

Pen-to-mime: A Pen-Based Interface for Interactive Control of a Human Figure

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Abstract

We introduce a pen-based intuitive interface to control a virtual human figure interactively. Recent commercial pen devices can detect not only the pen positions but also the pressure and tilt of the pen. We utilize such information to make a human figure perform various types of motions in response to the pen movements manipulated by the user. A figure walks, runs, turns and steps along the trajectory and speed of the pen. The figure also bends, stretches and tilts in response to the tilt of the pen. Moreover, it ducks and jumps in response to the pen pressure. Using this pen-based interface, the user controls a virtual human figure intuitively as if he or she were holding a virtual puppet and playing with it.

1 Introduction

There are many demands for an interactive motion control of a virtual character on desktop environments. However, this has been a difficult challenge. Since human figures have a large number of degrees of freedom (DOF) and their movements are complicated, it is not easy to control them through a common device that has only a small number of DOF such as a mouse or gamepad. Although it is possible to control complex motions by combining multiple gamepads and/or mouse, the user needs a practice to learn such an interface design since the mapping from the multiple input devices to the movements of a controlled figure may not be intuitive.

2 User interface

We introduce a pen-based intuitive interface to control a virtual human figure interactively. The key idea is that we use a pen as a metaphor of a figure and map pen moments to the figure motion (Figure 1). Recent commercial pen devices can detect not only the pen positions but also the pressure and tilt of the pen. We utilize such information to make a human figure perform various types of motions in response to the pen movements manipulated by the user. A figure walks, runs, turns and steps along the trajectory and speed of the pen. The figure also bends, stretches and tilts

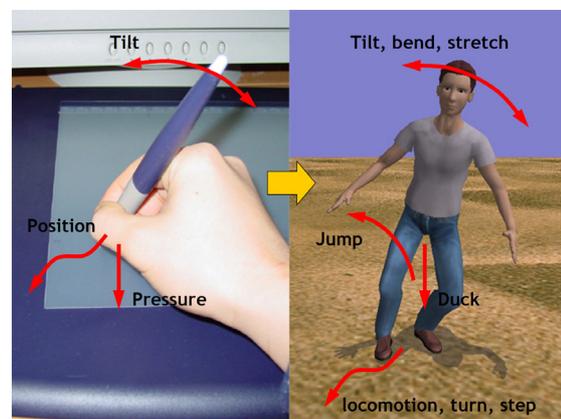


Figure 1: The pen-based interface. The figure movement is associated with the pen manipulated by the user. The positions, pressure, and tilt of the pen are used to make the figure perform various motions.

in response to the tilt of the pen. Moreover, it ducks and jumps in response to the pen pressure. Using this pen-based interface, the user controls a virtual human figure intuitively as if he or she were holding a virtual puppet and playing with it (Figure 2).

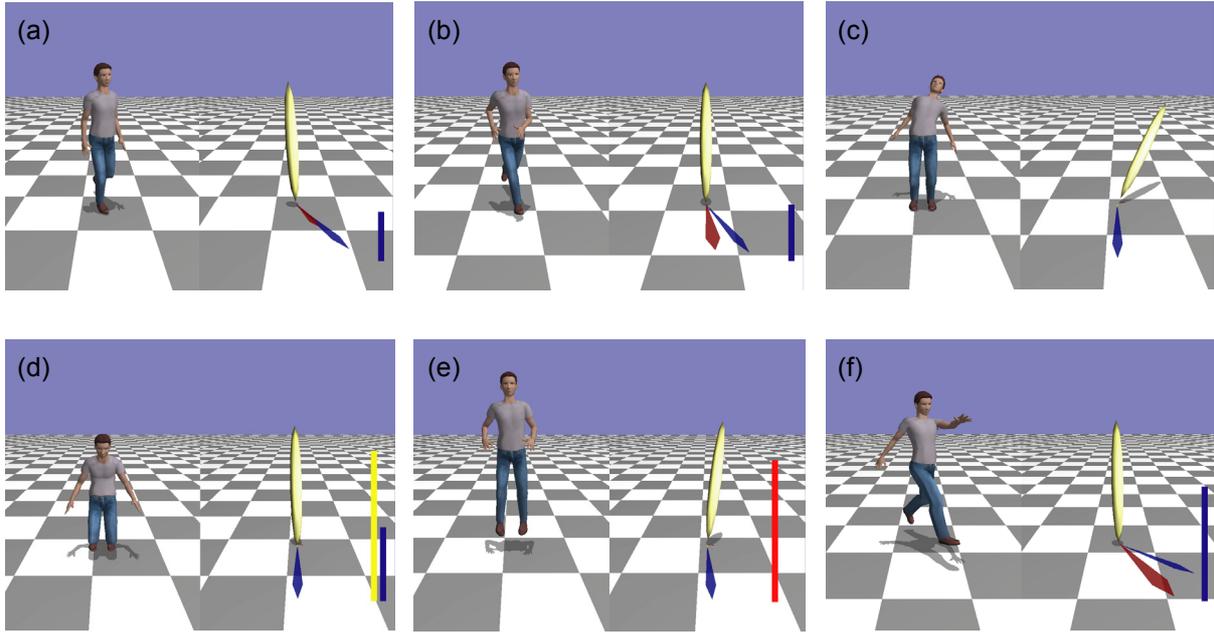


Figure 2: The pen-based motion control interface. On each image the left view shows the controlled figure and the right view visualizes the movements of the pen manipulated by the user. The yellow stick shows pan tilt. The red arrow under the pen shows the orientation and velocity of the pen movements. The blue arrow shows the figure's orientation. (a) The figure walks and (b) runs in response to the pen movements. The figure turns and steps if the pen is moved in a different direction with the figure orientation. (c) The figure also tilts, bends, and stretches in response to the pen tilt. (d) If the pen is pressed onto the tablet for a while, the figure ducks in response to the pen pressure. (e) In addition, if the pen is pressed and released quickly, the figure jumps. (f) The jump height and distance are determined based on the pen pressure and the locomotion velocity when the pen is released. The user can make the figure perform various motions through an intuitive interface.

3 Motion generation

In order to generate varying motions based on multidimensional parameters that are given from a pen device (speed, angle, bend, tilt and duck), we take a motion blending approach [PSS02] and construct motion blending modules with a set of small number of motion capture data for each type of motions: standing movements, locomotion, turns, steps, and jumps.

Motion parameters are computed based on the pen movements on each animation step. The speed and angle are computed from the velocity vector of the pen movements. Tilt, bend and stretch angles are simply computed from the pen tilt. Duck and jump heights are computed using a low-pass and high-pass filter with the pen pressure.

On each step, one of motion modules is in charge of figure control. We also introduce a motion transition scheme and foot constraints for generating continuous motions.

4 Experiments and discussion

We use a commercial pen and tablet device, intuos2 from WACOM [Wac], and have implemented the proposed interface with the WACOM Tablet Library.

On our preliminary experiments, although the users found that our interface design was very interesting and enjoyed it, at the first time, they had some difficulties in control of multidimensional input with a pen. For example, a user who tried to make the figure walk did not only move the pen but also tilt or press it on the tablet unconsciously. After five to ten minutes training, the users learned how to control the multidimensional input independently.

We currently use relative movements of a pen for locomotion. We take this approach since it is important in our interface design that the figure movements is directly associated to the pen movements. This interface works well when the user wants to the figure move in the specified direction. However, it does not ensure a precise control of locomotion trajectory. To realize both responsive and precise control, we need to introduce some control scheme based on both absolute and relative positional information.

References

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- [Wac] WACOM Tech. Co. <http://www.wacom.com>