Ms. Robot Will Be Teaching You:
Robot Lecturers in Four Modes of Automated Remote Instruction

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Abstract
Methods and materials are described for employing a human-shaped robot as a lecturer in automated remote instruction. Video segments from the stimuli of a 2 (participant substrate: VR or non-VR) x 2 (robot embodiment: copresent or screen) balanced between-participants experiment are provided. In each condition, a robot delivers the content for a lecture on the nutrition of carbohydrates. The robot uses identical speech and body movement while the same set of slides plays on an adjacent computer, thereby controlling for such factors as educational content, robot appearance and robot size. The experiment employs Aldebaran Robotics’ 25-degrees-of-freedom Nao as the robot and the Oculus Rift as the immersive VR system. The lecture speech and slides were obtained with permission from a Mandarin Chinese-language online course and translated into English. The setup for different delivery modes for automated remote instruction are illustrated using a robot delivering foreign language online content. These methods support the design and evaluation of robots that perform the role of lecturer.

Introduction
Experimental stimuli were prepared to assess human-robot interaction in which a learner views a lecture delivered by a human-shaped robot. Stimuli addressed four modes of delivery: immersive virtual reality with a 3D model of a robot (VR), immersive virtual reality with a video of a robot (VR*), a collocated robot without virtual reality (CR) and a video of a 3D model of a robot (CR*). Robots can be effective educational aids (Howley, Kanda, Hayashi, and Rosé 2014; Shirouzu and Miyake 2013), particularly as a means of remotely delivering foreign language content that has been translated. The substrate (i.e., immersive virtual reality or unmediated reality) and embodiment (virtual model or video) of these robots can be varied (Li 2015; Milgram, Takemura, Utsumi, and Kishino 1995). Methods and materials are described.

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the VR condition, an independent developer constructed a virtual version of the experiment room and wrote an interpreter to translate movements from the robot’s behavior file into a virtual-reality 3D model of the robot; these were made into a scene displayed on the Oculus Rift™ virtual reality headset. For VR*, the same scene was used as in VR, except the robot was filmed and the resulting video displayed on a computer screen in the VR environment. For CR, the robot’s behavior was executed on the robot itself while in front of the user (no virtual-mediation was used). For CR*, the robot was replaced by a computer screen displaying a 3D model of the robot (taken from the VR condition). All conditions featured a 27-inch iMac computer displaying slides with a keyboard and mouse (logos were removed in VR conditions).

Future Work

We are currently running this experiment with 40 participants from the student population at Stanford University. We hope this work illustrates how robots can be used in automated remote instruction for foreign language content. We also hope our results will demonstrate how exploratory assessment can be used to evaluate user perception of design variations in a robot that mediates face-to-face communication in virtual and real environments.

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References


