Design Process, Model and Strategies of the Prevention and Rehabilitation of Lumbar Spine Disease Based on Smart Somatic Games

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Abstract. In recent years, Play Therapy has emerged as the core concept of somatic play therapy, which is more applicable and promising, yet this highly promising programme has not been much explored in research or practice. This study aim to reconceptualize the design of somatic play for application in the prevention of lumbar spondylosis, which has long plagued contemporary population in both physical and mental way. Firstly, we designed a structured questionnaire based on the Technology Acceptance Model(TAM) and data mining. The 311 valid sample data collected were then modelled and tested to generate a strategic model. The findings show that three factors of Security, Playfulness and Competitiveness have an indirect effect on use intention through the mediating effects of perceived ease of use and perceived usefulness, with a direct effect on use intention. Playfulness is the most significant of these factors, as users expect to receive more emotional interactive feedback. Finally, the author discusses the design work based on the results from the perspective of designers and engineers, and proposes a variety of immersive and emotional AI strategies that can access the process in a human-centred manner, which is important for the study of smart healthcare with Play Therapy as a concept.

Keywords: Intelligent industrial design, somatic games, lumbar spondylosis, perceptual and behavioral computing, human computer interaction design.

1 INTRODUCTION

In recent years, due to the accelerated ageing of the population and the sedentary lifestyle of most modern people, the trend of spine diseases among the younger has become more and more prominent, with a significantly higher incidence rate, and has become a major public health problem in China. According to statistics from the Chinese Ministry of Health, the number of lumbar spine patients in China has exceeded 200 million, with lumbar disc herniation accounting for 15.2% of the total population, and there is a rising trend. Lumbar spine diseases that are not treated in time will lead to a series of physical and mental health problems. With the rapid development of science and technology, the health consciousness and consumption level of the

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public have increased and people are paying more and more attention to the protection of the cervical and lumbar vertebrae, and the new form of exercise, physical games, has received widespread attention. Especially during the New Crown epidemic, fitness-based physical games are popular among young people for their playability, entertainment and socialization.

This research focuses on combining artificial intelligence technology with industrial design. While there are many games and studies on the market today that target the effects of fat loss and plasticity, there are very few products that incorporate artificial intelligence and specifically target the prevention, treatment and rehabilitation of lumbar spine conditions. In this study, we hope to investigate whether intelligent somatic games can be used as a new exercise medium that integrates lumbar spine exercise and games to provide a feasible and practical solution for lumbar spine health care. Based on subsequent quantitative experiments, the author hopes to explore whether the current human-computer interaction design has theoretical and practical implications, follows the principles of participation, contextuality and safety, and covers the concepts of emotionality, greenness and interactivity. At the same time, we want to test whether the parallel perspectives of Security, Playfulness and Competitiveness can improve user acceptance and participation in physical games, and to make new design decisions based on a combination of subject, action, tool, purpose and scenario.

2 LITERATURE REVIEW

2.1 The Hazards and Rehabilitation Defects of Lumbar Spondylosis

Lumbar spondylosis arises from a variety of degenerative triggers. Pathology suggests that patients may suffer from neuropathic pain due to nerve compression, of which lower back pain is typical [6]. On one hand, untreated lumbar spine disease can lead to a variety of other associated conditions. Studies have shown that in the early stages of lumbar spine disease, approximately 4% of patients suffer from compression fractures, 3% from spinal stenosis, 2% from visceral disease and 0.7% from tumors or metastases [21], while other conditions such as lumbar stiffness, limb numbness, urinary incontinence, sexual dysfunction and even lifelong paralysis are also likely to be triggered. On the other hand, lumbar spine disorders tend to cause long-term, ongoing mental and psychological distress to patients. Patients with lower back pain can be affected in their daily life, work and exercise [16], and the psychological distress caused by lumbar spine disease may play an even greater role [9].

The current mainstream ways to rehabilitation of lumbar spine conditions is ineffective and counterproductive. Firstly, although the most mainstream, convenient and assessable forms of rehabilitation, such as weightlifting, hurdling, throwing and gymnastics, have a slow therapeutic effect, there is a lack of specific courses for the rehabilitation of lumbar spine disorders and unconscious trainers are prone to muscle injuries and even disc herniation [24]. Secondly, although the use of TCM-based rehabilitation methods is widely used, there are some safety concerns. Although controlled trials have shown better clinical performance, quality of life, and lumbar mobility in patients who underwent combined moxibustion and cupping interventions [40], this method usually has some negative effects on the treated person's epidermis due to the unstable negative pressure and heat intensity, such as burning epidermal blistering, pus, infection, and bruising [18]. Finally, medication-based methods are also highly recommended, but their healing mechanisms are not clear and they tend to cause allergic skin reactions. For example, the use of Tibetan Zizheng Pain Relief Paste (CZPRP) may improve acute low back pain, but the risk of bias is moderate and even high and the clinical relevance of this option is unclear, so its effectiveness is also disputable [36].

2.2 The Play Therapy-oriented Concept and Methods in Rehabilitation

Play Therapy is a new concept and approach to rehabilitation based on the integration of recreation and therapy, with a strong empirical, psychological and extended application. Play Therapy was originally developed as a psychotherapeutic approach for children by a large number of researchers in the 20th century and has been evaluated by the Substance Abuse and Mental Health Services Administration (SAMHSA) as an intervention that includes Theraplay, Adlerian Play Therapy (AdPT), Child Parent Relationship Therapy (CPRT), Child-Centred Play Therapy (CCPT), etc. [29]. Play therapy is divided into psychoanalytic, which is based on personality theory and emphasizes uncovering the causes of psychological discomfort between the id, ego and superego, and humanistic play therapy, which emphasizes a person-oriented approach and trust in the person's innate internal drives. The Association for Play Therapy (APT), a national professional organization established in 1982 to regulate, train and educate the play therapy industry and Registered Play Therapists (RPT), symbolizes the recognition of the therapy for its long history of evidence-based techniques [3].

With the development of interactive technologies, the integration and sustainability of emerging entertainment technologies in Play Therapy for rehabilitation has been demonstrated in several experiments. Firstly, researchers from Chiba University have investigated the effects of prolonged play of the Wii sports programme on the lumbar spine and rehabilitation. They selected 24 line workers diagnosed with chronic low back pain and randomly divided them into three groups: a control group, a Lumbar Spine Stabilisation Physical Exercise (LSE) group and a Nintendo Wii Exercise (NWE) group. Participants were treated three times a week with total eight weeks, with each session lasting 30 minutes. The results showed that the exercise programme significantly improved physical function related to low back pain, but the LSE group only showed significant improvements in the physical health composite, whereas the Nintendo Wii exercise programme, although not as significant as the traditional exercise group in terms of lumbar spine improvement, significantly improved mental and physical health in terms of quality of life, with a [biopsychosocial] composite intervention [28]. Subsequently, researchers from Lietuvos sporto universitetas used similar concepts in a controlled trial with 44 randomly selected patients, who were equally divided into a conventional physiotherapy group (control group) and a virtual walking integrated physiotherapy group (experimental group). The results showed an improvement in all indicators in both groups, but virtual walking integrated physiotherapy reduced pain and kinesiophobia in patients with subacute and chronic non-specific low back pain in the short term and was more effective than conventional physiotherapy [38]. In addition, the Intensive Neurophysiological Rehabilitation System for the rehabilitation of lumbar neurological pathologies has introduced a wider range of equipment during the rehabilitation trials, such as dance mats, balance boards, consoles and cameras, among other sensing devices. Recent results also confirm the potential of the new technology for the neurological rehabilitation of patients with movement and balance disorders [31].

2.3 Smart Motion Sensing Game in Rehabilitation Training

Smart games are a new genre of games that take use the user's body as a medium for communicating movement, integrating artificial intelligence, IoT and hardware computing, VR/AR and other technologies to enable a more immersive experience. The changes in the artificial intelligence industry have had a profound impact on the design, engineering and practice of physical games, with the development of a more precise interface between the front and back end of the workflow allowing for more than expected design engineering [32]. On one hand, game developers can build more accurate machine learning and deep learning models based on larger marker data sets and highly accurate algorithms, and can go further in designing motion capture models to give high satisfaction to large numbers of users for rhythm, style and enjoyment content. On the other hand, adaptive, self-learning mechanisms based on a combination of algorithms and participant evaluation allow the game system to effectively optimize the player's personalized service parameters [33].

With the gradual improvement of device terminal functionality and the combination of smart multi-sensory hardware, smart physical games are starting to come into the public mind.

Interface technology, and are gradually becoming an important part of home entertainment [25]. Human Interface Devices (HID) is a new device class definition that replaces a variety of legacy PS/2-style linkers with USB drivers that are compatible with HID devices, supporting not only hardware boot modes but also hardware innovation based on a standardized, scalable and low-threshold programming interface [23]. However, smart physical games use the body as the main non-direct contact medium, breaking away from the previous method of interaction based solely on keystrokes, and are a new type of video game that relies on body movements for change, while this new interactive interface technology is constantly being adapted to HID protocols for natural interaction in the industrial process. Based on the Internet of Things and the evolution of hardware technology, players can also use wireless networks or Bluetooth to connect their wearable terminals to relevant control devices to control and participate more openly in the game [26], with 3D sensors built into the devices to more accurately capture acceleration changes in solid space and axes, and infrared-illuminated The reference light source also captures 2D coordinates and enables aerial precision targeting. As a result, players are able to develop more multi-sensory and diverse virtual entertainment than traditional rehabilitation-centred physical games.

Some researchers have recently demonstrated the usefulness of intelligent physical play in Play Therapy in an experimental setting, but also explored the deeper therapeutic effects of self-efficacy. Dr Federica Alemanno from the San Raffaele Hospital in Milan, Italy, studied 20 patients with acute lower back pain. Before and after treatment, patients underwent a neurological examination, a neuropsychological assessment testing cognitive function (memory, attention, executive function), personality traits and mood, a pain perception test, and a motor function ability test. The patient underwent a total of 12 sessions of neurorehabilitation over a period of 6 weeks. Virtual reality technology was used as an intervention throughout the treatment, which consisted of augmented multisensory feedback (auditory, visual) based on VRRS provided to teach the patient to perform the correct movement for the painful body part in order to restore correct body image. Studies have shown that this non-pharmacological approach can work on multiple dimensions of pain, improving not only the patient's quality of life, pain intensity, but also modulating the subject's mood and functional capacity [2].

However, there is currently no academic or industrial expansion of the design content and framework for intelligent physical games in the field of lumbar spine disease prevention and treatment, so this study will break through the shortcomings of the previous studies and use models, experiments and strategies in the following to achieve.

2.4 Technological Acceptance Model in Design Process

The Technological Acceptance Model (TAM) is more suitable than other models for user acceptance of somatic gaming technology focused on the prevention and rehabilitation of lumbar spine disorders. The most commonly used models for research on the willingness to use new technologies are the Enterprise Content Management (ECM) model, the Unified Theory of Acceptance and Use of Technology (UTAUT) and the TAM model [11]. The ECM is based on the expectation confirmation theory proposed by Oliver in 1980 [5] and is mainly used to study the influence of subjective norms, satisfaction and other factors on users' willingness to continue using the system, but the model is more about the factors that influence users' continued use of a mature information system rather than the initial use of a new system, which is the focus of this study. the initial user attitudes towards a new system. The UTAUT model is an extension of the TAM model[13], which emphasises the influence of Social Influence and Facilitating Conditions on users' willingness to use. In this study, the social influence and motivating conditions were not used as the main variables for the time being, as they were not considered as individual intention to use the lumbar spine health games.

Technology Acceptance Model (TAM) is a research model proposed by Fred D. Davis in 1989 and originated from the Theory of Reasoned Action[1] to explain the potential factors that can influence users' acceptance of a new technology. The theory of Reasoned Action[1] was developed to explain the potential factors that can influence user acceptance of a new technology. The model suggests that the factor that influences whether people actually use a new technology is Behavioral Intention to Use (BU). BU is mediated by Attitude Toward Using (AU) and is strongly influenced by Perceived Usefulness (PU) and Perceived Ease of Use (PEU). The PU directly influences behavioral intentions, and the PEU influences the PU. Both are also influenced by External Variables (EV) [7].

TAM is a good indicator and tool for predicting user acceptance of new technologies in health and healthcare[37] and has been an important theoretical tool in recent medical technology research. It is also an important theoretical tool in recent medical technology research. For example, it has been widely used in research on the use of medical devices in the healthcare sector [10]. The acceptance of clinical information systems by health care professionals [22]. The willingness of physicians to use telemedicine technology [12], etc. However, in the case of the physical game for lumbar spine care, because of its specificity as a rehabilitation device and a gaming device in one, the author modified the external variables according to some of the needs derived from the interviews, thus proposing a new research model.

3 RESEARCH DEFINITION

3.1 Research Question

In order to explore the design elements of Somatic game applied to the field of lumbar spine disease prevention and treatment to better design the questionnaire, the author used data mining techniques to investigate the questionnaire content design (Figure.1). Firstly, the programming language Python was used to crawl Google Search for information related to Somatic game and Back Low, such as: news, technical monographs, communities and discussions, etc. The following co-word matrix and word map were presented using the knowledge mapping software Gephi after data cleaning. From the results of the data mining, I found that there is a possibility of combining physical games with the prevention and rehabilitation of lumbar spondylosis, but that three main factors, Security, Playfulness and Competitiveness, should be taken into account. The words Skills/Practice/Injury and Stability are used to describe security. Through literature review, I found that in addition to physical movement security, technical security is also a major concern when designing games. variable to explore its relationship with users' perceived usefulness, perceived ease of use and end-use attitudes. In order to demonstrate the impact of playability on increasing users' willingness to use the game, I set up questions on three scales: game mechanics, audio-visual design and interaction patterns. In addition to the two important factors of perceived safety and perceived playability, I also noticed that Olympic/Individual and Competitive were among the key words currently being explored, and therefore decided to introduce Perceived Competitiveness in the design of the questionnaire.

Fig. 1. The process of using data to mine the potential design elements of somatic game.

3.2 Research Question and Hypothesis

Although somatic games have been shown to be effective in improving the lumbar spine, they are also far more effective than traditional exercise therapy in terms of mental health. However, the feasibility of somatosensory technology in medical rehabilitation has been demonstrated more from the perspective of medical experiments, and there is a lack of thinking about the design of somatosensory games from the service design field. The author proposes a Research

Hypothesis and Model (Figure 2) for this study based on the TAM model from a user perspective. The model identifies several items as predictors of user acceptance of this new technology, the definitions and interrelationships of the factors in the research model are discussed below.

3.2.1 Perceived Usefulness

Fred Davids defines Perceived Usefulness as "the extent to which a person believes that using a particular technology product will improve his or her performance"[7]. This means whether the user perceives the technology to be useful for what they want to do. In this study, this variable was cited to examine users' attitudes towards the use of somatic play for lumbar spine care, and users were likely to accept somatic play if they felt it was useful for lumbar spine protection.

H1: Perceived Usefulness has a positive effect on the Behavioral Intention to Use.

3.2.2 Perceived Ease of Use

Perceived Ease of Use can be defined as "the degree to which a person perceives a particular system to be effortless to use"[7], i.e. the degree to which the user is comfortable with the system in terms of control and understanding. This variable was used in this study to explore the perceptions of users of different ages, genders, and experiences of using a relatively new technology, physical gaming.

H2: Perceived Ease of Use has a positive effect on the Behavioral Intention to Use.

H3: Perceived Ease of Use has a positive effect on the Perceived Usefulness.

3.2.3 Perceived Security

In this research, as a physical game for lumbar spine prevention and treatment, the main objective is to perform lumbar spine exercises through the game route. As a sport, poorly designed movements can not only waste time and reduce the therapeutic effect, but can also cause irreversible damage to the body [35]. In addition, with the development of data deciphering techniques, the security of sensitive and confidential information transmitted in games has become a concern for users [19]. The author therefore introduces Perceived Security as an independent variable to investigate its impact on system usefulness, ease of use and user behavioural intention to use.

H4a: Perceived Security has a positive effect on the Perceived Usefulness.

H4b: Perceived Security has a positive effect on the Perceived Ease of Use.

H4c: Perceived Security has a positive effect on the Behavioral Intention to Use.

3.2.4 Perceived Playfulness

For any game, technology is only an aid, playability is the core [14]. Although the ultimate goal of the somatic game in this study is to prevent and treat lumbar spine disorders by exercising against them, the lack of perceived playability will lose the player's interest in the somatic game and affect the player's sense of experience. This study therefore introduces a playability independent variable to consider the impact on perceived usefulness, perceived ease of use and user intention to use in terms of the dimensions of interactive content, entertainment environment and rehabilitation process. Therefore, the author proposes the following hypotheses.

H5a: Perceived Playfulness has a positive effect on the Perceived Usefulness.

H5b: Perceived Playfulness has a positive effect on the Perceived Ease of Use.

H5c: Perceived Playfulness has a positive effect on the Behavioral Intention to Use.

3.2.5 Perceived Competitiveness

By designing the rules of the game, the type of game and the competitive nature of the game scenario, players can be motivated to develop a sense of teamwork and competition, thus giving them a better sense of achievement and generating a stronger willingness to use the game [34]. Therefore, the author proposes the following hypothesis.

H6a: Perceived Competitiveness has a positive effect on the Perceived Usefulness.

H6b: Perceived Competitiveness has a positive effect on the Perceived Ease of Use.

H6c: Perceived Competitiveness has a positive effect on the Behavioral Intention to Use.

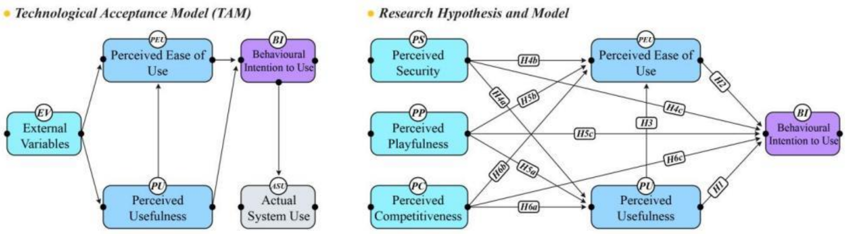

Fig. 2. The Structure of TAM and Adjusted Model.

3.3 Experimental Design

In order to understand the condition of the lumbar spine and the attitudes of the public towards the use of somatic games in the field of lumbar spine disease prevention and treatment, the author designed a study on the future of the use of somatic games in the prevention and treatment of lumbar spine disease. The questions designed for the survey were linguistically sound and corresponded to the research hypotheses and variables. Firstly, the five questions (Q1-Q5) were demographic information surveys (Gender, Age, Income, Daily sitting time, Lumbar health status) to assist the author in understanding basic user information. Q7, Q8 and Q9 were set for the three independent variables of Perceived Security, Perceived Playfulness and Perceived Competitiveness respectively, and Q10 and Q11 were set to understand Q10 and Q11 were designed to understand Perceived Ease of use and Perceived Usefulness, and Q12 was designed to understand Behavioral Intention, which is a positive and negative aspect of the user's willingness to try out these physical health care devices. In addition, three questions (Q13-Q15) were designed to allow users to choose between the types of games available on the market, as well as the types of games they would like to play and their prices, in order to provide a basis for subsequent game design.

Finally, the questionnaire was digitally designed and embellished by the Questionnaire Star platform and then placed in a sample format, which was distributed by the team members on Wechat to their close friends and relatives, groups and circle of friends, and further delivered and collected by other friends. To increase the age diversity of the sample and to further understand the attitude of various age groups towards the new technology of physical gaming, the author invited teachers from the Hong Kong Polytechnic University and their elders to distribute the questionnaire to their older friends.

4 DATA ANALYSIS AND MODELING

4.1 Demographic information

This research got 320 questionnaires returned, with 311 valid questionnaires and a valid completion rate of 97.2%. The questionnaire participants were predominantly young people aged 16 to 30, accounting for 59.17%, followed by those aged 31 to 40 (25.4%). As the younger age group made up the majority of this survey, nearly half of the respondents had a monthly income of less than 5,000. The vast majority of respondents indicated that they were sedentary, with the largest number of people (31.83%) being sedentary for 8 to 12 hours a day. Regarding physical games, about 64.63% of the respondents said they had tried them, and 11.58% even bought and used them regularly, while another 20.58% said they had some intention to buy them, which shows the promising future of physical games.

4.2 Reliability and convergent validity

The data analysis of the questionnaire was completed by using IBM SPSS 26 and AMOS 26. The overall reliability of the questionnaire was 0.923 (Table 2. Reliability and convergent validity), and the Cronbach's alpha for each variable ranged from 0.831 to 0.902, all above 0.8. This indicates that the reliability of the internal consistency of the questionnaire is high. Furthermore, the coefficients measuring convergent validity, such as item factor loadings (k), combined reliability (CR) and average variance extracted (AVE), all exceeded the required thresholds. Specifically, the factor loadings (k) for all variables were significant and exceeded 0.6; the combined reliability (CR) for each variable exceeded 0.8 and ranged from 0.831 to 0.902; and the values for each average extracted variance (AVE), with the exception of the AVE for PU (0.497), were all greater than 0.5, indicating a high level of internal consistency across the variables in the model. Therefore, the question items within this questionnaire are reliable for the hypothesized model.

4.3 Discriminant Validity

The author then assessed the discriminant validity to confirm that each hypothetical variable did not reflect other variables. Table 1 shows the square root of the AVE mean variance values for each item, which are consistently large in correlation with all other constructs. This indicates that all variables have some discriminant validity.

Table 1. Inter-construct correlations and discriminant validity

Construct	AVE	PP	PC	PS	PEU	PU	BI
PP	0.589	0.768					

PC	0.648	0.310	0.805				
PS	0.618	0.269	0.177	0.786			
PEU	0.497	0.523	0.401	0.330	0.705		
PU	0.534	0.502	0.338	0.410	0.485	0.731	
BI	0.514	0.659	0.451	0.475	0.647	0.706	0.717

4.4 Model's Degree of Fitting

Structural validity is a measure of the degree of fit, and the author assessed the following indices to check the validity of the model. The results and recommended thresholds are shown in Table 2. The $\chi 2$/df of 1.033 is within 3, indicating an acceptable model. The adjusted goodness of fit index (AGFI) value was 0.908 and the comparative fit index (CFI) value was 0.997, both greater than 0.9, indicating that the model is closer to the matrix in practice, i.e. the fit range is high. The root mean squared error of approximation (RMSEA) value was 0.010 and the root mean squared error (RMR) was 0.037, which is less than 0.05. All the resulting values met the recommended standard levels, indicating that the hypothetical model provided a good fit to the data collected.

Table 2. Model fit

Fit indexes	$\chi 2$/df	RMESA	RMR	GFI	AGFI	CFI	NFI	TLI
Recom-mend value	<2	<0.05	<0.05	>0.90	>0.90	>0.90	>0.90	>0.90
Results value	1.033	0.010	0.037	0.923	0.908	0.997	0.920	0.997

4.5 Hypothesis Test

Finally, the author tested these 12 hypotheses using structural equation modelling (SEM). The R-squared and path coefficients indicate the extent to which the data support the hypothesis model. The path coefficients are shown in Figure 3. and it can be seen that all paths are significant and most have very high significance levels, indicating that all the hypotheses presented in this study are confirmed. Figure 3. shows the coefficient of determination (R^2) path coefficients of the model, which assesses the degree of fit of the model and demonstrates the influential relationships that exist between the variables. an R^2 greater than 0.25 indicates that the model has good predictive power and strong explanatory power. In this model, the R^2 of PU and PEU are 0.386 and 0.366 respectively, while the R^2 of BI reaches 0.712, which can indicate the high explanatory power of the model. It is worth noting that PP, PC and PS not only have an indirect effect on users' attitudes and intention to use through the mediating effects of perceived ease of use and perceived usefulness, but they also have a direct effect on users' intention to use to some extent.

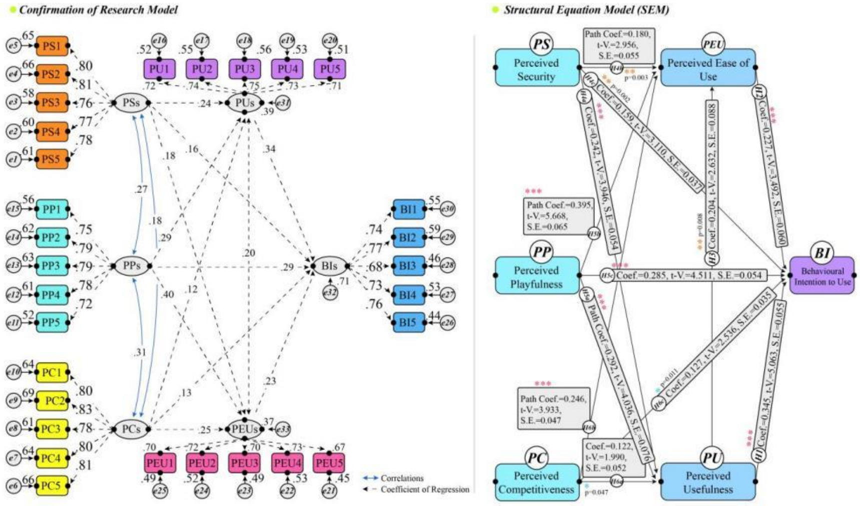

Fig. 3. The Confirmation of Research Model and Structural Equation Model.

5 NEW STRATEGIES FOR THE DESIGN AND ENGINEERING

All of the above elements are positively significant and suggest the importance of the respective modules that influence the design of somatic games, which forms the basis for the author's new strategy. Through the study, I found that Perceived Security, Perceived Playfulness, Perceived Competitiveness have a direct impact on user adoption of lumbar spine games. Perceived Playfulness had the greatest impact on user intention, with a direct effect of 28.5%, while Perceived Security and Perceived Competitiveness had a direct effect of 15.9% and 12.7% respectively. Secondly, they also have an indirect effect on users' intention to use through the mediating effects of perceived ease of use and perceived usefulness. Perceived Playfulness has the greatest effect on Perceived usefulness and Perceived Ease of use, with 29.2% and 39.5% respectively.

In the new Internet environment, user experience is undergoing a shift from the only pursuit of practicality to both enjoyment and practicality, and the enjoyment attribute that emphasizes diverse outcomes is more valuable than the practical attribute that only solves problems for a living, which makes the working mode of user experience design shift from the traditional "two-point-one-line" solution setting to a multi-dimensional and fluid [39]. Therefore, the following section will propose a strategy for industrial design that highlights the focus of the model through the lens of artificial intelligence.

5.1 Apply AI to Enhance the Security of Somatic Games

Designers should use artificial intelligence technologies to enhance the security of games. Firstly, from the perspective of an interactive medium, physical games were originally designed as a means of simplifying the cost of hardware and use and addressing the safety of potential entertainment through the integration of virtual interaction technologies. For the author's assessment of safety, the lightness of the facility, the professionalism of the content and the balance of duration are all essential components. Therefore, AI should not be added to the game interaction process as a flat technology, but rather incorporate more dynamic technological strategies, such as: building an optimal movement arrangement and planning system for the user by recording data on their movement habits, modality and length, combined with data on their own ailments and user feedback, while using computer vision (CV) for machine learning. At the same time, during the engineering engagement process, designers also need to interface precisely with researchers in biomedical engineering to understand how machines can realistically and accurately assess cases and personalize the building of strategic systems.

5.2 Apply AI to Enhance the Playfulness of Somatic Games

Designers should use AI technology to enhance the entertainment aspect of the game. Firstly, games should be socially accessible. Physiological studies have shown that post-traumatic stress (PTSD) affects immune suppression, increases susceptibility to disease and leads to an indelible vicious cycle [20], yet effective social activities can mitigate the effects of PTSD. An affective computing study comparing Twitter users' tweets during the epidemic found that they were more inclined to post positive and upbeat tweets than before, suggesting that the socializability of good digital products can actually improve users' mental health [30]. Thus, intelligent recommendation systems will play an important role in helping users to target potential social objects, people and content during the socialisation process. Secondly, the author understands that users prefer immersive music and art graphics, and that games should be designed with emotion in mind to enhance the user's space for entertainment exploration. From a social systems perspective, multimedia entertainment is itself a resource allocation centre that can bring a new sense of self-identity and display to those at the bottom of society [15]. Interesting and entertaining game content can help users to re-establish effective recovery processes, has entertainment and relaxation potential, and can be of great importance to the healthcare sector as it can reduce stress (and even temporarily alleviate extremely serious practical problems and fears) [17]. For example: as shown in Figure 4, designers can use interactive UI components and sound effects to improve the emotional perception of people during exercise. Intelligent systems evoke emotional states and increase therapeutic engagement by capturing the user's emotions and delivering emotionally charged words or music, while surreal art UI components and immersive scenes change in real time based on the interactor's feedback. However, designers may also consider using natural language processing (NLP) techniques to explore more depth of emotional interfaces, classification, etc.

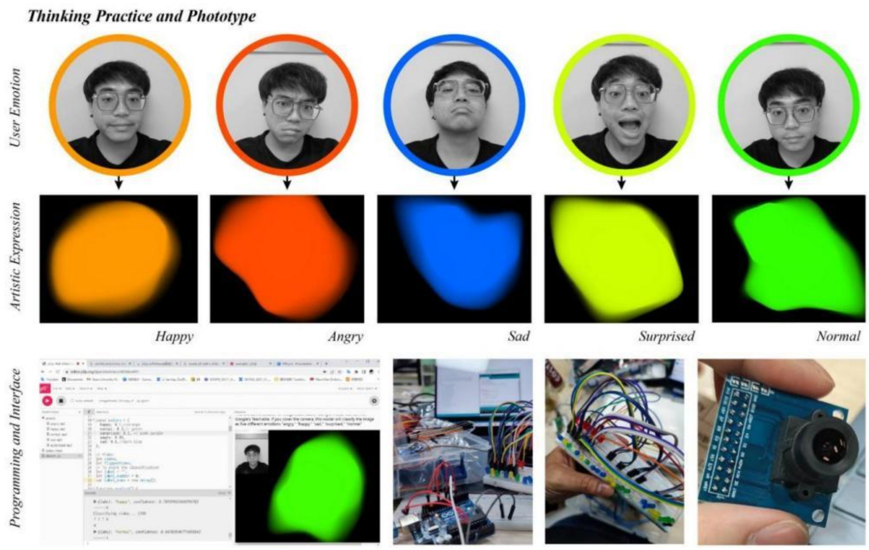

Fig. 4. Thinking Practice and Prototype.

5.3 Apply AI to Enhance the Competitiveness of Somatic Games

Designers should use artificial intelligence technology to enhance the competitive nature of the game. A major advantage of gamified therapy over other forms of health care is its ability to increase users' willingness to engage in therapy by enhancing their sense of engagement, participation and loyalty based on challenge mechanisms. Self-efficacy is the degree to which an individual feels capable of successfully completing a task. In the case of intelligent physical games, exercise tasks based on multisensory interactions, challenge and engagement tend to increase players' loyalty, sustainability and confidence and self-identity in continuing physical therapy [4]. Albert Bandura argues that human choice behaviour is influenced not only by outcome expectations but also by efficacy expectations.

However, the user's sense of challenge and control is difficult to measure and calculate. The author suggests that designers should refer to more theoretical models of cognitive science and simulate the challenge by building intelligent algorithms to understand the real psychological state of the user. For example: the concept of FLOW originates from positive psychology and is integrated with a cognitive and neuroscientific perspective, specifically describing the physiological and psychological state of people who are fully, highly and actively immersed in the corresponding productive activity. From a detailed perspective, it is defined as it is the main medium for increasing motivation in life and production, as well as well-being in society [27]. Most neuroimaging-based studies show that the prefrontal cortex of the brain is less active when flow occurs [8]. The prefrontal cortex is the area of the brain responsible for higher cognitive functions that belong to the external system, such as: perception of the external world, memory for behaviour and perception, perception of time and space, self-assessment and perception. Human functions such as cognition, emotion and behaviour management provide a clear cognitive will and mental state. When FLOW occurs, this part of the function is temporarily down-regulated and the creator's physiological function in this part of the brain is less subjective, allowing other areas of the brain to communicate freely and integrate more deeply into the play therapy process. Designers can therefore explore neuroimaging to understand the changes in brain regions when FLOW occurs, which can help when future expansions of Interface interfaces are made and explore the next generation of natural interaction with the creation of physical games.

6 CONCLUSION AND EXPECTATION

Firstly, in the study, the author proposed the feasibility of using somatosensory lumbar games to prevent and treat lumbar spine disorders through clinical medical experimental results and research hotspots, while incorporating the phenomenon into theoretical horizontal and vertical comparisons and finding gaps in existing research and the extensibility of the study. Secondly, the author designed research variables and hypotheses based on the TAM model, combined with the special characteristics of somatosensory games, published and collected 311 audiences' views on somatosensory lumbar games through a questionnaire, and used structural equation modelling to test and refine key variables to build a new model framework. Finally, the author combines the existing artificial intelligence technology and proposes an audience for future design directions.

Previous studies have also had certain shortcomings, and the design of the variables in this research is largely based on the authors' assumptions about lumbar spine physical games. It is unknown what other factors influence people's willingness to use them and to what extent actual behavioural intentions can be used to predict future users' use. Therefore, the authors will further disentangle and optimise these elements in the future.

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APPENDIX

Appendices 1. Variable measurement scale

Construct (Source)	Item code	Measurement Indexes	Items loading	AVE	C.R.	Cronbach's α
Perceived Security[35]	PS1	The game has passed medical professionals' audit and evaluation	0.803	0.618	0.890	0.890

	PS1	The game difficulty could be adjusted based on athletic ability	0.813			
	PS2	The game is free from any risk against lumbar	0.762			
	PS3	Equipment used in the game is safe	0.772			
	PS4	Health data are protected by privacy	0.781			
	PS5	The game has passed medical professionals' audit and evaluation	0.803			
	PP1	Has NPC, multiple tasks and plot mechanics	0.750			
	PP2	Art, visuals and music in game interaction are interesting	0.791			
Perceived Playfulness[14]	PP3	The game assistant could communicate intelligently	0.791	0.589	0.878	0.878
	PP4	The game will help expand social	0.781			
	PP5	The movement is immersive through tactile sensation	0.723			
	PC1	The game has exciting rewards and punishment mechanism	0.798			
	PC2	Game difficulty has a certain degree of challenge	0.833			
Perceived Competitiveness[34]	PC3	The game supports multiplayer online battles	0.781	0.648	0.902	0.902
	PC4	Game can update my health data and ranking	0.802			
	PC5	Game points will increase my initiative	0.811			
	PEU1	Game equipment is easy to use	0.703			
	PEU2	My instructions and habits be well grasped	0.720			
Perceived Ease of use [7]	PEU3	The game runs smoothly and buffering time is little	0.701	0.497	0.831	0.831
	PEU4	The interface layout and information are convenient	0.727			
	PEU5	My exercise movements could be recognized accurately	0.671			
	PU1	The game could relieve low back pain	0.724			
	PU2	The game should be effective in improving lumbar spine condition	0.741			
Perceived Usefulness [7]	PU3	The treatment through this somatosensory game is scientific	0.748	0.534	0.851	0.851
	PU4	The game will help to develop a love of sports	0.725			
	PU5	The game is good for my healthy life	0.714			
	BI1	I can accept the somatosensory game	0.744			
	BI2	I think my family and I need the game	0.765			
Behavioral Intention [5]	BI3	I am willing to recommend the game to people around me	0.681	0.514	0.840	0.840
	BI4	If I have it, I will use it regularly	0.728			
	BI5	The game will be popular in the future	0.660			

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