Sound Design Toolkit (SDT)

Handbook

version 0.6.0

Contents

1 Introduction

The Sound Design Toolkit (SDT) is a software package consisting of a set of physics-based sound synthesis models, available as a complete front-end application for Max/MSP/Jitter, and providing a palette of virtual lutheries and foley pits, that can be exploited in Sonic Interaction Design (SID) research and education. In particular, the package includes polyphonic features and connectivity to multiple external devices and sensors in order to facilitate the embedding of sonic attributes in interactive artifacts [2].

The provided physics-based sound models, developed and implemented as externals and patches, can be easily coupled with physical objects and are computationally affordable for real-time applications on ordinary hardware. The sound models algorithms are developed according to three main points: 1) auditory perceptual relevance; 2) *cartoonification*, i.e. simplification of the underlying physics and emphasis on its most relevant aspects in order to increase both computational efficiency and perceptual sharpness; 3) parametric temporal control ensuring appropriate, natural and expressive articulations of sound event sequences (for an in depth description of the sound models please refer to the User's Guide [1]).

The main features of the current release of the SDT are:

- a high level, general template of available sound models, organized according to a taxonomy of everyday sounds;

- the clustering of the control parameters into high and low level GUIs according to their more or less meaningful and immediate effects;

- an intuitive understanding of the control parameters, facilitated by a common sense and perceptually-based naming and ranging of the physical parameters;

- the possibility to allocate multiple instances (polyphony) of the sound models in order to facilitate the design of compound sound events;

- a comfortable integration of external devices to interactively control the sound models.

1.1 Installation

1. in "SDT_externals" there are 2 zip files with the externals for mac and win, and a folder containing all the common abstractions used in the SDT. Copy the directory "SDT_externals" to Max's default externals directory (Max5/Cycling '74);

2. get inside the copied directory and delete the zip file which is not for your OS (e.g., delete the win-related file if you are on a mac);

3. unzip the compressed file for your OS inside "SDT_externals";

4. copy the directory "SDT_help" to Max's default help directory (Max5/Cycling '74);

5. copy "SDTobjectlist.txt" listed in SDT_init to Cycling '74/init folder.

6. copy "SDT_overview.maxpat" in SDT_extras to Max5/patches/extras.

Usage: get inside "SDT_patches" and open *SoundDesignToolkit.maxpat* .

1.2 Navigating the SDT

The SDT is composed of a modular framework of patches and sub-patches, arranged in folders and subfolders (see Fig. 1.1) .

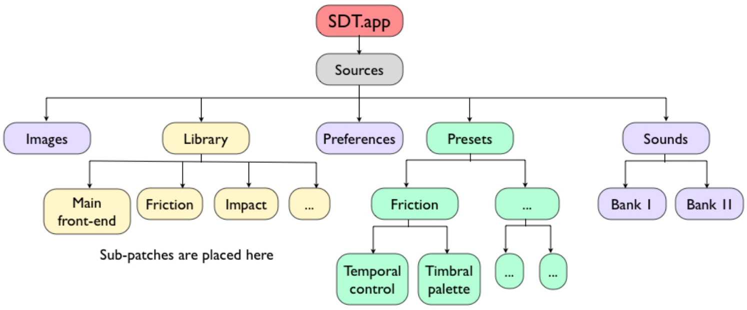

Figure 1.1: The SDT tree of folders and subfolders.

Patches, abstractions, general preferences and presets are respectively located in their pertinent subfolders. The *Library* folder is further split into as many sub-folders as the number of the available sound models, and it contains all patches and abstractions. In the *Presets* folder, sub-folders that refer to each sound models contain separate lower level folders where *Temporal control* and *Timbral palette* presets are saved as XML or TXT file. In the Sound folder, samples can be recorded as AIFF files.

The available sound models are hierarchically arranged from low-level sound events to more complex, patterned or compound processes (see Fig. 1.2). The corresponding low-level sound models are presented at the bottom of the graph, while the second level shows basic events and sound textures straightly derivable from them. Processes that can be related to temporal patterns of basic events and textures are presented in the third level. The top level contains several examples of the implemented simulations, while dashed connections represent expected dependencies for the simulations yet to be developed.

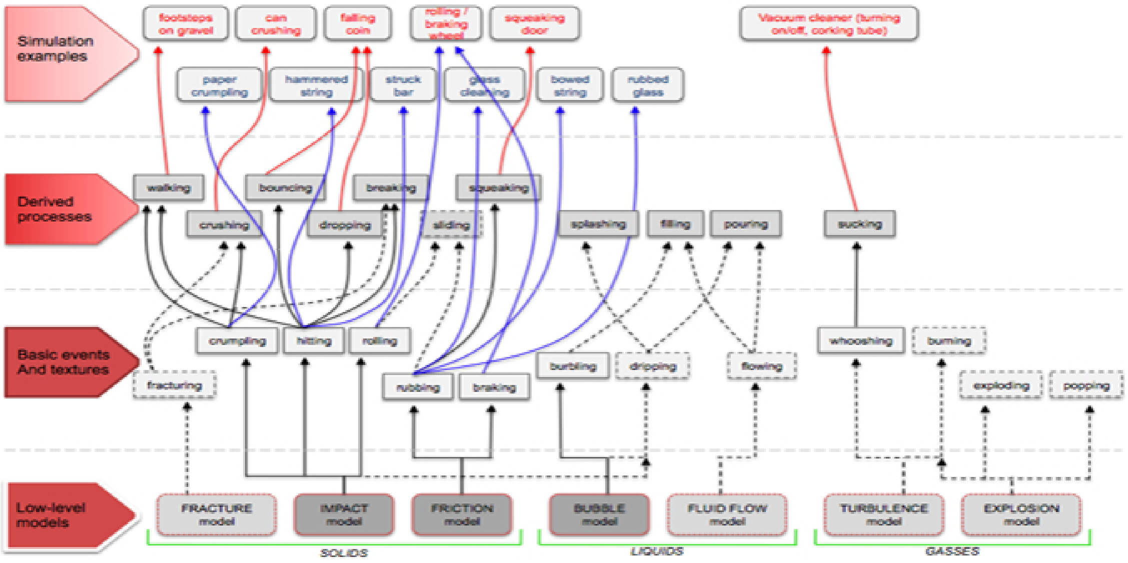

Figure 1.2: The taxonomy of everyday sounds.

2 The SDT Front-end

Open the *SoundDesignToolkit.maxpat patch.* A front-end shows up displaying the available sound models, hierarchycally organized (*SDT_taxonomy* patch). The colour of the boxes indicates the dependencies between the sound models. Click on the coloured boxes to load the correspondent sound model manager patch.

As a general disclaimer, every single patch is provided of a “read me” box containing the explanation of its GUI.

2.1 The Sound Model Manager

The overall framework of the SDT is designed in order to automatically rebuild the audio and control connections, where needed. In practice, it is possible to manage multiple instances of the same sound model within a single working session, so reducing to the minimum the editing operations of Max/MSP patches. In the model manager patch (see Fig. 2.1), the sound model instances are added indexically and can be browsed, removed or restored, at user’s choice.

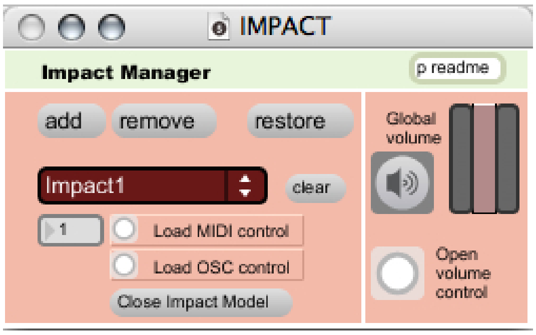

Figure 2.1: The impact manager patch.

- *Add*: click on the box to load and add multiple instances of the sound model in the same working session. Added instances are displayed as items in ascending order in the drop-down menu;
- *Remove*: in the drop-down menu, select the item to remove and click on the “remove” box. The corresponding item is displayed as “removed”;
- *Restore*: in the drop-down menu, select the ”removed” item to be restored, then click on the ”restore” box to restore the sound model;
- *Clear*: click on the box to clear the drop-down menu (recommended only when all instances have been removed);
- *Number box*: it displays the current selected item in the drop-down menu;
- *Button (load MIDI control)*: click on the button to load the MIDI control patch corresponding to the current selected item in the drop-down menu;
- *Button (load OSC control)*: click on the button to load the OSC control patch corresponding to the current selected item in the drop-down menu.
- *Button (open volume control)*: once the first instance is added click on the button to open volume control. Faders are grouped in a separated window;
- *Global volume*: the red slider between the meters works as master volume fader.

- *Close —— model*: click on the box to instantaneously close the manager patch and all the loaded instances of that sound model.

2.2 Mixing and Recording Audio

Volume controls and audio recording tools are automatically generated and grouped in a separate window, thus providing a global mixer (see Fig: 2.2).

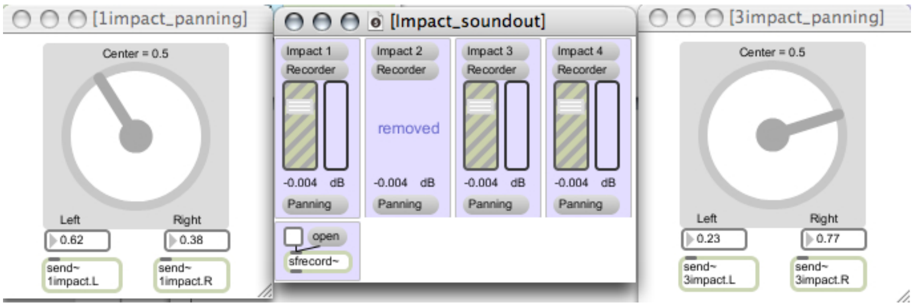

Figure 2.2: The mixer window with recording and panning tools.

Recording a sound: click on “recorder” to access the recording tools. Click on “open” to create and locate the sound file in your preferred folder, toggle on/off to start/stop recording. Sound is recorded as mono AIFF file.
Adjusting the panning: click on “panning” to access the correspondent panning window and locate the sound source along the stereo field. Two *send*˜ objects are automatically generated in order to send the audio signal to other Max/MSP patches for further signal processing.

2.3 The Sound Model GUI

For each sound model, the available control parameters are assigned either to low- or high-level interfaces. The current GUI provides a functional hierarchy of parameters: the intelligibility of the most effective control parameters is facilitated in the *high level interface*, though their accessibility is retained in the *low-level interface* too.

2.3.1 The high level interface

The *high level interface* is organized in three main sections (see Fig. 2.3): the *physical parameters* that encompass the most direct and effective parameters; the *temporal control* section provides an “off line” sequencing tool that allows to simulate gestures or patterns; the *timbral palette* allows to manage, store, recall, delete or interpolate configurations of sound parameters. Configurations are saved as presets in XML files, thus allowing them to be read, modified or generated from other XML compatible software.

- *Physical parameters*: available physical parameters are directly controllable via MIDI or OSC protocol, in the correspondent MIDI/OSC [Parameter] control patches accessible in the MIDI/OSC GUI;
- *Temporal control*: set BPM and sequence, click on toggle to switch the sequencer on/off,
- *Sequencer preset*: set the preset number in the box and then click on the button to store a sequence in a preset.
  “Recall” stored presets at index.
  “Read/writeagain” stored presets as TXT file on hard disk.

Preset files must be saved in SDT_contents/Presets/*[SOUNDMODEL]*/Rhythmic.
"Open" the text file associated to the current preset file;

- *Timbral palette*: the grey drop-down menu allows to browse and load the available preset.xml files. The button updates the drop-down menu with the items (preset.xml files) currently present in the pertinent timbral folder.
Timbral presets stored in the current preset.xml file can be recalled in the red drop-down menu.
To store or replace new presets switch off the toggle, then enter the new menu item position and the preset name (spaces in the preset name are not allowed, i.e. 3 metallic_coin).
To delete a single preset enter its menu item position and click on the button.
When the sound model is removed a dialogue box shows up asking to save the timbral preset file.
Preset.xml files must be saved in SDT_contents/Presets/*[SOUNDMODEL]*/Timbral;
- *Low level interface (red box)*: click on the box to open the low level interface. Click again on the box to close it;
- *Remove this model*: same as remove function in the sound model manager.

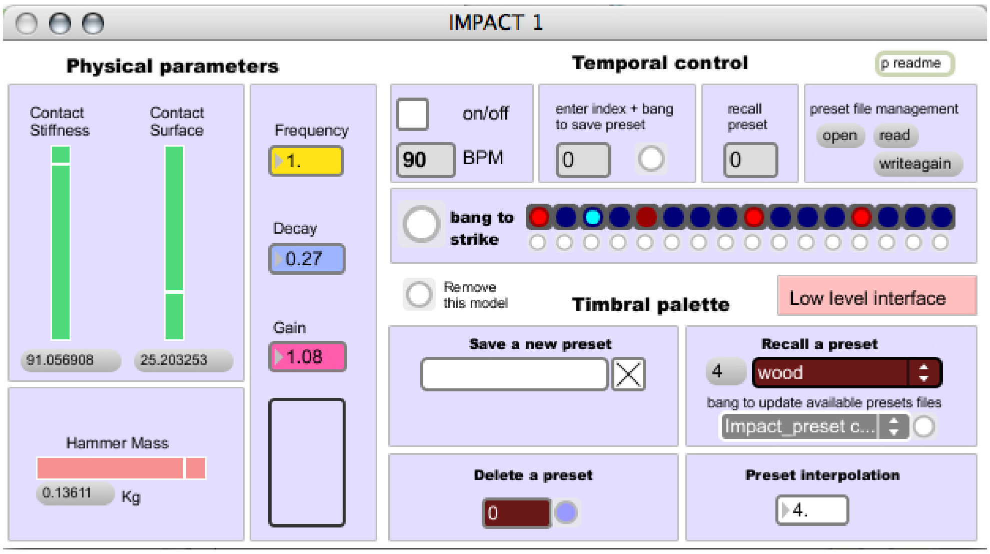

Figure 2.3: The high level interface.

2.3.2 The low level interface

The *low-level interface* gives access to all the available controls of the model, for further tuning and refining the sound. For example, it is possible to activate, deactivate or mute each resonant mode (up to 16 modes of resonance) and singularly modify its frequency, decay time and gain.

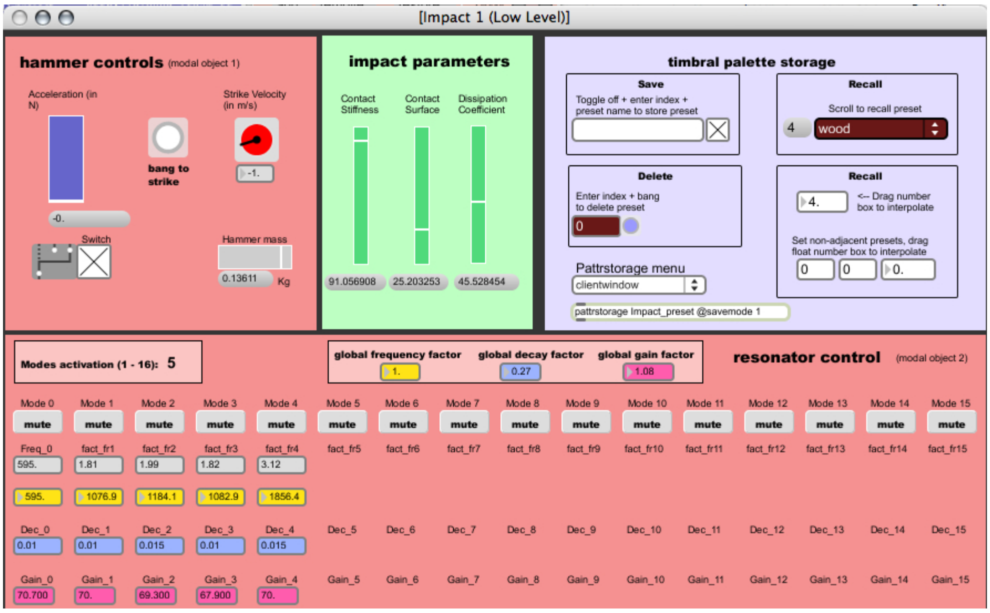
[Impact 1 (Low Level)]
hammer controls (modal object 1)
Acceleration (in N)
-0.
bang to strike
Strike Velocity (in m/s)
-1.
Switch
Hammer mass
0.13611 Kg
impact parameters
Contact Stiffness
Contact Surface
Dissipation Coefficient
91.056908
25.203253
45.528454
timbral palette storage
Save
Toggle off + enter index + preset name to store preset
Recall
Scroll to recall preset
4 wood
Delete
Enter index + bang to delete preset
0
Recall
4.
<-- Drag number box to interpolate
Set non-adjacent presets, drag float number box to interpolate
0 0 0.
Pattrstorage menu
clientwindow
pattrstorage Impact_preset @savemode 1
Modes activation (1 - 16): 5
global frequency factor 1.
global decay factor 0.27
global gain factor 1.08
resonator control (modal object 2)
Mode 0 Mode 1 Mode 2 Mode 3 Mode 4 Mode 5 Mode 6 Mode 7 Mode 8 Mode 9 Mode 10 Mode 11 Mode 12 Mode 13 Mode 14 Mode 15
mute
Freq_0 595.
fact_fr1 1.81
fact_fr2 1.99
fact_fr3 1.82
fact_fr4 3.12
fact_fr5 fact_fr6 fact_fr7 fact_fr8 fact_fr9 fact_fr10 fact_fr11 fact_fr12 fact_fr13 fact_fr14 fact_fr15
595. 1076.9 1184.1 1082.9 1856.4
Dec_0 0.01
Dec_1 0.01
Dec_2 0.015
Dec_3 0.01
Dec_4 0.015
Dec_5 Dec_6 Dec_7 Dec_8 Dec_9 Dec_10 Dec_11 Dec_12 Dec_13 Dec_14 Dec_15
Gain_0 70.700
Gain_1 70.
Gain_2 69.300
Gain_3 67.900
Gain_4 70.
Gain_5 Gain_6 Gain_7 Gain_8 Gain_9 Gain_10 Gain_11 Gain_12 Gain_13 Gain_14 Gain_15

Figure 2.4: The low level interface.

In Fig. 2.4, the red (object 1 and 2) and green (interaction description) sections encompass the physical parameters that describe the overall behaviour of the sound model. For the specific description of the control parameters, please refer to the User's Guide [1].

3 Connectivity to External Devices

The parameters displayed in the *high-level interface* of the sound models have been chosen as interactively controllable dimensions via MIDI and/or OSC protocols. Independent MIDI and OSC communication patches (see Fig. 3.1 and 3.2) for each instance of a sound model can be loaded in the manager patch.

Each MIDI/OSC control patch is provided with its own mapping setup section. A sensor data input/output matrix allows to choose a primary mapping configuration, *one-to-one* and *one-to-many*.

3.1 MIDI control patch

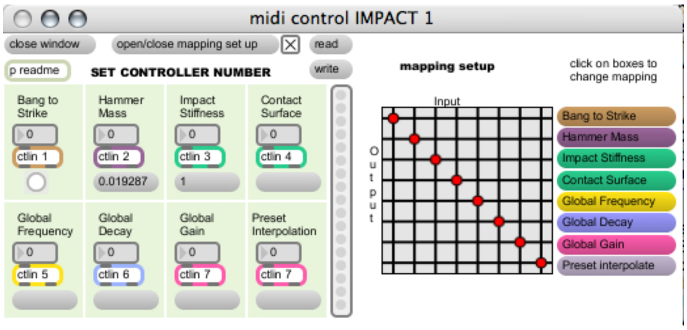

Figure 3.1: MIDI control patch.

- *Number boxes*: set MIDI controller numbers of each parameter. Preferred configurations can be saved in the preset box (shift-click to store);
- *Read/write*: read/write Max preset file. The preset file must be saved in SDT_contents/Presets/ *[SOUNDMODEL]*/MIDI;
- *Open/close mapping set up*: click on the box to access the mapping set up (matrix and parameters);
- *Matrix*: control MIDI input/output routing (default 1:1 routing, inputs are 1 to N from left to right). Many-to-one mapping is not allowed;
- *Parameters boxes*: click on the boxes to open, choose and modify the correspondent control map;
- *Boxes below the [ctlin] objects*: incoming values are displayed in 0.-100. range.
- *Close window*: click on the box to close the current MIDI control patch.

3.2 OSC control patch

- *Boxes*: incoming values are displayed in the corresponding ranges of the high-level interface;
- *Set local port*: set local port to listen for OSC message on;
- *Button (open OSC route set up)*: click on bang to access, choose and modify OSC routing set up (IMPORTANT: incoming OSC messages must be scaled to 0. - 100. floating);
- *Open/close mapping set up*: click on the box to access the mapping set up;
- *Matrix*: control input/output routing (default 1:1 routing). Many-to-one mapping is not allowed;
- *Parameter boxes*: click on the coloured boxes to open, choose and modify the correspondent control map;
- *Close window*: click on the box to close the current OSC control patch.

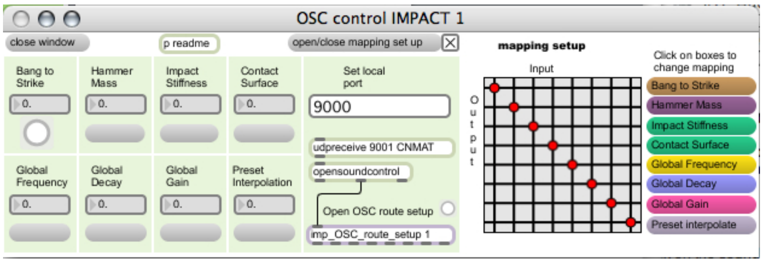

Figure 3.2: MIDI control patch.

3.3 [SOUNDMODEL] [PARAMETER] Control map patch

It is possible to edit and save, as Max/MSP patch, each specific interactive parameter map (see Fig. 3.3). Newer maps are automatically listed and can be recalled in the red drop-down menu in the parameter control mapping window.

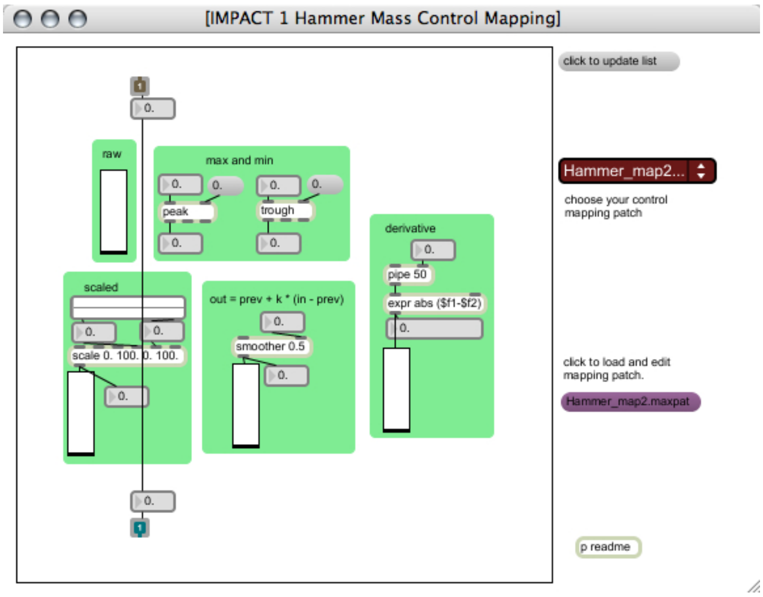

Figure 3.3: An example of control map patch.

- *Drop-down menu*: navigate menu items to select the available control maps. The selected map is loaded in the *bpatcher* window and displayed in the purple box below;
- *Display box (purple)*: click on the box to load and edit the correspondent control map patch. New control map Max patch must be saved in the pertinent SDT_contents/Library/*[SOUNDMODEL]*/MIDI_OSC_*[SOUNDMODEL]*/[INTERACTIVE PARAMETER];
- *Click to update the list*: click on the box to update the control maps items in the drop-down menu.

References

[1] S. Delle Monache, D. Devallez, C. Drioli, F. Fontana, S. Papetti, P. Polotti, and D. Rocchesso. Sound design toolkit. Deliverable of Project CLOSED, University of Verona, 2009.

[2] S. D. Monache, P. Polotti, and D. Rocchesso. A toolkit for explorations in sonic interaction design. In *Proceedings of the 5th Audio Mostly Conference: A Conference on Interaction with Sound*, AM '10, pages 1:1–1:7, New York, NY, USA, 2010. ACM.