Intelligent, Responsible, and Human-Centered Design Engineering

The papers in this issue of Big.D address a central challenge in contemporary engineering: how intelligent technologies can be designed not only for technical performance, but also for human adaptability, sustainability, privacy, cultural context, and responsible implementation.

Biomedical and human-centered technologies form one major direction. Research on intelligent prosthetic control through transcranial ultrasound neuromodulation, AI-enabled healthcare, and bioelectronics-supported cognitive-fatigue management illustrates how advances in sensing, computation, and neurotechnology can be integrated with human-centered engineering objectives. Such work increasingly requires design decisions to be supported by measurable physiological or behavioral information rather than by usability considerations alone.

A second direction concerns data-driven and adaptive design. Transformer-based prediction of design innovation trajectories and research on digital platforms and user behavior demonstrate the increasing role of computational models in understanding complex technological and behavioral systems. At the same time, studies of user experience in digital payments and culturally sensitive cognitive assessment emphasize that intelligent systems operate within diverse social and cultural environments.

Importantly, this issue also raises questions of responsibility and trust. Privacy-preserving data reprogramming and interventions related to moral perception point toward a wider engineering challenge: intelligent systems must address privacy, behavioral consequences, and value-sensitive design as part of their technical development.

The issue further extends sustainable engineering through advanced additive manufacturing of metal–polymer composites for circular and smart applications, linking manufacturing innovation with resource efficiency and circularity.

Together, these contributions demonstrate that future design-enabled engineering must integrate intelligence, technical performance, human factors, sustainability, and responsibility. This convergence is central to the mission of Big.D and to the development of emerging technologies that are both technically capable and meaningfully situated within human systems.