

The Samplemodeling™ Trumpet

Version 2.01

(Created by Giorgio Tommasini & Peter Siedlaczek)

A new approach to sample-based
expressive virtual instruments



The background.

Samplers and synthesizers have been for decades the cornerstones of virtual music.

The virtues and drawbacks of each approach are well known. Simply put, samplers, while preserving the basic timbre of the real instrument, result in a static, pre-recorded sound, which cannot properly morph across dynamics, vibrato, portamento etc. Use of prerecorded articulations does not solve the problem either, since it is by nature limited to only a finite number of possibilities. This is particularly true for solo instruments.

Synthesizers allow greater expressiveness, but at the expense of the realism of sound.

Despite recent improvements, the situation has not substantially changed over the last two decades, and the difference between real and virtual instruments is still easily perceived at the very first listening.

The purpose of our research and development was to overcome these limitations, leading to virtual instruments which could not be distinguished from the real ones.

This has been achieved by our **Sample Modeling**™ approach.

Identification of the "fingerprints" of high quality instruments has been carried out by state-of-the-art recordings of chromatically sampled notes, played by an excellent musician in an anechoic environment. Typical articulations and expressive phrases were also recorded for analysis purpose.

An "adaptive model", based on the physical properties of the instrument, and exploiting the knowledge of the performance characteristics was then constructed. The purpose of the model was to minimize the differences between the real phrases and those played by the virtual instrument.

Sophisticated technologies, including proprietary "harmonic alignment" (ref.1), de/reconvolution with modal resonances (ref.2), innovative techniques for sample modulation, along with advanced Artificial Intelligence midi processing, are used for real time construction of all articulations and morphing across dynamics, vibrato, legato and portamento.

The result is a user-friendly virtual instrument with few midi controllers, which can be played in real time or from a sequencer, in standalone mode or as a plugin, for PC or Mac. The played phrases are now virtually indistinguishable from the real thing.

Besides, it's a great fun to play.

References

- 1) "Time alignment of the phase of a set of musical sounds to be used with samplers" . Patent-pending. Filed by Giorgio Tommasini, as of September 23th 2004.
- 2) "Determination of modal resonances and body impulse response of a musical instrument by analysis of sounds performed with pitch changes. Application to the synthesis of vibrato & portamento with samplers". Patent-pending. Filed by Giorgio Tommasini and Stefano Lucato, as of December 20th 2004.

Technical notes

This is not a library, and no additional sampler or player is needed. The Trumpet is a Kontakt Player 2 Virtual Instrument, working either standalone, or as a plugin (VST or RTAS for the PC and VST, RTAS or AU for Mac). It employs (and requires) state-of-the-art technology. The instrument has been developed and thoroughly tested on a PC with IntelCore2 6600 & 2.40 Ghz, 2GB RAM, Windows XP, 2 SATA drives, a 24 bit audio card with low latency (<7 msec) Asio drivers, with a CPU load of approximately 5-10 %. It also satisfactorily worked on less powerful systems. More detailed information on the H/S tested so far are available on our website www.samplemodeling.com under "benchmarks".

A master keyboard with some configurable MIDI controllers, pitchwheel, modwheel, and an expression pedal (or breath controller) is also required for real time playing.

The base material of the instrument consists of 237 MB of samples, chromatically performed by a professional trumpet player over a very wide dynamic range, in an anechoic environment, and recorded with state-of-the-art technology. All samples are 24 bit, unlooped, and ten seconds long. The Virtual Trumpet engine is structured according to an adaptive model, based on the performance "fingerprints" of the real trumpet. The purpose of the model was to minimize the differences between the real phrases and those played by the virtual instrument. Dynamic interpolation is carried out at 32 bit, using a development of our proprietary "harmonic alignment" technology, successfully employed for the Stradivari Violin and the Gofriller Cello.

Features

A complete set of instruments in a single package

The set consists of seven instruments belonging to the same family:
Three different Bb trumpets, suitable for solo or sections.
Cornet, Flügelhorn, German and Piccolo Trumpet.

Continuous, seamless transitions across the full dynamic range

As implemented in the Stradivari Violin and the Gofriller cello, our “*harmonic alignment*” technology allows real-time, continuous morphing from ppp to fff while the note is being played, with no phasing artifacts.

Continuous control of vibrato intensity and rate

De/reconvolution with the modal resonances of the instruments, coupled with advanced sample modulation techniques, allow a very realistic vibrato, with continuous, real time control of vibrato intensity and rate.

Realistic pitchbend effects

The pitchwheel enables very realistic effects. Nonlinear mapping to +/- two semitone provides precise tune control in the middle range, but extends to +/- two semitones towards the extremes. This, coupled with spectral morphing and transitional flutter, allows perfect re-creation of several typical articulations, ranging from manual vibrato, to a full shake of any shape.

Modeled transitions

Our exclusive adaptive model allows for easily obtained transitions and phrasing, which sound indistinguishable from the real instrument: sforzato, crescendo, decrescendo, legato/portamento, semi-legato, forced staccato, shakes, vibrato-like endings, wah-wah, split portamenti, falls and much more.

Mutes

The three Bb trumpets may be played with several mutes, including Straight, Bucket, Cup, Harmon (with or without stem). Two different plungers are also available for wah-wah effects. In version 2.01, mutes can also be individually loaded via MIDI, using CC100.

Special Features

Velocity Remapping

It is well known that midi keyboards have different and uneven velocity response, and this may heavily influence the performance of a virtual instrument. To obviate this problem the instrument includes automatic detection of any velocity inhomogeneities or non-linearity emitted by the keyboard, and provides automatic remapping to any desired curve.

Controller Remapping

Version 1.01 only allowed to remap CC11, permitting those users with keyboards outputting only CC7 (volume), or those using a Breath or Wind Controller (CC2), to control the Dynamics.

Version 2.01 allows to remap all most important controllers, such as Dynamics, Vibrato Intensity, Vibrato Rate, Dynamic Pitch and Portamento Time.

GUI Knobs

In version 2.01, all the MIDI controllers needed for proper functioning of the instrument are mapped to virtual knobs in three GUI panels, which can be activated by a drop down menu. The function of each controller is indicated by the associated label. The virtual knobs permit to monitor the incoming midi data, but can also be used to directly control the instrument. This allows users of keyboards without physical MIDI controllers or knobs, to explore the expressive capabilities of The Trumpet.

Performance Keyswitches

This is an outstanding new feature, allowing to create real time articulations which are too difficult to perform with the usual interplay of expression pedal, pitchbend and modwheel. Sforzato, crescendo, decrescendo, on-the-fly complex modulation patterns and different types of release, can be obtained by a simple touch on one of the keyswitches. The intensity of the effect, and its duration, are under player's control. Please note that these are not just sampled articulations, but they are sample-modeled, indeed. This means that each time each of them will sound slightly different. No machine-gun nor mechanical repetitions here.

Split Portamentos and Falls

A real trumpet may play different types of legato/portamento, with or without valves. The sound is different, since a different harmonic resonance is excited. This is nicely reproduced by our adaptive model. One may choose to perform a continuous half-valve portamento over two octaves by simply overlapping two notes, to split it manually playing intermediate legato notes, or to split it automatically, exploiting the natural harmonic resonances of the instrument, using a single keyswitch. One can even choose to perform chromatically-split portamento or automated falls. Six different split portamento types and four different falls are activated by the touch of a keyswitch.

Wah-wah effect

The wah-wah effect is usually elicited by moving a plunger inside the bell. A very realistic reproduction of this effect is carried out by a simple touch on a keyswitch, with continuous control of the wah-wah intensity given by the expression pedal.

Windcontroller mode

With version 2.01, virtually any existing windcontroller can be effectively used to play The Trumpet.

WC mode automatically maps the Dynamics to CC2, assigns portamento time control to a separate controller (CC5), instead of velocity (mixed mode settings are also possible), and activates a sensitivity knob to compensate for the different pitch/pressure response of the various WC models.

Breathcontroller mode

In version 2.01, the BC mode automatically maps the Dynamics to CC2. In addition, it's now the BC which triggers note-on & off when overcoming or going below a certain threshold. As with the real instrument, the pressed key only determines the note which will be played.

Flexible Portamento Time control

In version 1.01 the duration of portamento was only determined by the velocity of the overlapped note. While this represents a very convenient approach to portamento control, there might be cases where linking portamento time to a separate controller would be preferable.

This has been accomplished in version 2.01. Portamento time can be completely controlled by CC5. A mixed-mode behaviour is also possible, partially linking the duration of portamento to both velocity and CC5, allowing even greater flexibility and expressiveness.

CC24 : dynamic pitch modulation. In the real instrument, the current pitch is modulated by transient changes of the dynamics. The Trumpet exactly reproduces this behaviour. The intensity of this pitch response can be varied, to better cope with different styles. For example, barock music generally exhibits less fluctuations, and the overall pitch tends to be more steady. You may reproduce this behaviour by decreasing CC24 somewhat from the default value of 64. Conversely, a "funny trumpet", mimicking the behaviour of a beginner, can be obtained by increasing CC24 to very high values.

About the Developers

Giorgio Tommasini holds a medical degree "magna cum laude" from Milano University, and had an illustrious career as a clinical cardiologist, researcher, and head of the Cardiovascular Division of a 400-bed Hospital. His pioneering research, mainly oriented on applications of computers in cardiology, and witnessed by more than 150 scientific papers, patents and presentations at international Meetings, led to new methods for quantification and treatment of myocardial infarction, new techniques for detection of silent ischemia and automatic quantification of coronary narrowings by intelligent image processing, and the invention of a revolutionary, 3D approach to coronary angiography. More recently, his research was devoted to the development of new strategies for relieving pain and anxiety in the setting of acute and chronic diseases.



As a musician, he played guitar and bass in various groups of the fabulous Sixties. He became interested in samplers as accompaniment for his music in the mid 1980's. Very unsatisfied by the lack of expressiveness of all available sample-based instruments, he began to think of methods capable to overcome this limitation. The "Harmonic alignment technique", and the "Determination of modal resonances and the impulse response of an instrument by analysis of pitched sounds" (in collaboration with Stefano Lucato), were the first results of this new research in an entirely different field. For the first time it was possible to crossfade from pp to ff, and from senza vibrato to vibrato, with continuity and no phase artifacts. These techniques were applied to "The Stradivari Violin", and "The Gofriller Cello", created in collaboration with Stefano Lucato and Gary Garritan.

Peter Siedlaczek graduated with honors as a tonmeister from the Chopin Academy of Music in Warsaw, where he stayed on to teach studio technology, taking part in numerous research projects in acoustics and psycho-acoustics. Prior to that - still as a teenager - he followed two courses of study: while earning a diploma in electronics at the technical high school, he also completed his diploma at the music high school as a promising pianist, who even as a student enjoyed numerous successes. After moving to Germany, he has contributed as a well-respected sound engineer to many German chart hits. As a producer, he reached the Top Ten of the American Billboard club play charts, as a sound designer he set new standards in classical orchestral sampling. He created sound libraries such as Advanced Orchestra, Classical Choir, Total Piano, Smart Violins and Orchestral



Colours appreciated around the globe. With a sure feeling for pop music and jazz, and his undisputed talent for and experience with classical music, Siedlaczek has specialized in complex orchestral productions, which he undertakes for film production companies, advertising agencies and record companies.

Company information and Contacts:



Please refer to our website : www.samplemodeling.com

Acknowledgements

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