

# USING THE IPHONE FOR LIVE-ELECTRONICS IN MY COMPOSITION *IRRGÄRTEN* FOR TWO PIANOS

*Hans Tutschku*

Department of Music, Harvard University  
tutschku@fas.harvard.edu

## ABSTRACT

*Irrgärten*, which makes use of “easy electronics,” is an outgrowth of my experience with live electronics and instruments. This composition, for two pianos and electronics, uses two iPhones and four small loudspeakers placed inside the pianos to render the electronic part.

## 1. INTRODUCTION

Unfortunately, when instrumentalists rehearse compositions with electronics, they often rehearse their parts like chamber music and do not accustom themselves to the electronic sound world, or to the interaction with it. The electronics are added at a very late point of the process, often only days before the concert, and the musicians have no time to adapt their interpretation to this new situation.

My desire to avoid returning to a pre-produced CD track, which causes many problems in terms of synchronization with the instrumental part and forces the musicians into a rigid timeframe, was the impetus to experiment with the capacity of the iPhone. The electronic sounds are short sequences, which are re-synchronized to the live part using amplitude tracking with the build-in microphone.

This set up is, indeed, very limited compared to live-processing with Max/MSP or other computer software. However, I wanted to see how far I could go, musically, with such a sparse configuration that avoids microphones, sound cards, and computers all together.

In *Irrgärten* I try to establish several layers of relationships: these exist between the two instrumental parts as well as between each piano and its own electronic ‘shadow’. The sounds of the electronics are, for the most part, recorded piano phrases and they create a second voice within each instrument.

## 2. EASY SET-UP

There is no need for loudspeakers in the concert hall. The electronics are played back through four small, high quality monitors, two of which are placed inside each piano. The monitors face the piano lid, which acts as a sound reflector, and they are placed as far apart as possible from each other. For example, one monitor is placed close to the keyboard in the highest register and the other one is close to the far end of the low strings. The electronic sounds should blend as much as possible with the instrumental sounds. The mini-jack output of each iPhone is connected to the monitors inside the

piano. The sound files from each iPhone are in stereo. I hope the setup more easily enables musicians to rehearse with the electronics and allows them to prepare the installation for a performance without a sound technician.



Figure 1. Two Fostex 6301B monitors inside the piano

## 3. THE IPHONE INTERFACE

There are two separate applications - one for each piano (*Irrgaerten-1* and *Irrgaerten-2*), downloadable from the iTunes AppStore.

### 3.1. Preparation for rehearsal and performance

The interface looks the same on both applications, but the electronic scores (the Events) and the sound files are different. To start a rehearsal, one presses the “settings” button on the main interface.

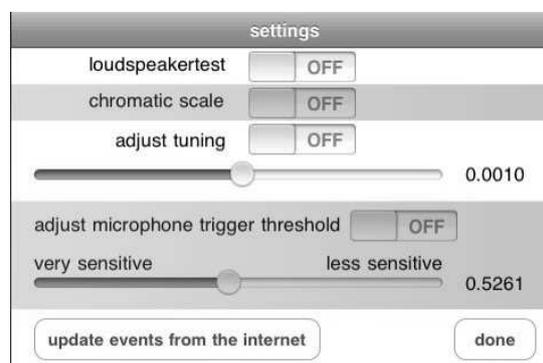


Figure 2. Settings dialog

The "loudspeaker test" is used to ensure that the two channels are connected to the corresponding speaker

inside the piano. The "chromatic scale" plays back a chromatic scale from the lowest to the highest piano note and serves to set the general level on the monitors (7 on the rotary knob for the Fostex Monitors is a good reference). The output volume of the iPhone should be set to maximum. This sound file can also be used to determine the sound quality of the loudspeakers in cases where the Fostex monitors are not available. The sound should be as natural as possible and evoke the impression that the real piano is playing. The use of small computer or game loudspeakers is not recommended, as they are unable to reproduce the piano sound.

The "Adjust tuning" feature will play a repeated A4 note at 440Hz. The iPhone tuning can be adjusted to the tuning of the piano with the slider below the switch. The new tuning value is stored in the preferences of the application and is ready to be used. There is, thus, no need to go back to the tuning procedure between rehearsal and concert. OpenAL, the lowest level of sound playback within the iPhone API had to be used to allow the tuning feature.

### 3.2. Using the iPhone as contact microphone

Because the various iPhone/iPod models have different built-in microphones, the input signal varies from model to model. The overall sensitivity is too high, which results in false triggers when the respective other piano is playing loud notes. The solution to that is covering the built-in microphones with sticky tape and taping the iPhones to the piano music stand. That way each iPhone is only picking up the notes from the own instrument. The sensitivity value of 0.99 (less sensitive) worked best for the iPod (4th generation) but this value may vary depending on the set up. To adjust the threshold on uses the function "adjust microphone trigger threshold." Each note played on the piano with the dynamic *forte*, should gate two consecutive chords in the electronics part. However, the second chord in the electronics part should not "auto-trigger" another sound file. If that happens, the microphone is set too sensitively. The sensitivity value is stored in the preferences of the application and used from then on.

### 3.3. Update events from the Internet

The electronic score is stored as a database on the device independent of the sound files. Each Event is marked in the musical score with a number. The numbers are different for each piano part because the sound files are not always triggered at the same time. Each Event contains the information as to which sound file to play, as well as data about volume and durations. If an update (corrections) to these electronic scores becomes necessary, I shall upload a new database onto a specific html page. The button "update events from the internet" can be used to download the updated version. The location of this updated file is known to the application, thus no further information is necessary.

### 3.4. Performance interface



Figure 3. Performance interface

The large rectangular area on the top of the screen of the performance interface is the progress bar. It gives a visual feedback, for example, how far along one is within any given Event. After an Event has begun, the progress bar scrolls from left to right.

When the progress bar reaches the right edge, the Event is finished. Most often, the display then presents a *green* progress bar. This indicates that the iPhone has activated the internal microphone and is waiting (listening) for the next note to be played. The pianist sees the indication *green* for such moments in the instrumental score.

When the pianist articulates the next note, the iPhone automatically starts the next Event, and thus plays synchronously with the piano. This gives musicians some freedom for rubato and interpretation. Nonetheless, the metronome indications in the score should be performed as accurately as possible. Additionally, there are several places where the pianist is required to touch the button, "touch," on the lower left corner of the interface to switch the listening feature back on (marked with the term *touch* in the score). If the following Event requires this manual "touch" action, the progress bar of the current Event shows in *red* to remind the player of the upcoming "touch" action. Once the previous Event has terminated and the iPhone is ready for the touch action the progress bar turns pink.

To navigate to a different Event during the rehearsal process, the pianist must press the "prepare" button, scroll to the desired Event number, and select it from the menu. The application returns automatically to the main screen, and the small number on the right side of the "prepare" button indicates the prepared Event number. The pianist activates an Event by pressing the "touch" button. After the pianist presses "touch," the progress bar advances while the sound files preload to give the pianist time to prepare to play before the Event is activated. The pianist can also use the "prev" and "next" buttons to navigate to adjacent Events during the rehearsal process. "Stop" stops playback and should not be used during a performance.

### 3.5. The electronic score and sound file handling within the iPhone application

The database contains information about the name of the current sound file, its length, the trigger threshold for the microphone, the duration for the progress bar and its color for each Event. The sound files are divided into two groups: streaming and buffer sounds. The streaming sounds are read from the hard disk; only the first two seconds are preloaded into memory. During playback, samples are constantly loaded into three circular buffers in order to maintain enough data in memory for gapless playback. Such preloading is necessary in order to start the sound files at the very moment the microphone level crosses the programmed threshold.

Certain Events (for example: piano 1 - Event 49) do not simply play one single sound file. For the entire duration of the Event, the microphone detects loud notes in the piano part and triggers short sound files. Those are at startup preloaded buffer sounds. In these sections, the rendering of the electronics may vary from performance to performance, depending on the interpretation. The progress bar is *blue* for these Events.

Figure 4. Score excerpt with indications for the interaction with the electronics

### 4. DISPOSITION OF THE PIANOS ON STAGE

In order for the piano lids to reflect the electronic sounds into the concert hall, they must be opened to their maximum height and face the audience. The proposed stage arrangement allows for this and it enables the pianists to communicate visually with the other player.

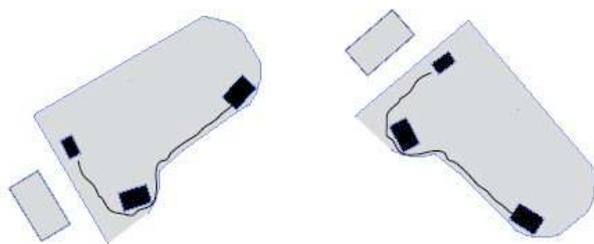


Figure 5. Disposition of pianos on stage

## 5. REMOTE CONTROL

In case a third musician wants to monitor the state of the two devices, an optional Max/MSP application on a Macintosh computer can be used as master control. The communication between the three devices uses OpenSoundControl over the wireless network. The Macintosh provides the network with the "create network" function. The two iPhones connect to that network and send their state to the master control application, which can be used to carry out all interface actions the pianists could perform directly on the devices. The third musician can thus monitor the progress of the electronics on both iPhones during the performance and intervene, in case a pianist missed a required action.



Figure 6. master control interface

## 6. TECHNICAL REQUIREMENTS FOR IRRGÄRTEN

- Two iPhone devices (possible models iPhone 3GS, iPhone 4, iPod touch 4th generation)
- Four small, high quality active monitors, two inside each piano, placed on pieces of foam (for example Fostex 6301B)
- Two cables to connect the output of the iPhones to the monitors
- Electricity on both pianos for the powered monitors
- Optional Macintosh computer for the master control application

## 7. CONCLUSION

While the easier technical environment should facilitate the rehearsal process and also the concert preparation, the compositional possibilities with the electronics are much more limited than using real-time processing with Max/MSP or other software.

For further information and recorded examples of the work, refer to [www.tutschku.com](http://www.tutschku.com).

## 8. REFERENCES

- [1] Max/MSP: <http://cycling74.com>
- [2] J. Chadabe, *Electric Sound: The Past and Promise of Electronic Music*, Prentice Hall, 1996.
- [3] T. Wishart, *On Sonic Art*, Hardwood Academic Publishers, 1996
- [4] K. Ebbeke, *Zur Geschichte der elektronischen Musik*, Berlin, édition spéciale à l'occasion de *Inventionen '84*, 1984
- [5] M. Supper, *Elektroakustische Musik & Computermusik*, Wolke, Berlin, 1997.
- [6] M. Wright and A. Freed. *Open Sound Control: A New Protocol for Communicating with Sound Synthesizers*. Proceedings of the 1997 International Computer Music Conference, 1997.
- [7] B. Dudney and Ch. Adamson, *iPhone SDK Development*, The Pragmatic Programmers, 2009
- [8] H. Tutschku, *Irrgärten for two pianos and electronics*, score