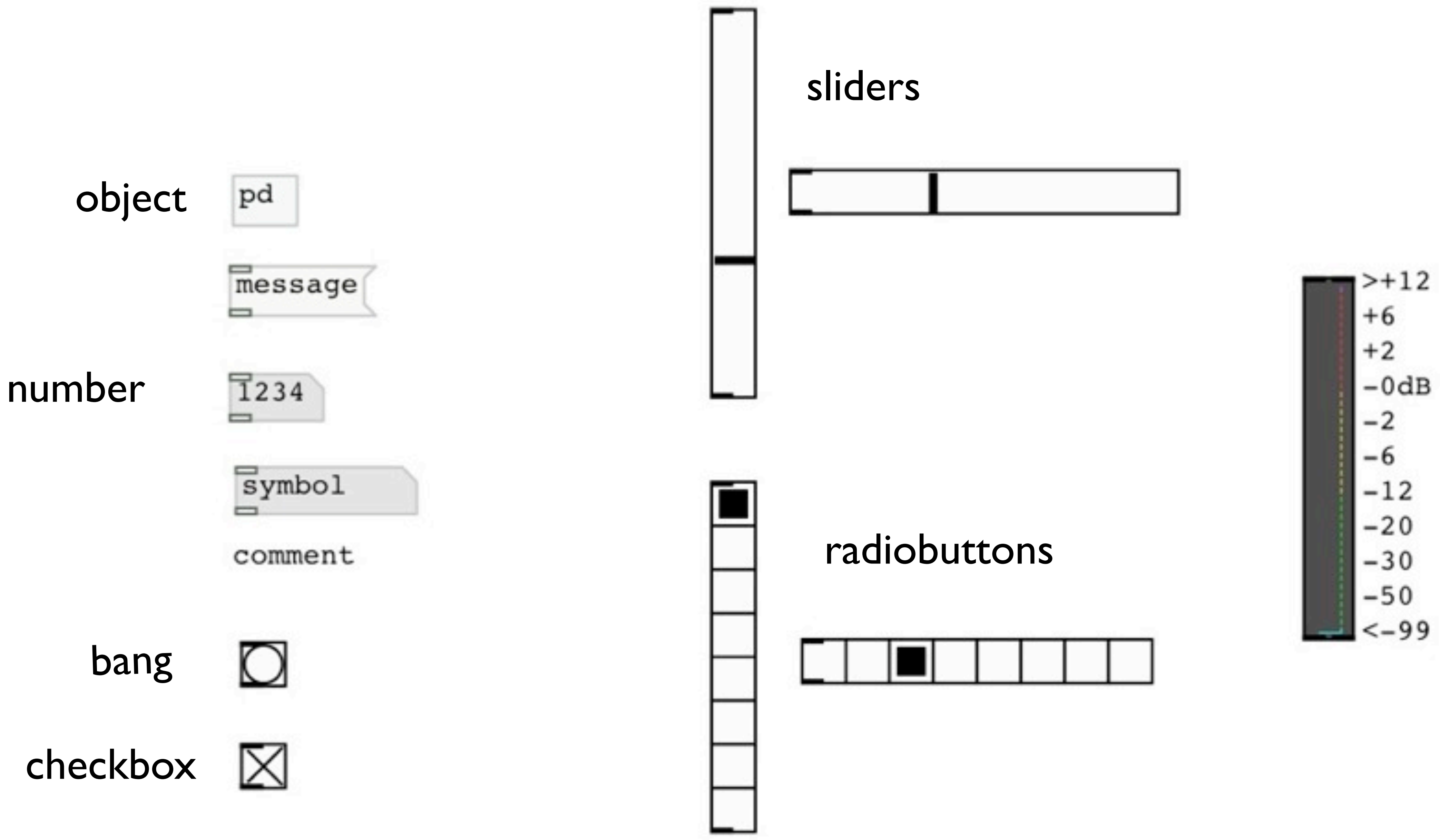
Intro to Pure Data

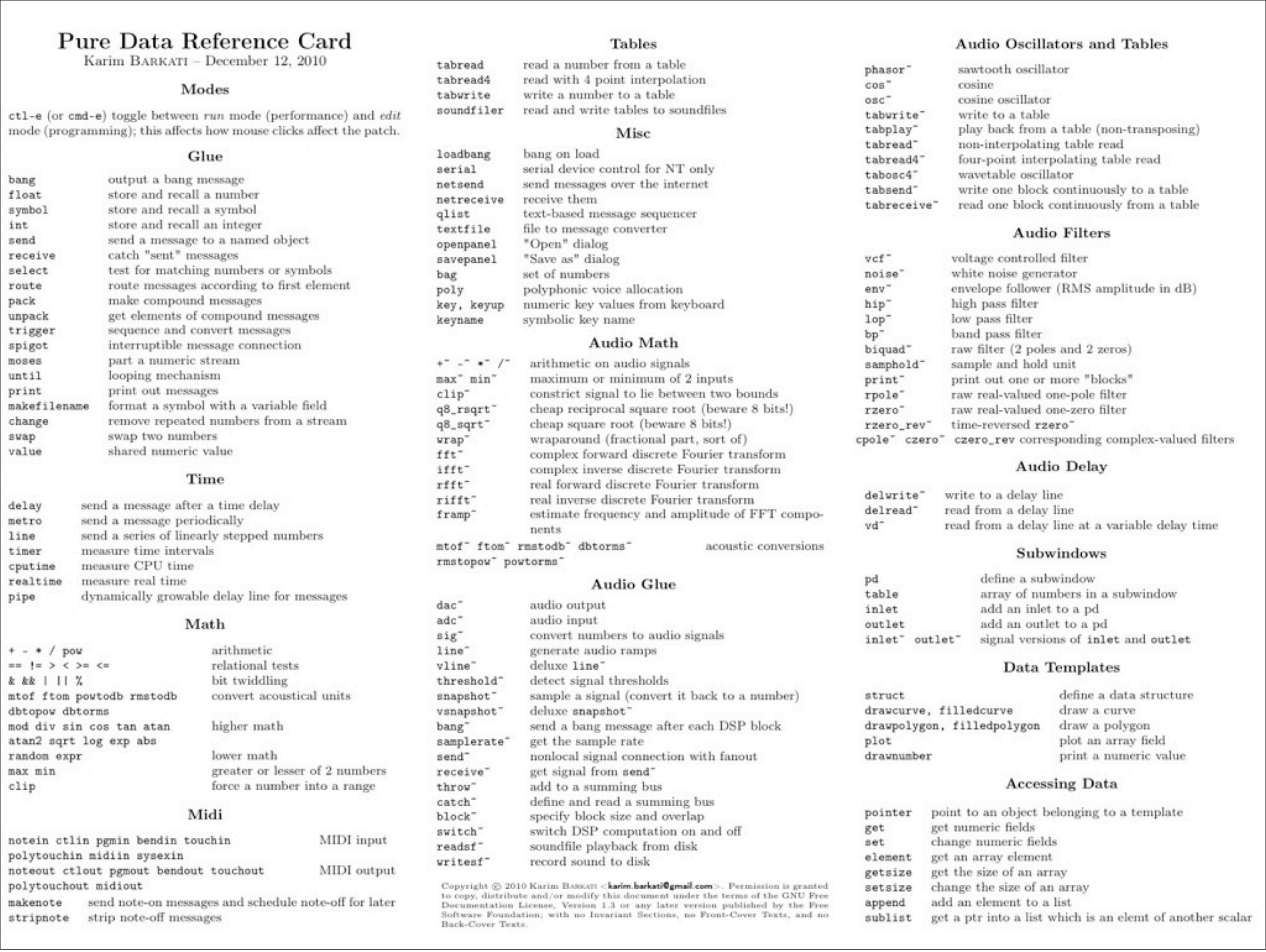
Mikael Fernström

Pure Data

- http://puredata.info/
- visual programming language
- originally by Miller Puckette, 1990s
- for creating interactive multimedia works.
- open source project
- similar to Puckette's original Max program

The basic pd building blocks





Pure Data Reference Card

Karim Barkati – December 12, 2010

Modes

ctl-e (or cmd-e) toggle between *run* mode (performance) and *edit* mode (programming); this affects how mouse clicks affect the patch.

Glue

bang	output a bang message
float	store and recall a number
symbol	store and recall a symbol
int	store and recall an integer
send	send a message to a named object
receive	catch "sent" messages
select	test for matching numbers or symbols
route	route messages according to first element
pack	make compound messages
unpack	get elements of compound messages
trigger	sequence and convert messages
spigot	interruptible message connection
moses	part a numeric stream
until	looping mechanism
print	print out messages
makefilename	format a symbol with a variable field
change	remove repeated numbers from a stream
swap	swap two numbers
value	shared numeric value

Time

delay	send a message after a time delay
metro	send a message periodically
line	send a series of linearly stepped numbers
timer	measure time intervals
cputime	measure CPU time
realtime	measure real time
pipe	dynamically growable delay line for messages

Math

+ - * / pow	arithmetic
== != > < >= <=	relational tests
& && | || %	bit twiddling
mtof ftom powtodb rmstodb dbtopow dbtorms	convert acoustical units
mod div sin cos tan atan atan2 sqrt log exp abs	higher math
random expr	lower math
max min	greater or lesser of 2 numbers
clip	force a number into a range

Midi

notein ctlin pgmin bendin touchin polytouchin midiin sysexin	MIDI input
noteout ctlout pgmout bendout touchout polytouchout midiout	MIDI output
makenote	send note-on messages and schedule note-off for later
stripnote	strip note-off messages

Tables

tabread	read a number from a table
tabread4	read with 4 point interpolation
tabwrite	write a number to a table
soundfiler	read and write tables to soundfiles

Misc

loadbang	bang on load
serial	serial device control for NT only
netsend	send messages over the internet
netreceive	receive them
qlist	text-based message sequencer
textfile	file to message converter
openpanel	"Open" dialog
savepanel	"Save as" dialog
bag	set of numbers
poly	polyphonic voice allocation
key, keyup	numeric key values from keyboard
keyname	symbolic key name

Audio Math

+~ -~ *~ /~	arithmetic on audio signals
max~ min~	maximum or minimum of 2 inputs
clip~	constrict signal to lie between two bounds
q8_rsqrt~	cheap reciprocal square root (beware 8 bits!)
q8_sqrt~	cheap square root (beware 8 bits!)
wrap~	wraparound (fractional part, sort of)
fft~	complex forward discrete Fourier transform
ifft~	complex inverse discrete Fourier transform
rfft~	real forward discrete Fourier transform
rifft~	real inverse discrete Fourier transform
framp~	estimate frequency and amplitude of FFT components
mtof~ ftom~ rmstodb~ dbtorms~ rmstopow~ powtorms~	acoustic conversions

Audio Glue

dac~	audio output
adc~	audio input
sig~	convert numbers to audio signals
line~	generate audio ramps
vline~	deluxe line~
threshold~	detect signal thresholds
snapshot~	sample a signal (convert it back to a number)
vsnapshot~	deluxe snapshot~
bang~	send a bang message after each DSP block
samplerate~	get the sample rate
send~	nonlocal signal connection with fanout
receive~	get signal from send~
throw~	add to a summing bus
catch~	define and read a summing bus
block~	specify block size and overlap
switch~	switch DSP computation on and off
readsf~	soundfile playback from disk
writesf~	record sound to disk

Audio Oscillators and Tables

phasor~	sawtooth oscillator
cos~	cosine
osc~	cosine oscillator
tabwrite~	write to a table
tabplay~	play back from a table (non-transposing)
tabread~	non-interpolating table read
tabread4~	four-point interpolating table read
tabosc4~	wavetable oscillator
tabsend~	write one block continuously to a table
tabreceive~	read one block continuously from a table

Audio Filters

vcf~	voltage controlled filter
noise~	white noise generator
env~	envelope follower (RMS amplitude in dB)
hip~	high pass filter
lop~	low pass filter
bp~	band pass filter
biquad~	raw filter (2 poles and 2 zeros)
samphold~	sample and hold unit
print~	print out one or more "blocks"
rpole~	raw real-valued one-pole filter
rzero~	raw real-valued one-zero filter
rzero_rev~	time-reversed rzero~
cpole~ czero~ czero_rev	corresponding complex-valued filters

Audio Delay

delwrite~	write to a delay line
delread~	read from a delay line
vd~	read from a delay line at a variable delay time

Subwindows

pd	define a subwindow
table	array of numbers in a subwindow
inlet	add an inlet to a pd
outlet	add an outlet to a pd
inlet~ outlet~	signal versions of inlet and outlet

Data Templates

struct	define a data structure
drawcurve, filledcurve	draw a curve
drawpolygon, filledpolygon	draw a polygon
plot	plot an array field
drawnumber	print a numeric value

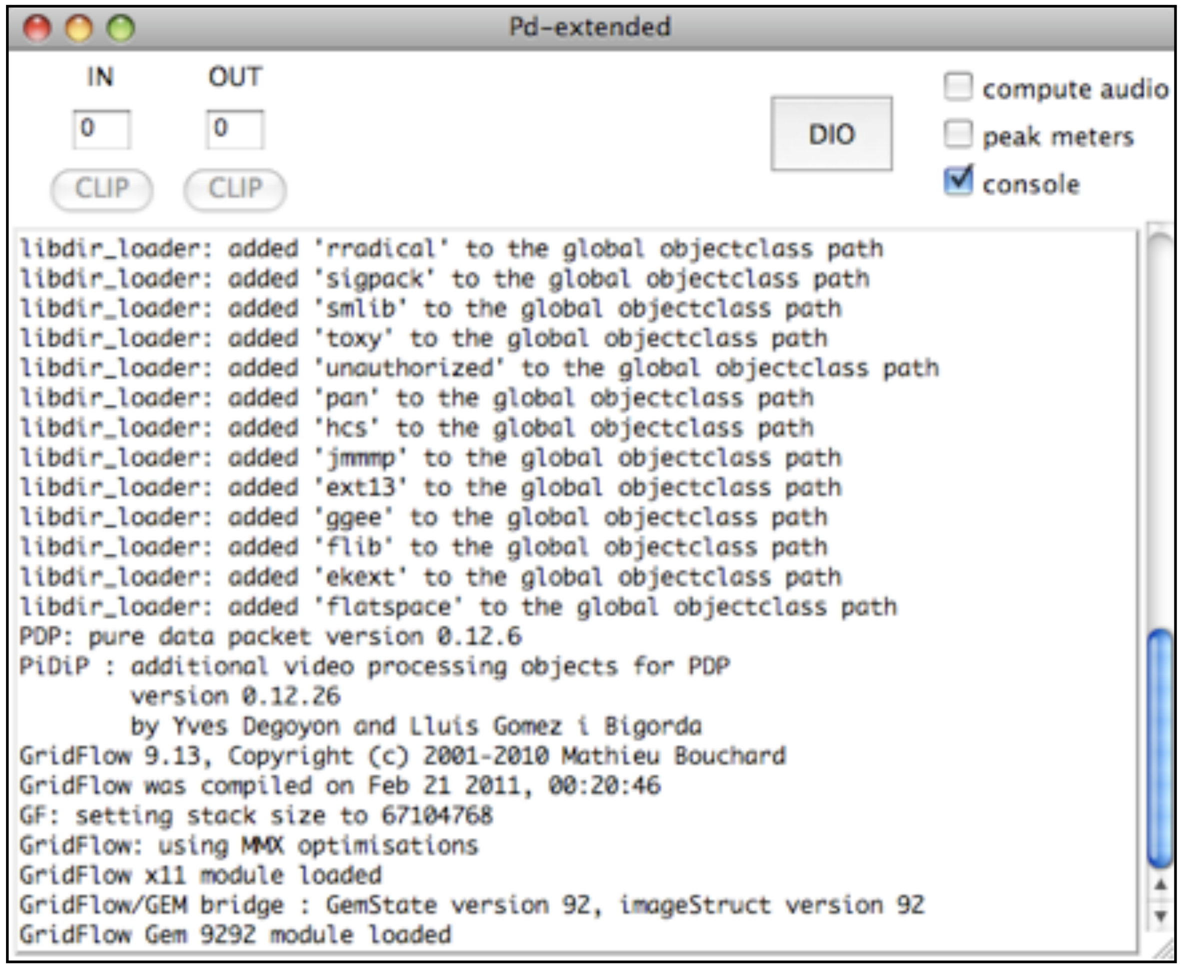
Accessing Data

pointer	point to an object belonging to a template
get	get numeric fields
set	change numeric fields
element	get an array element
getsize	get the size of an array
setsize	change the size of an array
append	add an element to a list
sublist	get a ptr into a list which is an elemt of another scalar

Getting started

- Start PD
- File -> New

Getting started



```
libdir_loader: added 'rradical' to the global objectclass path
libdir_loader: added 'sigpack' to the global objectclass path
libdir_loader: added 'smlib' to the global objectclass path
libdir_loader: added 'toxy' to the global objectclass path
libdir_loader: added 'unauthorized' to the global objectclass path
libdir_loader: added 'pan' to the global objectclass path
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libdir_loader: added 'ext13' to the global objectclass path
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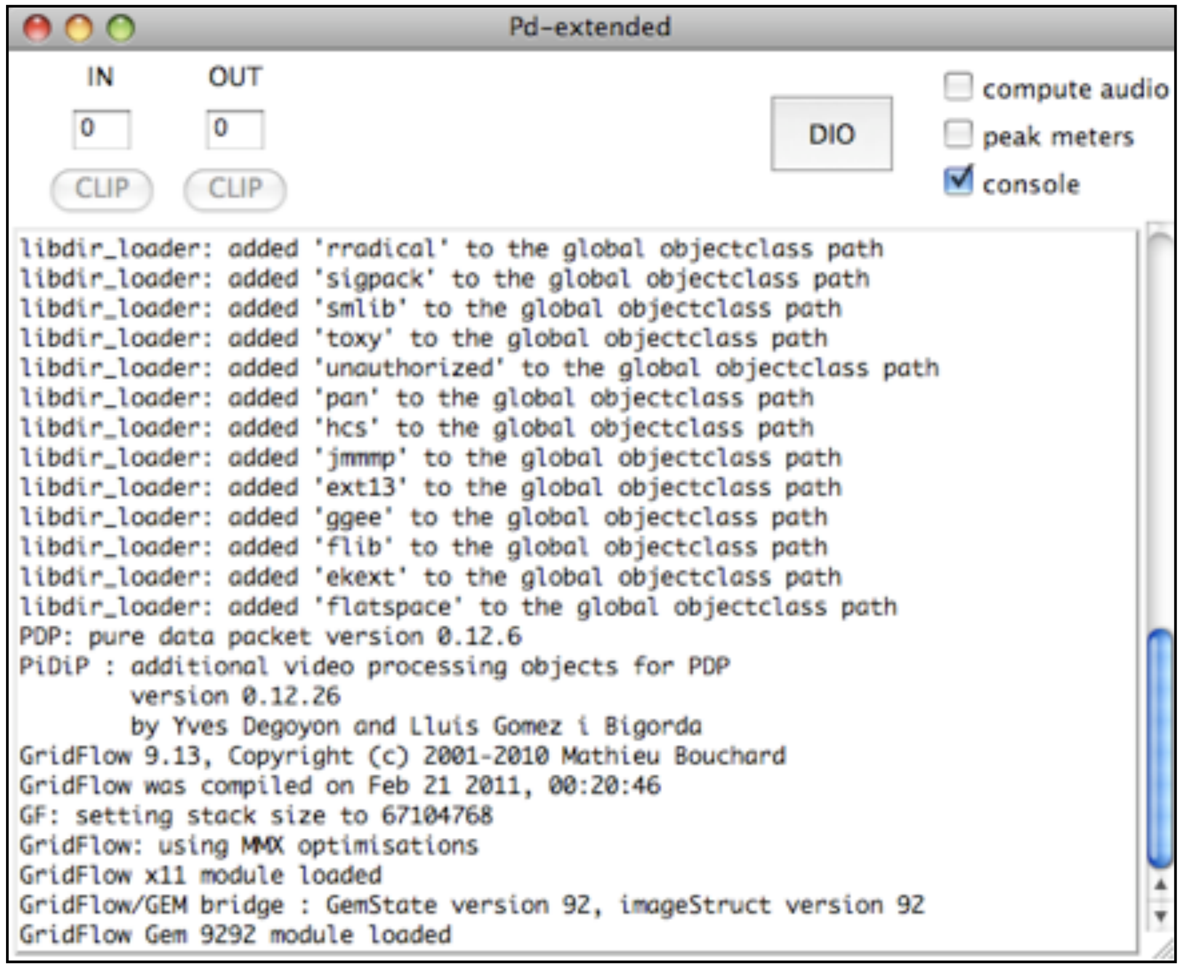
libdir_loader: added 'flib' to the global objectclass path
libdir_loader: added 'ekext' to the global objectclass path
libdir_loader: added 'flatspace' to the global objectclass path
PDP: pure data packet version 0.12.6
PiDiP : additional video processing objects for PDP
        version 0.12.26
        by Yves Degoyon and Lluis Gomez i Bigorda
GridFlow 9.13, Copyright (c) 2001-2010 Mathieu Bouchard
GridFlow was compiled on Feb 21 2011, 00:20:46
GF: setting stack size to 67104768
GridFlow: using MMX optimisations
GridFlow x11 module loaded
GridFlow/GEM bridge : GemState version 92, imageStruct version 92
GridFlow Gem 9292 module loaded
```

Getting started



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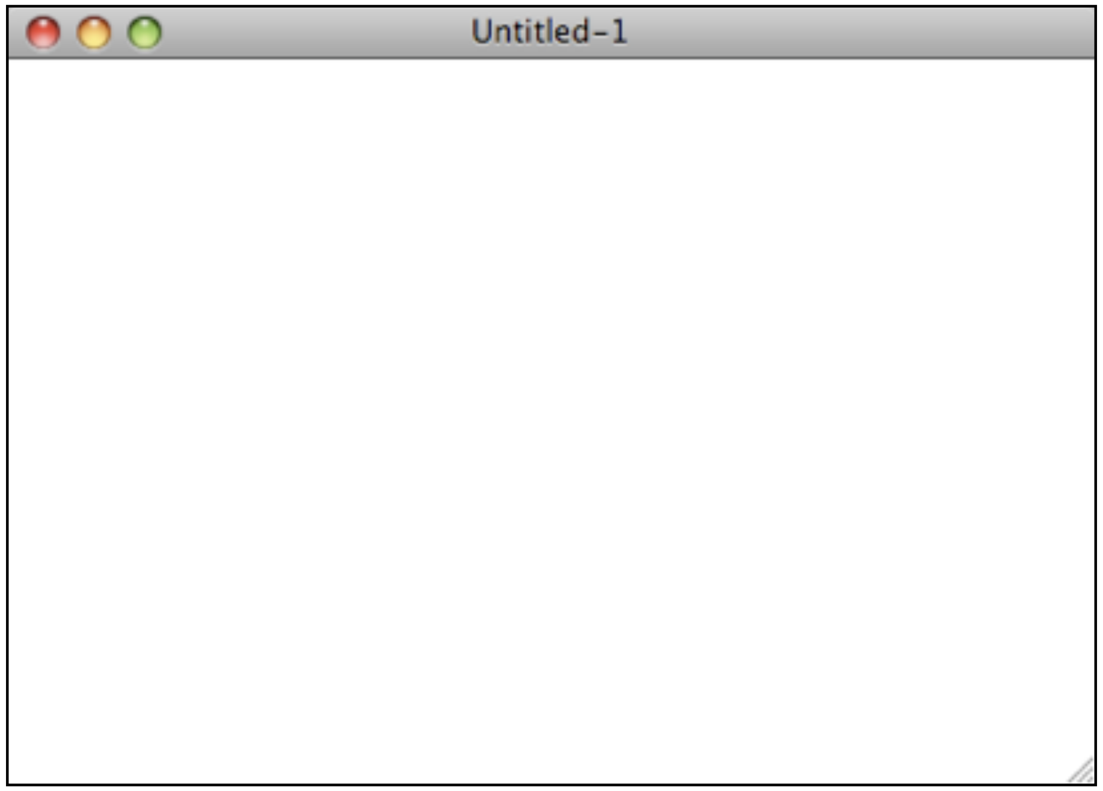
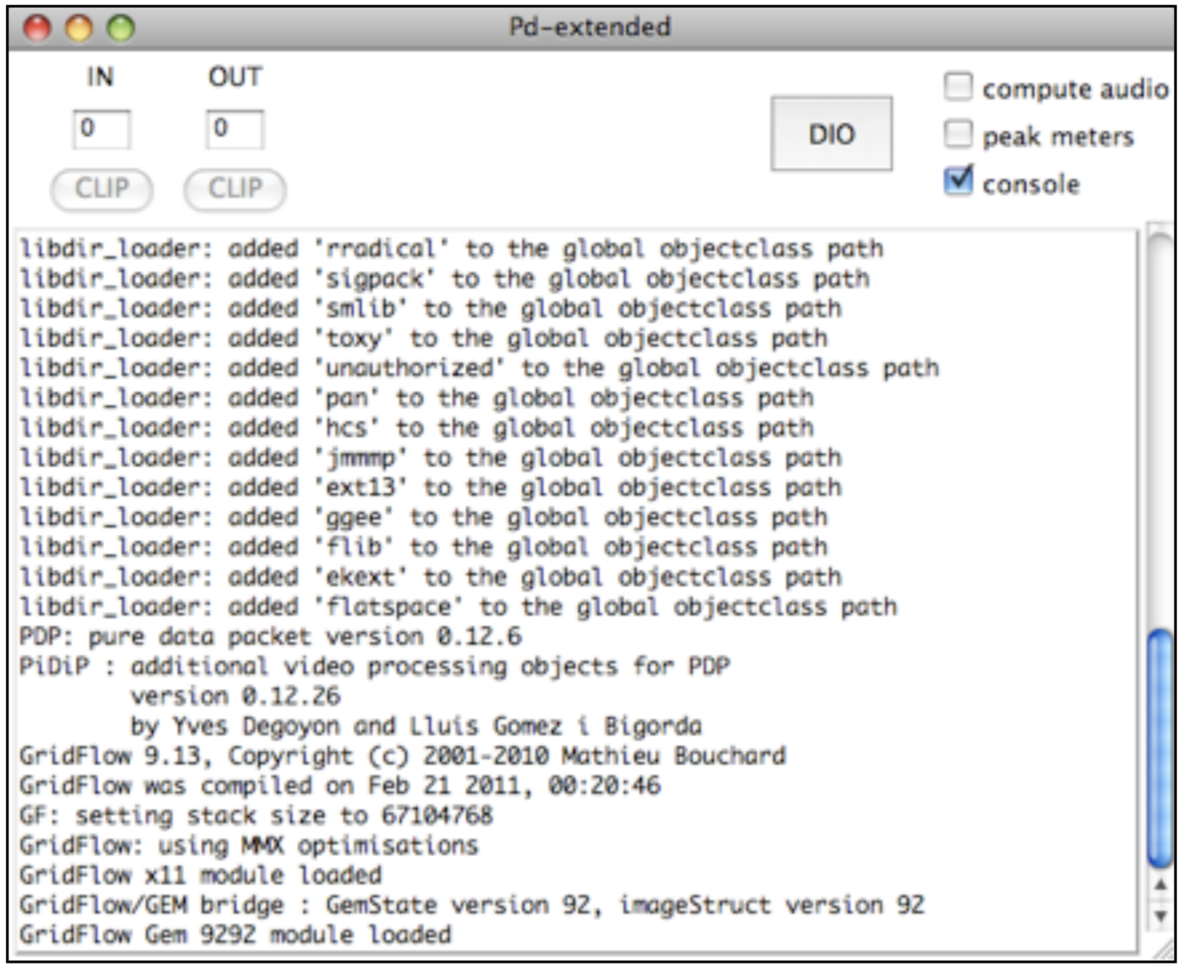


Getting started



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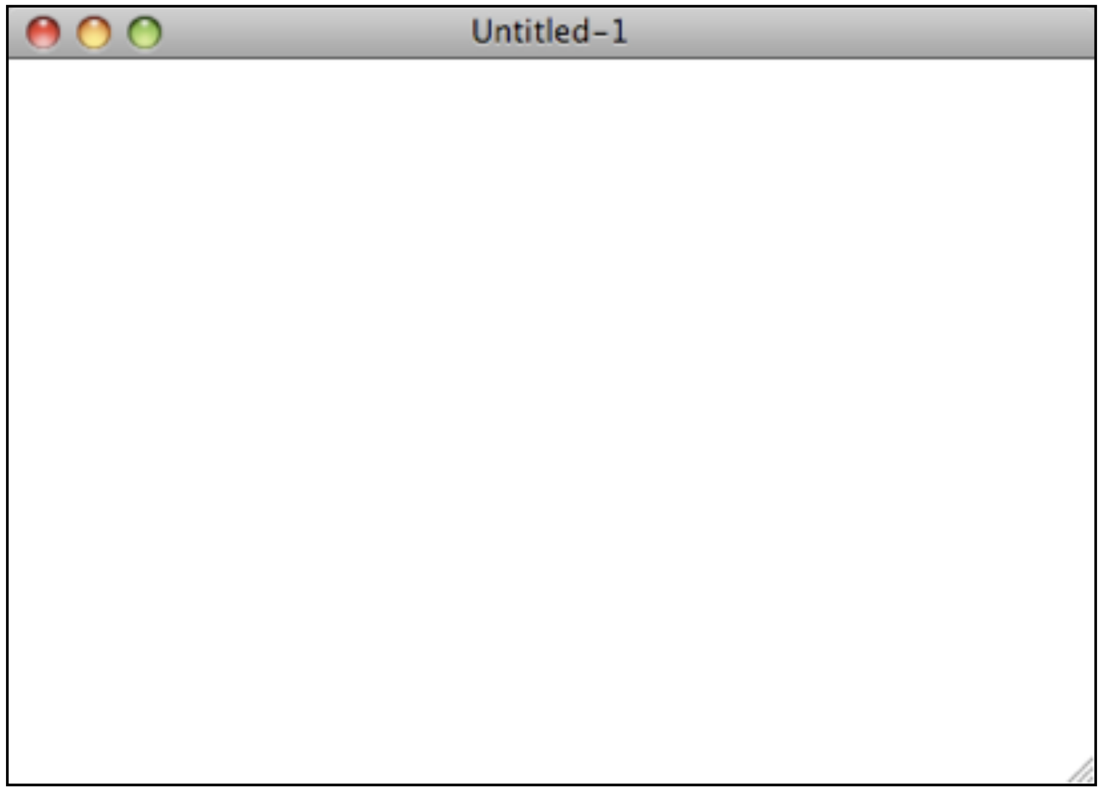
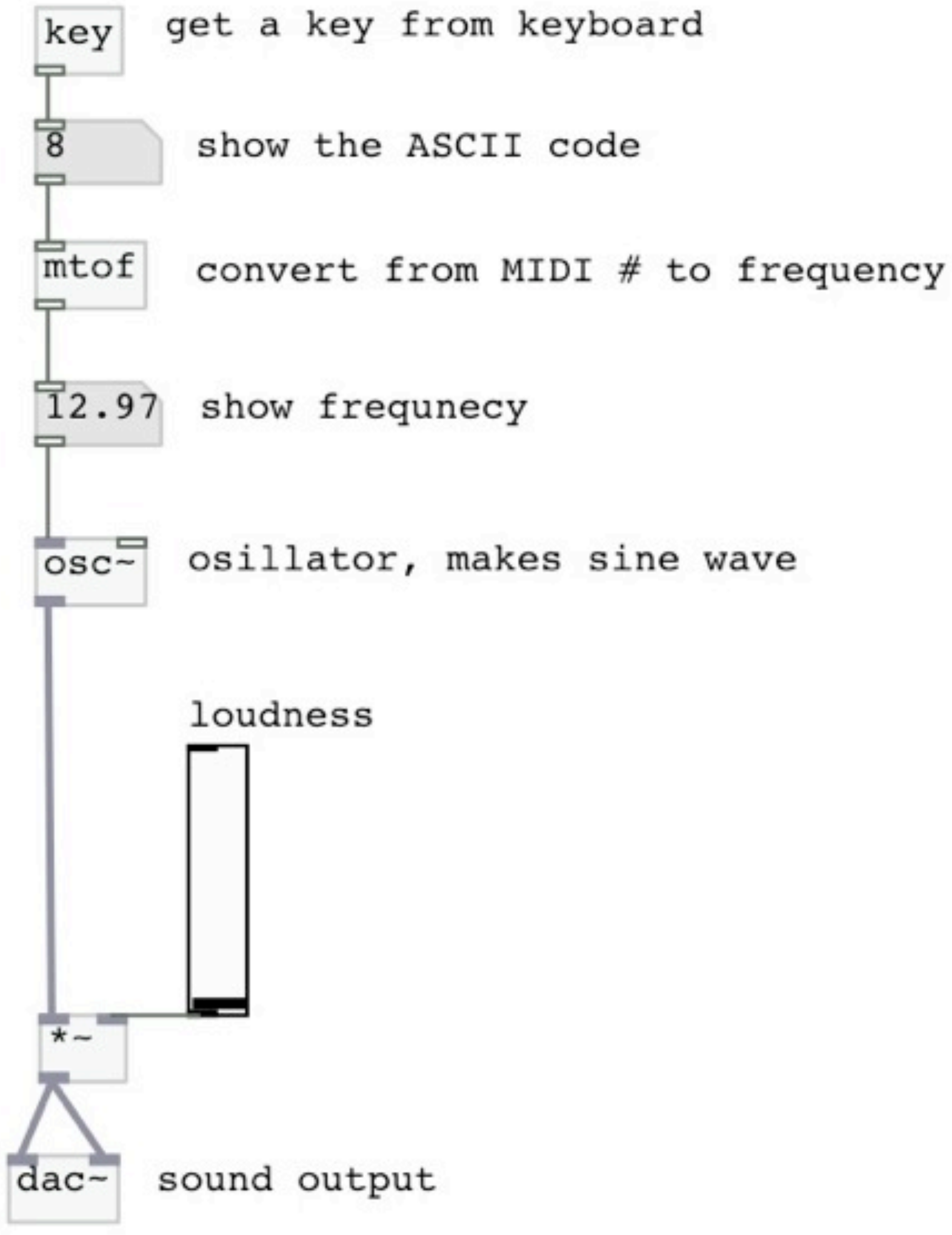
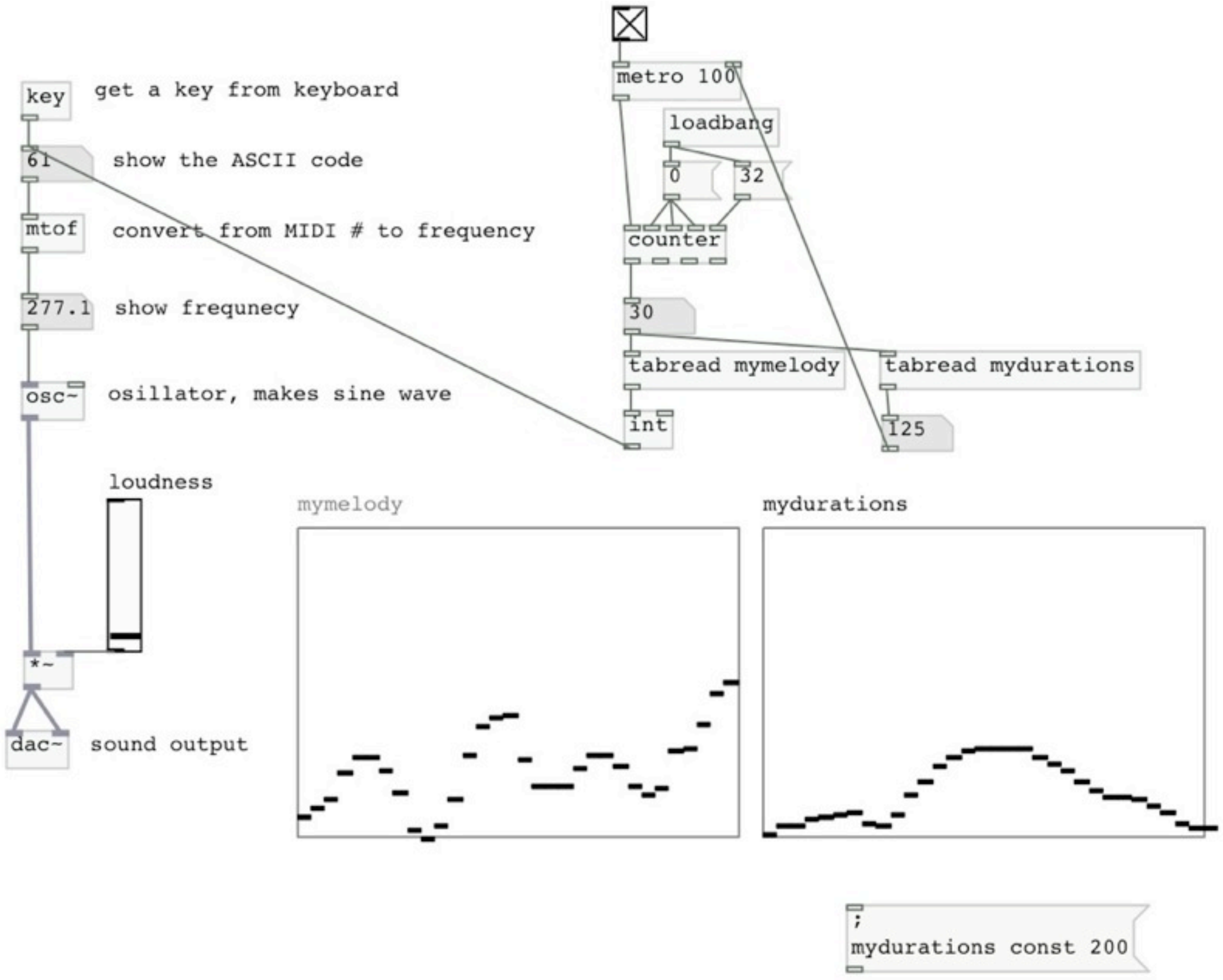


switch edit mode / run mode: **cmd + e**

Your first pd patch



Your second pd patch: draw a melody

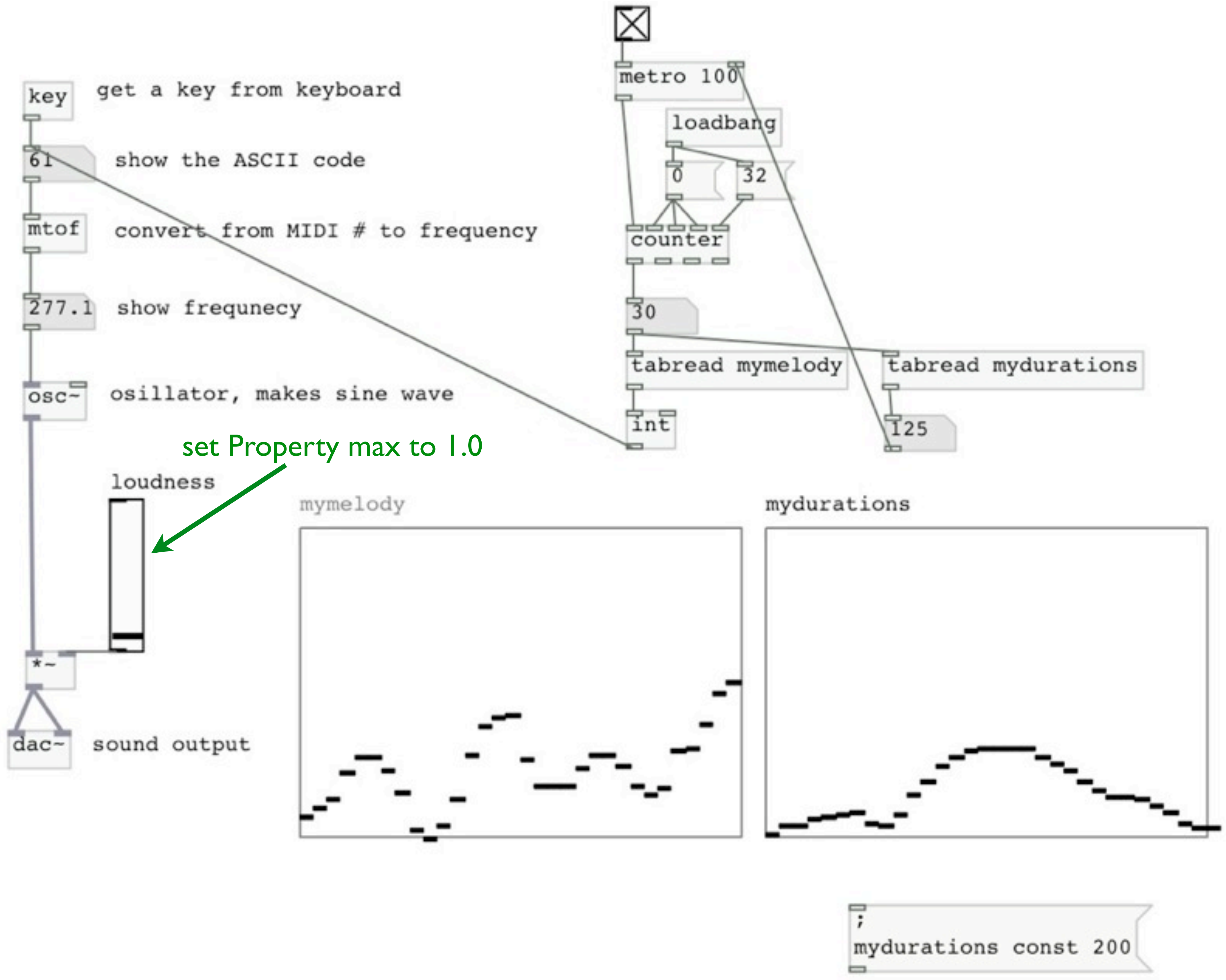


```
key        get a key from keyboard
61         show the ASCII code
mtof       convert from MIDI # to frequency
277.1      show frequnecy
osc~       osillator, makes sine wave
loudness
*~
dac~       sound output

metro 100
loadbang
0
32
counter
30
tabread mymelody
tabread mydurations
int
125

;
mydurations const 200
```

Your second pd patch: draw a melody



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61         show the ASCII code
mtof       convert from MIDI # to frequency
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osc~       osillator, makes sine wave
           loudness
*~
dac~       sound output

metro 100
loadbang
0    32
counter
30
tabread mymelody    tabread mydurations
int                 125

mymelody            mydurations

;
mydurations const 200
```

set Property max to 1.0

To continue your pd exploration

http://puredata.info/docs/StartHere/

My examples

(also including an extra 8 channel, 32 step sequencer):

www.idc.ul.ie/mikael/sounds/CAO-2012Examples.zip

Questions?