Ask, Inform, or Act: Communication with a Robotic Patient before Haptic Action

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ABSTRACT

Currently in medical education, clinical students learn how to interact with real patients via simulated patients, which are inexpressive, teleoperated robot mannequins. We obtained five simulations that used such a robot to explore verbal communication between clinical students and the robot patient, specifically if the students sought approval before performing haptic-actions. We found that in our sample, student clinicians frequently acted without seeking approval or providing information to the robot patient. We hope to further our studies in order to identify if either current training of clinical students in communication is ineffective, or if the robot patients are too nonhuman-like and inexpressive to engender appropriate communication.

Categories and Subject Descriptors

I.2.9 [Artificial Intelligence]: Robotics; J.3 [Life and Medical Science]: Medical information systems; H.5.2 [User Interfaces]: Haptic I/O

Keywords

Robotics, patient simulation, clinical communication, haptics

1. INTRODUCTION

In the field of medical education, there has been a push toward allowing clinical students a chance to hone their procedural and communication skills in simulated environments. Students typically work on full-bodied simulated patients (i.e., teleoperated mannequins), which afford a safe, replicable learning environment before interacting with real ones [5].

The problem with the current state of the art of these mannequins is that they do not offer a lifelike experience for clinicians, because most are inexpressive – unable to show facial expressions, move their head, or gesture. We wondered how such inexpressive robots might affect clinical training, and performed an exploratory study to find out.

Last summer, we observed five clinical simulations at the Ysbyty Gwynedd Hospital in Bangor, Wales. These simulations were comprised of interdisciplinary teams of medical and nursing students undergoing training on a robotic patient mannequin. The Bangor robot has no facial expressivity, though its torso can breathe, its heart can beat, and it can experience physiological changes to medication. It can also "speak" via an internal speaker, thought its lips do not move. It is semi-autonomous, controlled by a technician and clinical instructors behind a one-way mirror.

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Figure 1: An example of a haptic action on the robotic patient.

According to American and Welsh medical standards, communication between a healthcare provider and a patient is an important aspect in doctor-patient relations [4, 6]. Patients who receive effective communication from their providers positively respond to their treatments and regimens [2]. Poor communication alienates patients and causes anxiety and confusion. Thus, doctors pledge to communicate honestly. When treatment actions are necessary, acute care providers seek approval from a patient before proceeding, unless the patients are unable to make conscious decisions [1].

We analyzed the Ysbyty Gwynedd Hospital simulations in order to explore how providers are being trained to communicate with patients. We were particularly interested to see if providers sought approval from the robotic patient before proceeding with any physical actions, such as interventions, diagnostics, taking vitals, and gown opening and closing.

To analyze this dataset, we first developed a haptic-action coding scheme, which is described in Section 2. Two independent coders then used the coding scheme on the dataset, which is described in Section 3. Section 4 describes our results, and Section 5 discusses the implications of them for both the robotics and the medical education communities.

2. HAPTIC-ACTION CODING SCHEME

We developed a haptic-action coding scheme to analyze the Bangor simulations. Despite surveying the literature we could find not find a scheme that encompassed our goals; instead, our coding scheme was based on typical actions that occur in acute care environments.

Each haptic-action was sorted according to type: interventions, gown, vitals, or diagnostics. *Interventions* included haptic-actions related to inserting an IV, taking blood, putting on an oxygen mask, spraying the throat, administering drugs, suctioning, and attaching ECG leads. *Gown haptic-actions*

occurred whenever a student doctor or nurse opened or closed the patient's gown. *Vital haptic-actions* consisted of blood pressure and blood sugar readings, checking breathing with the stethoscope, attaching a finger monitor, and taking the patient's temperature. *Diagnostics haptic-actions* consisted checking the patient's pupils, their forehead for a fever, their pulse, their skin for clamminess or temperature changes, their airway, and their tongue.

For each haptic-action, we noted what verbal communication, if any, took place between the patient and the doctors or nurses. We determined that there were three types of verbal communication to the patient: *sought approval* (i.e., "Can I take your temperature?"), *gave information* but didn't seek approval (i.e., "I am going to take your temperature."), or *just acted* without saying anything to the patient.

3. METHODOLOGY

We used a dataset from Ysbyty Gwynedd Hospital's simulation day, where medical and nursing students interacted with a patient simulator robot. The dataset included eight fifth-year medical students from a six-year British medical school program and five final year nursing students from a three-year British nursing school program, along with one "behind the curtain" confederate nurse. Two anesthesiologist faculty members controlled the robot, as well as a technical operator who voiced for the patient according to faculty members' directions. All participants gave informed consent to participate in this research.

The students participated in five scenarios where they encountered patients having chest pain, left ventricular fluctuations, anaphylactic shock, septic shock, and an asthma attack. The students' task was to accurately identify the patient's condition based on their symptoms and then use an appropriate method to care for the patient. The confederate nurse would step in to guide the students when necessary.

Two independent coders analyzed the data using the haptic-action coding scheme. For this paper, we focused on seeking approval. As part of the American College of Emergency Physicians Code of Ethics, doctors should always communicate truthfully with their patients and obtain informed consent for treatment, unless the patient is in a dire situation [1]. The Welsh medical standards were found to be the same as American medical standards [6]. Thus, for this dataset, ideally clinicians would seek approval and/or give information before a doctor or nurse performed a haptic-action on the patient.

To test for inter-rater reliability, we calculated Krippendorff's α using SPSS. Then, to explore the data, we ran a MANOVA statistical analysis because we had multiple dependent variables - seeking approval, gave information, and just acted. These variables represented the degrees of communication that the provider shared with the patient before performing actions on the patient. Our fixed factor was the varying haptic-action types performed on the patient.

4. RESULTS

To determine inter-rater reliability between our coders, we calculated Krippendorff's α. Here, α was 0.88, which indicates high reliability.

Our MANOVA test indicated a significant effect of haptic action type on the form of verbal communication to the patient, $F(9, 108)$, $p < .001$. A discriminant analysis followed our MANOVA test to explore the relationships among the dependent variables (the levels of patient communication). For the *gown* haptic-actions and *diagnostic* haptic actions, we found a significant difference between *sought approval* and *just acting*. Figure 2 shows the average number of times each haptic action was performed across all five simulations. Our statistical analysis is ongoing, but from the graph it is clear that for opening and closing the gown and for taking diagnostics of the robot patient, it is more likely that clinicians just acted without first seeking approval or even telling the patient what they were doing.

5. DISCUSSION

Our results show that for our sample, student clinicians routinely acted without seeking approval or providing information to robot patients. Thus, as far as the medical education literature is concerned, these students weren't following the guidelines on informed consent.

It is unclear if this result is due to the training they received in patient interaction, or if it is due to the non-expressiveness of the robot. Further investigation is necessary to explore this question in depth. However, based on this and other work (c.f. [3]), we hypothesize a more expressive robot would lead to improved communication and patient empathy.

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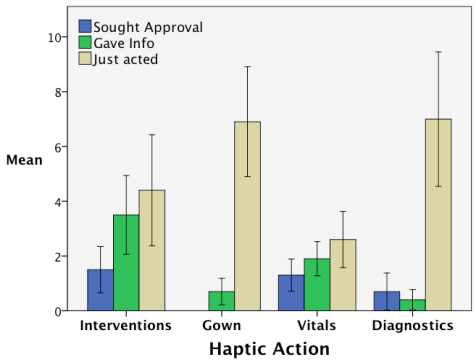

Figure 2: Mean number of haptic actions performed (across all simulations) with their degree of patient communication.