

Image-Based Simulated Use Methods for Evaluating App-Connected ENDS

Hubbard, S; Batista, D.; Hedgecock, M; Johnson, A; Dubey, H
Reynolds American Inc. Services Company, NC, USA; Womble Bond Dickinson, NC, USA.

Introduction

Human factors evaluation of app-connected electronic nicotine delivery systems (ENDS) presents distinct methodological challenges due to the integration of a physical device, embedded controls, and a companion mobile application (“the App”). An image-based simulated use approach was utilized, in virtual interviews, to evaluate user understanding, interaction, and potential use-related risks associated with an app-enabled ENDS product and its supporting software. This approach allows for easy testing of user interactions early in the ENDS development process. The results of this testing allow for early design refinement and proactive risk identification.

Test Articles

App and Device Screenshots

In lieu of a physical prototype, images from the ENDS device screen and from the mobile companion application were used as stimuli for the remote interview. Figma⁽¹⁾ software was used for iterative design through the App development process which easily allows export of any screen image displayed within the App. Figure 1 shows Cloud Control feature on the App User Interface (UI) and on the ENDS device screen.

Instructional Materials

Instructional materials provided to participants included the App tutorial screenshots and a user guide. They were used to assess the participants’ informed understanding of the ENDS device features. Figure 2 depicts examples of the instructional materials.

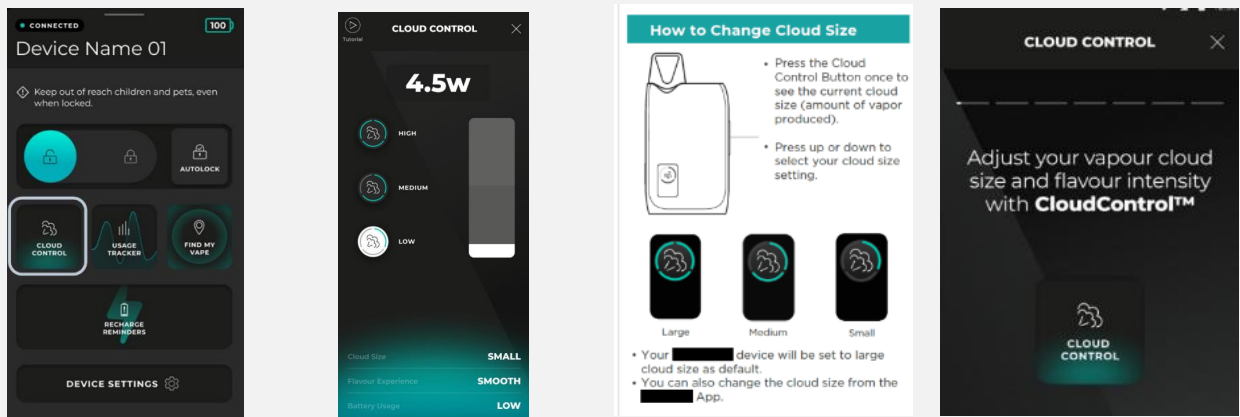


Figure 1: Cloud Control Feature in App UI and ENDS Device Screen

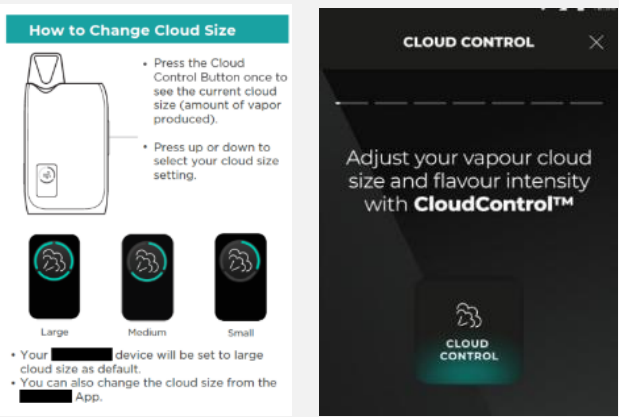


Figure 2: Instructional Materials

Methodology

Cognitive Walkthrough

The overall research method for this study was an image-based cognitive walkthrough in which participants were guided through the process of (virtually) using a device and encouraged to ‘think aloud’, to explain their thought processes as if they were using the device. The research consisted of online (i.e., virtual), one-on-one, 75-minute sessions with eight participants aged 21+ recruited in the U.S. Participants represented intended users of this product, who were current tobacco and/or nicotine-containing product consumers.

The research session involved exploring image-based workflows in a cognitive walkthrough of the ENDS device, pods, and associated mobile App. Participants did not handle or consume any tobacco or nicotine. A moderator presented participants with a series of task scenarios related to product setup and use; but rather than the participant handling the product to simulate use, they were presented with images of the product and App and asked to verbalize the actions they would take. The moderator informed the participant verbally or through imagery how the product responded to each action, enabling exploration of workflows (sequences of steps involved in use of a feature) using imagery only.

Intuitive Use

First, the study assessed intuitive understanding of the relevant UI features, prior to sharing instructional information with the participants. Scenarios were introduced in which the participant’s goal was to set up and use the product without assistance from the moderator or instructional information.

Informed Understanding Scenarios

The primary aim of the study was to assess whether and how instructional information impacts participant understanding of tested features and assess comprehension of new icons and UI features on the device display screen and App. A moderator introduced a series of scenarios which gathered informed understanding of icons, workflows, and features. The participants were shown relevant informational videos or sections of the user guide when the scenario was introduced. A total of six scenarios were assessed:

1. Preparation for Use
2. Use
3. In-App Features: Cloud Control
4. In-App Features: Lock Settings
5. Reset the Device
6. Error Codes Control

Cognitive Walkthrough Examples

Intuitive Use | Cloud Control

- Participants intuitively understood the concept of Cloud Control without any instructional materials. Before seeing any instructional materials, seven of the eight participants understood the concept of Cloud Control from the icon and name on the App home screen.
- The Cloud Control icon was interpreted intuitively as size of the ‘cloud’ or ‘puff’, and the filling of the circle sections around the icon correctly conveyed adjustment of cloud size to most participants.
- The participants were able to discern that the Cloud Control feature involved: the size of the exhaled cloud, the amount of vapor inhaled, and the device voltage control, before seeing any instructional materials.

Informed Understanding | Lock Settings

- The tutorial helped some participants to gain more understanding of the AutoLock behavior. However, the tutorial did not support correct understanding of locking/unlocking behavior for all participants. The virtual nature of the study and the lack of a physical prototype was a limitation which may have hampered the participants’ understanding.
- Scenario: “You run some errands and come home after 3 hours. When you come back home and pick up your device, you see the device display screen shows this [Bluetooth page] then this [standby (unlocked) state] and then goes blank [Standby state]. You feel two short vibrations. What do you think has happened?”

Conclusion

A human factors investigation was sponsored on an app-connected ENDS device. Eight adult participants (21+), completed moderated, virtual cognitive walkthrough sessions. In the absence of a functional prototype, simulated use of an app-enabled ENDS product was conducted using sequential images of device screens, mobile application interfaces, and instructional materials.

These findings demonstrate the utility of remote, image-based simulated use testing for evaluating app-dependent user interactions early in ENDS development. The results from early testing drive iterative design refinement, and proactive risk identification prior to validation testing.