

## Artistic Evaluation in Classical Ballet

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**Abstract :** *This study seeks to create objective criteria (an artistic evaluation model) that define what is “good” or “bad” in terms of the artistic aspects of classical ballet performance. The authors started by interviewing professional judges and dancers to determine which movements the study should target (1). Next, the impressions given by the music used during those movements were identified using a principal component and cluster analysis (2). In order to narrow down analytical targets, multiple regression analysis was then conducted to find out which movement elements had the greatest impact on overall scores (3). Motion capture technology was used to collect positional data on each of these movement elements; this data was used to determine how physical characteristics like body angle and speed correlated with the impressions given by the music. These relationships were then used to construct a model for artistic evaluation (4). The model was actually applied to dancers in order to check the validity of the analytical results, based on whether they improved their performance to give the same impression as the sound (5). The results were used to define clear criteria for artistic evaluations of classical ballet, and the desired results were obtained.*

**Keywords -** *Artistic evaluation, Sound impression model, Motion capture*

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### I. Introduction

There are no defined scoring criteria for classical ballet competitions. Points are awarded for technical and artistic performance, but evaluation standards within these two categories are based on subjective impressions from individual judges. What makes “good” and “bad” ballet is never clearly defined. Competition participants (dancers) are also coached without knowing what exactly they are being evaluated on, and compete according to these unspoken standards. As a result, dancers are never given feedback on what was good or bad about their technique—an unfortunate irony given that the purpose of the competitions is to educate them about what they need to do to improve [4].

The situation indicates that there would be some value in constructing objective criteria that defined exactly what was “good” and “bad” about a classical ballet performance. Creating these standards would have two outcomes. First, it would simplify the feedback that dancers get during competitions, which would in turn help them improve their technique in the future. Second, it would help instructors define their training methods more clearly, which would also improve their dancers’ technique. This study sought to develop a model that would support both of these aims.

There are several examples of previous research focused on technique [9-12], but the authors could find no examples of positional data being used to evaluate artistic performance—so it was this area that they chose for this study. They were also aware that the way to improve artistic performance was to create a better fit between the subjective impressions given by the sound and the subjective impressions given by the dancer’s movement, so they decided to tie these two concepts together to create their model for artistic evaluation.

The study was carried out in five overall stages. First, professional judges and dancers were interviewed in order to select the movements that the study should target (1). Next, the impressions given by the music used during those movements were identified using a principal component and cluster analysis (2). In order to narrow down analytical targets, multiple regression analysis was then conducted to find out which movement elements had the greatest impact on overall scores (3). Motion capture technology was used to collect positional data on each of these movement elements; this data was used to determine how physical characteristics like body angle and speed correlated with the impressions given by the music. These relationships were then used to construct a model for artistic evaluation (4). The model was actually applied to dancers in order to check the validity of the analytical results, based on whether they improved their performance to give off the same impression as the sound (5). The results were used to define clear criteria for artistic evaluations of classical ballet, which would encourage dancers to improve their technique.

### II. Background

Today’s classical ballet judges have no consistent set of evaluation criteria, and points are awarded based on their subjective assessments. This leads to a problematic situation where there exists a high degree of inconsistency among scores from different judges. According to *Barei Nyumon* (An Introduction to Ballet)

published by Miura in 2000, technical and artistic performance is basically scored according to the following five elements; however, there is room for interpretation in each and no clear definition of what is “good” or “bad” is given.

- i. Ability to understand and express the variation: Understanding the part and expressing it well
- ii. Appearance: Articulation and openness of the hip joints
- iii. Musicality: Correct musical expression, rhythm, and keeping in time with the music
- iv. Technique: Correct performance of each movement, positioning, rotation, jumping, balance, etc.
- v. Potential: Likelihood that the dancer will be able to make a name for themselves with continued growth and practice

The evaluation of artistic performance in particular is wholly dependent on the subjective impressions of each judge, and differences of opinion make it impossible to give dancers clear feedback on what they need to do in the future. Because there is no single set of criteria on what constitutes a “good” or “bad” performance, classical ballet faces a problematic situation where the competitions that are supposed to serve as educational opportunities (a chance for dancers to improve their technique) fall short of their intended goals.

There is some meaning, therefore, in creating a set of valid evaluation criteria that define what is good and what is bad in terms of artistic evaluations. It was hoped that constructing these artistic evaluation criteria would help (1) create a competition environment where it is easy to give dancers feedback, (2) set up a classical ballet learning environment that is structured to facilitate coaching, and (3) improve the artistic performance of individual dancers.

Through interviews with professional judges, the authors learned that the degree to which the impressions created by the dancers’ movements matched the feel of the music had a significant impact on the level of artistic performance. Given this fact, the study sought to identify the subjective impressions created by certain sounds and use it to specify the subjective impressions that classical ballet dancers should create through their range of movement. These two sets of data would then be brought together in order to construct the authors’ model for evaluating artistic performance in classical ballet.

### III. Selecting A Performance For Analysis

The authors conducted interviews in order to determine the analytical targets for their study. Based on the results, they decided on three key factors that should be used to select the most practical movements: (1) the movements should be practical as they are used in international competition, (2) the movements should include several movement elements as well as lateral movement, and (3) the movements should be strongly tied to the subjective feel of the music as well as the choreographic story. These factors were then used to select a dance performance.

When the study was proposed to the Prix de Lausanne international dance competition, the authors found that the choreography for *The Flower Festival in Genzano* used in their 2009 competition was an outstanding choice of subject in terms of the factors listed above. The part of the ballet selected was further narrowed down based on the following considerations: (1) the need for a one- or two-minute performance that mimicked competition conditions, (2) the portion of *The Flower Festival in Genzano* with the most emotional expressiveness, and (3) the need for the choreography of the excerpt to contain multiple movement elements.

## IV. Analyzing Subjective Impressions Of Sound

### 4.1 Identifying trends in sound structure

The score for the *The Flower Festival in Genzano* piece used in this study consists of 43 total measures. The music was broken down into individual measures and then further into 8 sounds per measure. Each sound was then numerically represented based on frequency. The calculations were done using the MIDI Tuning Standard developed by Scholz in 1991[3]. Then, since it was assumed that the subjective impression given by any sound was affected by the previous sound, the difference in the frequencies of the two sounds was calculated and collected as data. In addition, the presence of musical symbols (staccato, tenuto, slurs) was used as a dummy variable and converted into data as well.

The authors then subjected the data collected to a principal component analysis and cluster analysis in order to identify patterns in the sound structure. The groupings found through the cluster analysis as well as the component axes and principal component scores from the principal component analysis were compared with one another (Figure 1). This allowed the authors to define six clusters: (1) rising tone/intermittent, (2) falling tone/intermittent, (3) major change/intermittent, (4) sustained first note, (5) ties, and (6) rests. The authors were thus able to identify six trends in sound structure (Figure 2)

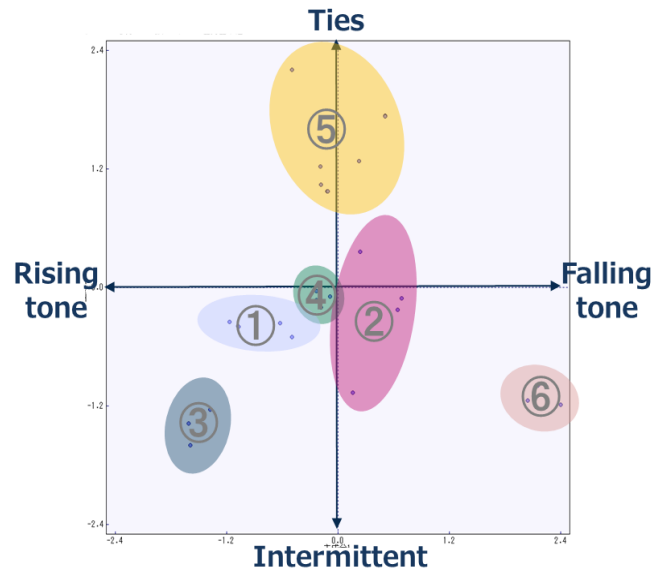


Fig.1 Principal component analysis and cluster analysis

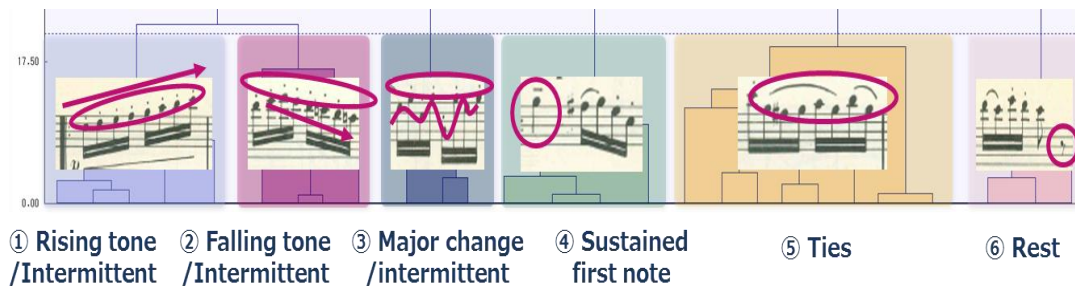


Fig.2 The six sound structures

#### 4.2 Subjective impressions created by the sound structure

Next, sensory words were used in order to determine the subjective impression created by each of the six sound structures. Test subjects were asked to listen to the music of *The Flower Festival in Genzano* and rate each phrase on a seven-point scale. Fourteen sensory words were used for the study: natural, happy, lonely, dynamic, solemn, flowing, sharp, exquisite, vivid, beautiful, clear, powerful, majestic, and exhilarating [1-2].

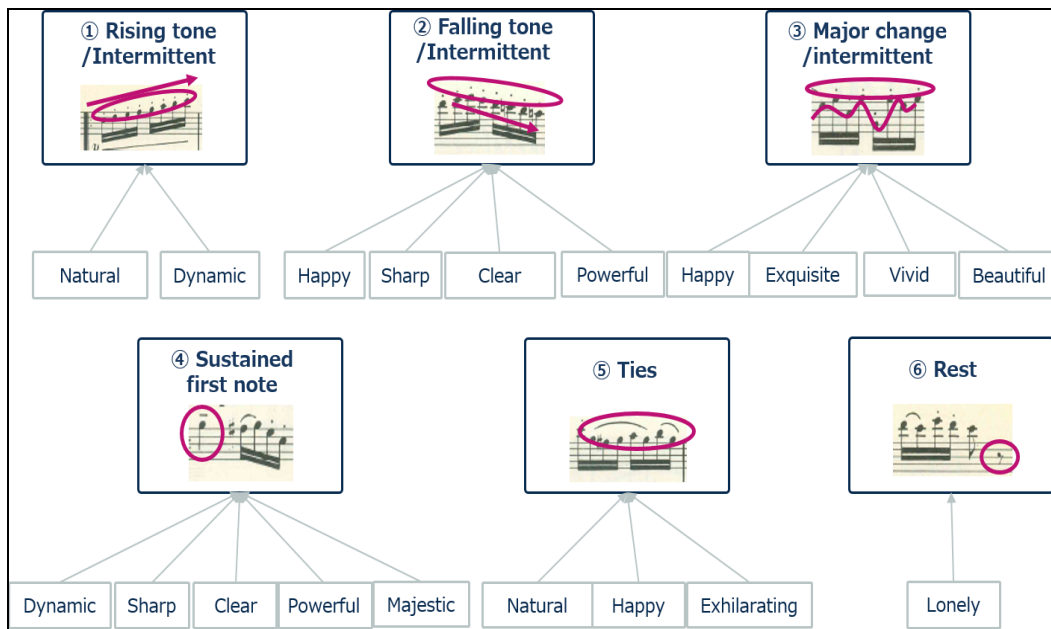
The authors prepared subjective impression questionnaires for each type that included the 14 sensory words and gave them to eleven professional judges and 33 members of the general public (which included those involved in ballet) for a total of 44 subjects.

The authors then used this data to compare partial correlation coefficients and identify the causal relationships between each cluster and sensory word. Items that score 0.6 or above were assigned a +++, those between 0.4 and 0.6 were assigned a ++, and those between 0.2 and 0.4 were assigned a +. Those with a score between 0.2 and -0.2 were marked with a triangle, while negative correlations between -0.2 and -0.4 were given a -, those between -0.4 and -0.6 were given a -- and those of less than -0.6 were given a --- (Table 1).

The items with a + ranking or above were judged to be sensory words with a strong correlation to their respective clusters, and were built into the sound impression model for the purposes of artistic evaluations (Figure 3).

**Table.1** Relationships between each cluster and sensory word

	Clusters					
	1	2	3	4	5	6
Natural	+	--	△	△	++	△
Happy	-	+	++	-	++	--
Lonely	△	-	△	-	-	+++
Dynamic	+	△	△	+	△	--
Solemn	△	△	△	△	-	△
Flowing	△	--	△	△	△	△
Sharp	△	+	△	+	--	-
Exquisite	-	△	+	△	△	△
Vivid	△	△	+	△	△	△
Beautiful	-	△	+	△	△	△
Clear	△	+	△	+	-	-
Powerful	-	+	△	+	--	△
Majestic	△	△	△	++	--	△
Exhilarating	+	--	-	△	++	△



**Fig.3** The sound impression model

## V. Analysis Of Movements Expressing Each Subjective Impression

### 5.1 Identifying the importance of each movement element

The authors identified which movement elements were most critical to the movements from The Flower Festival in Genzano performance used in this study. Based on the results of their interviews and keeping continuity of movement in mind, the authors were able to break The Flower Festival in Genzano into seven movement segments, which they labeled A through G. Part A was preparation; Part B was repeated port de bras, brisé, and coupe; Part C was repeated endehors and pas de bourree; Part D was repeated arabesque, à la seconde, and pique arabesque; Part E was pas de bourree and jete; Part F was a rond de jambe; and Part G was the croisé pose. The authors used these subdivisions to identify which movement segments had the greatest effect on overall scores, and then used those weights to determine which movements would be the subject of the remainder of the analysis as well as their relative priority.

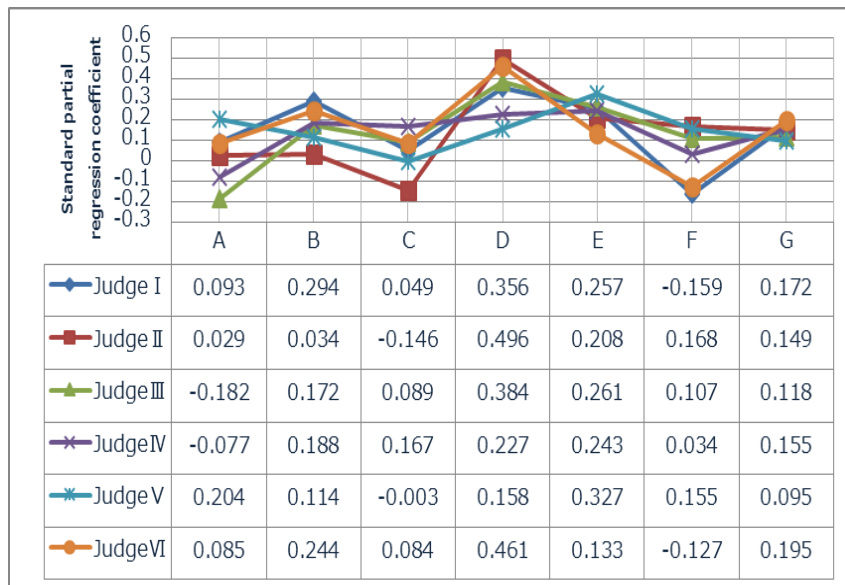
A total of six judges were asked to evaluate the movements of nine dancers on a 100-point scale as well as assign an overall score (Table 2). The weight of each movement in the overall results was subjected to a multiple regression analysis to determine the standard partial regression coefficients. The analysis revealed a standard partial regression coefficient for pattern D that was larger than those of the other segments (see figure 4), leading the authors to determine that it should be the area given top priority in the remainder of the study.

**Table.2** The score every segment and overall score

Judge 1	A	B	C	D	E	F	G	Total
①	65	63	75	73	71	69	65	70
②	50	46	46	45	42	46	45	45
③	54	60	50	56	55	55	50	55
④	65	75	65	69	68	72	65	70
⑤	45	50	40	53	45	45	44	45
⑥	55	50	55	57	55	50	54	55
⑦	55	51	50	52	52	50	52	50
⑧	55	53	50	62	55	56	54	55
⑨	51	55	50	62	51	55	50	50

Judge 9	A	B	C	D	E	F	G	Total
①	65	65	70	71	62	69	75	70
②	50	45	40	40	40	45	45	45
③	60	55	50	60	55	54	50	55
④	65	60	70	60	70	68	70	65
⑤	40	45	45	40	40	43	45	40
⑥	50	48	60	55	48	50	55	50
⑦	58	54	52	56	55	52	50	55
⑧	60	52	50	60	54	51	50	55
⑨	60	55	50	60	55	52	50	55



**Fig.4** The weight of segments in the overall scores

**5.2 Determining movement factors based on visual focus time**

Line-of-sight cameras were used for pattern D in order to measure how long viewers focused on each part of the body, which allowed the authors to identify the movement factors that contributed most to judges’ scores. Three professional judges participated in the study, and the degree to which they rested their eyes on various parts of the body was calculated.

Markers were placed at 38 locations on the body to collect movement information along three axes [9]. Lateral body movement was represented on the x-axis, forward and back body movement on the y-axis, and up and down body movement on the z-axis. This positional data was then used to calculate values for each movement factor and compare the result.

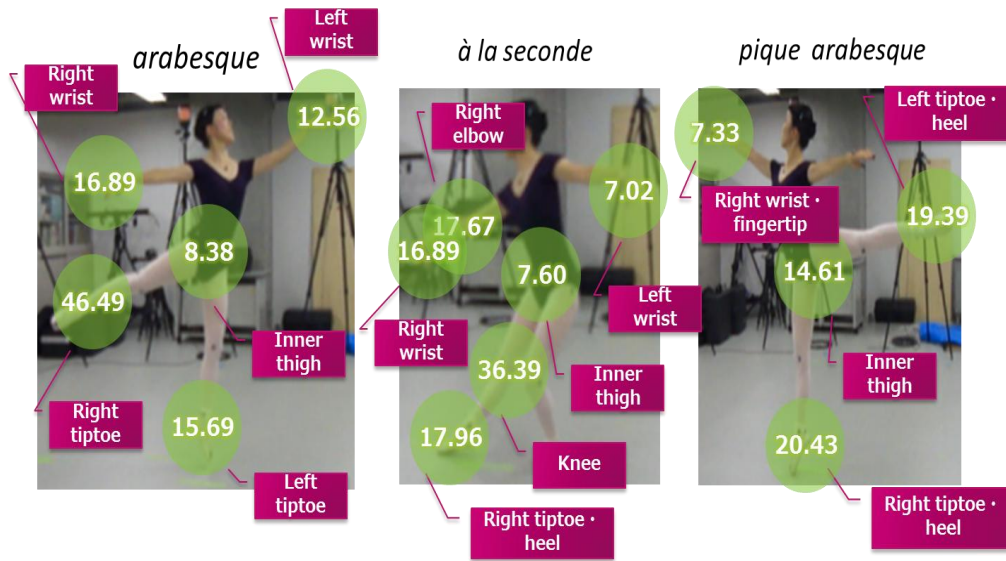


Fig.5 Visual focus time in pattern D

5.3 Subjective impressions for each movement element

This step will be explained using the *à la seconde* movement as an example. For the purposes of artistic evaluation, the sound impression model tells us that the *à la seconde* should evoke the same subjective impressions as those identified during the subjective sound impression model; namely, happy, majestic, sharp, clear, and powerful. Judges were asked to subjectively evaluate the nine dancers based on information collected from just the *à la seconde*, and then partial correlation coefficients were used to compare the relationship between the sensory words and the dancers. For each sensory word, the dancer with the strongest correlation, second-strongest correlation, weakest correlation, and second-weakest correlation for the movement factor was identified (Table 3).

Table.3 The relationship between the sensory words and dancers.

	Happy	Sharp	Clear	Powerful	Majestic
Dancer.1	0.436	0.121	0.362	0.353	-0.033
Dancer.2	-0.211	-0.361	-0.433	-0.136	-0.231
Dancer.3	0.124	0.226	-0.295	0.173	0.135
Dancer.4	0.265	0.317	0.113	0.513	-0.102
Dancer.5	0.356	-0.391	0.319	0.136	0.342
Dancer.6	0.124	0.427	-0.068	0.344	-0.311
Dancer.7	0.543	-0.281	0.401	0.264	0.283
Dancer.8	-0.256	0.169	-0.082	0.241	-0.224
Dancer.9	0.236	0.292	0.217	0.165	-0.249

Dancer 7 and Dancer 1 expressed “happy” most strongly, while Dancer 8 and Dancer 1 were the weakest in that expression. Within the movement factor, the data revealed a characteristic difference in the way the angle of the right knee changed between the high and low scorers.

It was noted that Dancer 7 and Dancer 1 showed a rapid decrease in knee angle and increase in speed during the middle of the pattern (frames 50–111) (Figure 6). Clearly bending the right knee to almost 80° seemed to be the key to creating a “happy” impression.

Dancer 5 and Dancer 7 expressed “magnificent” most powerfully, while Dancer 6 and Dancer 8 were the weakest in that expression. Within the movement factor, the data revealed a characteristic difference in the speed gap between the right wrist and right fingertips.

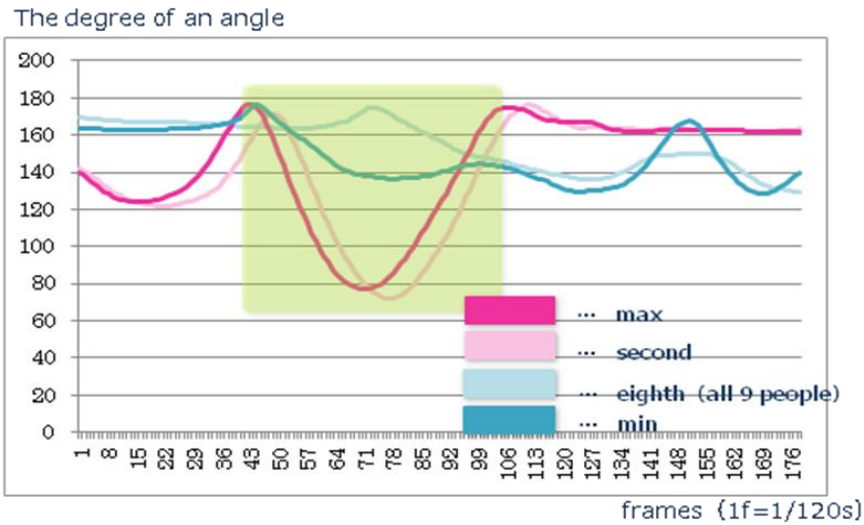


Fig.6 The change in the angle of right knee

It was noted that the right wrist of Dancer 5 and Dancer 7 moved faster than the right toes during the beginning of the pattern (frames 0–56), with the speed of the toes overtaking that of the wrist during the middle portion (frames 57–122) as the feet led the movement of the hands. During the end of the pattern (frames 123–179), the speed of the right wrist once again increased beyond that of the right toes, this time in the form of the hands leading the feet (Figure 7). This relationship between the speed of the right wrist and right toes—acceleration of the hand during the beginning, acceleration of the foot during the middle, and acceleration of the hand once again at the end—seemed to be the key to creating a “magnificent” impression.

Similarly, as soon as the authors understood the movement factor conditions that correlated most strongly to each sensory word during the arabesque, à la seconde, and pique arabesque, they were able to create a table showing the elements that most contributed to scores during evaluations of The Flower Festival in Genzano (Table 4).

**Hand is fast**

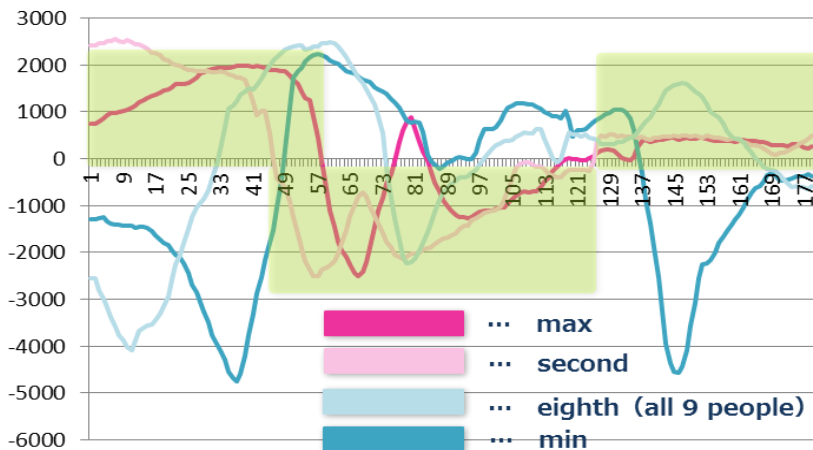


Fig.7 The speed gap between the wrist and fingertips

**Table 4.** The artistic evaluation scores

Movement elements	Giving impressions	Parts	How do dancers express the impressions by the movement of the parts
<i>arabesque</i>	Natural	Right wrist	To move the right wrist up and down slowly
	Dynamic	Inner thigh	To put up a foot at angles more than 70 degrees behind
	Lonely	Left wrist	You let left hand stop moving when you raising it
<i>à la seconde</i>	Happy	Right knee	To bend the right knee 80 degrees and gathering momentum and stretch it out
	Sharp	Right toe	To let out a foot quickly and take the stop moving time longer
	Clear	Right heel	You keep a foot to let out more than 140 degrees
	Powerful	Right wrist	Moving right hand adds variation in the rhythms of movements
	Majestic	Right wrist /toe	The image that the right hand runs after the right foot when you let out hands and feet aside
<i>pique arabesque</i>	Happy	Right middle finger	To raise a hand quickly, keep it uniformity time, and you reverse a handle quickly
	Sharp	Right heel	You stretch a foot more than 140 degrees and keep it
	Clear	Inner thigh	To raise a foot quickly, and take the splits more than 90 degrees for a long time
	Powerful		

In terms of judging, the results of the study show what should be prioritized at one time in the course of evaluations and allows for the introduction of a system that assigns scoring items for each of those points. In terms of teaching, the study reveals specific methods for evoking certain subjective impressions, which can be taught faithfully to dancers so that they can create more artistically expressive movements.

### VI. Verification

The validity of the artistic evaluation table was verified using The Flower Festival in Genzano as an example piece. Two methods were used, in which the model was applied again to the same dancers to measure any changes before and after its application. In the first method, ratings were quantified along a seven-point scale in terms of the consistency with sensory words and subjective impressions, and changes before and after the introduction of the model were measured (1). In the second method, professional judges and dancers were interviewed about the evaluations produced by the model in order to shed light on the results (2).

During the experiments, participating dancers were given a week to practice so that they could incorporate the model into their performance. When the three judges were asked to evaluate them, the average scores for each sensory word went up (Figure 8). The model was thus shown to have a high degree of validity.

Then, when professional judges, dancers, and instructors were interviewed, the following feedback was received: “I felt like knowing exactly what is being focused on during previously inexplicit artistic performance assessments made evaluation easier from a judging standpoint. The details were appropriate, and seemed close to what we’re looking for. In terms of instructors, I think it would be extremely effective if we could tap further into our dancers’ potential and improve their skills by giving them a single textbook that outlined these concepts.”

The above results confirmed that the authors were able to develop and offer a model that effectively captured what classical ballet judges, instructors, and dancers need and want from each other.



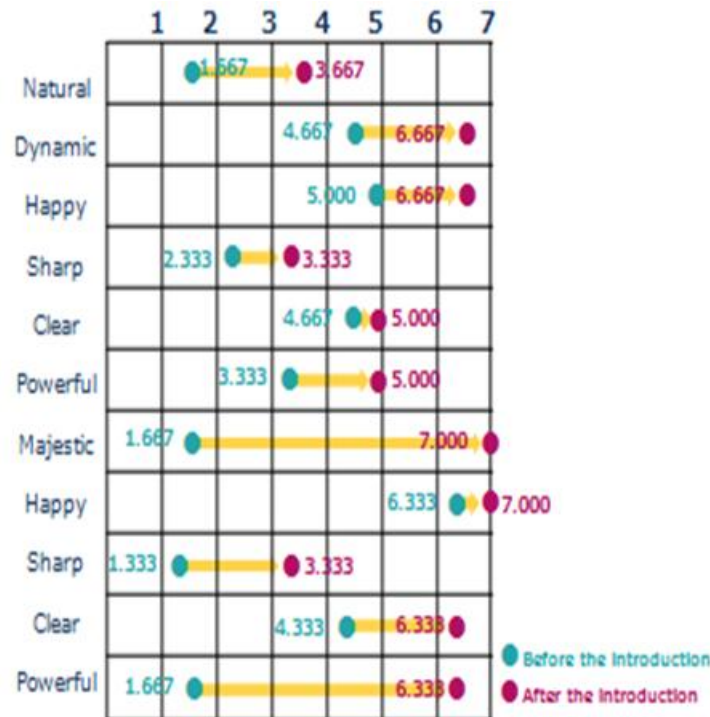


Fig.8 Before and after the introduction of the model

### VII. Conclusion

There are no defined scoring criteria for classical ballet competitions, and dancers are never given feedback on what was good or bad about their performances. This is an unfortunate irony given that the purpose of the competitions is to educate participants so that they can improve their technique. This study saw some value in creating objective criteria to indicate exactly what was “good” and “bad” about a classical ballet performance and sought to develop these criteria.

In step 1, the authors used a principal component analysis and cluster analysis to identify the subjective impressions given by the music that accompanied the movements; this data was then used to construct a sound structure model that could be used in artistic evaluations. This process made it possible to reduce the effort dancers previously needed to put into understanding the subjective impressions created by sound/music by specifying exactly what impressions they should recreate and generalizing them for future use.

In step 2, the analytical targets were narrowed down and movements were broken into individual elements. Multiple regression analysis was used to find which of those movement elements had the greatest impact on overall scores. For each movement element, the authors looked at the relationships between the subjective impressions given by the sounds and physical angle, speed, and other body movements calculated using positional information from motion capture equipment. This information was then used to construct their artistic evaluation model.

In step 3, the model was actually applied to dancers. Their performances were recorded and confirmed to see whether they danced in the way suggested by the model, and the effectiveness of the model was verified by confirming numerically that their ability to evoke subjective impressions had increased. Interviews with professional judges and dancers were then conducted, the results confirming that the study had value from both an evaluation and teaching standpoint.

It is hoped that the outcomes of this study can be used to simplify the feedback that dancers get after a competition, helping them to improve their technique in future performances. It is also thought that clarifying coaching and teaching methods will improve dancer technique as well. In this way, the study achieved its original objectives and confirmed the value of its artistic evaluation model.

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