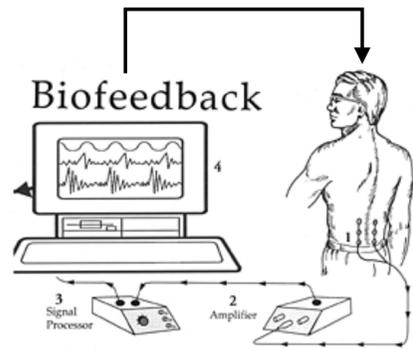
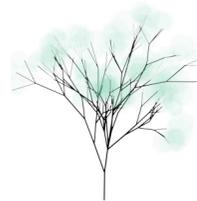


Ph.D. Journey

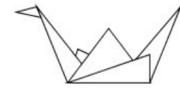


Metaphorical visual design



Autonomic Tree

First-perspective visual game



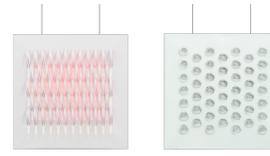
Light-Bird

Ambient Lighting



Ambient Lighting

Shape-changing display



BioMirror

Physical visualisation



Heart Bloom

Haptic feedback by touch

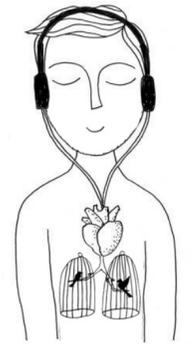


Breathe with Touch

Signification of HRV data



Heart Rhythm



Listen to Inner

On-screen graphic feedback

Autonomic Tree is designed to present stress-related physiological information in a more evocative, meaningful and thought provoking way. We use several attributes of the tree (thickness, length and direction of its branches and colours of leaves etc.) mapping to HRV parameters in real-time. We argue that the use of a botanical tree as a metaphor could not only translate the obscure physiological data into an image that is easy to understand, but also add more health-related meanings.

Light bird is a first-perspective flight game. In this game, we mapped the user's breathing data to the first person view. We try to bring users a relaxing flying or floating experience to biofeedback learning processing to promote the relaxation.

In this study, ambient lighting has been used as a communication medium. We designed a HRV biofeedback system which integrates with ambient lighting, assisting users in regulating breathing patterns for stress reduction at home. Ambient lighting seamlessly merged with the home environment could provide biofeedback information to users, making them aware of certain physiological processes and healthy regulation thereof. The combination of decorative and informative aspects makes intelligent lighting both pleasant and helpful for users.

Listening to nature sounds such as birdsong and sound of rain after exposure to a stressor should result in a positive emotional effect and significant reductions in anxiety, anger, and sympathetic nervous system arousal. In this study, we designed a Bio-soundscape, a nature-soundscape based auditory biofeedback interface to convey various physiological information for relaxation. The nature soundscape acts as the carrier of feedback. The parameters of the proposed nature soundscape model respond to an individual's respiration, skin temperature, galvanic skin response. Through the modulation of its parameters, Bio-soundscape presents the breathing pattern, arousal level, and heart rate variability based its effect on the listener's auditory perception of nature soundscape regarding quietness and dynamics.

Based on the characteristic of biofeedback-assisted relaxation, we designed an auditory interface named Sound Journey for supporting users being in the flow during a biofeedback relaxation session. Compared to the Bio-soundscape, sound Journey consists of multiple nature soundscapes. With Sound Journey, the users can voluntarily switch the soundscape between different nature scenes when they feel bored or tired. The intention here is to provide a condition for optimal flow experience by allowing the users moderate the challenge-skill balance in a biofeedback learning process.

Nature Soundscape based auditory interface

Musical interface

Bio-Soundscape

Sound Journey

Many musical interfaces have been developed aiming to harness the positive effects of music to promote the relaxation experience. The musical pitch, tempo and volume can be controlled by the participant's physiological state. The musical outputs of these interfaces sound still quite different from those musical pieces which are arranged meticulously by a given composer. But the real-time music notation techniques (also referred to as dynamic musical scores) might offer a better tool to get into the essence of the music and create a more melodious musical interface. But how to fascinate the aesthetic of the musical form with bio-data might still be a big challenge.

BioMirror is a set of interactive surfaces that respond to users' heartbeats, respiration and autonomic nervous system activities. The surface is complex paper-based structure with repetitive incisions created by laser cutting. the rear serves as a medium to transform force from servomotors, vibration motors or fans into an action, stimulating the patterns on the surface to vibrate, swing, bulge or rotate to display physiological information in dynamic physical form.

HEART BLOOM is a biofeedback device that collects heart rate data and visualizes it with the assistance of a pen plotter. The path and rhythm of the pen's movements are dynamically coupled to physiological information, such as heart rate variability, creating a new means for visualizing and monitoring personal medical information.

Breathe with Touch is a tactile interface of breathing assistance device that provides breathing guidance through a shape-changing airbag. It simulates human's breathing movements through the shape changes of an inflatable airbag. The expansion and contraction of the lungs are mirrored by the inflation and deflation of the airbag. The airbag inflates and deflates at a specific rhythm to simulate the targeted respiratory pattern.

- Visual feedback
- Haptic feedback
- Audio feedback