Development of Educational Application Using Standard Movement Code-Based on Human Behavior

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Abstract. The aims of this study is to extract a standard movement code according to specific emotional behavior patterns in the human behavior information database and to develop educational applications composed of corresponding opposite behavior codes. Among the various behaviors of the human being, we focused on the behavior of the emotional behavioral disorder group and accumulated the motion data and extracted the specific behavior motion code from it. Finally, we suggest an educational program for emotional and behavioral difficulties using this motion code.

Keywords: Emotional and behavioral disorder · Standard movement code · Behavior · Labanotation · Motion-capture · Kinect

1 Introduction

The purpose of this study is to extract a standard movement code according to specific emotional behavior patterns in the human behavior information database and to develop educational applications composed of corresponding opposite behavior codes. A standard movement code is the basic unit of the behavior classification system used for motion analysis and recording. This type of data includes elements, such as cognitive, emotional, and non-categorical movement in the 'movement' as 'nonverbal behavior' and is critical for understanding interactive information. Therefore, a standard movement code is the basis for building a source technology for the communication between human and machine and vice-versa in our digital environment. In fourth

industrial revolution it is essential to construct a service platform environment through the Internet of things, artificial intelligence, and big data, to improve quality of life.

In this study, we used Labanotation software (LabanWriter) to analyze behavioral data which is commercialized in the field of motion research. We coded common behavioral characteristics from the notation data and designed interventional education contents by constructing opposite behavior code. In addition, among the various behaviors of the human being, we focused on the behavior of the emotional behavioral disorder group and accumulated the motion data and extracted the specific behavior motion code from it.

2 Behavioral Data Collection

The contents for the emotional behavioral items of the AMPQ-II (Adolescent Mental Health and Problem Behavior Screening Questionnaire-II) (Jung et al. 2008), were developed and verified by Korean behavioral experts. The emotional behavior scenarios were constructed to induce basic movements such as hand, clapping, arm movement, walking and running on the spot (see Table 2).
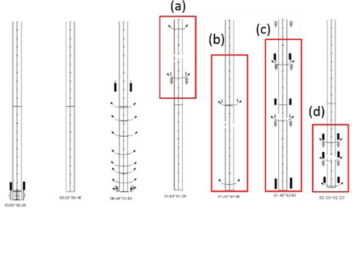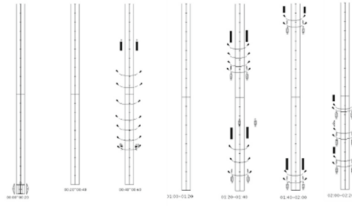
As a main group, 3 middle and high school students with emotional and behavioral disabilities (mood, depression, ADHD) who were accompanied by medication and adjunctive therapy were recommended from the doctor. As a control group, data from 7 university students majoring in drama and film were recorded. We extracted behavioral data by using motion capture and Labanotation recording, and extracted emotional behavioral characteristic movement codes through comparative analysis of interpersonal behavior data codes.

To analyze the behavior of the subject, we recorded their bodily movement with Labanotation and motion capture technique. The 50 markers were attached to the subject's head and body, and 3 Kinect cameras and 12 OptiTracks were installed. Three observers recorded object's behavioral observations at the experimental site, and after the experiment was completed, the Kinect video were recorded as LabanWriter[1] by the same observers. The notation information recorded by the LabanWriter of the patient and the normal group.

We selected one from each of the two groups for example. Their notations were compared with each other. Among the 7 items in Table 2, one example of comparison and derive the movement code from the notation data of 1-B as shown in Table 1. In AMPQ-II, the 1-B problem is related to the "Learning and Internet" question: "Do not concentrate when you need to focus and do not do anything else." And it was reconstructed as an interactive content that "give various shapes and applause when the stars are shiny". The behavior notation induced by the video was based on the Kinect video taken from the pilot. Notation is recorded in 1 s increments, and the notation results are summarized as Table 1 for parallel comparison of data. The interpretation of Labanotation data can be read from the bottom of the left line to the top and read to the right.

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[1] Labanotation Software for Mac developed by Ohio State University.

Table 1. An example of encoding and decoding data comparison

No.	Behavior-based Application	Notation		Movement Code
1-B	Clap hands when shapes flash	Subject from Patient Group		(a)wrong reaction (b)mistiming (c)hesitation (d)passive
		Subject from Normal Group		

3   Educational Application with Opposite Behavioral Code

The subjects' responses to the 1-B contents were appropriately met with applause from both the normal group and the patient group, as in the notation recording. There is also a significant difference between the two groups. In Table 1(a), the normal group did not applaud, whereas the disability group showed the wrong reaction. In (b), the normal group responds clearly and distinctly when applauding, whereas the patient group cannot clap properly and cannot judge and timed when to applaud. (c), the normal group still applauds clearly, while the patient group can read the hesitant pattern of narrowing the gap between the reaction and the reaction and not clapping properly. (d) showed that the normal group had more detailed and clear behaviors, whereas the patient group had three sections of behavioral response, but the number of microscopic applause and execution was negatively occurring. Therefore, emotion behavior movement codes such as wrong reaction, mistiming, hesitation, and passive are extracted from behavior of disability group by comparison analysis of notation data of normal group and disability group.

In order to mediate the emotional behavior problems revealed in the notation, we designed action scenarios composed of opposite codes. Inverse codes of wrong reaction, mistiming, hesitation and passive should be composed of behaviors contrary to AMPQ-II's question content while including these behavioral characteristics with

proper reaction, on-timing, immediate, simple and sharp. Based on these criteria, the scenario for each question was designed as follows.

– put the correct shape or color in the basket
– make shapes together
– make symbol of elements with own body
– exit the maze without stepping on the bottom line
– matchmaking, brick mining
– pausing and moving play
– mirroring, dance with myself

As shown in Table 2, the proposed application is a kind of educational behavior intervention program that expects emotional behavior intervention effect when applied for more than 12 weeks.

Table 2. Behavior-based application from selected questions of AMPQ-II and educational application designed with movement codes

no	Paper-based Questionnaire				Behavior-based Application		Educational Application	
	DSM-V		AMPQ-II		A Type	B Type	Opposite Movement Code	Educational Regulation
	Factor	Question	Factor	Question				
1	Inattention	1) Often fails to give close attention to details or makes careless mistakes in schoolwork, at work, or during other activities. 2) Often has difficulty sustaining attention in tasks or play activities. 4) Failure to follow directions or to perform missions in school work, chores, or workplace.	Learning and Internet	1) When I need to concentrate, I do not concentrate and do something else.	Focus on a various given shape	Clap hands when shapes flash	When I need to concentrate I concentrate well.	Put the correct shape or color in the basket.
2		3) Often does not seem to listen when spoken to directly	Mood and Suicide	10) I do not follow well because I have a sense of displeasure to the instructions of my parents or teachers.	Follow the Father Follow the Mother	Fallow the Teacher	Follow the instructions of the parents or teacher.	Make shapes together
3		5) Often has difficulty organizing tasks and activities 6) Often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort.	Mood and Suicide	12) I have difficulties to understand what I'm learning in class.	Animal Habitat Matching	Contents of mathematics, Korean language, and science subjects	I understand what I learn in class.	Make symbol of elements with own body
4	–	–	Violation of Regulation	22) I am often subjected to serious rule violations.	Walk to traffic lights	Walk to traffic lights with sound effect	Keep the rules well.	Exit the maze without stepping on the bottom line
5	Hyperactivity & Impulsivity	2) Often leaves seat in situations when remaining seated is expected. 3) Often runs about or climbs in situations where it is inappropriate. 4) Often unable to play or engage in leisure activities quietly. 5) Is often "on the go," acting as if "driven by a motor"	Learning and Internet	25) I cannot wait and action is ahead of thoughts.	Walk or run along the virtual path	Walk or run along the virtual path with arms	think carefully and then act on it	Matchmaking, brick mining
6	Inattention	1) Often fidgets with or taps hands or feet or squirms in seat. 8) Often interrupts or intrudes on others.	Learning and Internet	28) I cannot sit still and I keep digging my hands or feet.	Listen to boring subject	Listen to boring subject and make a quiz	I can sit calmly with my hands and feet.	Pausing and Moving play
7	Hyperactivity & Impulsivity	6) Often talks excessively.	Worry and Thought	34) I am afraid to speak in front of people.	Express joy, sadness, depressed mood	Express joy, sadness, depressed mood in the audience	I speak confidently in front of people.	Mirroring, dance with myself

4   Future Study

The debate on the intervention program is now being further intensified, and the next pilot will accumulate action data by expanding the total number of subjects and the disabled population. Furthermore, by analyzing the data through the machine learning technique, we want to construct behavior classification system and standard motion code of the emotionally disabled children. It is our hope that this standard movement code and content research based on emotional behavior will be extended for general ICT use. It is important to develop an ICT system that can be applied for everyday life (emotional communication digital environment), engineering (motion recognition based health care), performing arts (mixed reality realization performance culture), sports science (intelligent motion analysis system), education (emotional communication ubiquitous education) and design (customized environment design).

References

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Adolescent Mental Health and Problem Behavior Screening Questionnaire-II