WASPLC

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Restoration vs. Extraction

Brain Data, Biometrics, and the Emerging Battle Over Human Cognition: *A Policy Framework for Human-Centered Neurotechnology and Recovery*

Executive Summary

The governance of brain data and biometrics is no longer a narrow technology question, it is a civilizational one. As consumer technology platforms, defense contractors, AI laboratories, insurers, and wearable manufacturers race to measure, model, and monetize human cognition, the institutions responsible for restoring injured, traumatized, and dysregulated nervous systems remain chronically underfunded, fragmented, and reimbursement starved. The result is a structural asymmetry: capital flows toward the extraction of neurological data far more readily than toward the repair of neurological function. This paper argues that the asymmetry is not incidental but architectural, and proposes seven policy principles to realign neurotechnology governance around human restoration, dignity, and autonomy.

Operational definition. Restoration is defined as clinically meaningful, individualized improvements in neurological, autonomic, and cognitive function — as distinguished from symptom suppression, pharmacological maintenance, or behavioral compliance. By *extraction*, the paper means the collection, modeling, and commercial or strategic use of biometric, physiological, emotional, and neural data generated by human beings.

I. The Core Asymmetry: Extraction Outpaces Restoration

Modern institutions increasingly direct capital toward technologies that predict behavior, optimize engagement, influence cognition, enhance productivity, expand surveillance capability, and extract actionable neurological data. The same institutions routinely decline to fund the inverse set of capabilities — nervous-system repair, trauma recovery, cognitive rehabilitation, autonomic and sleep restoration, neuroplastic recovery, and individualized neurological healing. The implication is uncomfortable and unavoidable: contemporary systems are more financially interested in harvesting

brain function than in restoring it. This restoration-versus-extraction divide is now visible enough that policymakers, civil-rights advocates, and healthcare regulators can no longer treat it as a peripheral concern (Ienca & Andorno, 2017; Yuste et al., 2017).

The scale of the imbalance is concrete. The global neurotechnology market is projected to exceed $24 billion by 2027, with double-digit annual growth driven by consumer wearables, brain-computer interfaces, and behavioral analytics (Precedence Research, 2024). U.S. federal investment in traumatic-brain-injury rehabilitation research, by contrast, has remained an order of magnitude smaller for more than a decade, even as an estimated 2.8 million Americans sustain a TBI each year (CDC, 2023; National Academies, 2022). Capital and clinical urgency are pointing in opposite directions.

II. The Rise of the Cognitive Extraction Economy

The digital economy already monetizes attention, emotion, preference, outrage, behavioral prediction, and psychological vulnerability, a model documented extensively as "surveillance capitalism" (Zuboff, 2019) and refined through algorithmic "hypernudging" (Yeung, 2017). The next phase extends this model into biometric and neural data: heart-rate variability, sleep architecture, stress and emotional response, gaze, cognitive load, voice prosody, and, increasingly, direct neural signals captured by consumer-grade EEG headsets and emerging brain-computer interfaces (Royal Society, 2019).

Because such data enables increasingly precise behavioral models, it carries substantial commercial, governmental, and strategic value. The hazard, however, is not the technology itself but the absence of governance around it. Without enforceable guardrails, human biology risks becoming a resource-extraction industry on par with petroleum or rare earths, with the critical difference that the resource in question is the human mind. Recent jurisdictional responses underscore the stakes: Chile became the first nation to enshrine neurorights in its constitution (2021); Colorado (HB 24-1058) and California (AB 1008) became the first U.S. states to classify neural data as sensitive personal data under their privacy statutes (2024); and UNESCO has advanced the draft *Recommendation on the Ethics of Neurotechnology* (UNESCO, 2024). U.S. federal policy has not yet followed.

III. The Marginalization of Restorative Care

While billions flow toward optimization and behavioral analytics, patients seeking restoration encounter fragmented, underfunded, and frequently inaccessible care. A wide range of restorative modalities: neurofeedback, autonomic retraining, functional neurology, metabolic psychiatry, hyperbaric oxygen therapy, biomarker-driven neuroinflammatory treatment, vestibular rehabilitation, environmental medicine, precision sleep restoration, HRV-guided recovery, and integrative brain rehabilitation; exist in an institutional gray zone. Many demonstrate meaningful clinical benefit in peer-reviewed literature (Marzbani et al., 2016; Hadanny & Efrati, 2020; Palmer, 2022), yet reimbursement systems frequently classify them as experimental, non-standard, insufficiently codified, or economically inconvenient (Brain Injury Association of America, 2023).

The underlying bias is structural: the U.S. healthcare reimbursement architecture rewards symptom management and actuarial predictability more reliably than individualized restoration. Patients whose recovery requires multi-system, longitudinal, or biomarker-guided care are routinely channeled into pharmacological maintenance, the path of least administrative resistance, even when evidence supports more restorative alternatives.

IV. Trauma as a Cross-Sector Governance Failure

Trauma is no longer a purely psychological category. Converging evidence demonstrates that traumatic exposure produces measurable, durable changes across neurological function, autonomic regulation, inflammatory pathways, endocrine signaling, sleep architecture, immune response, and long-term morbidity and mortality (Felitti et al., 1998; van der Kolk, 2014; Porges, 2011; Heneka et al., 2018). Yet U.S. governance structures continue to silo mental health, neurology, physical medicine, immunology, endocrinology, and environmental health into disconnected institutional categories with separate funding streams, billing codes, and regulatory authorities.

Individuals suffering complex brain and nervous-system injuries are therefore trapped inside systems that cannot treat interconnected dysfunction holistically. This fragmentation benefits institutional simplicity, not human recovery. Addressing it is a governance task, not merely a clinical one — it requires aligning reimbursement codes, agency jurisdictions, and research funding around the empirical reality that the nervous system does not respect the boundaries of administrative specialties.

V. Structural Incentive Asymmetries

The current architecture produces incentive asymmetries that are difficult to defend on first principles. Platforms profit from dysregulated attention; pharmaceutical systems profit from chronic management rather than cure; insurers profit from limiting long-horizon expenditure; data brokers profit from behavioral predictability; and institutions accrue advantage from dependency and compliance metrics. The social goods produced by genuine neurological restoration: independence, resilience, critical thinking, emotional regulation, sustained cognitive recovery, and reduced institutional dependency are diffuse, hard to attribute to any single payer, and largely invisible to existing reimbursement models.

This is not, in most cases, evidence of coordinated malice. A system does not require conscious intent to generate dehumanizing outcomes; misaligned incentives are sufficient.

Anticipating the counter-argument. Defenders of the current arrangement argue that extraction-side investment underwrites research and development that eventually benefits restoration, a kind of neurotechnology "trickle-down." The empirical record does not support this claim in U.S. healthcare. Milliman's five-year analysis of 37 million insured Americans found that behavioral-health office visits were 5.4 times more likely to be out-of-network than medical visits by 2017, *worsening*, not improving, across the same period in which consumer-data monetization scaled (Milliman, 2019). The Government Accountability Office independently documented that covered consumers continue to face restrictive approval processes and coverage limitations for mental and behavioral health (GAO, 2022). The National

Academies similarly concluded that 'the rehabilitation and long-term needs of many TBI patients are not sufficiently provided for by current health and insurance systems,' with payment guidelines that are 'inadequate, too restrictive, and poorly timed' (National Academies, 2022). Decades of consumer-data monetization have not produced commensurate reimbursement reform, and the modalities showing the strongest restorative evidence remain the most reliably denied by payers. Investment in extraction has not, in practice, financed restoration; it has financed more extraction.

VI. Toward a Restoration-Oriented Policy Framework

The next decade will likely determine whether neurotechnology evolves primarily toward human flourishing and restoration, or toward extraction, optimization, surveillance, and behavioral control. Public policy must actively shape this trajectory rather than ratify whichever outcome markets and defense procurement happen to produce. The seven principles below are offered as a foundation for federal and state legislation, agency rulemaking, foundation grantmaking, and inter-institutional coordination.

VII. Seven Policy Principles

1. Brain Data Rights. Individuals must retain ownership of and informed-consent rights over biometric and neurological data. Brain data should receive protections equal to or greater than genetic data because of its predictive, behavioral, and identity-level implications. Federal legislation should codify the protections already pioneered by Chile, Colorado, and California.

2. Restoration-Oriented Healthcare Reform. Healthcare reimbursement structures should expand support for evidence-informed restorative neurological care, including multidisciplinary, biomarker-guided, and individualized approaches. CMS and state Medicaid agencies should establish pathways for coverage of treatments with credible clinical evidence even where traditional coding categories lag.

3. Nervous System Health as Public Health. Trauma, chronic stress injury, environmental neuroinflammation, and cognitive dysfunction should be treated as long-term public-health concerns with measurable societal costs, comparable in policy weight to cardiovascular disease or diabetes.

4. Transparency in Neurotechnology. Companies collecting biometric, emotional, or neurological data should disclose collection methods, commercial uses, predictive-modeling practices, third-party data-sharing relationships, and any behavioral-influence mechanisms deployed on the basis of that data.

5. Ethical Boundaries on Behavioral Manipulation. Governments and corporations should face strict, enforceable limitations regarding neurobehavioral targeting, emotional manipulation, and predictive behavioral exploitation. The European Union's AI Act (Regulation 2024/1689, Article 5) offers a usable template for federal adoption.

6. Independent Research Funding. Public funding should prioritize independent research into restorative neurological and trauma-recovery modalities rather than relying solely on pharmaceutical or corporate incentive structures. NIH and DoD trauma-recovery portfolios should be expanded with explicit restoration-oriented mandates.

7. Human Dignity as a Governance Principle. Technology policy should prioritize the preservation of agency, cognition, emotional sovereignty, family integrity, and human autonomy. Human beings must not be treated as raw material for institutional optimization systems.

8. Digital Identity Rights 20251019 WASPLC SPC: STATE - The Complete Digital Identity Rights F…

9. Behavioural Copyright 20251019 WASPLC SPC: STATE - From Likeness Copyright to Behavior…

Conclusion

The central question is not whether brain-data technologies will advance. They will. The real question is whether society will organize these systems around restoration, dignity, autonomy, and human flourishing, or around extraction, prediction, monetization, and behavioral control. The distinction matters, because the systems we build to measure the human mind may ultimately shape what it means to remain human at all.

Recommended next action. WASPLC recommends that congressional and state-level committees with jurisdiction over health, privacy, and emerging technology convene joint hearings on neural-data governance and restoration-oriented healthcare reform within the next legislative session, with testimony solicited from clinicians, patients, neuroethicists, privacy scholars, and independent researchers operating outside corporate-sponsored research structures.

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