Abaris: Capture and Access for Structured One-on-One Educational Settings

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ABSTRACT
We present Abaris, an automated capture and access application that provides access to details of particular sessions of discrete trial training (DTT), a highly structured intervention therapy for children with autism (CWA). By using Abaris, therapists can capture manual data and index automatically into video of their sessions using perception technologies. These indices allow them to easily find particular scenes within the video to correspond to salient moments indicated by the manually collected data. Abaris includes an access interface that allows therapists to review sessions similarly to their current practices while providing new features previously unavailable to them.

Keywords
Ubiquitous computing, automated capture and access, perception technologies, autism

INTRODUCTION AND MOTIVATION
Discrete Trial Training (DTT) represents a situation in which users have a high level of need for accessing captured activity, because it uses an evidence-based approach to intervention therapy. Thus, DTT demonstrates a need for a reliable capture system and the ability to review videos of therapy sessions and particular scenes. The structure of this therapy allows us to create well-indexed videos of sessions which can be reviewed and used in the future. To give therapists the ability to perform therapy as close as possible to common practice, we used several naturalistic perception techniques.

RELATED WORK
Our system falls into the category of automated capture and access applications, described by Abowd and Mynatt in [1]. Several of those applications from research have helped explore this area, such as eClass/ Classroom 2000 [3], Teamspace [8], and Tivoli [7]. Unlike these and other examples, Abaris represents the use of asynchronous capture of videos for a collaborative access system.

DESIGN OF PROTOTYPE
We used our deep understanding of the structure and methods of DTT gathered through an extensive qualitative study [4] to design the interface of the system. Through this study, it was determined that to increase the likelihood of acceptance, the capture interface needed to be as close to the current therapy practice as possible due to the structured and methodical nature of the therapy. Thus, to index the video, we decided to use two perception technologies that take advantage of features inherent to the therapy, such as beginning a trial with a voice command and finishing it by manually recording the grade for it. Thus, Abaris includes Nexidia's voice recognition technology [6] to find the start of each trial and Anoto's digital pen and paper technology [2] for the end.

Because the current practice of team meetings is much less methodical than therapy sessions, we had more freedom in designing the access interface for Abaris. We focused it on the familiar graphs used by the therapists while giving them the option to bring up videos when questions arose.

SYSTEM IMPLEMENTATION
The Abaris system was written almost entirely in Java, using Swing and the Java Media Framework, with some C++ for the Nexidia processing. Details of the separate capture and access systems are described below.

Capture
Recorded video from therapy sessions coupled with appropriate indexing allows fast access to particular scenes (discrete trials). Abaris's perception technologies leverage two important characteristics from a trial: a spoken command that indicates the task to the child and the beginning of the trial to the system and a written record of the child's performance that indicates the end of the trial.

Because Nexidia returns only "best guesses" and several different trials require the same command, Abaris first

estimates the time a trial ends using the digital pen. Therapists use their traditional data sheets now printed on Anoto paper for record keeping during therapy, and Abaris can determine the position and absolute timestamp of each stroke. Abaris includes several algorithms to avoid simple errors that could be introduced by normally benign human activities, such as tapping on the paper, strokes crossing multiple cells on the paper, or handwritten notes.

Figure 1: Basic system setup for the capture interface.

Abaris uses both technologies to determine the timestamps of each trial to index a segmentation of the video during an access situation. Using the ending timestamp provided by Nexidia, the system searches within a given timeframe (e.g. one minute) and chooses the beginning timestamp from all of the "best guesses." Both timestamps are then stored with additional data (e.g. time, date and therapist of a session) in a MySQL database for later use (Figure 1).

Access

The access interface provides therapists with the ability to review collected data and videos of sessions, including information about the current types of skills being worked on (programs) and the particular skill itself (targets).

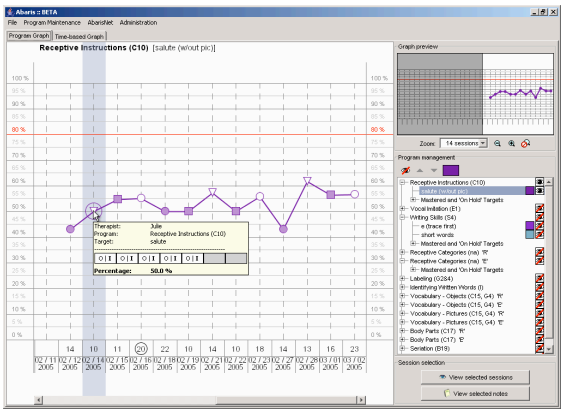

Figure 2: Main access interface showing a single graph

Traditionally, a lead consultant would have to turn from one hand drawn graph to another for each program and explain to others at the meeting what is going on. Using Abaris, every program and target can be displayed or any combination of subsets of these. This visualization allows for comparison of progress and displays tool tips in this mode each time the cursor is near a data point. (Figure 2).

These tool tips provide explanations for a sometimes cluttered graph and further details of the particular data that produced this graph; in effect, a "zoomed in" window reflective of lower level data.

A user can click on a specific date to open a new window and navigate through the video and other associated data using the timestamps for each trial. This window also displays detailed data from all programs in a similar format to the original paper-based version (Figure 3).

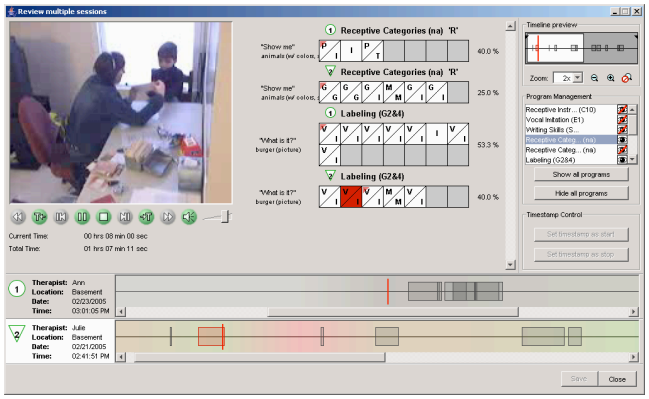

Figure 3: Session browser showing two different sessions

SUMMARY

The Abaris environment demo consists of both the capture and the access interfaces to give a quick impression of the usage of the system in structured one-on-one settings. The captured videos can easily be reviewed afterwards to see the correlation between perception technologies and the resulting indexed-videos. This work is covered more fully, including results from an initial deployment in [5].

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