RoboJockey: Robotic Dance Entertainment for All

Shigeo Yoshida, Daisuke Sakamoto, Yuta Sugiura, Masahiko Inami, and Takeo Igarashi
JST ERATO IGARASHI Design Interface Project, The University of Tokyo, and Keio University

Figure 1: *Left: User interface on a multi-touch display. Center: Robots. Right: Example of visual program.*

1. Introductions

RoboJockey is an interface for creating robot behavior and giving people a new entertainment experience with robots, in particular, making robots dance, such as the "Disc jockey" and "Video jockey" (Figure 1, left). The users can create continuous robot dance behaviors on the interface by using a simple visual language (Figure 1, right). The system generates music with beat and choreographs the robots in a dance using user-created behaviors. The RoboJockey has a multi-touch tabletop interface, which gives users a multi-user collaboration; every object is designed as a circle, and it can be operated from all positions around the tabletop interface. RoboJockey supports a humanoid robot, which has a capable of expressing human like dance behaviors (Figure 1, center).

This work had partially presented previously [Shirokura et al. 2010]. In this paper, we present an extended version of the visual language for choreographing humanoid robots, improvements of dance behaviors, and interaction that had utilized a multi-touch interface.

2. RoboJockey

This work is inspired by the "Turning the tables" [Taylor et al. 2009], which proposed an intuitive "visual jockey" interface on a tabletop interface. RoboJockey provides intuitive robot control similar to their work; however, a robot is an object that moves around the real world. Controlling and creating robot behaviors is difficult. For example, using a gamepad does not allow more than one robot to be simultaneously controlled nor continuous control of a single robot. Non-gamepad interface to manipulate the humanoid robot had presented [Sugiura et al. 2009]. This interface was intuitive enough for the non-expert user of robots to manipulate the humanoid robots; however, robot behavior creation, and simultaneous, continuous robot control was not considered as well. There are some visual languages and programming interfaces that use GUIs; however, they do not work in real time. Furthermore, non-robotics experts find it really difficult to create robot behavior. The RoboJockey interface provides both experts and non-experts the chance to enjoy themselves by creating robot behaviors.

2.1. Tabletop interface with a visual language

Users create robot behaviors by using a simple visual language on the tabletop interface. The visual language interface has two types of objects; one shows a robot object, and the other shows a behavior object. The user can create their robot's behavior by connecting the behavior object to the robot one.

Basic idea:
A robot object has one seek ball circulating around the robot object. When the seek ball meets a line connected to a behavior object, the robot performs the behavior. The performance continues until the seek ball meets another line. This mechanism enables the robots to perform various behaviors continuously and simultaneously.

Primitive Objects:
Robot Object
A robot object represents a physical robot. An association between the robot object and the physical robot is shown by the color of the robot object (Figure 2). The user can understand what robot is currently being controlled.
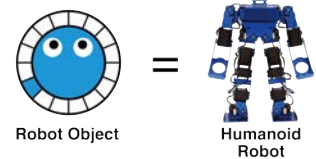

Figure 2: *Robot Object*

Action Object
Action objects represent actual actions of the robot (Figure 3). NULL object shows a fundamental condition of robots, which represents a standing pose of the humanoid robot. Sidestepping object represents a repetition of a sidestepping from side to side. And other action objects represent some arm behaviors of the humanoid robot.
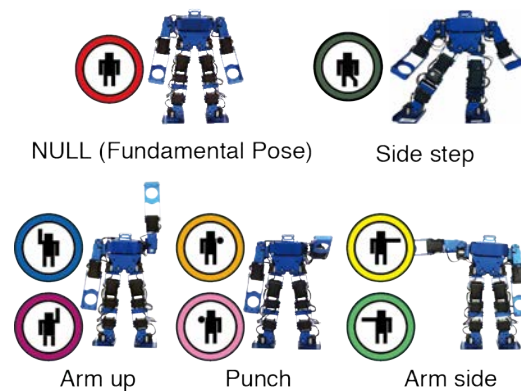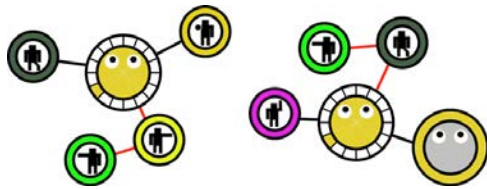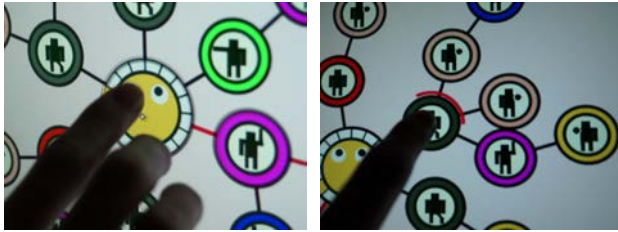

Figure 3: *Set of action objects for humanoid robot.*

Figure 4: *Example of visual programs. In left program, robot repeats 1) both arms side and down, 2) sidestepping, and 3) punching briefly. In right program, two robots synchronously repeat 1) right hand up with sidestepping and 2) left hand up briefly.*

Figure 5: *Left: Rotating a robot object with two fingers. Right: Deleting child objects by holding down an object.*

Combination:

Multiple behavior objects can be connected to a robot object. For example, the combination of left-arm-side and right-arm-side results in both arms side and down motion (Figure 4, left). The combination of side step and right-arm-side creates a side stepping with raising right arm motion. The user can also connect a robot to another robot to make them move in a synchronized way (Figure 4, right).

2.2. Interaction Design

RoboJockey system aims to provide the user a feeling of "Robot Jockey," which is similar to Disc Jockey and Visual Jockey so that the style of interaction is an important feature. This version of RoboJockey system employs a multi-touch display for allowing the user to not just operate the system intuitively and easily, but to make an attractive performance as a "Robot Jockey."

Rotating objects like a DJing:

The user is able to rotate objects, which are connected to a robot object, by rotating a robot object with two fingers. Rotating objects is useful for making a big visual program and pleasing for doing a Robot Jockey performance visually. (Figure 5, left)

Tapping objects for adjustment of a connection:

By double tapping an object, distances between its child objects are adjusted. Making a big visual program is sometimes going to overlap objects and overcrowded in a small space. This function arranges the connection at an appropriate distance and shows all objects, which are connected to an object that the use tapped.

Long tapping for deleting child objects:

By holding down an object for few seconds, we can erase child objects that are connected to it. (Figure 5, right)

2.3. Hardware

The input device used was a commercially-available multi-touch display (EIZO, FlexScan T2351W). The robot used was a small humanoid, which has a human-like body and can perform human-like behaviors (SMD, Tinywave). The humanoid robot has 16 DOFs, which is enough to express rich human-like behaviors. However, RoboJockey is not limited to the humanoids, and has capable of supporting another type of robot, such as the iRobot

Figure 6: *Exhibit at national science museum in Japan.*

Roomba, Lego mindstorms NXT, and so forth.

3. Demonstration

We demonstrated RobJockey system at a national science museum in Japan for three months, and thousands of people experienced it (Figure 7). Most of all audiences were non-robotics experts. Overall, from children to adults, they could use and play the RoboJockey interface without any instructions. They seem to enjoy both to see the dance by robots and to play with the RoboJockey system.

4. Conclusion

We presented the RobJockey, an interface for creating entertaining robot dance performances. The interface uses a visual language that is simple but powerful enough for creating complex robot dance performances interactively. The circulate timeline enable the robot performance continuously. The result of demonstration showed that experts and non-experts in robotics enjoyed using the interface and robots. We believe that they have an experience similar to being a "Robot jockey".

References

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