

Supporting Therapists' Assessment in Parent-Mediated Training through Autonomous Data Collection

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Abstract. Parental Training is a methodology where therapists teach caregivers how to train their kids in specific behaviors practicing. It can be used in verbal behavior acquisition for children with autism mediated by the parents. In this paper, we are presenting an innovative software that aids the assessment of children's tact acquisition where therapists can design interactive activities to support the remote measurement of the parental training progress. The developed software stores in its server the child's answers and autonomously compute, in run time, the child's face deviation through an Artificial Intelligence algorithm. The therapists have access to such data and can assess children's performance by that without watching the interaction. The performed experiment presents initial validation of the proposed system utilization by one therapist and one dyad of a child with autism and the mother. The system was applied to the child's evaluation phase of an entire parental training cycle in the Brazilian Portuguese language context. Through the interviews and questionnaires, all users claimed they considered our solution adequate and robust for its purposes. After comparing the child's performance in a baseline activity and an activity after the training session, the software was able to provide to the therapist the data to confirm an enhancement in the child's tact acquisition.

Keywords: Parental Training, Autism, Brazil, Artificial Intelligence, Attention Span Loss Detection.

1 Introduction

Previously to the need of social distancing brought by the COVID-19 pandemic, almost all the parental training for children with autism was made in person due to the advantages that performing this procedure in a controlled environment can provide to the therapists. Especially the advantages of instant correction and feedback that the therapist can give to caregivers and the in loco evaluation of the children progression. The parental training has shown to be a potential alternative to overcome the social distance barrier [1] and the so far available solutions to map and evaluate the children's

performance are few and, most of times, expensive [2]. We believe that Artificial Intelligence (AI) may play a key role for the next steps towards the progression of remote learning and autonomous assessment. AI contribution, in the scope of our studies, can be useful to such goal by automating mechanic tasks in the evaluation phase and potentially increasing the accuracy in autonomous measures and, consequently, optimizing therapist's and caregivers' available time.

Here, we are reporting the first steps we are taking into a deeper series of studies to validate our hypothesis, by presenting a high-level description of an innovative software to assess children with autism that had the tact learning acquisition mediated by their guardians. The presented system aims to support the therapist in this evaluation step by automating some tasks that were performed manually. Our proposal has three technical features to do so: an AI algorithm to detect attention span loss by face gaze; the storage of the answers gave by the children to every evaluation question of their selection in the 4 possible alternatives; and the audio record of the period of their answer.

2 The TeiAut Software

The here named TeiaAut is a software under development by the authors in the context of the *TEIA Educacional* project¹ - a Brazilian research collaboration group of Artificial Intelligence for education – adapted from other educational software developed for Human-Robot interaction activities [3]. It is not commercialized for being a program still in testing phase and can be requested for pilots and trial tests to its authors. For being applied in a Brazilian context, the software has all its functionalities in the Brazilian-Portuguese language.

The version used for these studies was developed in Python 3.8² and the Graphical User Interface (GUI) in PyQt5³. It also has OpenCV 3 libraries for the image processing and face detection algorithm of Haar Cascade, as used in [4]. For preserving the privacy of the participants, after processing the attention measures, the images are discarded. The users of this system are therapists and the caregivers of the children, that could be their parents or guardians.

The core of the evaluation process with the system is composed by a quiz-mode activity, in which a question is asked by a person (normally the therapist) in the video - or by the avatar of a robot with a synthesized voice - and the answers' alternatives are presented to the child as a multiple choice of images. Therefore, the therapists should prepare and insert the appropriate evaluation content into the system, the caregivers and children should perform these evaluative activities, and then the therapist will have access to the data collected from these activities later.

¹ www.teiaeducacional.com.br

² <https://www.python.org/>

³ <https://pypi.org/project/PyQt5/>

These three phases are named **Activity Design**, **Activity Execution** and **Data Validation**, respectively, and detailed in the next subsections. Figure 1 shows a screenshot of each one of these three phases.

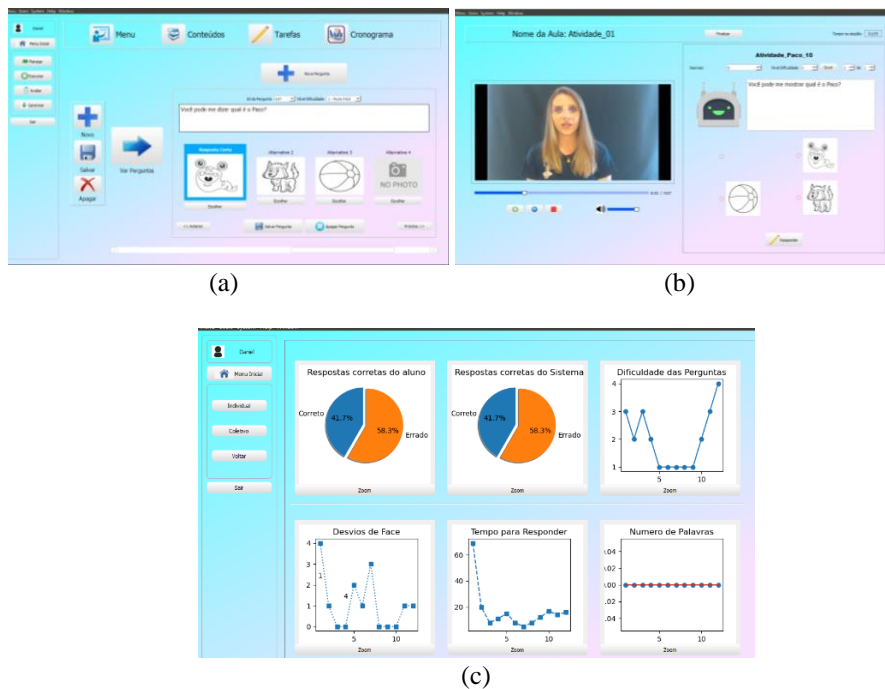


Fig. 1 Screenshots of Activity Design (a), Activity Execution (b) and Data Validation (c) phases⁴.

The Figure 1(a) shows the screen where therapists can create the questions, add the images of the answer's alternatives, associate a video to the question and type the text of the question.

The screenshot displayed in Figure 1(b) shows the software during the activity execution where it displays the video of the questions on the left section of the screen. On the right section, the robot avatar with (optionally) the written sentence of the question asked in the video followed by the possible answers as options of images are shown. In some questions, the current child might be only requested to speak loudly the name of the figure in the screen and then the caregiver is advised to click in the corresponding figure if the kid said it correctly. In any case, audio answers are analyzed and graded by the therapist in the next phase.

Based on all the information collected during the execution phase, the system calculates and displays the outcomes in the graphs, as shown in Figure 1(c). The measures are the number of right answers by the kid, the correct association of answers by the system, the difficulty of the performed questions, the face deviation count, the time the

⁴ A demo video of this phase can be seeing at the <https://youtu.be/R3zuw4C7NpQ>

child took to answer each question and the number of spoken words. Thus, it is worth highlighting that the measures presented in graphs second, third and sixth (top left to bottom right) corresponding to these measures are not quite useful in the current version but a when the system would autonomously analyze verbal vocal answers and would aim to adapt the difficulty of the question for each child.

3 Final Considerations

In this paper, we described a software which aims to facilitate the therapists' task of assessing tact acquisition mediated by parents. Initial feedback from therapist and parents supported our hypothesis that this proposal has potential to contribute to parental training in the context that it was applied.

In an initial validation, the use of the software was evaluated as very positive by the therapist and caregivers in interviews after using the system, especially in the aspects of data reliability and time optimization. Experiments with a larger population are already ongoing for a more complete and accurate evaluation of our program.

On a technical level, the data collection afforded by TeiAut allows the training of Machine Learning models to further aiding therapists in this task. More AI algorithms, such as recommendation systems and NLP methods are also easily to be aggregated to this solution. As said beforehand, these are goals to the new versions of the software.

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