

Flash 10, Making Music

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Dynamic Sound in Flash Player 10

Generate sound from scratch

Run-time sound manipulation

Alchemy

Use 3rd party applications

Flash Player 11 (?)

What is Sound?

It's a vibration of air created by some object

Mathematically can be represented by a 2D graph

Human-perceptible frequency range: 12Hz ~ 20kHz

Flash Sound Specifications

Sound quality

44100 Hz Stereo

You should provide 44100 sample values each second for each channel

SampleDataEvent

2048 ~ 8192 samples per channel per event

Every time the `SampleDataEvent.SAMPLE_DATA` event is dispatched, you may provide 2048 to 8192 samples for each channel

`(SampleDataEvent).data` is a `ByteArray`

To write the samples to output, handle the `SampleDataEvent.data` as a `ByteArray`.

AS3 Example

```
var mySound:Sound = new Sound();
function sineWaveGenerator(e:SampleDataEvent):void {
    for(var c:int = 0; c < 8192; c++) {
        //this first value refers to the left channel
        e.data.writeFloat(Math.sin((Number(c + e.position) / Math.PI / 2)) * 0.25);
        //this second value refers to the right channel
        e.data.writeFloat(Math.sin((Number(c + e.position) / Math.PI / 2)) * 0.25);
    }
}

mySound.addEventListener(SampleEventData.SAMPLE_DATA, sineWaveGenerator);
mySound.play();
```

Extracted from:

<http://livedocs.adobe.com/flex/3/langref/flash/events/SampleDataEvent.html#includeExamplesSummary>

Example01-SineWaveExample

<http://www.hellokeita.in/presentations/LFPUG/20090827/examples.zip>

Properties of Music

Music is a group of notes with following properties

Rhythm

Specifies the time and duration of a single note

Intensity

How strong this note is played

Pitch

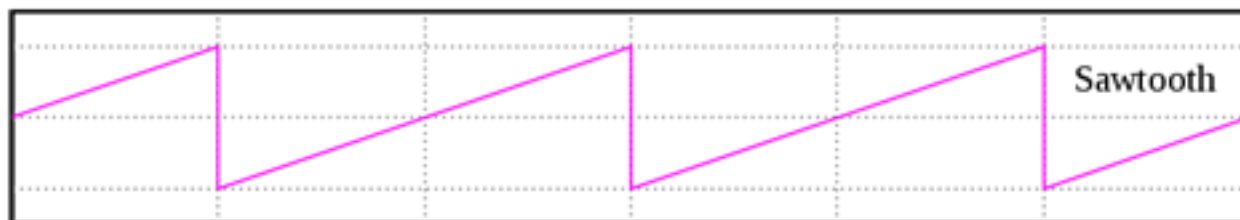
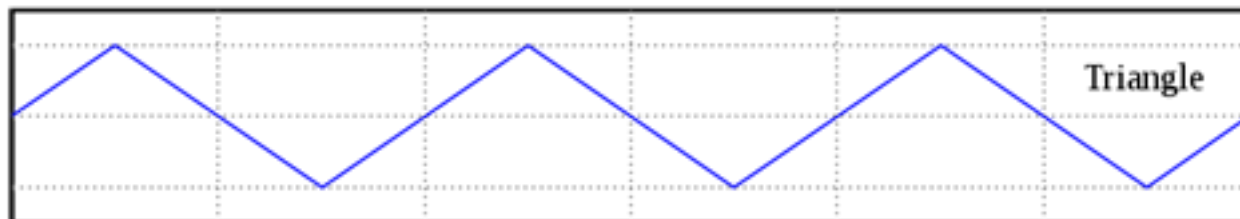
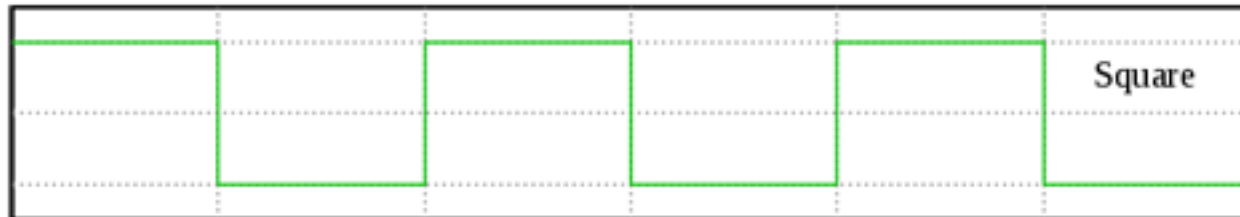
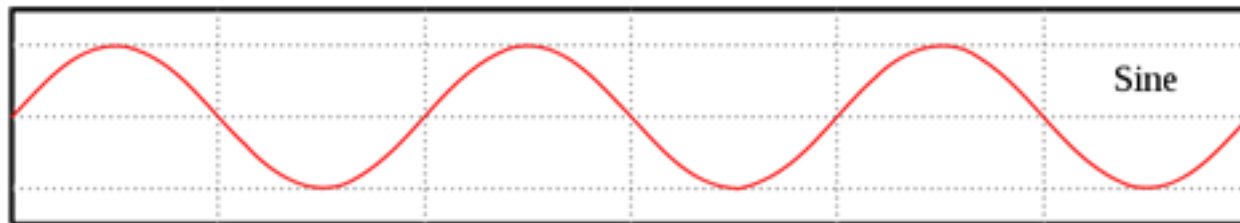
The different frequencies of a note

Timbre

Specific pattern of a sound, differs for each instrument

Sound Physics 101

Some examples of sound waves



Sound Physics 101

Period

Is the duration of one cycle of a repeating pattern of wave

Amplitude

Height of the wave

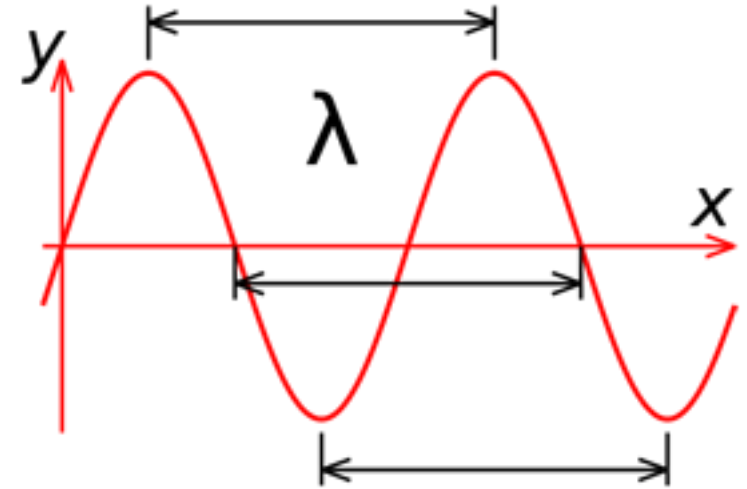
Frequency (Pitch)

How many times the pattern repeats in a second

Western music convention:

Octave with 12 notes (tones and semi-tones)

Standard frequency: 440Hz or A4



Sound Physics 101

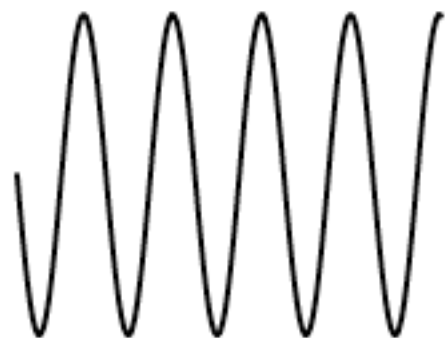
Sound wave properties



+



=



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Sound Physics 101

Frequency (Pitch)

$$2^{(n / 12)} * f$$

Example:

$$A4 = 440$$

$$C5 = 2^{(3 / 12)} * 440 \approx 523.251$$

Sound Physics 101

Example02-KeyboardExample

<http://www.hellokeita.in/presentations/LFPUG/20090827/examples.zip>

```
var frequency:Number = 440;
var playingNote:int;
var playing:Boolean = false;
var rate:int = 44100;
var c:int;
function sampleData(e:SampleDataEvent):void {
    var sample:Number;
    var f:Number = Math.pow(2, playingNote / 12) * frequency;
    for(var i:int = 0; c < 2048; i++) {
        sample = Math.sin((Math.PI * 2) * (c++ / rate) * f);
        e.data.writeFloat(sample);
        e.data.writeFloat(sample);
    }
}
```

Sound Physics 101

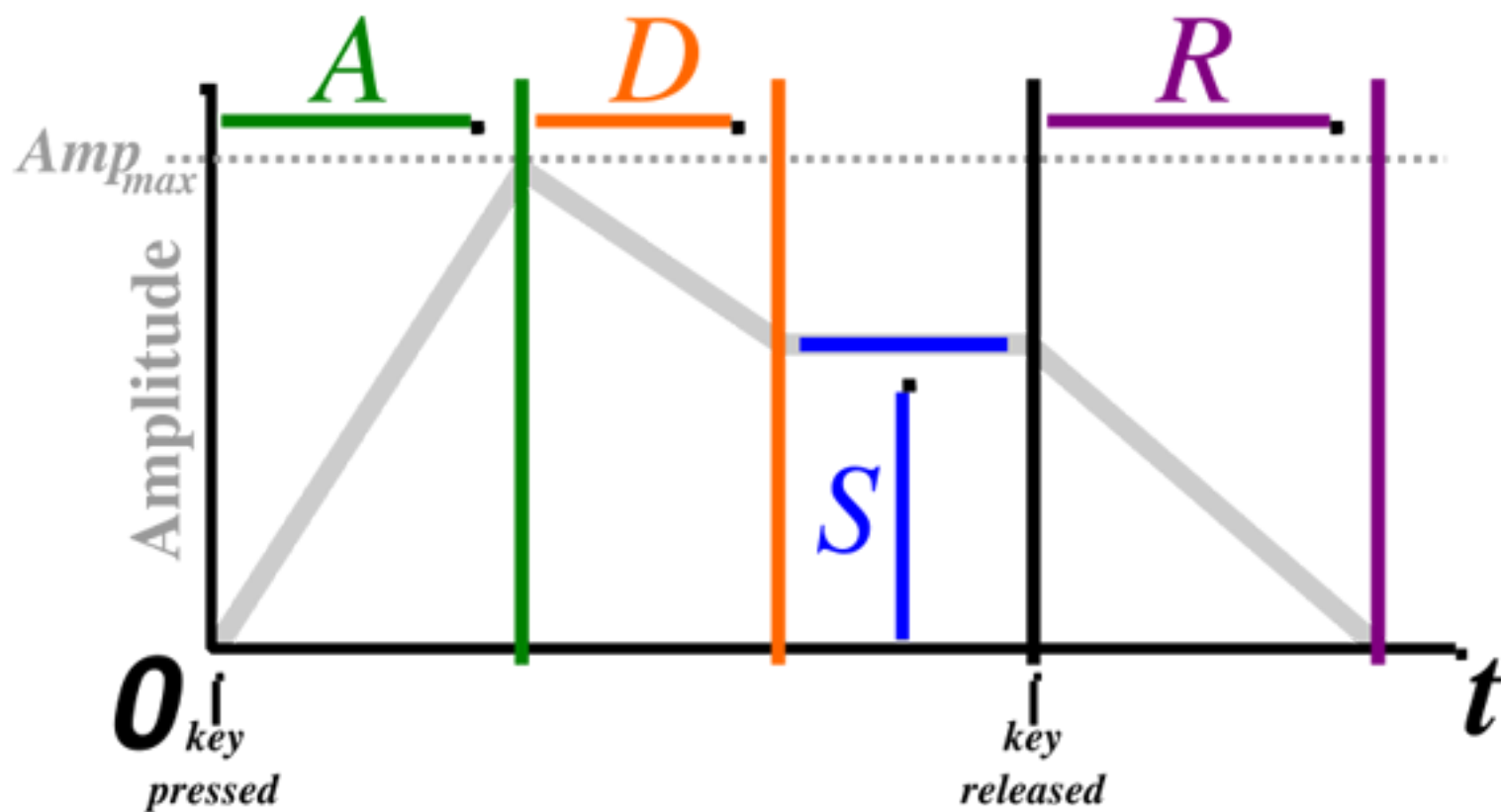
Waveform (Timbre)

Example03-WaveformExample

<http://www.hellokeita.in/presentations/LFPUG/20090827/examples.zip>

ADSR Envelope

ADSR (Attack, Decay, Sustain, Release)



Properties of Music

Time Stretching

Pitch Shifting

Example04-TimePitchExample

<http://www.hellokeita.in/presentations/LFPUG/20090827/examples.zip>

Some AS3 Sound Libraries and Links

Audio Tool <http://www.hobnox.com/audiotool>

Sound Touch <http://github.com/also/soundtouch-as3/>

Standingwave <http://code.google.com/p/standingwave/>