

# AUTOMATIC COMPOSITION OF DRAMATIC MOVEMENT

## *Analysis and Algorithm for Creating Contemporary Dance Sequences*

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Abstract: We have developed an automatic composition system for contemporary dance by using 3DCG animation. Our goal is to develop some useful tools in dance education such as creation-support system for teachers and self-study system for students. Our approach is not creating natural connection but creating conceptual sequences. As a result of previous experiment, we recognized the connecting method was not so important for contemporary dancers. We try to create short sequences that have dramatic stories according to the structure of Chinese poetry in ancient times. The basic movements of contemporary dance are classified and analyzed. The algorithm for automatic composition is integrated to create utilitarian choreographies for lessons. This system is valuable for online virtual dance experimentation and exploration by teachers and choreographers involved in creative practices, improvisation, creative movement, or dance composition.

## 1 INTRODUCTION

Our research approach focuses on creating and composing choreographies for dance. Our goal is to develop useful tools in dance education and creation such as a self-study system for students and a creation-support system for teachers. We have been developing a Web-based interactive simulation system with automatic composing function for ballet using 3D motion archive (Soga et al., 2007). Using our proposed system, one can interactively compose or automatically create ballet sequences. As a result of past evaluation, we verified that the created choreographies had a possibility to be used in the actual lessons.

In this research, we suggest an automatic composition for contemporary dance. Ballet encompasses the most basic movements and its method is strictly defined. The method complies with esthetics of formal beauty of ballet which has been brought up for 400 years. It is easy to consider and integrate into the system. On the other side, contemporary dance has no basic steps and no limit of motion. Therefore creating automatic composition algorithm for contemporary dance is our present challenge.

In 1980's, Merce Cunningham used the computer software called LifeForms to discover his

original movement. This software is the most famous application that can compose and edit dance scores. In recent works (Calvert, 2005), it has been extended to computer notation systems by using Labanotation, which is one of the most famous dance notations. By using this system, the user can simulate strictly scored dance animation. However, it is difficult to compose creative and effective choreographies. Our basic concept is "to separate dance movement into elemental motions and use them like building blocks." The basic approach is creating rough list of a sequence for contemporary dance.

In recent years, 3-dimensional motion data is often used in researches because it is getting easy to record human motion by using a motion capture system. There have been many studies for creating new motions by using human motion data such as controlling parameters of motions (Perlin, 1996), blending some resources (Pullen, 2002). Our approach is not creating natural connection such as motion graph (Kovar, 2002) but creating conceptual sequences.

We conducted an experiment on the automatic composition system for ballet and contemporary dance to evaluate its practicality (Soga & Umino, 2007). Three professional contemporary dancers who well know ballet evaluated the ten sequences.

Each sequence was created by automatically with a simple algorithm that is selecting each movement from beginning to ending randomly.

As a result, no sequence was evaluated as “cannot be performed.” In the case of contemporary dance only, no movement was evaluated as “difficult to perform.” This means that whatever sequences we create they can dance. The dancers enjoyed how to connect each movement and they said that they do not want the exact choreographies because the connecting way is the originality. We recognized the connecting method was not so important for contemporary dancers. What they want is creating unexpected but conceptual choreographies. Owing to these ideas, we aim to create a rough list of basic movements so that the dancer can arrange and express their own choreographies.

We suggest an automatic composing algorithm for contemporary dance. As we mentioned before, there is no rules in contemporary dance and strict algorithm is not recommended for them. However, in the case the algorithm has no rules the created choreographies have sometimes no meaning. Therefore, we try to create short sequences that have dramatic stories according to the structure of Chinese poetry in ancient times. Before describing the algorithm, we classify and analyze the basic movements of contemporary dance.

## 2 CLASSIFICATION AND ANALYSIS OF MOVEMENTS

### 2.1 Classification of Contemporary Dance Movements

First we have archived motion data of contemporary dance. As there is no basic step in contemporary dance, a choreographer made a list of basic movements that can be used in contemporary dance. In the present we have archived 53 kinds of basic movements performed by a professional dancer by using motion capture system.

Table 1: Classification of contemporary dance movements.

| Family    | Number | Examples              |
|-----------|--------|-----------------------|
| BodyParts | 22     | NeckRoll, ArmsSwing1, |
| Balance   | 14     | LegRound, OffBalance1 |
| Jump      | 5      | Jeté, SideDive        |
| Pivot     | 4      | ContractionStenu      |
| Floor     | 8      | BackRolling           |
| Total     | 53     |                       |

Table 2: Analysis of basic movements.

| Family      | Start | Repeat | Once | End |
|-------------|-------|--------|------|-----|
| BodyParts   | O     | O      | X    | O   |
| Balance:On  | O     | X      | X    | O/X |
| Balance:Off | O     | X      | O    | X   |
| Jump        | X     | X      | O    | O   |
| Pivot       | O     | X      | O    | O   |
| Floor       | O     | X      | O    | O   |

Then we classified these movements into five categories: BodyParts, Jump, Balance, Pivot, and Floor. BodyParts is a movement that can use one or more body parts such as neck, arms, shoulders and hip. Balance is the movement that is related to body balance such as standing in one leg. Jump and Pivot are almost same to ballet but it is used in the contemporary dance choreographies. Floor is in the case they do not stand on their legs such as lying down or rolling. This is one of the typical movements of contemporary dance. Table 1 shows the number of basic movements and examples of each category.

### 2.2 Analysis of Basic Movements

For creating choreographies automatically, we analyzed four features of each category. They are “Start,” “Repeat,” “Once,” and “End.” Table 2 is the analysis result of these features. For analyzing these movements, we divided Balance into two families; Balance:On and Balance:Off according to the existence of balance.

“Start” is the movement that can start a sequence. We defined that all category movement except Jump can be started because a jump needs a preparation such as a hop.

“Repeat” and “Once” are related but not exclusive. “Repeat” is the one that can be continually repeatable, while “Once” is that can appear only once during a sequence. In the case of short sequences, most of dynamic movement is enough to appear only once. Therefore, we define that each movement of Balance:Off, Jump, Pivot and Floor can be used only once. We also define that BodyParts movements are repeatable. Balance:On movements are not “Repeat” and not “Once”. These are not continually repeatable but they can intermittently appear some times.

All category movements except Balance can end because off balance movement is difficult to finish the sequence. In addition, some of Balance: On movements such as a hop are not allowed to end because a hop is the preparation of a jump and expected to continue other movement.

Table 3: The course of order and our interpretation.

| Section         | Interpretation                                  |
|-----------------|---|
| (a)Introduction | Starting movement                               |
| (b)Development  | Similar and repeatable movement                 |
| (c)Turn         | Most dynamic movement that can appear only once |
| (d)Conclusion   | Ending movement                                 |

### 3 AUTOMATIC COMPOSITION

#### 3.1 Basic Concept

For contemporary dance lesson, considering how to connect movements by dancers is important. Therefore we prepare a rough list of basic movements in order that the dancer can connect each movement freely.

We make a rough list of movements by selecting each movement randomly. To create a dramatic sequence, we have integrated the structure of Chinese poetry in ancient times to the algorithm, which is the course of order; Introduction, Development, Turn and Conclusion. The basic concept is that a movement starts and lasts smoothly then something changes and ends. In this research we define that most dynamic movement can be appeared in the Turn section. Table 3 shows our interpretation of each section for creating dance sequences.

#### 3.2 Algorithm for Automatic Composition

Figure 1 shows a transition diagram for creating contemporary dance sequence. We suggest an algorithm for automatic composition.

At first a movement for “Turn” is selected from Jump, Pivot, Floor and Balance:Off. This is the main movement and can appear only once.

In the second step, a movement for “Conclusion” is selected. This should be different from the selected movement in the first step. In the case of short sequences such as 8 beats, selecting no movement is acceptable unless the movement is Balance:Off.

In the third step, a movement for “Introduction” is selected. This is selected from except “Jump” because “Jump” cannot be a starting movement. This should be also different from the selected movement if that has the “Once” feature.

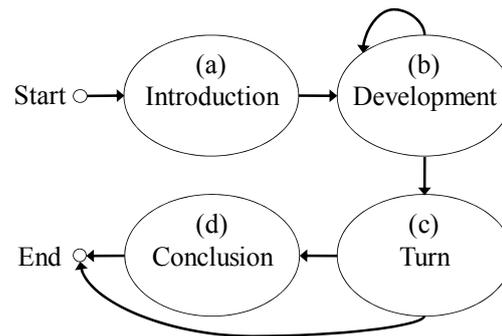


Figure 1: Transition diagram for contemporary dance sequence.

At the last, movements for “Development” are selected until the sequence has enough beats. In this step, we consider if a movement is repeatable or not. We also consider the selected movement is used once or not.

### 4 CREATION RESULT

Figure 2 shows an example of created sequence by automatic composition. This is a 13 beats sequence created by the proposed algorithm. At first JumpHop was selected as a “Turn” movement. Then BodySwing3 was selected as a “Conclusion” movement and ShoulderUpdown was selected as an “Introduction” movement. The rest of movements were selected as “Development” movements.

### 5 CONCLUSIONS

We tried to create short sequences that have dramatic stories according to the structure of Chinese poetry in ancient times. The basic movements of contemporary dance were classified and analyzed. The algorithm for automatic composition was integrated to create utilitarian choreographies for lessons. We verified the created choreographies have short story and our system has possibility to create dramatic movements.

In future works, we try to analyze longer pieces and create more complicated sequences for creative works. We aim to develop a system that can automatically create some sequences like a specific choreographer by introducing the function of the choreographer.

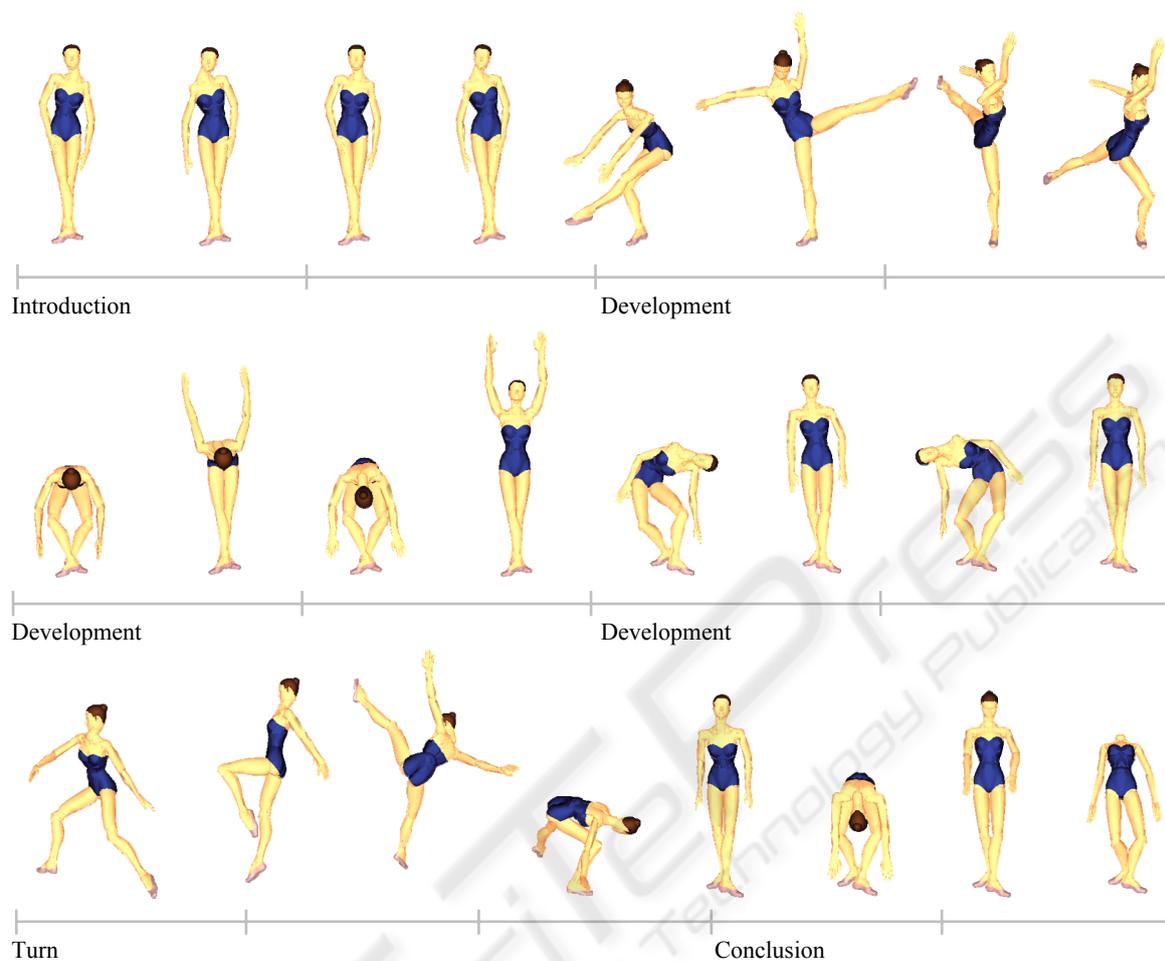


Figure 2: Example of created sequences by automatic composition.

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