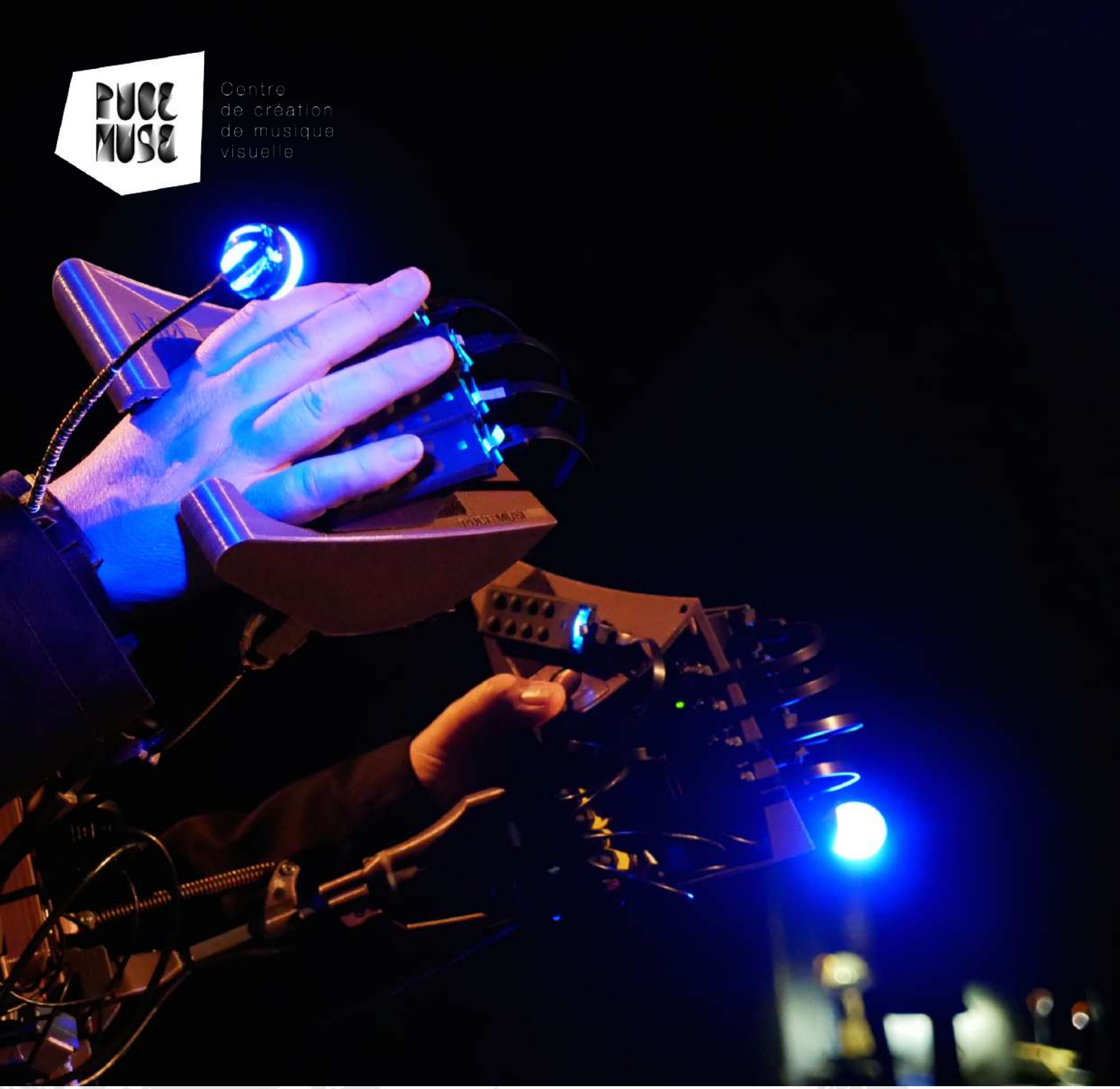
PUCE MUSE

Centre
de création
de musique
visuelle



MÉTA INSTRUMENT n°4

Digital technology at your fingertips

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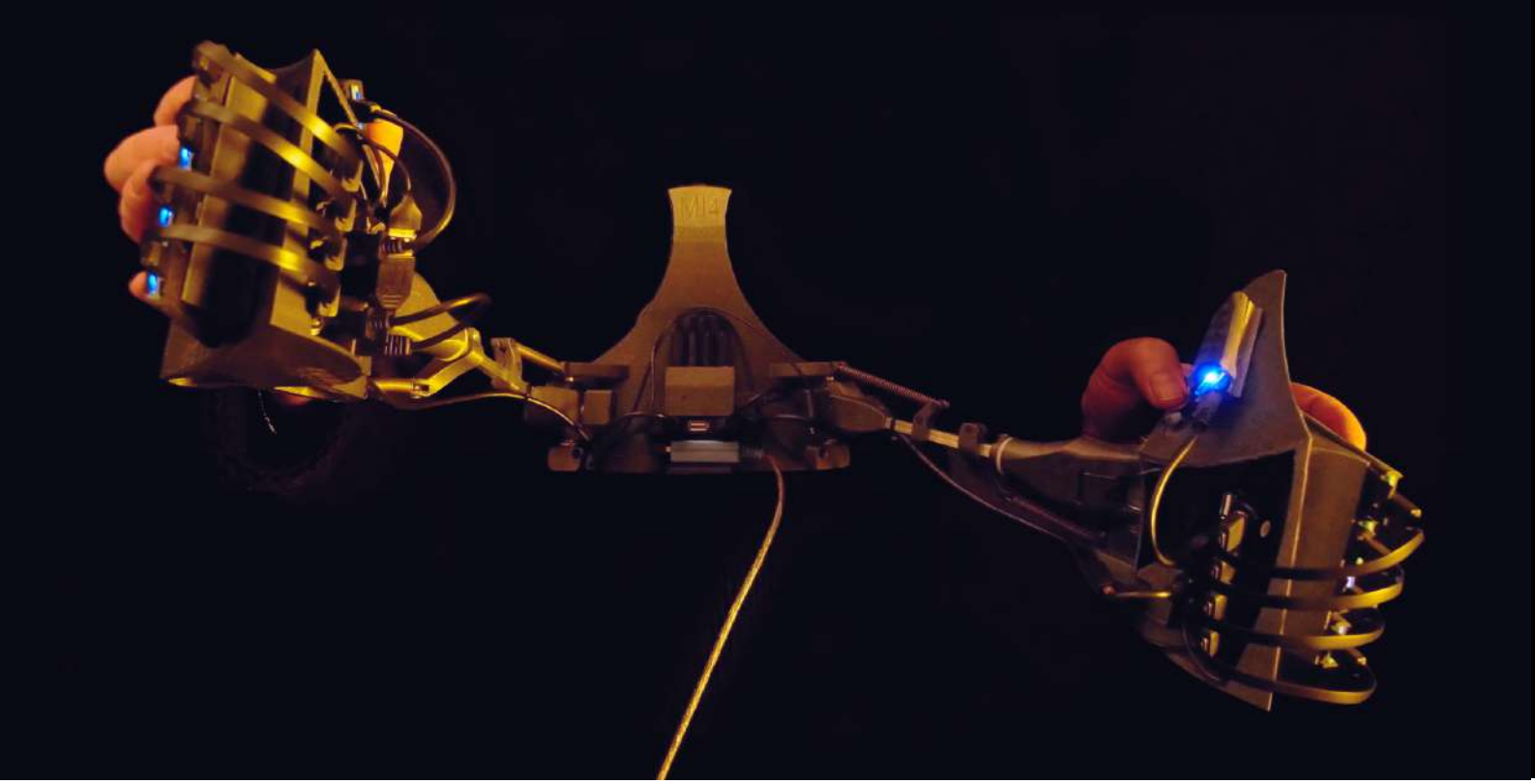


MÉTA-INSTRUMENT N°4

Digital technology at your fingertips

“The first Meta-Instrument was born in the late 1980s as a result of a desire to create an instrument capable of playing live music, but also of controlling the performance of sounds in space and associating image with sound. The Meta-Instrument is probably one of the few musical instruments invented in the twentieth century offering total openness—an instrument instrument or device—while using high-quality haptic sensor technology.”

Pierre COUPRIE, « Le Méta-Instrument : genèse et évolution d’un nouvel instrument », Musique, Images,

The **Meta-Instrument N°4** is a man / machine interface that combines hand and touch refinement with digital technology. It offers to play music and images in real time with new virtuosity. It allows a major innovation: a refined and highly accurate measurement of hand touch and movement to enable a new virtuosity. It is intended for anyone, amateur or professional musicians, people with reduced mobility, performers using digital in real time.... Each person can adapt his instrumental configuration to his needs, his gestural possibilities and his means. From immediate practice to expert action, it allows you to build and develop your musical practice.

1/ Accuracy and refinement

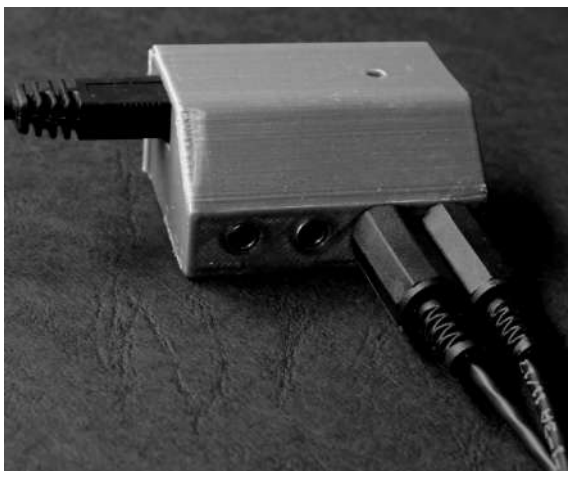
The Meta-Instrument N°4 is a refined gestural interface that consists of three families of very sensitive, precise, and instant MIDI sensors. These interfaces are arranged on two handles connected to two articulated arms fixed on a faceplate. In its complete configuration, the Meta-Instrument N°4 combines thirteen interfaces measuring 92 sensors and 184 variables. These 92 sensors can all be handled simultaneously and independently. This combination of independence and simultaneity makes the Meta-Instrument N°4 a unique instrument offering a new virtuosity in real time digital.

Three types of modular interfaces make up **Meta-Instrument N°4** :

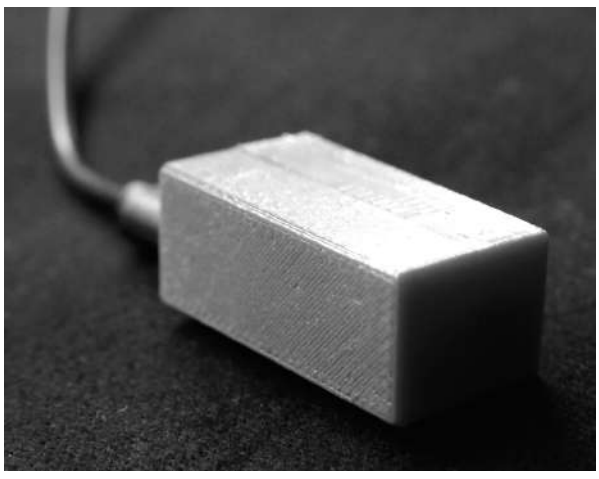
- The **Meta-Touch** gestural interface : a mini keyboard with eight hypersensitive keys the size of two phalanges. It measures the pressure, attack and release speed of each key.

- The **Meta-Digit** interface measures the values and speeds of mini-joysticks and precision potentiometers over 14 bits.

- The **Meta-Axis** interface is a three-axis inertial unit. It measures three axes of rotation over 360° and their variation rates over 14 bits.



Méta-Digit



Méta-Axis

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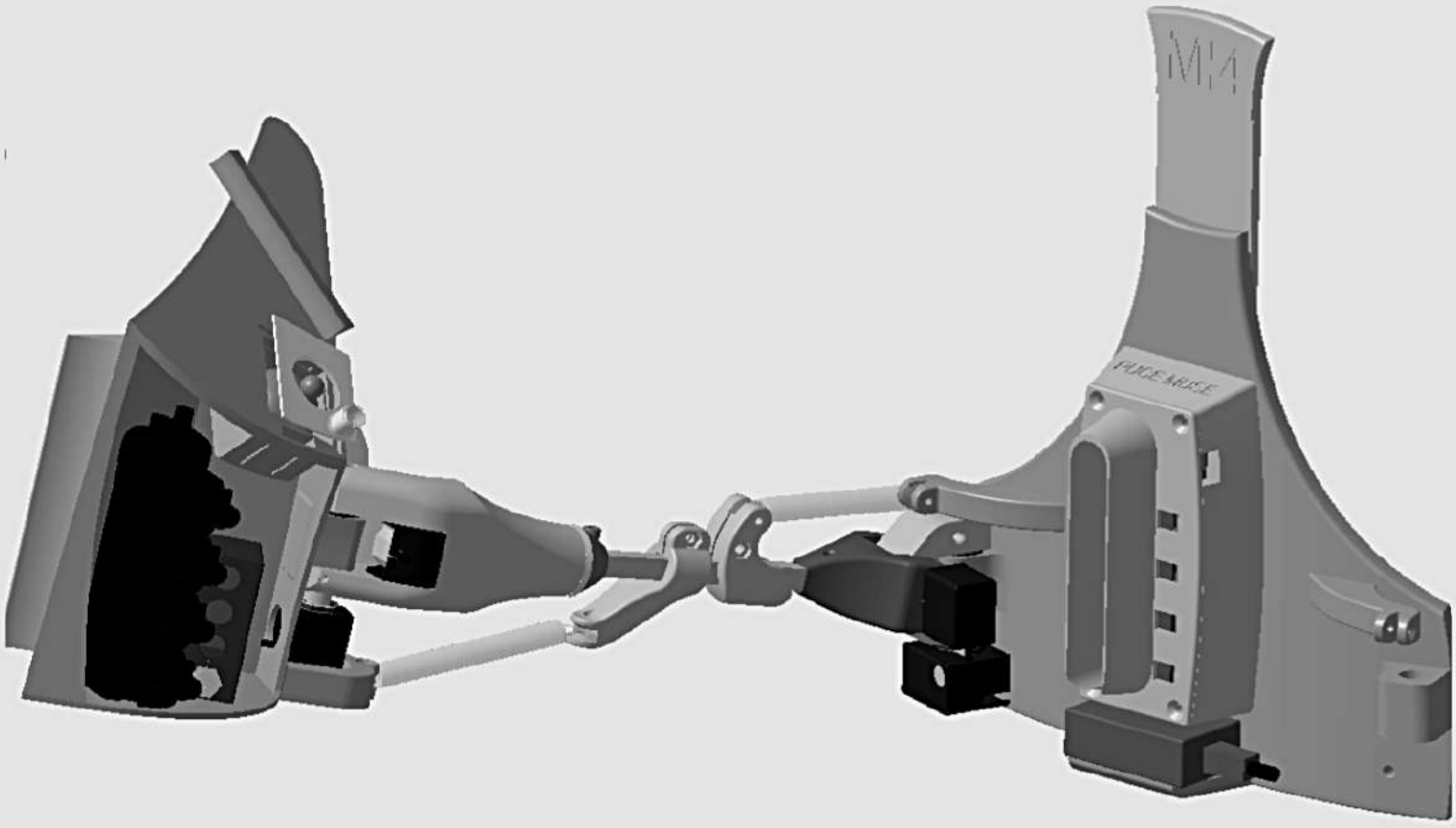
All interfaces are bi-directional: they are adjustable in sensitivity, accuracy, speed, rate and information format, they transmit MIDI information that can be directly used in most audio software.

A bank of gestural mapping functions is provided with each MI4.
An editor is available for each of the 13 MIDI interfaces of an MI4.

Potentiometers and **Meta-Digits** are digitized in 16 bits at 800 Hz for very high accuracy in motion measurement. The keys (**Meta-Touch**) are digitized in 12 bits at 2800 Hz for very high accuracy in measuring pressure motion, attack speed and release speed. The potentiometers are high-precision plastic track potentiometers. The sticks are of high quality with or without return springs.

The measurement quality of the various modules added to the possibility of configuring these modules makes the Meta-Instrument a refined interface that opens up a new level of virtuosity.

The Meta-Instrument N°4 allows 46 computer mice to be manipulated simultaneously and independently!



2/ Adaptability and modularity

These interfaces are as many elementary, complementary and conjugable building blocks. Lightweight and non-intrusive, they can be easily assembled according to the musical practice desired by the instrumentalist.

The **Méta-Touch** can be fixed on any support thanks to an adhesive surface. Attached to the body of an acoustic instrument, instrumentalists can, for example :

- transform their sound and control the transformation parameters in real time
- trigger the playback of sound or video files
- control video or light parameters, etc.

The modularity of its interfaces allows the creation of its own MI4. By combining different modules that can be configured according to the performer's specific needs, it is possible to build your own instrument perfectly adapted to your musical desire and the morphology of your hands.

Using the standard MIDI protocol and USB connection, these different gestural interfaces are compatible with all music software on the market and provide a plug & play experience.

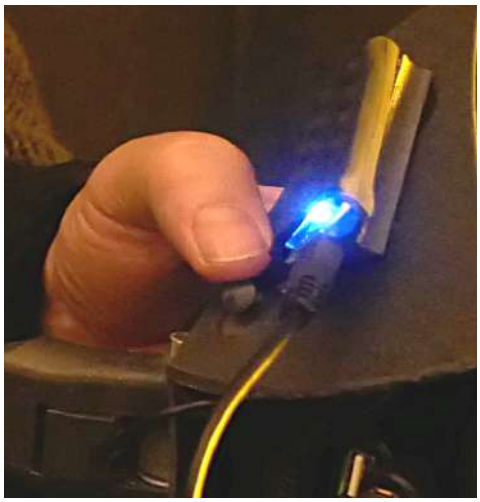
Each of the different modules can be configured and the instrumentalist can thus calibrate his interface according to his type of play or morphology (according to the size of the hand for the handle or according to the chosen position of the palm support).

The **Meta-Digit** interface can also be adapted to instrumental practices: the joystick positions are adjustable to adapt to different types of games and performers' gestures.

The Meta-Instrument N°4 is a modular interface, adaptable to multiple uses:

- Combination of 3 types of sensors
- Sensors configurable in sensitivity, speed and accuracy
- adjustable Méta-Touch positions

- adjustable joystick positions



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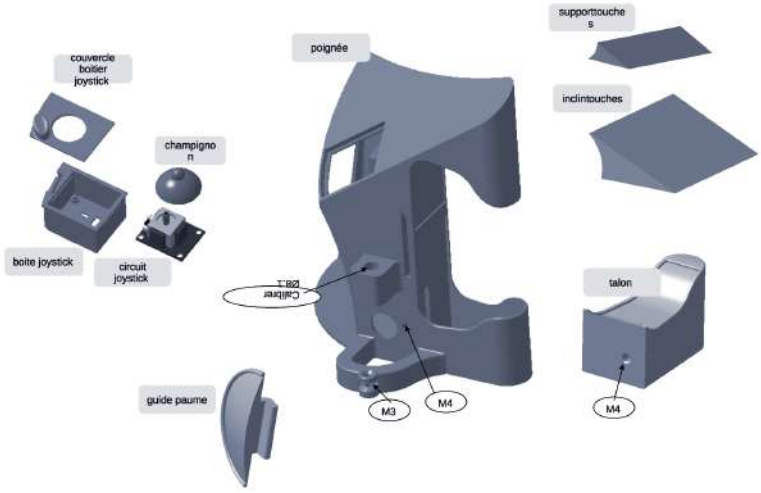
- Adjustable handle width and palm guide position



- Adjustable height of the straps

The modularity of its interfaces allows the creation of its own MI4, combining for example, 4 **Méta-Touch**, 2 **Méta-Digit** and 8 axes of two arms. By aggregating different modules that can be configured according to the interpreter's specific needs, it is possible to create an ultra-precise, individualized and unique instrument.

Made in 3D printing, it is possible to choose the plastic finish (grey or purple grey).

3/ A societal instrument, open to all musical practices

The Meta-Instrument 4 consists of 10 **Meta-Touch**: this interface is intended in particular to promote the musical practice of people with disabilities.

Developed by PUCE MUSE, the **Meta-Touch** is a lightweight, portable interface (the size of a USB key) composed of 8 keys equipped with very high measuring accuracy (impact, pressure, release). These Meta-Touch which compose Meta-Instrument 4 have been designed for a multiplication of uses since each of these 8 touch probes is fully configurable. Impact, pressure and release can be defined in advance for dedicated uses and according to the specific requirements. These **Meta-Touch** constitute an ultra-precise interface with a great flexibility of digital adaptation (MIDI files, configurable keys) and therefore intended for mechanical adaptation (to a microphone, musical instruments). Thus, the prior setting of the key pressure can be considered for performers with little muscular energy (myopaths).

Musicians and people with disabilities are not an ordinary audience. Both use their instruments for several hours a day. They also need to use an adapted object to reach their end. So they have also learned to be patient, if necessary, to obtain what they cannot otherwise obtain. It is therefore very rewarding to work with these two audiences.

MÉTA-INSTRUMENT n°4

The modularity of a fully adaptable and modular instrument allows for multiple practices and modes of interpretation. Fully configurable, the Meta-Touch is intended for all artistic uses, from the discovery of a tactile interface to the expert practice of an ultra-sensitive instrument, suitable for the most demanding interpretations (vidéo with Jean Haury).

The modules are fully adjustable in size and key hardness to ensure that no one is excluded. Each module is available in several versions to best adapt the instrument to each person.

MI4 is printed in fully recyclable PLA. It is fully repairable to avoid programmed obsolescence and promote sustainable development. It is for the most part made in France (short circuit). MI4 is transportable in a cabin suitcase.

The very design of MI4 promotes adaptable production and realization: hands are a bit like faces: they are unique and evolving. Each handle of MI4 provides an evolutionary adjustment of the layout of each mini keyboard in position and azimuth. The physical aspect can also be customized: choice of materials covering the support surfaces: palm, keys, hand strap.

The instrument thus becomes the very extension of the musician's body.

4/ Legacy and Meta-Instrument repertoire (1989-2018)

Since 1989, PUCE MUSE has been developing high-level gestural interfaces called **Meta-instrument** (™ PUCE MUSE). Four generations of Meta-instruments have been produced and practiced (1989, 1996, 2005 and 2017). MI1 was scanning 16 gestures, MI2 32 and MI3 54. By the number of sensors they carry, they offer a musicality that oscillates between that of the conductor and the man-orchestra. MI4 is compatible with the three previous MIs: MI No. 1 (1989), MI No. 2 (1997) and MI No. 3 (2005). He already has a repertoire of audiovisual compositions dating back more than 25 years with a few well-known composers.

Thus, the MI4 project maintains and develops access to the heritage of Meta-Instrument n°3, a pioneering instrument for the practice of music and images played in real time, i.e. 25 years of musical and visual creations dedicated to the Instrument. This is a unique heritage with renowned composers such as György Kurtag Jr and Bernard Parmegiani. The aim here is to develop a musical and technological heritage rather than a programmed obsolescence.

- Serge de Laubier is currently working at the SCRIME (University of Bordeaux/France) on a creation for Méta-Instrument N°4 called « ***La tête dans le piano (The head inside the piano)*** », a piece inspired by Johann Sebastian Bach's *Well-Tempered Clavier* (first prelude).

- A first work of visual music has already been created by Serge de Laubier for the quintet Print, at Le Triton (Les Lilas), on September 22, 2018.

5/ The creation and development team

Serge de Laubier, Director of the R&D department at PUCE MUSE

Composer, researcher and musician, Serge de Laubier has a dual background as a composer at the CNSM in Paris and as a sound engineer at the École Nationale Louis Lumière. Until 1998, he was in charge of developing computer lutherie within the INA's Groupe de Recherche Musicale (GRM). He co-invents with PUCE MUSE the Octophonic Space Processor (Patent n°8600153). He is also the designer of the Meta-Instrument and the author of the MIDI Formers software (© INA-GRM) which received first prize at the 1996 Bourges International Music Software Competition. He also won the 1992 Faust d'Or, the Grand Prix of the 1994 Locarno Festival (Switzerland) and the Special Jury Prize at SATIS 2001. Around visual music, Serge de Laubier is currently conducting research on several themes: playing together, developing listening by seeing it, amplifying the instrumental gesture, immersing the audience in sound and image, developing interactions between projection medium and projected image.

Serge de Laubier also creates street art performances that closely combine music, images and new technologies. His creations are characterized by their interactive and spontaneous play.

Developed by PUCE MUSE in collaboration with **Catherine Hospitel**, **Dominique Brégeard** and **Jérémie Gaston-Raou**l, the Meta-Instrument 4 is entirely produced by 3D printer.

6/ Meta-Sensor data sheets

Meta-Touch:
Size: 74x17x10mm
Weight: 16g
Fastening: self-adhesive back / possibility to attach a velcro
Connection: usb microphone
Real-time editing settings:
- MIDI channel
- value 1st note
- attack/release trigger threshold
- attack/release trigger time
- gain attack/aftertouch/release
- aftertouch delay
- offset attack/aftertouch/release
- repetition blocking time

Measured parameters: attack, aftertouch, release on 8 keys
Data transmitted: MIDI (attack, aftertouch, 7-bit release for each channel)
Quantization: 10 bits
Sampling frequency: > 1kHz

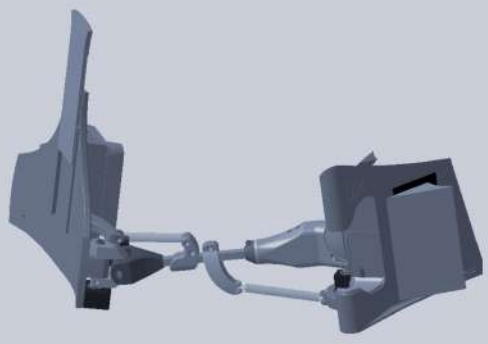
Meta-Digit:
Size: 51x36x24mm
Weight: 26g
Fastening: possibility of gluing a velcro
Connection: usb microphone
Real-time editing parameters (for each input channel):
- MIDI channel
- control change number
- 7- or 14-bit DC transmission
- jitter smoothing size
- min/max value
- smoothing
- transmission frequency
- scaling of the derivative

Measured parameters: voltage from 0 to 5v on 4 channels
Data transmitted: MIDI (voltage on 7 or 14 bits and derived on 7 bits for each channel)
Quantization and sampling frequency: 385Hz/16bits on each input channel, 250Hz/14bits on output

6/ Meta-Sensor data sheets

Meta-Axis:
size: 40x20x20x15mm
weight: 9g
fixing: possibility to glue a velcro
connection: usb microphone
real-time editing parameters (for each input channel):
- MIDI channel
- control change number
- 7- or 14-bit DC transmission
- jitter smoothing size
- min/max value
- smoothing
- transmission frequency
- scaling of the derivative

measured parameters: orientation on 3 axes
transmitted data: MIDI (orientation (over 360°) on 7 or 14 bits and derived on 7 bits for each of the channels)
quantization and sampling frequency: 250Hz/14bits output



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