METHOD AND APPARATUS FOR FACILITATING PLAYING AN ELECTRONIC GAME

Inventor: Lane T. Hauck, San Diego, CA (US)
Assignee: Mr. Lane T. Hauck, San Diego, CA (US)
Appl. No.: 13/473,474
Filed: May 16, 2012

Publication Classification
Int. Cl. A63F 9/24 (2006.01)

U.S. Cl. 463/7

ABSTRACT
A method and apparatus facilitates playing an electronic game using a group of game devices. A sequence of musical melody notes are generated forming a melody after all players have previously received on their game devices a recognition sequence of certain musical notes which form a portion of the musical melody notes. Stop signals on one or more of the game devices are then generated. Incrementally quantifying reaction time signals are generated relative to the playing of the last musical note corresponding to the recognition sequence for each game device. A score for each game device may be generated for each round in response to the reaction time signal.
FIG. 2

FIG. 3
FIG. 6

PATENT APPLICATION PUBLICATION
Nov. 21, 2013
Sheet 4 of 10
US 2013/0310124 A1

FIG. 7

FIG. 7
FIG. 8

Miss!

Next Round

Round Value 200
Ears-only Multiplier 1.5
Reaction Time Multiplier 1.3
Miss: Zero Round Score 0

Round 2 High: 2550

FIG. 9

Suite I
1st Movement
Johann Sebastian BACH
(1685-1750)
BWV 1007

Prelude

20

21 22 23

90
Deactivate the START button 42.

When the player taps the PREVIEW button 41, play the 3-note PREVIEW sequence 21 and activate the START button 42.

Did the player tap START?

Play the melody 20 that contains the 3-note PREVIEW sequence 25.

Is the round over?

Score the round.

Did the player tap START?

Game Over?

Terminate Game.
Establish communication with all players.

New Multiplayer Round. Deactivate all START buttons.

PREVIEW phase. When any player taps his PREVIEW button 41, play the 3-note preview sequence 21 and activate his START button 42.

Have all players previewed at least once?

PLAY phase. Play the melody 20 containing the 3-note PREVIEW sequence 21 on all units.

Have all players completed the round?

SCORING phase. Score the round.

FIG. 11
FIG. 15

New Game

1500

Single Player

1501

Local Multiplayer

1502

Internet Multiplayer

1503

Max Players: 6

FIG. 16

Searching for players...

1600

Found 5 players, starting the game

1601

FIG. 17

Searching for players...

1601

Found 0 players

1700
Player 4 won the round with 1,550 points.

Final Scores:
- P1 (LTH) 12,400
- P2 (TZR) 10,150
- P3 (DDR) 8,250
- P4 (MAH) 6,000
- P5 (KEV) 5,235

Highest Recorded Score is DEH with 42,500
METHOD AND APPARATUS FOR FACILITATING PLAYING AN ELECTRONIC GAME

FIELD OF THE INVENTION

[0001] The present invention relates in general to a method and apparatus for facilitating playing an electronic game. More particularly, the present invention relates to sight and sound electronic game apparatus and method of using it, either alone or with one or more similar game devices.

BACKGROUND ART

[0002] This section describes the background art of the disclosed embodiment of the present invention. There is no intention, either express or implied, that the background art discussed in this section legally constitutes prior art.

[0003] Electronic games are well known and very popular. Many electronic games utilize a display device to present colorful and fast-moving graphics to challenge a player’s visual and motor skills. While these games include sound generating means for simulating game sound effects, the role of such sound effects is to accent the action of the game, instead of taking part in the game action or strategy.

[0004] An example of such an electronic game is disclosed in U.S. Pat. No. 5,405,153, which is incorporated herein by reference. The patented game includes individual game devices for randomly selecting a sequence of musical notes for game playing purposes. The device enables a player to preview a recognition sequence of a portion of the sequence of musical notes prior to the game play. A switch device is actuated by a player to cause a signal to be generated indicative that the player identified the recognition sequence of notes embedded within the sequence of musical notes during game play.

[0005] The patented game enabled more than one player to play and to compete against one another by wiring together each one of the player’s game devices. A master device controlled the other slave devices. In this manner, the master device could play the notes for all of the players to hear and each player could activate his or her device once they heard the sequence of musical notes.

[0006] Such a patented electronic game has proven to be successful and highly challenging as well as amusing for the players. At the same time, the patented musical electronic game has been useful in simulating ear training. However, while the patented game has been highly successful, it would be well to enable a large group of players to compete with one another in playing the electronic game where the players may be located in diverse locations and thus may not be able to hear the master game device playing the notes. In order to enable many people to play the game even while located in widely diverse and scattered locations, it would be well to have a new and improved version of the patented musical electronic game which could be a multi-player game for a very large number of players and which would be even more challenging to play. This is particularly important for a more challenging game, when a very large number of experienced players are competing against one another. If the game is not very challenging for the experienced players, then it becomes too easy to play and the game becomes less interesting.
DETAILED DESCRIPTION OF CERTAIN EMBODIMENTS OF THE INVENTION

[0028] Certain embodiments of the present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all, embodiments of the invention are shown. Indeed, these embodiments of the invention may be in many different forms and thus the invention should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided as illustrative examples only so that this disclosure will satisfy applicable legal requirements. Like numbers refer to like elements throughout.

[0029] It will be readily understood that the components of the embodiments as generally described and illustrated in the drawings herein, could be arranged and designed in a wide variety of different configurations. Thus, the following more detailed description of the certain ones of the embodiments of the system, components and method of the present invention, as represented in the drawings, is not intended to limit the scope of the invention, as claimed, but is merely representative of the embodiment of the invention.

[0030] According to certain embodiments of the present invention, the method and apparatus enables, while playing the game, the players to be able to develop and improve his or her ability to recognize properly tuned notes of the scale in various patterns and in various keys, thus stimulating ear training. The new and improved electronic game helps the users recognize properly tuned notes of the scale in various patterns and in various keys. Such tuned notes preferably would be accurate electronic representations of actual notes played by actual instruments. To take advantage of stereo sound available in modern electronic devices, it would be desirable to provide a spatial cue as well as sight and sound cues.

[0031] Also, scores may be awarded to the players that are higher for greater degrees of difficulty. Such scores may be most effective when they contain multiple factors, such as a difficulty factor indicative of the round difficulty, a risk factor selectable by the player before each round starts, and an achievement factor based on a measurement of the player’s performance during a round.

[0032] For new players, the method and apparatus gives a new player a cue or hint about the best way to operate the game.

[0033] An embodiment of the present invention is to provide such a new and improved electronic game device that develops the ability of a player to recognize properly tuned notes of the scale in various patterns and in various keys, thus stimulating ear training. To further promote ear training, the embodiments of the present invention may use digitized sounds from actual instruments. This feature enables the use of different instruments, for example a marimba or a guitar, to add interest and variety to the game. The digitized sounds may be heard using a stereo effect, in which the notes of the scale move from left to right across a sound field, such as heard when the player uses earphones.

[0034] A further embodiment of the present invention is to provide a scoring feature that takes into account round difficulty, player adjustments for difficulty, and a more precise measurement of player performance to make the game even more challenging to the players.

[0035] Briefly, the above and further embodiments of the present invention are realized by providing a new and improved sight and sound electronic game device which is entertaining and even more challenging to the players, and which may be played by a large number of players, even when they may be located at widely diverse locations.

[0036] A method and apparatus facilitates playing an electronic game using a group of game devices. A sequence of musical melody notes are generated forming a melody after all players have previously received on their game devices a recognition sequence of certain musical notes which form a portion of the musical melody notes. Stop signals on one or more of the game devices are then generated. Incrementally quantifying reaction time signals are generated during the playing of the last musical melody note to identify the recognition sequence. A score for each game device may be generated for each round in response to the reaction time signal.

[0037] According to another embodiment, a selection signal corresponding to either a single player game mode or a multiple player game mode may be generated on one of the game devices.

[0038] In accordance with still a further embodiment, a selection signal corresponding to either a local game mode or a remote non-synchronous game mode may be generated.

[0039] A further embodiment relates to one of the game devices may generate a start signal during a non-synchronous game mode, while at least one of the other game devices may generate non-synchronously preview signals for playing the recognition sequence.

[0040] According to a further embodiment, all of the notes from the game devices may be played in stereo to provide a further cue for the user.

[0041] Referring now to the drawings and more particularly to FIG. 1 thereof, there is shown an electronic game device 10, which is constructed in accordance with the present invention. The electronic game device 10 includes a computerized digital device 11 such as a smart mobile telephone, tablet, computer or the like for controlling game play, and emitting audible sounds of a random melodic multiple note sequence (the MELODY) and various sound effects. Such a device may include a control surface 12 which may be activated by touch, and which may display various dynamic graphical elements such as the stop sign 14 or a series of graphical elements 13 that can animate in concert with the melody notes as they play.

Game Play

[0042] Referring now to FIG. 2 there is shown a musically annotated score that illustrates how the musical game is played. A game consists of multiple rounds which increase in difficulty as the game is played. Each round comprises three phases: a PREVIEW phase, a PLAY phase and a SCORING phase. At the beginning of a round, the game enters a PREVIEW phase. At the beginning of the PREVIEW phase the game logic internally generates a random MELODY 20 comprising N notes, for example N=32. The MELODY is generated using a random number generator, which may be the Musical Note Random Number Generator described hereinafter. The MELODY 20 is automatically changed during each round of play to provide the player or players with different note sequences and faster tempos to increase recognition difficulty.

[0043] The game logic also identifies a consecutive 3-note sequence 21,22,23 that is embedded in the N-note MELODY at a random location. The three notes are termed the PREVIEW SEQUENCE 25, because the player may hear (preview) them any number of times before starting a round in an attempt to memorize the 3-note pattern. Every time the player activates a PREVIEW actuator (41 in FIG. 4), which may
involve tapping a graphic symbol resembling a button on surface 12, the three-note PREVIEW SEQUENCE 25 is heard at the same tempo which will be used by MELODY 20 during the PLAY phase of the round.

Although a three note PREVIEW SEQUENCE and a thirty-two note melody are described it will be understood by those skilled in the art that other preview sequence lengths and melody line lengths are possible. For example, a four-note PREVIEW SEQUENCE and a forty note melody line.

The actual notes selected for MELODY 20, and the relative position of the PREVIEW SEQUENCE 25 in MELODY 20 are determined by the game software for every round on a random basis. Therefore, although in FIG. 2 the three PREVIEW SEQUENCE 25 appears as the twentieth, twenty-first and twenty-second notes in the thirty-two note MELODY 20, in the next round a different sequence of thirty-two notes are played, and the position of the PREVIEW SEQUENCE could be anywhere in the melody, for example the 5th, 6th and 7th notes. This variation of melodies and positions of the preview notes within the melody prevents a player from detecting patterns and anticipating the best times to activate the STOP actuator.

During the PREVIEW phase the player may elect to play the round with or without the aid of graphic elements such as 13 in FIG. 1, which animate in concert with the notes as they play. For example numeric digits 1-8 may correspond to the notes G5, A5, B5, C5, D5, E5, F5 and G6 respectively in MELODY 20. As each note of the MELODY 20 is heard, the corresponding graphic may animate, for example by moving down and to the right and increasing in size, and then moving back to its original location and size. This effect can be seen in FIG. 1 as the digit 4 represents the fourth note of the scale which is presently playing and animating the digit 15.

The player may elect to play a round by using the combined senses of sound and vision, or the player may turn off the graphic indicators to play the round exclusively by ear. Since the “Ears-only” choice is more difficult, the player can receive a higher score for a round played without benefit of the animating graphical symbols. The graphic indicators may be turned on and off in a toggling manner by the player tapping the surface 12 anywhere on the graphic array 13. A first tap may turn the graphic indicators off, a second tap may turn them back on, a third tap back off, and so forth.

Whether playing with sound and vision or sound only, the player may enhance his or her chance of success by listening to the notes in stereophonic sound, for example by connecting a set of earphones to the electronic device. The sound production as the PREVIEW or MELODY are played may be arranged such that the lowest note of the scale sounds in the left channel, the highest note of the scale sounds in the right channel, and the intermediate notes sound at proportionally intermediate positions between left and right channels. Such an effect is commonly called the “pan” factor and is readily calculated from the note numbers.

When the player is satisfied that he or she has memorized the preview notes 21, 22, 23, the player may activate a START actuator, which may involve tapping a graphic symbol on surface 12 resembling a START button. This causes the game to enter a PLAY phase or mode. In the PLAY phase, the MELODY 20 plays from the beginning note 26. The player’s goal is to identify the previously memorized preview notes which are embedded somewhere in the melody. Specifically, the player’s goal is to activate a STOP actuator, which may involve tapping a graphic symbol resembling a stop sign 14 on surface 12, when the PREVIEW SEQUENCE 25 is heard, which is precisely the time while hearing the final note 23 of the PREVIEW SEQUENCE 25 and before the next note in sequence 24 begins playing. A preferred game variation allows the player also to achieve a partial score if he/she activates the STOP actuator while hearing the note 23 immediately following the final note of the preview sequence. In FIG. 2 the final note of the preview sequence 23 is designated the HIT note (the player hit the exact note), and the note immediately following the HIT note is designated the NEARHIT note 24 (the player came close to hitting the exact note, missing only by one note). If the player activates the STOP actuator while hearing any other note than the HIT note 23 or the NEARHIT note 24, or does not activate the STOP mechanism at all before the entire MELODY 20 is played, a MISS is indicated.

The scoring system is arranged so that an additional bonus score can be added if the round was played without benefit of watching the graphic symbol animations such as 13. This gives players an incentive to develop ear training, since bonus points are only awarded to players who can successfully play rounds by ear alone. The scoring system also rewards players for having quick reaction times in activating the STOP actuator, as explained in the Scoring section.

To increase the challenge of the game as the rounds progress, the tempo of the notes generally increases for every round. The tempo of the notes played during a preview sequence, such as the PREVIEW SEQUENCE 25, is the same as the tempo of the notes played in the MELODY 20, so the player can hear the tempo for the upcoming round by noticing that the preview notes 25 are heard at a faster and faster rate as the rounds progress. In other words, the player “previews” the three-note pattern and the tempo of the melody for each upcoming round. Even the best players will probably need to start using the visual indicators (the animated graphic symbols) as the tempo reaches a very rapid pace. Deciding when to use the visual indicators thus becomes a strategic and competitive decision for each player.

To heighten the tension as the rounds progress, the musical key of the MELODY notes 20 can be raised in pitch as rounds progress. Accurate musical tuning is maintained in every key. The general increase in pitch and the quickened tempo of every round makes rounds more and more exciting and challenging as the game progresses.

Once the STOP actuator is activated or the MELODY 20 runs out without stopping, the game exits the PLAY phase and enters a SCORING phase. Scoring

In the SCORING phase the player is awarded a round score which can comprise multiple factors.

Depending on the accuracy with which the player identifies the three note PREVIEW SEQUENCE 25, different point values are possible. Scoring for a round can best be understood by dividing the FIG. 2 MELODY 20 into four regions during which the player may have activated the STOP actuator. For the round illustrated in FIG. 2:

A. If the player activated the STOP actuator any time after the first note 26 of MELODY 20 was played but prior to the playing of the third note 23 of the PRE-
A "MISS" is scored since the three notes of the PREVIEW SEQUENCE 25 have not yet been heard.

If the player activated the STOP actuator after the playing of the third note 23 of the PREVIEW SEQUENCE 25, but before the playing of the next note 24, a "HIT" is scored. This gives the highest possible score, since the player has correctly identified the appearance of the three-note PREVIEW SEQUENCE 25 before any other notes thereafter have been heard.

If the player activated the STOP actuator after the playing of note 24, which is one note past the notes in the PREVIEW SEQUENCE 25, but before the playing of the next note in sequence, a "NEARHIT" is scored, since the MELODY 20 has played one note past the three-note PREVIEW SEQUENCE of notes 25.

If the player activated the STOP actuator any time after the playing of note 24 or never activated the STOP actuator, a "MISS" is scored because the melody has proceeded two notes or more past the PREVIEW SEQUENCE 25.

Therefore the outcomes for a round are HIT, NEARHIT and MISS. For a MISS, the player can be awarded zero points (preferred) or a negative penalty value. For HIT or NEARHIT, the awarded score may depend on further factors. These factors may include (a) a Round Value indicative of increasing melody tempo and therefore round difficulty, (b) whether or not the player played the round with "EARS-ONLY", and (c) the player's measured reaction time in activating the STOP actuator. Such factors may be calculated as in Table 1.

\[
\text{TABLE 1}
\]

<table>
<thead>
<tr>
<th>Round</th>
<th>Round Value</th>
<th>EarOnly Multiplier</th>
<th>Reaction Time Multiplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-10</td>
<td>100*Round</td>
<td>1.0</td>
<td>1.0 to 2.0</td>
</tr>
<tr>
<td>11-up</td>
<td>200*Round</td>
<td>1.2</td>
<td>2.0 to 3.0</td>
</tr>
</tbody>
</table>

In Table 1 the score for a HIT equals the following formula:

\[
\text{Hit Score} = \text{Round Value} \times \text{EarOnly Multiplier} \times \text{Reaction Time Multiplier}
\]

For NEARHIT can be:

\[
\text{NEARHIT Score} = \frac{1}{2} \times \text{Hit Score}
\]

To reflect the greater difficulty above round 10, the Round Values and the two multipliers may increase to award players much higher scores for the rounds in which the melody tempo are very fast.

A method for calculating the player reaction time is shown in FIG. 3, which shows two consecutive notes 30, 32 being played in a MELODY 20. The time interval 31 is indicated between notes 30 and 32. This time interval decreases as the rounds progress because the temps increase. A software down-counter is initialized, for example to the value 2.0, and started at the onset of note 30. The down-counter is scaled to divide interval 31 into eleven equal-time zones 34 ranging from 2.0 to 1.0, corresponding to the reaction time multiplier in the first row of Table 1. If the player activates the STOP actuator at 35, the firmware down counter is frozen and the value 1.4 is indicated for the reaction time multiplier. The sooner the player hits STOP after the onset of note 30 playing, the higher is the reaction time multiplier. As Table 1 suggests, the down-counter values may be increased for the more difficult rounds. The software down-counter is re-initialized for every note, so the reaction time may be computed for every note in the melody no matter when the player activates the STOP actuator.

The game could end when a player scores a MISS or after a certain number of Y misses. A preferred way to end the game is to allow the player unlimited misses up to a certain round, such as round ten, and then to end the game for any MISS after round ten. This allows beginners to play ten rounds without ending the game. An on-screen indication such as "From now on any MISS ends the game" may appear on surface 12 at the onset of round 10.

Game Appearance

FIGS. 4-7 illustrate various game screens that may appear on surface 12 in the course of playing a game. FIG. 4 is a PREVIEW phase of the game. An invisible area of touch sensitivity 40 surrounds the graphic indicators 13 (FIG. 1) to allow the player to tap anywhere in this area to toggle the appearance or disappearance of the graphic indicators 13. The player may tap a PREVIEW button 41 to hear the PREVIEW SEQUENCE 25. When the PREVIEW phase commences, the Start button 42 is invisible or dimmed to indicate that the player cannot start the PLAY phase of the game until the player has previewed the PREVIEW SEQUENCE 25 at least once. Therefore tapping the PREVIEW button 41 once causes the STOP button 42 to become active. The player may tap the PREVIEW button 41 as many times as necessary to memorize the PREVIEW SEQUENCE 25.

Scoring values 43 and 44 show the player the scoring factors that are known at the beginning of a round. The Round Value 43 can be column 2 of Table 1, or a value that increases with increasing round numbers. The "Ears-only Multiplier" can have values as shown in Table 1. For rounds 1-10, as the player taps the graphic zone 40, the numerical value of 44 changes as follows:

Initially, the graphical indicators appear and the Ears-only multiplier value displays as 1.0. Tapping zone 40 to remove the graphic indicators displays an Ears-only multiplier of 1.5. Tapping the zone 40 again restores the graphic indicators and changes the Ears-only multiplier back to 1.0, and so on. The player thereby is given visual feedback that a higher score will be achieved in any round played by hearing only.

As an added incentive to the player, the highest score 46 recorded for previously played games is displayed. In a SETUP screen (not shown) the player may reset this high score to 00000. Anytime a player’s game score 47 exceeds the High Score value, the High Score value 46 changes to reflect the new high score.

Once the player taps the START indicator 42, a PLAY phase commences as seen in FIG. 5. The screen 12 is cleared of PREVIEW and START buttons and the two score indicators 43 and 44, and a touch-sensitive, graphic representation of a STOP sign 14 appears. For this particular round, it is seen that the player elected to play by using both senses of sight and sound, evidenced by the presence of the graphical indicators which are the numeric digits 1-8. At the moment in
time represented by FIG. 5, the second note of a scale is presently playing, as indicated by animation of the second graphic symbol 50.

[0071] In FIG. 6 the player has tapped the STOP sign while the third note of the PREVIEW SEQUENCE was playing, and therefore the player scored a HIT as previously described. The “Hit!” indicator 60 indicates success, and the player may see the score calculation 33, 34, 60 and 61. Round Value 33 and Ears-only Multiplier 34 are the same values that were displayed during the PREVIEW phase. Reaction time multiplier 61 is a measurement of the player’s reaction time to hit the STOP button as previously described. Because the player scored a HIT, the round score is the Round Value times the Ears-only Multiplier times the Reaction Time Multiplier, or 200*1*1.7 = 340. This value is added to the player’s total score 47. The player may inspect the round score as long as desired; when the player is ready to start the next round he/she can tap the button 63, taking the player to a new round as in FIG. 4.

[0072] Because the electronic device 11 includes sophisticated sound producing means, the notes heard during the PREVIEW phase and the PLAY phase may be digitized versions of notes played by actual instruments, such as a marimba. Furthermore, the sophisticated sound means allow different reward sounds to play to reinforce the player’s performance when a round is scored. When the “Hit!” graphic appears, it may be accompanied by a crowd cheer sound. In FIG. 7 the player has tapped the STOP sign while the note immediately following the third note of the PREVIEW SEQUENCE was playing, and accordingly the player scored a NEARHIT as indicated by the “Close!” graphic 70. When the “Close!” graphic indicator 70 appears, it may be accompanied by a more subdued crowd cheer sound than the one heard for a HIT. The scoring is computed according to Table 1 and the scoring formulas: The Round Value times the Ears-only Multiplier times the Reaction Time Multiplier, divided by 2 because the player scored NEARHIT instead of a HIT. On this particular round the player elected to play with sound only, as indicated by absence of the graphic indicators and the Ears-only Multiplier value of 1.5. A HIT would have scored 200, 1.5*1.3 or 350, but dividing this by two to account for the NEARHIT (missing the correct note by one) gives the round score of 195.

[0073] In FIG. 8 the player has tapped the STOP sign during a note other than those indicated by FIG. 6 or FIG. 7 and accordingly scored a MISS as indicated by appearance of the “Miss!” graphic 80. When the “Miss!” graphic indicator 80 appears it may be accompanied by a crowd groan sound to punctuate the failure of the player to score in the round. The “Miss: Zero Round Score” graphic 81 is accompanied by a round score of zero, regardless of the factors 33, 34 or 61.

[0074] Because the game uses various sound effects, it is advantageous to give the player accessing means to adjust the relative volume levels of the sounds. For example, activating a Settings function (not shown) may allow the player to adjust the volume of the melody, the HIT sound, the NEARHIT sound, and the MISS sounds. The Settings function may also allow the player to reset the high score value, as previously described.

Musical Note Random Number Generator

[0076] The notes of the melody played during a round are selected on a random basis, so that the melodies are never predictable from round to round or from game to game. Also, for the same reason of unpredictability, the position of the preview sequence notes in the melody pattern is selected on a random basis. The random sequence of tones used to play the melody every round is generated by a computer algorithm that generates random numbers with special properties. An informative article by Martin Gardner in the April 1978 issue of Scientific American entitled “White and Brown Music, Fractal Curves and 1/F Fluctuations” (pp 16-31) which is incorporated herein by reference, discusses computer-generated music, and investigates various types of random number generators and their suitability for generating “random” music. To summarize the article, three types of random number generators can be used to produce random melodies: white noise, brownian noise, and 1/f noise. If a computer is programmed to generate sequences of random numbers of each of these three types, and notes of the scale are assigned to the random numbers so generated, then the resulting melodies will have distinctly different characteristics, some more interesting and pleasing than others.

[0077] Melodies generated with white noise tend to have no correlation, and sound like the dull kind of music that would result from a monkey hitting piano keys with one finger. Melodies generated using brownian noise (where the step sizes, although random, are small) has a “meandering” scale-like sound, also with little interest or aesthetic appeal.

[0078] Melodies generated with 1/f noise have the characteristic of a “fractal” curve, i.e. the sequence of notes is moderately correlated, not just over short runs but throughout runs of any size. (A common fractal example in graphic form is an aerial photograph of a coastline, where the detail of the coastline appears the same no matter what magnification is used to inspect it.) Because of the partial correlation that exists in runs of notes generated with 1/f random numbers, melodies generated with a 1/f noise algorithm are judged by most observers to be more pleasing than those generated with either white-noise or brown-noise random numbers.

[0079] Furthermore, the moderate correlation that exists in melodies generated with a 1/f noise algorithm makes the present invention very interesting and challenging, for the following reason. If a sequence of tones is generated with a 1/f-noise generator, and if a small portion of notes is removed from the sequence and played in isolation (the “preview” notes), then when the entire melody is played there will be many instances when three-note sequences are heard that are very close to, but do not exactly match, the preview notes. This makes the game very entertaining and challenging, and discourages the player’s natural tendency to anticipate by pressing the stop button after hearing two of the three sought notes, just as the third one starts playing.

[0080] The computer algorithm described in pages 24-25 of the Gardiner article for generating “1/f” noise is implemented in the Microsoft C# language subroutine “oof” shown below.

```csharp
1. int d1, d2, d3, d4;
2. byte oof;
3. {
4.    int throwthese, diesum;
5.    throwthese = mask++mask; // XOR old and incremented value
6.    if (((throwthese & 1) == 1) d1 = randObj.Next(); // throw die whose
7.    if (throwthese == 2) d2 = randObj.Next();
8.    if (throwthese & 4) d3 = randObj.Next();
9.    if (throwthese & 8) d4 = randObj.Next();
10.    diesum = d1 + d2 + d3 + d4;

```
[0081] Considering now the function "oof" in greater detail, the "one-over-I" random sequence generator is based on the algorithm mentioned in the Gardner article. The algorithm is based on the analogy of considering four imaginary eight-sided dice, each capable of giving random values between 0 and 7. To generate a random number that has the properties of "1/8" noise, certain imaginary dice are tossed, and the spot totals for all four imaginary dice are added together to give the random value. The key to the algorithm is that not all the imaginary dice are tossed every time, but all of the imaginary dice, whether thrown or not, contribute to the sum. Thus some return their values while others contribute randomly to the sum for any particular "toss," giving the partial correlation property.

[0082] Prior to calling the oof() function the program has initialized the four dice d1-d4 with random numbers. Which of the imaginary dice are tossed each time is determined by incrementing a four bit counter (defined as the integer variable "throwthese" in line 4) and exclusive-ORing the previous counter value with the incremented value. Any "1" bits of the result indicate a changed bit in the 4-bit count "throwthese" For every "1" in "throwthese" the appropriate die d1-d4 is thrown by generating a random number in lines 6-9. Finally, the dice are summed in line 10 and returned after masking with the value 7 to restrict the return value to the numbers 0-7.

Bach Round

[0083] In addition to the random generation of melodies, an added feature of the device 10 is that melodies may also be pre-stored, and substituted for the random melodies, but on a very unpredictable basis. For example, if a player is able to reach round 5 with no misses, and as long as no subsequent round misses occur there is a 50-50 chance in any subsequent round that a melody which consists of an edited version of J. S. Bach's Suite no. 1 in G minor for unaccompanied cello (BWV 1007) will be played in place of the random melody, but only once per game. This melody is stored in a byte array labeled, "bach_notes".

[0084] int[] bach_notes = {0, 1, 3, 5, 6, 6, 1, 2, 0, 2, 6, 7, 7, 2, 0, 2, 0, 3, 7, 6, 7, 7, 3, 2, 0, 4, 6, 5, 6, 4, 6, 4};

[0085] As shown in FIG. 9, the first 32 notes of a Bach piece 90 may be substituted for a randomly generated MELODY 20. If it is decided to substitute the special pre-stored melody in place of the randomly generated melody, the preview notes 21, 22, 23 are selected from the pre-stored MELODY 20 in a random position, exactly in the manner that preview notes are randomly selected in a random melody. The appearance of a pre-stored melody can have a very startling and amusing effect, especially to a musician playing the game who recognizes the pre-stored melody. Due to the unpredictable and fleeting appearance of the pre-stored melody, there will be much puzzlement regarding whether or not the game "randomly played Bach", and players may try in earnest to cause it to occur again.

Game Flowchart

[0086] The game and all of the features therein are implemented by a computer program in electronic device 11. The program for a single player is organized in accordance with the flowchart of FIG. 10, which shows a "top level" flowchart 1000 of the game operations.

[0087] A new game begins at 1001, where determination is made at 1002 if the game is to be played by a single player or multiple players. A player may play a single-player game by default, or the player may direct the device (view a menu item or the like) to attempt to find other players to play a multiplayer game. The multi-player decision is indicated at 1003, which branches to the multi-player flowchart FIG. 11. If the player elects to play the multi-player version and other players are not found (in FIG. 11), the flow re-enters the single-player flowchart at 1013.

[0088] At the beginning of the game, as indicated at 1001, the slowest tempo value and lowest starting note of the scale are initialized.

[0089] The program then sets up a new round at 1004, where it calculates the MELODY and a random number which is limited to possible beginning points in the melody for the three note PREVIEW notes. The program also determines a round tempo, which for the first round is a fixed value, but for subsequent rounds generally increases the MELODY tempo. The program also disables the START button at 1005 to prompt the player that a round cannot start until the PREVIEW sequence has been heard at least once.

[0090] The program then enters the PREVIEW phase at 1006, where the player may tap the Preview button as many times as desired to memorize the 3-note PREVIEW sequence. The first tap enables the START button to indicate the player may now start the MELODY at any time. Also during the PREVIEW phase (not shown) the player may tap the graphical indicators (the digits 1-8) to turn them off or on potentially to increase the round value for "ears-only" mode.

[0091] Once the player taps the START button at 1007, the game enters the PLAY phase at 1008 and the MELODY commences playing. As the MELODY plays, the PLAY phase termination is checked at 1009. If the STOP button is tapped, or if the MELODY has played in its entirety without the player tapping the STOP button, the PLAY phase ends and the SCORING phase 1010 is entered. Otherwise the MELODY continues playing at 1008. At the end of the PLAY phase the MELODY stops playing, a sound effect indicating success or failure is heard, and the program proceeds to the SCORING phase 1010.

[0092] The round is scored at 1010 and the score is indicated to the player. At 1011 the game unit determines whether the game is over, for example if a MISS is scored after round 10. If the game is over the game ends at 1112, where the program checks to see if the historical high score was exceeded, and if it was, the program updates the historical high score to equal the present game score. If the game is still underway in 1011, the program loops back to 1004 to initialize the next round.

Multiple Players

[0093] The game may be extended to play with two or more players in a competitive manner. For example, electronic device 11 may include a wireless link which allows it to communicate with other electronic devices running the same game program. Two common wireless links are Bluetooth and 802.11, otherwise known as "Wi-Fi". Alternately, multiple electronic devices 11 may be linked using the Internet, whereby each device establishes an Internet connection that allows sharing of data between the devices. Such an Internet
The multi-player game operates as described for the single-player game, with the competitive enhancements in the game flowchart in FIG. 11, which shows a “top level” flowchart 1100 of the game operations. The multi-player flowchart may be entered at 1101 as the result of the player selecting the multi-player option 1003 in FIG. 10.

A new game starts at 1102 with the device 11 searching for other players. To be identified as a group player, a player (or players) would have a device 11 in which the game program is installed. For a local group, for example a group of players in the same room, the discovery may be done using the device’s wireless links such as Bluetooth or Wi Fi. For a remote group, the discovery may be conducted by each player logging onto an Internet site. If no other players are found in 1103, the game reverts to single-player mode by returning to the FIG. 10 flowchart at 1104.

If one or more other players are found, each player is notified at 1105 and the multi-player game may commence at 1106. At 1106 a round is initialized as for the single-player game, but with the difference that due to the communication between devices, each device shares the same round number, MELODY, tempo and PREVIEW sequence. As with the single-player game, each players’ START button is deactivated until each player previews the 3 preview notes at least once.

At 1109 a decision is made to start the melody by entering the PLAY phase. There are at least two options for starting a group round:

- After all players have previewed at least once, and any player taps START, or
- After all players have previewed at least once, all players but one have tapped START, and the remaining player then taps START.

The first option (a) can add a competitive and strategic element to the multi-player game. For example, for players A, B, C, and D, each player may have tapped his own PREVIEW button once, and player B may wish to hear the preview notes additional times. However, before player B can tap his PREVIEW button again, player A may tap START to terminate (prematurely, from player B’s point of view) the PREVIEW phase and start playing the MELODY. Therefore the player that thinks he can correctly identify the preview notes after hearing the preview notes only once may gain advantage over those who think they require more hearings by tapping the PREVIEW button multiple times.

A “kinder” method is (b), because the MELODY starts only after all players have tapped their START buttons. However other players may grow impatient while one player repeatedly taps his PREVIEW button, thereby delaying the start of the PLAY phase. Therefore other variations are possible, such as option (b) with the added condition that the PLAY phase starts after a predetermined time, for example 20 seconds. Another option would be option (b) with the added condition that any player has tapped his PREVIEW button a predetermined number of times, for example 4 times.

Another game option may depend on if the group is in all in close proximity, for example in the same room (“local”), or if they are geographically separated (“remote”). For a local group, the PREVIEW notes and MELODY notes may be played in synchronism, with each player hearing the notes at exactly the same time. This would prevent confusion which would ensue if the notes were sounded at different times by each electronic device. For remote users, there is no need to synchronize the playing of notes since each player cannot hear any other player’s electronic device.

For remote players, each round may be played using any PREVIEW-PLAY-STOP timing, but using the same preview notes, melody and tempo as all the other players. This is a great advantage for wireless links and Internet-connected devices because latencies can be significant and unpredictable. Because each electronic device contains a precise, crystal-controlled time base, each player may play identical rounds using identical tempos, with no need to synchronize the actual playing of the notes between devices. Any communication between devices occurs at non-time-critical moments, such as receiving MELODY, PREVIEW and tempo information preceding a round, and tallying round results to determine a round winner.

At 1110 the game program determines if it is time to start the PLAY phase. In the PLAY phase the common MELODY unfolds playing on all devices, at the same tempo. Each player activates his own STOP button at any time, and at 1111 a check is made to determine if all players have tapped their STOP buttons, or the MELODY completed playing with at least one player not tapping his STOP button. At termination of the PLAY phase the game enters the SCORING phase 1112.

In the SCORING phase 1112 the devices communicate among themselves to determine which player was the highest round score. If all players score a MISS, no player is awarded points. The highest scoring player is awarded his round points, and the victory sound plays only on the winning player’s device. The players other than the winning player may receive a message such as “Sorry, Player 2 won the round” accompanied by a sound, for example a “raspberry” sound.

As the competitive game is played, players will drop out of the game due to a MISS. At 1113 the program checks to see if any players are still active, and if so it loops back to 1106 to initialize a new multi-player round. Note that the game continues even with only one player active, to allow that player to maximize his game points and attempt to best the historical high score. If the game is over at 1114 the results are shown on all electronic devices, for example “Winner” on the winning device and “Loser” on the others.

As previously mentioned, a concern with wireless links can be delay time or latency. The multi-player arrangement exchanges data between devices only at moments that are not time-critical. For example, each device keeps its own accurate time base for playing PREVIEW or MELODY notes, and for recording precise player reaction times. Since data is exchanged only at the setup and scoring phases of the game, the wireless link may incur delay between the devices with no detrimental effect on group play. This makes the multi-player version of the invention amenable to a group of players in the same room, or across the world and connected by the Internet or another network including but not limited to a wireless network.

FIG. 12 illustrates how three LOCAL players A (1200) B (1201) and C (1202) may play a multi-player game. Such players are typically located in the same room or in close proximity as indicated by 1203. In this case the devices can communicate among themselves in a local (non-Internet connected) manner, for example over their Wi-Fi or Bluetooth wireless links. After a LOCAL multi-player game is initiated,
each round plays in a synchronous manner, whereby the MELODY is heard in each electronic device in synchronism (or “in step”) with all the other players’ devices. In other words, each player hears the MELODY from his or her individual device as if it were emanating from a single speaker. This eliminates the distracting effect of hearing the MELODY playing at different times by each other player’s electronic device.

FIG. 13 illustrates how a multi-player game may be played between geographically dispersed players D-H (1302-1306). The “cloud” 1300 is a well-known term describing remote services available on the Internet, for example to store documents or to coordinate multi-player games. Each player 1302-1306 logs onto a remote game server 1301 which supervises the formation of multi-player groups and coordinates the rounds between the players as will be described.

FIG. 14 is a combination of local and remote players playing a multi-player game. The Players A, B and C may elect to play locally among themselves as in FIG. 12, or they may elect to play with remote players G (1305) and H (1306). In the latter case players A-C each log onto the Game Server 1301 as would any remote player. This mixed configuration, where local players may play against geographically dispersed players, can encourage team play, since the local players A-C can confer among themselves as the rounds are played.

Turning now to FIG. 15-FIG. 20, a series of game screens is shown that may be used to initiate, play, and score a multi-player version of the game.

In FIG. 15 each player is shown a “New Game” indication 1500 and given multiple choices for starting a new game. The player may tap 1501 to play a single-player game as shown on the flowchart branch 1002-1004 in FIG. 10.

If the player taps the LOCAL MULTIPLAYER button 1502 the electronic device may begin searching for other local players using a local link, such as the wireless links using Wi-Fi or Bluetooth. If the player taps the INTERNET MULTIPLAYER button 1503, the electronic device may attempt to log on to an Internet GAME SERVER 1301.

Ahead of time, the player may have used a menu screen (not shown) to indicate the maximum group size desired for multi-player play, and the game may indicate this at 1504. If the player never accesses this menu it is advisable to set a default maximum group size, for example six.

In FIG. 16 the game indicates that a search for other players is underway 1600, corresponding to 1103 in the FIG. 11 flowchart. Whether the game is being played locally (because the player tapped button 1502) or remotely (because the player tapped button 1503), the game indicates success connecting to other players at 1601, or failure to find other players at 1700 (FIG. 17). Failure to find other players may depend on several factors, and the game may give diagnostic information to aid the player in correcting a situation that would prevent discovery of other players. Two examples are:

1. One or more electronic devices in a local group may have its Bluetooth or Wi-Fi radio turned off, in which case the game program may inform the player to turn it on to enable multi-player play.

2. One or more electronic devices may not have an Internet connection, in which case the game program may inform the player to turn on Wi-Fi or the telephone connection to the Internet.

Once a connection problem is corrected the player may see the FIG. 15 screen again and initiate another game.

A multi-player PREVIEW phase is shown in FIG. 18, which is the PREVIEW screen of FIG. 4 with added graphic symbols 1800. The set of graphic symbols 1800 may be tokens that indicate the round status of each individual player in the multi-player game. For example, observing the color of each player’s token, GREEN may indicate the player is in the MELODY phase of the round, and RED may indicate the player has completed the round. For a LOCAL multi-player game, all the player tokens would turn YELLOW at the same time because the melody is playing at the same time for all players. For a REMOTE (Internet-Connected) multi-player game, the player tokens would change colors independently indicating that each player may PREVIEW, play, and end his or her individual round at different times (“non-synchronous” play).

Once all numbers 1800 indicate that all players have completed the round, the game program running in each electronic device causes the devices to communicate in order compare individual scores for the purpose of determining the winner of the round. For a local group 1203 this may be accomplished over the electronic devices’ wireless links. For a remote group as in FIG. 13 the Game Server 1301 communicates with the game program in each player’s electronic device and sends the necessary scoring data.

As previously described, the player with the highest round score wins the round, and each player is given this indication, for example 1901. In addition, the winning player’s token 1900 may animate, for example blinking a new color. If any players are still in the game, the multi-player game then returns to the PREVIEW screen in FIG. 18 and the next round is played.

If the game is over the wireless links or Game Server 1301 communicate information to the game program in each electronic device to enable the game program to display a screen showing game results, which may consist of a score tally for each player 2001, and animation of the winning player’s token 2000. For Internet-connected players, and as additional player incentive, the Game Server 1301 may also communicate the historical world-wide high score to all electronic devices for display by each game program in 2002. As is common in the literature, the game program in each electronic device may provide for each player to register his or her initials using a menu screen (not shown) which allows player initials to appear in 2001 and 2002.

Although the invention has been described with reference to the above examples, it will be understood that many modifications and variations are contemplated within the true spirit and scope of the embodiments of the invention as disclosed herein. Many modifications and other embodiments of the invention set forth herein will come to mind to one skilled in the art to which the invention pertains having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the invention shall not be limited to the specific embodiments disclosed and that modifications and other embodiments are intended and contemplated 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.

What is claimed is:

1. A method of facilitating the playing of an electronic musical game using a group of game devices, each being activated by a different player, comprising:
generating non-synchronously a sequence of musical melody notes forming a melody on the game devices after all players have previously received on their game devices a recognition sequence of certain notes forming a portion of the musical melody notes; generating STOP signals on one or more of the game devices; generating on each game device incrementally quantifying reaction time signals during the playing of the musical melody notes to identify the recognition sequence; generating a score for each game device for each round in response to the reaction time signal; and

generating a score for each game device for each round in response to the reaction time signal.

7. In a method of facilitating the playing of a game, a computer program for being executed by a computerized game device, according to claim 6, further including generating a selection signal corresponding to either a single player game mode or a multiple player game mode on one of the game devices.

8. In a method of facilitating the playing of a game, a computer program for being executed by a computerized game device, according to claim 7, further including generating a selection signal corresponding to either a local game mode or a remote non-synchronous game mode, or both.

9. In a method of facilitating the playing of a game, a computer program for being executed by a computerized game device, according to claim 8, wherein during a non-synchronous game mode, one of the game devices can generate a START signal, while at least one of the other game devices can generate non-synchronously preview signals for playing the recognition sequence.

10. In a method of facilitating the playing of a game, a computer program for being executed by a computerized game device, according to claim 9, further including playing all notes from the game devices in stereo to provide a further cue for the user.

11. A method of facilitating the playing of an electronic musical game using a group of game devices, each being activated by a different player, comprising: generating non-synchronously a sequence of musical melody notes forming a melody on the game devices after all players have previously received on their game devices a recognition sequence of certain notes forming a portion of the musical melody notes; generating STOP signals on one or more of the game devices; generating an incrementally quantifying reaction time signal relative to the playing of the last musical note corresponding to the recognition sequence for each game device; and

generating a score for each game device for each round in response to the reaction time signal.

12. A method according to claim 11, further including a group of graphic signals displayed on the game devices to indicate PREVIEW and MELODY.

* * * * *