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(54) **SYSTEMS, METHODS, DEVICES, AND COMPUTER PROGRAM PRODUCTS PROVIDING A BRAIN-EXERCISING GAME**

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(57)   **ABSTRACT**

Systems, methods, devices, and computer program products are provided for exercising the user's brain, and in particular the user's short-term memory. More particularly, a gaming application is provided that may be executed by the processor of an electronic device, such as a mobile terminal. The gaming application provides a game where the user gains an advantage in the game by using his or her short-term memory. The amount of information that the user must store in his or her short-term memory may be adjusted based on the user's performance in the game. A popular puzzle-like game involving the manipulation of a sequence of polyominoes may be improved upon to provide short-term memory testing or training.
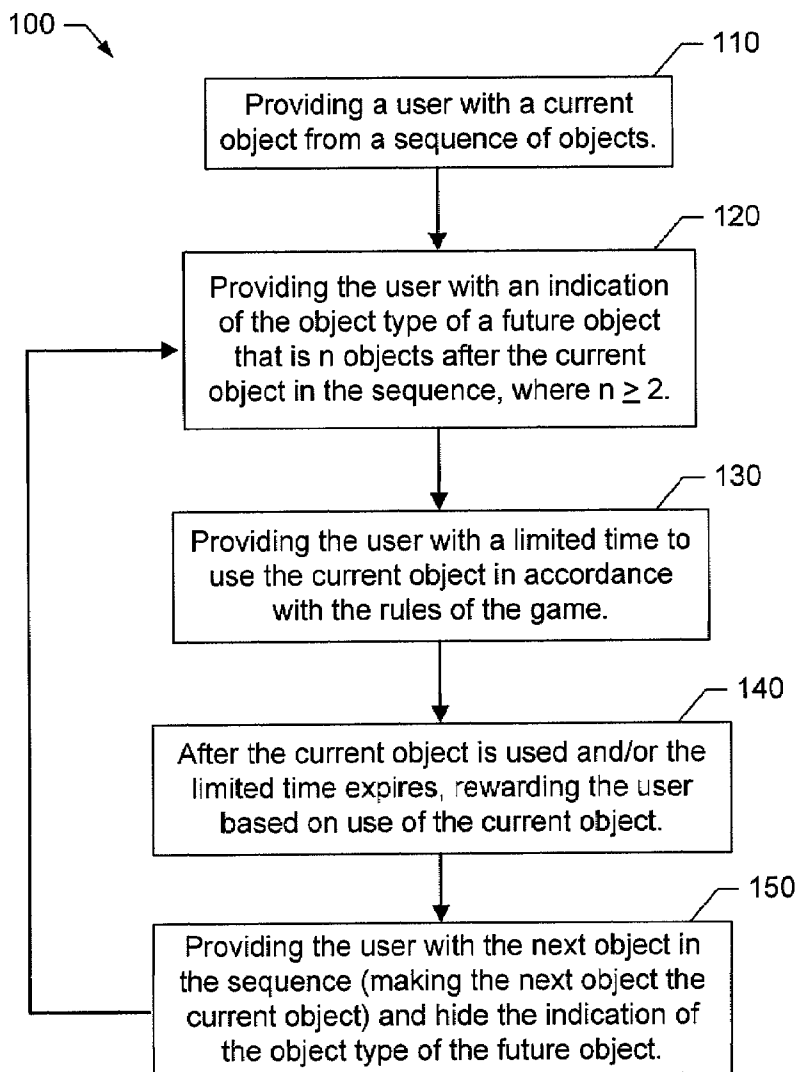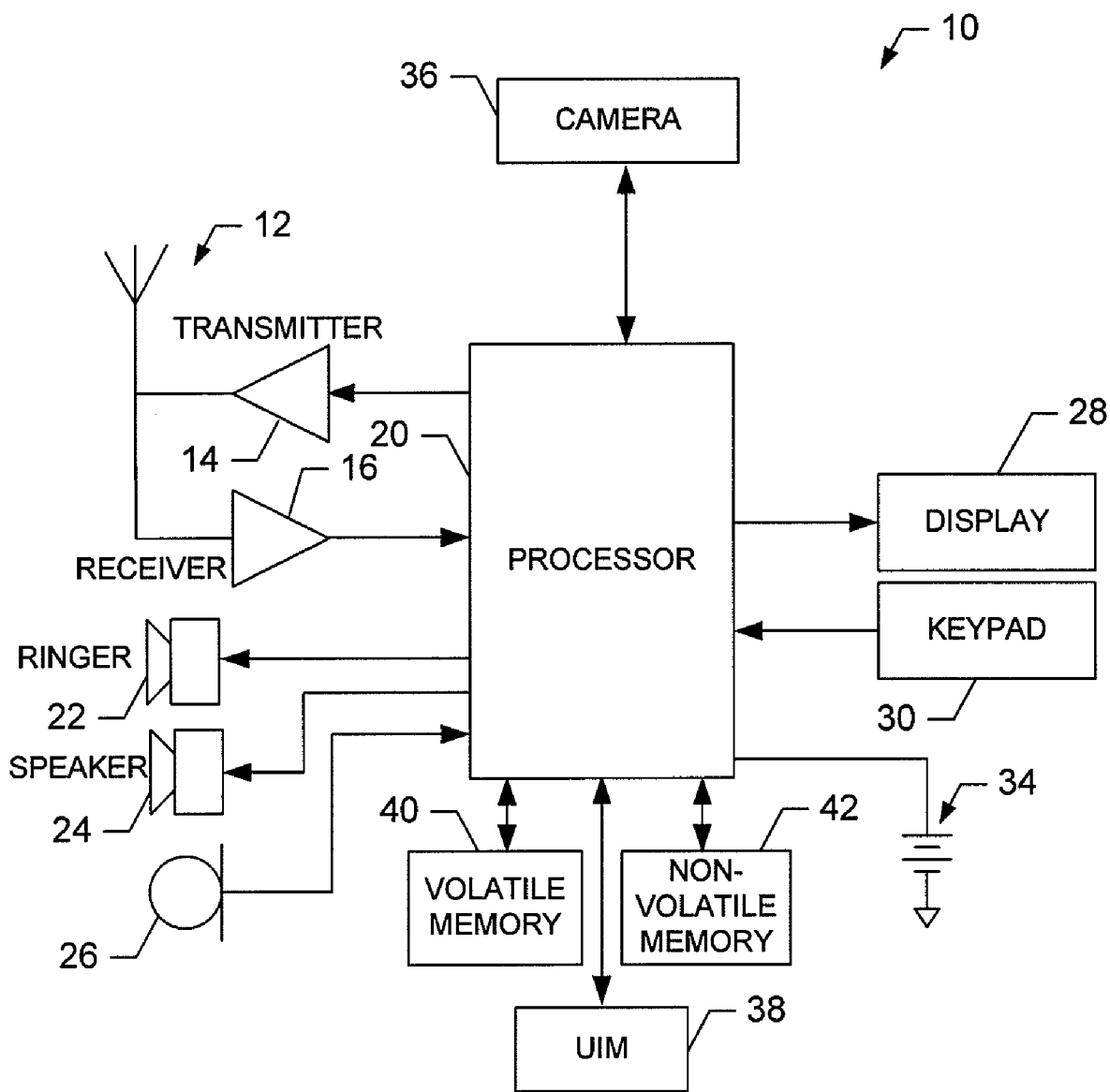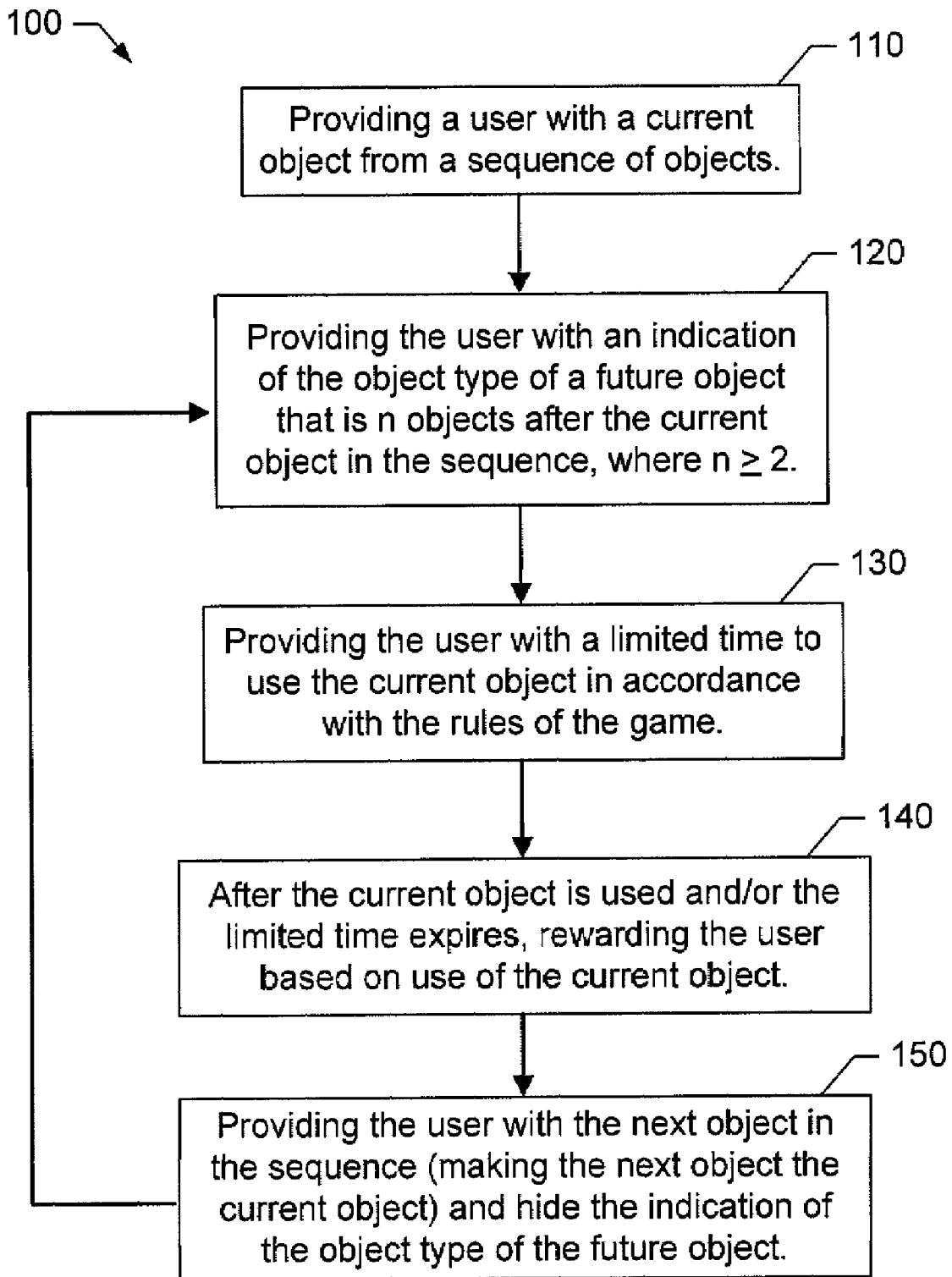
100 ⟍

110
Providing a user with a current object from a sequence of objects.

120
Providing the user with an indication of the object type of a future object that is n objects after the current object in the sequence, where $n \geq 2$.

130
Providing the user with a limited time to use the current object in accordance with the rules of the game.

140
After the current object is used and/or the limited time expires, rewarding the user based on use of the current object.

150
Providing the user with the next object in the sequence (making the next object the current object) and hide the indication of the object type of the future object.

FIG. 1

100 —

┌─────────────────────────────────┐ — 110
│   Providing a user with a current │
│ object from a sequence of objects. │
└─────────────────────────────────┘

┌─────────────────────────────────┐ — 120
│ Providing the user with an indication │
│ of the object type of a future object │
│   that is n objects after the current │
│ object in the sequence, where n ≥ 2. │
└─────────────────────────────────┘

┌─────────────────────────────────┐ — 130
│ Providing the user with a limited time to │
│ use the current object in accordance │
│   with the rules of the game. │
└─────────────────────────────────┘

┌─────────────────────────────────┐ — 140
│ After the current object is used and/or the │
│   limited time expires, rewarding the user │
│   based on use of the current object. │
└─────────────────────────────────┘

┌─────────────────────────────────┐ — 150
│ Providing the user with the next object in │
│   the sequence (making the next object the │
│   current object) and hide the indication of │
│   the object type of the future object. │
└─────────────────────────────────┘

FIG. 2

211

214

200

210

220

250

213

Three Objects from now:

225

215

230

255

Level: 2

Score: 5,250

233

212

FIG. 3

300

310

320

330

340

350

360

370

FIG. 4

400

410

420

Three Objects from now:
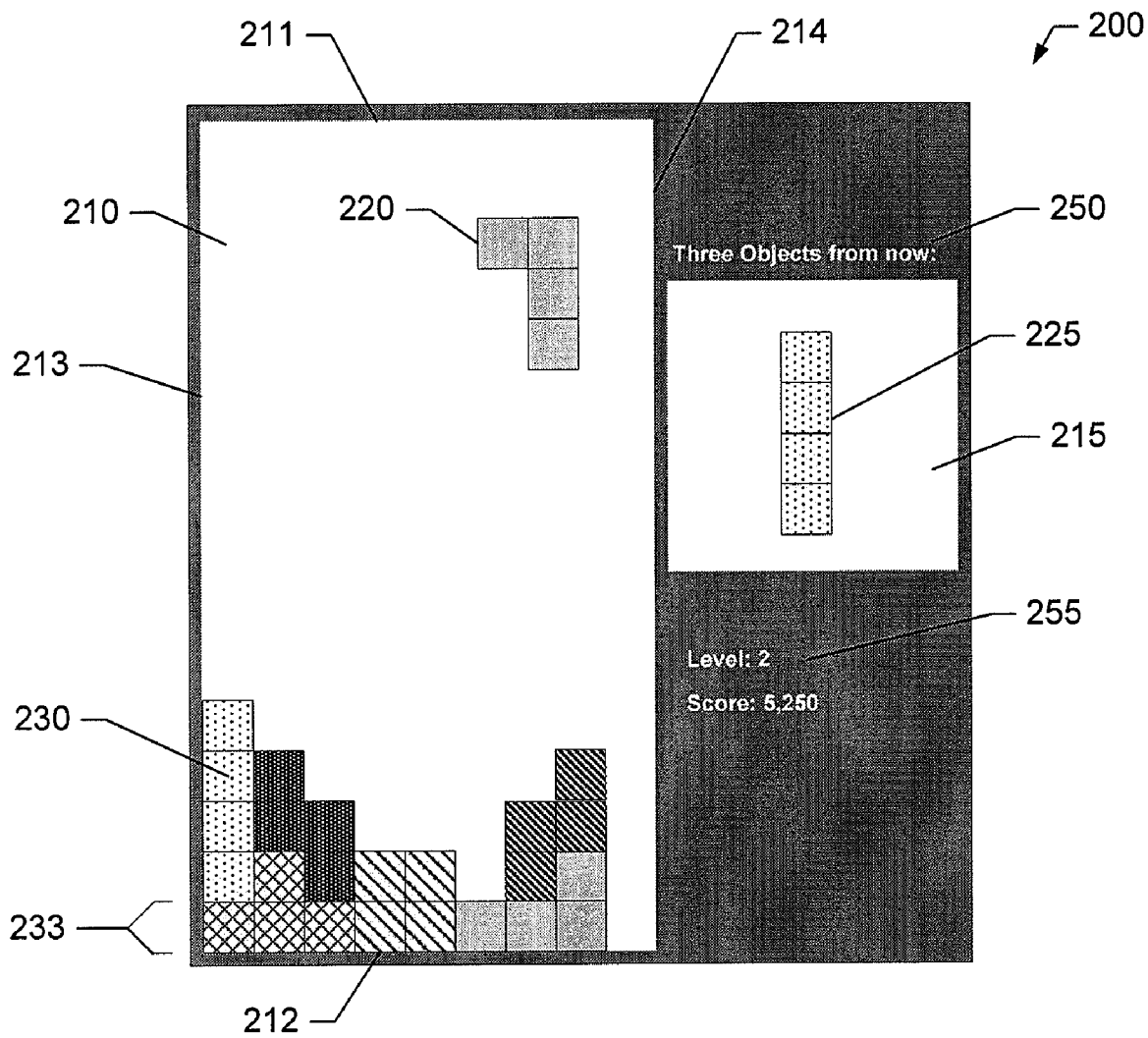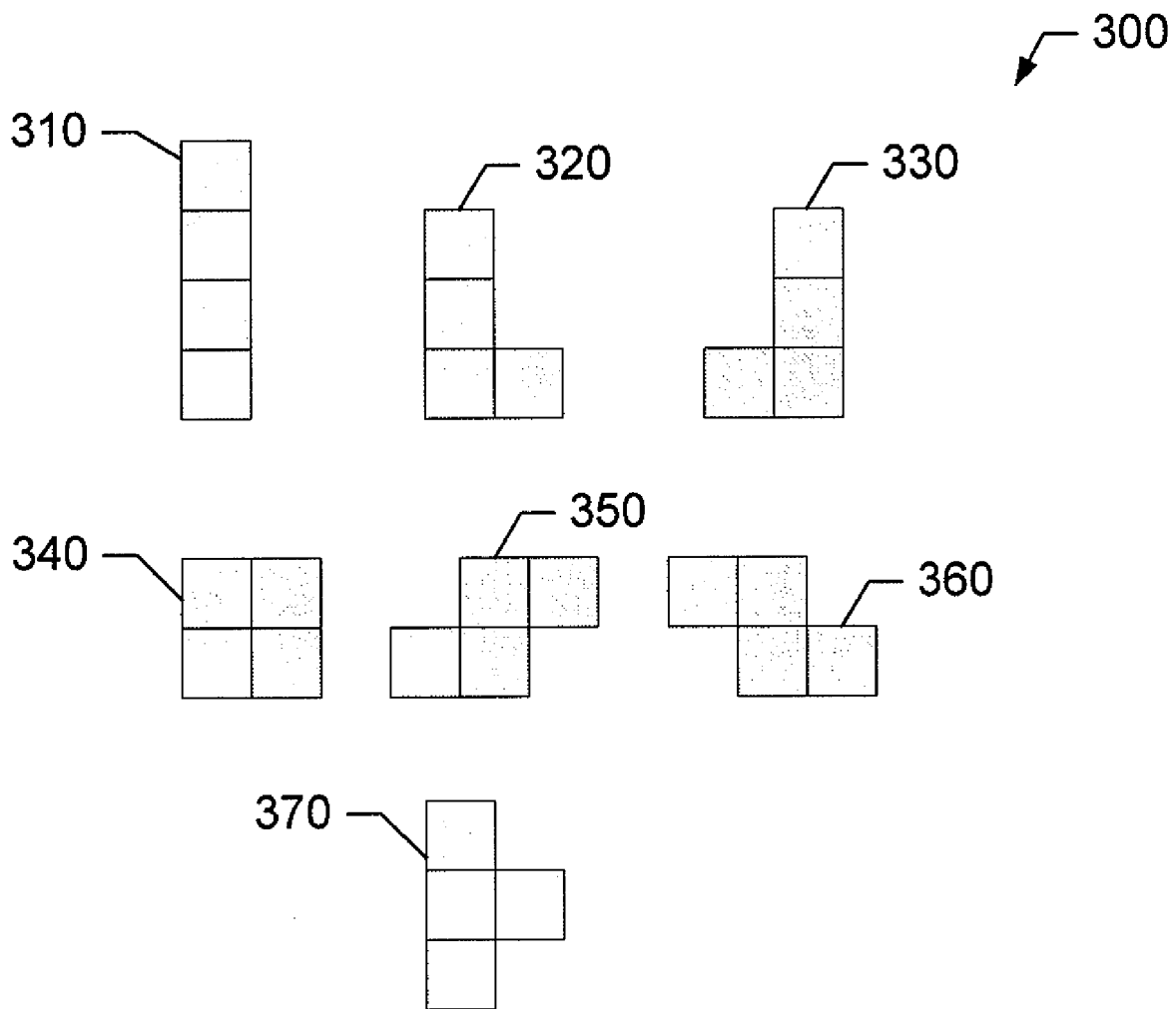
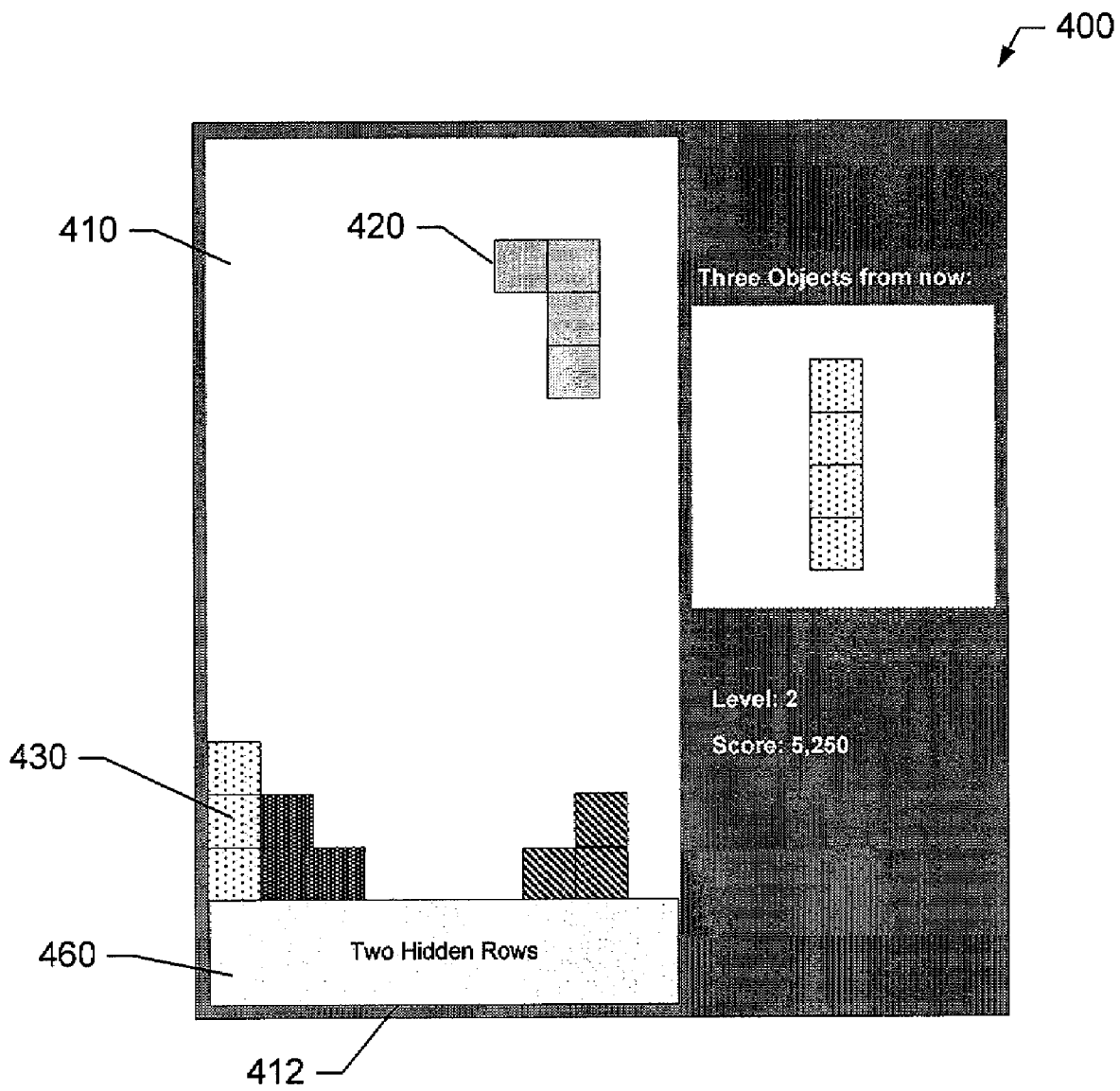430

Level: 2

Score: 5,250

460

Two Hidden Rows

412

FIG. 5

SYSTEMS, METHODS, DEVICES, AND COMPUTER PROGRAM PRODUCTS PROVIDING A BRAIN-EXERCISING GAME

FIELD OF EMBODIMENTS OF THE INVENTION

[0001] Embodiments of the invention relate generally to brain-exercising games. More particularly, embodiments of the present invention relate to systems, methods, devices, and computer program products for providing a puzzle-like video game where aspects of the game provide incentives for a user to utilize short-term memory.

BACKGROUND OF EMBODIMENTS OF THE INVENTION

[0002] It is said that a person can store up to seven pieces of independent information, such as seven words, in short-term memory if a person is given a task to memorize independent pieces of information in a very short period of time. The ability of a person to store information in short-term memory is generally reduced if the person is required to perform other tasks at the same time that the person is asked to remember the information. For example, a person asked to memorize words in a short period of time while performing another task may only have the capacity to remember three or four words. This short-term memory capacity varies based on the individual, and it is sometimes thought that a person having a larger short-term memory capacity will be able to make better decisions when solving certain problems. This may be particularly true if the person has a good short-term memory while performing other rapid tasks.

[0003] Therefore, it may be useful to have a system directed towards exercising (e.g., training and/or testing) short-term memory capacity. It would be advantageous if such a system causes a person to use short-term memory while performing other rapid tasks. It would also be advantageous if such a system, particularly a system directed towards training short-term memory, is enjoyable for the user so that the user desires to use the system often and for long periods of time.

BRIEF SUMMARY OF EMBODIMENTS OF THE INVENTION

[0004] Therefore, embodiments of the present invention provide systems, methods, devices, and computer program products for exercising (e.g., training and/or testing) the user's brain, and in particular the user's short-term memory. More particularly, embodiments of the present invention provide machine code and/or signals that may be executed by the processor of an electronic device, such as a mobile terminal. The machine code and/or signals can represent many different applications for exercising one's memory, such as games, training tasks, strategy simulation, etc. The gaming application provides a game where the user is rewarded in the game by correctly and accurately using his or her short-term memory. In one embodiment, the amount of information that the user must store in his or her short-term memory is adjusted based on the user's performance in the game. In one embodiment, a popular puzzle-like game involving the manipulation of a sequence of polyominoes is improved upon to provide for exercising of the user's short-term memory. A polyomino is a geometric shape that is constructed by placing a number of identical squares in distinct locations in a plane and in such a

way that at least one edge of each square coincides with an edge of one of the other squares. A tetromino is a polyomino constructed of four squares.

[0005] In one embodiment of the present invention, a computer program product is provided for providing a memory exercising application. The computer program product may include at least one computer-readable storage medium having computer-readable program code portions stored therein. The computer-readable program code portions may include: a first executable portion for introducing a current object, from a sequence of objects, in a gaming area of a display, wherein each object is one of a plurality of different object types; a second executable portion for providing the user with an indication of a future object, wherein the future object is spaced apart in the sequence of objects by at least one intermediate object after the current object; a third executable portion for allowing a user a limited amount of time to utilize the current object, based at least partially on the object type of the current object; and a fourth executable portion for advancing the sequence after the current object is utilized or after the limited time expires, such that the object in the sequence immediately following the current object becomes the current object.

[0006] The second executable portion may be configured to provide the user with the indication of the future object without concurrently displaying the object type(s) for at least one intermediate object. The second executable portion may be configured to provide the user with an indication of the object type of the future object. The second executable portion may also be configured for providing the user with an indication of the number of objects between the current object and the future object. The third executable portion may be configured to provide incentives for the user to utilize the current object based at least partially on the object type(s) of at least one intermediate object.

[0007] The computer program product may further include an executable portion for allowing the user to specify the number of objects between the current object and the future object. The computer program product may also include an executable portion for automatically determining the number of objects between the current object and the future object based at least partially on the use of the current object. The computer program product may also include an executable portion for automatically determining the number of objects between the current object and the future object based at least partially on a period of time expiring.

[0008] The computer program product may include an executable portion for rewarding the user based on the use of the current object. The objects may be polyominoes and the object type may be a type of polyomino. The polyominoes may include tetrominoes. In one embodiment, the current object in the gaming area falls toward a side of the gaming area until the current object comes to rest at the side of the gaming area or adjacent to a portion of another object at rest. In such an embodiment, the third executable portion may be further configured to receive user input and move the object based on the user input, the computer program product further comprising. An executable portion may also be included for rewarding the user when the user utilizes the current object to complete at least one row spanning the gaming area. Such an executable portion may also be configured for removing the at least one completed row.

[0009] The computer program product may further include an executable portion for outputting a score based at least

partially on utilization of the current object and for indicating that the score is representative of the user's short-term memory capacity. Another executable portion may be for randomly generating the sequence of objects.

[0010] In one embodiment, an executable portion is provided for hiding a portion of the gaming area displayed on the display. For example, where the objects are tetrominoes, each tetromino having four squares, and where the gaming area is comprised of a plurality of rows that span the gaming area, and the computer-readable program code portions may further include: an executable portion for rewarding the user when the user utilizes the current object to completely fill at least one of the rows with squares of one or more tetrominoes, and an executable portion for hiding from view on the display an area of the gaming area that includes at least one row of the gaming area.

[0011] In one embodiment of the present invention a method is provided for exercising short-term memory in a user. The method may include: providing a sequence of objects, each object in the sequence being one of a plurality of object types; introducing a current object, from the sequence of objects, in a gaming area of a display; displaying an indication, on the display, of a future object, wherein the future object is spaced apart in the sequence of objects by at least one intermediate object after the current object; and allowing the user a limited time to enter user input immediately after the current object is introduced into the gaming area.

[0012] In another embodiment of the present invention, an apparatus is provided having a display; a user input interface; and a processor operatively coupled to the display and to the user input interface. The processor may be configured to: introduce a current object, from a sequence of objects, in a gaming area of the display, wherein each object is one of a plurality of different object types; provide the user with an indication of a future object, wherein the future object is spaced apart in the sequence of objects by at least one intermediate object after the current object; allow a user a limited amount of time to utilize the current object by entering user input based at least partially on the object type of the current object; and advance the sequence after the current object is utilized or after the limited time expires, such that the object in the sequence immediately following the current object becomes the current object. In one embodiment, the system is embodied in a mobile terminal.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

[0013] Having thus described the invention in general terms, reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

[0014] FIG. 1 illustrates a block diagram of an electronic device that may be used to execute a gaming application, in accordance with embodiments of the present invention;

[0015] FIG. 2 is a flow chart that illustrates, in general terms, a process implemented by a gaming application, in accordance with on embodiment of the present invention;

[0016] FIG. 3 illustrates a graphical user interface of the gaming application in accordance with one embodiment of the present invention;

[0017] FIG. 4 illustrates the possible different types of two-dimensional tetrominoes that may be used in one embodiment of the present invention; and

[0018] FIG. 5 illustrates a graphical user interface of the gaming application in accordance with one another embodiment of the present invention.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0019] Embodiments of the present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all embodiments of the inventions are shown. Indeed, these inventions may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. Like numbers refer to like elements throughout.

[0020] Embodiments of the present invention are directed to providing a system directed to exercising (e.g., training and/or testing) aspects of a user's brain or thinking process. More particularly, embodiments of the present invention provide a gaming application that causes a user to utilize short-term memory while performing other rapid tasks. In this way, some embodiments of the present invention may provide a system, method, device, and computer product that can be used to exercise the short-term memory of the user.

[0021] In this regard, FIG. 1 illustrates a block diagram of an electronic device, and specifically a mobile terminal 10, that may be used to execute gaming applications, in accordance with embodiments of the present invention. While several embodiments of the mobile terminal 10 are illustrated and will be hereinafter described for purposes of example, other types of electronic devices, such as digital cameras, portable digital assistants (PDAs), pagers, mobile televisions, computers, laptop computers, gaming consoles, and other types of systems that can execute gaming applications, can readily employ embodiments of the present invention. Such devices may or may not be mobile.

[0022] The mobile terminal 10 includes a communication interface comprising an antenna 12 in operable communication with a transmitter 14 and a receiver 16. The mobile terminal 10 further includes a processor 20 or other processing element that provides signals to and receives signals from the transmitter 14 and receiver 16, respectively. The signals include signaling information in accordance with the air interface standard of the applicable cellular system, and also user speech and/or user generated data. In this regard, the mobile terminal 10 is capable of operating with one or more air interface standards, communication protocols, modulation types, and access types. By way of illustration, the mobile terminal 10 is capable of operating in accordance with any of a number of first, second and/or third-generation communication protocols or the like. For example, the mobile terminal 10 may be capable of operating in accordance with second-generation (2G) wireless communication protocols IS-136 (TDMA), GSM, and IS-95 (CDMA) or third-generation wireless communication protocol Wideband Code Division Multiple Access (WCDMA).

[0023] It is understood that the processor 20 includes circuitry required for implementing audio and logic functions of the mobile terminal 10. For example, the processor 20 may be comprised of a digital signal processor device, a microprocessor device, and various analog to digital converters, digital to analog converters, and other support circuits. Control and signal processing functions of the mobile terminal 10 are allocated between these devices according to their respective

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capabilities. The processor **20** thus may also include the functionality to convolutionally encode and interleave message and data prior to modulation and transmission. The processor **20** can additionally include an internal voice coder, and may include an internal data modem. Further, the processor **20** may include functionality to operate one or more software programs, which may be stored in memory. For example, the processor **20** may be capable of operating a connectivity program, such as a conventional Web browser. The connectivity program may then allow the mobile terminal **10** to transmit and receive Web content, such as location-based content, according to a Wireless Application Protocol (WAP), for example.

[0024] The mobile terminal **10** also comprises a user interface including an output device such as a conventional earphone or speaker **24**, a ringer **22**, a microphone **26**, a display **28**, and a user input interface, all of which are operatively coupled to the processor **20**. The user input interface, which allows the mobile terminal **10** to receive data, may include any of a number of devices allowing the mobile terminal **10** to receive data, such as a keypad **30**, a touch display (not shown) or other input device. In embodiments including the keypad **30**, the keypad **30** may include the conventional numeric (0-9) and related keys (#, *), and other keys used for operating the mobile terminal **10**. Alternatively, the keypad **30** may include a conventional QWERTY keypad. The mobile terminal **10** further includes a battery **34**, such as a vibrating battery pack, for powering various circuits that are required to operate the mobile terminal **10**, as well as optionally providing mechanical vibration as a detectable output.

[0025] In an exemplary embodiment, the mobile terminal **10** includes a camera **36** in communication with the processor **20**. The camera **36** may be any means for capturing an image for storage, display or transmission. For example, the camera **36** may include a digital camera capable of forming a digital image file from a captured image. As such, the camera **36** includes all hardware, such as a lens or other optical device, and software necessary for creating a digital image file from a captured image. Alternatively, the camera **36** may include only the hardware needed to view an image, while a memory device of the mobile terminal **10** stores instructions for execution by the processor **20** in the form of software necessary to create a digital image file from a captured image. In an exemplary embodiment, the camera **36** may further include a processing element such as a co-processor which assists the processor **20** in processing image data and an encoder and/or decoder for compressing and/or decompressing image data. The encoder and/or decoder may encode and/or decode according to a JPEG standard format.

[0026] The mobile terminal **10** may further include a user identity module (UIM) **38**. The UIM **38** is typically a memory device having a processor built in. The UIM **38** may include, for example, a subscriber identity module (SIM), a universal integrated circuit card (UICC), a universal subscriber identity module (USIM), a removable user identity module (R-UIM), etc. The UIM **38** typically stores information elements related to a mobile subscriber. In addition to the UIM **38**, the mobile terminal **10** may be equipped with memory. For example, the mobile terminal **10** may include volatile memory **40**, such as volatile Random Access Memory (RAM) including a cache area for the temporary storage of data. The mobile terminal **10** may also include other non-volatile memory **42**, which can be embedded and/or may be removable. The non-volatile memory **42** can additionally or alternatively comprise an

EEPROM, flash memory or the like, such as that available from the SanDisk Corporation of Sunnyvale, Calif., or Lexar Media Inc. of Fremont, Calif. The memories can store any of a number of pieces of information, and data, used by the mobile terminal **10** to implement the functions of the mobile terminal **10**. For example, the memories can include an identifier, such as an international mobile equipment identification (IMEI) code, capable of uniquely identifying the mobile terminal **10**.

[0027] In one embodiment of the present invention, the mobile terminal **10** comprises a gaming application that is executed by the processor **20** and provides for a game to run on the mobile terminal **10**. The gaming application may be stored in a memory of the mobile terminal **10**. The memory may be a removable memory, such as a game cartridge, that is removably coupled to the mobile terminal **10**, or other electronic device, so that the processor **20** of the mobile terminal **10** can execute the application stored in the removable memory. In general, when executed on the mobile terminal **10**, the game generates a graphical user interface that the processor **20** presents on the display **28**. The user of the mobile terminal **10** interacts with the game by actuating a user input device, such as the keypad **30**, in order to communicate information to the processor **20**. The application is referred to herein as a "gaming" application since, in a one embodiment, the user finds the game executed by the gaming application enjoyable to use. However, in other embodiments of the present invention the gaming application may be strictly used for memory training, memory testing, or other brain-exercising purposes.

[0028] In general, the game of embodiments of the present application involves providing one or more objects on the display **28** and further involves the user manipulating and/or performing actions with these one or more objects based at least partially on the attributes of the one or more objects. More particularly, the game comprises a plurality of object types. Each object of a particular object type has an attribute or a combination of attributes that is different from the attributes or combination of attributes of an object that is a member of a different object type.

[0029] Referring now to FIG. **2**, a flow chart is provided that illustrates, in general terms, a process **100** that is implemented by the processor **20** executing the gaming application, in accordance with one embodiment of the invention. As represented by block **110**, during game play, an object of a sequence of objects is provided to the user one object at a time. At any given moment during the game, the object most recently introduced to the user is referred to herein as the "current object." After the current object is introduced to the user, the user has a limited amount of time to use the current object in accordance with the rules of the game, as illustrated by block **130**. Once the current object is used and/or the limited amount of time expires, the next object in the sequence is provided to the user as a new current object, as represented by block **150**. In general, the process of providing a current object, allowing the user to utilize the object during a limited amount of time, and providing a new current object is repeated until the game ends or otherwise stops. The objects provided to the user are provided in a sequence such that, at any given moment in time, the current object is followed immediately in the sequence by a next object, which is followed by other future objects. In one embodiment, the sequence of objects is randomly generated by the processor

20, such that a random distribution of object types is provided to the user throughout the game.

[0030] In some embodiments of the present invention, the user is rewarded based on what the user does with the current object during the limited amount of time, as represented by block **140**. In general, different object types can be used in different ways based on the attributes of the object. The attributes of an object are determined by the object type. Often, the way in which the user utilizes the current object will affect how the user will be able to utilize the next object in the sequence of objects as well as other future objects in the sequence. Therefore, embodiments of the game are configured such that, if the user knows the sequence of future object types that will follow the current object, then the user may be able to plan out how to best use the current object (in view of the future sequence of object types) in such a way as to maximize the user's overall reward. In other words, a user who knows at least a portion of the sequence of object types that will follow the current object has an advantage over a user that does not know the sequence. In general, the greater the portion of the sequence that the user knows in advance, the greater advantage the user has in the game, at least up to some maximum sequence length that a human is capable of processing and effectively using in the limited amount of time.

[0031] In order to provide an incentive for the user to make use of his or her short-term memory, embodiments of the game provide the user with an indication of the object type of a future object in the sequence, as represented by block **120**. For example, the game may provide an indication of the object type of a future object that is at least two objects after the current object in the sequence. The game may further be configured to hide any indication of the object types of the object(s) that are in the sequence between the current object and the indicated future object. In this way, if the user is to have the advantage of knowing the sequence of objects in advance, then the user is required to hold the object type for at least one future object in his or her short-term memory from the time that the future object is indicated until the time that the future object becomes the current object.

[0032] For example, suppose that, at a given moment in time, the sequence comprises an order of objects such that the current object will be immediately followed by object type A, which will be immediately followed by object type B, which will be immediately followed by object type C. In such a situation, one embodiment of the present invention would be configured such that the game would display to the user object type B as an indication of the object type of the future object that is two objects after the current object in the current sequence. After the current object is used, a new current object would be introduced that is an object type A. The next object in the sequence would then become object type B, and object type B would no longer be displayed to the user and instead would be hidden from view on the display. Instead, the future object that would now be two objects after the new current object (i.e., two objects after object type A) would be an object type C and, thus, object type C would be displayed to the user. Therefore, in this example, as the user plays the game, if the user is to have the advantage of knowing the object type of the object that is to immediately follow the current object, then the user must remember the object type of the next object, which is hidden when it is the immediately next object, but was earlier displayed to the user. The user

must do this while also trying to commit the currently displayed future object to memory and while making use of the current object.

[0033] In one embodiment of the present invention, the next object (i.e., the object immediately following the current object) is hidden from the user, but the object type for the future object located two objects after the current object in the sequence is displayed to the user. In other embodiments, the future object that is located three objects after the current object in the sequence is displayed to the user, while the two objects between the current object and the displayed future object are hidden from the user. In other embodiments, even more objects in the sequence are hidden between the current object and the displayed future object type. For example, since it is often said that a person can hold up to seven pieces of information in short-term memory at any given time, then one embodiment of the present invention may provide the user with an indication of the object type for the future object that is located seven objects from the current object in the sequence, but hide all of the object types in between the current object and the displayed future object. In such an embodiment, the user must retain six previously-displayed objects in memory while trying to commit a seventh object to memory if the user is to continually know the sequence of objects scheduled to follow the current object.

[0034] In some embodiments of the present invention, the user may choose which objects in the future sequence to display and which objects to hide. In some embodiments of the present invention, the game automatically adjusts how many future objects should be hidden between the current object and the displayed future object. For example, the game may increase the number of hidden objects between the current object and the displayed future object in order to increase the difficulty of the game. The game may be configured to automatically increase the difficulty of the game whenever the user reaches a certain performance goal or whenever a predetermined period of time passes during game play.

[0035] Referring now to FIG. **3**, an exemplary embodiment of the present invention is illustrated and descried herein below. In this regard, FIG. **3** illustrates a graphical user interface **200** that may be provided on the display **28** of the mobile terminal **10** when the processor **20** is executing the gaming application, in accordance with one embodiment of the present invention. The graphical user interface **200** shown in FIG. **3** illustrates how the graphical user interface may appear on the display **28** at one moment in time during game play, in accordance with one embodiment of the present invention. The graphical user interface **200** comprises a gaming area **210** and a future object viewing area **215**. In the illustrated embodiment, the gaming area **210** is a generally rectangular area comprising a top edge **211**, a bottom edge **212**, a left edge **213**, and a right edge **214**. The future object viewing area **215** is positioned to one side of the gaming area **210**. In other embodiments, the gaming area **210** and the future object viewing area **215** may be shaped and configured differently, for example, the future object viewing area **215** may be positioned over or within the gaming area **210**.

[0036] In the illustrated embodiment, the objects in the game are all polyominoes, and more particularly are all tetrominoes. As described above, a polyomino is a geometric shape that is constructed by placing a number of identical squares in distinct locations in a plane and in such a way that at least one edge of each square coincides with an edge of one of the other squares. A tetromino is a polyomino constructed

of four squares. FIG. 4 illustrates the possible different types of two-dimensional tetrominoes 300 that may be used in the illustrated embodiment of the present invention. Each object in the illustrated embodiment of the game is a tetromino and each different object type represents a different type of tetromino, such as tetrominoes of the types 310-370 illustrated in FIG. 4.

[0037] During the operation of the game, a sequence of objects, such as current object 220, are introduced into the gaming area 210 one object at a time. At any given moment in time during the operation of the game, the current object 220 is the most recent object to be introduced into the gaming area. In the illustrated embodiment, the current object 220 is introduced proximate the top edge 211 of the gaming area 210. The current object 220 then "falls" towards the bottom edge 212 of the gaming area 210 at a generally constant rate. The current object 220 continues to fall towards the bottom edge 212 until the object 220 comes into contact with the bottom edge 212 of the gaming area 210 or with another object in the stack of objects 230. When such contact is made, or shortly after such contact is made, the object 220 comes to rest in the position and location that the object was in when the contact was made or very shortly thereafter.

[0038] While the object 220 falls towards the bottom edge 212, the user of the mobile terminal 10 may actuate a user input device, such as one or more keys on the keypad 30, in order to change the orientation of the current object 220 and/or move the current object 220 within the gaming area 210. The user may be able to change the orientation of the current object 220 by rotating the current object 220 about a point of rotation typically at or near the center of the current object 220. For example, actuation of a particular key on the keypad 30 may rotate the current object 220 about its center in the clockwise direction and in ninety degree increments each time the key is actuated. Actuation of a different key on the keypad 30 may rotate the object 220 about its center in the counterclockwise direction and in ninety degree increments each time the key is actuated.

[0039] In general, the user can move the current object 220 in the gaming area 210 by moving the object 220 laterally from side to side, e.g. towards the left edge 213 or towards the right edge 215. In some embodiments, the user may also increase the speed of the object's falling motion toward the bottom edge 212 of the gaming area 210. The user may move the object 220 using a user input interface of the mobile terminal 10, such as by using a joystick, a directional key on the keypad 30, a plurality of keys on the keypad 30, a touch screen, a touch pad, and the like.

[0040] The current object 220 continues to fall towards the bottom edge 212 of the gaming area 210 as the user changes the orientation of the object and/or moves the current object 220 in the gaming area 210. Therefore, the user only has a limited amount of time to adjust the orientation and the position of the current object 220 before the current object 220 comes to rest at the bottom 212 of the gaming area or on the stack of objects 230. The goal of the illustrated embodiment of the game is generally to receive a high number of points by the end of the game or to reach some higher level by the end of the game. The game ends when the stack of objects 230 reaches the top edge 211 of the gaming area 210. The user can reduce the stack of objects 230 and also receive points or other rewards by positioning the current object 220 such that, when the current object comes to rest, one or more squares that make up the current object 220 combine with squares in the

stack of objects 230 to form complete rows 233 that span the width of the gaming area 210 from one side 213 to the other side 214. When a row 233 of the gaming area 210 is completely filled with squares of one or more objects, the squares in the stack of objects 230 that form the complete row are removed and the portion of the stack 230 located above the removed row is shifted one row toward the bottom 212 of the gaming area 210. In one embodiment of the game, the user receives extra points or other extra rewards if the user can complete two or more rows simultaneously using only one current object 220.

[0041] Once the current object 220 comes to rest on the bottom 212 of the gaming area 210 or on the stack of objects 230, the game is configured such that a new object, and in particular the next object in the sequence, is introduced at or near the top edge 211 of the gaming area 210 as a new current object. After this new current object is used, another object is introduced as the current object, and so on. This process continues until the game is ended or otherwise stopped. In general, the sequence of object types introduced into the gaming area is randomly generated by the processor. Therefore, each time a new current object 220 is introduced into the gaming area 210, the user must consider the object type of the current object 220 and then decide how to best orient and position the current object 220 in the stack 230 in order to best achieve the goal of the user, which may be to receive the highest amount of points by the end of the game. Since each object type represents a different tetromino, certain object types will fit into the stack 230 better than other objects types depending on the current form of the stack 230 and the object type. Furthermore, a current object 220 coming to rest on the stack 230 becomes part of the stack 230 and, therefore, changes the stack 230. As a result, the placement of the current object 220 will have an affect on the options available for positioning future objects. Therefore, the user has an advantage if the user can know the sequence of object types that will be follow the current object 220.

[0042] Embodiments of the present invention provide such an advantage by displaying the object type of a future object 225 in advance of introducing the future object 225 into the gaming area 210. Embodiments of the present invention, however, force a user to utilize his or her short-term memory by displaying the object type for a future object 225 that is at least two objects after the current object 220 in the sequence and by hiding the object type of the at least one object(s) in the sequence between the current object 220 and the displayed future object 225.

[0043] In the embodiment illustrated in FIG. 3, an image of a future object 225 is displayed in the future object viewing area 215. Text 250 may be included proximate to the future object viewing area 215 in order to indicate to the user how many objects the displayed future object 225 is from the current object 220 in the sequence. For example, in the exemplary graphical user interface shown in FIG. 3, the displayed future object 225 is indicated as being three objects from the current object 220 in the sequence of objects. Thus, the user knows that after he or she uses the current object and the next two immediately following objects, then the user will receive an object of the type shown in the future object viewing area 215, which in FIG. 3 is a straight tetromino (i.e., four squares positioned in a straight line). However, once the current object 220 shown in FIG. 3 is used, the sequence shifts so that a new current object is introduced and a new future object is displayed in the future object viewing area 215 since a new

object will be three objects from the new current object in the sequence. The object that was previously displayed in the future object viewing area becomes hidden from view. For example, in the illustrated example, once the sequence shifts, the user must remember that a straight tetromino is hidden from view and is now located only two objects from the new current object.

[0044] Therefore, by displaying and then hiding a future object 225 in this way, the user must hold the object type of the hidden future object in his or her short-term memory from the time that the future object 225 ceases to be displayed in the future object viewing area 215 until the time that the future object becomes the current object 220 by being introduced into the gaming area 210. This may be challenging since the user must remember at least one hidden future object while using the current object 220 and while trying to commit a newly displayed future object to memory, all in what may be a very limited amount of time. If the user can remember the sequence of the hidden objects, then the user can position the current object 220 on the stack 230 based at least partially on the sequence of objects to follow the current object 220.

[0045] Since it is often said that a person can only retain up to seven pieces of information in short-term memory at any one time, then embodiments of the present invention may be configured such that the displayed future object 225 is at least seven objects in the sequence after the current object 220. However, other embodiments of the present invention may be configured to display future objects that are only four, five, or six objects from the current object since it is also sometimes believed that a person generally cannot hold seven pieces of information in short-term memory while performing other rapid tasks at the same time.

[0046] In some embodiments, the user can adjust how many objects are hidden between the current object 220 and the displayed future object 225 or exactly which future objects are to be displayed and which objects are not. In one embodiment, the game is configured such that the number of hidden objects between the current object 220 and the displayed future object 225 is automatically adjusted by the game during operation of the game. The game may be configured to automatically adjust the number based on the user's performance or after certain predetermined time periods expire. Other characteristics of the game may also be adjusted by the user or automatically in order to adjust the level of play. For example, the speed of the falling motion of the current object may be increased in order to adjust the difficulty of the game.

[0047] In one embodiment, the user is provided with a score and/or a level 255 based on the user's performance. In some embodiments, this score or level may provide the user with an indication of the user's short-term memory capacity or other cognitive ability or at least the game may be configured to claim that the score represents the user's short-term memory capacity of other cognitive ability. The game may be configured to compare the user's performance to the performance of other individuals. In one embodiment, the game is configured such that the user's performance is compared to how a computer would have performed given the same amount of information about future sequence of objects.

[0048] Referring now to FIG. 5, another embodiment of the present invention is illustrated. More particularly FIG. 5 illustrates a graphical user interface 400 similar to the one described earlier with reference to FIG. 3. As with FIG. 3, FIG. 5 illustrates one moment in time during the execution of

the game. FIG. 5, however, illustrates how, in one embodiment of the present invention, one or more rows in the gaming area 410 may be hidden by screening object 460. This embodiment also requires that the user utilize short-term memory by requiring that the user try to remember the shape of the stack 430 hidden behind the screening object 460. The user must try to remember the shape of the stack 430 behind the screening object 460 so that the user can determine how to best utilize the current object 420. In the illustrated embodiment, the bottom two rows are hidden from the user's view. In other embodiments one or more rows are hidden from view. The hidden rows may or may not be the bottom most rows in the gaming area 410. The number of rows that are hidden may be user controlled or may be automatically controlled based on the user's performance or on other predetermined conditions.

[0049] It should be appreciated that embodiments of the present invention may require or at least provide incentives for a user to utilize his or her memory or other specific mental process. In particular, embodiments of the present invention may provide incentives for the user to repeatedly and rapidly utilize the user's short-term memory while simultaneously performing other rapid tasks. Embodiments of the present invention may require this of the user in a way that is enjoyable for the user. As such, embodiments of the present invention may provide the user or other individuals with a system, method, device, or computer program product for exercising (e.g., training and/or testing) a user's short-term memory or some other aspect of the user's cognitive ability. Other embodiments of the present invention merely provide an enjoyable and challenging video game.

[0050] The above described functions may be carried out in many ways. For example, any suitable means for carrying out each of the functions described above may be employed to carry out embodiments of the invention. According to one aspect of the present invention, all or a portion of the system of the present invention generally operates under control of a computer program product. The computer program product for performing the various processes and operations of embodiments of the present invention includes a computer-readable storage medium, such as a non-volatile storage medium, and computer-readable program code portions, such as a series of computer instructions, embodied in the computer-readable storage medium. For example, in one embodiment, the processor of the mobile terminal generally executes a gaming application in order to perform the various functions described above.

[0051] In this regard, FIG. 2 is a flowchart or block diagram of operations performed by methods, systems, devices, and computer program products according to embodiments of the present invention. It will be understood that each block of a flowchart or each step of a described method can be implemented by computer program instructions. These computer program instructions may be loaded onto a computer or other programmable apparatus to produce a machine, such that the instructions which execute on the computer or other programmable apparatus create means for implementing the functions specified in the described block(s) or step(s). These computer program instructions may also be stored in a computer-readable memory that can direct a computer or other programmable apparatus to function in a particular manner, such that the instructions stored in the computer-readable memory produce an article of manufacture including instruction means which implement the function specified in the described

block(s) or step(s). The computer program instructions may also be loaded onto a computer or other programmable apparatus to cause a series of operational steps to be performed on the computer or other programmable apparatus to produce a computer implemented process such that the instructions which execute on the computer or other programmable apparatus provide steps for implementing the functions specified in the described block(s) or step(s).

[0052] It will also be understood that each block or step of a described herein, and combinations of blocks or steps, can be implemented by special purpose hardware-based computer systems which perform the specified functions or steps, or combinations of special purpose hardware and computer instructions.

[0053] Many modifications and other embodiments of the inventions set forth herein will come to mind to one skilled in the art to which these inventions pertain having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the inventions are not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

That which is claimed:

1. A computer program product for providing a memory exercising application, the computer program product comprising at least one computer-readable storage medium having computer-readable program code portions stored therein, the computer-readable program code portions comprising:

a first executable portion for introducing a current object, from a sequence of objects, in a gaming area of a display, wherein each object is one of a plurality of different object types;

a second executable portion for providing the user with an indication of a future object, wherein the future object is spaced apart in the sequence of objects by at least one intermediate object after the current object;

a third executable portion for allowing a user a limited amount of time to utilize the current object, based at least partially on the object type of the current object; and

a fourth executable portion for advancing the sequence after the current object is utilized or after the limited time expires, such that the object in the sequence immediately following the current object becomes the current object.

2. The computer program product of claim 1, wherein the second executable portion is further configured to provide the user with the indication of the future object without concurrently displaying the object type(s) for at least one intermediate object.

3. The computer program product of claim 1, wherein the third executable portion is further configured to provide incentives for the user to utilize the current object based at least partially on the object type(s) of at least one intermediate object.

4. The computer program product of claim 1, wherein the second executable portion is further configured to provide the user with an indication of the object type of the future object.

5. The computer program product of claim 1, wherein the second executable portion is further configured for providing the user with an indication of the number of objects between the current object and the future object.

6. The computer program product of claim 1, further comprising:

a fifth executable portion for allowing the user to specify the number of objects between the current object and the future object.

7. The computer program product of claim 1, further comprising:

a fifth executable portion for automatically determining the number of objects between the current object and the future object based at least partially on the use of the current object.

8. The computer program product of claim 1, further comprising:

a fifth executable portion for automatically determining the number of objects between the current object and the future object based at least partially on a period of time expiring.

9. The computer program product of claim 1, further comprising:

a fifth executable portion for rewarding the user based on the use of the current object.

10. The computer program product of claim 1, wherein the objects comprise polyominoes and wherein the object type comprises a type of polyomino.

11. The computer program product of claim 10, wherein the polyominoes comprise tetrominoes, wherein the current object in the gaming area falls toward a side of the gaming area until the current object comes to rest at the side of the gaming area or adjacent to a portion of another object at rest, and wherein the third executable portion is further configured to receive user input and move the object based on the user input, the computer program product further comprising:

a fifth executable portion for rewarding the user when the user utilizes the current object to complete at least one row spanning the gaming area.

12. The computer program product of claim 11, wherein the fifth executable portion is further configured for removing the at least one completed row.

13. The computer program product of claim 1, further comprising:

a fifth executable portion for outputting a score based at least partially on utilization of the current object and for indicating that the score is representative of the user's short-term memory capacity.

14. The computer program product of claim 1, further comprising:

a fifth executable portion for randomly generating the sequence of objects.

15. The computer program product of claim 1, further comprising:

a fifth executable portion for hiding a portion of the gaming area displayed on the display.

16. The computer program product of claim 1, wherein the objects comprise tetrominoes, each tetromino comprised of four squares, wherein the gaming area is comprised of a plurality of rows that span the gaming area, and wherein the computer-readable program code portions further comprise:

a fifth executable portion for rewarding the user when the user utilizes the current object to completely fill at least one of the rows with squares of one or more tetrominoes; and

a sixth executable portion for hiding from view on the display an area of the gaming area that includes at least one row of the gaming area.

17. A method of exercising short-term memory in a user, the method comprising:

    providing a sequence of objects, each object in the sequence being one of a plurality of object types;

    introducing a current object, from the sequence of objects, in a gaming area of a display;

    displaying an indication, on the display, of a future object, wherein the future object is spaced apart in the sequence of objects by at least one intermediate object after the current object; and

    allowing the user a limited time to enter user input immediately after the current object is introduced into the gaming area.

18. The method of claim **17** wherein displaying the indication of the object type of the future object occurs without concurrently displaying the object type(s) for the at least one intermediate object.

19. The method of claim **17**, further comprising:

    providing the user with incentives to enter user input based at least partially on the object type of the current object and the object type(s) of the at least one intermediate object.

20. The method of claim **17**, wherein displaying the indication of the future object comprises displaying an indication of the object type of the future object.

21. The method of claim **17**, further comprising:

    choosing the future object in the sequence.

22. The method of claim **17**, further comprising:

    repeating the steps of introducing, displaying, and allowing for each object in at least a portion of the sequence.

23. The method of claim **17**, wherein the providing of a sequence of objects comprises generating a random sequence of objects having a random sequence of object types.

24. The method of claim **17**, further comprising:

    providing an indication of the user's performance based on the user input in response to the sequence of objects introduced into the gaming area.

25. The method of claim **24**, wherein the displaying of an indication of a future object in the sequence comprises displaying an image of an object having the same object type as the future object.

26. The method of claim **17**, wherein the objects comprise polyominoes.

27. The method of claim **17**, further comprising:

    rewarding the user based on user input entered in response to the sequence of objects introduced into the gaming area.

28. The method of claim **27**, wherein the user input that is more likely to achieve higher rewards is at least partially based on the object type of the object introduced into the gaming area.

29. An apparatus comprising:

    a display;

    a user input interface; and

    a processor operatively coupled to the display and to the user input interface;

    wherein the processor is configured to introduce a current object, from a sequence of objects, in a gaming area of the display, wherein each object is one of a plurality of different object types;

    wherein the processor is configured to provide the user with an indication of a future object, wherein the future object is spaced apart in the sequence of objects by at least one intermediate object after the current object;

    wherein the processor is configured to allow a user a limited amount of time to utilize the current object by entering user input based at least partially on the object type of the current object; and

    wherein the processor is configured to advance the sequence after the current object is utilized or after the limited time expires, such that the object in the sequence immediately following the current object becomes the current object.

30. The apparatus of claim **29**, wherein the processor is further configured to provide the user with the indication of the future object without concurrently displaying the object type(s) for at least one intermediate object.

31. The apparatus of claim **29**, wherein the processor is further configured to provide incentives for the user to utilize the current object based at least partially on the object type(s) of at least one intermediate object.

32. The apparatus of claim **29**, wherein the processor is further configured to provide the user with an indication of the future object by displaying an indication of the object type of the future object.

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