

# The Wii Loop Machine

## Musical Software Development for the Nintendo Wii Remote

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**Abstract.** This paper will discuss the Wii Loop Machine, a standalone application built in March 2007 in Max/MSP that enables anyone to generate and manipulate music wirelessly using the Nintendo Wii Remote. While not the first “software hack” to use the Wiimote to play with music, I would argue that it is perhaps the most successful. I will explain the conception and creation of this project, as well as its reception. I will examine why the Wii Loop Machine was so successful, and share some ideas concerning its potential as a commercial product.

### 1. Introduction

The Nintendo Wii console was released towards the end of 2006 in North America, Japan, and Europe. By all accounts the reception took virtually everyone by surprise – Amazon.co.uk’s entire pre-order stock was sold out in just seven minutes, making it the fastest selling product in the site’s history.<sup>1</sup> Since then the console has unexpectedly outsold the Sony Playstation 3, has even outpaced the Xbox 360 to become (according to some reports) the highest selling seventh generation gaming console.<sup>2</sup>

Why is the Wii console such a success, breaking all sales predictions and perhaps even reinventing the console gaming market? Many have remarked on its relatively poor graphics and sound capabilities, at least compared to the rival Xbox and PS3 devices. However this is only a consequence of consumer-oriented, rather than spec-oriented design. Much thought has been put into making the Wii console fun, classy, and endearing to as many people as possible; this is a breath of fresh air in a market where consoles are typically designed only for speed and power, in order to play blindingly fast and realistic games.

Perhaps even more crucial to the Wii’s success has been the innovative wireless Wii Remote. By using motion sensing technology the controller has captured the imagination of millions of people who imagine swordfighting, driving, or playing an instrument simply by moving around. Gestural control is certainly a romantic notion that appeals to gamers and non-gamers alike, although it has ironically become one of the major critiques of the console as well; when not completely accurate it can be infuriating.

Parallel to this success a growing “hacking” community has flourished online, generally centered around using the innovative wireless Wii Remote as anything from a replacement mouse to a Vjiiing tool. Thanks to the tools developed by this loosely affiliated group of independent programmers I was able to create a piece of music software called the Wii Loop Machine, which uses the Wiimote to launch and manipulate audio in real time. This software was unexpectedly successful, in part thanks to a general enthusiasm for all things Wii, but mostly because it was the first standalone application for creating music with the Wiimote. I believe that the success of the Wii Loop Machine exposes a major untapped style of commercial music software.

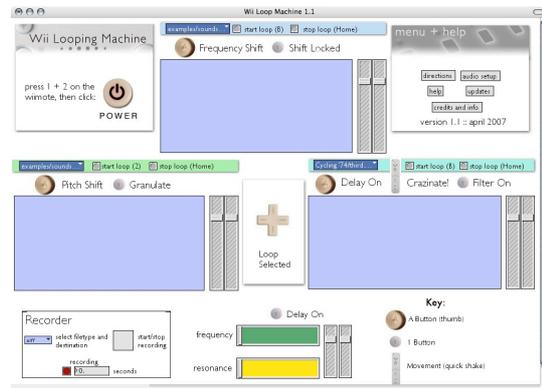


Figure 1: Wii Loop Machine Screenshot

### 2. Development of the Wii Loop Machine

#### 2.1. The Wiimote and the “hacker” community

The Wiimote was very quickly picked up by the so-called “software hacking” community, with sites like Wiili.org sharing information about how to access and manipulate the Wiimote data. Part of the allure was the controller’s use of the Bluetooth wireless standard to communicate with the console. This theoretically meant that it could also be used with any Bluetooth enabled computer, making it the most easily appropriated major console controller on the market. In addition, the Wiimote can be bought separately from the console for US\$40, which is an extremely attractive price considering it has three accelerometers, 11 buttons, and an infrared sensor. Building a comparable controller yourself would be significantly more expensive (and probably not as solid).

Much of the hacking community has focused on using the Wiimote as a gestural interface for music and video. The use of movements to manipulate media is particularly appealing to electronic musicians and video artists sick of performing with a computer mouse and keyboard.

Three of the major successes to date, in terms of independent Wiimote development, have been GlovePIE, Darwiin Remote, and aka.wiiremote.

GlovePIE<sup>3</sup>, by Carl Kenner, is a Windows-only text-based coding application (similar to Java and BASIC) that creates an emulation of a joystick or a keyboard from a video game controller input. This has been used very successfully with the Wiimote to control a number of different types of software. The

<sup>1</sup> *Wii Crushes Amazon Pre-Order Records*, computerandvideogames.com

<sup>2</sup> *Nintendo Wii is market leader in home console business*, vgchartz.com

<sup>3</sup> <http://carl.kenner.googlepages.com/glovepie>

interface is not particularly user friendly, however, and someone without at least some coding knowledge would be unable to do anything complex.

Darwiin Remote<sup>4</sup>, by Hiroaki, is a nicely designed software interface for the Wiimote on Mac OS X. It accesses the Wiimote automatically and allows you to use it as a mouse replacement, or to control other software. While very simple to use and well designed, Darwiin is not a very powerful tool.

Aka.wiiremote,<sup>5</sup> however, is an extremely powerful object for Max/MSP that facilitates access to the Wii Remote data. Created by Masayuki Akamatsu, it has been continuously updated since it's release, and now boasts full data capture from the Wiimote as well as many of the peripheral controllers (nunchuck, classic, etc). It is well designed and easy to use, with a very nice help file. The only downsides are that you must be quite familiar with Max/MSP to take advantage of its features, and it is only available for Mac OS X. Similar Max objects have appeared for Windows, although nothing quite as powerful.

Although many pieces of computer software have been released in the past few months that use the Wiimote to control music, video, games, and much more, GlovePIE, Darwiin, and aka.wiiremote have been perhaps more important, in that they are tools that allow for the relatively easy development of software to use the Wiimote. Nearly all independent computer-based Wiimote software is indebted to at least one of these three tools.

## 2.2. The concept

In March of 2007 I decided to use the aka.wiiremote object in Max/MSP to create a piece of standalone Wiimote-enabled music software as part of my Sound Design Masters course at the University of Edinburgh. I wanted it to be loop-based, much like Ableton Live, and at every point I wanted to make it simple and straight forward, easy enough for anyone to use. I had found then, and I still find to a certain extent, that nearly every software tool for using the Wiimote was unnecessarily difficult to use, and accessible only to coders and programmers. In addition, I generally find that most „pro-sumer“ music creation software (Reason, Live, etc) has a relatively steep learning curve, shutting out a vast quantity of people who want to make music but do not have the time or prior knowledge needed in order to do so. These two concerns, I felt, could be addressed and combined with the general enthusiasm for the Wiimote by gamers and non-gamers alike.

## 2.3. Building the Machine

Although linking the controller to the computer can be a bit confusing at first, as a general rule the aka.wiiremote object is quite simple to use and allows very easy access to the data from the Wiimote. However I soon learned, as have most independent Wiimote developers, that this data is quite difficult to use and manipulate.

While using movement to control various musical parameters from filter frequency to grain location is an exciting concept, accelerometers are not necessarily a very efficient way to achieve those goals. The three accelerometers in the Wiimote can very accurately measure rotation, which means that slow turning motions can be used effectively, but this is a rather boring method of manipulating music, and is not what people expect or want to do with a Wii controller. Faster or more drastic movements are much more difficult to track, as the

accelerometers only give useful data whilst the Wiimote is moving. It is very difficult to accurately describe mathematically where someone has moved the controller, or how far. This in turn makes designing musical applications for the accelerometer data quite problematic (particularly for a musician with no mathematical training).

Unfortunately, the first thing most people do when picking up a Wiimote is swing it about like a sword – a far cry from the delicate movements that are easy to track and map to musical parameters. Therefore I decided to create some effects that would take advantage of these extreme movements, if not entirely accurately.

The infrared sensor in the Wiimote is, of course, far more precise than the accelerometers, and is used by pointing towards the screen. This sort of tool has huge potential in terms of musical interface, but requires a “sensor bar” to triangulate the infrared signal and turn it into useful data. The Wii console comes with a sensor bar, and they are not terribly difficult to build (regular LED's work fine, as do two candles). However when starting the Wii Loop Machine I decided not to force people to locate or build another peripheral in order to use my software. I wanted to have as much control over the final product as possible, and including an infrared system would have been just another variable to control.

## 2.4. Making the musical side of things

My goal for the Wii Loop Machine (WLM) was to essentially make a very simple version of Ableton Live, in the sense of a tool for controlling and manipulating loops of audio. However I wanted to make my software as accessible as possible to non-musicians and non-programmers. I thus settled on dividing the interface into four “modules”, corresponding to the four directional arrows on the Wiimote. Three of these are looping audio players, and the fourth is a very simple subtractive synthesizer.

The audio modules each have different effects that are activated by pressing one of the buttons, and manipulated by moving the controller. Any number of audio files can be loaded into each module (by dragging a folder over the module), and the loops are selected and launched with the controller.

I was not sure how much quantization to build into the WLM. On the one hand a system that always plays the loops in time will always sound “right”, but it also takes away a good deal of control and feedback. Having no quantization, on the other hand, forces the user to listen carefully and work on their timing. This can be frustrating, but more importantly it can be rewarding. A truly musical interface must be designed with the “dexterity/musical result curve”<sup>6</sup> in mind; it must be set up to give the user a sense of accomplishment in order to encourage them to do more. A lack of quantization, I decided, could create that challenge.

I did, however, create a very simple time stretching system to make sure that all loops were played back at the same length. The top audio module is the “master” loop, and the other two loops are automatically re-pitched and re-sized correspondingly. Thus when the user launches the loops they will all be the same length.

Each module has a different set of effects. These are a granulation/pitch shifting system, a frequency shift/hold system, a filter, and a “crazinator” (a randomly variable delay effect). Each of these can be manipulated by moving the controller.

The Wii Loop Machine is far from perfect. Only one module can be selected or launched at a time, for example, and ideally

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<sup>4</sup> <http://www.wiili.org/index.php/Darwiin>

<sup>5</sup> <http://www.iamas.ac.jp/~aka/max/>

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<sup>6</sup> Behrman, ‘Designing Interactive Computer-Based Music installations’ (p. 140)

the master quantization and tempo settings should be changeable. Future builds will begin to address these and many other issues.



Figure 2: Frame from the Wii Loop Machine Demo Video

## 2.5. Release and reception

The Wii Loop Machine was originally made as a project for my Sound Design Masters course, and as such had a very fixed deadline. I finished the software the night before the deadline, and decided to make a demo video (Figure 2) showing it in action. I shot and edited the video at 5 am and submitted the software, video, and a small writeup a few hours later. I was not sure whether what I had done would be of any interest to anyone at all.

The next day I posted the software on my blog ([theamazingrolo.blogspot.com](http://theamazingrolo.blogspot.com)) and on the electronic music forum [em411](http://em411.com). By the end of the day I had received some very positive feedback, and within the next few days my project was featured on Engadget, Make, Amazon, and more (by way of Create Digital Music). I received phone calls from the Wall Street Journal and the Times, and hundreds of emails from all over the world. To call it a surprise would be a gross understatement – I had not imagined more than a few hundred people being interested in my project, but within a week I was getting several thousands hits and downloads a day. A very conservative estimate would put the number of Wii Loop Machine software downloads in the hundreds of thousands at least. That a Mac-only prototype software would garner so much attention is remarkable, and shows the potential for this type of application.

I was not the first person to use the Wiimote to make music on a computer, however I was the first to create a standalone software that was easily downloadable and usable by anyone with no programming or musical skills. While that can explain a certain amount of its popularity, the continuing attention paid to the software shows that there are other underlying reasons for the success.

It would be naïve to overlook the importance of the demo video I made in the early morning hours of my submission. The video was featured on virtually every blog entry about the software, and much of the praise (and dismissals) was actually directed at my performance rather than the software itself. More than anything, though, the video contributed to the success of the software by showing the Wiimote in action making music.

Of course, the main attraction of the WLM is the appropriation of existing hardware. The vast majority of people who have used the software, I imagine, are owners of Wii consoles who are familiar with the Wiimote and are either disappointed with the games available on the console or are simply curious to see what else can be done.

The simplicity of the software appeals to most people as well. While many people have heard that it is possible to pair the Wiimote with a computer, it is certainly difficult for anyone to do without some programming skill and a fair amount of free time. My software, thanks to the `aka.wiiremote` object (and

reasonably compliant Mac Bluetooth drivers), is quite simple for anyone to use. This applies as well to the musical side of things. I included some default audio loops, so the user can begin making music right away. The interface is fairly rigid and unchangeable, which may not appeal to hardcore musicians, but it is powerful enough for a user to feel that the music they are generating is their own.

Music production software is a big business, as the growing number of prosumer quality digital audio workstations can attest. Faster computers and better quality software has made the production of music accessible to more people than ever before, but there is still a large untapped market of people who want to make their own music but are unable to do so due to the learning curve and time outlay required for existing software. What the WLM proposes and delivers is a system for creating highly personalized and creative music by using familiar pre-existing tools – essentially a game where the only goal is original music. The success of the WLM shows just how universal the desire to make original music is, and it provides the tools to do so.

## 2.6. Criticism

Like any music software, the WLM was somewhat polarizing, and was the target of heavy critiques, some quite damning and others constructive and helpful.

The biggest complaint was that the software is currently unavailable for Windows. While not a complaint as such (actually it is quite flattering that people want a Windows version so much), it is definitely a major concern. The only reason I have not yet done so is because the `aka.wiiremote` object has not been successfully compiled for Windows. While this sounds simple, the true culprit is easily pairing the Wiimote with Windows Bluetooth drivers. For the moment the easiest way to do so is by using BlueSoleil, a third party Bluetooth stack, and from there either use GlovePIE or a Windows Wii Max/MSP object like `tk.wii`, but these methods are not yet satisfactory. I hope to find a solution and compile a Windows version within the next few months.

A more damning critique had to do with the sound and the manipulations of the audio in my demo video. The effects in the WLM, particularly the granulation and “crazinator” functions, were designed with a very specific glitchy electronic sound in mind. This sonic aesthetic, I felt, was a good match for the movements I imagined people would make with the software. While some commenters (on sites like Joystiq or Engadget) appreciated that sound, saying “That sounds like an Aphex Twin song”, others said “the more he manipulated the beat the worse it sounded”.<sup>7</sup> I am certain, however, that the people who left the most negative feedback did not bother to download the software and try it out for themselves, as they would have learned that my performance was only a demo showing one possible way of using the WLM.

A more confusing critique was that the software was “pointless”. While that in of itself can be explained as someone who is not interested in making music, it was often followed a statement along the lines of “this could be done much better with \_\_\_\_”. The blank was generally the name of some commercial hardware or software, from the Kaoss Pad to Fruity Loops.<sup>8</sup> I often found that these commenters were simply trying to show off their own knowledge of consumer level music production, and were ignorant of the possibilities that a system like mine offered. Certainly, traditional musical production tools will always offer better quality sound and far more precise

<sup>7</sup> *Drop mad beats with the amazing Wii Loop Machine*, Joystiq.com

<sup>8</sup> *Wii Loop Machine*, The Amazing Rolo

manipulations of the music. However moving and dancing around with the Wii controller will almost certainly be more fun than twisting a knob or clicking a mouse, and it is definitely more fun to watch.

I have received many emails from people asking me to make either a Wiimote Theremin or a Wiimote Drum Kit. A version of latter has since been released as the Wiinstrument, and numerous attempts at emulating a theremin have been made,<sup>9</sup> but I have very little interest in those types of projects. Rather than use the Wiimote to create poor imitations of existing tools, I would much rather try and make a system that takes full advantage of the innovative controller to make something that could not have existed before.

Despite these critiques, however, the response to the WLM was overwhelmingly positive, with a vast majority of encouraging comments. I was pleasantly surprised by the number of people who used the Wii Loop Machine, even posting videos on YouTube of their performances. Perhaps even more rewarding personally were people like Soressa Gardner, a musician from Vancouver, Canada, who modified the WLM for use in her degree in applied music.

### 2.7. Continued development

As mentioned earlier, the Wii Loop Machine is still essentially a prototype, a proof-of-concept that the Wiimote can be used to make music, and that this is a type of software that could develop a very strong and devoted fanbase. As an initial prototype the WLM was been a resounding success, and now much thought must be put into what lies ahead.

The most pressing step, as mentioned earlier, is to develop a Windows version. I hope to do so in the coming weeks, along with a Version 2.0, which will feature more stable architecture and much more flexible quantization and effects systems, all still built in Max/MSP. In addition, I hope to implement some MIDI and/or ReWire support, to enable users to easily integrate the Wii Loop Machine into their existing setup. With those new features, as well as a general redesign, the software should reach it's full potential as a prototype.

From there, my thoughts turn towards making a commercial product. This would involve rebuilding the software from the ground up in C++, using the initial Max/MSP prototypes as guides. Ideally it would be cross-platform and support multiple players and network jamming, and have several different "modes" (loops, synths, customizable effects, etc). The system would have to be expandable, flexible, simple, customizable, and of course sound good and be fun to play. Eventually I would aim for a release on the Wii console.

However it would always be important to differentiate the Wii Loop Machine from karaoke-style video games like *Guitar Hero*. The WLM should always be aimed towards people who want to generate and perform their own music, rather than play along with pre-existing tracks. The user must always feel a certain ownership and relationship with the music they are creating. In this sense the WLM could be most closely associated with Toshio Iwai's *Electroplankton* for Nintendo DS, which sets up innovative and intuitive graphical systems for making music. Much in the same vein, I do not want to make a game, but rather a tool that happens to be fun to play.

Of course, game consoles do not have very long lifespans. However the gestural control interface pioneered by the Wii will almost certainly continue in future console systems by Nintendo and others. I would therefore like to develop the Wii Loop Machine as a general framework for generating music which

could be applied to any gaming system with a movement-based controller.

### 3. Conclusion

The Wii Loop Machine has proved to be a popular system with great potential. It has shown that there is a major untapped market for music generation software, particularly using existing video game hardware. Until now electronic music production has been the domain of computer musicians or programmers. Very little fills the gap between karaoke-style video games that let you play along with pre-existing tracks and powerful music production tools with steep learning curves. The Wii Loop Machine has the ability to fill that gap and create a game that takes advantage of the exciting possibilities inherent in the Wiimote, allowing anyone to intuitively create and manipulate music with their movements.

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<sup>9</sup> *Nintendo Wiimote Theremin with Moog Little Phatty*, [youtube.com](http://youtube.com)