

Human Melody Oriented Chaotic Sound Generation System Using Music Conductor Gesture

指揮者のジェスチャーによるメロディ調整可能なカオスサウンド生成システム

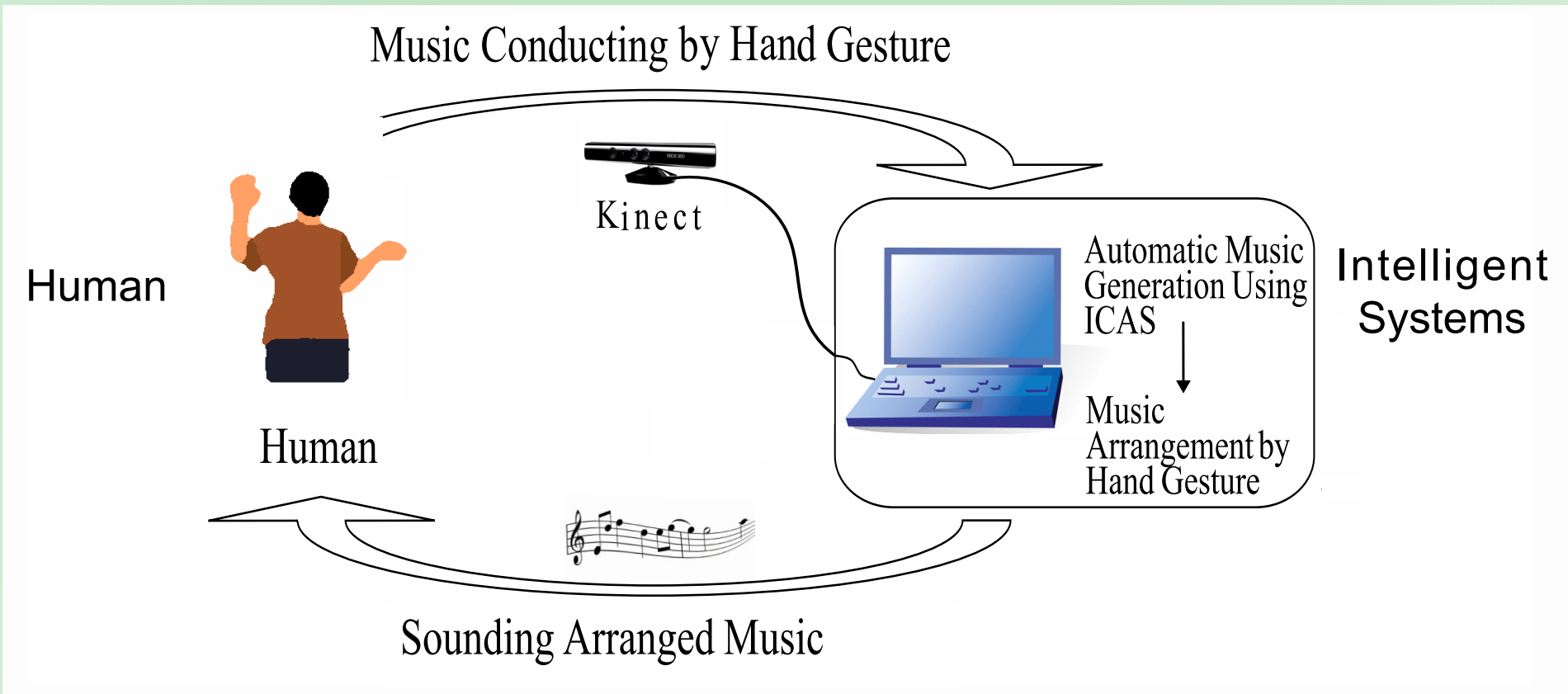
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Introduction

Our system makes it possible for the people, who only have the interest but know nothing about the instruments, not only to be a listener, but also can produce the music by themselves.

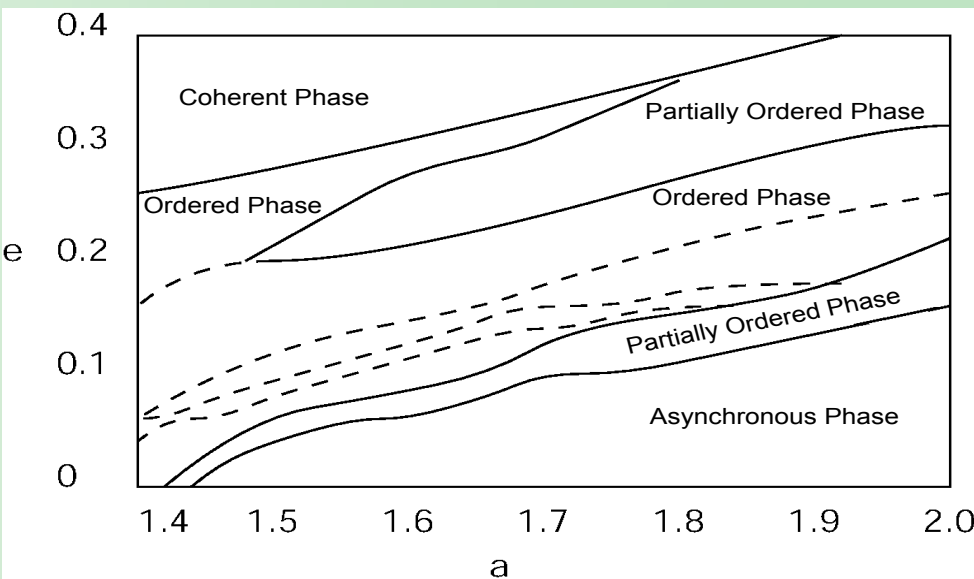
In this research, the active cooperation of human affecting directly in the chaotic iteration of GCM have succeeded. And the increasing of interactivity improves the outcome of our system.

System Overview

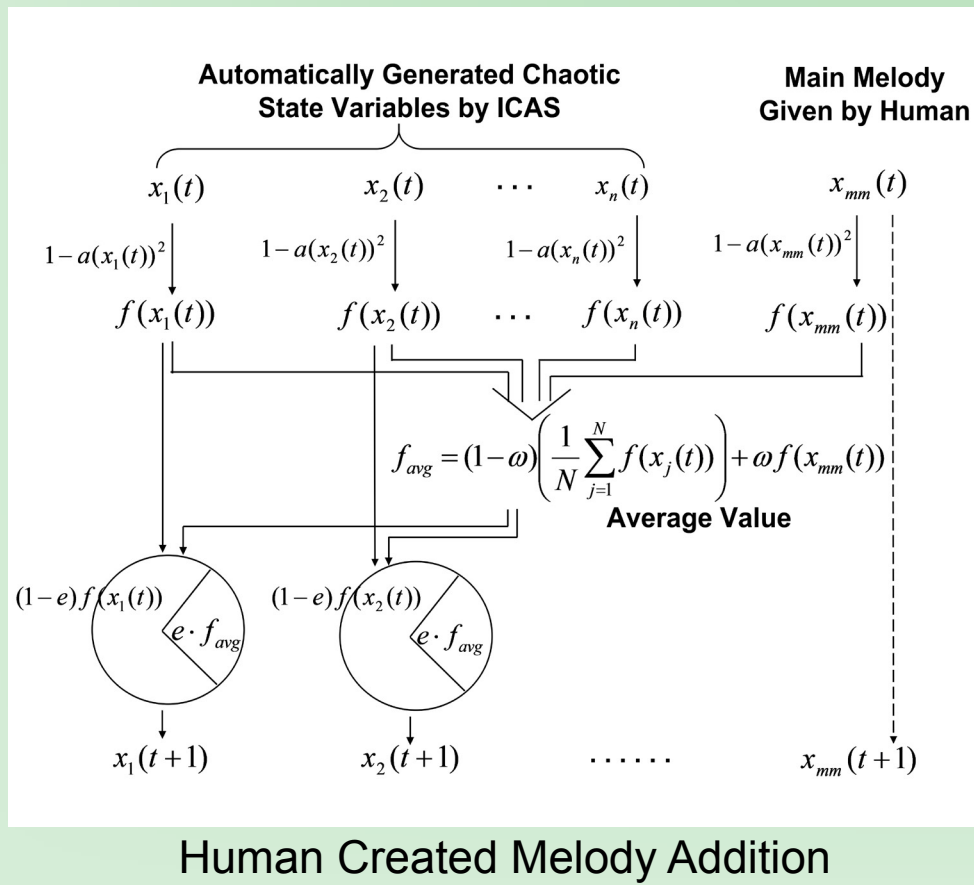


Sound Generation Coordinating with Human

In this research, we proposed human created main melody oriented sound generation method (HUMO-ICAS), based on Interactive Chaotic Amusement System (ICAS) based on network of chaotic elements[1]. ICAS united the chaotic elements to generate various sounds by GCM. Globally Coupled Map(GCM) is a model considering a non-linear elements in a global chaos network, that changed by all other elements interacting with the same degree of intensity.



Rough Phase Diagram of GCM [2]

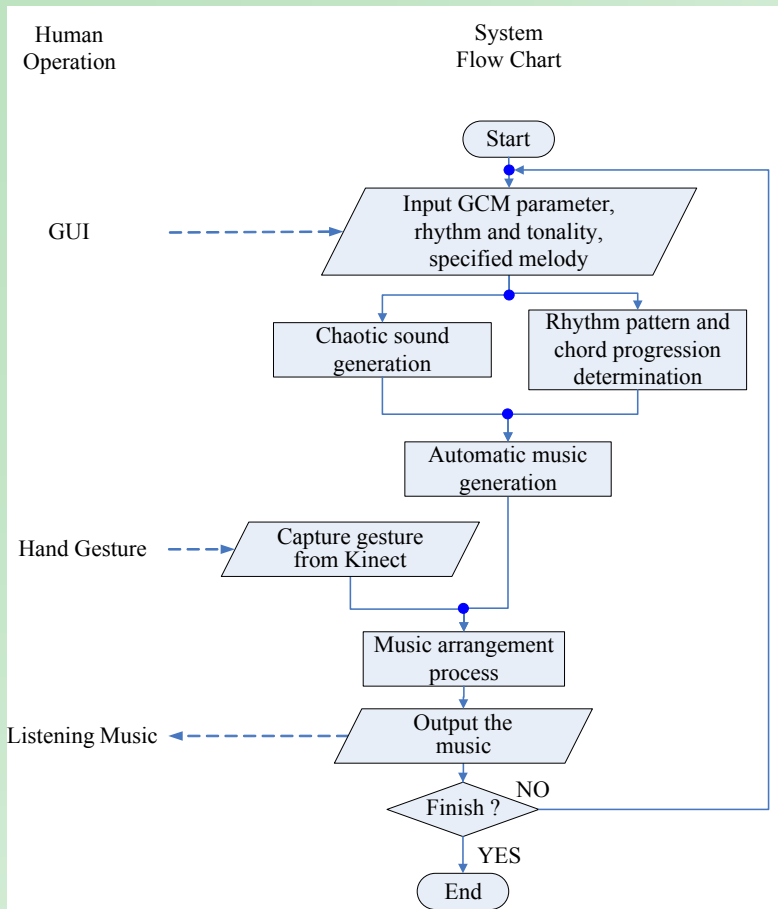


Human Created Melody Addition

$$f(x_i(t)) = 1 - ax_i^2(t) \quad [i = 1, 2, \dots, n], \quad (1)$$

$$x_i(t+1) = [1-e]f(x_i(t)) + \frac{e}{N} \sum_{j=1}^N f(x_j(t)), \quad (2)$$

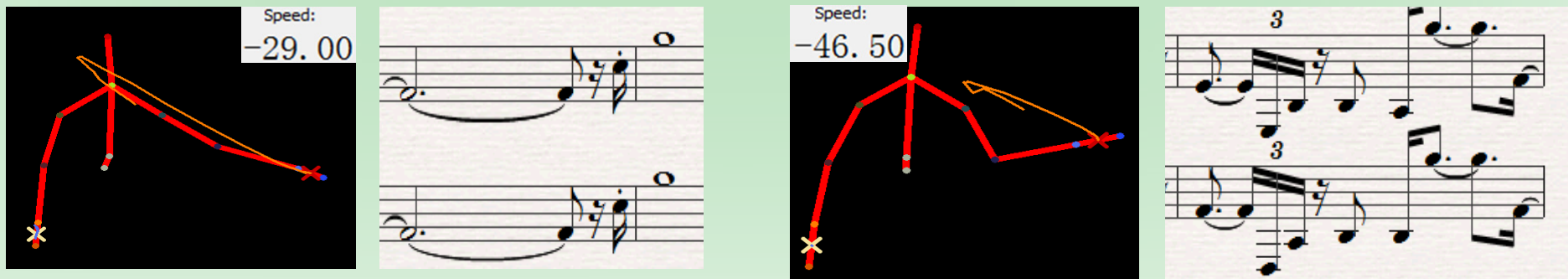
- $x_i(t)$ State of element i at a discrete time t ,
- $f(x)$ Logistic map,
- e Strength of the entire combination,
- N Total number of elements.



System Flow Chart

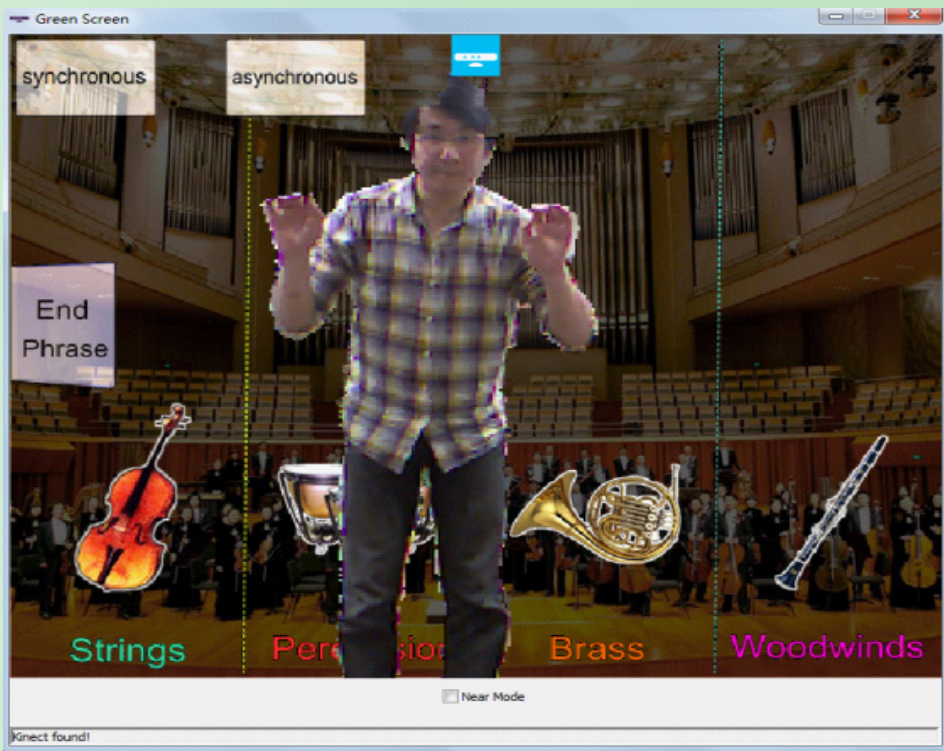
Hand Gesture for Music Arrangement

- The amplitude of hand arranges the volume of music generated by ICAS.
- The speed of hand arranges the speed of music generated by ICAS.

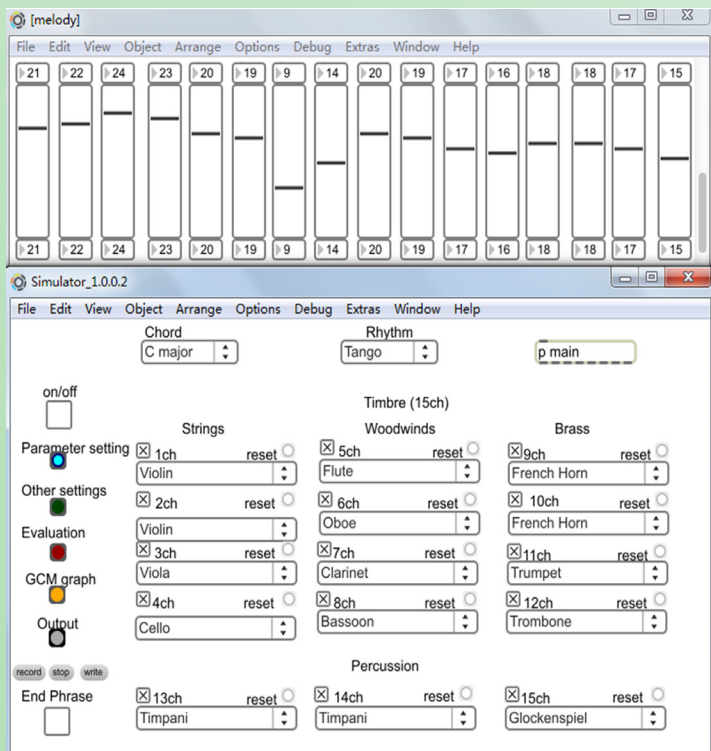


Simulation & Kansei Evaluation

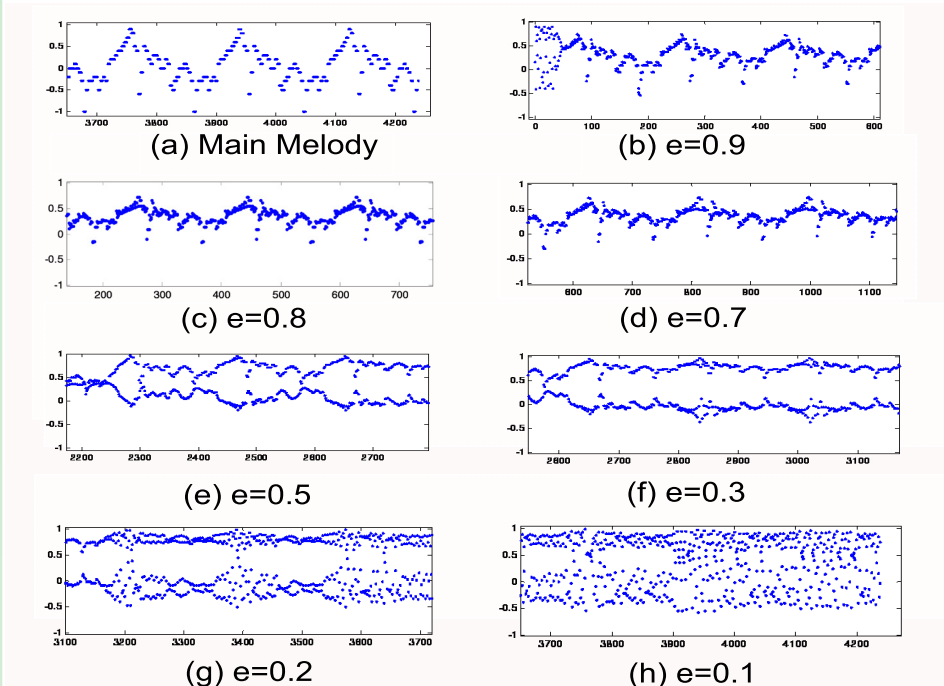
We have implemented the system described in this paper, and evaluated the effect of the system using SD method.



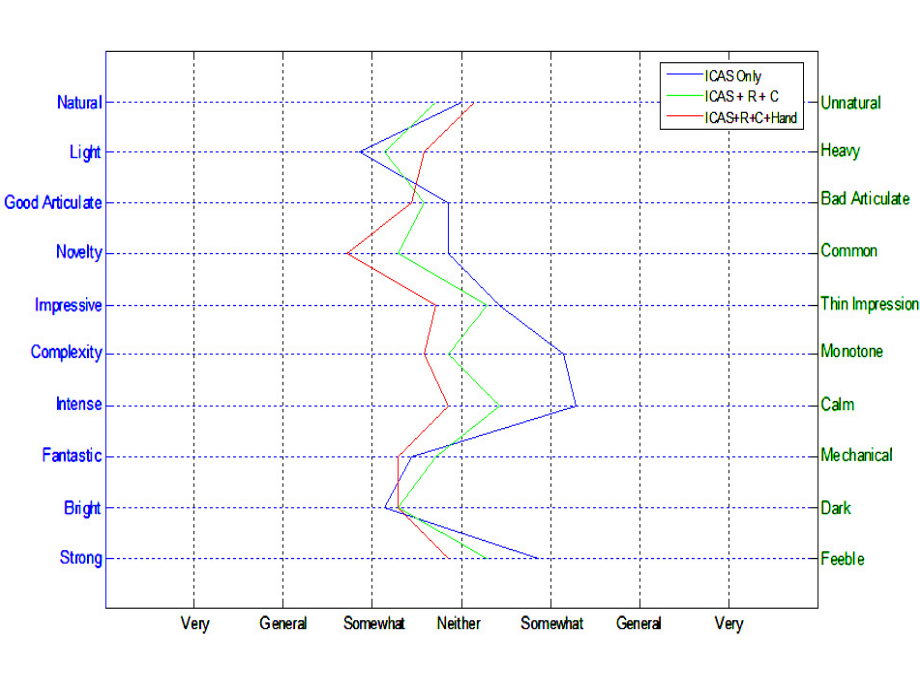
GUI of Simulation System



GUI of HUMO-ICAS Simulator



Output while e from 0.1 to 0.9



Evaluation Result

Conclusions & Outlook

In this research, we proposed the hand gesture-based ICAS. Validation experiment of main melody orientation and comparative evaluation of proposed music generation method were carried out.

For the further research, we will enrich the musical expressions and the conducting gestures to achieve a better output sound and a higher level of interaction.

References

- [1] M. Yamamoto and Y. Maeda: "Interactive Kansei System for Sound Generation Based on Network of Chaotic Elements ", Proc. of the Fourth International Symposium on Human and Artificial Intelligence Systems: From Control to Autonomy (HART 2004), pp. 315-320, 2004
- [2] K. Kaneko: "Clustering, Coding, Switching, Hierarchical Ordering, and Control in a Network of Chaotic Elements", Physica D, vol. 41, pp. 137-172, 1990
- [3] R. W. Ottman, Elementary Harmony: Theory and Practice, Prentice Hall, 1997.
- [4] A. Blatter, "Revisiting music theory: a guide to the practice", p.28, 2007.