Human-Robot Interaction Research Issues of Educational Robots

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Abstract

Today's commercial robots are getting smaller and smaller. The price of robots are also getting close to the mobile phones and becoming affordable to be personal. In order to make the researchers and educationists using the personal robots in the schools and classes, this paper overviews the human-robot interaction factors, e.g. emotions and appearances, and summarizes important things needed to be noted before using the robots for educational purpose. In addition, the paper proposes five possible research directions include gender issues, appearances, humanoid or non-humanoid robots, priority of HRI factors, and interaction issues. Each direction covers several important research topics.

1. Introduction

Nowadays, small-sized and powerful personal robots are getting affordable to ordinary people, for example, Takaratomy Omnibot17μi-SOBOT is around $250 CAD and GeStream Bc Robot is around $300 CAD [4][7]. These robots can be programmed to carry out a variety of actions and behaviours, even speaking. Sony also has a wireless card for their AIBO Messenger robots to allow the robot to connect with other computers [6]. Under such circumstance, the robots can be private.

This paper trying to provide researchers and educationists an overview about the human-robot interaction issues which are needed to be considered before the researchers and the educationists start to apply the small-sized and powerful personal robots into their researches and classes.

Before talking about the HRI factors, first of all, we need to know the types of robots. There are different types of robots, including humanoid robots (anthropomorphism), animal-like robots (zoomorphism), caricatured robots, and machine-like robots [3].

2. Emotions

Fong et al. (2003) indicated that emotion is important to a robot's social development and Billard (2003) considered speech processing to be important in designing robots [1][3]. Woods (2006) also explored the children's perceptions and evaluations of different robots, and they found that there are two issues that affect children's choices of robots: behavioural intention and emotional expression [9]. Similarly, Plaisant et al. (2000) developed a storytelling robot with emotional behaviours [5]. They used the robot to help rehabilitate children and found the robot can help the children with therapy. The emotions can be expressed by facial expression, as Breazeal and Scassellati did in 1999 [2]. They built a robot, Kismet, who is a face robot. Emotions can also be expressed by sounds, for examples, laughing when happy, crying when sad, and shouting when angry.

Most of emotions we mentioned can be done by animated agents or virtual characters easily. Robots can perform emotions with another different way, which is "touch". For examples, when the robot wants to comfort the student, it can pat him/her; when the robot wants to show the student its angry, it can hit him/her; and, when the robot wants to encourage the student, it can use its two arms to pat his/her shoulders. Therefore, when we are thinking how to use robots for educational purpose, we should also think about "body languages" and "body emotions".

3. Appearances

Beside the perceptions of robots, a much more important thing of using robots for educational purpose is "what kinds of robots can help students learn". Van Vugt et al. (2007) find that the students' engagement is

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influenced by task-relevance and perceived aesthetics, furthermore, the student's satisfaction is influenced by his/her engagement and performance [8]. From their research results, we can know that the appearances of educational robots are very important, because of a better looking robot can increase students' engagement and make students feel satisfy. When we think about a better looking robot, we need to think it with caution. In general, a better looking robot means much more like human beings, but the animal-like robots and caricatured robots, sometimes, are also quite cute and can attract children and young people.

If the humanoid robot is chosen to use, then the Uncanny Valley hypothesis should be taken into consideration. The Uncanny Valley hypothesis made by Mori in 1970, the hypothesis said that users will feel uncomfortable with robots' whose outlooks are very close to human especially when the robots' behaviours are not close enough [9]. If the human-like "thing" can walk but not so smoothly like human being, then the "thing" will give people a feeling just like it is a zombie. Similar to the perception of moving zombies, if the human-like "thing" doesn't move just like a statue but it is so close to human being, then people may think it is a dead body. Both of the perceptions of zombies and corpses are not good to the students.

Woods' (2006) research results also confirmed the hypothesis really exists after let 159 children score forty robot images and describe their feelings about the robots. If the humanoid robots represent the robots who have legs, arms, and facial expressions. A very interesting finding is the genders of robots, it seems male robots give the children "sad" and "aggressive" imagines. Also, perhaps "wheels" make the robots running fast, the robots with wheels make the children feeling "aggressive"

5. Research Issues

There are five possible research directions of using robots for educational purpose: gender issues, appearances, humanoid or non-humanoid robots, priority of HRI factors, and interaction issues. Due to the page limitation, we only list the details of the gender issues here.

There are several research topics in the gender issues: (1) do male students and female students have different attitudes toward to the robots? (2) do male students and female students like different types of robots? (3) do male students and female students have different interaction ways and frequency with the robots? (4) what genders the robots should have for different courses or disciplines?

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