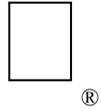


Apple II Technical Notes



Developer Technical Support

HyperCard IIGS

#3: Pitching Sampled Sounds

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1991

This Technical Note describes the “relative pitch” field used in sound resources played by HyperCard (and sound scraps that HyperCard doesn’t use)—what it does and what to put in it.

What is this relative pitch thing?

There are basically two ways to use a sound sample, in HyperCard or anywhere else: as a sample of a wave of definite pitch, or as a miniature “tape recording” of some sound that is not intended to be used as a sample of indefinite pitch.

Definite Pitch

To play a sample at the correct pitch, HyperCard assumes two things about the sample: it was sampled at a rate of 26.32 KHz, and the associated wave was playing a pitch of 261.63 Hz, when it was sampled.

In the real world, where most of us live, this is not very practical. To help compensate for reality, the sample sound format includes a “relative pitch” field, which can tell HyperCard (or anyone else playing the sound) how to compensate for the difference in pitch between the sample’s actual pitch and a pitch of 261.63 Hz.

Follow these steps to calculate the relative pitch parameter for a given sampled sound resource. If the wave is of definite pitch, you must know the frequency of the source wave and the sampling rate for the sample in question.

1. Calculate the difference ratio r . In the equation below, F_w is the frequency of the sample (in Hz) and F_s is the sampling rate for the sample.

$$r = \frac{F_w}{261.63} \cdot \frac{F_s}{320}$$

2. Extract an offset to the pitch:

$$offset = 3072 \cdot \log_2(r)$$

(Remember that you can substitute $\frac{\ln(r)}{\ln(2)}$ if your calculator doesn't provide the log in base 2.)

3. If $offset$ is negative, make it positive and set bit 15 to tell sound players to lower the pitch instead of raise it. If $offset$ is negative:

$$relative = \text{NOT}(offset) + \$8000$$

If $offset$ is positive:

$$relative = offset$$

That's all. Store the value of $tuning$ in the sampled sound for the "relative pitch" field and HyperCard will take care of the rest.

Indefinite pitch

Sounds which are not samples of definite pitch (for example, a thunder clap or the sound of your mother saying "hello") should not need to be made to match pitch. Only sounds produced using optional parameters of HyperCard's Play command need to go through the same process outlined for "Definite pitch". In these cases, however, you don't need to worry about the frequency of the sample. Instead of using the equation provided in step 1 above, use this instead:

$$r = \frac{F_s}{320}$$

(or just use 261.63 for F_w .) Take the value of r and use it for steps two and three above.

A HyperTalk sample

The following simple button script will calculate the correct value of $relative$ for you, given the other values in card fields named F_w , F_s and card fields named $offset$ and $relative$ to use as containers:

```
on mouseUp
  lock screen
  set numberFormat to "0"
  put the value of card field Fs * 261.63 into r
  put the value of card field Fw into denominator -- the bottom of the fraction
  multiply denominator by 26320
  divide r by denominator

  put log2(r) into card field offset
  multiply card field offset by 3072

  if card field offset <0 then
    put abs(the value of card field offset) into card field tuning
    add 32768 to card field relative
  end if

  unlock screen
end mouseUp
```

Further Reference

- *HyperCard IIGS Script Language Guide*
- Apple IIGS Technical Note #76, Miscellaneous Resource Formats
- Apple IIGS Technical Note #99, Supplemental Scrap Types