Guitar Hero*: "Not like playing guitar at all"?*

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Abstract

This paper examines the *Guitar Hero* franchise's 'simulational' fidelity in respect to actual guitar-playing. This relationship is often overlooked by many who claim that the game is "not like playing guitar at all". While there are some significant differences between *Guitar Hero* and guitar playing, the author takes an in-depth look at the game's controller and interface to argue that these differences are not as important as they may first seem. This paper will argue that game does not perfectly simulate any one dimension of music and guitar playing because it takes another approach toward simulation, favoring breadth over depth. This investigation herein results in a distinction being made between two simulation models for games.

Introduction

I first encountered *Guitar Hero* (Harmonix Music Systems, 2005) at the 2006 Canadian Game Studies Association symposium. In a room filled with friends and strangers, I laughed and head banged relentlessly, madly clawing at the plastic buttons of the attractively-shaped special controller that would soon become ubiquitous among gamers both casual and hardcore. The game's contagious appeal had begun to spread, and I was infected. *Guitar Hero* had such tremendous success that, late into the second night of the conference, the game room was still resonating with rock anthems. The other available games – a dozen or so – remained on a table, collecting dust and occasional looks of pity from the players and spectators. We merrily sang and strummed through the various songs well into the wee hours of morning. Clearly I was not the only one affected by the *Guitar Hero* virus: it seemed to rival the mythical *Pac-Man fever* (Namco, 1980, for the game; Buckner & Garcia, 1982, for the music album) that I had read about.

Yet all was not perfect beneath this surface of festivity. My fingers were fumbling between the large plastic buttons. I was frequently missing notes – easy notes! – and the structure of chords seemed confusingly arbitrary. At times I had trouble understanding the link between what the screen was telling me to play and what my ears were decoding. I was often playing many more notes than the game was asking me to. This was not right. After all, I was both a good gamer and a good guitar and bass player; there had to be some sort of rational explanation for this phenomenon. After blaming the guitar's strum bar, the game's interface, and some lag that I imagined to be occurring somewhere along the cable running from the *PlayStation 2* to the video projector, I finally tried to justify my poor performance to the strangers in the room by saying that, "this game is not like playing guitar at all".[1] Obviously there was pride at stake in that sentence, but it was not completely unfounded either. Can a plastic controller shaped like a guitar, with five buttons and a crude 'strum bar', manage to represent the act of playing a guitar, if not perfectly, at least accurately enough for us to recognize it as such? In what ways is it different from the act of really playing a guitar, and how do game mechanics and hardware attempt to

bridge these gaps?

Music and guitar fundamentals

The choice of the title *Guitar Hero* marks a choice on the developers' part: the game promises to tap into common fantasies of rock superstars playing in front of large audiences more than it guarantees raw simulational fidelity in the act of playing guitar. Nevertheless, this does not mean the game is not trying to accurately model the act of playing guitar, albeit with a greater focus on fun and accessibility than on realism. In terms of game mechanics, this difference can be understood as an emphasis on breadth and a deliberately limited depth. The strategy is to represent 'a little of everything' to ensure the game experience is close enough to the idea of playing guitar, but to keep everything simple so people with no prior guitar skill can easily pick up the game and play.[2]

The exact breadth the game needs depends on the object it attempts to model: in this case, a musical instrument. Therefore, the basic components of music need to be distinguished in order to properly evaluate the accuracy of *Guitar Hero* and its controller. At the core, they are *melody*, *harmony*, and *rhythm*. Melody can be understood as the succession of pitch intervals (the horizontal axis on sheet music), harmony as the simultaneity of multiple pitches (the vertical axis on sheet music), and rhythm as "the controlled movement of music in time"[3]. Sometimes *timbre* ('sound colour' or 'texture') is added to the mix, or the essential quality of *structure* that is responsible for organizing sound into music, or the *dynamics* that differentiate between notes played softly or aggressively. But insofar as these are already taken care of in *Guitar Hero* (since the songs have already been written and the guitar track is pre-recorded and simply played back), we need not concern ourselves with them for the purpose of this investigation. Each of the three main dimensions of music enumerated above need to be somehow simulated in accordance with the way they are handled by a real guitar. Does the controller live up to the task?

Most of the discussions that revolve around the game controller and its simulational fidelity (such as one to be found on Jesper Juul's blog[4]) note three problems:

1. The controller only has five buttons, while a guitar has at least four times as many frets;
2. These buttons are all aligned as if to form a single virtual 'string', while a guitar usually has six strings;
3. Because of these limitations – and since songs use more than five notes – pressing the same button produces different notes throughout a song, whereas on a real guitar, pinching a string on a given fret always yields the same note. This makes the construction of chords[5] and melodic progressions in *Guitar Hero* seemingly arbitrary. For instance, during the first verse of the song "Dead!" by My Chemical Romance in *Guitar Hero 2* (*Xbox 360*, Expert difficulty), the 'power chords' (perfect fifths) are simulated by the player having to push down two buttons separated by a button in-between. The first two chords, G and F#, require the player to hold down the red(2) and blue(4) buttons, then the green(1) and yellow(3) buttons, which is, so far, a fairly accurate representation of playing the song on a real guitar. The third chord, E, however, is another power chord that should follow the same structure, but this time the game represents it with two buttons next to each other, green(1) and red(2). This is a good example of inconsistent simulation.

While these observations are all valid, they turn out to be much more complex under further scrutiny. Without delving into the technical details of lutherie, it is necessary to list a number of guitar

properties and explain how they interact in the instrument's sound generation process across the three dimensions of music. A guitar is a plucked or strummed stringed instrument (unlike a violin, which is played using a bow), although a plectrum (a 'pick') can be used instead of one's fingers. The player's hand (left or right) is used to strum, pluck or pick the strings, which produces sound in *rhythm*. Since a guitar has six strings, up to six notes can be played simultaneously, that is, in *harmony*. The strings can be played 'open' (without the guitarist using their left hand) as they are carefully tensioned to particular notes (E, B, G, D, A and E in standard tuning). When the player pinches a string on the fretboard with her left hand, she effectively shortens the length of the string, which alters the frequency of the sound produced and thus provides a higher pitch: this is the basis of guitar *melody*.

A guitar fretboard is divided into frets (horizontal metal bars placed at mathematical intervals) to even out the pitch variations.[6] The 6th string played open results in the lowest possible pitch of the instrument, an E in standard tuning (seen at the lower-left corner of *Figure 1*). Going down (right on the figure) one fret on the fretboard corresponds to one key forward (including blacks) on a piano, and every string can be thought of as a 'jump' forward five or four keys. A standard electric guitar has six strings and typically sports 21 to 24 frets which yield a range of 47 to 50 different notes, as illustrated in *Figure 1*.

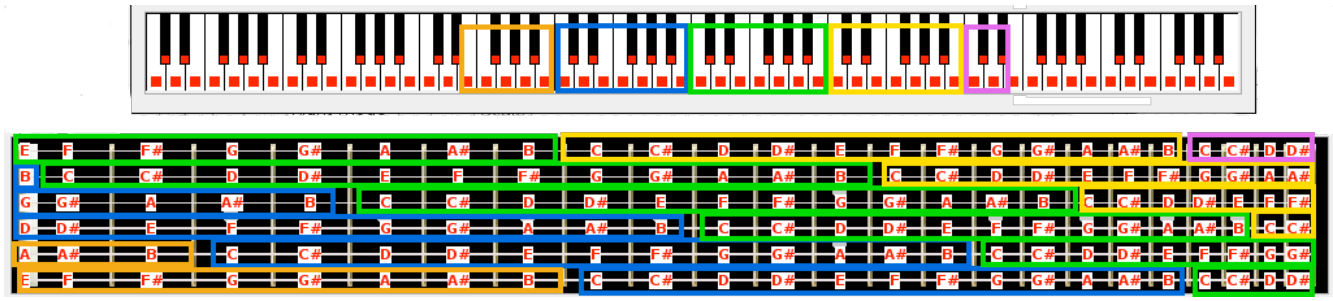

Figure 1: Range of a 22-fret electric guitar (bottom), shown next to a keyboard (top) as reference

Guitar Hero's **physical interface**

This initial difference between a real electric guitar's 22 frets and the *Guitar Hero* controller's measly five buttons appears to be the most fundamental. There are, after all, a substantial forty-ish notes lacking. Is this not as limiting as if a hypothetical *Piano Hero* game were to be released with a five-key controller? Not quite. The act of playing the guitar is a combination of two playing styles. The first can be described as moving the left hand up and down the neck (horizontally on *Figure 1*) to reach different frets. The second, commonly called 'position playing', consists in covering four frets with one's four fingers and playing across all six strings (vertically) without moving the hand up or down the neck, stretching the little finger to cover a fifth fret when needed. This method gives access to 29 different notes in a single position, and is necessary for one to successfully play fast passages. Thus, while the game controller only offers five buttons, there is a similarly sizable proportion of guitar playing that involves only five frets at a time. What is missing from the simulation is not the 20-or-so other frets found on a real guitar, but rather the quick transitions from one five-fret position to another on the fretboard. This feature reduces the apparent gap in complexity between the game hardware and an actual instrument, and any attempt at equating the number of buttons on the controller with the number of frets on a real guitar, such as the first observation I have listed above, must take this into account.

This observation directly ties into the third typical reaction toward the game. Many new players (myself included) are baffled or confused by the way *Guitar Hero* represents many of the songs' melodic phrases. As mentioned earlier, the problem is simple: the game controller has only five buttons (and even then, only three or four of them are used on Easy and Medium difficulty levels), but many melodies contain more than five notes. The solution to this problem is complex, in part because of our expectations. Intuitively, players expect the controller buttons to represent incremental pitch, as on a piano: one button forward should mean one degree higher on the scale. Yet it is not unusual, when playing the game, to be asked to do some back-and-forth between buttons to play what sounds like a linearly ascending melody. The irony is that these parts can be the most realistically simulated sections of a song. They may seem non-intuitive, but playing a linearly ascending melody on a real guitar is just as non-intuitive.

For instance, if one insists on linearly playing a simple C Major scale, one can pinch the 3rd fret on the 5th string with the index to get a C, then the 5th fret on the 5th string with the ring finger to get a D, then the 7th fret on the 5th string by stretching the little finger to get an E. So far, so linearly good. Then the player pinches the 3rd fret on the 4th string with the index to get an F (there goes linearity!), and so forth. But a more efficient way to do this on a guitar would be the following: 3rd fret/5th string with middle finger for a C; open 4th string for a D; 2nd fret/4th string with index for an E; 3rd fret/4th string with middle finger for an F; open 3rd string for a G, and onwards. In any case, unless one plays slow songs that allow him the luxury of moving his hand up and down the neck to sound every note from a single string, finger work in guitar playing has no direct correlation to pitch. If the index finger is positioned over the 3rd fret it can pinch any of the six strings, and thus very well play a higher note than the other three fingers that cover the 4th to 7th fret if it pinches a physically lower (and thus higher-pitched) string.

Thus, the observation I listed earlier to the effect that, on a real guitar a fret will always yield the same note whereas in *Guitar Hero* a single button can stand in for many different notes, is not entirely true because it is not fully articulated. A given fret will not always yield the same note, but any of *six* notes, depending on which string is pinched. The source of this confusion seems clear: at first glance, when we look at the controller we see five buttons aligned vertically but the horizontal dimension of guitars (the strings) appears to be absent. We consequentially assume that these buttons are meant to represent one virtual string. In reality, six strings are compressed into each button. To say that the controller's fifth button is meant to simulate the fifth fret of a guitar is only a partial statement; it is actually meant to simulate the fifth fret of a guitar *across all six strings*.

The *Guitar Hero* controller flattens the width of the guitar neck. With this in mind, the construction of melodic phrases in the game can be understood, and it appears there is a method to this madness after all. But *Guitar Hero* seems to only model actual guitar fingering patterns as a last resort, or 'when all else fails'. Most of the time, the songs are coded in the game engine as simple relative pitch differentiation. All the pitch intervals of a given segment are calculated, ordered, and then assigned to buttons for the player to push in sequential order from lowest to highest pitch, without taking into consideration the actual fingering patterns that would be required to play the segment on a guitar. It is frequently found that, to take a simple example, a linear descending or ascending motion along four or five notes is coded in-game as a simple progression from the first button to the fourth (or fifth), even if these notes clearly would not be immediately adjacent to one another on a guitar.[7] *Guitar Hero* privileges this because it is much more intuitive for everyone (except perhaps the trained guitarist), in keeping with the game's focus on breadth and accessibility. Every person with a basic sense of pitch can easily foresee whether the next note in a known (or expected) melody will be higher or lower than the previous, but knowing the position of this next note on a guitar fretboard requires a

transposition that is near-impossible without training (and especially in real-time performance).

To conclude with melody, there is indeed something arbitrary about the transposition of notes into *Guitar Hero* buttons, but it is not wholly inaccurate or without foundation. It is the sudden switch from one mode of transposition to the other – from a simulation of guitar fingering patterns to simple differential pitch intervals – which creates this impression. A more serious problem that the *Guitar Hero* player faces is the impossibility of playing an open string.[8] In some cases the song is coded in-game by ignoring the open-string note, but in others, it is assigned to one of the buttons (typically the topmost), which requires unnaturally difficult movements. This can make some parts, or even whole songs, much harder to play than they would be on a real guitar (I would personally pick Avenged Sevenfold's "Beast and the Harlot" song from *Guitar Hero 2* as a case in point). However, it does not detract enough from the simulation to make it completely alien to what playing a guitar is, because it makes sense within the mode of differential pitch intervals.

Guitar Hero's visual interface

Earlier I mentioned that *harmony* is achieved on a guitar by virtue of its six strings. I then demonstrated how the *Guitar Hero* controller folds these strings into each single button. While this resolves the issue of faithfulness to melody, it does not help with harmony at all. If the game controller effectively flattens the width of the guitar's neck, it is not exaggerated to say that a dimension goes missing in the process: the possibility of playing across strings. By itself, the game controller is not a perfect simulation, but the game software remedies this through its visual interface that successfully models the two remaining dimensions of music, harmony and rhythm.

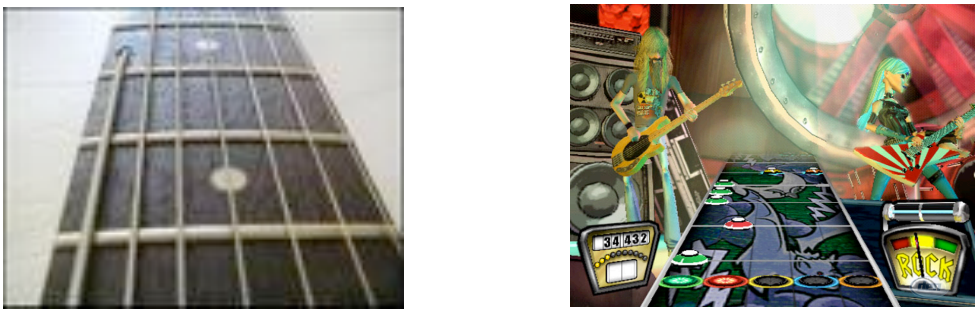

Figure 2: A view of a real guitar (left) trying to replicate the *Guitar Hero* interface (right)

When a player performs a song in *Guitar Hero* (as in *Figure 2*), she is shown a guitar fretboard (decorated with ornaments and engravings such as skulls or hearts, depending on the character she chooses to play as) stretching indefinitely into the Z-axis. The different buttons on the game controller, each with its own colour, are laid out horizontally at the bottom of the screen. Their placement has nothing to do with simulating frets, but instead simulate guitar strings as illustrated with the image of a real guitar in *Figure 2*. This allows the integration of chords into the songs. The game's visual interface then provides a way of simulating harmony that is absent from the controller. As was the case with melody, chords are generally constructed using differential intervals rather than accurate guitar fingering. When it is possible, the omnipresent 'power chord' (the perfect fifth interval so popular in hard rock and metal music) is modeled rather faithfully, the player having to press down two buttons separated by another. Sometimes, however, this is not possible, as the structure of a power chord means there are only three fingering possibilities among a five-button span (1+3, 2+4, and 3+5). Any song

with more than three power chords in a single section (or even less when playing on Easy or Medium, or when there are three-button chords) must resort to differential pitch intervals instead, usually by compressing power chords to simply two consecutive buttons (which then yields four fingering possibilities: 1+2, 2+3, 3+4, and 4+5), or mixing both (for a total of seven). In any case, differential pitch cannot be avoided when an interval of a fourth needs to be simulated, as a fourth on a guitar is played by pinching two strings across the same fret: a feat that is not possible using the *Guitar Hero* controller. As was the case with melody, the simulation of harmony is satisfactory, but not perfect. It is, however, and quite puzzlingly, better than the simulation of *rhythm*, a point which is never brought up in discussions on the game's simulational accuracy and which I want to address here.

When a player plays through a song, the virtual guitar neck scrolls towards her like a conveyor belt at the tempo of the song and, as the notes are revealed, she must hit them with precise timing. When she does, the guitar track is heard over the song as normal. When she misses a note, the guitar track is muted while the other instruments (and singer, if any) keep going, until the player can successfully hit another note, and the guitar is heard again. (As an aside, it is interesting to note that on the virtual guitar neck displayed on-screen, the horizontal bars that would normally stand for frets are converted into measure bars to mark the song's tempo.) The game's algorithm takes care of the rhythm, in a sense, since every note has been programmed in accordance with the rhythm. Usually when *Guitar Hero*'s capacity to actually teach something about playing guitar is questioned, people are willing to admit that it at least helps one's sense of rhythm. After all, does this game not belong to the genre called 'rhythm' games?

I am willing to take a risk here and argue that rhythm is the worst simulated dimension of guitar playing in *Guitar Hero*. First, let me clarify what I mean by that. I strongly believe that *Guitar Hero* can be a powerful tool to teach rhythm since it requires perfect timing from the player. However this capability and the game's simulational accuracy are two completely different things. If I play out of rhythm with my band, every note I play will be distinctly produced just as if I had played it in time, much to the ire of my fellow musicians. It would be a lot more convenient if anyone who played out of time had his amplifier or microphone instantly turned off (or his drum sticks withheld) until he made his way back in tempo. Correcting a bad sense of rhythm could be done very easily. So, in a sense, it is desirable that *Guitar Hero* works this way as I suspect it would be difficult for the player to receive proper feedback, and to understand why their performance was poor, if they were slightly out of time yet the game allowed them to continue regardless. However, this system is radically different from what playing guitar is: it is much too strict.

In the end, perhaps there was more pride than fact when I hastily declared that "this game is not like playing guitar at all". Throughout this discussion I have tried to argue that *Guitar Hero* can be seen as a simulation (or that it is at least closer to a simulation than some would make it appear to be), insofar as we accept that the term can describe a range of varying accuracy and purpose. Rune Klevjer's usage of the word in his article "In Defense of Cut-Scenes" illustrates this:

> In a strategy game like *Sim City*, the simulation establishes a characteristic analogy between the player-machine-relation and the player-world-relation: balancing parameters *is like* rational managment of a city. System A (the computer program) is analogous to system B (the city) — both systems being a specific interpretation of the other. (Klevjer, 2002)

Guitar Hero may feature a guitar without strings (on the controller, the physical interface), a guitar without frets (in the game's visual interface), and a guitar without sound (when the player does not play in tempo), but when taken as a whole, it is nevertheless accurate since it appropriately

simulates the way a guitar handles melody, harmony, and rhythm. *Guitar Hero* stays at the surface level but that does not mean it cannot be an accurate simulation, just as *Sim City* succeeds at being a simulation of city management by the sheer amount of interlocking mechanics it features. *Guitar Hero* shows us that a simulation can work in either of two ways: by modeling as many facets of an experience as possible (breadth), or by simulating as closely as possible a few parameters of an object or experience (depth).

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Footnotes

1 Robert Parungao would later corroborate my first-time impressions by stating, in a *Guitar Hero* study day organized by video game research groups Ludiciné and Montreal GameCODE on January 26th, 2007, that his guitar-playing friends made identical observations when they first played the game.

2 See http://booboo.phpwebhosting.com/~ubiq/index.php?p=158 for more on breadth and depth in video games (accessed November 30th, 2007).

3 Virginia Tech Multimedia Music Dictionary, accessed November 30th, 2007, at http://www.music.vt.edu/musicdictionary

4 Jesper Juul's blog, accessed November 30th, 2007, at http://www.jesperjuul.net/ludologist/?p=312

5 I use the word here in the colloquial sense of 'more than one note at once' and not, as in music theory, to refer to at least three notes (which excludes dyads).

6 Without frets, a string can be pinched a few millimeters higher than the position required to produce an A but still below what it takes to get an A#, which results in an off-pitch note. This can happen on fretless instruments such as a violin, double bass, or on fretless guitars and basses.

7 A perfect example are the two introductory sections to Megadeth's "Hangar 18" song in *Guitar Hero 2*.

8 This is not a hardware problem *per se* but rather a design choice, as the controller can indeed recognize stand-alone toggling of the strum bar. However, it concerns the player's physical interaction with the game's controller, so I will list it here.