

SOMEONE TO TALK TO: A VIRTUAL PATIENT FOR MEDICAL HISTORY INTERVIEW TRAINING IN A SECOND LANGUAGE

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Abstract

Low language proficiency remains a significant barrier to healthcare access for many patients throughout the world. Language training of linguistically and culturally competent healthcare professionals, therefore, should lead to greater healthcare access, lowered costs, better health outcomes, and improved patient satisfaction [1]. One important aspect of language training involves the development of cost-effective and pedagogically sound language-training materials. The goal of this paper is to describe the development and testing of the “Virtual Language Patient”, a virtual language-training module based on the Virtual Dialogue Method [2] using automatic speech recognition (ASR) technology.

Keywords

ESL, ESP, ASR, medical history interview, virtual dialogue, pronunciation training, automatic speech recognition, nurse, healthcare professional, communication

1. LINGUISTIC BARRIERS TO HEALTHCARE ACCESS

Effective communication between healthcare providers and their patients is an important factor in patient satisfaction. A large study conducted at 57 Canadian hospitals found that global patient satisfaction was lower among patients who had more provider-patient communication problems [3]. The most commonly reported problems in the study all involve failures to communicate with patients when communication was expected. They include being examined by someone who did not explain what he or she was intending to do, being kept in the dark about daily routines, not being told how much pain to expect from a test or procedure, and a lack of communication involving discharge planning.

Dissatisfaction with healthcare communication becomes more acute, however, when either the healthcare provider or patient cannot effectively communicate in the other’s language. Spanish-speaking patients in San Francisco were less satisfied with the care they received from non-Spanish speaking physicians [4], and in the Northeastern United States, a variety of non-English speaking patients reported less satisfaction than their English-speaking counterparts with emergency room care, courtesy and respect, and with discharge instructions [5]. Comparisons made between members of the same linguistic minority group also showed a correlation between language proficiency and satisfaction levels. For example, low-English-proficiency Korean patients over the age of 60 in the U.S. were less likely to be satisfied with the healthcare service they received than Koreans with higher levels of proficiency [6].

Using interpreters is not always the best solution for this problem. Whereas the use of hospital-trained interpreters in pediatric emergency departments was found to increase parents’ satisfaction with their physicians and nurses [7], a reliance upon interpreters can be problematic in primary care medical interviews. Aranguri, Davidson and Ramirez [8] observed that during regular doctors’ appointments with Hispanic patients about half of the words exchanged between doctor and patient were missing from interpreters’ translations. Small talk, known to increase patients’ emotional engagement in their treatments and their doctors’ ability to get a comprehensive patient history, was eliminated. Patients’

questions, an important indication of a patient's engagement with their own care, were also significantly reduced when an interpreter was used.

To alleviate the need for interpreters, Zambrana et al. [1] recommend more minority, linguistically competent, and culturally competent healthcare providers in managed care networks. They argue that having health care providers that speak the same language as their patients will lead to lowered costs, greater healthcare access, better health outcomes, patient satisfaction, and patient compliance. One study investigating patient outcomes where such linguistically competent healthcare providers work found that asthma patients cared for by doctors who spoke their language were more likely to take their medication and less likely to miss office appointments or make resource-intensive emergency room visits than patients with doctors who did not speak their language [9]. Another study found that patients whose doctors spoke their language asked more questions and had a better recall of their doctor's recommendations [10]. Indeed, not speaking the language of the healthcare provider may add to a patient's suffering. One emergency department study found that Spanish-speaking Hispanic patients were half as likely to receive analgesia in the treatment of their long bone fractures than were their English-speaking counterparts [11]. Worse still, a failure to anticipate communication problems and accommodate low-language proficiency clientele can turn fatal, as was recently illustrated in a news story of an Albanian immigrant who killed himself, thinking his wife had been diagnosed with AIDS when hospital staff told him his wife's blood type was A-positive [12].

Even small accommodations to patients' communication needs can make a big difference. Mastering just a few key words and phrases such as *push*, *stop pushing*, *breathe* was found to help build a rapport with Arabic speaking women during labour in a delivery ward [13]. In their study of low English proficiency nurses working in the psychiatric wards of major American hospitals, Cameron and Williams [14] found that miscommunications rarely occurred where communication strategies were employed. Specifically, it was found that by clearly framing the purpose of an interaction for a patient (i.e. *I am going to take your family history*), nurses speaking in their second language could restrict a patient's expectations regarding possible questions from the outset of a medical interview and thus guide the patient to the most relevant interpretation of a problematic utterance.

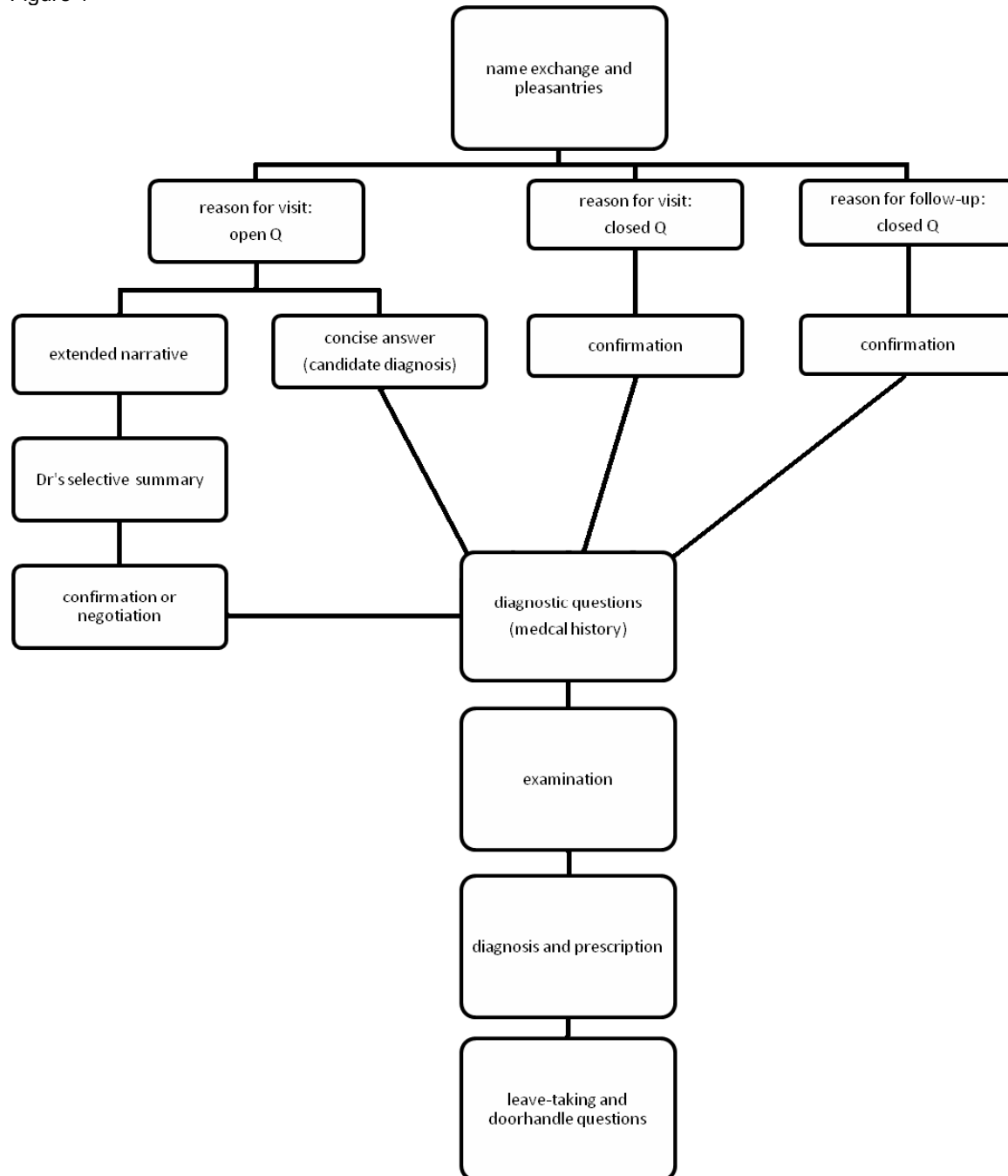
For the development of linguistically proficient healthcare providers, language training is of course the best option. In a survey given to 165 pre-service health professionals in South Carolina, listening and speaking skill development was identified as a much higher priority than reading and writing [15]. Appreciating the importance of authentic face-to-face encounters, these respondents also indicated a preference for learning situations that would bring them into direct contact with speakers of the target language. In contrast, a qualitative case study reporting on the learning needs of in-service healthcare professionals (those who already had considerable contact with Spanish speakers in the community they serve) identified high priority language learning needs of a more specific nature. They wanted help with pronunciation, a repertoire of commonly asked questions to draw from during routine medical interviews, and the development of greater aural comprehension by drawing on a list of phrases to get patients to speak more slowly, explain, or repeat [16].

2. THE MEDICAL HISTORY INTERVIEW

Of the variety of medical interviews in evidence within the research literature on healthcare communication, we chose the comprehensive medical history interview as the focus for our materials development efforts. Taking comprehensive medical histories involves healthcare workers asking an extensive list of routine questions useful in formulating a diagnosis. Apart from being one of the most likely medical interviews that nurses have to perform [17] and a task given to medical school students as part of their training [18], medical histories in one form or another are also taken by midwives, paramedics, physicians, pharmacists, dentists and their assistants, and by the patients themselves through self-report on a questionnaire.

When embedded within a primary care consultation with a physician, the medical history usually occurs after the patient has identified his or her chief complaint and just before the physician begins a physical examination (see Figure 1). Busy practicing physicians tend not to have the time to take a full history, and so either get a nurse to take it prior to the consultation or ask a more limited set of diagnostic questions as they test a diagnostic hypothesis.

Figure 1



Nurses are likely to go about taking a medical history in two distinct ways [19]. An experienced RN-nurse will first attempt to establish a referential frame with the patient (“We are just going to be talking about you and how you manage at home” p. 178) that will simultaneously identify the purpose of the interaction and allow the nurse to manage the various health topics as they arise. In the skilled hands of an experienced nurse, the exchange is thus conducted as a conversation that is open to digressions. A non-RN, novice nurse may, in contrast, tend to be more controlling in the way conversations with patients unfold, framing the interaction explicitly as an interview (“I’m going to interview you if you don’t mind on a few questions about yourself” p.178) and sticking more closely to the order of the medical history questions as they appear on their proforma.

Similar to a nurse's proforma, a typical comprehensive medical history questionnaire [20] will likely contain all or some of the following elements appearing in a predictable order. Each begins with fields for the patient to fill in his or her name, contact information, and demographics. Following this general identification section, present illnesses, current medications, past illnesses, surgeries, allergies and drug reactions are elicited. Social and lifestyle questions come next about religion, sexual orientation, educational information, occupation, personal drug and alcohol habits, and amount of regular physical exercise. The next section elicits details of the medical history of family members and is followed by a review of organ systems (general, cardio-vascular, vision, ear-nose-throat, bones and joints, endocrine, pulmonary, gastrointestinal, neuropsychiatry, haematology, dermatology, and genitourinary systems).

When a patient is unable to complete a comprehensive medical history questionnaire in a second language, the onus falls upon the healthcare practitioner to find a way to conduct a medical history interview in the patient's language. For busy doctors and nurses wanting to avoid using an interpreter, language courses targeting this important conversational skill may be unavailable or require a time commitment that is difficult or impossible to make. A technological solution that could deliver language training at a distance, and at any time of the day, would likely be an attractive option to these learners. The availability of such a training option may indeed mean the difference between being able to serve minority language speakers' health needs when they are at their most vulnerable, or making do.

3. CALL AND THE VIRTUAL DIALOGUE METHOD

Helpful technological solutions for the development of oral language skills have been largely constrained in the past by the pairing of inadequate technology with poor language pedagogy. When the phonograph was introduced into language classrooms as a way to engage students in oral practice and pronunciation training, initial enthusiasm eventually gave way to general abandonment. The reason given at the time was that the recording quality and inauthentic oratorical style used in the recordings provided an inadequate model for imitation and memorization [21]. When recording quality improved, research efforts shifted to providing the learner with some form of feedback. The introduction of rapid algorithms for speech analysis supplied learners with an instant graphical representation of the intonation contour associated with their utterances [22] and thus marked the beginning of computer-assisted feedback on pronunciation, a technique that is still widely used today. Even so, this listen-repeat-feedback approach to computer assisted language learning (CALL) tends not to provide the learner with meaningful oral interaction.

The decontextualized drilling of language forms has been thoroughly discredited as an approach to effective language teaching [23]. Rather, all oral repetitions, it is believed, must occur in a genuinely communicative context where each formulation of a repeated structure is part of a meaningful message conveyed to a receptive interlocutor [24]. It is not, therefore, until the recent development of automatic-speech-recognition (ASR) enabled dialogues that one effective pairing of technology and pedagogy for oral language acquisition became possible.

In 1999, Harless, Zier, and Duncan [2] reported on a prototype of an ASR-enabled multimedia system they had developed to provide the learner with a form of virtual language immersion. Their Conversim™ system attempted to address the problem of language attrition in military translators who found themselves in the difficult situation of having to maintain their language skills for battle readiness without any opportunity to practice their productive oral Arabic between language courses. Employing Defense Language Institute instructors as actors to play four Iraqi prisoners, each was videoed answering a variety of carefully scripted questions. The video clips of the individual answers were strung together in a closed dialogue system where pronouncing one of three question prompts (provided at the bottom of a computer screen) into a headset microphone triggered a meaningful answer in the form of a video clip. The choice of question led the conversation in different directions, either closer to or further from the goal of the interrogation as well as digressions into discussions about the virtual prisoner's hometown and culture.

It should be noted here that virtual dialogue multimedia systems for language training were first attempted in the mid-1980s with videotape and videodisc technology. The videotape system proved too slow at spooling the tape forward and backward to retrieve the appropriate video clip to a selected question [25]. Videodisc systems were much faster but proved too expensive [26]. Neither employed

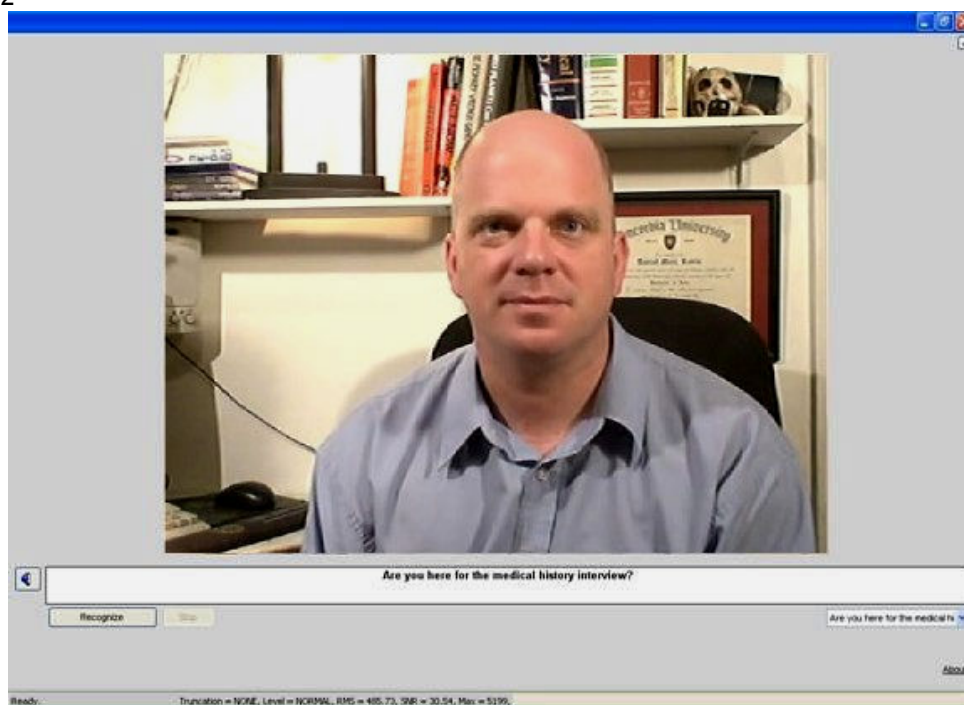
ASR. Requiring keystrokes to advance the dialogue, learners were nevertheless told to say the questions aloud as if the machine was listening. In the field of medical simulation, a text-based virtual medication history interview has been developed for pharmacy students using a keyword-searching approach to interpreting typed questions [27]. No ASR-enabled second language training system using the virtual dialogue method for healthcare professionals is in evidence in the research literature to date.

4. VIRTUAL LANGUAGE PATIENT

Our Virtual Language Patient (VLP) system challenges the learner to use his or her second language to take a comprehensive medical history by engaging in a virtual dialogue with a patient. The system comprises the VLP software launched on a desktop or laptop computer running a recent version of Microsoft Windows 2000/XP/Vista and equipped with headphones and a microphone. Programmed using Microsoft's Visual Studio 2005 and SRI's EduSpeak Speech Recognition System, the intuitive graphical user interface of the VLP is set up to be simple to use without extensive training, instructions, or demonstration videos. Anybody using it for the first time will quickly be able to understand how it works.

Upon launching the software, a video image of Danny, a 40-year-old male patient, appears at the centre of the screen (Figure 2). Danny does not say anything at first but just looks around, waiting quietly for the learner to begin the virtual dialogue by asking the first question. Just underneath the video image is a box with the first question to be asked: *Are you here for the medical history interview?* The learner initiates the virtual dialogue by clicking the "Recognize" button and pronouncing the sentence into the microphone. If the system recognizes the learner's utterance as being similar enough to the expected sentence, a video plays Danny's response, *Yup*, and the second question appears on the screen.

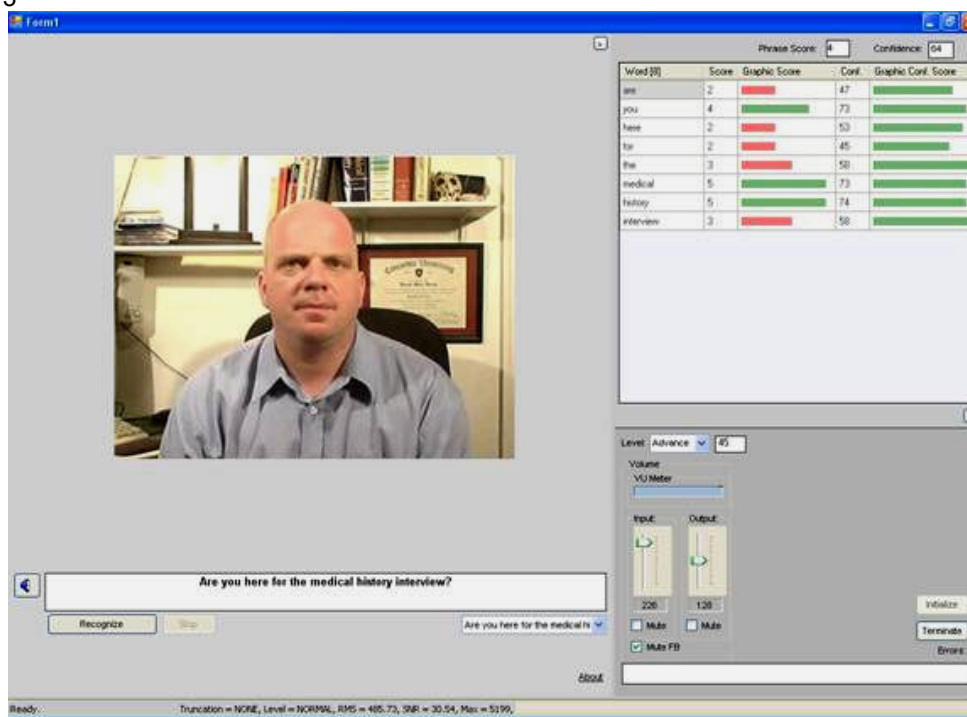
Figure 2



At the same time, a feedback panel is displayed after each recognition, providing feedback on confidence ratings associated with each word and the whole utterance (Figure 3). Ratings for words that fall below a threshold are displayed in red, otherwise in green. The learner can thus get a sense of which words he or she needs to say more clearly. When the entire sentence does not meet the software's threshold of what is acceptable due to either poor microphone placement or errors in pronunciation, a video with a request for the learner to try again (i.e. *Could you say that again,*

please?) plays and an opportunity to try again is made available. The learner may at this point wish to hear an audio recording of a native speaker pronouncing the sentence. This is possible at any time by clicking a button to the left of the question prompt (identifiable by its small speaker icon) and then listening to the recording through the headphones.

Figure 3



Some adjustments to the system's speech recognizer are available to the learner by using a settings panel at the lower right of the screen. Using the mouse, the learner can change the microphone sensitivity, headset volume, and recognition threshold. The advantage of being able to set the recognition threshold to a lower or higher level is that the learner can make Danny more or less forgiving of pronunciation errors and thus make the pronunciation demands of the experience less frustrating or more challenging according to the learner's individual needs.

This is important because getting Danny to recognize the question is necessary in order to advance through the dialogue and complete the task of taking his medical history. Provided with a pen and paper questionnaire (synthesized from a number of medical history questionnaires for employment and hospital use found on the internet) the learner is prompted to ask a series of 71 questions related to contact information, allergies, family medical history, personal medical history, personal habits, and employment status. Each of the questions was formulated by the first author from the synthesized questionnaire using his own "native speaker" intuition, and then audio recordings were made of the questions read by a native-speaker of standard Canadian English. Each of the videos contains a video recording of Danny's authentic answer to these questions.

Danny is not a professional actor. All of his answers are authentic responses to the prompted questions with the exception of the false address and phone number he gives at the outset. Otherwise, he is talking about his own unscripted medical history. His high blood pressure, his insulin dependency, and the history of cancer in his family are subjects that Danny talks about sincerely and in detail without anyone putting words in his mouth. No attempt was used to elicit specific grammar forms or technical jargon. The answers given are unrehearsed and reflect Danny's natural way of speaking English. Furthermore, the medical language he uses to describe himself is the language he has picked up through his own encounters with the local healthcare system. When asked about his eyesight, Danny responds, "My eyesight is relatively good. I have a little bit of retinopathy, though." His reference to retinopathy, a degenerative eye disease caused by the effect of high blood sugar on the small blood vessels in the eye, was unprompted and is entirely consistent with someone with a long history of diabetes.

Adding to the realism, Danny is not always direct at first about his personal habits and so needs to be pressed for an honest answer. When asked, "Do you drink alcohol," he answers, "Occasionally." Following up with the question "Really?" causes him to reconsider his answer and say, "Actually, I'm lying. Yes, I do drink...frequently." As in real life, this strategy does not always work with Danny. To the question, "When was the last time you got a tetanus shot?" Danny answers, "Hmm. I really can't remember the last time I got a tetanus shot." Pressing him by saying "Try to remember" gets only the answer, "Honestly, I don't know."

In addition to getting experience talking to an English-speaking diabetic about his medical history, a non-native healthcare professional practicing his or her English with this system will also get multiple exposures to a variety of question types. By the end of the questionnaire, the learner will have asked questions with do you 23 times, are you and have you eight times each, is there five times, and did you four times. What, how, and when questions are prompted eleven, nine and four times, respectively. This is an important point worth emphasizing since these oral repetitions occur entirely within a communicative context. At no time is the learner asked to drill these forms in a mechanical, meaningless way. Indeed, duplicating the medical history interview task with additional patients promises to provide the learner with a further source of repetitions all within a strictly communicative exchange. This departure from the drill-and-fill pedagogy of the past while still maintaining a high number of oral repetitions is what makes the virtual dialogue such an attractive option for teaching a language using CALL.

5. DEVELOPMENT AND TESTING

The virtual dialogue with Danny represents only one possible line of development for the VLP. In contrast to the linear dialogue structure employed in this first prototype, a second line of development could involve virtual dialogues that provide the learner with more than one question at a time from which to choose. Supplying a variety of possible questions would allow the learner to explore different topics, sequences, and question types, adding to the naturalness of the conversational experience. Opportunities for garden path exchanges could be included where the question the learner asks might make the virtual patient more or less cooperative. He or she might take offence, for instance, at impolite questions or volunteer more detailed medical history information after stretches of rapport-building small talk. Alternately, incorrect question forms could appear among the possible questions giving the learner opportunities to make grammatical errors and receive on the spot corrective feedback.

A third line of development would vary the variety of English the virtual patient speaks. In one virtual dialogue, the learner would be exposed to a patient who, although proficient in English, speaks with an accent. In this way, the learner could become more familiar with common regional or foreign accents. In another dialogue, a low-English proficient virtual patient could challenge the learner to make sense of a combination of accent, specific mispronunciations, and errors in verbal morphology. In either situation, opportunities would arise to learn and use clarification requests and verification procedures. Questions such as "What does X mean?" and "Did you say Y?" could be included among the prompts where X and Y are words used by the virtual patient that might require clarification and verification.

Each VLP dialogue, whether in the testing or planning stage, is expected to be of particular benefit to our target population of learners—Francophone nurses in the province of Quebec where English (one of the two official languages of Canada) is spoken by a minority of the population and where there is a growing immigrant population [28]. Our current testing plans for the VLP prototype involve a small feasibility study using pre-service Francophone nurses studying at the junior college or university level. An analysis of the results of this study will then guide our efforts in the development of the various features of the VLP prototype and of future virtual dialogues.

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