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Emerging Market Dynamics: Exploring the Convergence of Human Psychology and Digital Technology in Mindtech Services

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Abstract

This paper explores the emerging trends in remote counseling services, also known as 'Mind Tech,' which integrate human psychology and digital technology. It examines the market dynamics, technological advancements, and the potential of Mind Tech in measuring and enhancing human cognitive and emotional abilities. The study reveals a significant increase in demand for non-face-to-face counseling, with various platforms and applications offering psychological counseling, emotional support, and mental health interventions. These services leverage natural language processing, chatbots, and other AI-powered technologies to provide personalized and cost-effective solutions. The global cognitive assessment and training market is projected to experience substantial growth, driven by the increasing demand for digital health and mental health services. However, challenges remain in automating data collection, analysis, and standardization processes to facilitate the creation of robust psychological datasets.

Keyword : mind tech, digital technology, psychology, market trends, challenges

1. Introduction

Since COVID-19, the proportion of people experiencing mental illness has increased due to more time spent at home and limited social interaction. At-risk depression rose from 3.8% in 2018 to 20.0% in 2020, and suicidal ideation increased from 4.7% in 2018 to 13.4% in 2020 [1]. Among OECD countries, South Korea has ranked first in suicide rates for 14 consecutive years, with an average annual

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rate of 24.6 suicide deaths per 100,000 people, more than double the OECD average of 11.3 [2]. Despite having the 10th largest GDP globally, South Korea ranks 63rd in terms of happiness, indicating a very low level of mental health. To match the OECD average of 19.2 psychologists per 100,000 population, South Korea needs 9,900 psychologists [3]. However, as of 2020, there were only 1,695 professional counselors, which is one-eighth of the OECD average [4]. These counselors are unable to provide quality services and are forced to rely on face-to-face counseling. In response to this situation, new technologies are being developed to analyze human psychology and provide remote counseling, known as Mind Tech. This paper explores the emerging trends in Mind Tech, which integrates human psychology with digital technology. It examines market dynamics, technological advancements, and the potential of Mind Tech to measure and enhance human cognitive and emotional abilities.

2. Remote Conseling Services as Mind Tech

2.1 Trends in the Market for Remote Counseling Services as Mind Tech

The proportion of in-person counseling decreased by more than 50%, while non-face-to-face counseling such as phone counseling more than tripled. In addition, psychological counseling on the portal increased by 237% in 2021 compared to 2020. By topic, counseling on comfort and healing topics such as stress due to COVID-19 and mental and physical stability accounted for 38%, an increase of 192% compared to 2020, and MBTI tests centered on the MZ generation accounted for 35.8%, an increase of 2,800% compared to 2021 [5]. Due to the above growth, the revenue of the non-face-to-face counseling platform has increased tenfold.

[Table 1] Counseling Fees for Major Counseling Programs in South Korea

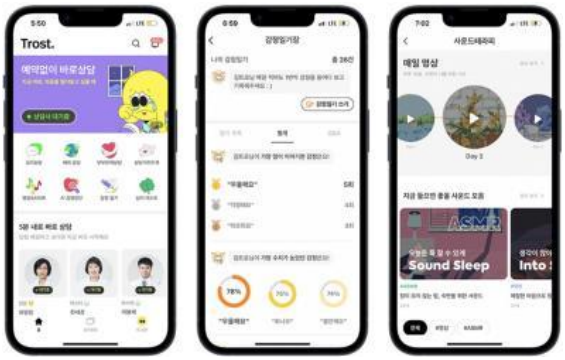
Company Name	Product Name	Selling Price (KRW)
Yatave	Metaforest	Beta Service
Maseongui todagtodag	Maseongui todagtodag	Free
Humartcompany Co., Ltd	Trost	3,000 - 4,000 (per session)
Aimmed Co., Ltd	Hello Mind Care	3,300 - 7,200 (per session)
Mabo	Mabo	3,400 (per year)
Atommerce	Mind cafe	5,500 - 10,000 (per session)

Currently, various non-face-to-face psychological counseling apps are emerging, and the number of users ranges from 35,000 to 950,000, depending on the published figures. As shown in [Table 1], the

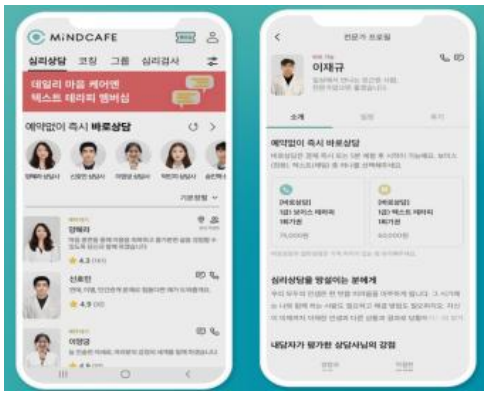
cost ranges from 15,000 to 120,000 won for a 50-minute psychological consultation, which is up to 90% cheaper than face-to-face counseling [6].

The market for psychological counseling platforms that provide non-face-to-face counseling services is also on the rise. Mindcafe (mindcafe.co.kr), one of the leading non-face-to-face counseling platforms, has grown five times annually for the past two years, accumulating more than 1 million members, and provides counseling services via phone and text (chat). trost (trost.co.kr), one of the leading counseling apps, provides EAP services to more than 80 companies, and in 2021, the number of customers increased 8 times and sales increased 15 times compared to the previous year.

As shown in [Fig. 1], launched in 2016, Humart Company's Trost has accumulated more than 30,000 users in four years. Its customers are women in their 20s, college students, and the MZ generation, who are the first generation to enter the workforce, and the main focus is on counseling for interpersonal stress management such as depression and anxiety. The counseling fee is around 15,000 to 40,000 won for 50 minutes, which is cheaper than face-to-face counseling fees of over 100,000 won, so the barrier to entry is low.



[Fig. 1] Trost App by Humart Company



[Fig. 2] Mind Cafe App by Atommerce

Another example is Atomus' MindCafe as shown in [Fig. 2]. It grew 1,120% in revenue in Q1 2021 compared to Q1 2020 [7]. It has 850,000 subscribers, the largest in South Korea, and offers specialized counseling in various fields such as marriage, parenting, career, work, and trauma.

2.2 Technology Trends in Remote Counseling Servicies as Mind Tech

The contactless counseling market is gaining market share through enterprise customers as it moves into the corporate EAP market and expands into B2B(G) services. As shown in [Table 2], these examples illustrate how companies are integrating remote psychological counseling services to support their employees while highlighting the expansion and effectiveness of mind tech in the corporate sector. Competitors in the counseling industry can be divided into counseling platform type and content delivery type, but the content type is limited because it is mainly based on cognitive behavioral therapy, which means that there are few content alternatives for users (clients) to choose from, and it provides passive content (one-way), which requires customized and specialized content [8].

[Table 2] Examples of Remote Psychological Counseling for Employees Operated by Companies

Company Name	Program Name	Features	
LG Chem	The Good Mind Group	- Targeting 20,000 employees worldwide, available in 8 languages. - Provides phone and chat services.	
Weme	W-Mind Healing	- Remote psychological counseling program via phone and chat.	
Lotte Department Store	Remote Psychological Counseling	- Conducts psychological assessments through an online site, followed by 50-minute video chat counseling.	

As shown in [Table 3], a one-way communication method without interaction can cause stress for the user (client), which feels like homework or studying. If clients want to maintain persistence only with app-based push notifications, the intervention will be less effective, and there is a risk of unclear intervention effects due to the involvement of non-professional counselors [9].

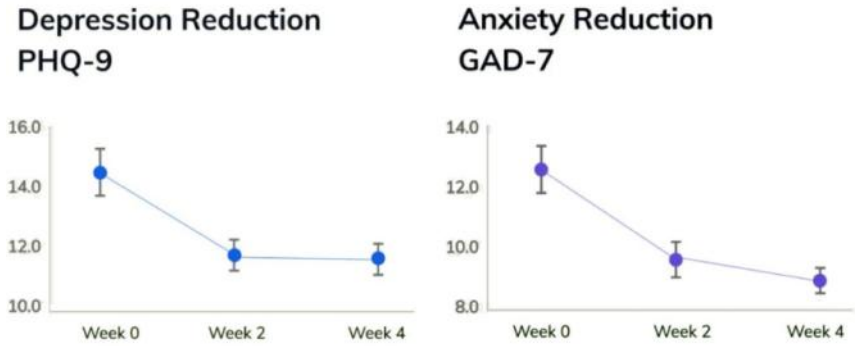
In order to solve these shortcomings, in addition to non-face-to-face counseling, the recent development of natural language processing (NLP) technologies such as ChatGPT has led to the experimental launch of counseling tools through chatbots that help with various counseling skills. Tess, developed by Silicon Valley startup X2AI, and Weobot Heath, developed by Warbot Labs, use natural language processing technology to talk to users in real time to understand their state of mind and

empathize with people struggling with mental health. A user test of the app conducted by Northwestern University reported a 13% reduction in depression and an 18% reduction in anxiety among students who used the app. Also, as shown in [Fig. 3], the Youper app also monitors symptoms of depression and anxiety through self-checklists and offers mood-boosting suggestions. [Fig. 4] describes the results of a study from Stanford University on the effectiveness of the Youper app in reducing depression (PHQ-9) and anxiety (GAD-7) over four weeks [10].

[Table 3] Comparison of Domestic and International Online Psychological Counseling Services

Classification	Psychological Counseling Content	Psychological Test Content	Mental Health Intervention Content	Form	Features
Trost	○	○	X	Text / Voice	Psychological Test Content - Depression, MBTI, personality, self-esteem, employment, and job stress tests Psychological Counseling Services - Text therapy (non-face-to-face anonymous text counseling) - Anonymous phone and video counseling - Options for counseling time, counselor, coordination, and choice of phone or video counseling
MindCare	○	○	X	Text / Voice	- Psychological Test Content Personality and character tests, Enneagram, MBTI, multidimensional career exploration test, self-regulation learning test, etc. - Psychological Counseling Services Video and voice counseling for individuals and organizations
Maru	X	X	○	Text	Mental Health Intervention Content - Body relaxation scan before sleep, week-long meditation training
BetterProfits	○	X	○	Text / Voice	Psychological Counseling Services - Facial expression recognition-based video counseling for individuals and organizations
Happify	X	X	○	Text / Voice	Mental Health Intervention Content - Positive psychology, psychological well-being, happiness enhancement activities - Gamification-based content
Somang	○	X	○	Voice	Mental Health Intervention Content - Counseling based on cognitive behavioral therapy Psychological Counseling Services - Interlinked counseling sessions with referral to specialists if necessary
BehaVR	X	X	○	Text / Voice	Mental Health Intervention Content - Using immersive VR to treat patients with various anxiety and depression disorders - Anxiety management, maternal health, pain management, mental illness, etc.

[Fig. 3] Counseling App 'Youper' Developed by Youper, Inc. Using a CBT (Cognitive Behavioral Therapy) Treatment Chatbot



[Fig. 4] Effectiveness of the Youper App on Depression and Anxiety Symptoms After Two Weeks of Use: Results from a Stanford University Study

[Fig. 5] Humanoid Robot 'Nao' Being Tested with Children with Autism

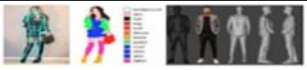
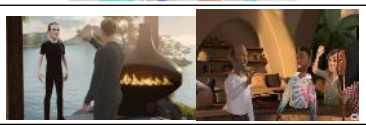
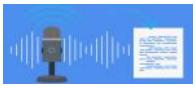
As shown in [Fig. 5], SoftBank's Nao has developed an AI robot that provides psychological counseling and special education through emotion recognition based on voice recognition, camera and

touch sensors, and natural language processing technology. The robot builds rapport with children through light conversations using their voices and asks a series of questions to diagnose their emotions.

[Table 4] Non-verbal and Psychophysiological Factors among Biological Signals

Nonverbal Behavioral Items	Measurement Factors
Facial cues	• Facial expressions, facial muscle movements • Eye movements, eye gaze, gaze direction, mutual gaze • Smiles
Audio, language-related cues	• Tone, pitch, speaking rate, duration of speech • Pauses, silences, volume, expressiveness • Interruptions, interjections
Body clues	• Nodding, head shaking • Gestures: Fidgeting, self-touching • Body position, posture, body orientation • Contact

Nonverbal behaviors	Measurement factors
Physical cues	• Clothing style/appearance • Hair style/color • Height, weight • Accessories
Environmental clues	• Location, spatial arrangement • Sound, light, temperature • Mobility options, density
Interacting behaviors	• Handshakes, interpersonal distance • Synchrony, mimicry • Turn-taking

Psychological Element	Main contents	
Body clues	• Nodding, posture, body orientation • Eye movements • Facial expression recognition	
Appearance cues	• Attire • Height	
Environmental cues	• Location • Spatial arrangement	
Interaction behaviors	• Handshakes, interpersonal distance • Turn-taking	
Gaze behavior	• Eye movements, blinking	
Speech analysis	• Speaking rate • Silence • Utterance duration	

With the development of super-sized artificial intelligence (AI), there are many attempts to replace counseling with it. However, most experts agree that AI can help counselors, but it cannot completely replace counselors, as counselors are responsible for counseling and need to consider various situations [11]. Therefore, most counseling content relies on self-reported questionnaires, which suffer from fatal flaws such as false reporting and idealized reporting. In order to supply the flaw, as shown in [Table 4] and [Table 5], the most prominent examples are behavioral data (reaction time, movement, and error rate) and vital sign collection, which can be helpful in contactless counseling.

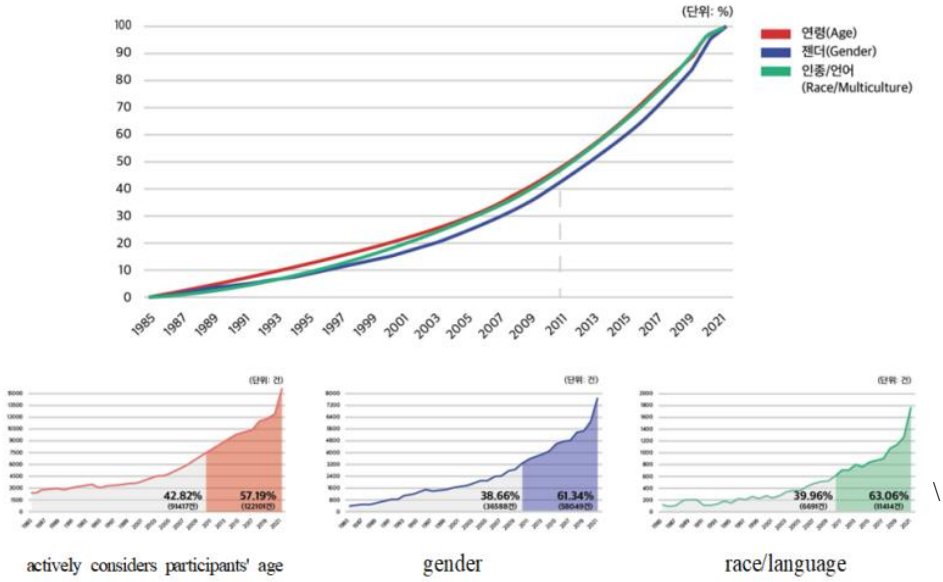
[Table 5] Examples of Companies Measuring and Analyzing Biological Signals

Physiological Signals: Utilize available modules - Advances in physiological signal acquisition technology - Many third-party recognition modules are publicly available - Capable of analyzing body, facial expressions, speech, etc.	
ETRI (Electronics and Telecommunications Research Institute) Deep Learning-based Real-time Facial Expression Recognition Technology (Technology Transfer Product)	• (Sub-technology 1) Tip-learning4-based real-time facial expression recognition technology • (Sub-technology 2) Tip-learning-based facial expression recognition technology and 68-point landmark-based facial expression recognition technology • Trained on basic six emotions: joy, sadness, surprise, fear, anger, disgust, although the disgust emotion is substituted with a more commonly expressed emotion among Koreans • Applicable in general CCTV cameras or inexpensive USB camera environments
Affective	• Utilizing computer vision to analyze facial expressions and voice data for detecting and measuring emotions, an emotion AI platform. • Facial expression analysis technology is currently being used across various industries such as automotive, healthcare, and marketing.
Microsoft Azure Face API	• Pioneering API that utilizes computer vision and machine learning to detect and analyze facial expressions, emotions, and attributes in images and videos. • However, due to recent ethical concerns related to privacy, key emotion analysis functionalities have been restricted or removed, posing some challenges for the implementation of this project.
Amazon Rekognition	• A deep learning-based service that can be utilized for facial analysis, including detecting facial expressions, gender, age group, and facial features. • Animation-transformed facial expressions extracted through frame-level 3D information extraction can be applied in counseling.
Baikal AI Co., Ltd	• A specialized company in voice analysis. • Possesses expertise in natural language processing for voice, including intonation, tone, pitch, sentence analysis, and speech-to-text (STT) technologies.
Korea Cloud Co., Ltd	• An artificial intelligence company specializing in facial expressions, tone, and movement modules, offering SDKs for integration.
National Task Development Team	• FACS-compatible digital human facial expression style transfer technology: Core technology development for realistic content. • Technology development for quantitative emotion-sentiment evaluation models for remote environment users: Commercialization technology development for digital content. • Multimodal-based Arousal-Valence emotion delivery interface technology.

In conclusion, there is a need for non-face-to-face counseling to improve mental health in various countries, including South Korea, and the key to its success is the provision of validated promotional content through accurate measurement. The measurement of individual psychological status should be complemented by various measurement methods (vital signs, behavioral data) other than self-reporting, and the effectiveness should be verified through scientific measurement methods.

3. Mind Tech in Measuring Human Abilities (Cognitive/Emotional)

The science of cognitive psychology approaches the human mind from an information processing perspective, encompassing early perceptual processing, which includes attention, memory, and learning, and later higher-order cognitive processing, which includes language and decision-making [12]. It explores the characteristics of each processing stage and the interactions between them including not only cognitive aspects but also emotional and social ones. It takes an experimental and scientific approach to studying the mind. Different objective experimental procedures have been devised for each processing stage, and it is essential to consider and analyze psychological science data from these different paradigms together to improve the quality of the mind tech industry. As shown in [Fig. 6] the growing number of studies in psychology since the 2010s that actively consider the age, gender, and race/language of participants [13].



[Fig. 6] Trends in Psychological Research by Age, Gender, and Race/Language by Year

Overseas, there are many large databases in the field of psychology and mental health. For example, the National Institute of Mental Health (NIMH) in the United States collects, analyzes, and publishes a wide range of data in the field of psychology and mental health, which allows researchers to conduct a variety of cognitive and emotional studies. In addition, the European Union's H2020 program, for example, is supporting a project to build a mental health database. This project aims to integrate and analyze mental health data from each country and develop new mental health services based on the data.

In South Korea, the National Mental Health Information Portal (mentalhealth.go.kr) provides 'disease-specific information' on mental health. However, there is no systematic collection of usable multimodal (verbal, vocal, visual) data that can be used in various fields such as medicine, AI, brain science, public policy, health diagnosis, career prediction, disease prevention and health, industry, and education by scientifically studying psychology, including actual cognitive and emotional functions. Worse, there is a lack of understanding of the need for such large-scale multimodal psychological data, and therefore no attempt is made.

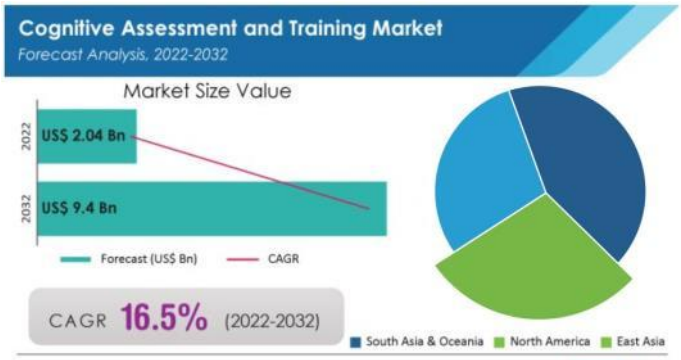
3.1 Market Trends in Mind Tech for Measuring Human Abilities (Cognitive/Emotional)

The global cognitive (part of psychological science measurement) assessment and training market size for the period 2019-2024 is forecast to reach $13,355 million by 2024. As shown in [Fig. 7], the market is expected to grow at a CAGR of 33.07% over the five-year period from 2019 to 2024, with North America being the fastest growing region at 33% [12].

[Fig. 7] Global Cognitive Assessment and Training Market (2021-2025)

The global market for Cognitive Assessment and Training is expected to reach USD 9.4 million in 2032, from USD 2 million in 2022, is expected to reach USD 9.4 million by the end of 2032,

according to the forecast period. As shown in [Fig. 8], the CAGR for the 10-year period from 2022 to 2032 is expected to be 16.5%, with Oceania growing at 19% and Asia at 16% [12].



[Fig. 8] Cognitive Assessment and Training Market (2022-2032)

3.2 Technological Trends in Mind Tech for Measuring Human Abilities (Cognitive/Emotional)

As shown in [Fig. 9], Cognifit, a US-based company that provides more than 24 types of cognitive tests, tabulates the results, and offers brain games, has extracted 4 million data points in 18 languages. It has partnered with hospitals and research organizations to build brain training wellness solutions.

[Fig. 9] Brain Training Wellness Solution Established by Cognifit in Collaboration with Hospitals and Research Institutions

In South Korea, as listed in [Table 6], online cognitive-emotional testing platforms and software are also being developed for commercialization. Developers of online cognitive tests include Goomon, a teacher, Digital Cognitive Function Test by Professor Kim Sang-yoon of Seoul National University Bundang Hospital, Sylvia Health, and Digital Therapeutic Social Cooperative.

In the case of SylviaHealth and Digital Therapy Social Cooperative, high intent to continue and satisfaction were reported by a significant proportion of users, respectively. However, these cognitive-emotional online testing platforms and software do not measure the full spectrum of cognitive and emotional traits of the mind. Specifically, they measure less than 10 domains, including attention and memory, which is not enough to be used as a large-scale, multimodal psychological big data. In addition, most of the tests do not measure the characteristics of the mind in real time and online processing, so they cannot be considered as a true measure of human psychological characteristics.

[Table 6] Examples of Companies Developing Cognitive Ability Measurement and Training Tools Domestically and Internationally

Company or Program Name	The expandability of psychological experiments.	Collecting physiological signals.	Data standardization	Collection/Storage of experiment results.	Analysis of artificial intelligence experiment results.	Comparison with other data.
Kumon	×	×	×	○	×	×
People Bio	×	×	×	×	×	×
Sylvia Health	×	×	×	×	×	×
Cognifit	×	×	×	○	×	×
Lumosity	×	×	×	×	×	×
Cogmed	○	×	×	○	×	×
Elevate	×	×	×	○	×	×

The market for cognitive measurement and therapy, a crucial component of digital health and mental health services, shows great promise. However, data collection and analysis remain primarily in the hands of specialists. To lower barriers to entry and enable the creation of extensive datasets, automation of these underlying processes is essential.

Once a comprehensive database of organized psychological and personal data is established and cognitive abilities are analyzed, significant social issues can be addressed. These include workplace stress, social traumas such as the “Don't Ask, Don't Tell” murders and the Sewol ferry incident, youth bullying, school violence, addiction problems like drug abuse, and post-traumatic stress for police officers and firefighters. Additionally, the collected psychographic data can be utilized in education and career training to analyze learners' patterns, preferences, and abilities, thereby suggesting customized learning paths. This approach can enhance learning efficiency and boost learner motivation. The development of such psychological data measurement and analysis is urgent. It has the potential to significantly improve mental health, reduce social costs, and contribute to the realization of a healthier society.

4. Conclusion

In this paper, it highlights the significant potential of Mind Tech in addressing the growing mental health crisis and enhancing human cognitive and emotional well-being. The integration of psychology and digital technology has given rise to innovative remote counseling services, offering accessible and cost-effective solutions to individuals and organizations. While the market for non-face-to-face counseling and cognitive assessment is rapidly expanding, there is a need for more comprehensive and multimodal approaches to measuring psychological traits. The development of large-scale psychological databases, incorporating biometric data, behavioral analysis, and standardized experimental procedures, is essential for advancing Mind Tech and enabling data-driven solutions.

A key challenge confronting the mind tech industry lies in the scientific and objective measurement of the effectiveness of psychological interventions and content [14]. Many current services lack robust scientific validation due to the nascent stage of the market. However, as the field progresses, it is expected that these services will converge towards more empirically validated and evidence-based practices [15]. Thus, efforts are underway in developed countries to collect multimodal psychological data including behavioral, biometric, and survey data. This data holds significant implications for various sectors including healthcare, education, mental health, policymaking, and marketing. As a crucial enabler for the advancement of mind tech, the urgent development of robust psychological datasets is necessary. Furthermore, the integration of human psychology principles with digital technologies is expected to expand into areas such as user experience (UX) and user interface (UI) design, environmental psychology, food psychology, ethics, and the development of digital human avatars in the future.

This paper has a limitation that it primarily discusses market trends, technological advancements, and the potential of Mind Tech in measuring cognitive and emotional abilities. Thus, further studies can be extended to provide specific empirical data or research studies that validate the effectiveness and accuracy of the various Mind Tech solutions. mentioned, such as remote counseling platforms, chatbots, and cognitive assessment tools.

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