Designing and Choreographing Robot Arm Movements in Group Dance Improvisation

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1 INTRODUCTION

Robots play a unique role in technology-mediated performanced due to human performers' perception of them as either creative agents or background props in different improvisational contexts. To explore how human experts can create nonhumanoid movements to incorporate into their own improvisational routines, we held design and performance workshops with professional dancers, allowing them to co-create robot arm movements in one-human-to-one-robot and three-human-to-one-robot contexts. We find that dancers create more continuous movements in the one-to-one condition, where performers perceived greater intimacy and presence with the robot acting as a co-performer. In contrast, dancers divided attention between other human performers and the robot in the three-to-one condition, resulting in greater use of space and more stop-and-go behaviors, perceiving the robot as part of a background set of props. This work demonstrates the way interactions with new technology can provoke humans to construct creative designs and lead to fresh strategies to work with these designs that transcend traditional routines.

RQ 1 - How can a non-humanoid robotic presence affect the ability of performers to generate creative body movements during improvisational processes?

RQ 2 - How do performers and choreographers design for the robotic presence in order to facilitate and prototype narrative movement-based performances?

RQ 3 - How do performers work in teams to collaboratively narrate performance choreographies while working with the robotic presence?

2 METHODS

Previous works have shown that performers take unique perspectives when working with technologies, treating them as creative constraints for improvisational processes [2, 6]. Methods like interactive visuals [1], wearable sonification interactions [3], exhibition-style performances [5], and live-coding environments [4] allow performers to improvise

in the context of technology, creating novel interactions that go beyond the classical stage. In this work, we adapt a co-design strategy [7] allowing dancers to create movements for a robotic arm that they then improvise to. In addition to reacting to the technology, performers are also empowered to design for the movements that they improvise to either as individuals or in a group.

In the workshop process (Fig. 1), we first allow performers to sketch out their ideas, and implement robotic arm movements by recording them directly. This is followed by an improvisation session with the previously designed movements in a one-to-one manner with the robot. To investigate the way groups of dancers work with the robot movement design, we then ask a group of three professionals to create a set of robot movements that they then improvise as a group with. Finally, to highlight the differences between improvisation and choreography, we allow one choreography to work with one or two dancers in creating a performance with the robotic arm. Example interactions during the dancing phase are shown in Fig. 2). Examples of the designs created by the dancers and the recorded movements they created are shown in Fig. 3. This paradigm of interactions allows us to explore the difference in robotic interaction between individual and group-based dance improvisation, as well as how different workflows with robotics is created when performers create choreography vs improvisation. The findings we discuss will highlight the ways that performers use space and perceive the robot when working with it 1-1 vs 3-1, as well as in choreographic rather than improvisational contexts. This methodology demonstrates how technologies like nonhumanoid robotics can lead to new strategies of movement design and improvisation for professional movement artists, transcending boundaries of traditional performance paradigms.
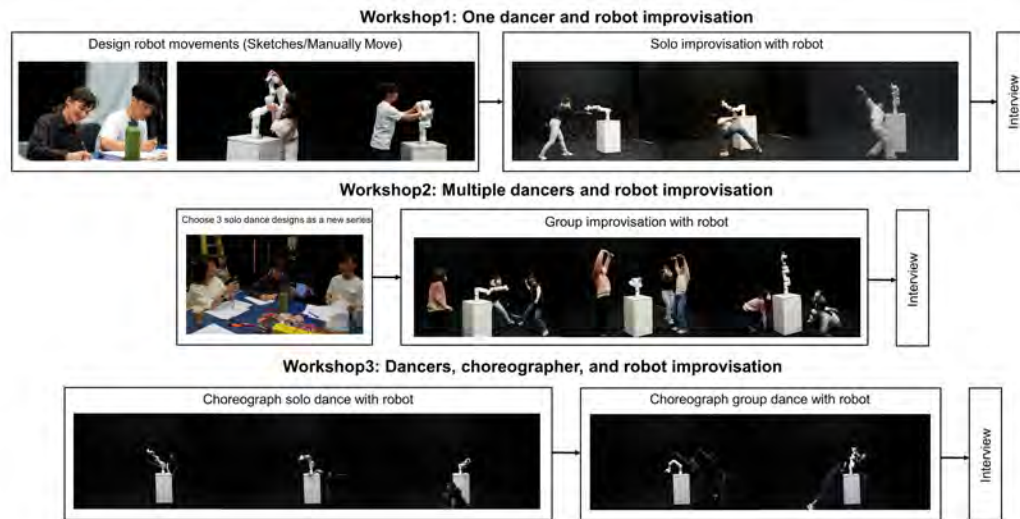

Fig. 1. Co-designing robot arm movements with professional dancers. (Top) Each performer individually sketch and record robot movements, then perform solo with the programmed movements in improvisation. (Middle) The group pf performers create a set of movements that synthesizes their previous individual design, and record them to the robot arm. Then the group perform all together with the robot. (Bottom) One choreographer creates a set of robot arm actions for a single other dancer, or for two other dancers. The performers then rehearse and perform the piece with the robot.
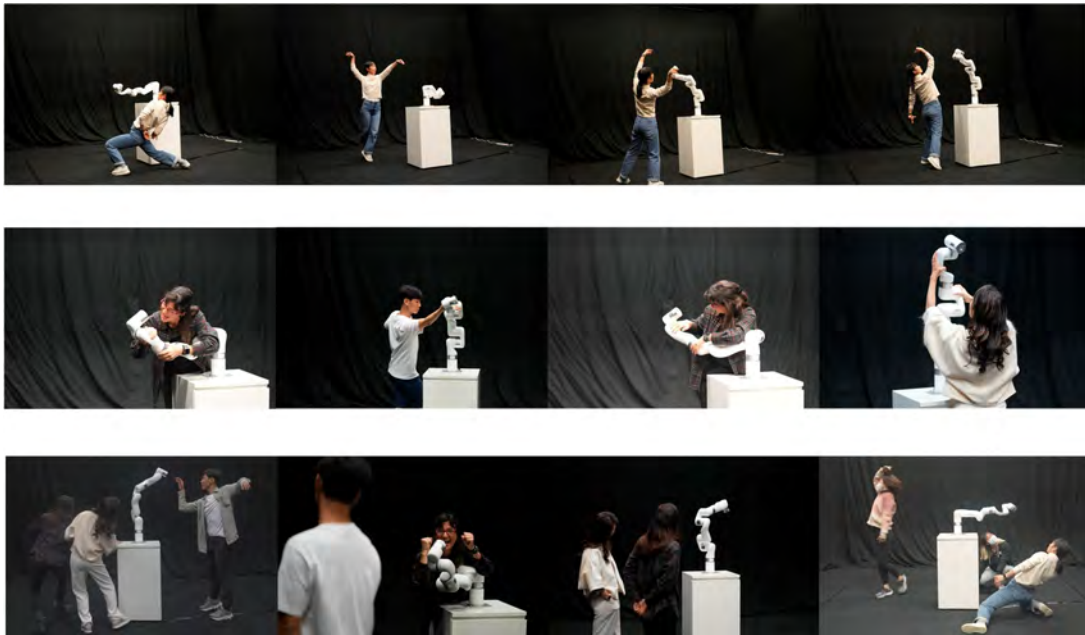
Fig. 2. Examples of performer-robot interactions during the co-design engagement. (Top, Middle) One human-one robot improvisation examples. (Bottom) Multiple humans-one robot sessions from different groups.
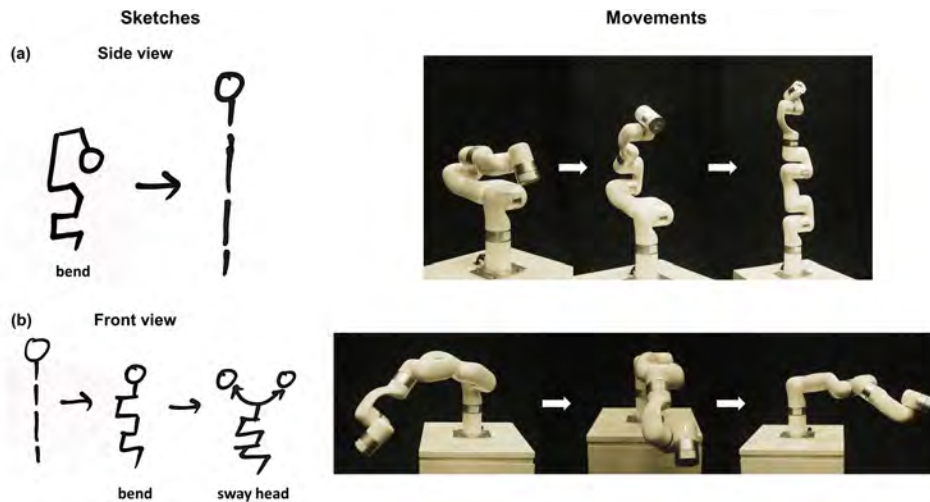

Fig. 3. Examples of designs made by participant performers. (Left) Designs of movements created by professional dancers. (Right) The recorded robot movements made by the dancers from their designs.

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