Designing Prosthetic Instruments for Interactive Performance of Music and Dance

Joseph Malloch, Ian Hattwick, Marlon Schumacher and Marcelo M. Wanderley

Input Devices and Music Interaction Laboratory (IDMIL) • www.idmil.org
Centre for Interdisciplinary Research in Music Media and Technology (CIRMMT)
Schulich School of Music, McGill University

performer: D. Andrew Stewart
photo: Vanessa Yaremchuck

2006

The T-Sticks are a family of digital musical instruments designed and built in the IDMIL [1,2]. The hardware is currently in its third revision and approximately twenty instruments have been built, including several prototypes integrating haptic feedback and additional sensing modalities. The T-Stick has been performed and demonstrated many times internationally, including appearances in Canada, the USA, Brazil, Mexico, Portugal, Norway, and Italy.

The T-Stick uses several types of sensing to enable control of sound synthesis:

- capacitive multitouch sensing
- resistive pressure sensing
- 3-axis MEMS accelerometers
- piezo-electric deformation sensing

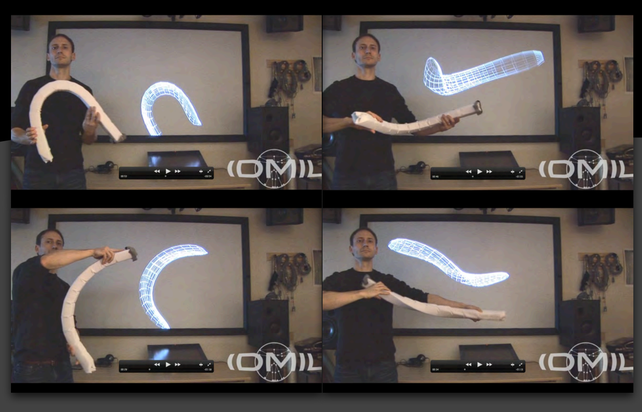
performers: Chloé Dominguez, Elijah Brown
photos: Joseph Malloch

2008

The T-Stick was used in the piece "Duo pour un violoncelle et un danseur", developed in collaboration with the choreographer Isabelle Van Grimde, composer Sean Ferguson, and composer / software developer Marlon Schumacher. For this work, the T-Stick was adapted to use a much more robust monocoque form, wireless communication, and sensing of magnetic fields for estimating orientation.

2010

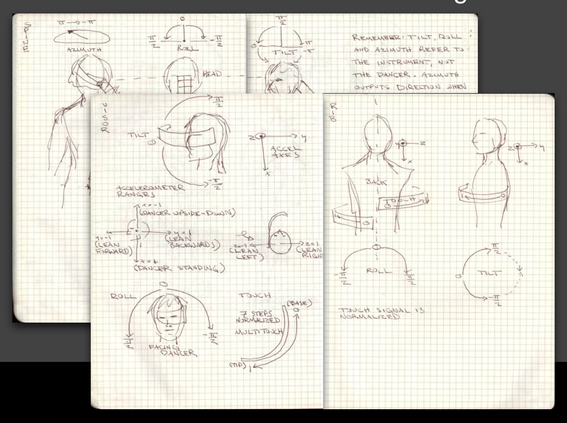
The project "Les Gestes" was proposed by Ferguson, Wanderley, and Van Grimde. This project promised a longer collaboration with the same personnel, a larger piece, and exploration of new forms for the instruments. A series of workshops was planned, in which instrument designers, composers, choreographer, dancers and musicians would work together to refine the instrument concepts, develop a gestural vocabulary / performance practice for the new tools, and explore mappings between gesture and sound.

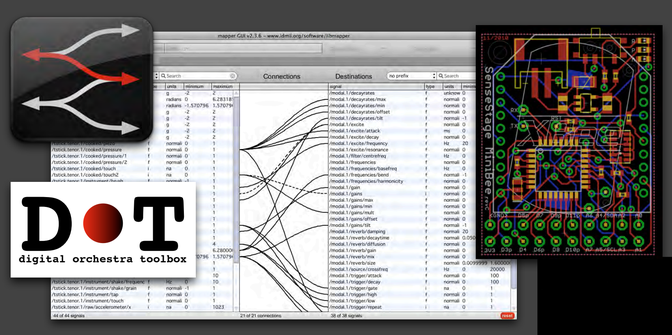


2011–2013

New "prosthetic" instruments were conceived and developed by a process of extreme participatory design. Each generation of prototypes was immediately put to use in workshops with dancers and musicians. Extensive use was made of digital fabrication techniques such as 3D printing and computer-controlled laser cutting to enable fast iteration of working prototypes.

Inertial and magnetic-field sensing were combined with sensor fusion algorithms to track orientation and deformation of flexible instruments, and capacitive touch sensing was implemented with transparent conductive materials.

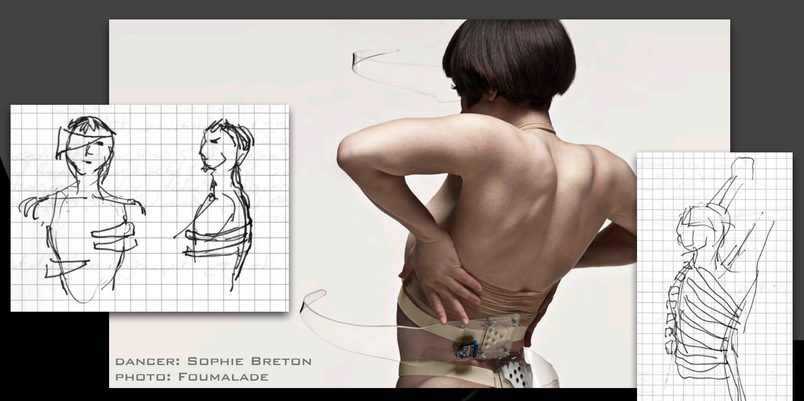




The project made extensive use of tools under development in the IDMIL for supporting collaborative development of new digital musical instruments and other interactive systems, including:

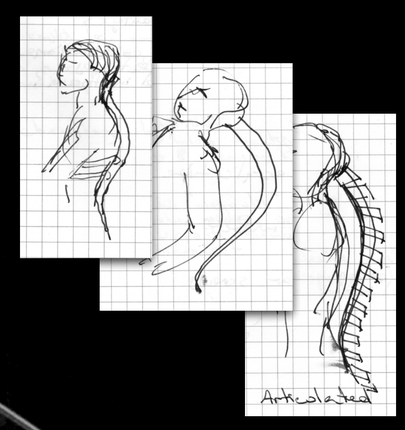
- libmapper [3]
- mapperGUI
- Digital Orchestra Toolbox (DOT)
- CIRMMT Live Electronics Framework (CLEF)
- MiniBee wireless sensor nodes
- OMPrisma / OM-Pursuit

The Rib / The Visor



dancer: Sophie Breton
photo: Foumalade

The Spine



dancer: Soula Trougakos
photo: Vanessa Yaremchuck

1. Joseph Malloch, "A Consort of Gestural Musical Controllers: Design, Construction, and Performance", M.A. thesis, McGill University, Montréal, 2007.

2. Joseph Malloch, and Marcelo M. Wanderley. "The T-Stick: From Musical Interface to Musical Instrument". In Proceedings of the International Conference on New interfaces for Musical Expression (NIME), pp. 66-69, New York City, USA, 2007.

3. Joseph Malloch, Stephen Sinclair, and Marcelo M. Wanderley. "A network-based framework for collaborative development and performance of digital musical instruments". In R. Kronland-Martinet, S. Ystad, and K. Jensen (Eds.): CMMR 2007 - Proceedings of the Computer Music Modeling and Retrieval 2007 Conference, LNCS 4969. Berlin Heidelberg: Springer-Verlag, pp. 401–425, 2008.

Input Devices and Music Interaction Laboratory
Centre for Interdisciplinary Research in Music Media and Technology
Van Grimde Corps secrets
Digital Composition Studios
Fonds de recherche Société et culture Québec
McGill
Schulich School of Music École de musique Schulich