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(54) **APPARATUS AND METHOD FOR PROVIDING SERIOUS GAME**

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(52) **U.S. Cl.**
USPC **463/9**

(57) **ABSTRACT**

A serious game providing apparatus comprises a content providing unit that provides at least one of a multiple number of serious game contents for cognitive ability measurement and development to a user terminal of a registered user; and an assessment processing unit that provides cognitive ability assessment data corresponding to the registered user based on a result of at least one time performance of the multiple number of serious game contents.

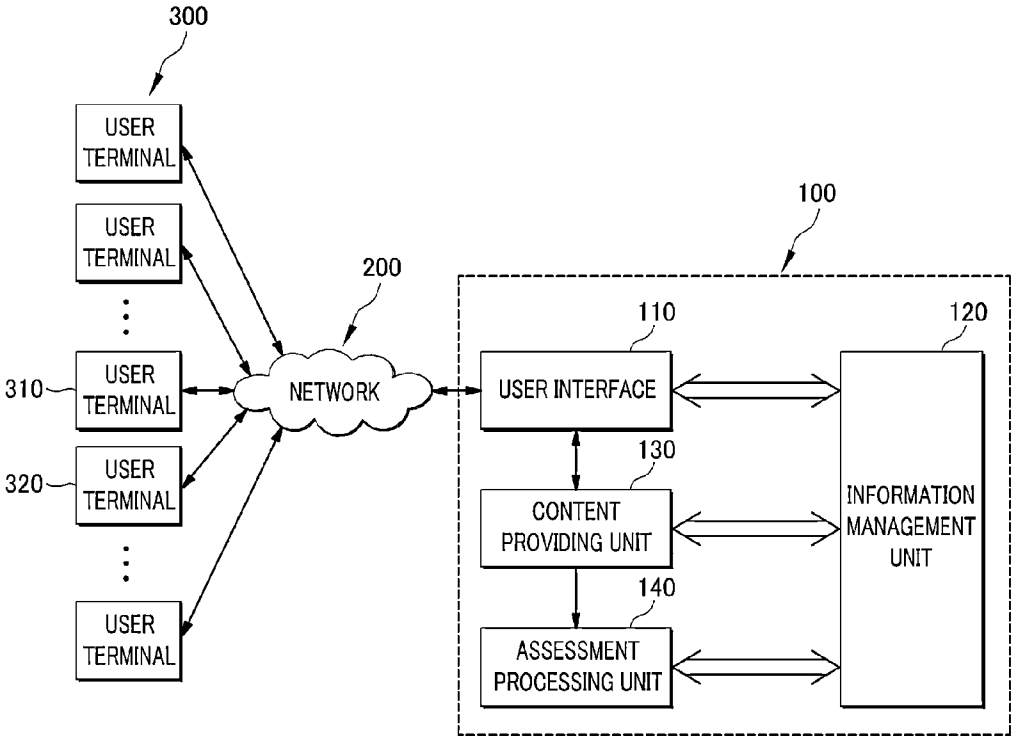


FIG. 1

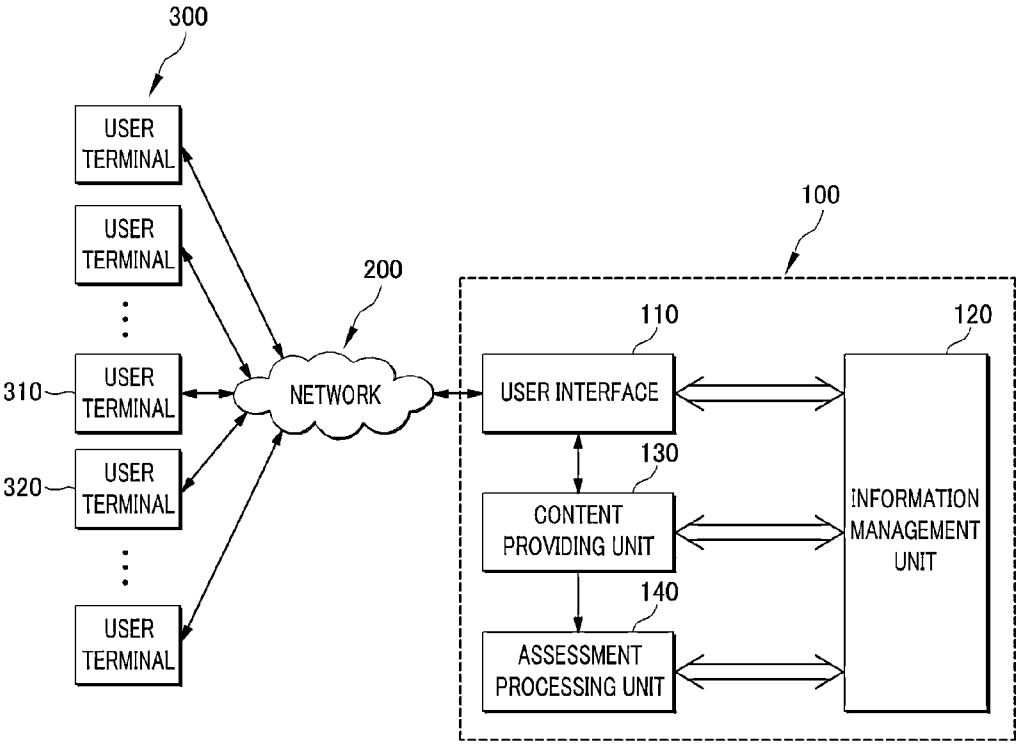

300
USER TERMINAL
USER TERMINAL
310
USER TERMINAL
320
USER TERMINAL
USER TERMINAL
200
NETWORK
100
110
USER INTERFACE
130
CONTENT PROVIDING UNIT
140
ASSESSMENT PROCESSING UNIT
120
INFORMATION MANAGEMENT UNIT

FIG. 2

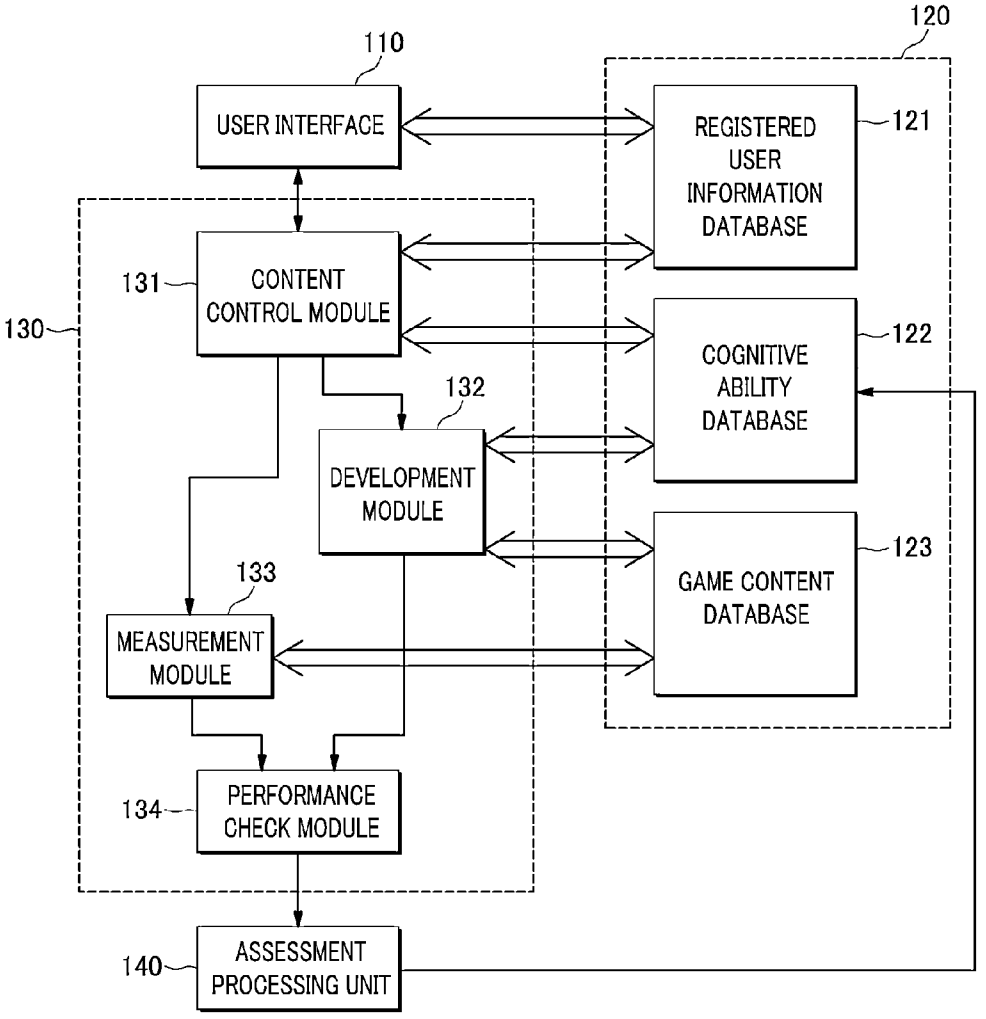

120
110
USER INTERFACE
REGISTERED USER INFORMATION DATABASE
121
131
CONTENT CONTROL MODULE
130
COGNITIVE ABILITY DATABASE
122
132
DEVELOPMENT MODULE
GAME CONTENT DATABASE
123
133
MEASUREMENT MODULE
134
PERFORMANCE CHECK MODULE
140
ASSESSMENT PROCESSING UNIT

FIG. 3

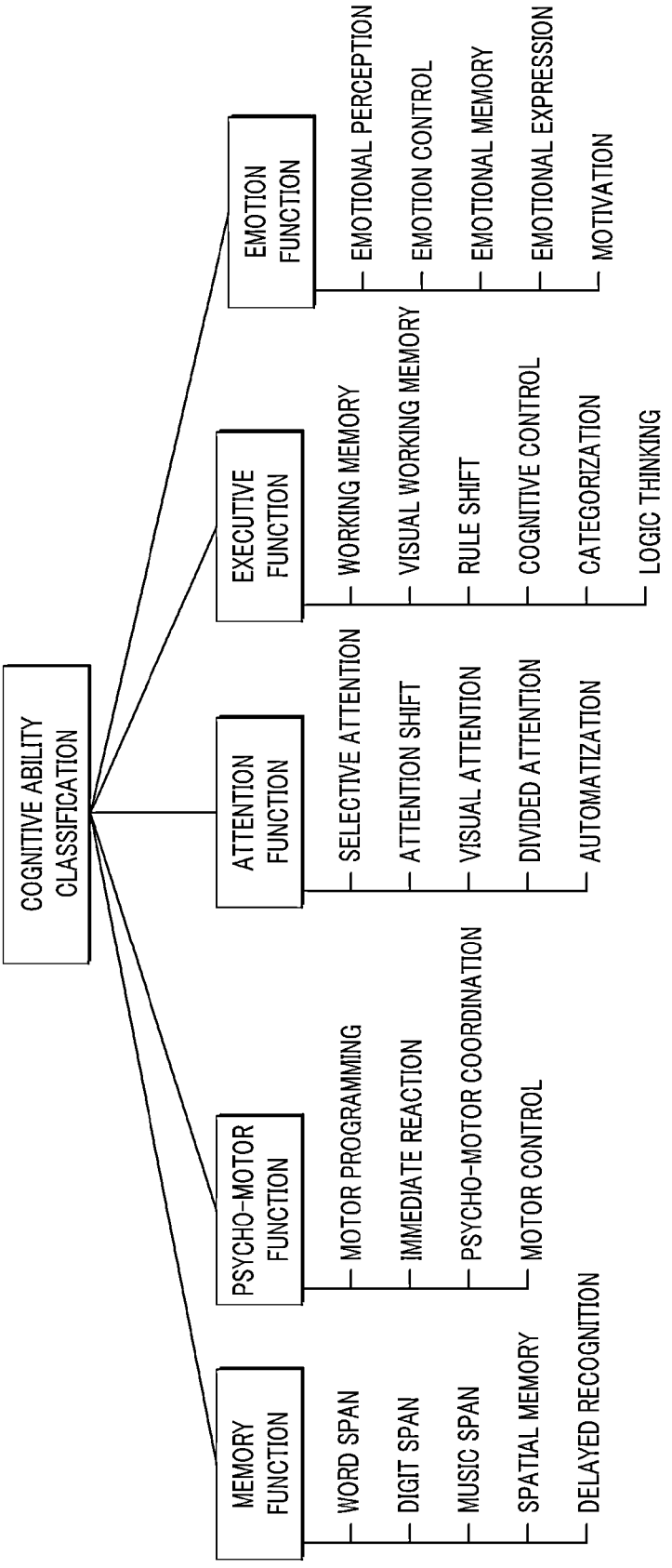

COGNITIVE ABILITY CLASSIFICATION
MEMORY FUNCTION
WORD SPAN
DIGIT SPAN
MUSIC SPAN
SPATIAL MEMORY
DELAYED RECOGNITION
PSYCHO-MOTOR FUNCTION
MOTOR PROGRAMMING
IMMEDIATE REACTION
PSYCHO-MOTOR COORDINATION
MOTOR CONTROL
ATTENTION FUNCTION
SELECTIVE ATTENTION
ATTENTION SHIFT
VISUAL ATTENTION
DIVIDED ATTENTION
AUTOMATIZATION
EXECUTIVE FUNCTION
WORKING MEMORY
VISUAL WORKING MEMORY
RULE SHIFT
COGNITIVE CONTROL
CATEGORIZATION
LOGIC THINKING
EMOTION FUNCTION
EMOTIONAL PERCEPTION
EMOTION CONTROL
EMOTIONAL MEMORY
EMOTIONAL EXPRESSION
MOTIVATION

FIG. 4

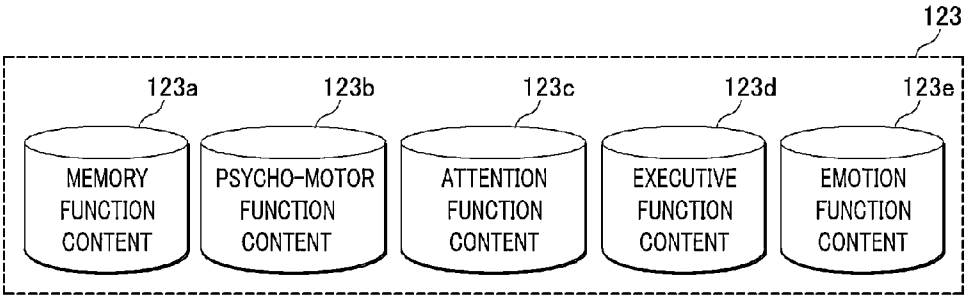

123
123a
123b
123c
123d
123e
MEMORY FUNCTION CONTENT
PSYCHO-MOTOR FUNCTION CONTENT
ATTENTION FUNCTION CONTENT
EXECUTIVE FUNCTION CONTENT
EMOTION FUNCTION CONTENT

FIG. 5

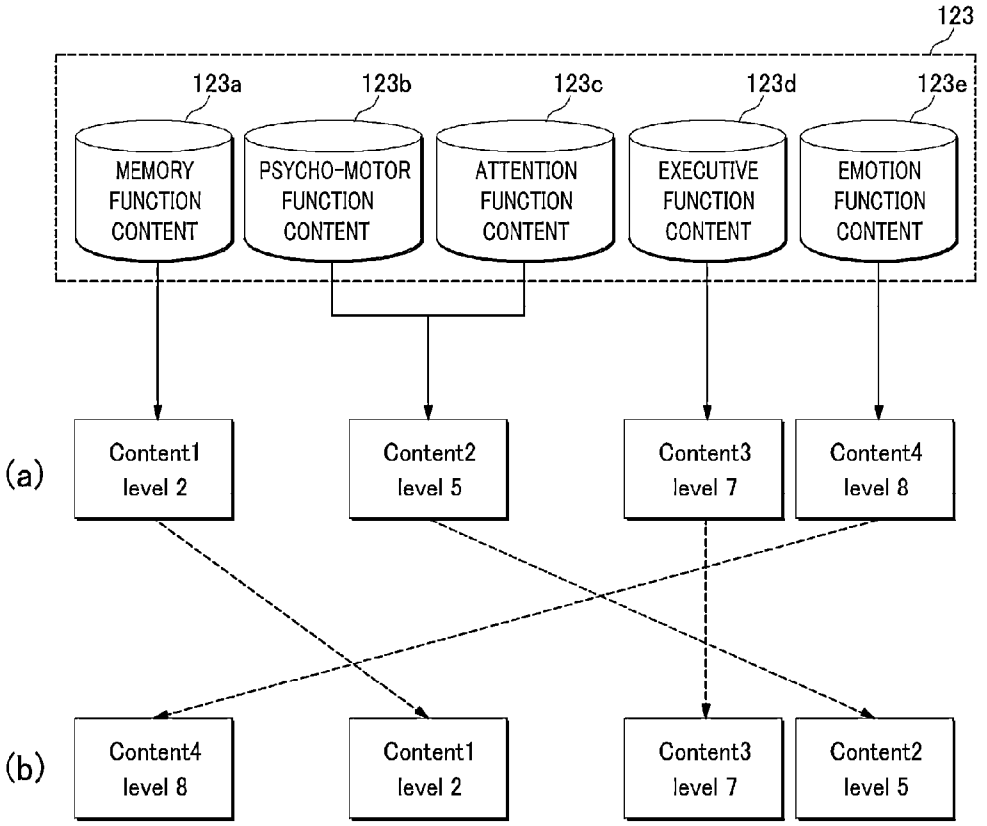

123
123a
123b
123c
123d
123e
MEMORY FUNCTION CONTENT
PSYCHO-MOTOR FUNCTION CONTENT
ATTENTION FUNCTION CONTENT
EXECUTIVE FUNCTION CONTENT
EMOTION FUNCTION CONTENT
(a)
Content1 level 2
Content2 level 5
Content3 level 7
Content4 level 8
(b)
Content4 level 8
Content1 level 2
Content3 level 7
Content2 level 5

FIG. 6

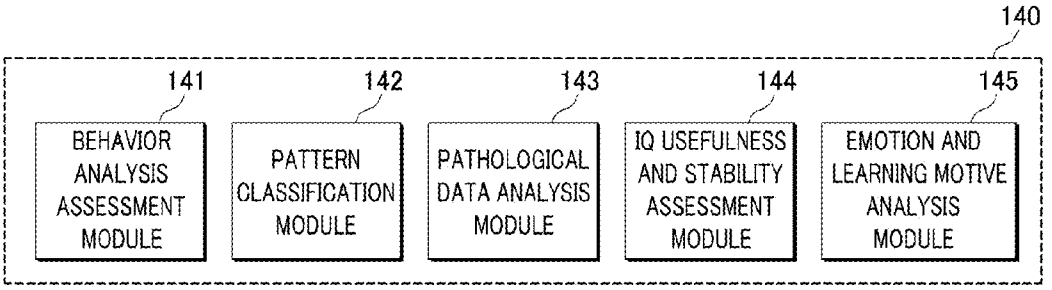

140
141
142
143
144
145
BEHAVIOR ANALYSIS ASSESSMENT MODULE
PATTERN CLASSIFICATION MODULE
PATHOLOGICAL DATA ANALYSIS MODULE
IQ USEFULNESS AND STABILITY ASSESSMENT MODULE
EMOTION AND LEARNING MOTIVE ANALYSIS MODULE

FIG. 7A

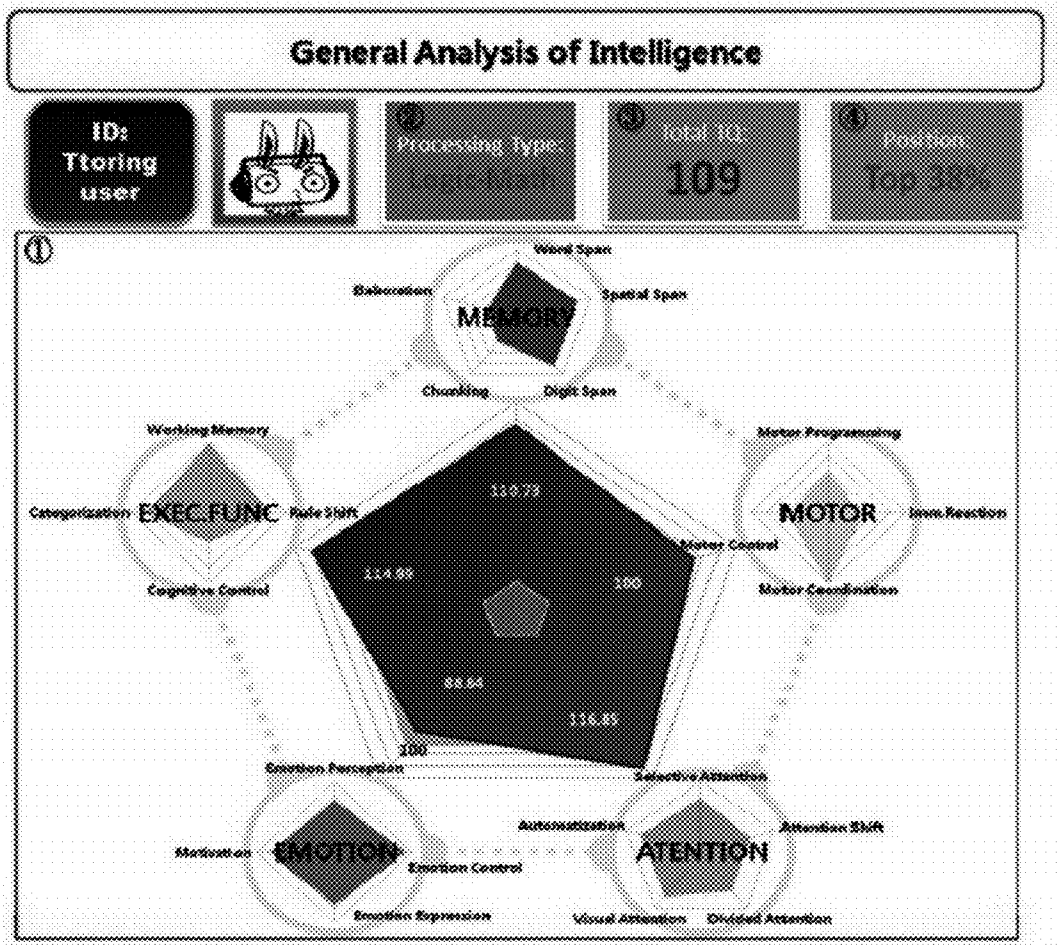

General Analysis of Intelligence
IDs
Ttoring
user
109
MEMORY
EXEC.FUNC
MOTOR
EMOTION
ATENTION

FIG. 7B

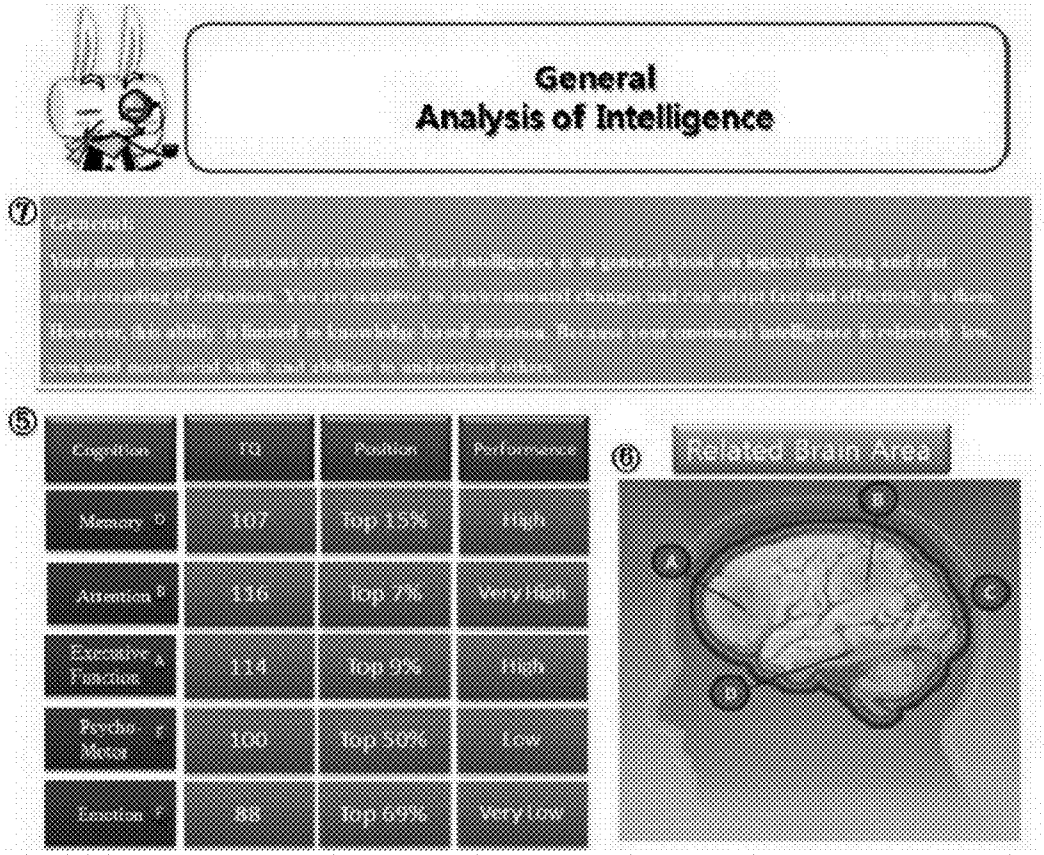


FIG. 7C

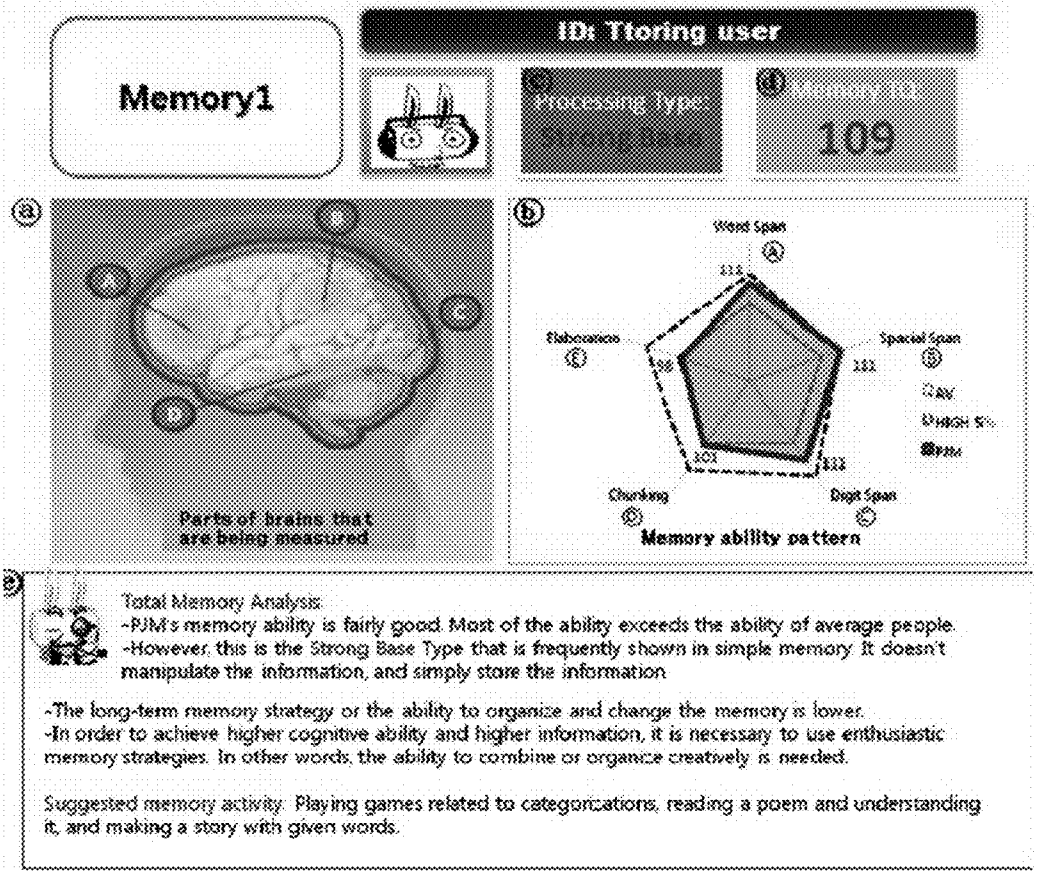

Memory1
ID: Tloring user
109
Parts of brains that are being measured
Memory ability pattern
Total Memory Analysis
-PJM's memory ability is fairly good. Most of the ability exceeds the ability of average people.
-However, this is the Strong Base Type that is frequently shown in simple memory. It doesn't manipulate the information, and simply store the information.
-The long-term memory strategy or the ability to organize and change the memory is lower.
-In order to achieve higher cognitive ability and higher information, it is necessary to use enthusiastic memory strategies. In other words, the ability to combine or organize creatively is needed.
Suggested memory activity: Playing games related to categorications, reading a poem and understanding it, and making a story with given words.

FIG. 7D

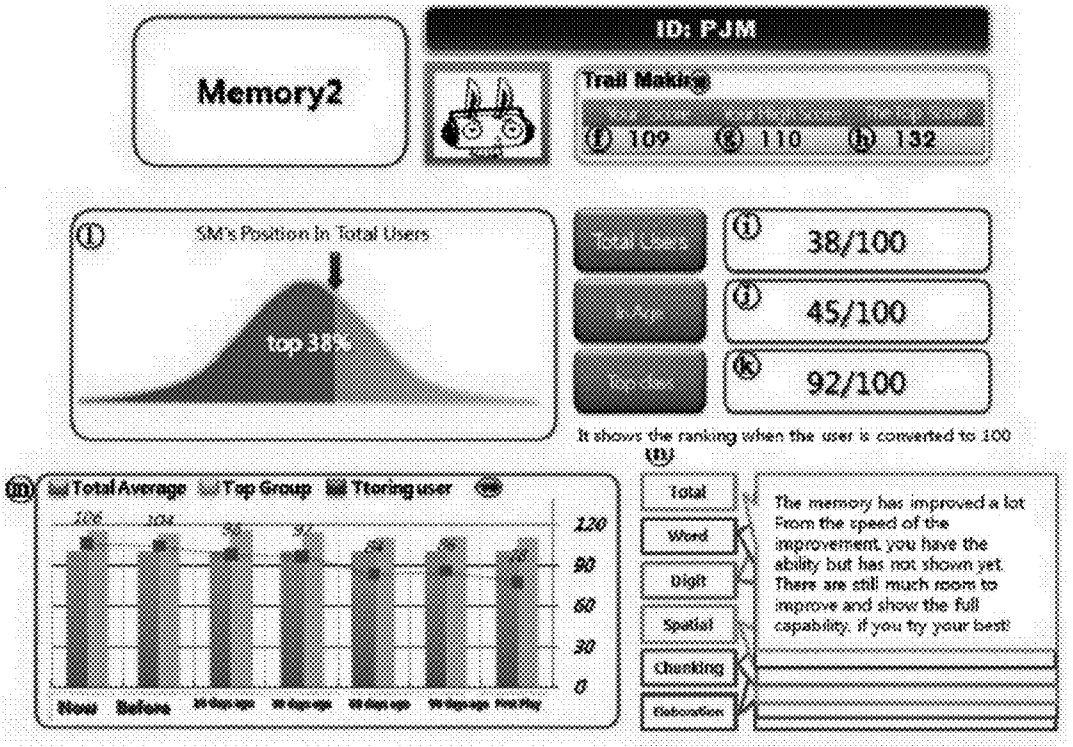

Memory2
ID: PJM
Trail Making
109
110
132
SM's Position In Total Users
top 38%
38/100
45/100
92/100
It shows the ranking when the user is converted to 100
Total Average
Top Group
Ttoring user
120
90
60
30
0
Before
Total
Word
Digit
Spatial
Checking
The memory has improved a lot From the speed of the improvement, you have the ability but has not shown yet. There are still much room to improve and show the full capability, if you try your best!

FIG. 8

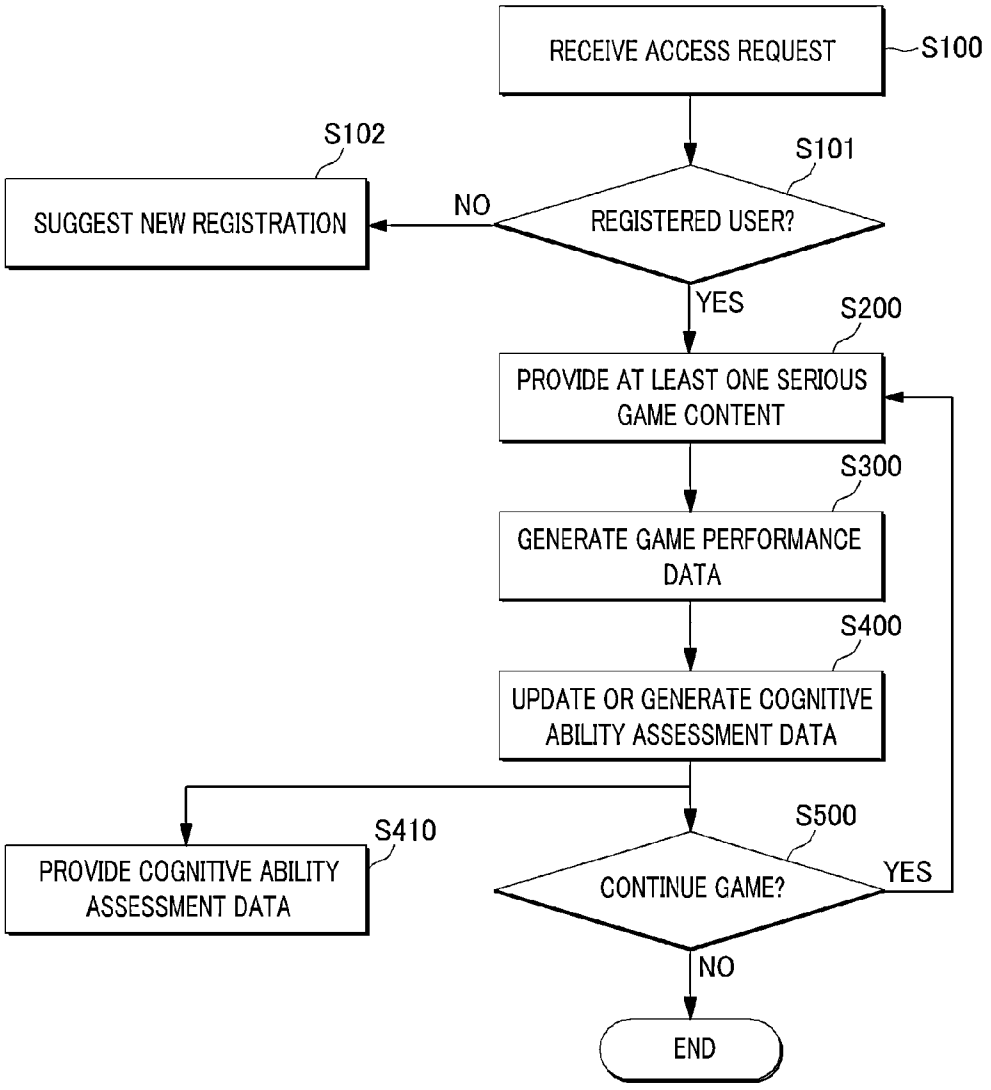

RECEIVE ACCESS REQUEST
S100
S101
REGISTERED USER?
NO
S102
SUGGEST NEW REGISTRATION
YES
S200
PROVIDE AT LEAST ONE SERIOUS GAME CONTENT
S300
GENERATE GAME PERFORMANCE DATA
S400
UPDATE OR GENERATE COGNITIVE ABILITY ASSESSMENT DATA
S500
CONTINUE GAME?
YES
NO
S410
PROVIDE COGNITIVE ABILITY ASSESSMENT DATA
END

FIG. 9

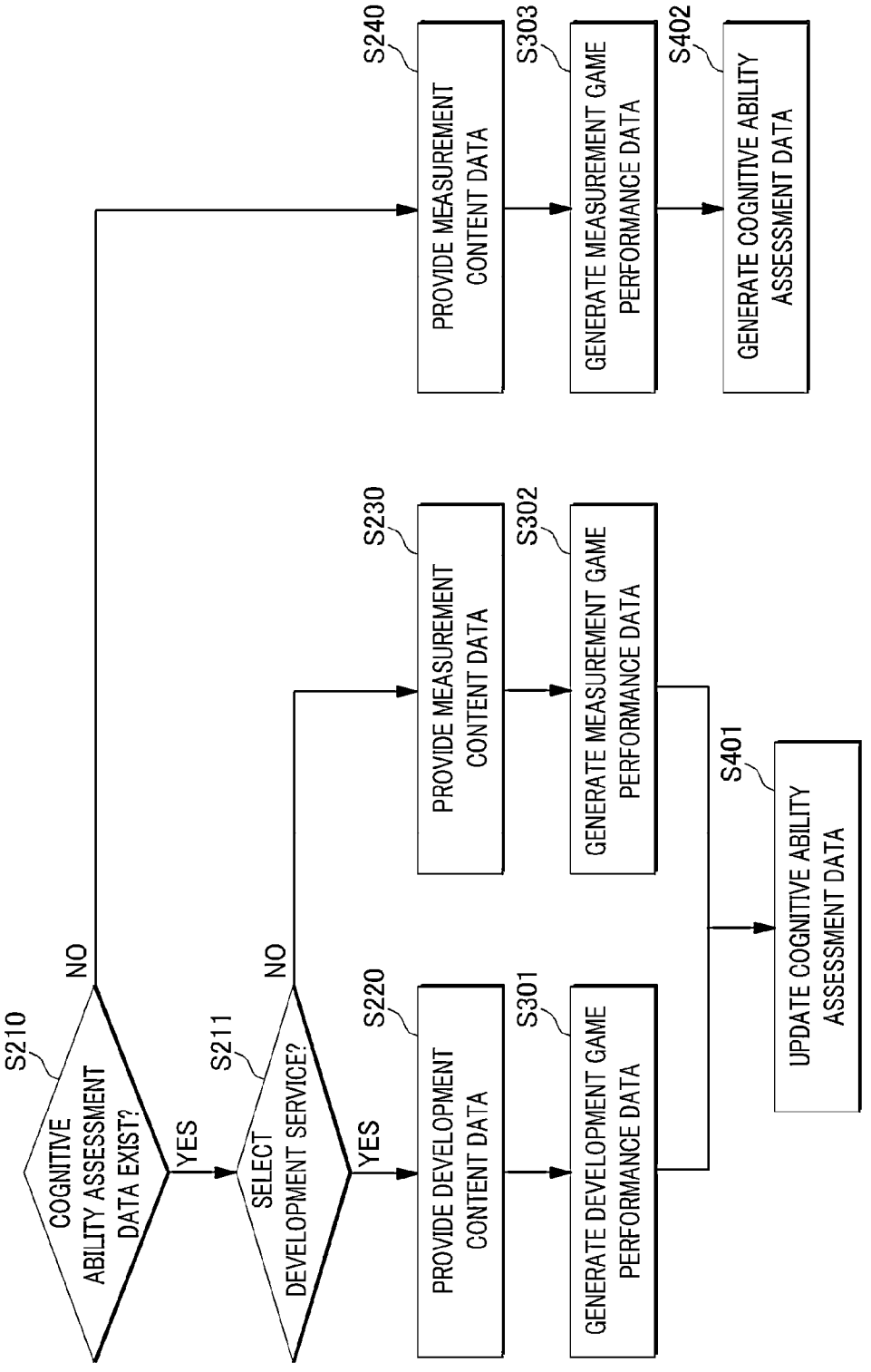

S210
COGNITIVE ABILITY ASSESSMENT DATA EXIST?
NO
YES
S211
SELECT DEVELOPMENT SERVICE?
NO
YES
S220
PROVIDE DEVELOPMENT CONTENT DATA
S301
GENERATE DEVELOPMENT GAME PERFORMANCE DATA
S230
PROVIDE MEASUREMENT CONTENT DATA
S302
GENERATE MEASUREMENT GAME PERFORMANCE DATA
S240
PROVIDE MEASUREMENT CONTENT DATA
S303
GENERATE MEASUREMENT GAME PERFORMANCE DATA
S401
UPDATE COGNITIVE ABILITY ASSESSMENT DATA
S402
GENERATE COGNITIVE ABILITY ASSESSMENT DATA

FIG. 10

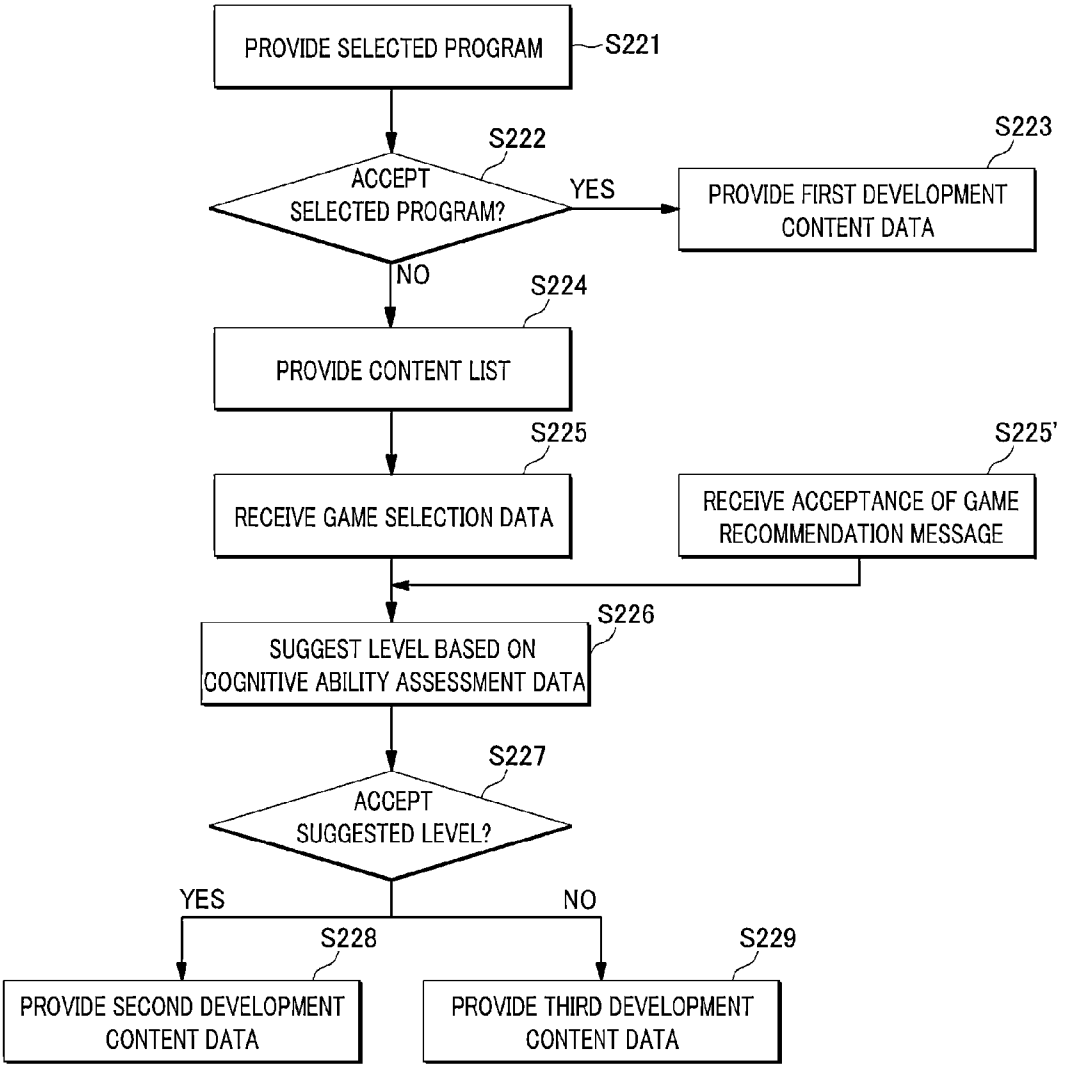

PROVIDE SELECTED PROGRAM
S221
S222
ACCEPT SELECTED PROGRAM?
YES
S223
PROVIDE FIRST DEVELOPMENT CONTENT DATA
NO
S224
PROVIDE CONTENT LIST
S225
RECEIVE GAME SELECTION DATA
S225'
RECEIVE ACCEPTANCE OF GAME RECOMMENDATION MESSAGE
S226
SUGGEST LEVEL BASED ON COGNITIVE ABILITY ASSESSMENT DATA
S227
ACCEPT SUGGESTED LEVEL?
YES
NO
S228
PROVIDE SECOND DEVELOPMENT CONTENT DATA
S229
PROVIDE THIRD DEVELOPMENT CONTENT DATA

FIG. 11A

FIG. 11B

FIG. 11C

FIG. 11D

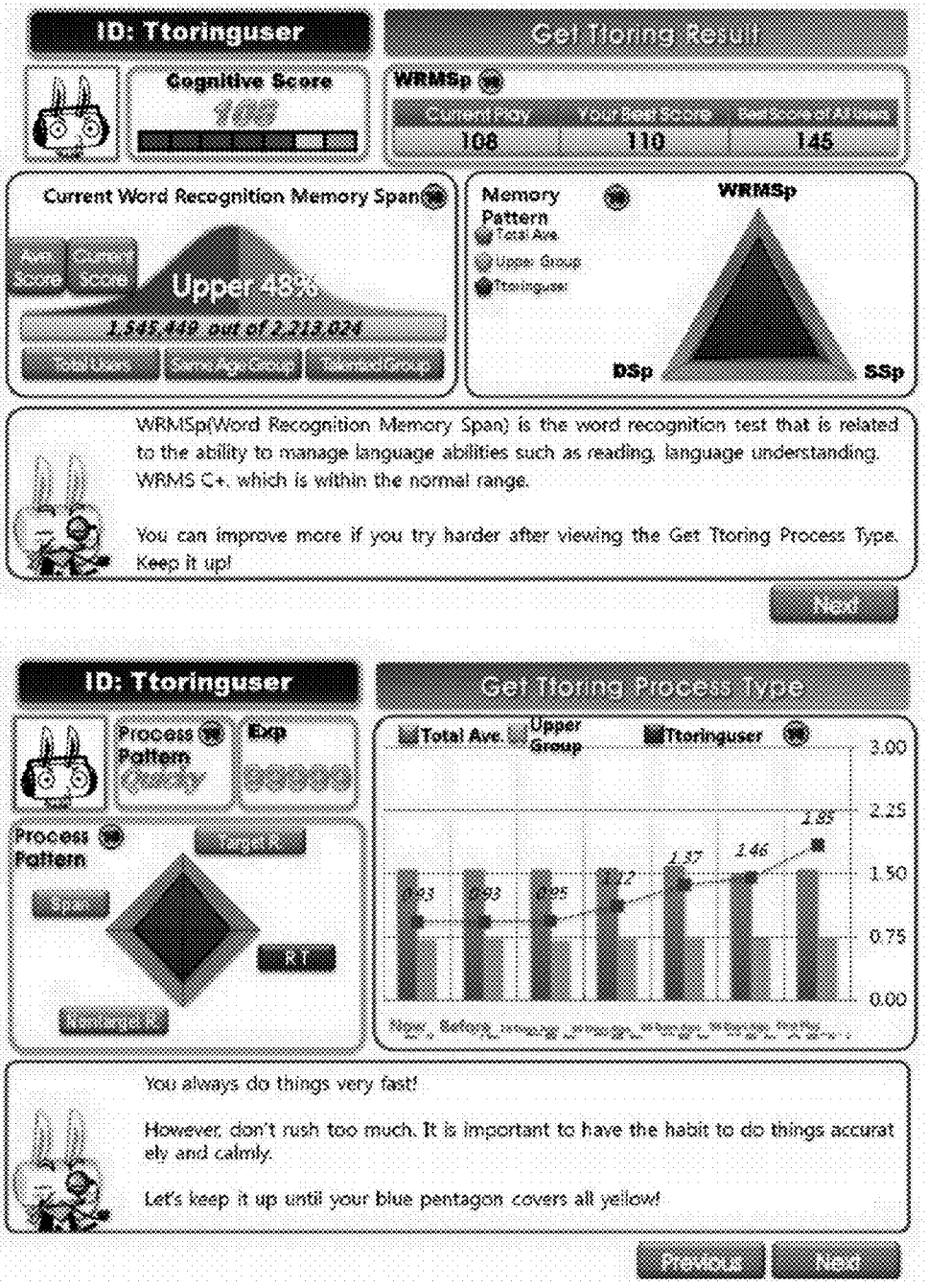

ID: Ttoringuser
Get Ttoring Result
Cognitive Score
WRMSp
Current Avg.
Your Last Score
Best Score of All Time
108
110
145
Current Word Recognition Memory Span
Upper 48%
1,545,449 out of 2,213,024
Memory Pattern
WRMSp
Total Ave.
Upper Group
Ttoringuser
DSp
SSp
WRMSp(Word Recognition Memory Span) is the word recognition test that is related to the ability to manage language abilities such as reading, language understanding. WRMS C+, which is within the normal range.
You can improve more if you try harder after viewing the Get Ttoring Process Type. Keep it up!
Next
ID: Ttoringuser
Get Ttoring Process Type
Process Pattern
Exp
Process Pattern
RT
Total Ave.
Upper Group
Ttoringuser
3.00
2.25
1.50
0.75
0.00
1.57
1.46
2.85
You always do things very fast!
However, don't rush too much. It is important to have the habit to do things accurat ely and calmly.
Let's keep it up until your blue pentagon covers all yellow!
Previous
Next

FIG. 12A

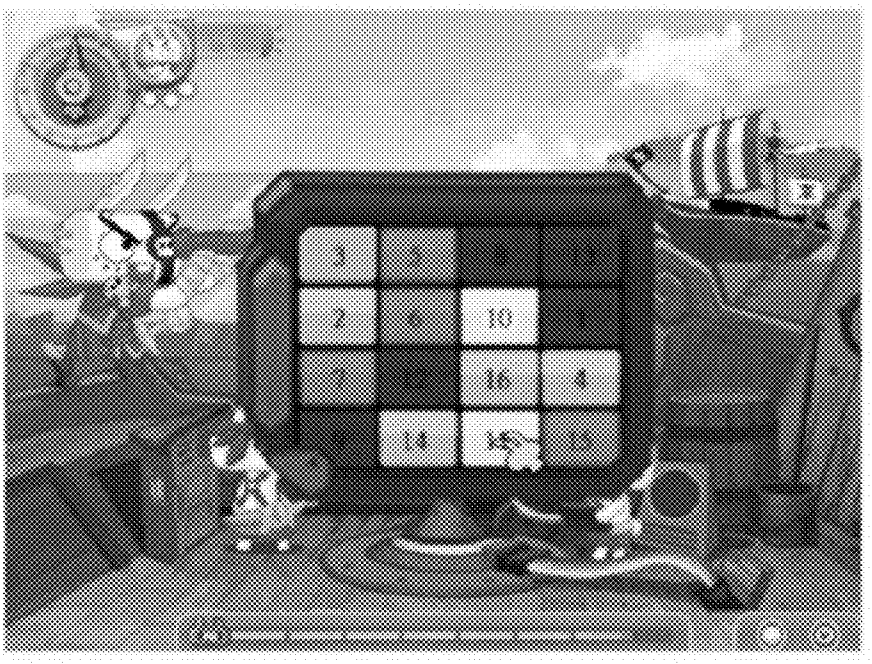


FIG. 12B

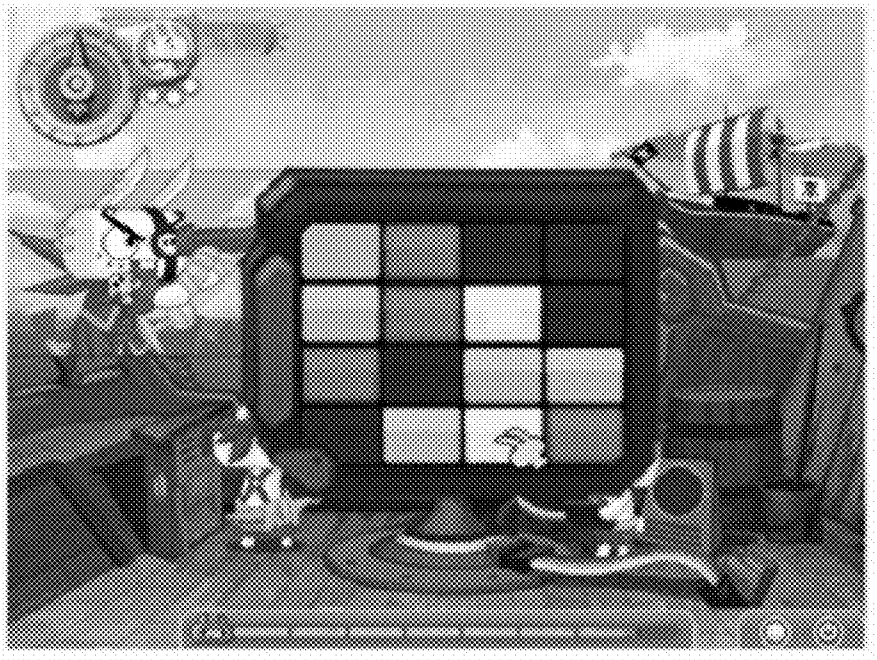


FIG. 12C

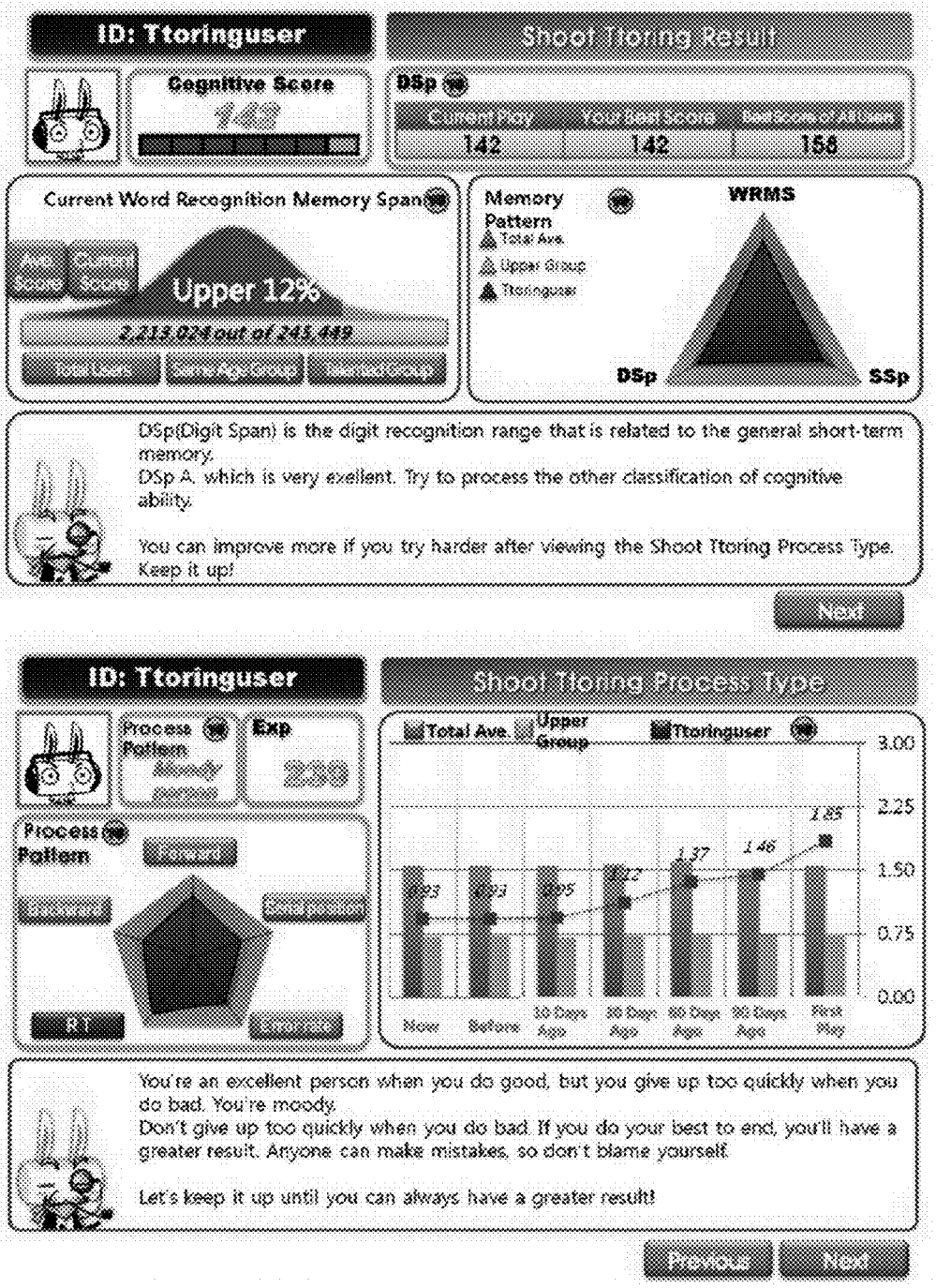

ID: Ttoringuser
Shoot Ttoring Result
Cognitive Score
DSp
142
142
158
Current Word Recognition Memory Span
Upper 12%
2,213,024 out of 243,449
Memory Pattern
WRMS
Total Ave.
Upper Group
Ttoringuser
DSp
SSp
DSp(Digit Span) is the digit recognition range that is related to the general short-term memory.
DSp A, which is very exellent. Try to process the other classification of cognitive ability.
You can improve more if you try harder after viewing the Shoot Ttoring Process Type.
Keep it up!
Next
ID: Ttoringuser
Shoot Ttoring Process Type
Process Pattern
Exp
Process Pattern
Total Ave.
Upper Group
Ttoringuser
3.00
2.25
1.50
0.75
0.00
1.85
1.46
1.37
Now
Before
30 Days Ago
90 Days Ago
180 Days Ago
365 Days Ago
First Play
You're an excellent person when you do good, but you give up too quickly when you do bad. You're moody.
Don't give up too quickly when you do bad. If you do your best to end, you'll have a greater result. Anyone can make mistakes, so don't blame yourself.
Let's keep it up until you can always have a greater result!
Previous
Next

FIG. 13A

FIG. 13B

FIG. 13C

FIG. 14

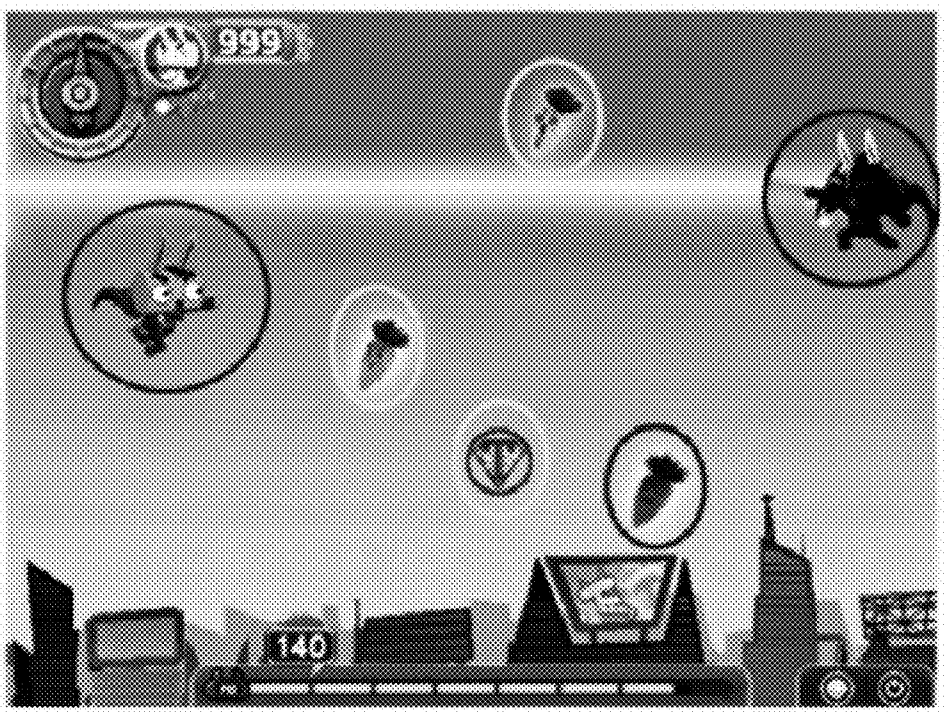


FIG. 15A

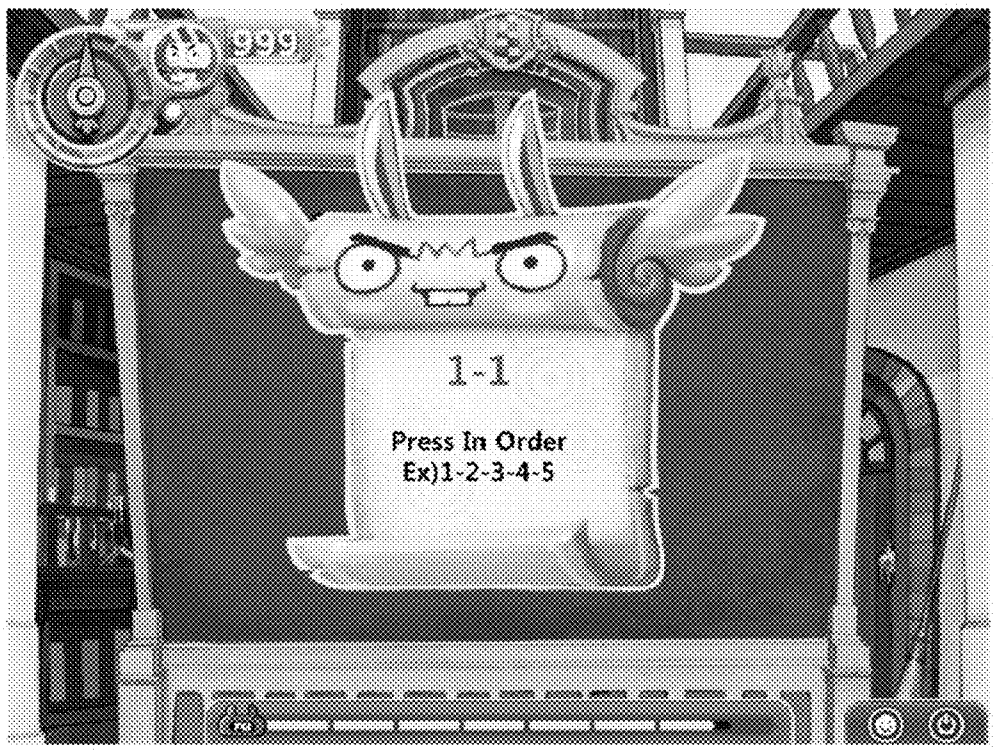


FIG. 15B

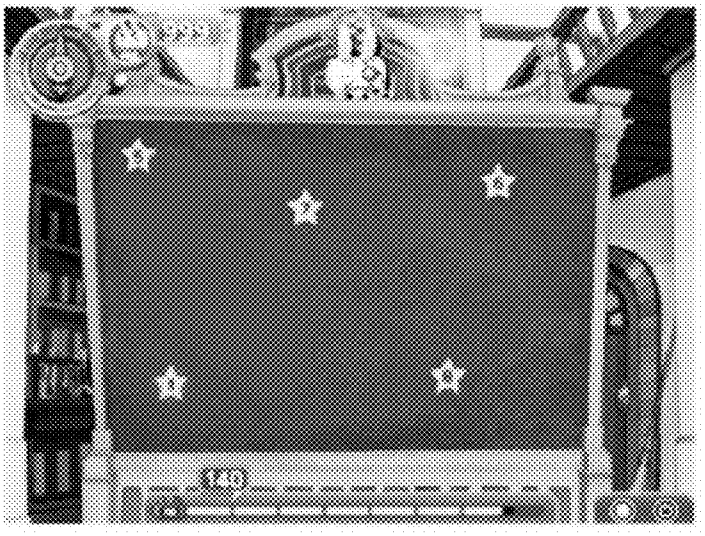
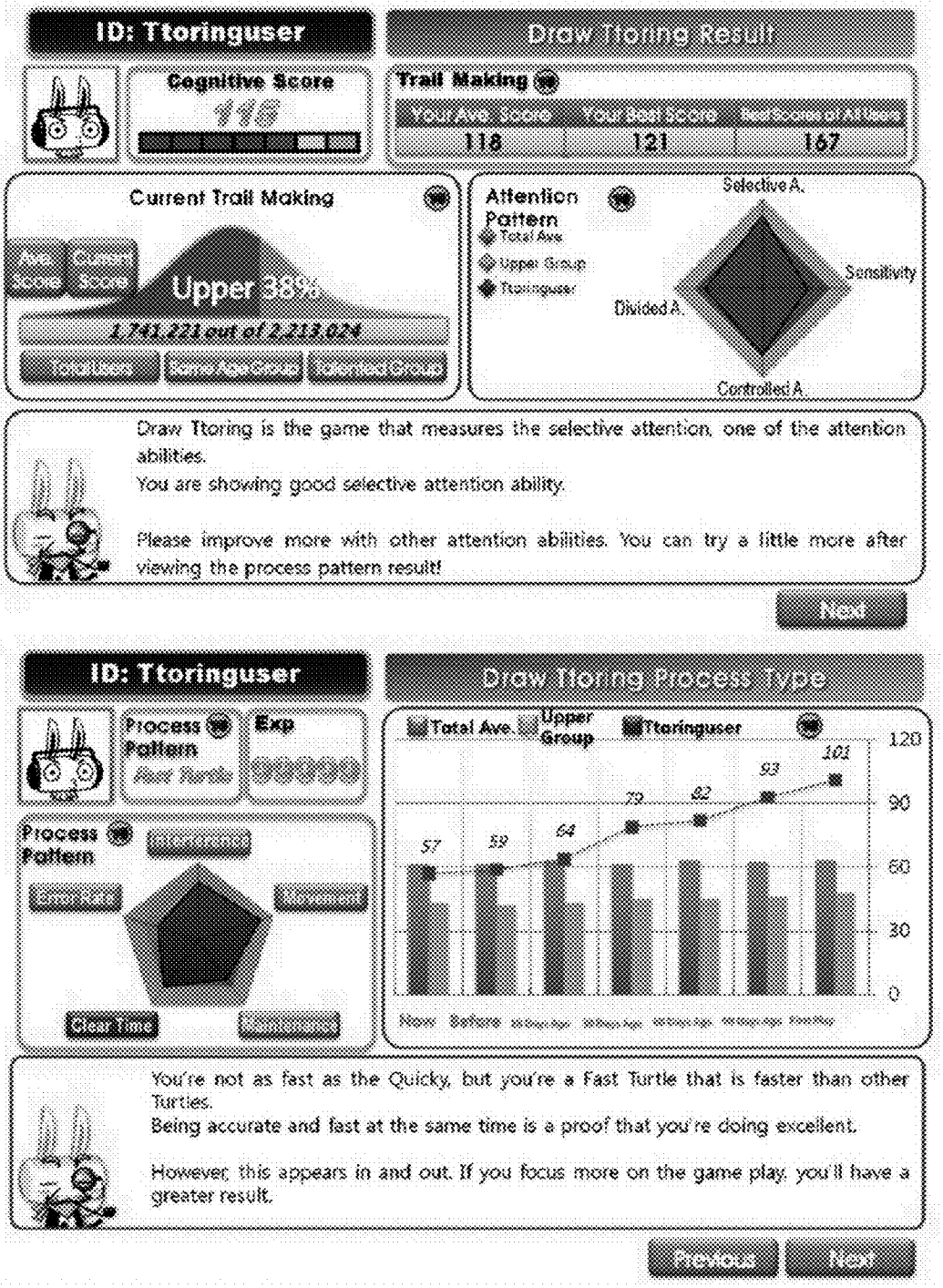


FIG. 15C


ID: Ttoringuser
Draw Ttoring Result
Cognitive Score
Trail Making
Your Ave. Score
Your Best Score
Best Score of All Users
118
121
167
Current Trail Making
Upper 38%
1,741,221 out of 2,213,024
Attention Pattern
Total Ave.
Upper Group
Ttoringuser
Selective A.
Sensitivity
Divided A.
Controlled A.
Draw Ttoring is the game that measures the selective attention, one of the attention abilities.
You are showing good selective attention ability.
Please improve more with other attention abilities. You can try a little more after viewing the process pattern result!
Next
ID: Ttoringuser
Draw Ttoring Process Type
Process Pattern
Exp
Total Ave.
Upper Group
Ttoringuser
120
90
60
30
0
57
59
64
79
82
93
101
Now
Before
You're not as fast as the Quicky, but you're a Fast Turtle that is faster than other Turtles.
Being accurate and fast at the same time is a proof that you're doing excellent.
However, this appears in and out. If you focus more on the game play, you'll have a greater result.
Previous
Next

APPARATUS AND METHOD FOR PROVIDING SERIOUS GAME

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of Korean Patent Application No. 10-2011-0098472 filed on Sep. 28, 2011, the entire disclosures of which are incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present disclosure relates to an apparatus and a method for providing a serious game for measuring and developing cognitive abilities.

BACKGROUND OF THE INVENTION

[0003] As an online game is continuously popular, a game industry has rapidly grown. Further, serious games applicable to education, training, medical treatment, and exercise have attracted great attention.

[0004] The serious games are structured activities designed by combining an original purpose of entertaining humans to have happiness and fun and a proper functional purpose of helping humans in doing disagreeable activities without aversion. In early days, the serious games were designed for military purpose. In recent years, the serious games have been developed and used in various genres and in various fields, such as education, training, medical treatment and public services.

[0005] Meanwhile, a cognitive ability is a primary faculty for mental activities and may be involved in all processes of rapidly and efficiently processing and analyzing information from the surrounding environment. That is, the term "cognition" refers to active metal processes including awareness, attention, remembering, learning, producing and understanding language, thinking, feeling, solving problems, and doing skilled activities.

[0006] If there is a lack of a cognitive ability, a child may have developmental disabilities or developmental delays and also may have a speech defect, an attention disorder, and poorness of processing information, which may cause him/her difficulty in leading a social life.

[0007] Therefore, a cognitive ability testing service for checking a decline or delay in a cognitive ability and a service helpful for developing a cognitive ability using a training of repeated use of the cognitive ability to prevent a decline or delay in the cognitive ability have attracted great attention.

[0008] As a conventional cognitive ability test, there are Korean-Wechsler Intelligence Scale, Kaufman Assessment Battery for Children (K-ABC), KWIS, and Ray-Kim Test as one of Korean memory test.

[0009] To be specific, Korean-Wechsler Intelligence Scale is used to measure an intelligent quotient (IQ) through subtests including a verbal test and a performance test. K-ABC is used to measure an IQ and achievement through a mental processing test and an achievement test and places more emphasis on mental processing. KWIS is made up of a verbal scale and a performance scale including various subtests such as general information, picture completion, arithmetic, and the like and used to generally assess a personal ability. And, Ray-Kim Test places more emphasis on memory and is made up of an auditory verbal learning test and a complex figure test to measure a degree of memory retention, an efficiency of retrieval, and the like.

[0010] Such conventional cognitive ability tests have been used to measure a cognitive ability as defined in each test. However, they focus on only a part of cognitive ability such as an IQ or memory. Therefore, a cognitive ability test capable of generally measuring a cognitive ability having various functions as well as a memory function is needed.

[0011] Generally, conventional cognitive ability measurement and development services have been served offline. That is, a user who wants to get a cognitive ability measurement and development service is required to visit a specialize agency such as a hospital and based on an expert's analysis on the user's answers in written form or questions and answers during an interview, the user can check his/her own cognitive ability or can get a training for developing his/her own cognitive ability.

[0012] Therefore, the conventional cognitive ability measurement and development services have low accessibility due to insufficient special agencies, a long time required to provide a service, high cost and a user's inconvenience caused by a personal visit. Further, a cognitive ability measurement entirely depends on experience and knowledge of an expert and statistical data based thereon, and, thus, reliability of the service cannot be improved. Furthermore, the questions and answers for the conventional cognitive ability measurement and development are made up of boring contents, and, thus, the user may lose interest easily.

BRIEF SUMMARY OF THE INVENTION

[0013] In order to solve the above-described problems, the present disclosure provides an apparatus and a method for providing a serious game having improved accessibility and reliability and capable of retaining a user's interest.

[0014] In view of the foregoing, there is provided+claim **1**.

[0015] There is provided+claim **16**.

[0016] Further, there is provided+claim **21**.

[0017] An apparatus and a method for providing a serious game in accordance with an embodiment of the present disclosure provide a multiple number of serious game contents for cognitive ability measurement and development to a user terminal of a registered user via a network. Therefore, it is possible to solve problems such as a user's inconvenience caused by a personal visit, a long time required to provide a measurement and development service, and high cost, and, thus, accessibility can be improved.

[0018] Further, in accordance with an embodiment of the present disclosure, cognitive ability assessment data of a registered user are provided based on a result of at least one time performance of a multiple number of serious game contents by the registered user. In this case, the multiple number of serious game contents are provided to draw cognitive ability measurement data corresponding to at least one function among multiple functions of a cognitive ability, and, thus, all of the functions of the cognitive ability can be measured equally. Therefore, reliability can be improved.

[0019] Furthermore, due to the improvement in accessibility, a multiple number of users may have easy access. Therefore, statistical data of cognitive abilities of more users than before can be obtained and a result of analyzing cognitive ability assessment data is provided by using the statistical data, and, thus, reliability can be further improved.

[0020] Moreover, in accordance with an embodiment of the present disclosure, a multiple number of serious game contents is used for cognitive ability measurement and development, and, thus, it is possible to retain a user's interest higher than before.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] Non-limiting and non-exhaustive embodiments will be described in conjunction with the accompanying drawings. Understanding that these drawings depict only several embodiments in accordance with the disclosure and are, therefore, not to be intended to limit its scope, the disclosure will be described with specificity and detail through use of the accompanying drawings, in which:

[0022] FIG. **1** is a block diagram of a serious game providing apparatus in accordance with an embodiment of the present disclosure;

[0023] FIG. **2** is a block diagram specifically showing an information management unit and a content providing unit shown in FIG. **1**;

[0024] FIG. **3** is a chart showing a multiple number of functions of a cognitive ability in accordance with an embodiment of the present disclosure;

[0025] FIG. **4** is a block diagram specifically showing a cognitive ability database shown in FIG. **2**;

[0026] FIG. **5** shows an example of a selection program and a first development content data corresponding thereto in accordance with an embodiment of the present disclosure;

[0027] FIG. **6** is a block diagram specifically showing an assessment processing unit shown in FIGS. **1** and **2**;

[0028] FIGS. **7***a* to **7***d* show examples of a result display window of the assessment processing unit shown in FIG. **6**;

[0029] FIG. **8** is a flow chart showing a serious game providing method in accordance with an embodiment of the present disclosure;

[0030] FIG. **9** is a flow chart specifically showing "providing at least one serious game content" shown in FIG. **8**;

[0031] FIG. **10** is a flow chart specifically showing "providing development content data" shown in FIG. **9**;

[0032] FIGS. **11***a* to **11***d* show examples of a serious game content corresponding to a memory function among a multiple number of serious game contents in accordance with an embodiment of the present disclosure;

[0033] FIGS. **12***a* to **12***c* show other examples of a serious game content corresponding to a memory function among a multiple number of serious game contents in accordance with an embodiment of the present disclosure;

[0034] FIGS. **13***a* to **13***c* show still other examples of a serious game content corresponding to a memory function among a multiple number of serious game contents in accordance with an embodiment of the present disclosure;

[0035] FIG. **14** is provided to explain an example of a serious game content corresponding to a psycho-motor function among a multiple number of serious game contents in accordance with an embodiment of the present disclosure; and

[0036] FIGS. **15***a* to **15***c* are provided to explain examples of a serious game content corresponding to an attention function among a multiple number of serious game contents in accordance with an embodiment of the present disclosure.

DETAILED DESCRIPTION OF THE INVENTION

[0037] Hereinafter, embodiments of the present disclosure will be described in detail with reference to the accompanying drawings so that the present disclosure may be readily implemented by those skilled in the art. However, it is to be noted that the present disclosure is not limited to the embodiments but can be embodied in various other ways. In drawings, parts irrelevant to the description are omitted for the simplicity of explanation, and like reference numerals denote like parts through the whole document.

[0038] Through the whole document, the term "connected to" or "coupled to" that is used to designate a connection or coupling of one element to another element includes both a case that an element is "directly connected or coupled to" another element and a case that an element is "electronically connected or coupled to" another element via still another element. Further, the term "comprises or includes" and/or "comprising or including" used in the document means that one or more other components, steps, operation and/or existence or addition of elements are not excluded in addition to the described components, steps, operation and/or elements unless context dictates otherwise.

[0039] Referring to FIGS. **1** to **6** and FIGS. **7***a* to **7***d*, a serious game providing apparatus in accordance with an embodiment of the present disclosure will be explained.

[0040] FIG. **1** is a block diagram of a serious game providing apparatus in accordance with an embodiment of the present disclosure. FIG. **2** is a block diagram specifically showing an information management unit and a content providing unit shown in FIG. **1**. FIG. **3** is a chart showing a multiple number of functions of a cognitive ability in accordance with an embodiment of the present disclosure. FIG. **4** is a block diagram specifically showing a cognitive ability database shown in FIG. **2**. FIG. **5** shows an example of a selection program and a first development content data corresponding thereto in accordance with an embodiment of the present disclosure. FIG. **6** is a block diagram specifically showing an assessment processing unit shown in FIGS. **1** and **2**. FIGS. **7***a* to **7***d* show examples of a result display window of the assessment processing unit shown in FIG. **6**.

[0041] As depicted in FIG. **1**, a serious game providing apparatus **100** in accordance with an embodiment of the present disclosure is connected to at least one of user terminals **300** via a wired and wireless network (hereinafter, network) **200** and provides at least one of a multiple number of serious game contents for cognitive ability measurement and development to a user terminal i **310** of a registered user among at least one of the user terminals **300**.

[0042] To be specific, the serious game providing apparatus **100** includes a user interface **110**, an information management unit **120**, a content providing unit **130**, and an assessment processing unit **140**.

[0043] The user interface **110** receives an access request from each user terminal **300** via the network **200** and checks an access record of each registered user. Then, the user terminal i **310** of the registered user among the user terminals **300** is allowed to access the content providing unit **130**.

[0044] That is, the user interface **110** authenticates or registers a user who requests a cognitive ability measurement and development service via the user terminal **300**.

[0045] By way of example, if the user interface **110** receives an access request from the user terminal i **310**, the user interface **110** searches for an access record corresponding to the access request of the user terminal i **310** from access

records of respective registered users stored in the information management unit **120**. If a user using the user terminal i **310** is a registered user, the registered user's access record corresponding to the access request of the user terminal i **310** can be drawn. In this case, the user interface **110** authenticates the user using the user terminal i **310** as the registered user and allows an access of the user terminal i **310** of the registered user to the content providing unit **130**.

[0046] Meanwhile, if the user interface **110** receives an access request from a user terminal j **320**, the user interface **110** searches for an access record corresponding to the access request of the user terminal j **320** from access records of respective registered users stored in the information management unit **120**. If a user using the user terminal j **320** is a non-registered user, the registered user's access record corresponding to the access request of the user terminal j **320** cannot be drawn. In this case, the user interface **110** suggests new registration of the user using the user terminal j **320** instead of authenticating the user using the user terminal j **320** as a registered user. Herein, the access record of each registered user includes an ID and a password pre-established by the registered user.

[0047] The information management unit **120** stores an access record of each registered user, cognitive ability assessment data, and a multiple number of serious game contents for cognitive ability measurement and development.

[0048] As depicted in FIG. **2**, the information management unit **120** includes a registered user information database **121** that contains an access record of each registered user, a cognitive ability database **122** that contains each registered user's cognitive ability assessment data generated or updated by the assessment processing unit **140**, and a game content database **123** that contains a multiple number of serious game contents.

[0049] The registered user information database **121** contains an access record of each registered user. In this case, the access record includes general information, such as a name, an age, an educational level, of the registered user, user authentication information such as an ID and a password pre-established by the registered user, and the number of times of access of the registered user. This registered user information database **121** provides an access record of a registered user in response to a request of the user interface **110** or the content providing unit **130**.

[0050] The cognitive ability database **122** contains cognitive ability assessment data of each registered user. In this case, the cognitive ability assessment data are obtained by quantitatively converting a result of a cognitive ability measurement of the registered user through a multiple number of serious games and are based on a result of at least one time performance of a multiple number of serious game contents for cognitive ability measurement and development by the registered user. That is, the cognitive ability database **122** stores each registered user's cognitive ability assessment data generated or updated by the assessment processing unit **140** and provides cognitive ability assessment data of a registered user in response to the content providing unit **130**.

[0051] The game content database **123** contains a multiple number of serious games. In this case, the multiple number of serious games is used to draw a measurement value corresponding to at least one of multiple functions of a cognitive ability.

[0052] As depicted in FIG. **3**, in accordance with an embodiment of the present disclosure, a cognitive ability can be classified into five functions: a general memory function; a psycho-motor function; an attention function; an executive function; and an emotion function.

[0053] The general memory function is involved in memorizing information input into a brain and measured separately for each target to be memorized. By way of example, the general memory function includes a word span involved in memorizing and outputting words, a digit span involved in memorizing and recognizing numbers, a music span, as an ability for music, involved in memorizing a tempo and pitch, spatial memory involved in memorizing and outputting space and time, and delayed recognition used to know how much information can be remembered after a predetermined time period without immediately outputting memorized information.

[0054] The psycho-motor function is involved in a connection between a brain and a neuromuscle and includes a motor programming involved in measuring a series of connected movements, an immediate reaction involved in measuring how rapidly a physical reaction is made, motor coordination involved in measuring how smoothly a sight and a physical movement work together, and a motor control involved in executing and controlling a physical reaction.

[0055] The attention function is involved in selectively concentrating on a target and includes selective attention involved in paying attention to a stimulus selected from multiple stimuli, an attention shift used to know, when a subject is changed from a current one to a next one, how quickly and smoothly attention required for the next subject is shifted, visual attention involved in measuring, particularly, a visual attention function, divided attention involved in measuring how well attention can be divided and used when multiple tasks are performed concurrently, and automatization involved in minimizing attention required for performing a specific task.

[0056] The executive function is involved in getting used to conditions and controlling an execution and includes working memory involved in manipulating stored information and maintaining the manipulated information, visual working memory involved in measuring an ability of simultaneously selecting, manipulating, and maintaining various visual information, a rule shift involved in an ability of suppressing a preservation tendency to stick to current performance and rule, a cognitive control involved in suppressing automatically processed information through reading or the like and recognizing necessary information, categorization involved in categorizing multiple targets into several categories according to a certain quality or rule, and logic thinking involved in an ability of inferring a logical structure or a causal relationship to solve a problem.

[0057] The emotion function is involved in controlling emotional factors and includes emotional perception involved in an ability of quickly and accurately recognizing a difference and a change in emotional information and context of the emotional information, an emotion control involved in an ability of minimizing or maximizing an effect of a rapid emotional reaction, an emotional expression involved in efficiently expressing current emotional information of oneself, emotional memory involved in measuring how quickly and accurately emotional information of oneself and other people can be memorized, and motivation involved in setting up a goal and measuring and assessing the goal by exerting self-control or shown in a competitive situation or concentration.

[0058] Thus, the game content database **123** in accordance with an embodiment of the present disclosure may contain the multiple number of serious games classified into respective categories.

[0059] That is, as depicted in FIG. **4**, the game content database **123** includes a memory function content database **123***a* that contains serious game contents corresponding to the memory function, a psycho-motor function content database **123***b* that contains serious game contents corresponding to the psycho-motor function, an attention function content database **123***c* that contains serious game contents corresponding to the attention function, an executive function content database **123***d* that contains serious game contents corresponding to the executive function, and an emotion function content database **123***e* that contains serious game contents corresponding to the emotion function.

[0060] Meanwhile, examples of the serious game contents corresponding to the memory function, the serious game contents corresponding to the psycho-motor function, and the serious game contents corresponding to the attention function will be provided later.

[0061] Each of the multiple number of serious game contents contained in the game content database **123** has two or more different levels of difficulty and a measurement level randomly combining the two or more different levels of difficulty. Further, in each of the multiple number of serious game contents, the two or more different levels of difficulty and the measurement level respectively include at least one stage made up of different questions or problems.

[0062] Again, FIGS. **1** and **2** will be explained.

[0063] As depicted in FIGS. **1** and **2**, the content providing unit **130** includes a content control module **131**, a development module **132**, a measurement module **133**, and a performance check module **134**.

[0064] The content control module **131** searches an access record of a registered user and determines whether there are cognitive ability assessment data corresponding to the registered user or not. In this case, if it is confirmed that the cognitive ability assessment data do not exist, the user terminal i **310** is allowed to access the measurement module **133**. That is, a cognitive ability of the registered user is measured first and a serious game content for cognitive ability development can be appropriately provided based on the measurement result.

[0065] In other words, if a cognitive ability of the registered user using the user terminal i **310** is measured not once and cognitive ability assessment data corresponding to the registered user do not exist, there is no standard for how much of development is needed for which function of the cognitive ability, and, thus, it is difficult to appropriately provide a serious game content for cognitive ability development. Therefore, if the cognitive ability assessment data do not exist, the content control module **131** first allows the user terminal i **310** to access the measurement module **133** so as to be provided with measurement content data.

[0066] When the content control module **131** searches the access record of the registered user, if it is confirmed that the cognitive ability assessment data exist, the content control module **131** allows the user terminal i **310** to access the development module **132** or the measurement module **133** by a request of the user terminal i **310**. That is, if the registered user who has cognitive ability assessment data wants to be further provided with a measurement service, the user terminal i **310** can separately select a measurement service and can access the measurement module **133**.

[0067] Meanwhile, if the user terminal i **310** does not separately select a measurement service, i.e. if the user terminal i **310** selects a development service, the content control module **131** allows the user terminal i **310** to access the development module **132**.

[0068] The development module **132** provides development content data that execute at least one of the multiple number of serious game contents by respective development levels. Herein, the development level is selected as one of two or more development levels in the at least one serious game contents.

[0069] The measurement module **133** provides measurement content data that execute all of the multiple number of serious game contents by each measurement level in order to measure a cognitive ability. Herein, the measurement level is established by randomly combining two or more different levels of difficulty in each of the multiple number of serious game contents.

[0070] The performance check module **134** generates game performance data (hereinafter, referred to as "development game performance data") based on a performance assessment of the registered user for at least one of the serious game contents executed by respective development levels according to the development content data. Otherwise, the performance check module **134** generates game performance data (hereinafter, referred to as "measurement game performance data") based on a performance assessment of the registered user for the multiple number of serious game contents executed by each measurement level according to the measurement content data.

[0071] In this case, the game performance data quantitatively show a level of achievement of the registered user depending on a rule or level of difficulty of each serious game content.

[0072] Further, the performance check module **134** generates game performance data based on a performance result corresponding to a level or a stage of each serious game content. That is, the game performance data can be generated based on a performance result corresponding to a serious game content at all stage of the development level or the measurement level, or a performance result corresponding to a serious game content at each stage of the development level or the measurement level.

[0073] When the content control module **131** allows the user terminal i **310** to access the development module **132**, the content control module **131** provides the development module **132** with control data corresponding to each of the following cases.

[0074] The content control module **131** selects at least one of the multiple number of serious game contents, and respective development levels of the at least one selected serious game content based on the authenticated cognitive ability assessment data. And the content control module **131** provides the user terminal i **310** with a selection program according to the selection result.

[0075] In this case, if the user terminal i **310**'s acceptance of the selection program is received, the content control module **131** transfers first control data corresponding to the selection program to the development module **132**.

[0076] If the first control data are received, the development module **132** provides first development data that execute the selected at least one serious game content by the selected respective development levels based on the selection program. In this case, in the first development content data, an

arrangement order of the selected at least one serious game content may be determined based on the selection program or may be determined in a random order regardless of the selection program, by a request of the user terminal i **310**.

[0077] By way of example, according to the cognitive ability assessment data corresponding to the registered user of the user terminal i **310**, an assessment value of the memory function may be noticeably below average and assessment values of the executive function and the emotion function may be similar to average.

[0078] In this case, as depicted in FIG. **5**(*a*), the content control module **131** may select a second level of a first serious game content (Content **1**, level **2**) related to the memory function, a fifth level of a second serious game content (Content **2**, level **5**) related to both the psycho-motor function and the attention function, a seventh level of a third serious game content (Content **3**, level **7**) related to the executive function, and an eight level of a fourth serious game content (Content **4**, level **8**) related to the emotion function in order from the multiple number of serious game contents, based on the cognitive ability assessment data, and generate a selection program that contains the first to fourth serious game contents, the respective development levels thereof and order thereof.

[0079] The development module **132** provides the user terminal i **310** with the first development data, corresponding to the first control data of the selection program, that execute the first to fourth serious game contents (Content **1** to Content **4**) by the respective development levels (level **2** of Content **1**, level **5** of Content **2**, level **7** of Content **3**, and level **8** of Content **4**). In this case, if the user terminal i **310** makes a request for being provided with the serious game contents in order determined based on the selection program, the first to fourth serious game contents (Content **1** to Content **4**) are executed in order by the respective development levels according to the first development content data of the development module **132** in order of the selection program as depicted in FIG. **5**(*a*).

[0080] If the user terminal i **310** makes a request for being provided with the serious game contents in order regardless of the selection program, the first to fourth serious game contents (Content **1** to Content **4**) are executed in order by the respective development levels according to the first development content data of the development module **132** in a random order regardless of the selection program, as depicted in FIG. **5**(*b*).

[0081] If the user terminal i **310**'s refusal of the selection program is received, the content control module **131** provides the user terminal i **310** with a content list showing two or more available serious game contents among the multiple number of serious game contents. In this case, the content list may include all of the serious game contents.

[0082] The user terminal i **310** transmits game selection data to the content control module **131**. The game selection data is in response to the registered user's control input that selects at least one of the serious game contents based on the content list.

[0083] Further, another registered user using another user terminal **300** may want to share at least one randomly selected serious game content with the registered user of the user terminal i **310**. Or another registered user using another user terminal **300** may want to introduce at least one selected serious game content to the registered user of the user terminal i **310** since it is determined that the at least one selected serious game content is effective for cognitive ability development or very interesting. In this case, the user terminal **300** of another registered user may selectively send the user terminal i **310** a game recommendation message that recommends the at least one selected serious game content. In response to this, the user terminal i **310** sends the content control module **131** acceptance or refusal of the game recommendation message.

[0084] If the game selection data or the acceptance of the game recommendation message is received from the user terminal i **310**, the content control module **131** confirms that at least one selected serious game content according to the game selection data or according to the acceptance of the game recommendation message of the another user terminal **300** is provided the user terminal i **310** through the development module **132**.

[0085] Then, the content control module **131** suggests, based on the cognitive ability assessment data of the authenticated registered user, at least one development levels for each of the at least one selected serious game content according to the game selection data or the acceptance of the game recommendation message.

[0086] If the user terminal i **310**'s acceptance of any one of the suggested development levels is received, the content control module **131** transfers the game selection data and second control data corresponding to the accepted level to the development module **132**.

[0087] If the second control data are received, the development module **132** provides second development content data that execute the at least one selected serious game content according to the game selection data by the respective accepted development levels.

[0088] If the user terminal i **310**'s refusal of the suggested levels is received, the content control module **131** provides the user terminal i **310** with a level list showing two or more selectable development levels for the at least one selected serious game content according to the game selection data. Further, based on the level list, the content control module **131** receives level selection data that select respective development levels for the at least one selected serious game content from the user terminal i **310**. Then, the content control module **131** transfers third control data corresponding to the game selection data and the level selection data to the development module **132**.

[0089] If the third control data are received, the development module **132** provides third development content data that execute the at least one selected serious game content according to the game selection data by respective selected development levels according to the level selection data of the user terminal i **310**.

[0090] The assessment processing unit **140** updates or generates cognitive ability assessment data of the registered user based on the game performance data generated by the performance check module **134**.

[0091] That is, if the content control module **131** confirms that cognitive ability assessment data corresponding to the registered user exist, the assessment processing unit **140** updates the authenticated cognitive ability assessment data based on the game performance data.

[0092] If the content control module **131** confirms that cognitive ability assessment data corresponding to the registered user do not exist, the assessment processing unit **140** generates the authenticated cognitive ability assessment data based on the game performance data.

[0093] To be specific, as depicted in FIG. **6**, the assessment processing unit **140** includes a behavior analysis assessment module **141**, a pattern classification module **142**, a pathological data analysis module **143**, an IQ usefulness and stability assessment module **144**, and an emotion and learning motive analysis module **145**.

[0094] The behavior analysis assessment module **141** combines the game performance data generated by the performance check module **134** to generate cognitive ability assessment data in a quantitative form.

[0095] As described above, if it is confirmed that the cognitive ability assessment data corresponding to the registered user using the user terminal i **310** do not exist, the content control module **131** allows the user terminal i **310** to access the measurement module **133** so as to measure an cognitive ability.

[0096] Accordingly, the behavior analysis assessment module **141** generates cognitive ability assessment data indispensably containing measurement game performance data generated based on performance assessment of the registered user for all of the multiple number of serious game contents executed according to the measurement content data.

[0097] Thus, the cognitive ability assessment data are generated based on the performance assessment of the registered user for all of the multiple number of serious game contents executed at least one time according to the measurement content data.

[0098] The pattern classification module **142** analyzes a repeated pattern in the cognitive ability assessment data according to items pre-established by experts and generates pattern classification data.

[0099] The pathological data analysis module **143** draws any particular matter from the cognitive ability assessment data of the registered user using the user terminal i **310** based on average of cognitive ability assessment data corresponding to the registered user using the user terminal i **310** and at least one of other registered users and generates pathological data based on the particular matter.

[0100] The IQ usefulness and stability assessment module **144** analyzes a change in the cognitive ability assessment data during a predetermined time period and generates improvement assessment data showing a level of improvement in the cognitive ability of the registered user using the user terminal i **310**.

[0101] The emotion and learning motive analysis module **145** analyzes a difference between the cognitive ability assessment data of the registered user using the user terminal i **310** and average of cognitive ability assessment data corresponding to the registered user using the user terminal i **310** and at least one of other registered users and generates comparison data.

[0102] The assessment processing unit **140** provides at least one of the cognitive ability assessment data, the pattern classification data, the pathological data, the improvement assessment data, and the comparison data to a user terminal so as to be displayed on a result display window. In this case, the result display window displays at least one of numerical values, diagrams, and an opinion of an expert.

[0103] Hereinafter, referring to FIGS. **7***a* to **7***d*, a result display window in accordance with an embodiment of the present disclosure will be explained.

[0104] As depicted in FIG. **7***a*, the result display window displays a polygonal diagram ① showing a cognitive ability measurement result in respective functions of a cognitive ability and sub-functions thereof. In this diagram ①, as the polygon is closer to a regular polygon, the respective functions of the cognitive ability and sub-functions thereof are developed evenly. In addition to the diagram ①, a pattern ② of the cognitive ability corresponding to the diagram ①, a total quotient (hereinafter, referred to as "TQ") ③ of the respective functions as a general standard of the cognitive ability, and top percent ④ of the TQ may be further displayed.

[0105] As depicted in FIG. **7***b*, the result display window may further display a table ⑤ showing a measurement value (TQ) of each function of the cognitive ability and a top percent (position) and a meaning (performance) corresponding thereto, an image ⑥ showing sections of the respective function of the cognitive ability, and an expert's opinion or explanation ⑦ about the table ⑤.

[0106] As depicted in FIG. **7***c*, regarding a specific function of the cognitive ability ("memory function" shown in FIG. **7***c*), the result display window may further display an image ⓐ showing a section corresponding thereto, a polygonal diagram ⓑ showing a measurement result in each function of the cognitive ability, a pattern ⓒ of the cognitive ability corresponding to the diagram ⓑ, a total quotient (hereinafter, referred to as "TQ") ⓓ of the respective functions as a general standard of the cognitive ability, and an expert's opinion or explanation ⓔ about the table ⓑ.

[0107] As depicted in FIG. **7***d*, the result display window may further display a score ⓕ of a performance result of a user for an executed game content, the highest score of the user ⓖ, and the highest score ⓗ of total users. Further, the score ⓕ of the performance result may include a top percent ⓘ in total users, a top percent ⓙ in age group, and a top percent ⓚ in top class. Furthermore, the result display window may further display a graph ⓛ showing the percent ⓘ in total users regarding the score ⓕ of the performance result, a histogram ⓜ showing a change in scores of the user during a certain period, and an expert's opinion or explanation ⓝ about the performance result of the user.

[0108] Referring to FIGS. **8** to **10**, a serious game providing method in accordance with an embodiment of the present disclosure will be explained.

[0109] FIG. **8** is a flow chart showing a serious game providing method in accordance with an embodiment of the present disclosure. FIG. **9** is a flow chart specifically showing "providing at least one serious game content" shown in FIG. **8**. FIG. **10** is a flow chart specifically showing "providing development content data" shown in FIG. **9**.

[0110] As depicted in FIG. **8**, a serious game providing method in accordance with an embodiment of the present disclosure includes receiving an access request from at least one user terminal via a network (S**100**), determining whether a user using the user terminal is registered or not by searching an access record of each registered user (S**101**), suggesting new registration of the user terminal of a non-registered user (S**102**), providing at least one of a multiple number of serious game contents for cognitive ability measurement and development to the user terminal of a registered user (S**200**), generating game performance data based on a performance result of the registered user for the at least one provided serious game content (S**300**), updating or generating cognitive ability assessment data corresponding to the registered user based on the game performance data (S**400**), providing the updated or generated cognitive ability assessment data (S**410**), and end-

ing or continuing providing serious game contents depending on whether the connected user terminal continues playing a game or not (S**500**).

[0111] Herein, the cognitive ability assessment data are quantitative data of a cognitive ability of each registered user based on a result of at least one time performance of a multiple number of serious game contents by the registered user.

[0112] Each of the multiple number of serious game contents corresponds to at least one of a multiple number of functions of a cognitive ability. In this case, as described above by reference to FIG. **3**, the multiple number of functions includes the general memory function involved in memorizing information, the psycho-motor function involved in a connection between a brain and a neuromuscle, the attention function involved in selectively concentrating on a target, the executive function involved in getting used to conditions and controlling an execution, and the emotion function involved in controlling emotional factors.

[0113] Further, each of the multiple number of serious game contents has two or more different levels of difficulty and a measurement level randomly combining the two or more different levels of difficulty. In this case, the two or more different levels of difficulty and the measurement level respectively include at least one stage made up of different questions or problems.

[0114] As depicted in FIG. **9**, the providing at least one of a multiple number of serious game contents for cognitive ability measurement and development (S**200**) includes determining whether cognitive ability assessment data corresponding to the registered user exist or not by searching an access record of the registered user using the connected user terminal (S**210**), when it is confirmed that cognitive ability assessment data exist, receiving service selection data that select a measurement service or a development service from the connected user terminal (S**211**), when the development service is selected according to the service selection data, providing development content data for cognitive ability development (S**220**), and when the measurement service is selected according to the service selection data, providing measurement content data for cognitive ability measurement (S**230**). Further, when it is confirmed that the cognitive ability assessment data do not exist, providing the measurement content data for cognitive ability measurement (S**240**).

[0115] Herein, the development content data are provided to execute at least one of the multiple number of serious game contents by respective development levels. The at least one serious game content is selected so as to correspond to the cognitive ability assessment data or selected by the registered user. The development level is selected as one of two or more development levels in the at least one serious game contents so as to correspond to the cognitive ability assessment data or selected by the registered user. Further, the measurement content data is provided to execute all of the multiple number of serious game contents by the respective measurement levels.

[0116] After the providing development content data (S**220**), in generating game performance data (S**301**), development game performance data are generated based on a performance result of the registered user for a serious game content performed according to the development content data.

[0117] After the providing measurement content data (S**230** and S**240**), in generating game performance data (S**302** and S**303**), measurement game performance data are generated based on a performance result of the registered user for a multiple number of serious game contents by the respective measurement levels according to the measurement content data.

[0118] In the determining whether cognitive ability assessment data exist or not (S**210**), when it is confirmed that the cognitive ability assessment data exist, cognitive ability assessment data are updated based on the development game performance data or the measurement game performance data generated in S**301** and S**302** while cognitive ability assessment data are updated or generated (S**401**).

[0119] Meanwhile, in the determining whether cognitive ability assessment data exist or not (S**210**), when it is confirmed that the cognitive ability assessment data do not exist, cognitive ability assessment data are generated based on the measurement game performance data generated in S**303** while cognitive ability assessment data are generated (S**402**).

[0120] As depicted in FIG. **10**, the providing development content data (S**220**) includes when it is confirmed that cognitive ability assessment data correspond to the registered user, selecting at least one of the multiple number of serious game contents and respective development levels thereof based on the authenticated cognitive ability assessment data and providing a selection program depending on the selection result (S**221**), receiving the user terminal's acceptance or refusal of the selection program (S**222**), and when the user terminal's acceptance of the selection program is received, providing first development content data that execute the at least one selected serious game content by respective selected development levels according to the selection program (S**223**). In this case, by a request of the user terminal, the first development content data execute at least one selected serious game content in order according to the selection program or in a random order regardless of the selection program.

[0121] Further, the providing development content data (S**220**) includes when the user terminal's refusal of the selection program is received, providing a content list showing two or more available serious game contents among the multiple number of serious game contents (S**224**), and receiving game selection data that select at least one serious game content based on the content list (S**225**) or receiving acceptance of a game recommendation message (S**225'**) from the connected user terminal. In this case, the game recommendation message recommends at least one of the multiple number of serious game content selected by a user terminal of another registered user instead of the registered user.

[0122] The providing development content data (S**220**) further includes suggesting at least one of two or more development levels contained in the at least one selected serious game content according to the game selection data or the game recommendation message based on the cognitive ability assessment data of the registered user (S**226**), receiving the user terminal's acceptance or refusal of the suggested development levels (S**227**), and when the user terminal's acceptance of at least one of the suggested development levels is received, providing second development content data that execute the at least one selected serious game content by the respective accepted development levels (S**228**). Moreover, the providing development content data (S**220**) includes when the user terminal's refusal of at least one of the suggested levels is received, providing third development content data that execute the at least one selected serious game content according to the game selection data by respective development levels selected by the user terminal (S**229**).

[0123] Hereinafter, referring to FIGS. **1** and **2**, a serious game providing method in accordance with an embodiment of the present disclosure will be explained in detail.

[0124] The user interface **110** receives an access request from each user terminal **300** (S**100**) and searches for an access record of a registered user corresponding to the access request of the user terminal **300** from access records of respective registered users stored in the registered user information database **121** (S**101**). Herein, the access record includes general information, such as a name, an age, an educational level, of the registered user, user authentication information such as an ID and a password pre-established by the registered user, and the number of times of access of the registered user.

[0125] In S**101**, if the access record of the registered user corresponding to the access request of the user terminal **300** is searched, the user interface **110** authenticates a user using the user terminal **300** as a registered user. On the contrary, if the access record of the registered user corresponding to the access request of the user terminal **300** is not searched, the user interface **110** refuses to authenticate a user using the user terminal **300** and suggests new registration (S**102**).

[0126] The user interface **110** allows the user terminal i **310** of the registered user to access to the content providing unit **130** so as to be provided with at least one of a multiple number of serious game contents for cognitive ability measurement and development (S**200**). In this case, the user terminal i **310** is connected to the content control module **131** of the content providing unit **130**.

[0127] The content control module **131** searches an access record of a registered user and determines whether there are cognitive ability assessment data corresponding to the registered user (S**210**). That is, a cognitive ability of the registered user is measured before a serious game content for cognitive ability development is provided, and, thus, a more appropriate cognitive ability development service can be provided.

[0128] In the determines whether there are cognitive ability assessment data (S**210**), if it is confirmed that the cognitive ability assessment data exist, the content control module **131** requests, to the user terminal i **310**, for service selection data that select one of a measurement service and a development service and receives the service selection data from the user terminal i **310** (S**211**).

[0129] If the development service is selected according to the service selection data of S**211**, the content control module **131** selects at least one of the multiple number of serious game contents and respective levels based on the cognitive ability assessment data confirmed in S**210** and provides the user terminal i **310** with a selection program depending on the selection result (S**221**).

[0130] If the user terminal i **310** accepts the selection program of S**221**, the content control module **131** transfers first control data corresponding to the selection program to the development module **132** and connects the user terminal i **310** with the development module **132**. Accordingly, in response to the first control data, the development module **132** provides the user terminal i **310** with first development content data that execute at least one selected serious game content by respective selected development levels according to the selection program (S**223**).

[0131] If the user terminal i **310** refuses the selection program of S**221**, the content control module **131** provides the user terminal i **310** with a content list showing two or more available serious game contents among the multiple number of serious game contents (S**224**). In this case, the user terminal i **310** selects at least one of the two more serious game contents in the content list of S**224** and transmits game selection data depending on the selection result. Thus, the content control module **131** receives the game selection data (S**225**).

[0132] The user terminal i **310** receives a game recommendation message about at least one serious game content selected by a user terminal **300**, instead of the user terminal i **310**, of another registered user that accesses the serious game providing apparatus **100** and transmits acceptance or refusal of the game recommendation message to the content control module **131**. Thus, the content control module **131** receives the acceptance of the game recommendation message (S**225'**).

[0133] That is, in S**225** or S**225'**, the content control module **131** recognizes at least one selected serious game content among the multiple number of serious game contents through the game selection data or the accepted game recommendation message.

[0134] Then, the content control module **131** suggests at least one development levels of the two or more different levels of difficulty for the at least one selected serous game content in S**225** or S**225'**, respectively, based on the cognitive ability assessment data confirmed in S**210** (S**226**).

[0135] The user terminal i **310** selects any one of the at least one suggested development levels in S**226** and transmits a message of acceptance of the selected development levels or refusal of the at least one suggested development levels.

[0136] If the user terminal i **310**'s acceptance of any one of the at least one suggested level is received, the content control module **131** transfers second control data corresponding to the at least one selected serious game content and the respective accepted development levels to the development module **132** and connects the user terminal i **310** with the development module **132**. Accordingly, in response to the second control data, the development module **132** provides the user terminal i **310** with second development content data that execute the at least one selected serious game content in S**225** or S**225'** by the respective accepted development levels in S**226** and S**227** (S**228**).

[0137] If the user terminal i **310**'s refusal of the at least one suggested level is received, the content control module **131** provides the user terminal i **310** with a level list showing two or more selectable levels for the at least one selected serious game content in S**225** or S**225'**. The user terminal i **310** selects respective development levels for the at least one selected serious game content based on the level list and transmit level selection data depending on the selection result.

[0138] Thus, the content control module **131** transfers third control data corresponding to the at least one selected serious game content and the respective selected development levels to the development module **132** and connects the user terminal i **310** with the development module **132**. Accordingly, in response to the third control data, the development module **132** provides the user terminal i **310** with third development content data that execute the at least one selected serious game content in S**225** or S**225'** by the respective development levels selected by the user terminal i **310** (S**229**).

[0139] The registered user using the user terminal i **310** preforms at least one serious game content executed by respective levels according to any one of the first development content data of S**223**, the second development content data of S**228**, and the third development content data of S**229**. And

the performance check module **134** generates development game performance data, based on a result of this performance (S**301**).

[0140] As confirmed in S**210**, since the cognitive ability assessment data corresponding to the registered user already exist, the assessment processing unit **140** updates the cognitive ability assessment data based on the development game performance data generated in S**301** (S**401**).

[0141] If the measurement service is selected according to the service selection data of S**211**, the content control module **131** connects the user terminal i **310** with the measurement module **133**.

[0142] In this case, the measurement module **133** provides the connected user terminal i **310** with measurement content data that execute the multiple number of serious game contents by the respective measurement levels (S**230**).

[0143] Then, the registered user using the user terminal i **310** performs the multiple number of serious game contents executed by the measurement levels according to the measurement content data of S**230**. And the performance check module **134** generates measurement game performance data, based on a result of this performance (S**302**).

[0144] As confirmed in S**210**, although the cognitive ability assessment data corresponding to the registered user already exist, the measurement content data are provided according to the selection of the registered user. Thus, the assessment processing unit **140** updates the cognitive ability assessment data based on the measurement game performance data generated in S**302** (S**401**).

[0145] In S**210**, if it is confirmed that the cognitive ability assessment data corresponding to the registered user do not exist, the user terminal i **310** is forced to access the measurement module **133** by the content control module **131**. Thus, prior to providing a cognitive ability development service, cognitive ability assessment data of the registered user are generated first through a cognitive ability measurement service and based on the generated cognitive ability assessment data, the suggesting a content list (S**221**) and the suggesting levels (S**223**) can be readily performed.

[0146] The measurement module **133** provides the user terminal i **310** with measurement content data that execute the multiple number of serious game contents by the respective measurement levels (S**240**).

[0147] Then, the registered user using the user terminal i **310** performs the multiple number of serious game contents executed by the respective measurement levels according to the measurement content data in S**240**. And the performance check module **134** generates measurement game performance data, based on a result of this performance (S**303**).

[0148] As confirmed in S**210**, the cognitive ability assessment data corresponding to the registered user do not exist, and, thus, the assessment processing unit **140** generates cognitive ability assessment data based on the measurement game performance data generated in S**303** (S**402**).

[0149] Further, the assessment processing unit **140** provides a result display window of the user terminal i **310** as depicted in FIGS. **7***a* to **7***c* with the cognitive ability assessment data updated and generated in S**401** and S**402**, respectively (S**410**) and the updated or generated cognitive ability assessment data are stored in the cognitive ability database **122**.

[0150] The content control module **131** ends or continues providing serious game contents in response to a request of the user terminal i **310** (S**500**).

[0151] Hereinafter, there will be explained examples of a multiple number of serious game contents in accordance with embodiments of the present disclosure.

[0152] FIGS. **11***a* to **11***d* show examples of a serious game content corresponding to a memory function among a multiple number of serious game contents in accordance with an embodiment of the present disclosure.

[0153] As an example of a serious game content corresponding to a memory function among a multiple number of serious game contents in accordance with an embodiment of the present disclosure, there is a game carried out to memorize at least one target such as a word, a number or an image.

[0154] That is, as depicted in FIG. **11***a*, at least one target such as a word is displayed for a task showing time, and as depicted in FIG. **11***b*, a question window that displays at least one obstacle different from the target together with the at least one target is provided. Then, a user carries out the task by selecting the target from the question window within a time limit for selection, so that a memory function of a cognitive ability can be measured or developed.

[0155] In the example of the serious game content corresponding to the memory function, a level of difficulty can be adjusted depending on a task showing time, the number of targets, the number of obstacles, and a time limit for selection.

[0156] Further, a performance assessment of the user for the task can be carried out based on items including the number of times of selecting a target, a response time required for selecting a target or an obstacle, and the number of times of selecting an obstacle. As depicted in FIG. **11***c*, game performance data obtained by the performance assessment for the task are numerically provided for each item, and as depicted in FIG. **11***d*, cognitive ability assessment data reflecting the game performance data of FIG. **11***c* can be provided through a result display window.

[0157] FIGS. **12***a* to **12***c* show other examples of a serious game content corresponding to a memory function among a multiple number of serious game contents in accordance with an embodiment of the present disclosure.

[0158] As an example of a serious game content corresponding to a memory function among a multiple number of serious game contents in accordance with an embodiment of the present disclosure, there is a game carried out to memorize respective positions of a multiple number of targets such as words or numbers and an order of the multiple number of targets.

[0159] That is, as depicted in FIG. **12***a*, a multiple number of targets irregularly displayed on a multiple number of sections is displayed for a task showing time, and as depicted in FIG. **12***b*, a question window that displays the multiple number of sections without showing the multiple number of targets is provided. Then, a user carries out the task by selecting the multiple number of sections in order according to a reference order of selecting the multiple number of targets within a time limit for selection, so that a memory function of a cognitive ability can be measured or developed.

[0160] In this example of the serious game content corresponding to the memory function, a level of difficulty can be adjusted depending on the number of targets, a task showing time, a time limit for selection, and a reference order of selecting.

[0161] Further, a performance assessment of the user for the task can be carried out based on items including the number of times of selecting sections according to a reference order of selecting, the number of times of selecting sections in

order contrary to a reference order of selecting, and a response time required for selecting sections. Game performance data obtained by the performance assessment for the task are numerically provided for each item, and as depicted in FIG. **12***c*, cognitive ability assessment data reflecting the game performance data can be provided through a result display window.

[0162] FIGS. **13***a* to **13***c* show still other examples of a serious game content corresponding to a memory function among a multiple number of serious game contents in accordance with an embodiment of the present disclosure.

[0163] As an example of a serious game content corresponding to a memory function among a multiple number of serious game contents in accordance with an embodiment of the present disclosure, there is a game carried out to memorize a position of at least one target such as a word, a number, or an image and an order of appearance of the at least one target.

[0164] That is, as depicted in FIGS. **13***a* and **13***b*, tasks including at least one target (a character circled on left upper side in FIG. **13***a*) and at least one obstacle (a character on right upper side in FIG. **13***b*) different from the target are irregularly arranged on a multiple number of sections (depicted as lotus leaves in FIGS. **13***a* and **13***b*) and each task arranged in each section is provided in a random order. Then, as depicted in FIG. **13***c*, a question window that displays the multiple number of sections without showing the tasks is provided. Then, a user carries out the task by selecting, in order, a section where the target is positioned, from the multiple number of sections within a time limit for selection, so that a memory function of a cognitive ability can be measured or developed. In particular, the user may receive a task of selecting a section according to a reference order of selecting (for example, an order of appearance of targets).

[0165] In this example of the serious game content corresponding to the memory function, a level of difficulty can be adjusted depending on the number of sections, the number of targets, the number of obstacles, a task showing time, a time limit for selection, and a reference order of selecting.

[0166] Further, a performance assessment of the user for the task can be carried out based on items including the number of times of selecting a section where a target is positioned, the number of times of selecting a section where a target is positioned according to a reference order of selecting, the number of times of selecting a section where an obstacle is positioned, and a response time required for selecting sections. Game performance data obtained by the performance assessment for the task are numerically provided for each item and cognitive ability assessment data reflecting the game performance data can be provided through a result display window.

[0167] FIG. **14** is provided to explain an example of a serious game content corresponding to a psycho-motor function among a multiple number of serious game contents in accordance with an embodiment of the present disclosure.

[0168] As an example of a serious game content corresponding to a psycho-motor function among a multiple number of serious game contents in accordance with an embodiment of the present disclosure, there is a game carried out to move hands or arms in association with information obtained with eyes.

[0169] That is, as depicted in FIG. **14**, at least one correct target (circled in grey on center in FIG. **14**) and at least one incorrect target (circled in black on each side in FIG. **14**) controlled by game rules and a user object (circled in red in FIG. **14**) moved in the control of a user are displayed on a screen. Then, the user carries out the task by moving the user object (red) so as to be overlapped with the correct target (yellow) while avoiding the incorrect target (blue), so that a psycho-motor function of a cognitive ability can be measured or developed.

[0170] In this example of the serious game content corresponding to the psycho-motor function, a level of difficulty can be adjusted depending on the respective numbers of correct targets and incorrect targets, an appearance interval, an appearance position, a speed of movement, and a time for keeping a movement.

[0171] Further, a performance assessment of the user for the task can be carried out based on items including the number of times of overlapping a user object with a correct target, and the number of times of overlapping a user object with an incorrect target. Game performance data obtained by the performance assessment for the task are numerically provided for each item and cognitive ability assessment data reflecting the game performance data can be provided through a result display window.

[0172] FIGS. **15***a* to **15***c* are provided to explain examples of a serious game content corresponding to an attention function among a multiple number of serious game contents in accordance with an embodiment of the present disclosure.

[0173] As an example of a serious game content corresponding to an attention function among a multiple number of serious game contents in accordance with an embodiment of the present disclosure, there is a game carried out to recognize an order of a multiple number of targets such as words, numbers or images.

[0174] That is, in accordance with an example of the serious game content corresponding to the attention function, as depicted in FIG. **15***a*, a reference order of selecting a multiple number of targets is provided, and as depicted in FIG. **15***b*, a question window that displays the multiple number of targets dispersed at random is provided. Then, a user carries out the task by selecting the multiple number of sections according to the reference order of selecting the multiple number of targets within a time limit for selection, so that an attention function of a cognitive ability can be measured or developed.

[0175] In this example of the serious game content corresponding to the attention function, a level of difficulty can be adjusted depending on the number of targets, a time limit for selection, and a reference order of selecting.

[0176] Further, a performance assessment of the user for the task can be carried out based on items including the number of times of selecting a multiple number of targets according to a reference order of selecting, the number of times of selecting a multiple number of targets in order contrary to a reference order of selecting, and a response time required for selecting a multiple number of targets. Game performance data obtained by the performance assessment for the task are numerically provided for each item, and as depicted in FIG. **15***c*, cognitive ability assessment data reflecting the game performance data can be provided through a result display window.

[0177] As described above, a serious game providing apparatus and a serious game providing method in accordance with the embodiments of the present disclosure provide a serious game for cognitive ability measurement and development of a user. Based on a result of at least one time performance of a multiple number of serious game contents respec-

tively corresponding to at least one of a multiple number of functions classified from a cognitive ability, the cognitive ability is measured, and, thus, all of the functions of the cognitive ability can be measured equally. Therefore, reliability can be improved. Further, various serious game contents can be used, and, thus, it is possible to retain a user's interest. Furthermore, by adjusting a level of difficulty of each serious game content, it is easy to update the serious game content to be suited to a user, and, thus, it becomes easier to provide a personalized service.

[0178] The above description of the present disclosure is provided for the purpose of illustration, and it would be understood by those skilled in the art that various changes and modifications may be made without changing technical conception and essential features of the present disclosure. Thus, it is clear that the above-described embodiments are illustrative in all aspects and do not limit the present disclosure. For example, each component described to be of a single type can be implemented in a distributed manner. Likewise, components described to be distributed can be implemented in a combined manner.

[0179] The scope of the present disclosure is defined by the following claims rather than by the detailed description of the embodiment. It shall be understood that all modifications and embodiments conceived from the meaning and scope of the claims and their equivalents are included in the scope of the present disclosure.

EXPLANATION OF CODES

[0180] **100**: Serious game providing apparatus
[0181] **110**: User interface
[0182] **120**: Information management unit
[0183] **130**: Content providing unit
[0184] **131**: Content control module
[0185] **132**: Development module
[0186] **133**: Measurement module
[0187] **134**: Performance check module
[0188] **140**: Assessment processing unit
[0189] **300**: User terminal
[0190] **310**: User terminal i of registered user
[0191] **320**: User terminal j of non-registered user

What is claimed is:

1. A serious game providing apparatus comprising:

a content providing unit that provides at least one of a multiple number of serious game contents for cognitive ability measurement and development to a user terminal of a registered user; and

an assessment processing unit that provides cognitive ability assessment data corresponding to the registered user based on a result of at least one time performance of the multiple number of serious game contents,

wherein the multiple number of serious game contents corresponds to at least one of a multiple number of functions classified from the cognitive ability, and the multiple number of functions includes a memory function involved in memorizing information, a psycho-motor function involved in a connection between a brain and a neuromuscle, an attention function involved in selectively concentrating on a target, an executive function involved in getting used to conditions and controlling an execution, and an emotion function involved in controlling emotional factors.

2. The serious game providing apparatus of claim **1**,

wherein each of the multiple number of serious game contents includes two or more different levels of difficulty and a randomly combined measurement level from two or more different levels of difficulty, and

the content providing unit includes:

a development module configured to provide development content data that execute at least one of the multiple number of serious game contents by respective levels;

a measurement module configured to provide measurement content data that execute all of the multiple number of serious game contents by the measurement level;

a performance check module configured to generate game performance data based on a performance result of the registered user for at least one serious game content executed by the respective levels according to the development content data or based on a performance result of the registered user for the multiple number of serious game contents executed by the respective measurement levels according to the measurement content data; and

a content control module configured to allow the user terminal of the registered user to access the measurement module or the development module depending on whether there are the cognitive ability assessment data corresponding to the registered user or not.

3. The serious game providing apparatus of claim **2**,

wherein the content control module determines whether there are the cognitive ability assessment data corresponding to the registered user or not based on an access record of the registered user, and

if it is confirmed that the cognitive ability assessment data do not exist, the user terminal of the registered user is allowed to access the measurement module.

4. The serious game providing apparatus of claim **3**,

wherein if it is confirmed that the cognitive ability assessment data exist, the content control module selects the at least one serious game content and respective development levels of the different levels of difficulty for the at least one serious game content based on the cognitive ability assessment data and provides a selection program according to the selection result, and

if the user terminal's acceptance of the selection program is received, first control data corresponding to the selection program are transferred to the development module, and

if the first control data are received, the development module arranges the at least one selected serious game content in order based on the selection program or in a random order regardless of the selection program by a request of the user terminal and provides first development data that execute the at least one serious game content by the respective selected development levels.

5. The serious game providing apparatus of claim **4**,

wherein if the user terminal's refusal of the selection program is received,

the content control module provides a content list that shows two or more available serious game contents among the multiple number of serious game contents and receives game selection data that select the at least one serious game content based on the content list from the user terminal, or

the content control module receives, from the user terminal, acceptance of a game recommendation message that recommends at least one serious game content selected by another user terminal instead of the user terminal, and

the content control module suggests at least one development levels of the two or more different levels of difficulty for the at least one selected serious game content based on the cognitive ability assessment data.

6. The serious game providing apparatus of claim **5**,

wherein if the user terminal's acceptance of the at least one suggested level is received, the content control module transfers second control data corresponding to the at least one selected serious game content and the accepted level to the development module, and

if the second control data are received, the development module provides second development content data that execute the at least one selected serious game content by the respective accepted development levels.

7. The serious game providing apparatus of claim **6**,

wherein if the user terminal's refusal of the at least one suggested level is received, the content control module provides a level list that shows two or more selectable development levels of the two or more different levels of difficulty for the at least one selected serious game content, and

if level selection data that select a level for the at least one selected serious game content based on the level list are received from the user terminal, third control data corresponding to the at least one selected serious game content and the level selection data are transferred to the development module, and

if the third control data are received, the development module provides third development content data that execute the at least one selected serious game content by the respective development levels selected by the user terminal.

8. The serious game providing apparatus of claim **2**, further comprising:

a user interface that receives an access request from each user terminal via a network and by using an access record of each registered user, a user terminal of the registered user among the user terminals is allowed to access the content control module; and

an information management unit that stores an access record corresponding to each registered user, the cognitive ability assessment data, and the multiple number of serious game contents.

9. The serious game providing apparatus of claim **2**,

wherein if it is confirmed by the content control module that the cognitive ability assessment data exist, the assessment processing unit updates the cognitive ability assessment data based on the game performance data, and

if it is confirmed by the content control module that the cognitive ability assessment data do not exist, the assessment processing unit generates the cognitive ability assessment data based on the game performance data based on a performance result of the registered user for the multiple number of serious game contents executed by the respective measurement level according to the measurement content data.

10. The serious game providing apparatus of claim **1**,

wherein the assessment processing unit includes:

a behavior analysis assessment module that combines the game performance data generated by the performance check module to generate the cognitive ability assessment data in a quantitative form;

a pattern classification module that analyzes a repeated pattern in the cognitive ability assessment data and generates pattern classification data;

a pathological data analysis module that draws any particular matter from the cognitive ability assessment data based on average of cognitive ability assessment data corresponding to the registered user and at least one of other registered users and generates pathological data based on the particular matter;

an IQ usefulness and stability assessment module that analyzes a change in the cognitive ability assessment data and generates improvement assessment data showing a level of improvement in the cognitive ability of the registered user; and

an emotion and learning motive analysis module that analyzes a difference between the cognitive ability assessment data and the average of cognitive ability assessment data and generates comparison data,

wherein at least one of the cognitive ability assessment data, the pattern classification data, the pathological data, the improvement assessment data, and the comparison data are provided to the user terminal through a result display window displaying at least one of numerical values, diagrams, and an opinion of an expert.

11. The serious game providing apparatus of claim **1**,

wherein a serious game content corresponding to the memory function is carried out to memorize at least one target such as a word, a number or an image, and the at least one target is displayed for a task showing time, a question window that randomly displays at least one obstacle different from the target together with the at least one target is provided, and a task of selecting the target from the at least one obstacle and the at least one target within a time limit for selection is provided, and

a level of difficulty of the serious game content corresponding to the memory function is adjusted depending on the task showing time, the number of the targets, the number of the obstacles, and the time limit for selection, and

items for assessing the registered user for the task include the number of times of selecting the target, a response time required for selecting the target or the obstacle, and the number of times of selecting the obstacle.

12. The serious game providing apparatus of claim **1**,

wherein a serious game content corresponding to the memory function is carried out to memorize respective positions of a multiple number of targets such as words or numbers and an order of the multiple number of targets, and a multiple number of targets irregularly displayed on a multiple number of sections is displayed for a task showing time, a question window that displays the multiple number of sections without showing the multiple number of targets is provided, and a task of selecting the multiple number of sections in order according to a reference order of selecting the multiple number of targets within a time limit for selection is provided, and

a level of difficulty of the serious game content corresponding to the memory function is adjusted depending on the number of the targets, the task showing time, the time limit for selection, and the reference order of selecting, and

items for assessing the registered user for the task include the number of times of selecting the sections according to the reference order of selecting, the number of times

of selecting the sections in order contrary to the reference order of selecting, and a response time required for selecting the sections.

13. The serious game providing apparatus of claim **1**,

wherein a serious game content corresponding to the memory function is carried out to memorize a position of at least one target such as a word, a number, or an image and an order of appearance of the at least one target, and tasks including at least one target and at least one obstacle different from the target are randomly arranged on a multiple number of sections for a task showing time and each task arranged in each section is provided in a random order for each task showing time, a question window that displays the multiple number of sections without showing the tasks is provided, and a task of selecting, in order, a section where the at least one target is positioned, from the multiple number of sections within a time limit for selection is provided, and

a level of difficulty of the serious game content corresponding to the memory function is adjusted depending on the number of the sections, the number of the targets, the number of the obstacles, the task showing time, the time limit for selection, and the reference order of selecting, and

items for assessing the registered user for the task include the number of times of selecting the section where the target is positioned, the number of times of selecting the section where the target is positioned according to the reference order of selecting, the number of times of selecting a section where the obstacle is positioned, and a response time required for selecting the sections.

14. The serious game providing apparatus of claim **1**,

wherein a serious game content corresponding to the psycho-motor function is carried out to move hands or arms in association with information obtained with eyes, and at least one correct target and at least one incorrect target controlled by game rules and a user object moved in the control of a user are displayed on a screen and a task of moving the user object to be overlapped with the correct target while avoiding the incorrect target is provided, and

a level of difficulty of the serious game content corresponding to the psycho-motor function is adjusted depending on the respective numbers of the correct targets and the incorrect targets, an appearance interval, an appearance position, a speed of movement, and a time for keeping a movement, and

items for assessing the registered user for the task include the number of times of overlapping the user object with the correct target, and the number of times of overlapping the user object with the incorrect target.

15. The serious game providing apparatus of claim **1**,

wherein a serious game content corresponding to the attention function is carried out to recognize an order of a multiple number of targets such as words, numbers or images, and a question window that displays the multiple number of targets dispersed at random and a reference order of selecting the multiple number of targets are provided, and a task of selecting the multiple number of targets in the reference order of selecting within a time limit for selection, and

a level of difficulty of the serious game content corresponding to the attention function is adjusted depending on the number of the targets, the time limit for selection, and the reference order of selecting, and

items for assessing the registered user for the task include the number of times of selecting the multiple number of targets according to the reference order of selecting, the number of times of selecting the multiple number of targets in order contrary to the reference order of selecting, and a response time required for selecting the multiple number of targets.

16. A serious game providing apparatus comprising:

a content providing unit that provides at least one of a multiple number of serious game contents for cognitive ability measurement and development to a user terminal of a registered user; and

an assessment processing unit that provides cognitive ability assessment data corresponding to the registered user based on a result of at least one time performance of the multiple number of serious game contents,

wherein the at least one serious game content is contained in a selection program provided by the content providing unit according to a selection result based on the cognitive ability assessment data corresponding to the registered user, or

the at least one serious game content is selected by the user terminal based on a content list that shows two or more available serious game content from the content providing unit among the multiple number of serious game contents, or

the at least one serious game content is selected by another user terminal connected with the content providing unit instead of the user terminal.

17. The serious game providing apparatus of claim **16**,

wherein the multiple number of serious game contents corresponds to at least one of a multiple number of functions classified from the cognitive ability, and the multiple number of functions includes a memory function involved in memorizing information, a psycho-motor function involved in a connection between a brain and a neuromuscle, an attention function involved in selectively concentrating on a target, an executive function involved in getting used to conditions and controlling an execution, and an emotion function involved in controlling emotional factors, and

each of the multiple number of serious game contents includes two or more different levels of difficulty and a randomly combined measurement level from two or more levels.

18. The serious game providing apparatus of claim **17**,

wherein the content providing unit includes:

a development module configured to provide development content data that execute the at least one selected serious game content by respective levels;

a measurement module configured to provide measurement content data that execute all of the multiple number of serious game contents by the measurement level;

a performance check module configured to generate game performance data based on a performance result of the registered user for at least one serious game content executed by the respective levels according to the development content data or based on a performance result of the registered user for the multiple number of serious game contents executed by the measurement level according to the measurement content data; and

a content control module configured to allow the user terminal of the registered user to access the measurement module or the development module depending on whether there are the cognitive ability assessment data corresponding to the registered user or not,

wherein the content control module determines whether there are the cognitive ability assessment data corresponding to the registered user or not based on an access record of the registered user, and if it is confirmed that the cognitive ability assessment data do not exist, the user terminal of the registered user is allowed to access the measurement module.

19. The serious game providing apparatus of claim **18**,

wherein if it is confirmed that the cognitive ability assessment data exist, the content control module selects the at least one serious game content and the respective levels based on the cognitive ability assessment data and provides a selection program according to the selection result,

the development module provides a user terminal that accepts the selection program with first development content data that execute the at least one selected serious game content by the respective selected levels, and

the first development content data execute the at least one selected serious game content in order based on the selection program or in a random order regardless of the selection program by a request of the user terminal.

20. The serious game providing apparatus of claim **19**,

wherein the content control module provides the content list to a user terminal that refuses the selection program and receives game selection data that select the at least one serious game content based on the content list from the user terminal, or

the content control module receives, from the user terminal, acceptance of a game recommendation message that recommends at least one serious game content selected by another user terminal instead of the user terminal, and

based on the cognitive ability assessment data, the content control module suggests at least one of the two or more levels for the at least one selected serious game content, and

the development module provides a user terminal that accepts any one of the at least one suggested level with second development content data that execute the at least one selected serious game content by the accepted level, and

the development module provides a user terminal that refuses the at least one suggested level with third development content data that execute the at least ones selected serious game content by the respective levels selected by the user terminal.

21. A serious game providing method comprising:

receiving an access request from at least one user terminal via a network;

providing at least one of a multiple number of serious game contents for cognitive ability measurement and development to a user terminal of a registered user among the at least one user terminal by searching an access record of each registered user;

generating game performance data based on a performance result of the registered user for the at least one provided serious game content;

updating or generating cognitive ability assessment data corresponding to the registered user based on the game performance data;

providing the updated or generated cognitive ability assessment data,

wherein the cognitive ability assessment data are based on a result of at least one time performance of the multiple number of serious game contents by the registered user, and

the multiple number of serious game contents corresponds to at least one of a multiple number of functions classified from the cognitive ability, and the multiple number of functions includes a memory function involved in memorizing information, a psycho-motor function involved in a connection between a brain and a neuromuscle, an attention function involved in selectively concentrating on a target, an executive function involved in getting used to conditions and controlling an execution, and an emotion function involved in controlling emotional factors.

22. The serious game providing method of claim **21**,

wherein each of the multiple number of serious game contents includes two or more different levels of difficulty and a randomly combined measurement level from two or more levels,

the providing at least one of a multiple number of serious game contents includes:

determining whether the cognitive ability assessment data corresponding to the registered user exist or not by searching an access record of the registered user;

when it is confirmed that cognitive ability assessment data exist, providing development content data that execute at least one of the multiple number of serious game contents by the respective levels; and

when it is confirmed that the cognitive ability assessment data do not exist, providing measurement content data that execute all of the multiple number of serious game contents by the measurement level.

23. The serious game providing method of claim **22**,

wherein the providing development content data includes:

when it is confirmed that cognitive ability assessment data, selecting the at least one serious game content and respective levels based on the confirmed cognitive ability assessment data and providing a selection program depending on the selection result;

when the user terminal's acceptance of the selection program is received, arranging at least one selected serious game content in order based on the selection program or in a random order regardless of the selection program by a request of the user terminal and providing first development content data that execute at least one arranged serious game content by the respective selected levels;

when the user terminal's refusal of the selection program is received, providing a content list showing two or more available serious game contents among the multiple number of serious game contents;

receiving the user terminal's game selection data that select the at least one serious game content based on the content list;

suggesting at least one of two or more levels contained in at least one selected serious game content according to the game selection data based on the cognitive ability assessment data;

when the user terminal's acceptance of any one of the at least suggested level is received, providing second development content data that execute the at least one selected serious game content by the accepted level; and

when the user terminal's refusal of at least one suggested level is received, providing third development content data that execute the at least one selected serious game content by respective levels selected by the user terminal.

24. The serious game providing method of claim **22**,

wherein the updating or generating cognitive ability assessment data corresponding to the registered user includes:

when it is confirmed that the cognitive ability assessment data exist in the determining whether the cognitive ability assessment data corresponding to the registered user exist or not, updating the cognitive ability assessment data corresponding to the registered user based on the game performance data; or

when it is confirmed that the cognitive ability assessment data do not exist in the determining whether the cognitive ability assessment data corresponding to the registered user exist or not, generating the cognitive ability assessment data corresponding to the registered user based on the game performance data.

25. The serious game providing method of claim **21**,

wherein the providing the updated or generated cognitive ability assessment data includes:

generating numerical data by quantitatively converting the cognitive ability assessment data;

generating pattern classification data by analyzing a repeated pattern in the cognitive ability assessment data;

generating pathological data by drawing a particular matter from the cognitive ability assessment data based on average of cognitive ability assessment data corresponding to the registered user and at least one of other registered users;

generating improvement assessment data showing a level of improvement in the cognitive ability of the registered user by analyzing a change in the cognitive ability assessment data;

generating comparison data by analyzing a difference between the cognitive ability assessment data and the average of cognitive ability assessment data; and

providing at least one of the numerical data, the pattern classification data, the pathological data, the improvement assessment data, and the comparison data to the user terminal through a result display window displaying at least one of numerical values, diagrams, and an opinion of an expert.

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