Personalized Dance Synthesis Based on Physical and Cognitive Intensities

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ABSTRACT

This supplemental file provides additional details for the paper *"Personalized Dance Synthesis Based on Physical and Cognitive Intensities."* The content is organized as follows:

- Kinetic Energy Computation Details
- Experiment Details
- User Study Details

1 KINETIC ENERGY COMPUTATION DETAILS

Table 1 lists the simplified mass distribution and radius of gyration coefficients used for computing translational and rotational kinetic energy. Each SMPL joint is associated with an approximate body mass proportion and segment description. The weight represents the estimated mass of the segment between a joint and its parent.

Table 1: Simplified mass distribution and radius of gyration coefficients for SMPL joints. Weight ratios are proportions of total body mass M; k is the radius of gyration coefficient normalized by segment length L.

Joint	Weight	k	Description
Hands (L/R)	$0.012M$	0.297	Wrist to fingertips
Wrists (L/R)	$0.012M$	0.303	Elbow to wrist joint
Elbows (L/R)	$0.032M$	0.322	Elbow to wrist
Shoulders (L/R)	$0.020M$	0.285	Thorax-arm junction
Collars (L/R)	$0.010M$	0.200	Neck–shoulder link
Neck	$0.020M$	0.310	Base of skull to trunk
Head	$0.061M$	0.320	Skull and face
Spine1	$0.017M$	0.350	Lower spine
Spine2	$0.017M$	0.380	Mid spine
Spine3	$0.016M$	0.400	Upper spine
Pelvis	$0.139M$	0.300	Hip structure
Hip (L/R)	$0.030M$	0.323	Pelvis–thigh joint
Knees (L/R)	$0.200M$	0.323	Thigh segment
Ankles (L/R)	$0.093M$	0.302	Shank segment
Feet (L/R)	$0.029M$	0.475	Foot segment

2 EXPERIMENT DETAILS

Constraining Joint Intensities. For physical intensity, we used the Intense mode with $\rho^L = 147.2$ and $\rho^R = 106.5$. For cognitive intensity, we used the Easy mode with $\rho^V = 67.4$. Transition terms were enabled, and the target duration was set to 32 seconds.

Varying Physical and Cognitive Intensity. We set the overall duration target to $\rho^D = 128$ seconds and enabled the transition term. For the *Varying Physical Intensity* experiment, we alternated between Intense and Light modes in 32-second intervals by setting the translational energy target to $\rho_s^{\mathrm{L}} \in \{56.5,\ 147.2\}$ and the rotational energy target to $\rho_s^{\mathrm{R}} \in \{31.8,\ 106.5\}$. For the *Varying Cognitive Intensity* experiment, we alternated between Easy and Hard modes every 32 seconds by setting the variety target to $\rho^V \in \{67.4,\ 143.1\}$.

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3 USER STUDY DETAILS

We employed three questionnaires: (1) A screening survey to recruit participants with varying dance experience. (2) A dance feedback survey (Figure 1), completed after each dance sequence to assess whether the generated dance sequences met expectations. (3) A system feedback survey, which collected participants' overall impressions of the generation system and training game, including the Physical Activity Enjoyment Scale (PACES).

Table 2: Enjoyment ratings based on the Physical Activity Enjoyment Scale (PACES). Scores range from 1 (strongly disagree) to 7 (strongly agree).

Item	Mean	SD	Item	Mean	SD
Enjoy	6.1	1.3	Energizing	5.9	1.2
Gratifying	5.5	1.5	Interested	6.3	1.5
Happy	6.1	1.3	Exhilarating	6.0	1.2
Like	5.8	1.2	Pleasant	5.2	1.7
Stimulating	5.9	1.2	Pleasurable	5.5	1.7
Feel Good	5.7	1.6	Strong Accomplishment	5.8	1.3
Absorbed	5.9	1.6	Invigorating	6.0	1.2
Refreshing	5.5	1.6	Fun	6.1	1.5
Not Frustrated	5.2	1.4	Nothing else preferred	5.0	1.7

REFERENCES

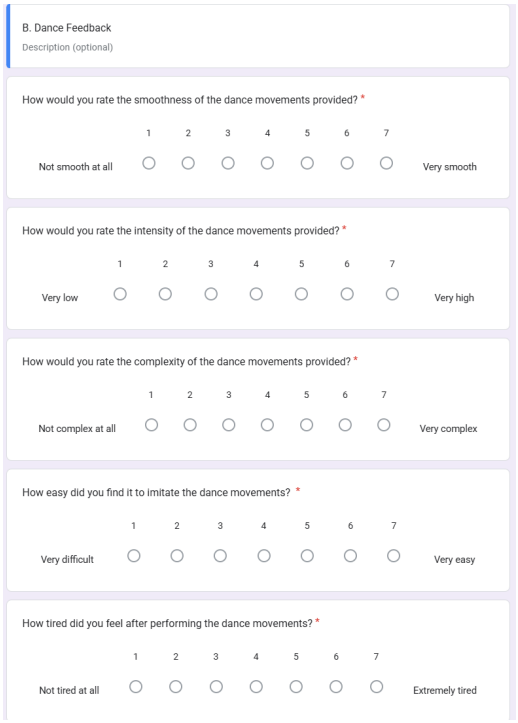

Figure 1: The screenshot of dance feedback.