Transmission of Experiences with Augmented Human Techniques

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Abstract
Transferring human experience is one of fundamental and vital activities in our history. Teachers, trainers, textbooks, instruction movies, etc. has been introduced for the transmission. New methods that enhance transmission of human experiences are always desired according to the social and economic situations. Recent developments of virtual reality (VR), augmented realty (AR) and augmented human (AH) technologies make us expect a future that we can instantaneously (or at least more efficiently) transfer the skills or knowledges from one to another, like in Sci-Fi movies. However, for that, we need to optimize the transmission method for each person. We propose the augmented-human based approach for the experience transmission, and review some factors that are essential but not well focused in past studies.

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Augmented Human; Sports; Health Care; Cognitive Bias; Experimental Supplement

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H.5.1 Multimedia Information Systems: J.3 LIFE AND MEDICAL SCIENCES: Miscellaneous

Introduction

The aim of our study is to establish the method of "experience" transmission, as a part of a research project: Behavioral change and harmonious collaboration by experiential supplements [1]. Experiential supplements (ES) denotes the transmission of experience for improving one's physical/mental condition, skill and knowledge, via any possible methods especially using VR, AR and AH technologies. In the framework of the ES project, the following processes run concurrently and interactively:

- Accumulation of human behavioral/physiological/psychological data from large number of participants during activities such as e-learning, physical training and sports.
- Data clustering into subgroups (i.e., in terms of the characteristics of individual strategy in learning).
- Identification of the subgroup in which the participant in concern belongs to.
- (Real-time) modification of the transmission method depending on the identified subgroups

In short, the main concept of ES project is the individual optimization of the transmission method using recent digital technologies, which has not been established well yet. In the next section, we will explain in which fields we apply the ES concept.

Application Fields

Training with Slow Movement and Posture Correction for Health Care and Sports

Maintenance and improvement of physical conditions become more and more serious social issues, due to the aging society (especially in Japan). Watanabe et al. proposed LST method (low-intensity resistance training with slow movement and tonic force generation), which have a practical accomplishment even for the elderly to gain muscles with small load [7]. However, physical training methods are needed to be adjusting to individual characteristics, personality and condition of the body. Conventionally, experienced trainers support such adjustments. VR, AR, and AH techniques can substitute some of those adjustments and even have a potential to establish more efficient adjustment methods. We already confirmed that VR technique such as real-time sensory feedback of posture data helps for the training in LST method [4]. For the next step, we are planning to introduce ES concept to innovate more efficient way of training and behavior modification in daily activities.

Superhuman Sports

Superhuman sports aim to invent new sports with AH technologies, that are ideally available to anyone, anywhere and anytime. Technologies include but are not limited to: drones, augmented bodies and perceptions, neuro-devices, tele-existence, other AR/VR technologies, transportation devices such as hovercrafts [エラー! 参照元が見つかりません。, 5].

The advantages of utilizing superhuman sports as an application field of ES are:

1) Natural integration of physiological and locational sensors with the superhuman sports.

2) Step by step observation how players would adapt to unfamiliar interactions between themselves, environment and other players.

3) The result of analysis can be immediately reflected to the rules and device configurations. Playing and creation of superhuman sports are not clearly separable.

4) Simply, sports are entertaining.

Approach

Again, the key idea is the individual optimization. To design the optimization system, we need to focus on controllable factors that 1) reflect individual characteristics, 2) are closely related to the transmission of experience and 3) experimentally controllable. In this section we will explain some of factors we specifically focus on in our approach.

Identifying Individual cognition style in terms of Cognitive Biases

What is the individual characteristics at cognitive level? Explicitly or implicitly, cognition is "biased" to some extent in most decision-making situations and introspections. Even when a content of cognition seems rational and neutral, with careful inspections we could identify biased factors in it. In other words, without the biases we cannot make any decision or introspection at all, because sensory information is essentially limited and memories and knowledges are imprecise in principal[1].

Some of the biases are generally considered as practical strategies (i.e., symmetry bias in word acquisition tasks), where others as mere disturbances of rational decision makings (i.e., normalcy bias in risk judgement tasks). Note that however, depending on situations, any biases can be either harmful or beneficial. To put it simply, cognitive bias is a relative notion.

In addition and most importantly from the perspective of our approach, the characteristics of biases are different with each person. For instance, in an identical situation, some participants show a conservative kind of bias while others show radical one. It is obvious that we cannot simply transmit the experience of former to latter if they take the transformed information differently. Hence it is important to identify biases *before or during* the transmission of experiences.

For that purpose, we need to establish the identification procedure beforehand, using any VR/AR/AH technologies and conventional psychophysics and subjective reports. In the workshop we will disclose some ideas for the identification.

Identifying and Designing Cognitive Biases during Human Augmentation

Note that cognitive biases are optimized to THIS reality we all experience together with this particular version

1 Same logic can be applied to any biological systems and many search tasks by computer algorithms.

of physical laws. AH inevitably accompanies the transformation of reality since (subjective) reality are formed through interactions between surrounding environments, body and mind. Accordingly, cognitive biases change both quantitatively and qualitatively depending on the degree of the transformation. Therefore, to identify and design biases with/during AH, we need to tackle following questions:

- Which known biases do remain untouched, with what kind of AH techniques?
- If any, why untouched? Is it unchangeable because it is innate, or simply robust enough through its development?
- What kind of biases will emerge, and how?
- How can we control and utilize them?

Recently we have initiated the series of cognitive experiments for designing biases both with classic visual experiments with table-top displays and VR techniques[2]. One of them specifically aims to manipulate a well-known strong cognitive bias related to Monty Hall Problem. The problem illustrates that in many situations human cannot properly evaluate relation between external events and internal decision makings. We are now trying to improve the evaluation, introducing apparently strange VR world.

2 The drastic manipulation of metacognition (the style of cognition) has been already implemented with the Substitutional Reality System (ref), in which physical reality and virtual reality are subjectively indistinguishable to each other for users.

Somatosensory system with Human Augmentation

In our application fields (trainings and superhuman sports), the contents of experience to be transmitted are mainly related to somatosensory system (tactile/interoceptive perception, motor control and corresponding nervous system, etc.).

Each person developed his/her own robust somatosensory system through the interaction between environments. Some characteristics can be revealed with sensors (i.e., position sensors) embedded to AH devices. So we focus on them and identify to which subgroups a participant belongs and accordingly modify the methods in real-time basis. In the case of correction of postures in during walk or deskwork, for example, the grouping factors include the position of the body center during daily activities (e.g., "stable body center" group and "unstable body center" group). Suppose one is identified as in the unstable body center group, then the corresponding training methods with AH (i.e., the real-time feedback through human somatosensory system to modify one's posture or behavior by working on the subconscious) will be picked up from the method database according to one's physical/mental characteristics.

One practical way to identify the characteristics in somatosensory system is to give the participants unfamiliar AH devices. We already confirmed the spontaneous strategy to integrate the devices into their somatosensory system individually varies significantly, possibly reflecting participants characteristics of somatosensory systems. Such identification is the next step in our research.

Note that cognitive and somatosensory system are not independent. Indeed previous studies confirmed that cognitive and somatosensory factors interact with each other [3]. In our approach with AH, we will try to utilize the interaction, not only identifying them.

Discussion

As a first step of our approach, currently we are working on the identification of (cognitive or somatosensory) individual characteristics in correcting posture, fitness, and superhuman sports, as well as the VR cognitive experiments how AH affect cognitive biases. In the workshop, we will present preliminary results and review the relationship between cognitive biases and somatosensory system in more detail.

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