. Additional expected outcomes include that frequent users will prefer reusable e-cigarettes over disposables and that

female users will be more concerned with safety features of e-cigarette devices compared with male users. [5]

Expected Limitations

Due to e-cigarettes being relatively new innovations, there is limited existing research into these devices. The long-term health effects of frequent e-cigarette use are still massively under-researched, let alone research into the design and ergonomics of these devices. More attention has been paid to perfecting the nicotine levels and flavors of e-liquids than to the user experience and product design of e-cigarettes. [6]There is much room and opportunity to applying human centered-design principles and human factors research methods to improve the user experience of e-cigarettes. Additionally, due to federal regulations of electronic nicotine delivery systems (ENDS) as well as stigma towards using nicotine products, people may be less inclined to participant in research activities regarding e-cigarettes.

[5] (Zare et al., 2018)
[6] (Yang, 2014)

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