Modes of Sonic Interaction in Circus: Three Proofs of Concept

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ABSTRACT

The art of circus is a vibrant and competitive culture that embraces new tools and technology. In this paper, a series of exploratory design processes resulting in proofs of concepts are presented, showing strategies for effective use of three different modes of sonic interaction in contemporary circus. Each design process is based on participatory studio work, involving professional circus artists. All of the proofs of concepts have been evaluated, both with studio studies and public circus performances, taking the work beyond theoretical laboratory projects and properly engaging the practice and culture of contemporary circus.

The first exploration uses a contortionist's extreme bodily manipulation as inspiration for sonic manipulations in an accompanying piece of music. The second exploration uses electric amplification of acoustic sounds as a transformative enhancement of existing elements of circus performance. Finally, a sensor based system of real-time sonification of body gestures is explored and ideas from the sonification of dance are translated into the realm of circus.

1. INTRODUCTION

In the ever evolving art of circus, the use of new tools and technologies is wide spread. Circus practice is open to new ideas and is fuelled by a spirit of competition, making new forms of expression highly sought after. The KTH Royal Institute of Technology in Sweden has collaborated with University of Dance and Circus, a part of Stockholm University of the Arts in the *Gynoïdes Project*. Gynoïdes Project is an academic line of enquiry through artistic practice lead by circus specialist and choreograph/artistic director Marie-Andrée Robitaille (hereinafter referred to as MAR). The project raises the question of women agency in the circus arts and intervenes in thestructure of circus-practice to produce, test and describe feminist strategies in circus composition [1]. The project integrates novel use of technology in circus, with a special focus on sound and interaction.

Practice-based artistic research in circus offers an opportunity to generate new modes of creation, composition and expression in circus. This paper focuses on using technology that will enable performers to interactively control computer generated sounds by means of their own body. Used in this manner, interactive sonification [1], and related artistic practices, can be a tool to overcome the standardized traditional formats of circus, re-invent choreographic methods and to redefine the use of music and sound support in circus expression. Furthermore, by novel use of technology in circus, the traditional hierarchy in the creation of circus oeuvre is challenged. Involving circus artists to engage in the development of new tools gives authorship status to the circus artist, as opposed to the role of disposable interpret.

In this article we present in chronological order three exploratory design processes that demonstrate different modes of integration of sound in circus, extending beyond the practice of performing to a set musical performance. Each exploration has informed the design of the next one.

The first exploration is a modern update of the attentive accompaniment that has been used in the circus tradition. Here the musical ensemble is substituted with signal processing that bends a well known musical performance as a contortionist's body is being bent on stage.

The second exploration uses microphones to bridge the sonic divide between performer and audience, allowing for the faint but revealing sounds of strain on both equipment and performer to be communicated to the audience.

Finally, the third exploration, an evolved synthesis of the first two proofs of concepts is presented. Here the movements of the circus performer is turned into sound via motion capture technology based on wearable sensors.

2. BACKGROUND

Since the creation of modern circus in England by Philip Astley in 1770, music has been an important feature [2]. Up to the 1970s, the screamers, or circus marches, are typical of the time period and the genre [3]. In the early 1970s, circus experienced a new revolution, in the wake of the political and social upheavals of the late 1960s.

[1] www.cirkusperspektiv.se

The blending of traditional circus practices with contemporary aesthetic sensibilities has revitalised the art of circus. Even though the music we hear in contemporary circus covers a wide variety of genres, e.g., rock, electronic popular music, *manouche* or *gypsy jazz*, it still seem to serve the same purpose; music follows the action on stage and stirs up the audience during the show. Music is used for setting the mood of the audience, indicating the tempo of the acts, highlighting specific tricks, accentuating the suspense of the anticipation and marking the success of it. Overall music is there to enhance the performance by emulating its dramaturgical development.

Music can be both a live performance or a recorded one. If it is played live or manipulated in real time, a relationship between the music and the performance must be decided upon. The music can either be oblivious of the performance on stage and thus exist in parallel or as a background to the performance, or it can be continuously adapted to fit the performance as it progresses. This is not a binary option but rather a continuous scale between the two extremes. Even by the simple act of synchronising the beginning and end of the music with the beginning and end of the performance, one creates a more complex relationship between the music and circus performance. From this point one can add complexity until all aspects of the music are tied those of the circus performance.

3. RELATED WORK

In recent years a few but relevant studies on the use of music and sound in relation to specific circus disciplines have been conducted and they are presented and discussed briefly in this section.

Juggling has been the use case of two studies. In a first study, Bovermann and colleagues have developed a system for real time auditory monitoring of juggling patterns [4]. They explored different approaches to gain insight into the movements and possible applications in both training and juggling performance of single-juggler patterns. In particular, positions and movements of the clubs could be tracked and sonified in real-time using a motion capture system. In a second study on juggling, the positions and gestures of four performers on a stage were used as parameters for generating musical tones while juggling [5]. In another project, Hummel and co-workers [6] investigated the use of sonic feedback in training practice applied to the case of the German wheel. The movements of the wheel were captured by sensors and sonified. It was found that the use of sound could improve performance and accelerate learning especially for novice learners.

Jay Gilligan and Luke Wilson, professional jugglers and prominent leaders of the international innovative juggling movement, have been investigating the relation between juggling and music, in particular by analysing the translation of juggling into music generated by manipulation of objects on a tabletop tangible interface such as the reacTable [7].

4. MODES OF SONIC INTERACTION IN CIRCUS

In this section we present three proofs of concept in which interactive sonification has been used for the design of sonic interaction for augmenting the performance of circus artists. Sonic interaction has been used as a mean for accompanying, amplifying, and interacting with the performances.

4.1 Exploration 1: Accompaniment

The first exploratory design process examined the manipulation of sound as a metaphor for the manipulation of the body. In 2011 to 2013, within the explorations of the Gynoïdes Project, Bêta Test II-III-IV (BT2, BT3, BT4), the circus artist Manda Rydman was doing contortion, a form of extremely flexible acrobatics, as can be seen in Figure 1. The appeal of the discipline of contortion has been described as the fascination for *otherness* and the dual simultaneous feelings of estrangement and connection experienced by spectators, both in regards to the performers' bodies and their own [8, 9]. To create a similar acoustic estrangement to accompany and heighten the performance, a very well known piece of music was to be used as an accompaniment, but it was to be bent in a fashion similar to the bodily contortions of the circus artist. The chosen piece was the prelude of J.S. Bach's *Suite for Solo Cello no. 1 in G major*, and the chosen method of sonic manipulation was the changing of the playback speed.

In BT2, BT3 and BT5, an engineer [2] would perform the filtering, in real-time, as a response to the acrobats movements, using a *Korg Kaoss Pad*. In BT4 another engineer [3] used a similar system build in the SuperCollider programming language [4].

As the skill of the engineer increased with rehearsals, the manipulated music worked as a system for interactive

[2] Niklas Blomberg
[3] Ludvig Elblaus
[4] http://supercollider.sourceforge.net/

Figure 1. Contortionist Manda Rydman in performance in Gynoïdes Project Bêta Test V.

sonification, even though the system was not automated. This is comparable to the Wizard of Oz evaluation methods used in human computer interaction [10, 11]; even though the performer in this case was aware that the system was not automatic, the experience of an automatic sonification could be explored by both audience and performer. The study functioned as a prototype of the work using sensor driven sonification of gestures, presented in *Exploration 3: Interaction*.

4.2 Exploration 2: Amplification

The work presented in this section draws from two projects that started in the last quarter of 2013 and in the spring of 2014 respectively. The first one, called Gynoïdes Bêta Test IV (BT4), served as a exploratory studio project that laid the foundation for the second project, Gynoïdes Project Bêta Test V (BT5). While BT4 was shown as an internal work-in-progress performance at the University of Dance and Circus, BT5 was shown for a full audience at *Cirkör LAB*, *Cirkus Cirkör*, Stockholm, Sweden and at the *Pisteurs d'Etoiles* festival in Obernai, France [5] .

Initially, the project sprang from the audible difference between experiencing a circus performer in action up close and the muted experience of watching the same performance from a seat in the audience. Many sounds that were aesthetically powerful and filled with information about the performance didn't travel all the way to the audience. These were the sounds of breathing or the tense lack thereof, or the many different sounds of contact between the performer and the tools she was using.

The question to be researched was whether one could bridge this sonic divide between performer and audience, using regular microphones and unmodified circus tools. And if so, how it would change the performance, both from the audience and the performers point of view. Similarly to how the act of recording is a transforming act that affects the art form that is being recorded, see for instance Katz [12], the act of amplification was expected to be equally transformative.

This was explored through several iterative design processes running in parallel that all shared the same characteristics, one for each performer and type of circus equipment. First, new technology was acquired or a new way to use existing technology was found to augment circus performers or equipment with wireless microphone capabilities. This was then applied, and compositional and exploratory improvised work probed the new assemblage. Engineers and artists evaluated together the artistic and technical findings from this work. The results of the evaluations were then used as basis for a new iteration in the design process. This meant that the artists were placed centrally (User-Centred Design) in the development process to allow their embodied artistry to influence the development, as previous similar projects had proved this to be a successful method [13].

[5] www.pisteursdetoiles.com

Figure 2. Marianna De Sanctis performing with a hoop in Gynoïdes Project Bêta Test V.

4.2.1 Hoop

In circus, the hoop is a tool comparable to the hula hoop, i.e., a somewhat flexible plastic ring with a circular cross section and a diameter of about one meter. It is light and can be made to twirl around the body with quite small body motions.

The hoop performer was Marianna de Sanctis [6] . De Sanctis uses explosive high energy gestures as can be seen in Figure 2. She often uses several hoops at the same time, intertwining her body with the hoops. She often throws her hoops into the air but she also works closely to the ground in an acrobatic fashion.

After some experimentation with different types of microphones, clip on microphones made for brass instruments were attached to the hoops. This type of microphones withstood the physical strain of the hoop routine, but were at the same time sensitive enough to pick up breath noises and other more faint material. This allowed for a very dynamic vocabulary ranging from De Sanctis tapping and scratching with her nails on the hoop to pounding the hoop into the floor of the stage full force. As the use of vocal sounds resonated with De Sanctis work, she was also equipped with a headset microphone. The sounds were sent through a DAW [7] running some plugins for spectrum equalisation and dynamic compression as well as a simple delay with feedback, allowing De Sanctis to create layers of sounds. A set of actions that were interesting, both sonically and from a circus perspective, were assembled and a performance was put together that showcased the full range of De Sanctis' expressivity.

4.2.2 Aerial Hoop

The Aerial Hoop is ring similar to the above mentioned hoop, but it is suspended in the air to allow the performer

[6] Marianna de Sanctis' website: www.mariannadesanctis.com

[7] Digital Audio Workstation software, in this project *Ableton Live* and *Cockos Reaper*.

Figure 3. Alexanda Royer performing with an aerial hoop in Gynoïdes Project Bêta Test V.

Figure 4. Sarah Lett performing with a Cyr wheel in Gynoïdes Project Bêta Test V.

to hang from it or sit in it. For structural reasons this also means that it has to be made of metal instead of plastic. The aerial hoop hangs from a single rope with a swivel that allows the hoop to rotate freely. It is usually around 1.5 meters in diameter.

Manda Rydman [8] performed with the Aerial Hoop in both BT4 and BT5. In BT4 the hoop was hung low enough for Rydman to reach it from the ground, and in BT5 the hoop was initially on the ground and was raised with Rydman hanging from it. There was also a second performer, Alexandra Royer [9] , using an aerial hoop in BT5. Royer's hoop was different from Rydman's in that it used a climbable rope to suspend it. Royer's aerial hoop and Royer making use of the rope can be seen in Figure 3.

As with the plastic hoop, clip on microphones for brass instruments were used in addition to the basic equalisation and compression done with the hoops mentioned above. A variety of reverberation and delay algorithms were used to emphasise the deep bell like qualities that the metal hoops produced when struck. For the Royer's performance, a granular pitch shifter was added that layered the harmonics that the hoop produced naturally, producing rich tonal clusters.

4.2.3 Cyr Wheel

The Cyr Wheel, named after the performer who popularised it in a circus context, Daniel Cyr, is an acrobatic device consisting of a single large, metal hoop similar to the Aerial Hoop. It does not hang from the ceiling, instead the performer rolls around stage with it while keeping themselves suspended inside by pushing their arms and legs on the inner side of the wheel.

Nathalie Bertholio [10] performed with the Cyr wheel in BT4 and Sarah Lett [11] , seen in Figure 4, joined the ensemble for BT5. While their acts were different, they shared a dramatic finish where the wheel was spinning around the performer crouched on the floor, slowly loosing energy and finally coming to a stop flat on the ground with the performer in the centre of the wheel.

The Cyr wheel was acoustically similar to the aerial hoop, but lower in pitch due to its larger size. In addition, the rolling motion, heavily used with the Cyr wheel, produces a low frequency rumbling sound that vibrates through the whole wheel. In an organological taxonomy the three rings could be classified as a soprano, alto, and tenor version of the same principal instrument. The sound processing used on the sounds of the Cyr wheel emphasised this difference, by further lowering the perceived pitch by emphasising the lower frequencies that are present in the sound. Again, the same brass instrument microphones were used.

4.2.4 Vertical Rope

The rope used in circus is a slightly elastic woven cotton rope between 3 and 4 centimetres thick. It hangs from the ceiling rigging in swivels and usually extend all the way to the floor. In BT4, the rope act was performed by Nathalie Bertholio who performed very dynamically, sometimes moving very fast and sometimes very slowly. In BT5 the performer was Saara Ahola [12] and her act was shorter and higher in energy, making for an interesting contrast between the two performances.

The rope has very different acoustical properties compared to the hoops, and another approach was needed. However, the basic form of the exploration was the same, the co-development of new material through studio work involving artist, engineer and choreograph/artistic director. For the rope, a lavaliere microphone intended for speech was used. It had an emphasis of the midrange and top end of the spectrum, bringing out some of the finer details of the sounds of rope manipulation such as creaking

[8] Manda Rydman's website: www.mandarydman.com
[9] Alexandra Royer's website: www.alexroyer.wix.com/cirque
[10] Nathalie Bertholio's website: www.nathaliebertholio.com
[11] Sarah Lett's website: www.sarahloop.com
[12] Saara Ahola's website: www.saaraahola.com

Figure 5. Saara Ahola performing with vertical rope in Gynoïdes Project Bêta Test V.

and friction sounds when the rope was looped back onto itself. This high frequency detail was further enhanced in the DAW, allowing in the end for a single microphone, placed at the top of the rope, to pick up sounds of manipulations all the way in the other end of the rope.

4.2.5 Summary

Although the different combinations of microphones, equipment, performers, and acts led to a very wide range of results, on the whole, the research question is answered in a positive way. From interviews with the participating performers as well as comments from the audience, it was concluded that the integration of general purpose microphones into a circus act can enhance the expressive qualities from the performer's and the choreographer's view, as well as enhance the audience's experience.

The challenges met were both technical and artistic, and it was clear that the combination of a development process, a composition process, and a rehearsal process meant that new forms of organisation and work was needed. While this became stressful at times it was also to be expected; when you challenge a performance practice by adding new expressive elements to it, the underlying structure that supports and produces that practice needs to adjust to allow for the new material to get the attention it needs.

Moving ahead, the results pointed to exploration of other kinds of connection between circus performance and responsive sound, as the benefits of having a high degree of interaction and a tight connection between motions on stage and the accompanying sounds had been sufficiently demonstrated.

4.3 Exploration 3: Interaction

The third exploration introduces three performances that have been implemented within Gynoïdes Project Bêta Test VI (BT6), a collaboration between the KTH Royal Institute of Technology and the University of Dance and Circus, over November and December 2013. The outcomes of BT6 were artistic performances, discussed later, and a lecture by MAR all delivered within the *Women in Circus Consortium* [13] , a public event held on 18th December 2013 at the KTH R1 Experimental Performance Space and Presence Laboratory [14] , Royal Institute of Technology, Stockholm, Sweden.

BT6 involved a collaboration between six artists and two researchers. The main research objectives were to further test the use of real time sonification to enhance expressive possibilities in circus performances, and to explore good strategies for implementing sonification in circus performances.

Prerecorded sounds were used for the sonification of the performer's actions. This is a different choice than the one made in the first exploration described above where the sound was the amplification of the noise produced by the performer him/herself, or by the tools. In using prerecorded sounds a deep correspondence of the sound with action was possible and the sonic representation of the movements was more effective compared to amplification. At the same time a larger palette of timbres and greater expressiveness was achieved. Musical fragments were used too. However, these were regarded as pieces of sound to be used interactively as any other sound during the sonification process, and not as an accompaniment like in the second exploration.

As a tool for motion sonification the EGGS [15] (Elementary Gestalts for Gesture Sonification) system was chosen. The EGGS basic principle is the analysis of a motion trajectory that is done with its segmentation in elementary categories which are then mapped into different sounds. The EGGS system has already been used effectively as a sonification tool for several interactive dance performances during which it proved to offer valuable expressive possibilities from the point of view of the performer as well as the audience. For this reason its utilization in a circus context seemed promising.

At an early stage of BT6, a question arose: How to place sensors and/or markers on the body of circus performers? It was clear from the beginning that there was not a unique solution to the problem since there are many different disciplines in circus arts. Each circus discipline requires that different parts of the body are left free for example for touching the floor, or interacting with the tools, during the performance.The dimensions of the sensors can also play a crucial role.

During BT6 the design process required a continuous collaboration between three team members; the performers, the choreograph/artistic director, and the sound designer/engineer. The production process was organized in five phases, each iteratively feeding into the next one:

- prototyping (the sound designer/engineer creating a new version of the sonification system specific to the particular kind of performance)

[13] Women in Circus Consortium: www.cirkusperspektiv.se/news/women-in-circus-consortium

[14] KTH R1 Experimental Performance Space and Presence Laboratory: www.r1.kth.se

[15] EGGS project: www.visualsonic.eu

Figure 6. Nathalie Wahlberg performing with the EGGS system in Gynoïdes Project Bêta Test VI.

Figure 7. Nathalie Wahlberg holding two trackable light bulbs in Gynoïdes Project Bêta Test VI.

- testing (the new prototype being tested by the user/performer)
- calibrating and setting up the new prototype on the basis of performers feedback and compositional needs
- composing
- performing

In each phase feedback given from team members informed the activity, and proved to be a very effective strategy.

4.3.1 Dance

The first of the three performances was a dance composition. The piece is an adaption of Swish'n'Break [14], a previous interactive dance performance realized using the

Figure 8. Kajsa Bohlin performing with a Cyr wheel augmented with sensors in Gynoïdes Project Bêta Test VI.

EGGS gesture sonification system [15]. The decision to use an already tested dance setup was made in order to understand the EGGS system's potential for research in sonic interaction applied to the field of circus arts. The EGGS's setup was the same as in Swish'n'Break: sounds and a certain number of choreographic gestures were used.

Six artists took part to the performance: Nathalie Wahlberg [16], Kajsa Bohlin, Marianna De Sanctis, Line Rosa Lee Pallisgaard, Manda Rydman, Lea Norrman Firus. Wahlberg's hands movements generated sounds and led the choreographic action of the other performers, as seen in Figure 6. A 2D optical motion tracking of her hands was realized by means of two electric bulbs she handled, as can be seen in Figure 7. These had the function of active markers tracked by the infrared sensor of a Wii Remote. The moving bulbs had also an interesting scenographic role, continuously changing the lighting of the performers' bodies. The trajectories of the two lights were analyzed in real time, and segmented into the following categories: straight, circular clock-wise, circular counter clock-wise, inversion of direction, stillness.

The sounds used were of swish, broken glasses, wind, water, fire, all taken from the Freesound project [17]. The mapping between gestures and sounds is inspired to simplicity, that has always been a guiding principle during the development and use of the EGGS system. The piece is divided in sections and in each different sounds and different mappings are used. For example when a clock-wise circular hand gesture is performed this produces a wind sound, while a counter clock-wise circular hand gesture produces a water sound, and a straight hand movement produces a fire sound. Further, the dynamic parameters of the gesture are mapped into sound parameters in order to get a more expressive sonification [16].

[16] Nathalie Wahlberg's website: http://www.nathaliewahlberg.wix.com/nathaliewahlberg
[17] Freesound project website: www.freesound.org

4.3.2 Cyr Wheel

For the second performance the research challenges were to sonify the movements of the tool and not those of the performer herself as it occurred in the previous performance, and to understand if there can be an effective sonification of the tools motion [17]. In this exploration, the tool was the Cyr Wheel, and the artist specialist in that discipline was Kajsa Bohlin [18] who is active as a dance-acrobat and a poet.

Instead of using well tested types of sonification, as in the lights performance, here the research objective was to experiment new categories of elementary gestures not implemented yet in the EGGS system. The aim here was to expand the repertoire of elementary gestures detectable. Given the circular shape of the Cyr Wheel it seemed natural to work on rotations in the 3D space, thanks to the inertial wireless sensors, and to verify if these could bring new expressive possibilities. Gyroscope sensors, those that are found inside the Wii Remote, were used. Two Wii Remote were fixed on the internal side of the Cyr Wheel placed diametrically opposite in a position not to hinder the artist's movements Figure 8.

After some preliminary trials, the main possible types of movements with the Cyr Wheel were identified: rolling with or without the performer inside, movements similar to that of a coin with or without the performer inside, spinning with or without the performer inside, and different manipulations of the Cyr Wheel.

Many data can be gathered from the Wii Remote inertial sensors. This ranges from the acceleration on three axes to the velocity of rotation on three axes, to the angles of rotation (i.e. orientation) on three axes. In order to evaluate the most suitable motion mapping into sound, both data and video recording of the main types of movements were realized. The sound designer/engineer made a comparison of different setup replaying exactly the same recorded motion data.

Finally the motion parameters to be taken into account were chosen. These were the angular velocity on one axis, and the angular position on another axis. Also in this exploration, the sounds were selected from the Freesound project, and their categories were breath, wind, scanner, and different types of industrial loops The sounds were organised in a sort of transition from the human element to the natural element, and finally to the mechanical one. The motion parameters were used to trigger the samples, and to change their playback speed.

4.3.3 Acrobatics

In the third performance the research objective was to use body movements to generate voice. The sound part was the recording of the reading of an ironical and humorous text. The author and the actor reading the text was the performer herself, Kajsa Bohlin, this time in the role of free body acrobat. The text recording was segmented into single words, or at least into the smallest recognizable piece of phrase, and was triggered by the motion of the limbs. Four

[18] Kajsa Bohlin's website: www.kajsabohlin.com

Figure 9. Kajsa Bohlin performing acrobatics with sensors attached to her arms and legs in Gynoïdes Project Bêta Test VI.

Wii Remote were used, each placed on a different limb of the performer Figure 9. During the rehearsals a one-to-one mapping [18] was defined between movements and single words. It was established that in this exploration, the most suitable category of motion for triggering sounds was the velocity of rotation. When the velocity of rotation on a defined axis overcame a certain threshold value, a sound file was triggered. Ten file players were used to let play up to ten words at the same time, so to avoid words truncation in the fast parts. There were three main modalities to trigger the words: in sequence, random, and four selected words, one per limb. These modalities changed several times during the performance.

4.3.4 Summary

The first test was successful: the purpose, that all the roles involved acquired knowledge about the EGGS system and tested it with dance having in mind future possible applications in circus arts, was achieved. The kind of sonification used resulted to be effective from the point of view of the composition, the performance, and the response from the audience. One positive observation is that the amount of time required for the performer to well understand the functioning of the system, and the different gesture categories, could be reduced. This because it was the sound feedback itself that helped to understand if a movement was right or wrong. Another observation was that the choice of sensors/markers used was critical. For example the use of electric bulbs is not, in general, a suitable solution for the circus stage. Electric bulbs are fragile and carry high probability of accidental impacts with body parts of the performer, with other tools, or with the floor. The second test was also successful from a research point of view, because it showed that the sonification of circus tools can be an interesting field for further explorations. The use of wireless inertial sensors showed to be a valid choice, since

it allowed to get good data even without the need to process it. The third test had the simplest setup of the explorations analyzed in this section, and thanks to the cleverness of the performer it worked fine and provided a rich performance. A consideration can be made here: simplicity and easiness of use are rewarding. Throughout BT6 it emerged that simplicity let the human element to be more spontaneous and expressive.

5. CONCLUSIONS

There are some compelling conclusions that can be drawn from the work presented in this paper, based on interviews with circus performers, both the ones directly involved in the work and professionals in the audience, as well as from audience comments and reviews in the press.

In studying the method of amplification of the immanent sounds of circus performance, the power of relaying those sounds to the audience was substantial. A previously narrow channel of information and communication was opened up, and the positive effects of this were unambiguous. The increased connection between audience and performer pointed towards many new interesting ways to include dynamic interactive sounds in circus performance.

Using an off-stage performer as a conduit for interactivity, a known piece of music was manipulated to emulate the contortions of a performer on stage. Using non-traditional signal processing on a well known piece of music echoed the extreme movements on stage and showed how mappings between circus performance and signal processing can work to highlight certain conceptual or emotional aspects of a performance.

Finally, methods already adopted in dance can be successfully used in circus arts to create expressive performances. The use of an interactive sensor-based motion sonification system was successful in widening the possibilities of expression in dance-related circus practice.

By using these modes of sonic interaction, the performers automatisms generated by years of training were revisited with a new awareness, and proprioception, allowing all participants to further explore intrinsic expressive potentials.

However, the strain of using precious rehearsal time for development of new techniques that emanated from other sources than those traditional to circus, e.g. software development or microphone adjustment, was felt. This is something that has to be planned for in projects similar to the one presented in this paper, both in regards to practicalities like time and resources as well as the increased intellectual and artistic demands put on the performers.

In summary, the use of interactive sound in circus is an excellent way to add new channels of expressivity to the communication between performer and audience.

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A. ABOUT GYNOÏDES PROJECT

Gynoïdes Project is an academic enquiry through artistic practice that raises and examines the question of women agency in circus art.

Gynoïdes Project is based on the premise that the oppressed identity of circus takes roots in the structure of the circus practice itself.

By intervening in the structure of the practice the project aims at generating alternative models of women representation in circus and favour the emancipation of the art form and of its artists. The project engages in a female-centered circus making and seeks to describe and produce feminist strategies in circus composition.

Gynoïdes Project interacts with educational and research institutions, with organizations and members of the circus community, and with contributors from scientific and artistic fields.

For more info see: http://www.cirkusperspektiv.se

B. VIDEOS OF PERFORMANCES

Bêta Test VI Acrobatics	https://vimeo.com/88395101
Bêta Test VI Cyr Wheel	https://vimeo.com/87856666
Bêta Test VI Dance with light bulb	https://vimeo.com/87856667
Bêta Test V Contortion	https://vimeo.com/89224891
Bêta Test V Aerial Hoop	https://vimeo.com/89203380
Bêta Test V Hula Hoop	https://vimeo.com/89199084