R&D Item

3. Social Implementation of Awareness AI

1. Overview

To bring the systems developed through other two themes into real-world use, what kinds of approaches are necessary? And what benefits might a society that coexists with such AI-powered robotics bring to our daily lives? This R&D thema aims to answer these questions through empirical validation and practical experimentation using the Awareness AI system.

Among the many challenges, managing the concept of *awareness* itself poses a particularly complex task—one that sets this project apart from conventional technological development. Awareness often arises from subtle changes deep within the unconscious mind, which means that a person's subjective perception may not always align with actual neural activity or behavioral changes.

As demonstrated in the *Application of Awareness AI*, the changes detected by the AI often rely on fine-grained physiological signals expressed through the body. Furthermore, the "ability to read the atmosphere"—discussed in the *Development of Awareness AI*—represents an attempt to assign a form of logic to ambiguous, subjectively elusive phenomena. For AI, this requires an exceptionally high level of inferential capability.

How can we objectively evaluate these *unconscious changes*, and translate them into forms suitable for societal implementation? Addressing this question demands the establishment of new evaluation criteria and implementation guidelines that go beyond traditional ergonomic and psychological assessment frameworks.

Equally important is that the changes prompted by Awareness AI must be *desirable* from the perspective of the individual. This means not only promoting physical improvement, but ensuring that the direction of change aligns with the person's own latent, unconscious aspirations. Rather than relying on conventional tools like questionnaires or self-reports, this approach seeks to analyze subtle shifts in behavior and biosignals that individuals themselves may not be aware of and to use those signals to gently prompt meaningful awareness.

To support this, we are also working to construct a mathematical framework capable of theoretically modeling how awareness emerges and transforms. By integrating psychological insight with formal modeling, and identifying issues that arise during real-world implementation, this project is formulating concrete strategies for the future deployment of these systems.

Ultimately, we aim to build a society in which Awareness AI can go beyond subjective self-perception to accurately understand a person's physical and mental state—and guide them, naturally and unobtrusively, toward the direction they inherently wish to pursue. The realization of such a society, in which humans and robots live together in harmony, will make significant contributions to improving individual quality of life, enabling early detection and prevention of illness, and designing a more human-centered future.

2. Results in 2024

As discussed in the *Development of Awareness AI* section, creating sustained behavioral change through Awareness AI requires a system that enables continuous engagement. The key to this is the concept of intrinsic reward.

Intrinsic rewards refer to psychological incentives that motivate a person to continue an activity even in the absence of external rewards such as money, praise, or recognition. These include feelings of enjoyment, personal growth, or fulfilled curiosity. In this research project, we have focused particularly on linking interventions in natural walking to an individual's *aspirational self*—developing a framework in which the act of walking itself becomes inherently rewarding.

Specifically, as shown in Figure 1, we have categorized walking patterns into four distinct types. By guiding individuals to gradually transform their current gait into a preferred walking style, we developed an approach that encourages the formation of healthy walking habits—*effortlessly and almost unconsciously*. The transformation process itself is designed to function as an opportunity for generating intrinsic reward.

In parallel, we are working to mathematically define unconscious movement patterns that trigger awareness. In particular, by applying Lyapunov functions as illustrated in Figure 2, we have begun to quantify the stability and directional change of human unconscious movement. These insights provide a theoretical foundation for the development of motion assistance and behavioral intervention algorithms that promote natural and effective motor adaptation.

Furthermore, the real-world implementation of the walking analysis system equipped with Awareness AI is steadily advancing. As shown in Figure 3, the system has already been adopted as part of corporate wellness programs, where employees' walking patterns are measured and analyzed, and feedback is provided to promote greater daily health awareness and the establishment of lasting exercise habits.

Beyond corporate use, we are also working to bring this technology to the general public. For example, we have introduced the system as part of health-focused activities at public bathhouses and wellness facilities, giving a broader population the opportunity to gain insights into their own physical condition in an engaging and accessible setting.

3. Future plans

Moving forward, we plan to refine the intrinsic reward delivery system and the mathematical approaches—in collaboration with other research and development initiatives—into a form that is ready for real-world deployment. These advancements will be integrated as an upgrade to our current implementation systems, further advancing the path toward full societal adoption.

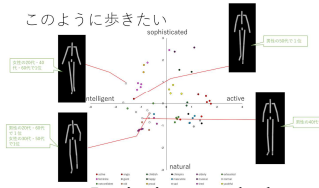

Fig.1 Approach to provide Intrinsic rewards through walking

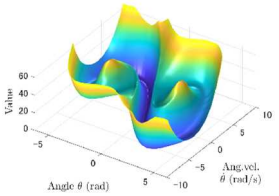

Fig.2 Lyapunov Function to describe natural behavior

Fig.3 Walking gait Training in Maru-Biul

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