Making long motion sequences is a time-consuming task even with motion capture equipment or animation editing systems. We propose a smart motion synthesis system for making a long motion by combining existing motions. A user is asked to put input motions on the timeline. The system then automatically generates a continuous and natural motion (Figure 1).

Recent animation systems such as MotionBuilder, Maya, Softimage, 3ds Max also provide a similar interface for the same purpose with ours. However, they simply blend the overlapped segments of input motions. In order to get a continuous and natural motion, animators need to adjust appropriate blending ranges, additional constraints, motion speeds and so on. Menardais et al. [MKMA04] proposed a similar approach with ours but they use only one synthesis method (motion transition).

Our system employs the following four motion synthesis methods. Based on the constraints and timing of input motions, the appropriate method is determined and applied the pairs of nearby input motions. Alternatively, the user can make the system execute an input motion as soon as possible so that it follows the previous one smoothly. The four motion synthesis methods are:

- **Motion transition** is to make a smooth transition from one motion to another by blending motion segments of two input motions. This method is applied to motion segments that share same single support constraints (e.g. left leg support or right leg support) and overlap with each other. In Figure 1, motion transition is used between running kick and walk.

- **Motion connection** is to connect from one motion to another by transforming a motion segment of the previous motion so that it connects the following motion. This method is applied when the previous motion include a moving-leg segment. In Figure 1, motion connection is used between kick and jump.

- **Motion adaptation** is to adapt one motion so that it follows the previous motion. This method is needed when the previous motion do not have a moving-leg segment. The leg motion of the following motion is transformed using an inverse kinematics and is smoothly blended in the original motion when the figure moves the support leg next time. Motion connection is used with motion adaptation for generating the upper body motion. In Figure 1, motion adaptation is used between jump and running kick (the initial posture of the running kick is adapted to the jump).

- **Motion composition** is to compose two motions by combining the movement of some body parts of one motion and the movement of other body parts of another. This method is applied when one motion is entirely overlapped by another. Unlike existing methods [HKG06], we extract the effects from the movement of the arms to the movement of the spine and the pelvis and blend them into the other motion. In Figure 1, motion composition is used between walk and waving. The lateral swing of spine from the waving motion is blended in the composed motion.

Since the entire process is automatic, even novices can use our system easily. A prototype system demonstrates the effectiveness of our approach.

References
