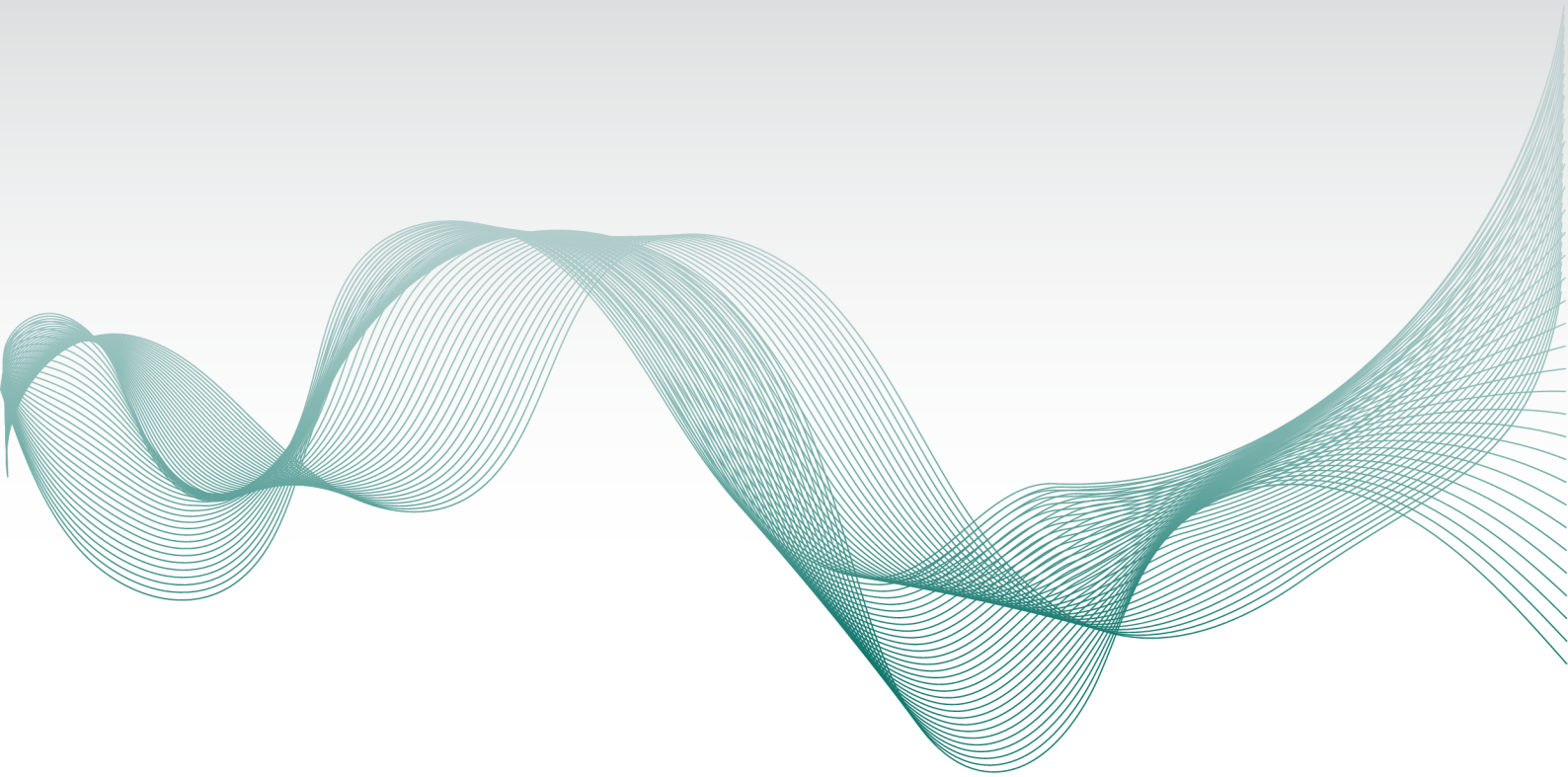


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C O N S U M E R N E U R O T E C H

FROM LAB TO SCALE



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Consumer Neurotech – From Lab to Scale

Scope

We've observed that many teams trying to transition EEG technology from research to market encounter common hurdles regarding scalability and user adoption.

We wrote this brief guide on approaches for increasing the chances that your product will stick - addressing various points from the early stages in the lab to delivering customer value at scale.

1. Prototyping and Iteration

- **Initial Prototyping:** Start with basic, low-fidelity prototypes to explore and test the technology's feasibility, functionality, and core concepts. Early sketches, simulations, or hardware demos help identify strengths and weaknesses while minimizing costs. Gather user feedback at this stage to align the product vision with real-world needs.
- **Functional Prototypes:** Develop high-fidelity, working prototypes (e.g., functional EEG systems) that offer a more accurate representation of the final product. Functional prototypes allow for more in-depth testing of technical performance, such as signal quality, electrode placement, and wireless transmission. Run usability studies to test the product in real-world conditions, refining comfort and ergonomics.
- **Iterative Refinement:** Based on feedback from early prototypes, iterate on the design, continually improving technical performance, comfort, and ease of use. Use agile development cycles to adapt quickly to user needs, regulatory requirements, and emerging technical challenges.
- **Alpha/Beta Testing:** Conduct controlled alpha and beta tests between iterations to refine the final design. This stage focuses on fixing bugs, enhancing product usability, and making final adjustments before mass production. This is also a good time to explore partnerships with key opinion leaders in your field who can provide feedback and testimonials.
- **Be Brave:** Don't be afraid to release an early-stage product to a test market for user feedback. Even if you believe the product is not finished, it will be useful for the right audience and those early adopters will give you invaluable feedback to inform your product development.

2. User-Centric Design

- **Focus on Usability:** Ease-of-use beats number of features 10/10. Make usability a priority by developing an intuitive interface and easy-to-understand controls. The target audience for EEG technology may include both medical professionals and consumers, so understanding their unique needs is critical. For instance, clinicians may want detailed data visualizations, while general consumers may prefer simplified reports and insights.
- **Comfort and Fit:** Pay close attention to the physical design to ensure the EEG device can be worn comfortably for extended periods. This is especially important for applications like sleep

monitoring, long-term brain health tracking, or continuous focus assessments. Consider integrating into existing form-factors to lower the entry hurdle.

- **Aesthetic Considerations:** The appearance of the device matters for consumer acceptance. Sleek, modern designs that blend into everyday life (e.g. brain-sensing earbuds) are more likely to gain user adoption than weird caps or clinical-looking devices. Look at the designs of successful wearables like smartwatches and fitness trackers for inspiration.

- **Personalization:** Consider how the device can be adapted to individual users, both for hardware and algorithms. For the fit, try to find the middle ground between one-size-fits-all and custom shapes. Make use of emerging AI tools to drive the personalization of UX, insights and interventions. Personalized devices are more likely to appeal to consumers and increase their long-term benefits.

3. Scalability Strategies

- **Modular Design:** Develop a modular hardware and software approach that allows for the addition of new features or capabilities without the need for complete system overhauls. For example, create EEG systems where components like sensors, processors or communication stack can be upgraded as technology improves.

- **Manufacturing Partnerships:** Partner with experienced suppliers and electronic manufacturing services (EMS) who understand how to scale medical-grade or consumer-facing wearables. Look for companies with experience in mass production, but who can also adhere to strict quality control standards.

- **Supply Chain Optimization:** A robust supply chain is essential for scaling, especially when sourcing sensitive or specialized components like low-power biopotential front ends, wireless chips, or biocompatible materials. Secure reliable suppliers and stock-up early to avoid scaling pains. Keep your ear to the ground for early warnings about global supply shortages and react accordingly. If you can afford it, have a large stock or otherwise a plan B for critical components.

- **Automation:** Leverage automation in both hardware assembly and software deployment. In hardware, pick the right production methods and automation level for each scaling step and factor in sufficient lead-time for tooling and process optimization. In software, start early with a robust CI/CD pipeline, monitoring, database automation and infrastructure as code.

4. Regulatory Compliance

- **Position yourself:** Are you building a medical or a consumer device? Although the border between the two worlds starts to dissolve you need to position yourself as early as possible. The path that follows will be dramatically different. Familiarize yourself with regulatory frameworks, understand the difference requirements for different target markets and integrate them into your product development. Work closely with regulatory experts and policy makers who specialize in wearables and neurotechnologies to anticipate upcoming regulatory changes (e.g. brain data as special category in GDPR).

- **Compliance Documentation:** Keep detailed records throughout the design, testing, and manufacturing processes. Study and potentially clinical trial data, performance validation, and safety test results should be documented to support regulatory filings. If you are going medical, become ISO 13485-compliant.
- **Studies and Clinical Trials:** When you develop a wearable brain-sensing device people will want to see validation against gold standard devices. This can range from small, controlled studies to reproduce established neuromarkers to large-scale clinical trials for medical applications like epilepsy monitoring. Work closely with regulatory bodies to determine the exact requirements.
- **Pre-Submission Meetings:** Engage regulatory authorities early in the process. Pre-submission meetings with the FDA or local ethics committees can provide valuable feedback and help you understand what regulators expect.

5. Neuroethical Considerations

- **Work with Experts and established tools:** Unless you are a neuroethics professional yourself, put together an ethics advisory board with seasoned experts that helps you navigate the challenging decisions that will inevitably occur. Feel free to use our [Ethics Tools for Neuro-Entrepreneurs](#) developed together with [Brain-Mind](#) and [Ningen Neuroethics Co-Lab](#) to ensure safety, equity, autonomy, and privacy for Neurotechnology startups, partners, and end-users. The Tool Kit includes templates for our ethics charter, advisory board terms, acceptable use policy, partner evaluation rubric, and ethics responsibility map.
- **Privacy and Data Security:** Widespread adoption of novel technologies requires end-user trust. Given the sensitivity of EEG data, state of the art privacy preserving techniques must be prioritized in your product and business development. Clearly outline how user data will be used and provide transparent and dynamic opt-in/opt-out mechanisms.
- **Ethical Use of Data:** EEG can reveal a wealth of personal insights, including mental states, emotional patterns, and even neurological conditions. Developers must establish strict ethical guidelines about how data will be used, shared, and monetized. Avoid potential misuse scenarios, by creating an [ethics charter](#), [acceptable use policy](#) and [partner evaluation matrix](#).
- **Informed Consent:** Ensure that all users—whether they are participants in studies or consumers using the device—are provided with clear and comprehensive informed consent documents. These should explain what data is being collected, how it will be used, and the risks involved in using the device. Keep the language and explanations plain and simple.
- **Bias and Accessibility:** Strive to reduce bias in EEG signal processing algorithms. Ensure that data is collected and validated across diverse populations, including different age groups, ethnicities, and neurological conditions, to avoid biased or inaccurate outcomes.

6. Market Education and Adoption

- **Educational Initiatives:** Market adoption of EEG technology often requires significant education to overcome scepticism or unfamiliarity. Create a strong content strategy that includes webinars, case studies, white papers, and video demos. Explain complex neurotechnology concepts in accessible language and easy to understand use-cases.
- **Demonstrating Clinical and Real-World Value:** Conduct case studies and publish results showing how your technology improves outcomes, whether in clinical settings (e.g., epilepsy monitoring) or everyday wellness applications (e.g., sleep tracking or stress management). Scientific validation, combined with real-world success stories, will resonate with healthcare professionals and consumers alike.
- **Partnerships with Healthcare and Tech Companies:** Partnering with key players in the healthcare industry can lend credibility and aid in market penetration. Consider partnerships with consumer tech companies that can already have a large customer base and can scale EEG technology into existing ecosystems, such as smartphone apps or health platforms.
- **Pricing and Reimbursement Strategies:** For consumer applications, consider tiered pricing models to make the technology accessible at different price points to different target audiences and volumes (e.g. academia vs. startup vs. big tech). For medical applications, early discussions with insurance companies or health providers about potential reimbursement pathways are essential.
- **Community Engagement:** Build a user community around your technology by engaging with early adopters, influencers, and health advocates. Support communities and online forums where users can share their experiences, tips, and outcomes, fostering a sense of trust and advocacy for the technology.

Conclusion

The successful commercialization of EEG technology requires a holistic approach that balances technical innovation, regulatory compliance, ethical practices, and user-focused design. By following these best practices—from rigorous prototyping and user testing to carefully managing scalability and fostering market adoption—teams can avoid common pitfalls and pave the way for brain-sensing solutions that are both effective and widely accepted. This thoughtful approach helps bring EEG technology into new markets, improving lives and health outcomes in a wide range of applications.