

Wind Instrument Building

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Overview

- Day 1: focus on making sensors
- Day 2: focus on receiving and processing data
- Day 3: focus on connecting the data to sound and visuals

Day 3: connecting data to sound and/or visuals

- Process data
 - *Introduction*
 - scaling
 - smoothing
 - change
 - send out triggers
 - Try out processing data
 - View output
 - *Share observations*
- Afternoon:
 - Examples from V.L.I.G. and Wind Instrument
 - Discussing concepts for connections
 - Work on creating the connections and trying them out
 - *Show the outcomes*

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Code updates are at <https://github.com/sensestage/wind-instrument-building>

Exploring and scaling the range of data

What is the range of the data?

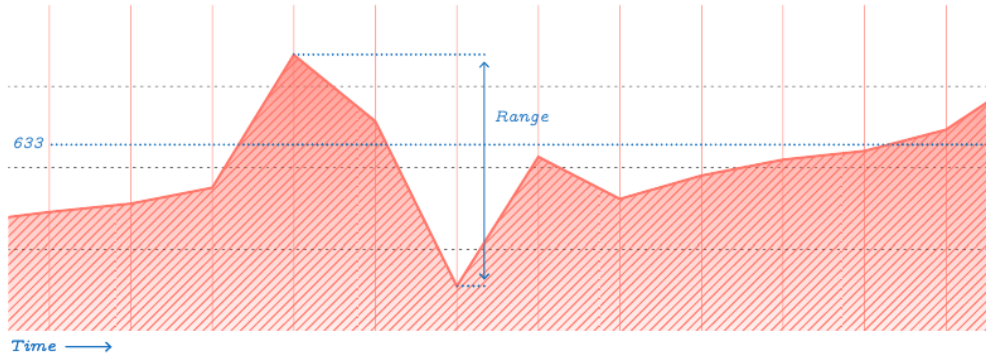


Figure 17.6 — Determining the range of the data

Scaling the data

$$V_{out} = \frac{V_{in} - V_{min}}{V_{max} - V_{min}}$$

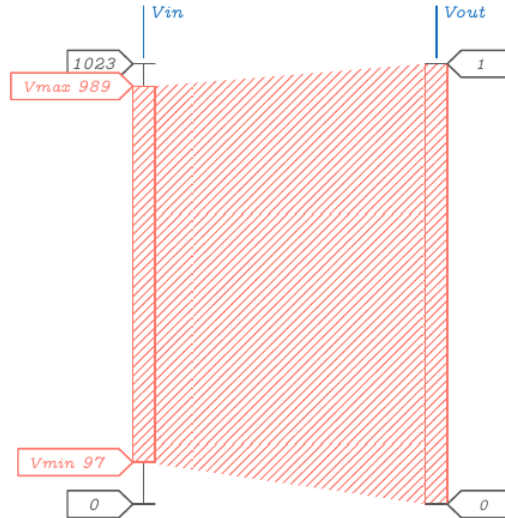


Figure 18.1 — Scaling the sensor input range (97 to 989) to a standardized range

Scaling and inverting the data

$$V_{out} = 1 - \frac{V_{in} - V_{min}}{V_{max} - V_{min}}$$

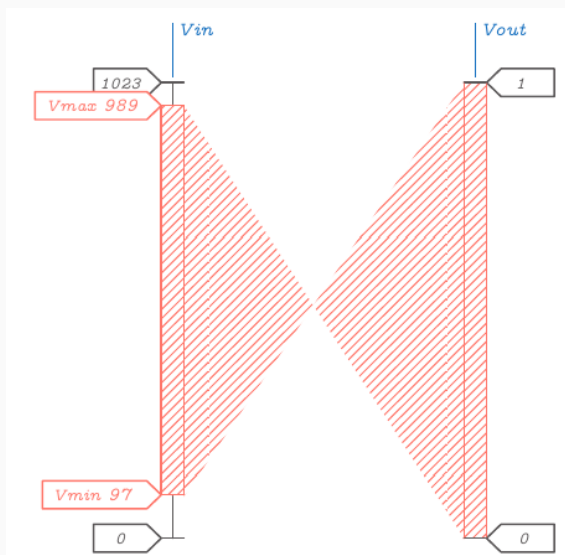
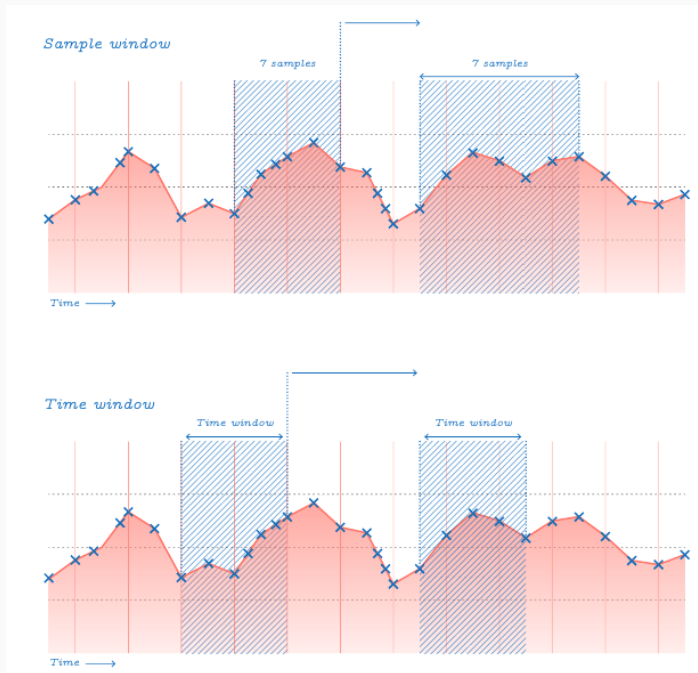


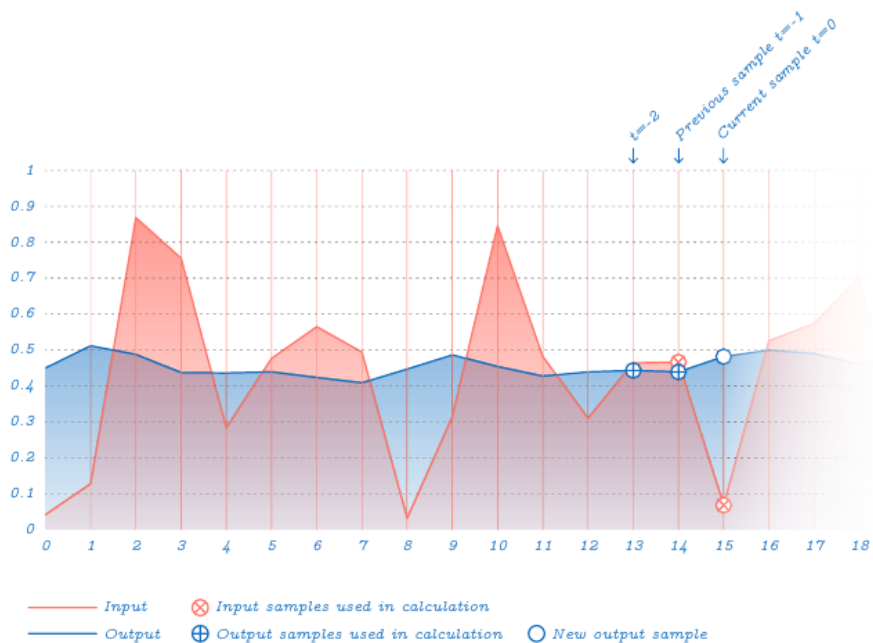
Figure 18.4 — Scaling of the sensor input range (97 to 989) with inversion to the output range (compare with figure 18.1)

Processing data

Windowed calculation



Using past input and output



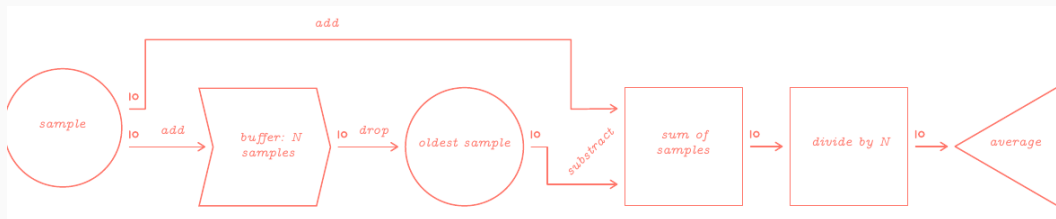
Smoothing data

Average over N samples

- You keep a number (N) of samples. This is your buffer;
- Each time you add a new sample to the buffer, you
 - drop the oldest sample out of the buffer,
 - take the sum (Σ) of all the samples, and
 - divide this sum (Σ) by the number of samples (N).

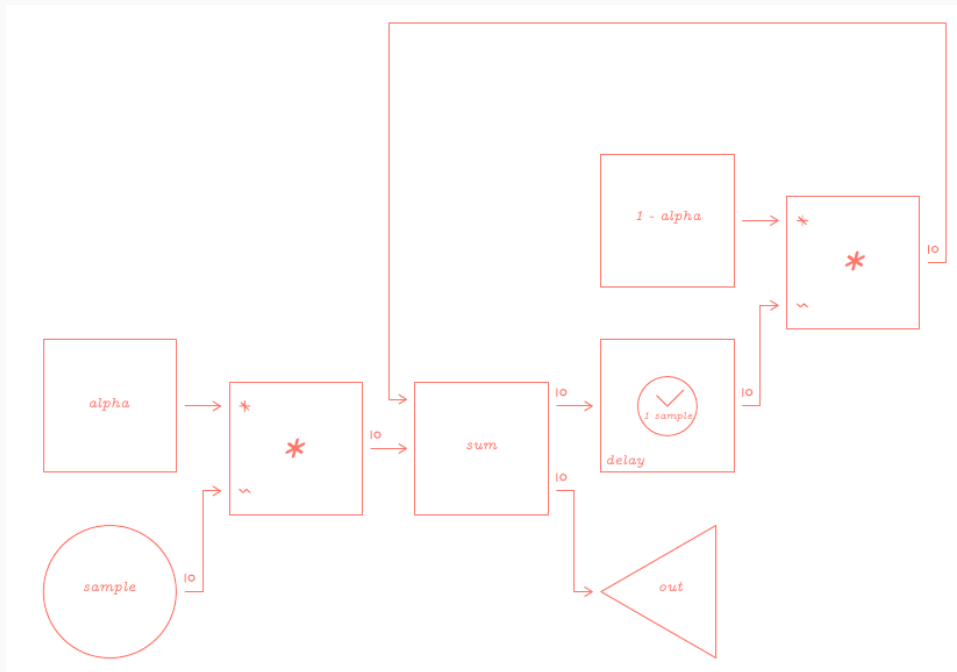
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Exponential smoothing

$$s_t = \alpha v_t + (1 - \alpha)s_{t-1}$$



Variation or change in the data

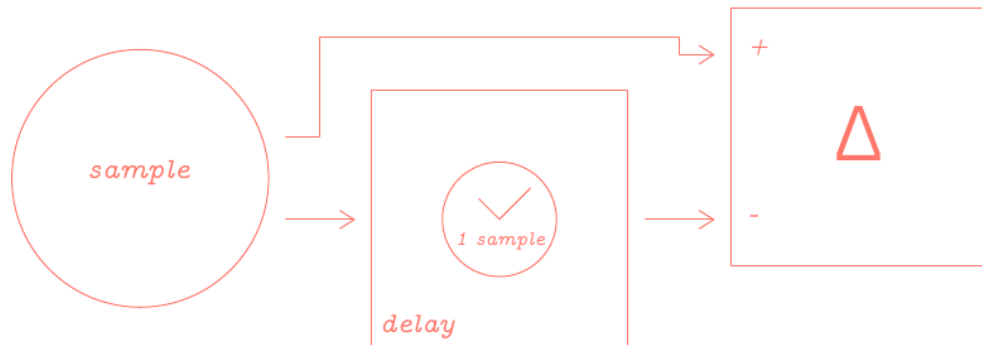


Figure 19.15 — Calculating the difference

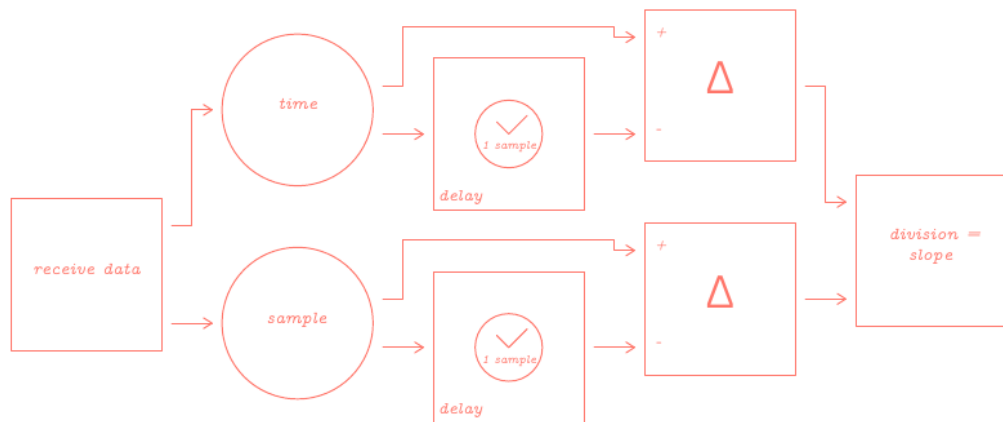


Figure 19.16 — Calculating the slope

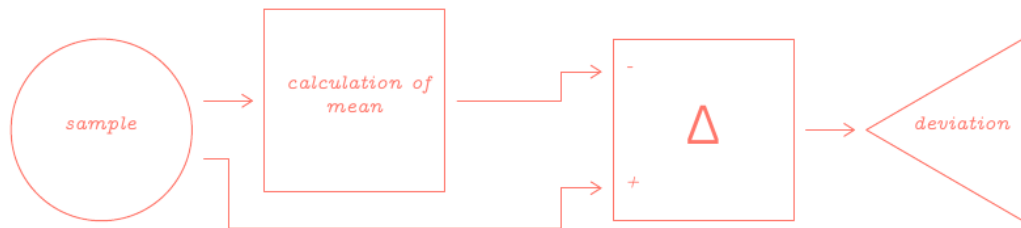
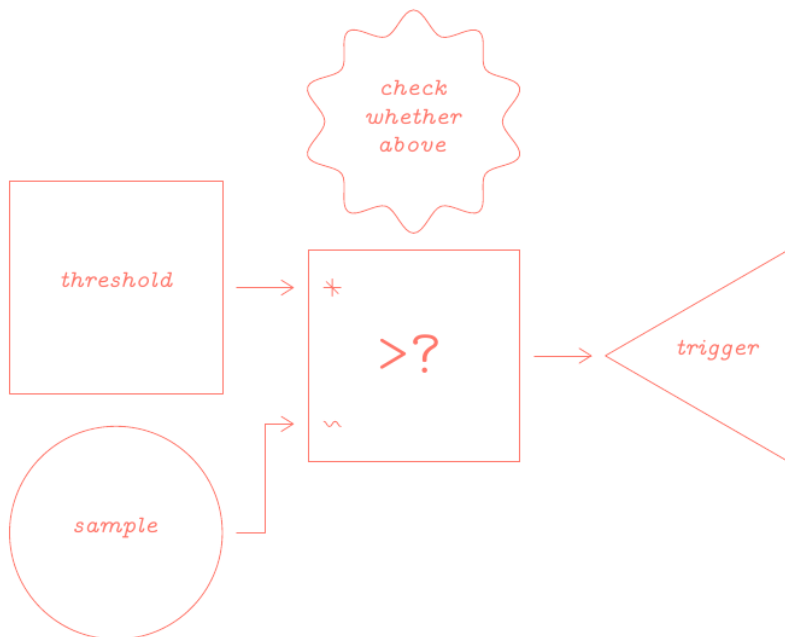


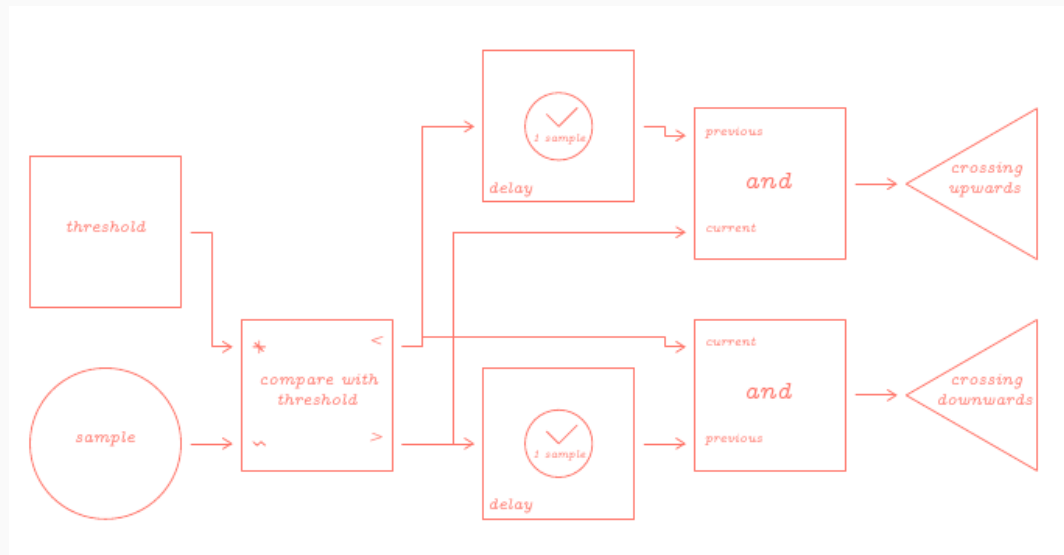
Figure 19.17 — Calculating the deviation from the mean

Using triggers

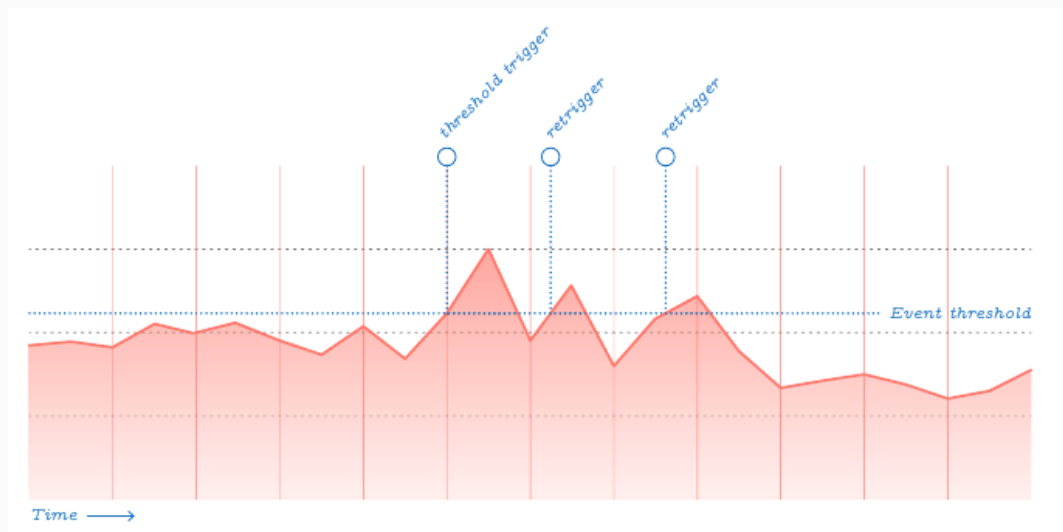
Trigger upon threshold



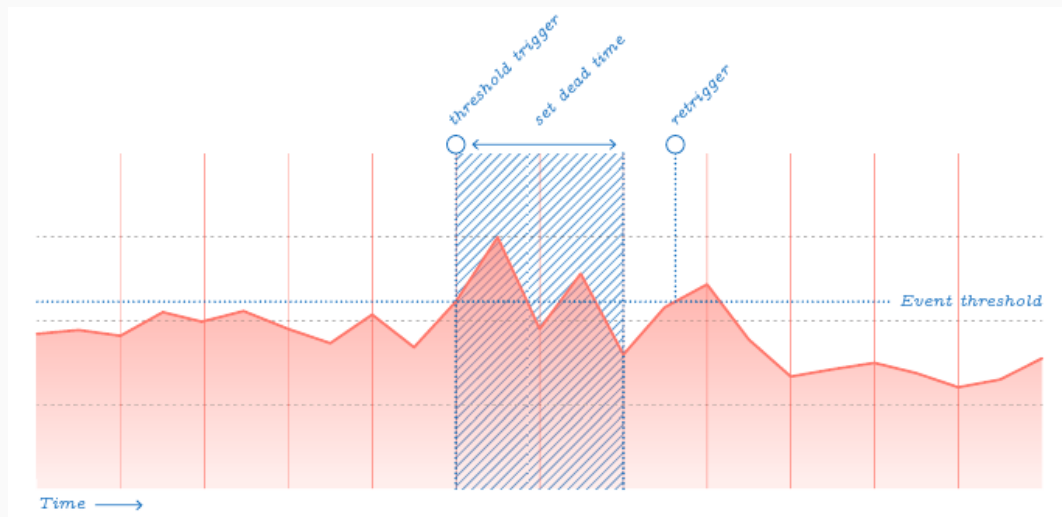
Threshold passing upwards or downward



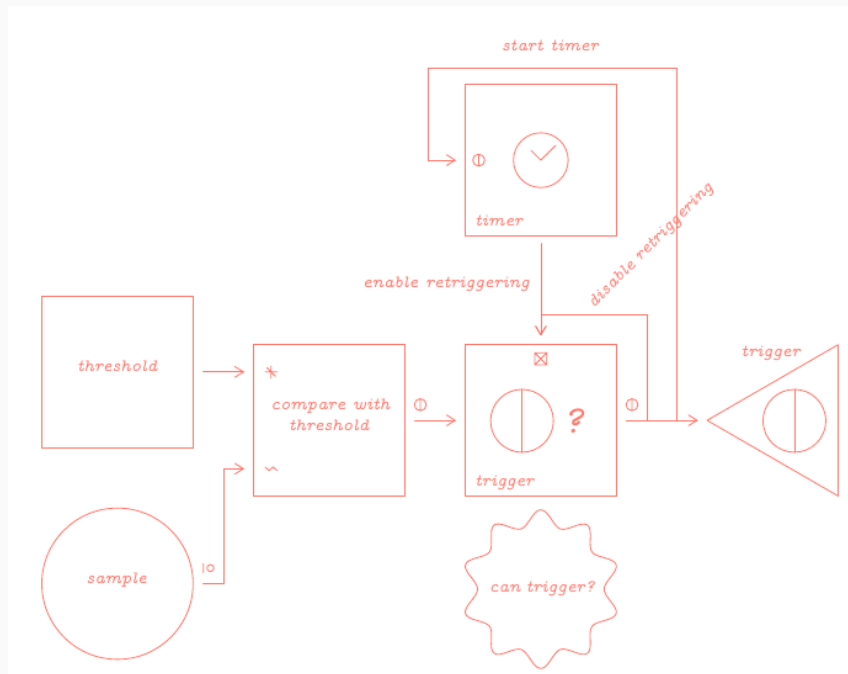
False triggers



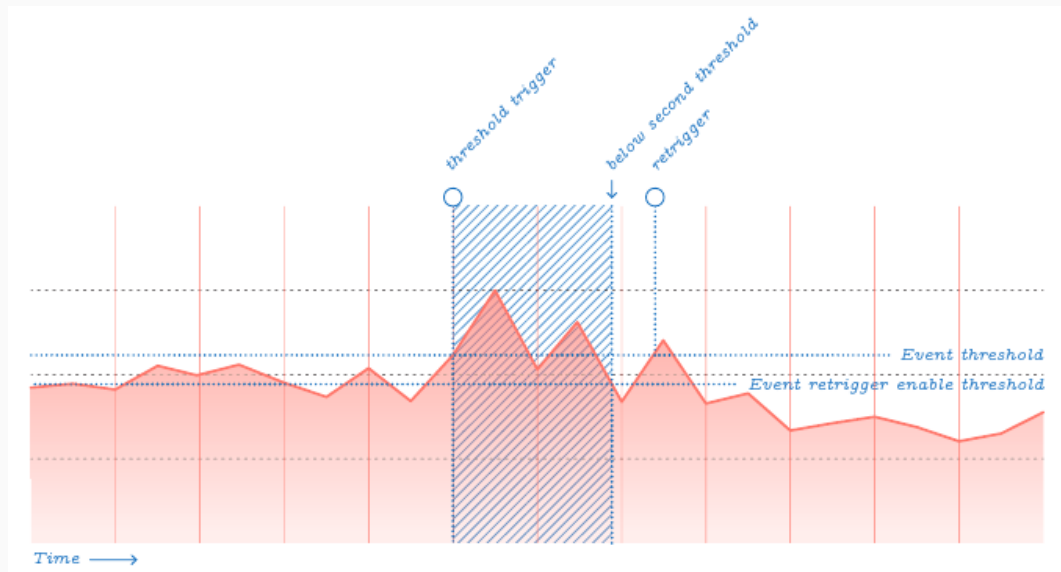
False triggers - dead time



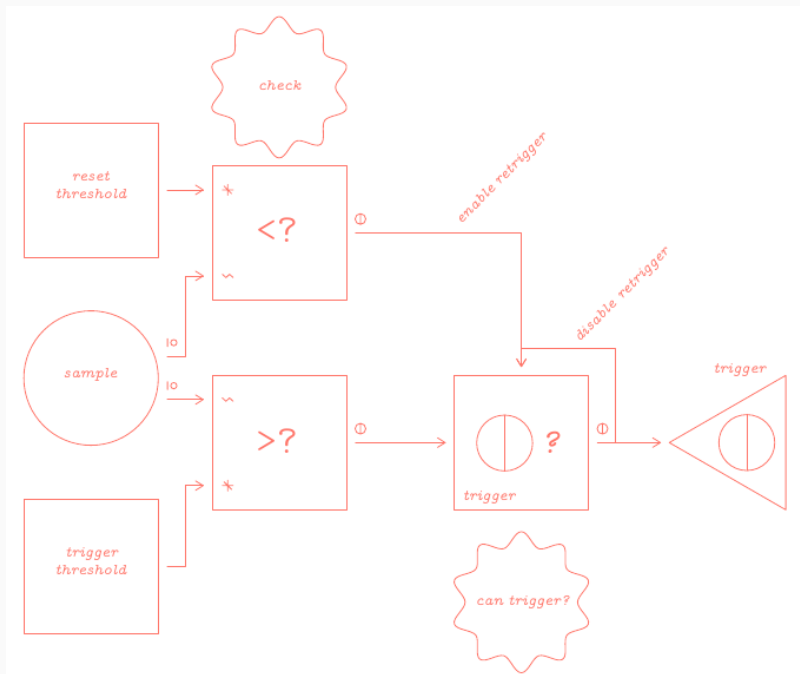
False triggers - dead time - calculation



False triggers - reset threshold



False triggers - reset threshold - calculation



Connecting data to sound

- We can use the different trigger methods to trigger sounds, when thresholds are crossed.
- Or we can use one threshold to start the sound, and another to stop a sound.

- We can use the data to change the frequency of a sound
- Or to set the frequency of a triggered sound
- Or other parameters like duration, amplitude, etc. . .

<https://marijebaalman.eu>

- iii - instrument inventors initiative
 - National Taiwan Science Education Center
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- Some images are taken from the book *Composing Interactions*
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