Etat du contrôle gestuel à l'Ircam

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Résumé : Les résultats récents dans le domaine du contrôle gestuel reflètent surtout une diversité d'approches. Le contrôleur de violon SuperPolm permet de piloter la synthèse utilisant un gestuel similaire à celui d'un violoniste. Escher est un système pour la création d'applications de contrôle gestuel implémenté en jMax, un environnement de programmation visuel temps réel.
Par ailleurs, un contrôleur à vent MIDI a servi comme interface pour le pilotage en temps réel d'un modèle physique de la trompette. L'analyse des mouvements des clarinettistes a également été étudie à fin de mieux comprendre les gestes d'un musicien pendant une exécution musicale. Enfin, une interface pour le contrôle de Chant en Max/MSP utilisant une tablette Wacom a été utilisé dans la simulation d'un archet de violoncelle. Nous
présenterons l'état actuel de ces travaux ainsi que les projets de leur utilisation dans les productions futures de l'Ircam, notamment dans le domaine de la danse.

Gestural Control at Ircam.

This report presents an overview of Ircam activities related to gestural control in music over the last five years. We comment on the different activities, from music creation and courses, to developments in hardware and applied research.

1. Historical Perspective

Since its inception, Ircam has been interested on how to control sound synthesis gesturally (Sequential Drum) [MathewsBennet78].
In the eighties, a man-machine interface project was carried out [Battier86] that has given light to developments such as the MIDI flute [Pousset92] and the PACOM [StarkierPrevot86] that have both been extensively used in compositions and musical productions at the institute and abroad.
G. Dubost wrote a dissertation (D.E.A.) on the theme: ``Sensor techno log and their Musical Applications' [Dubost93]. As a result of this work, a sonar type sensor was built, that was used initially by X. Chabot [Chabot93]. Among other researchers/composers, A. Tanaka has also taken part in related projects, such as a children workshop in previous Ircam Open House events (1995).
Interest in historical perspectives has led to consultancy with the Musée de la Musique in Paris [Battier93] and an ongoing collaboration with Electronic Music Foundation (EMF) (http://www.emf.org/institute/index.html).

2. Current Activities

The report focuses on the period form 1996 to the present (February 2001).
During these five years, various activities have been carried out related to gestural control at Ircam. They are summarized below.

- Publications

Two publications have been edited at Ircam concerning gestural control and man-machine interfaces:
- Interfaces Homme-Machine et Création Musicale, Hermes Science Publications - 1999, edited by Hugues Vinet and Francois Delalande (GRM) is the revised proceedings of the workshop held at Ircam in December 1998.
Invited speakers have made a detailed review of several fields related to human-computer interaction in music, such as graphical interfaces, musical controllers, interactive systems, etc.
- Trends in Gestural Control of Music, Ircam - Centre Pompidou - 2000, edited by Marcelo M. Wanderley and Marc Battier, is an Electronic Publication (CDROM) containing varions articles and tutorials on gestural control of music. Specifically, it consists of:

a) a round table with leading instrument builders and performers,
b) twenty-four articles, tutorials and case studies on gestural control of music,
c) an extensive bibliography (around 500 entries), and
d) a detailed list of resources. It includes several videos and sound examples illustrating the articles, which are especially formatted for screen reading and printing.

Research and Development Many projects focusing on or related to gestural control are cure-ongles being developed in the Research Department, headed by Hugues Vinet. These projects relate to new instrument design and the control of different synthesis methods, physical and signal models.

- Alternate Controllers

P. Pierrot and A. Terrier developed the SuperPolm violin controller for composer/performer S. Goto [Goto99]. Seven sensors integrated in a violin-like controller provide 11 continuous output variables. The ensemble provides an interface that is able to control different synthesis parameters departing from a gesticulation similar to that of a violin player.
A. Terrier, P. Pierrot and X. Rodet collaborated with on the development of JERRY, a four dimensional mouse - a normal computer mouse equipped with two pressure sensors, allowing the simultaneous control of 4 continuous parameters [RodetTerrierPierrot97]. Real-Time Additive Synthesis Control – ESCHER The development of a real-time synthesis system with applications to gestural control, based on j-MAX has been carried out from the end of 1997 by Butch Rovan, Norbert Schnell, Shlomo Dubnov and Marcelo Wanderley. The system is intended to provide a flexible environment for sound synthesis and a basis for experimentation in human-computer interaction in music [RWDD97][WSR98]. It is built as independent modules that may be replaced according to the synthesis method used, and to the type (level) of interaction desired.

- Haptic devices

During a sabbatical leave in 97/98, Vincent Hayward (McGill University) worked collaboration with Butch Rovan, what led to the development of a tactile feedback system to be used in conjunction with open-air computer music performance devices [RovanHayward00]. The VR/TX system is proposed as a solution for adding tactile feedback to open-air controllers.

- Real-time control of Physical Models

Research by Christophe Vergez and Xavier Rodet focuses on the control of a physical model of a trumpet in real-time [RV96] [VR01]. The control interface was developed using a MIDI wind controller for the information concerning mouth's pressure and piston position. The resulting interaction between the player and the model closely simulates the one experienced by a performer and his instrument. Stefania Serafin has used the WACOM tablet (Cf. below) to control a physical model of a violin [SDWR99].

- Modelling Performer Gestures

Still regarding research topics, M. Wanderley and Ph. Depalle develop research on gesture capture [DTW97], modeling and application to the control of sound synthesis by signal models [WDW99]. The analysis of clarinetists movements has been carried out in [Wanderley00] and [Wanderley01] in order to understand the basis of performance gestures. Wacom Tablet In collaboration with CNMAT, a research project on the use of the WACOM tablet as an instrument controller has been carried out in 1999 and 2000, funded by the France-Berkeley Fund. During this period, a MSc. thesis by Jean-Philippe Viollet and a final undergraduate report by Fabrice Isart were produced [WVIR00]. Viollet implemented a real-time control of CHANT in Max/MSP using the WACOM tablet, while Isart studied the ergonomics of the tablet when used as a tool for the simulation of a cello bow [Isart99].

- Pedagogy

Many activities related to gestural control have been carried out by the Pedagogy Department, under the directorship of Marie-Hélène Serra (Jean-Baptiste Barrière until May/97). These consist of support to composers interested in this area, courses proposed for different audiences and the coordination of trainees working closely in relation with the composers.

- Compositions

Young composers are accepted each year as part of the Cursus de Composition', a one year course on computer music. During the last years, three compositions have been created using different sensors and/or gestural interfaces: Suguru Goto - Virtual AERI, Lucia Ronchetti - Eluvion-Etude, and Roland Auzet - OROC.PAT and Le Cirque du Tambour.

- Courses

Also regarding the Pedagogy department, a regular course on sensors and gestural capture is given yearly. They may be part of the ATIAM MSc. or the cursus de composition (one-year long), or offered as weekend courses. Lecturers included C. Cadoz, M. Waisvisz, B. Rovan, Emmanuel Flety, Benjamin Thigpen and Marcelo Wanderley. MSc Course on Multimedia at CNAM In the school years 1998-1999 and 1999-2000, the Pedagogy Department at Ircam has taken part in the MSc. course at the Conservatoire National des Arts et Metiers offering a week-long course on Sound and Interactivity. This course deals with different subjects such as sound synthesis, interactive synthesis, new instrument design, gestural control, etc. Apart from Ircam lecturers, invited speakers included, among others, Sally-Jane Norman, Michel Waisvisz, Robin Bargar, Insook Choi, and Robin Minard.

- **Research**

Emily Morin and cellist Benjamin Carat developed a joint project on the measurement of cellists bowing techniques by developing a sensor (FSR) glove and measuring different performances of various performers [Morin2000].

- **Session and Workshop at ISEA 2000**

Marie-Helene Serra and Marcelo Wandeley organized a special session at ISEA2000: Towards a Descriptive Approach of Gesture and Sound Interaction. It consisted of four lectures by researchers Marcelo Wanderley and Antonio Camurri and percussionist Roland Auzet and composer Yan Maresz. They were joined by choreographer Francois Raffinot in a round table coordinated by Marie-Helene Serra. Also during ISEA2000, Emmanuel Flety and Benjamin Thigpen gave a workshop on sensors and interactive systems.

- **Hardware Developments**

Engineer Emmanuel Flety has developed several devices these last years at Ircam. These include the AtoMIC Pro I and II Analog-to-MIDI interface, a ultrasound sensor [Flety00], and an infrared sensor used for interactive dance pieces by the Choreography Department recently created at Ircam.

- **Dance**

The Choreography Department, headed by Francois Raffinot, was created in 1999. The first interactive piece produced is a collaboration between Raffinot and composer Yan Maresz called Al Segno. It uses an infrarouge sensor frame of 2 by 2 meters developed by Emmanuel Flety during one of its movements.

3. Other Activities

Discussion Group - Gesture Research in Music Homepage The Groupe de Discussion sur le Geste Musical was created in 1997 by composer B. Rovan, and researchers M. Wanderley and S. Dubnov. The group's main activities, apart from the maintenance of the site, relate to the development of a bibliography on the subject and the organization of regular meetings. Apart from its internal site, an external site called Gesture Research in Music contains various links and information to different researches and developments related to gestural control.

Meetings and Invited Lectures

Meetings may be either organised as discussion meetings on a pre-determined theme or may consist of an invited lecture by a researcher in this field.
Lectures have been presented by David Wessel (CNMAT), Axel Mulder (Infusion Systems) and Mark Goldstein (Buchla and Associates), Christophe Ramstein (Haptic Technologies, Canada) and Dinesh Pai (University of British Columbia, Canada).
Other invited lecturers include Robin Bargar, Insook Choi, Atau Tanaka, Camel and Steve Coleman, Cadoz, Steim, Robin Minard, Sally-Jane Norman, Michel Waisvisz, among others.