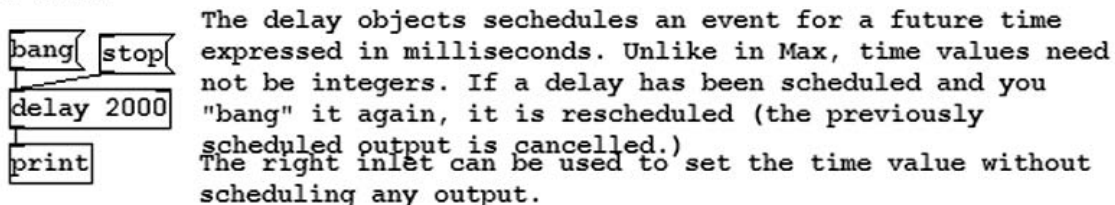
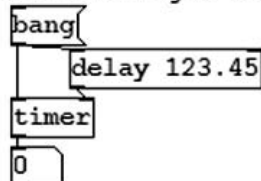


Besides the metronome, there are three objects for dealing with time:

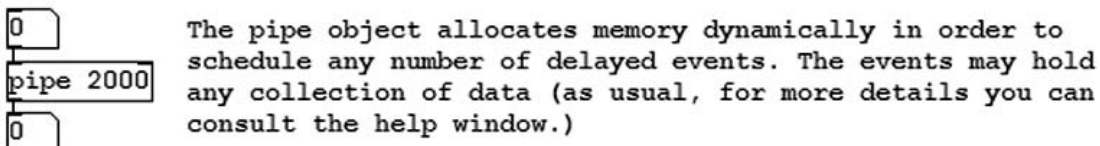


The delay object schedules an event for a future time expressed in milliseconds. Unlike in Max, time values need not be integers. If a delay has been scheduled and you "bang" it again, it is rescheduled (the previously scheduled output is cancelled.)
The right inlet can be used to set the time value without scheduling any output.

The timer, shown below, measures the time elapsed between its left and right inlets:



Note that all time calculations are idealized; they do not show the effects of computation time or OS latency. This way you can write deterministic algorithms dealing with time passage.



The pipe object allocates memory dynamically in order to schedule any number of delayed events. The events may hold any collection of data (as usual, for more details you can consult the help window.)

updated for Pd version 0.34

Pure words – (Ab)using Pd for Text-Based Score Generation

Thomas Grill

Writing a chapter for a book involves taking suitable words, forming sentences, and considering various formulations so that the desired content gradually comes into existence. This is related to writing a musical score, where following some pattern, one note follows another. This can be tiresome.

marking_time thinking discursive reflection discursive reflection decide action intuitive idea realize generate structure score music performance represent notion lively time marking_time movement circulating movement circulating movement time marking_time movement circulating movement process movement time onset break chain following associated network weight trigger generate structure pattern structure network connected following pattern parameters score music performance lively human intuitive idea realize action intuitive lively human voice discursive thinking process movement time marking_time

Hence, it might be advantageous to just sketch all relevant rules and relationships and let a machine decide about the details, like when improvising musicians follow the general structure of a score but decide upon the sound microstructure instantaneously. Machines won't get tired of this work; they will just strictly follow the given rules. The result might be boring, since it's probably too well ordered, but on the other hand, one can always take it as pure material, rearrange parts, introduce faults and thus make it more lively and human.

movement process performance represent notion lively time onset break gradually break gradually time onset break gradually break gradually break gradually time marking_time movement time boring lively time onset break chain following associated following pattern structure patch chain following pattern structure pattern parameters score music performance represent notion lively human tasteful music performance represent notion parameters score music performance lively human intuitive lively time boring lively human voice discursive notion lively human intuitive lively time marking_time movement

Not too long ago I was asked to write a score for clarinet, viola, cello, and narrator upon the subject of the anti-capitalist fairy-tale “Das kalte Herz” (“The cold heart”) by Wilhelm Hauff. Written in the first half of the 19th century at the climax of romanticism, the language of the narration wasn't really what I considered suitable for contemporary music and on-stage recital. Nonetheless, the ideas and notions used in the tale were interesting and timeless. Therefore, I decided to understand the composition as a reflection of the essence of the tale rather than of the story itself, like when thinking of reasoning as a process as opposed to an actual physical movement.

notion parameters score music performance represent notion lively time onset break chain following pattern boring lively time onset break chain following associated network weight trigger generate structure network weight trigger action intuitive lively time onset break chain following pattern structure network weight trigger action intuitive idea music performance represent notion parameters score music performance represent notion

The idea was that the musicians and the narrator would stand still in a musical sense, just marking time, circulating the same few ideas over and over again but on different trajectories, therefore being independent in principle but meeting many times in various constellations in the course of half an hour of performance. To underline the idea of physical immobility with highly discursive activity, I would let the musicians play in an atmosphere of traffic and people walking, played from tape, so that the instruments and voice would often not even be audible, masked by the noise of vehicles passing by. The audience should notice within the first few minutes that no action is taking place and therefore calm down and take part in the reflective process.

score music performance lively human intuitive lively human intuitive idea realize generate structure score
 music performance lively time marking_time movement process movement time boring lively time onset
 break chain following pattern parameters score music performance represent notion lively human voice dis-
 cursive thinking process performance represent notion parameters score

When considering how to realize the structure of the piece without being too tasteful in a musical sense, or simply too human, I thought of the patch structure of Pd, which with its objects is able to represent various ideas chosen from the tale, each one connected to a specific musical expression, and where the interconnections of objects represent semantic relationships between the several ideas. The patch would then form a semantic network, where each object in the patch is able to trigger in turn another associated one and gradually make up the material for a score.

time marking_time movement time marking_time movement process movement process performance lively
 human intuitive lively time boring lively human voice discursive reflection discursive decide action intuitive
 lively time marking_time movement process movement time boring lively human voice discursive thinking
 discursive reflection discursive realize action intuitive lively human intuitive lively time onset break chain fol-
 lowing associated following associated network connected following associated following pattern parameters
 score music performance represent notion lively time onset break onset break chain following associated fol-
 lowing associated network weight trigger action intuitive lively time

This representation of interdependencies is also known as a Markov chain¹, which is commonly displayed as a table of probabilities between associated elements. The advantage of the patch representation is that the interconnections can be set up and tuned much more intuitively than by filling numbers into a table. On the other hand, it has the drawback that associations can hardly be generated automatically, which is also a widespread technique. For the given application, however, it's just fine.

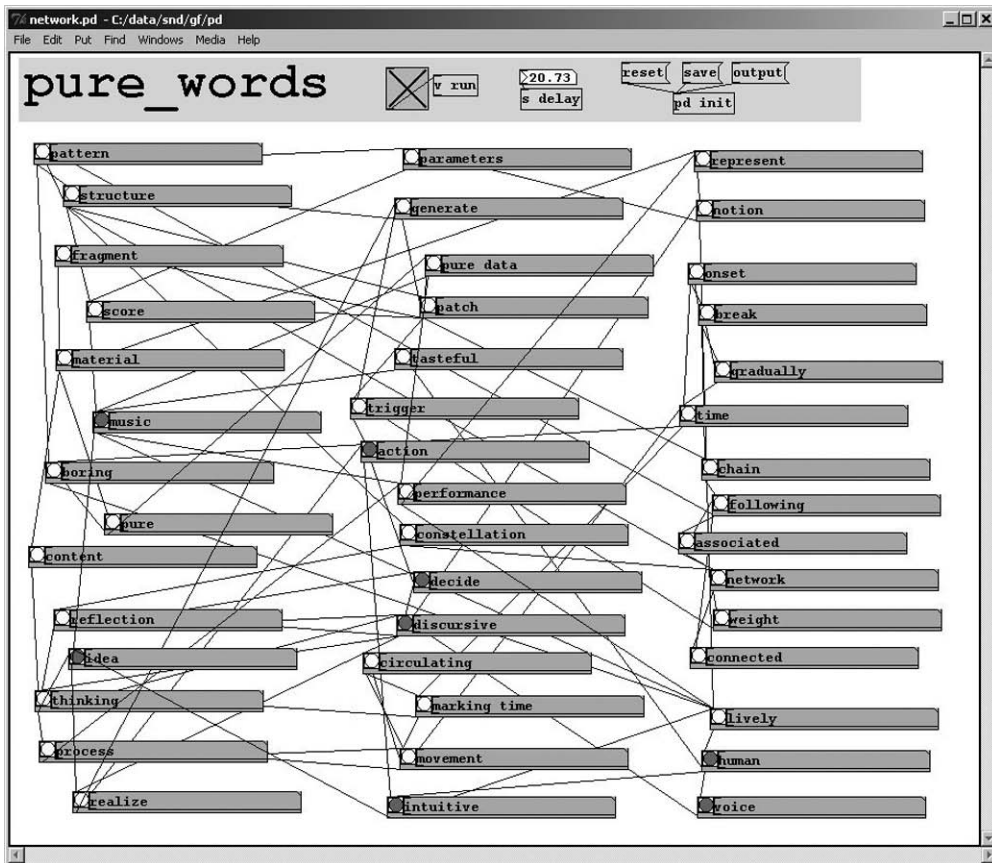
discursive notion lively time boring lively time boring lively time onset break chain following associated net-
 work weight trigger action intuitive idea realize generate structure pattern boring lively human tasteful music
 performance lively time marking_time movement time boring lively human tasteful music performance lively
 time marking_time movement process movement circulating movement time boring lively human voice dis-
 cursive

There are two main difficulties when using the patch structure of Pd for this kind of network.

¹ <http://en.wikipedia.org/wiki/Markov_chain>

First, it should be possible to connect several downstream elements to one object, but only one of them should be triggered to pass the relay on to the next elements. Second, it should be possible to weight the connections so that one association can be stronger than another one. Both issues can be mastered with some tricky patching. Although it's not strictly necessary, I decided to use py/pyext² for reading in the word database, for constructing the score as a list notion by notion, and for saving the score to a file. The advantages of using py/pyext instead of common Pd objects are that it's very convenient and makes for quick coding³.

reflection decide action intuitive lively time onset break chain following associated following pattern structure score music performance lively human voice discursive realize action intuitive idea realize action intuitive lively human intuitive lively time boring lively human intuitive idea music performance lively time onset break chain following associated following associated network connected following pattern structure patch generate structure pattern boring lively time onset break chain following associated network connected following pattern structure constellation reflection



² <<http://grrr.org/ext/py>>

³ The respective patches can be downloaded at <<http://grrr.org/ext/patches/purewords>>.

Finally, the process of automated thinking – a path of associations defined by a complex network of selected ideas and their interdependencies – will generate a bunch of text. I associated six more or less orthogonal musical parameters – such as energy, purity, duration, variety, brightness, opposition – with each of the ideas. The fact that these parameters of one idea in the score will in many cases be not too different from the preceding ones creates a kind of smooth envelope over time. On the other hand, rapid changes in one or more parameters seldom can be used to mark the time structure in the score. Manual filtering and reviewing the resulting gestures are indispensable and finally render the structure to music – with three instrumental voices this gives a quite complex pattern of autonomous or concerted movements, of onsets and breaks, accompanied by associative text fragments recited by the narrator⁴.

⁴ “sich über sich” was performed on June 29, 2005 at Grabenfesttage, Vienna with Gerald Preinfalk (clarinets), Petra Ackermann (viola), Andreas Lindenbaum (cello) and Johannes Poigenfürst (voice).