

# Appraising the Aesthetics of Human Movement: An Application to Contemporary Dance Using a Motion Capture System

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## ABSTRACT

The present study describes a way of appraising the aesthetic meaning of dance motor skills generated by professional modern dancers. Using a motion capture system (Vicon MX), both real images and 3D stick figures were simultaneously obtained from 96 trials of dance motor skills performed by four experienced contemporary dancers. Subsequently, 101 students of Physical Activity and Sport Sciences used semantic differentials to appraise the aesthetic value of each type of motor dance skill, comparing the virtual and real images of dancers.

## Author Keywords

Aesthetic movement, aesthetic perception, motion capture, contemporary dance.

## INTRODUCTION

Every choreographic production is susceptible not only to being observed from the theatre stalls as something ephemeral, in the successive appearance and disappearance of bodies, but can also be observed in a scientific and objective way as a genuine block of text that offers an exhaustive and lasting description of the text written by bodies in movement.

Davies [3] draws upon Laban's legacy of movement analysis or Labanotation, stating that space is related to the extent of the 'bubble' in which we move, referred to by Laban as the kinesphere. Dance is dynamic in both space

and time, and is always subject to aesthetic appraisals based on stimuli, as well as to subjective perception (see Depatri, 2009; Figure 1). The present study focuses on motion capture so as to compare it with real images, the aim being to determine whether the dancer's real body and image influences the aesthetic appraisal of dance.

The system (Vicon MX) we used makes use of retro-reflective markers placed on defined points of the dancer's anatomy (PlugInGait marker set), thus enabling his/her dance motor skills to be reconstructed in three dimensions and to be observed from any perspective (Figures 1 and 2).

By generating a faithful virtual reproduction of motion, this approach enables us to identify which kinesic dance styles are most highly appraised. Specifically, we compared stick and real images from a total of 96 trials related to the essential dance motor skills of displacements, turns, jumps

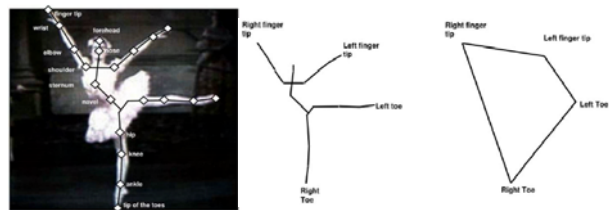


Figure 1. Lines of dance movements (Depatri et al., 2009).

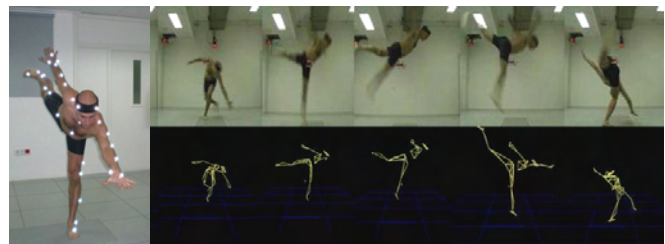


Figure 2. Retro-reflective markers on a dancer's anatomy, and real and 3D stick images from motion capture.

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Figure 3. The eight essential dance motor skills analysed.

and balance (Figure 3), which were chosen according to the criteria of Gallahue & Cleland-Donnelly [8] and Castañer et al. [1].

**Aims**

In order to focus on the aesthetic appreciation of human dance we observed and judged eight essential motor dance skills involving displacements, turns, jumps and balance. Although a dancer’s image, as well as his/her expression, can modify the perception of motion, the influence of these features is unknown. However, these features disappear when observing only the animation of a stick figure obtained via 3D motion capture.

The aim of the study was therefore to establish the influence of non-kinematic parameters on aesthetic judgement in dance, this being achieved by comparing virtual and real images of dancing bodies in order to determine whether the dancer’s real body and image influences the aesthetic appraisal of dance.

**METHODS**

Four experienced contemporary dancers performed three repetitions of eight dance motor skills in a space measuring (3 x 4 x 2.5) m. Retro-reflective markers were attached to defined locations of each dancer’s anatomy, as established by the PlugInGait marker set (VICON). This enables us to obtain stick-figure animations of each danced skill.

The dancers performed eight motor skills associated with contemporary dance. Each skill was repeated in three different kinds of movement, according to Laban’s criterion of muscular tension (strong, mild and moderate). A total of 96 trials were simultaneously filmed with a traditional video camera and ten 3D cameras.

A total of 101 students of Physical Activity and Sport Sciences observed all 96 animations using the Polygon Viewer software (Figure 4), this being done over two sessions spaced one week apart. The students used semantic differentials [7] (Figure 5) to appraise levels of aesthetic beauty in the observed movement. One semantic

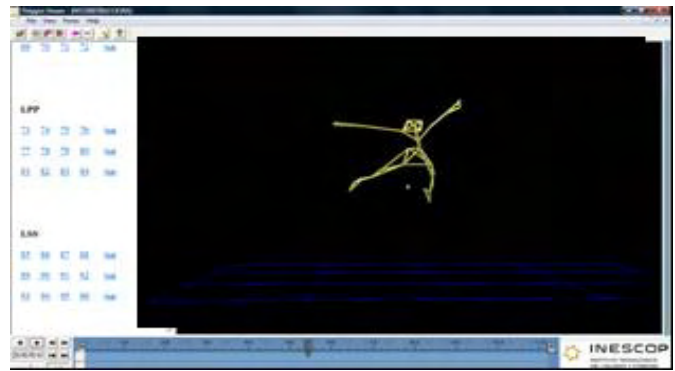


Figure 4. Screen capture of Polygon Viewer software.

differential was completed by observing the virtual images of dancers obtained via the motion capture system. A week later a second semantic differential was completed by visualising the real filmed images of each dancer.

Beauty	1	2	3	4	5	6	7	Ugliness
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Figure 5. Polarity of aesthetic appraisal used as a semantic differential.

**Instrument**

The following instruments were used:

- Vicon Mx motion capture system with ten cameras operating at 125 Hz.
- Vicon Nexus 1.4 (VICON) capture software. Analysis software: Ad hoc routines developed within MATLAB (The Mathworks Inc).
- Traditional filming using a video camera.
- Semantic differentials [7] applied *ad hoc* to the aesthetics of human movement [2], in which opposing aspects related to the beauty of aesthetic appreciation were appraised.

**DATA ANALYSIS**

Correlations between the ratings of stick figure and video representations showed an r of about 0.5 (Table 1), the exceptions being the two turns and jump 2 (a jump performed while turning). By way of an example, Figure 6 shows the histogram of ratings corresponding to stick figures and videos, considering all skills together.

	R	p	Mean score 3D	Mean score real
All skills	0,4783	0,0001	3,7	3,6
Displacement 1	0,4855	0,0001	2,8	2,9
Displacement 2	0,4588	0,0001	4,0	3,7
Balance 1	0,5362	0,0001	3,8	4,1
Balance 2	0,5135	0,3690	3,2	3,3
Turn 1	0,3321	0,0001	4,2	3,8
Turn 2	0,2399	0,0001	3,9	3,4
Jump 1	0,5309	0,0001	4,5	4,0
Jump 2	0,3597	0,0070	3,6	3,5

Table 1. Correlations between the ratings for stick figure and video representations.

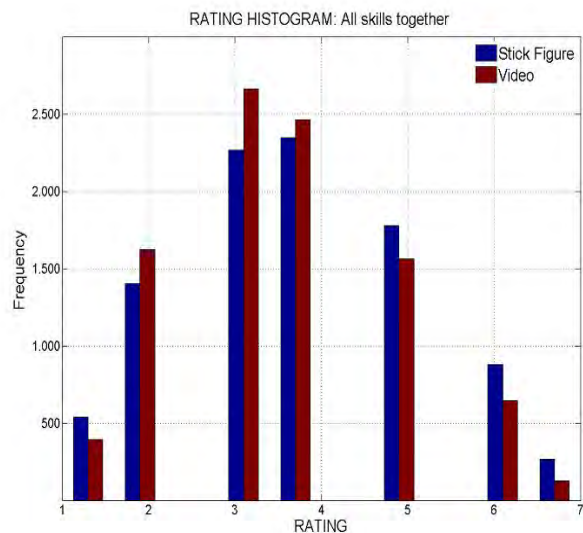


Figure 6. Ratings corresponding to the stick figures and for the videos.

## CONCLUSION

Analysing the two semantic differentials (one of the elided images and another of the real filmed images) allows us to determine the prior experience of observers when it comes to appraising the aesthetic value of the danced motor skill series.

The data analyses show that although ratings are correlated due to kinematic parameters, the influence of non-kinematic parameters is also present. The larger differences corresponding to turns may be due to the dynamics and expressivity of these skills. It is likely that in this case, expressivity has had a greater influence on subjective judgment.

Stick figures are awarded higher scores, probably because some subtle movements (position of the hands, tension in

the arms, etc.) are hidden when using 3D images. Indeed, the fact that these subtle movements are not reflected in the stick images, as opposed to what occurs when observing the movement of real bodies, illustrates that although aesthetic experience probably depends on the subjective perception of the observer, it is also induced by particular stimuli or their properties.

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