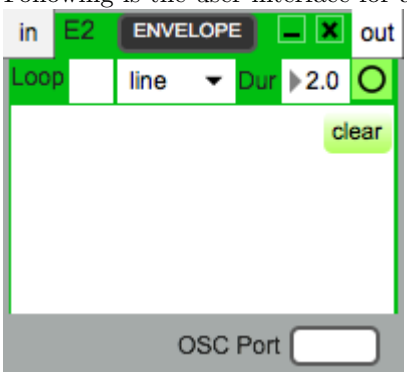
# Soundcool's Envelope Module Specification

September 24, 2019

## User interface

Following is the user interface for an envelope module in Soundcool:




- **Drop points:** User can drop points on the canvas by clicking. After two points are dropped, there will be lines connecting each pair of two x-adjacent points. That is, in terms of x coordinate, each pair of neighboring points.
- **Drag points:** User can drag points. This will result in the connecting line also change.
- (Optional) **Delete points:** If possible we will implement the delete point feature, since there is none in soundcool 3.1
- **Clear canvas**.
- **Change duration:** duration indicates the time interval that the envelope on the canvas get applied to. In seconds, enter an integer greater than 1.
- **Loop:** selecting loop will result in the envelope applied consecutively.
- The button next to duration: click to apply or bypass the current envelope.

# Web Audio Implementation

## Terminology

canvas = the window where user specifies the envelope curve
y-value = Y coordinate on canvas (amplitude multiplier). Range: [0,1].
x-value = X coordinate on canvas (discrete sample index)

An envelope specification requires a JavaScript(JS) `Object` with following fields: 1) `startSample` 2) `endSample` 3) `sustainAmp` 4) `arr`. Since envelope can be looped and could be of arbitrary shape, the only way to achieve this in Web Audio is to use a Audio Buffer Source Node (ABSN). The idea is to represent user specified envelope as discrete samples in a `Float32Array`. Here is the definition of the parameters:

**`startSample:(integer)`[1] `number`**

x-value where user specified curve starts

**`endSample:(integer)`[1] `number`**

x-value where user specified curve ends; means there exists no user-selected point that has a greater x-value than `endSample`.

**`sustainAmp:(float)`[1] `number`**

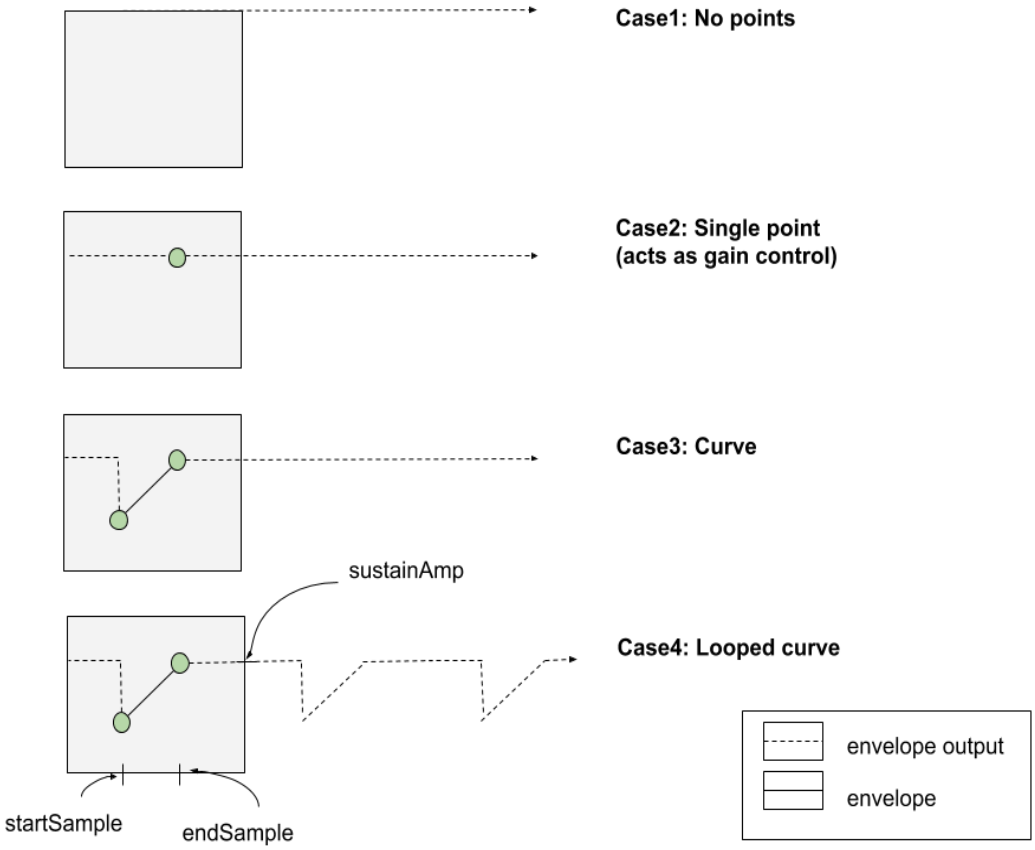
y-value where user specified curve ends

**`arr:Float32Array`**

user specified curve stored as `Float32Array` of sample rate length (assume 44100). Note that for the samples that do not have user specified y-value, default it to 0.

[1] type `number` in JS refers to both `int` and `float`. Prefix indicate whether to cast to nearest integer.

The figure below shows all valid envelopes and their respective outcomes. Parameters of the envelope curve are annotated as well for brevity.




Note that for the case1: set `startSample` and `endSample` to `0`. For case2: set `startSample` = `endSample` = selected `x-value`.

## Methods

**`set duration:number`**

`duration` is the length of wave (in seconds) to apply envelope to. `duration` can be set by tweaking `playbackRate` audio param of ABSN.

```
playbackRate = 1 / duration
```
(1)

**`set loop:boolean`**

`loop` setter wraps ABSN's `loop` audio param.