# Auditory Illusion and Violin: Demonstration of a Work by Jean-Claude Risset Written for Mari Kimura

Mari Kimura
The Juilliard School
60 Lincoln Center Plaza
New York, NY 10023 USA
mkimura@juilliard.edu,
mari.kimura@nyu.edu

Jean-Claude Risset
Laboratoire de Mécanique et d'Acoustique, CNRS
31 chemin Joseph Aiguier
13402 Marseille cedex 20, FRANCE
+ 33 4 91 16 40 78
jcrisset@lma.cnrs-mrs.fr

## ABSTRACT

This is a description of a demonstration, regarding the use of auditory illusions and psycho-acoustic phenomenon used in the interactive work of Jean-Claude Risset, written for violinist Mari Kimura.

## Keywords

Violin, psycho-acoustic phenomena, auditory illusions, signal processing, subharmonics, Risset, Kimura.

## 1. INTRODUCTION

In 1995, composer Jean-Claude Risset collaborated with violinist Mari Kimura to write *Variants* for violin and signal processing. He used signal processors as well as Kimura's extended technique subharmonics. This bowing technique enables one to play pitches below the open G on the violin without changing the tuning of the instrument, and Edward Rothstein of the New York Times called it 'revolutionary' [5]. From this 1995 collaboration emerges this year a new collaboration aimed at creating a work for violin, featuring more psycho-acoustic phenomena and acoustic illusions. The demonstration at NIME2006, Paris, in June 2006 will show excerpts of this work and the concepts behind the collaboration. This paper describes the demonstration and introduces the various techniques used in the piece.

## 2. *VARIANTS* (1995)

### 2.1 Collaboration History

Originally, Kimura approached Risset in 1995 with the idea of a piece featuring acoustic illusions,' which Risset wrote about in the 1970s [1, 2]. In the program notes for *Variants*, for violin and digital processing (1995), Risset writes: "[*Variants*] is the first state of a work dedicated to Mari Kimura. The title refers to the transformations of violin sounds produced by digital processing, but also to certain variation processes within the violin part. For instance, the timing intervals of melodic groups, causing so-called stream segregation, are echoed as mere rhythms. Digital echoes and reverberation build up a contrapuntal and harmonic fabric which extends the violin melodies." At the time, Kimura did not have access to the MaxMSP program and the work was realized using an Ensoniq DP/4 parallel effect digital signal processor. The first line of the score in shown in Figure 1. A few years after *Variants* was written, Kimura converted all the processes of *Variants* into a MaxMSP program, to be performed interactively with computer.

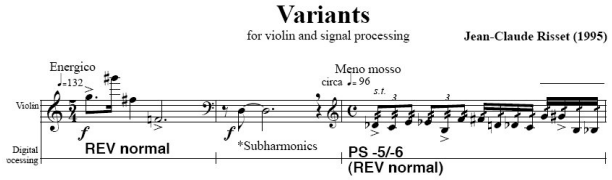


**Figure 1: *Variants* by Jean-Claude Risset.**

### 2.2 *Variants* and Subharmonics

In *Variants*, Risset also uses *subharmonics* [3, 4]. In this and in other works by Kimura, the resulting acoustic phenomenon is used as a compositional tool. Risset is the first composer to incorporate Kimura's bowing technique in works for violin and signal processing, aside from Kimura in her own works.

## 3. AUDITORY AND PHYSICAL ILLUSIONS

### 3.1 Physical Illusion and Sound

Occasionally, some effects in Kimura's repertoire (which she uses in both her compositions and her improvisations) can leave the performer somewhat disoriented, both physically and auditorily. Figure 2 shows such an example actually used by Kimura in her performances: two fingers on two strings are playing in glissando in opposite directions, up and down, switching fingers in the middle and joining in unison. This is a rather subjective example, but it illustrates especially well that towards the narrow intervals between two pitches, the performer could get a little disoriented about which finger is doing what exactly. The disorientation is more pronounced as this is played at faster speeds. As a performer, this experience is interesting as it might be akin to trying to hold your hands in your back, one arm from above and another from below, then switching hands rapidly to do the same.

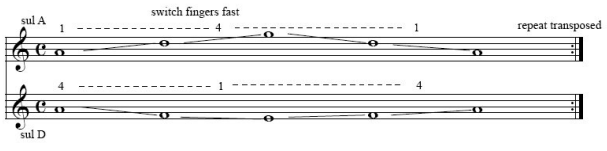


**Figure 2: Fast *glissando* on two strings in opposite directions.**


*NIME 06,* June 4-8, 2006, Paris, France

## 3.2 Auditory Illusions

Composers throughout the ages have been using auditory effects and incorporating them in their musical compositions. There are many examples, but a common one well-known to violinists is Tchaikovsky's *Violin Concerto*, which uses the pitch ranges of all instruments to highlight the soloist. Despite the thick orchestration of this romantic era concerto, the solo violin maintains dominance over the entire orchestra throughout the piece. One of the reasons is that Tchaikovsky never lets the highest-pitched instrument in the orchestra, namely the flute, to go above the violin for more than 4 measures at most. Every time the flute goes higher beyond the solo violin, never more than 4 measures later the solo violin takes over the highest note in the entire orchestra.

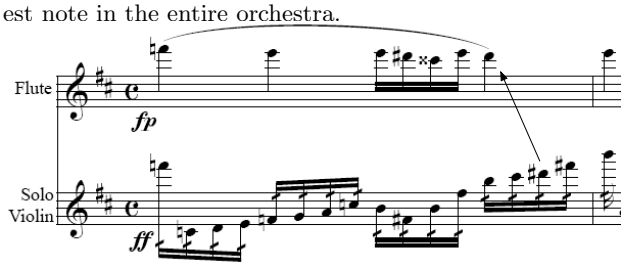


**Figure 3: Excerpt from Tchaikovsky's *Violin Concerto*.**

In a more recent example, Mario Davidovsky's *Synchronisms No.9* for Violin (1988) uses auditory illusions between violin and electronics both on performer's and listener's ears. Davidovsky, himself a violinist by training, is fully aware that the higher the note you play on the violin (above 1000 Hz B on two octaves above middle C), the more ambiguous the instrumental timbers become to the human ear. He combines seemingly innocent sine-wave like chords on the tape part, weaving the violin in the middle. This actually does affect the performer's auditory center, making the performer slightly disoriented auditorily to what he is actually playing, as the tape part is quite close to the timber of the violin itself (Figure 4).

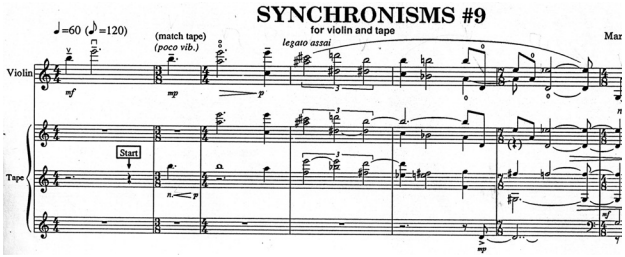


**Figure 4: Excerpt from *Synchronisms No.9* for Violin and Tape by Mario Davidovksy (Courtesy of Edition Peters).**

# 4. RISSET'S *VIOLONÉ* (2006)

## 4.1 Concept

The word 'Violoné' was used mostly to characterize the Louis XV style of furniture, with curved shapes similar to those of a violin. Risset would use the violin to generate structures giving rise to illusions or to certain processes - but these structures would be kin to the violin, since the violin provided their material.

## 4.2 Devices

In *Violoné*, Risset uses real-time MaxMSP processing as the device that creates auditory illusions with the violin. Some of the auditory illusions described in Risset's past research will be incorporated in this musical creation. Risset and Kimura develop a musical language that derives from the acoustic characteristics of the violin (and of course, not so characteristic as Kimura's *subharmonics*) combined with such electronic effects, creating auditory illusions both for the performer and the listener. It is a challenge for performers to be auditorily disoriented while performing, at the same time it is also a very intriguing prospect as one of the performance practices of electronic music for the violin. Compositionally speaking, several auditory illusions have been demonstrated thanks to computer sound synthesis, which afford a precise control of the physical structure of the synthetic sound; but some can be realized with instruments, granted a careful control. The control by the virtuoso instrumentalist can yield unexpected effects. This was already demonstrated in works from Bach to Ligeti, in Risset's orchestral works *Phases* and *Escalas*, and Kimura's *subharmonics*.

## 4.3 Methods

One of the methods used in realizing such auditory illusions will be the way Risset initially harmonizes the violin using MaxMSP, then gradually this harmonization turns into octaviations, so that the descents or ascents on the violin turn into illusory endless ascents or descents. The instrumental sound can also be taken as a point of departure for subsequent digital sound processing, so as to impose specific structures that are conducive to creating sonic illusions. For instance, going down a scale can be turned into an infinite descent, using either harmonization or delay and multi-play.

# 5. CONCLUSION AND FUTURE PLANS

Kimura's extended technique *subharmonics* for the violin has been developed not as a mere novelty but as a musical necessity, stemming from the desire to expand the musical language of the violin. One should also be aware that illusions are not mere curiosities: they reveal the inner processes of our auditory perception. As Purkinje stated, *illusions, errors of the senses, are truths of perception.*
Risset and Kimura have been considering collaborating with visual artists, in order to combine both auditory and visual illusion to create *Violoné* as interactive audio visual work. The parallel seen between Risset's auditory illusion concepts and visual illusions seen in the works of Victor Vasarely could easily be combined. By June 2006, we plan on having more concrete realization plans along these lines.

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