<Bomi>

In 2008 we finished the construction of our automated 6 octave quartertone organ <Qt>. It was the output of a three-year post-doctoral research project on the extension of expressive possibilities by applying modern automation and robotic principles to traditional instrument-building practice. For the realisation of this robot, we were assisted by Ghuislain Potvlieghe (organ builder) and Johannes Taelman (engineer). The research, design and realisation was in our own hands.

The experience gained from the construction of <Qt> continued to intrigue us and raised quite a few new challenges. In <Qt> we achieved touch sensitivity for each pipe by driving the flat solenoid valves in the wind chest with a variable voltage. To what extent could this be improved by using conical or spherical valves? Would it be possible to fully implement aftertouch control? What would be the consequences of designing the organ to operate at very low wind pressure? Qt was designed to work with 14 mBar pressure, which is quite high by traditional organ standards. The modulation characteristics of the sound when modulating the wind pressure are very different when the nominal pressure changes. At low pressure, modulation possibilities appear to be larger.

To obtain an experiment-based answer to these questions, we set up another relatively small building project: <Bomi>, finished by the end of 2010. The design of this musical robot was triggered by an offer found on the August Laukhuff website for a semi-finished and incomplete wooden 4-feet register that seemed perfectly suitable to carry out these experiments. The stopped pipes are made of light oak wood and we made an extra five pipes ourselves, so that the lowest note is now 55 (low G). With 37 pipes in total, we obtained an ambitus of three octaves.

The sound was designed to be soft and gentle, but still pretty rich in overtones and with a clear and slightly spitting attack. This was achieved using traditional techniques of organ pipe intonation and tuning. To aid in adjusting the instrument we added regulating screws in the pipe feet. The wood has been left in its natural and untreated state. The pipes are tightly fitted to the wind chest using easily replaceable Teflon tape (PTFE). Since the instrument is designed for transportation, the pipes are inserted deeper into the upper plate of the wind chest than usual in organ building.

 The wind flow to each pipe is controlled inside the wind chest with solenoid-driven conical electrical pallets. Conical valves allow for a much better airflow regulation than the flat pallet valves we had used hitherto. Thanks to these valves, we obtained velocity sensitivity for each individual note as well as individual key pressure modulation (note aftertouch).

Global wind pressure control is possible over a wide range, although as can be expected from flue pipes, tuning cannot be guaranteed under extreme deviation from the normal pressure circumstances. A tremulant, using a softshift solenoid valve on the wind inlet in the wind chest, is also part of the design. Its operation can be seen as we have made the wind chest transparent. The softshift valve used here to steer a large conical valve can be controlled with a midi controller. It is important to the user to know that the velocity byte in the midi note-on command does not control sound volume, but only the way the pipes begin sounding. It is strictly an attack control.

Since its finalisation, many composers have used <Bomi> as a much welcomed sound in the robot orchestra. The robot was also demonstrated at the festive opening of the STAM museum for over 20000 visitors. Due to its flexibility in tone production and modulation, <Bomi> is extremely well suited to real-time interactive playing using our gesture sensing and recognition system. This was convincingly demonstrated in our Namuda studies, a collection of interactive compositions. Study #7 ('RoboBomi') was written for a dancer, the gesture system and <Bomi>. These pieces are performed regularly on the concerts of the robot orchestra at Logos in Ghent.