

# Analysis of Timpani Preparatory Gesture Parameterization

Alexandre Bouënard\* †, Marcelo M. Wanderley\*, and Sylvie Gibet†

(\*) IDMIL, McGill University, Montreal, Qc, Canada

(†) Samsara/VALORIA, Université de Bretagne Sud, Vannes, France

**Key words:** Instrumental Gesture Analysis, Percussion Gesture, Gesture Synthesis.

## 1 Introduction

The appearance of novel gestural interfaces for instrumental performance, such as virtual character gesture synthesis, yields to a growing interest for the analysis of the expressive components that are at stake during instrumental gestures.

Several quantitative studies on instrumental gestures have been carried out, extracting and evaluating gesture parameters for instance based on classification/recognition methods such as k-Means classifiers [1]. Considering gesture synthesis, data-driven techniques for virtual character animation benefit from the realism of human motion capture data. These are based on large sets of gestures in varying contexts, and rely also on features extraction and data reduction methods for keeping the realism of the produced motion and generating style [2] with relatively low computational costs.

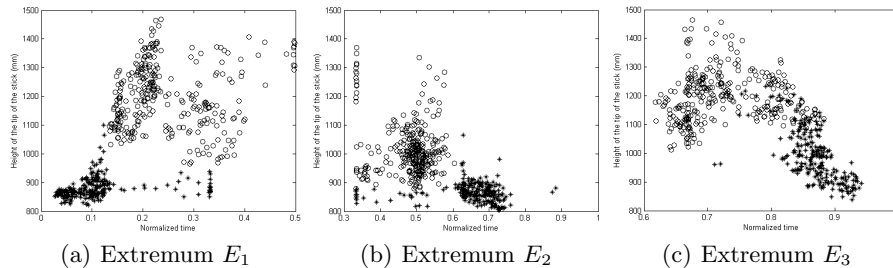
Our project aims at combining these analysis and synthesis approaches. The present contribution focuses on timpani preparatory gestures, and especially on the evaluation of the relevance of gesture parameters that can be handled by our virtual character animation system [3].

## 2 Gesture Parameterization and Evaluation

We have built a timpani gesture database by using motion camera tracking for three timpani performers [3]. The database emphasizes timpani playing characteristics such as stick grips, gesture variations and beat locations. Each captured gesture has been segmented so that the database is made of beat-to-beat units that characterize performer’s preparatory gestures.

A descriptive analysis has been conducted [4] for discriminating French ( $F$ ) and German ( $G$ ) grips for two timpani players. This has led to the extraction of three parameters  $E_1$ ,  $E_2$  and  $E_3$ , the local extrema of the height trajectories of the tip of the stick.

The evaluation of the relevance of these parameters is measured using the kNN classification method (k Nearest Neighbors), with a training set randomly composed of 1/8th of 544 points and a threshold fixed at 10 neighbors. Figure 1 shows the clusters related to the extrema  $E_1$ ,  $E_2$  and  $E_3$ . The high recognition rates of these extrema (Table 1) indicate that such a parameterization is well-suited for characterizing the grips of the two players under study.



**Fig. 1.** Extrema clusters for French (denoted by  $\circ$ ) and German (denoted by  $*$ ) grips.

**Table 1.** kNN recognition results of the parameters  $E_1$ ,  $E_2$  and  $E_3$ .

<i>Test / Training</i>	$E_1$		$E_2$		$E_3$	
	F	G	F	G	F	G
<i>F</i>	97.1%	2.9%	86.4%	13.6%	83.9%	16.1%
<i>G</i>	3.4%	96.6%	5.5%	94.5%	24.3%	75.7%

We are currently working on the evaluation of an extended parameterization that takes into account more characteristics of timpani playing, such as the gesture variations (legato, tenuto, accent, vertical accent and staccato). We plan to present this extended parameterization as part of the final contribution.

### 3 Acknowledgments

The authors would like to thank the timpani performers (McGill University) for their help in this study. This work is partially funded by the *Natural Sciences and Engineering Research Council of Canada* (Discovery and Special Research Opportunity grants), the *Pôle de Compétitivité Bretagne Images & Réseaux* and the *International Doctoral College of the Université Européenne de Bretagne*.

### References

1. Rasamimanana, N.H., Fléty, E., Bevilacqua, F.: Gesture Analysis of Violin Bow Strokes. In *Gesture-Based Communication in Human-Computer Interaction*, LNAI 3881, Springer Verlag, pages 145-155, 2005.
2. Hsu, E., Pulli, K., Popović, J.: Style Translation for Human Motion. In *ACM Transactions on Graphics*, vol. 24-3, pages 1082–1089, 2005.
3. Bouënard, A., Gibet, S., Wanderley, M.M.: Enhancing the Visualization of Percussion Gestures by Virtual Character Animation. In *Proceedings of the 2008 International Conference on New Instruments for Musical Expression (NIME)*, pages 38–43, 2008.
4. Bouënard, A., Wanderley, M.M., Gibet, S.: Analysis of Percussion Grip for Physically Based Character Animation. To appear in the *International Conference on Enactive Interfaces*, 2008.