NEUROUX

White Paper

Key Terms: Context, User Experience, Electroencephalography (EEG), Consumer Journey, Usability, Utility, Cognitive States, Neural Responses, Behavioral Strategies, Mix Methods Research

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NeuroUX: Measuring how participants feel when interacting with a system (i.e., website, software, app, consumer product, etc.).

Well-designed consumers' experiences are achieved through the creation of a simple, easy, and pleasing process. From enjoyment to usability, designing a successful, customer-centric product or service means creating a frictionless experience that satisfies needs and expectations. Yet, deciding which deep foundational changes will drive action is a challenge that benefits from a mixed-methods approach. NeuroUX is a modern approach, to identifying unmet needs during the consumer journey by using a powerful combination of neuroscientific, behavioral, and traditional user experience (UX) measures.

As with any research, it is important to target the most impactful research questions and objectives before deciding which tools to use. TThis step is crucial in NeuroUX research as it provides guided principles and action standards determined by research goals that determine metrics and provide actionable insights.

The "Neuro" of NeuroUX

Understanding the usability and utility of an experience requires analyzing how, when, and why users complete a task or navigate an interface. To dive deep into a user experience involves seeing reactions in-the-moment to uncover latent needs. To evaluate an authentic experience, passive measures allow researchers to investigate unobtrusively. Tools from neuroscience, such as the electroencephalography (EEG), reveal cognitive and emotional drivers of behaviors as consumers naturally engage with different interfaces. These reactions expose areas such as frustration, excitement, mental effort, and fatigue to help designers and developers create engaging, accessible, and seamless systems.

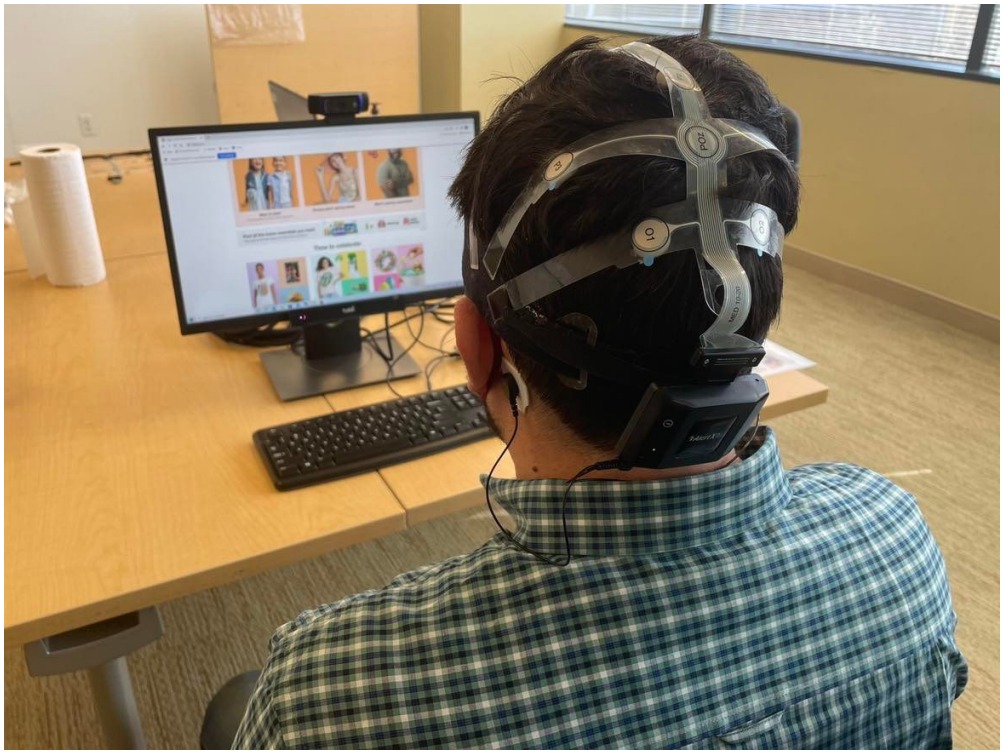

Figure 1: A participant is tasked with purchasing a shirt for himself on a website while the EEG cap records brain activity and the desktop eye-tracker measures gaze behavior.

The EEG measurement reveals opportunities to optimize usability and minimize friction through neural outputs. Through brain waveforms, this blunt tool can detect electrical activity by placing sensors (electrodes) on the scalp. EEG is a minimally invasive and portable tool that can be applied to a range of naturalistic stimuli within both physical and digital environments (Bazzani et al. 2020). The EEG has high temporal resolution, meaning that it can capture real-time processes and cognitive mechanisms that underlie observed behaviors. Further, study designs can reveal event-related potentials (ERPs) through the neural changes that occur in response to events or stimuli (Shang et al., 2018; Zhang et al. 2019). To learn more about this tool in-depth, read HCD's EEG White paper.

The moment-by-moment brain wave frequencies represent different dynamics in the brain that correlate with certain brain functions and responses (Allen et al., 2004; Peng-Li et al., 2022). For example, frontal alpha asymmetry (FAA) is determined by recording frontal hemispheric alpha power for both sides of the brain to determine the FAA score. This reveals the affective responses during an experience. A higher score implies there is a more positive response, while the lower score suggests a more negative response. Other cognitive states, like workload, engagement, distraction, or fatigue, can also be integrated into the research design to diagnose areas of improvement.

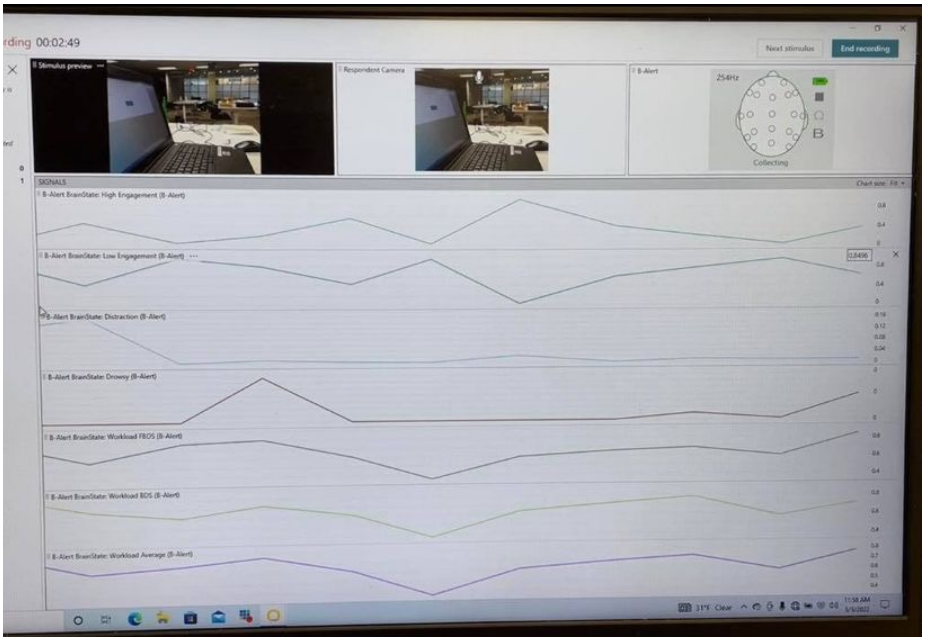

Figure 2: An example of an output recording from an EEG headset.

There is a nuance to understanding the cognitive states. Parameters set within the study design provide context for the interpretation of the data and give more shape to the user decision-making process.

The "UX" of NeuroUX

User experience (UX) research focuses on developing and designing simple and accessible experiences. Its purpose is to streamline any process and make it intuitive to avoid any user trouble or annoyances (Hibbeln et al., 2017). While approaches like think-alouds, card sorting, and retrospective self-reporting (via diary entries, surveys, focus groups, generative user interviews) serve as great exploratory methods to discover opportunity areas, they often require the individual to be removed from the experience. This can result in trouble with recall or difficulty articulating how they are feeling (Bazzani et al., 2020). With NeuroUX, helpful behavioral strategies to explain what the user is doing can fill in the blanks. Some approaches include (but are not limited to):

- Eye-tracking: Measures visual attention through gaze behavior to follow covert eye-movements
- Ethnographic Behavioral Coding: Quantifies a participant's actions within an environment or with a particular stimulus by assigning codes or labels to the overt, observed behavior
- Click Testing: Reveals the position of website users' mouse cursors and gives insights into activities such as clicks, scrolls, and general mouse movements

The behavioral performance reveals the flow of the user journey, while the neuroscientific outputs determine how the design is impacting cognitive states. This hybrid solution, jointly using subjective and quantitative data, gives researchers clear indications of what is and is not working.

Using traditional UX metrics in tandem with behavioral and neuro tools gives an overall idea of the user experience in context. Having exposure to the neural response, behavioral reaction, and the user's beliefs and impressions can effectively pinpoint problems and uncover opportunities (Bazzani et al. 2020). Further, by evaluating the participant's responses to a product or an interface, information about its appeal, intuitiveness, and functionality are exposed to make the finished product stronger.

Putting it all together

NeuroUX is an adaptable methodology, making it something that can be used during any stage of product development from concept validation to post-launch iterations. This approach can help companies differentiate from competitors by going beyond self-reporting during the consumer journey while also harmonizing across platforms by confirming the emotional and cognitive experiences translated from each consumer point of contact (from a website to an app to a physical product).

The customization based on the research objectives gives clear results and valuable learnings with the capability of measuring everything from cognitive workload to levels of engagement while knowing exactly when those responses were occurring (through behavioral measures) and why (through traditional self-reports). Combining this information with user log data or survey data then creates a cohesive experience to generate key takeaways that either validate or improve the current design.

An attractive consumers' user experience builds loyalty, increases conversions, and improves satisfaction (Ding et al., 2020). Reduce the risk of dropout, distraction, and confusion by ensuring the workflow is a straightforward, enjoyable experience with NeuroUX.

White papers of interest: Eye-tracking, Electroencephalography (EEG), Behavioral Coding, Brand Harmony

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