



# Ergonomic and Usability Analysis of Platform for Communication of People with Limited Talk

Caroline Torres<sup>1(✉)</sup> and Marcelo M. Soares<sup>1,2(✉)</sup>

<sup>1</sup> Federal University of Pernambuco, Recife, Brazil

<sup>2</sup> School of Design, Hunan University, Changsha, People's Republic of China

**Abstract.** The educational applications developed for smartphones inaugurate a new form of interaction, since the experience of use happens with the touch of the fingers on the screen, allowing a greater control on the interface. However, because it is a recent equipment, it still needs studies that lead to the adequate development of these applications, especially when these involve the internalization of knowledge beyond the operational level. Therefore, they involve conducting usability tests and analyzing the results.

Previously, projects were carried out for certain segments of the population today, designers should think about the wide variety of existing consumers and their limitations. Thus, a design project must contain features that can encompass as many users as possible; what we call universal design. These types of concerns aim to improve the usability of the product and facilitate its use for the largest number of people, including left-handed people, elderly people, people with disabilities and/or people with special needs, always observing their daily lives.

In this context, this research aimed to study the most appropriate way to present educational content on smartphones, starting from the methodological analyzes of Leventhal and Barnes (1998), regarding three applications: LetMeTalk, Aboard and Jade Autism. This work will not only focus on the ergonomic and usability analysis of platforms for alternative communication, but above all on the learning efficiency and skills of people with speech limitations, such as autistic individuals.

**Keywords:** Communication media · Users · Limitations · Universal design · Usability · Autism

## 1 Introduction

Design has always been related to various areas of knowledge, such as psychology, engineering, art, and lately it is increasingly related to usability, where product design has shifted from being object-centric to user-centric (Iida and Buarque 2016).

From the advances in technology, the market for consumer products was characterized by constant changes, including more user interaction and practicality with tools such as smartphones and tablets, which appeared in the market in 2007. Combining this advance in technology, With the number of people who somehow need to use an alternative medium to communicate, digital tools have increased in importance. As a result,

content production also had to be rethought and adapted to these new ways of relating to learning, always thinking about the user and how he will handle the artifact in his daily life and how it will positively influence in their learning development (Traxler 2007).

Every day millions of people still seek full inclusion in society, as they have difficulty communicating, moving around, shopping, using transport, and still suffer from it. One alternative that many researchers have been working on and refining for years is the use of digital technologies to improve communication for this group of people, such as mobile apps. An entire path had to be trod to achieve the goal of creating a mobile app that could greatly benefit the treatment of children with autism, for example. Initially, it was necessary to establish milestones in order to define the necessary steps for the construction of an efficient and effective tool. The first step outlined was to understand the particularities of the autistic universe. Knowledge of the symptoms, characteristics of the autism spectrum, specificities, peculiarities, variants and other details of this universe was fundamental, after all, all software needs to adapt to the real needs of its target audience, which in this particular case are children with autism (Farias and Cunha 2013).

## 2 Methodological Procedures

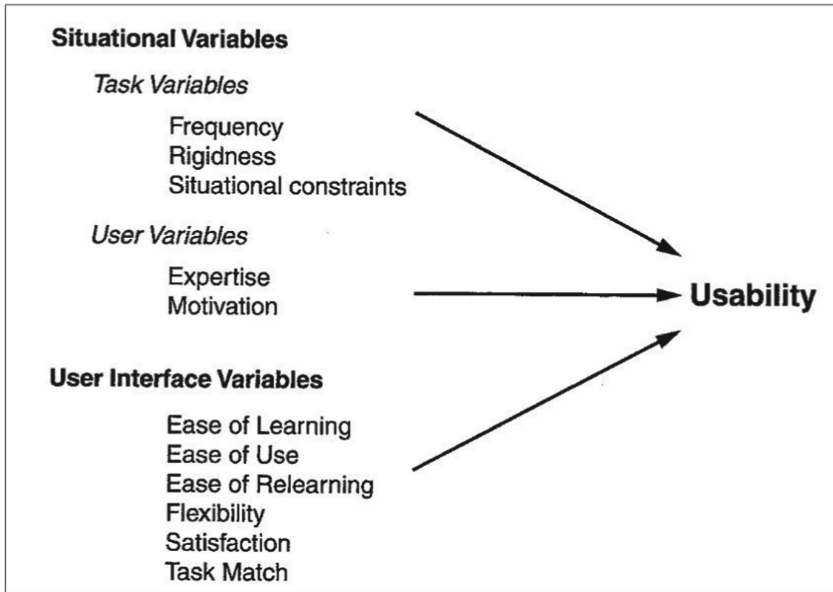
For this study we analyzed applications that could be evaluated by usability principles. These are: Jade Autism, LetMeTalk, and Aboard, which are available for free from App Stores accessed by people around the world to seek information, entertainment, and other content that can help the everyday lives of people with disabilities. speaks. The principles studied here and led to analyze the applications in question were proposed by Leventhal and Barnes (1998), for the evaluation of their interfaces.

The methodology of this research is qualitative and quantitative, composed of two phases: the first, theoretical and analytical, aims to identify the methods, techniques and/or tools directed to an ergonomic and usability evaluation of communication applications; The second part consists of a field study, divided into similar steps, with questionnaires, interviews and observations on the handling of the applications studied by the research subjects on smartphones, in order to verify the effectiveness of these applications.

The research is initially grouped into 20 subjects: 5 autistic children, aged 2–8 years; 5 fathers or mothers of these autistic; 5 speech-language and 5 occupational therapy professionals; recommended by Nielsen (2006) for quantitative studies.

Regarding the methodology itself, for this project was chosen the methodology of Leventhal and Barnes (1998), because it presents more complete principles in relation to systems interface and welcomes other methodologies for itself, such as the models developed by Shackel (1991), Nielsen (1993), and Eason (1984) for usability analysis on software and websites.

According to Falcão and Soares (2013), the proposed model is an attempt to put together the most important factors of the three models that were considered, and assumes that a number of variables that are taken together will determine if the interface has good usability. These variables are divided into: situational variables and user interface variables, as illustrated in the Fig. 1.



**Fig. 1.** Usability model proposed by Leventhal and Barnes (1998). Source: Falcon and Soares (2013).

According to the situational variables, the frequency was recognized by Eason (1984) as a usability influencing variable, since if a task is performed too often, it becomes easy to perform later due to the memorization of the sequence by the user. Rigidness is linked to the amount of options that are available to the user to perform the same task. If many options are available to the user to complete a task, the level of stiffness is low. In this case, an interface that offers a simple and clear sequence should be friendlier than one that has an unclear sequence. Situational constraints refer to more specific constraints, such as knowing whether the task has unusual characteristics or whether a safety procedure must be performed before it can be executed, for example. Regarding situational variables related to the user, Eason (1984) realized that experience and motivation can directly influence the usability of a product or system. The user who has previous experience with a similar activity, will certainly be easier to use a product. Assuming the same assumption, a user who is more motivated to perform a task will certainly do it more easily and successfully (Araújo et al. 2017).

### 3 Applied Study

Aware that technology has proven beneficial in many sectors, including health and education, as it enables the automation of various tasks and facilitates the accounting of treatment outcomes, it is believed that the use of computer resources will generate positive impacts on the treatment of people with disabilities, since it has an increasingly ubiquitous character in the everyday life of society (Farias and Cunha 2013).

The significant evolution of mobile technologies has expanded the options of digital inclusion strategies and features as they allow interaction anytime and anywhere without the limitations of time and space as they are connected to wireless networks. Integrate mobility, communication and processing power (Hassan and Al-Sadi 2009). Visual stimulation, as it is worked on in training methods such as PECS and TEACCH, tends to ensure a child with ASD - Autistic Spectrum Disorder, for example, to better express their feelings, such as discomfort or need for something. For this, many professionals in the field of occupational therapy and speech therapy prefer the use of these learning mechanisms, where the child will have more freedom and options in social development, for example.

### 3.1 Speech Development Applications

The following are the three applications that will be used in this dissertation for ergonomic and usability analysis. They are: LetMeTalk, Aboard and Jade Autism.

LetMeTalk is an app that originated in Berlin, Germany, and is funded through donations, so it's free. People can easily find it for download from the Play Store or the official app page: <https://www.letmetalk.info/download.html> and can be used for Android or Apple IOS. On first use of LetMeTalk, the app will download a data packet with all images (about 70 Mb), then no need to stay connected anymore (LETMETALK - <https://www.letmetalk.info/en>).

LetMeTalk's proposal allows you to align images so that your set consists of meaningful sentences. Image alignment is known as ISPC (Pictographic Symbol Interchange for Communication, PECS) or CAA (Alternative and Augmentative Communication, AAC). The interface (Fig. 3) consists of several categories, where the professional, family member or even the user with preserved movements can navigate and assemble phrases according to their needs. The application comes pre-configured for children with autism spectrum disorders and has voice support for the images and phrases already established and for those that can be added later by the user and/or professional who helps with the use of LetMeTalk, in the languages: English, Spanish, French, Italian and German. Other languages supported without voice support: Chinese, Portuguese, Brazilian Portuguese, Arabic, Russian, Polish, Bulgarian, Romanian, Galician, Catalan, Basque (LETMETALK - <https://www.letmetalk.info/>) (Fig. 2).



**Fig. 2.** LetMeTalk – screen. Source: LetMetalk (<https://www.letmetalk.info/>)

Jade Autism is an application for stimulation and development of autistic and down syndrome children. According to its developers, it is a game that stimulates cognitive development, memory, reasoning, skill and performance, and reports on the child's performance during the game, providing valuable data for the therapists involved to apply the game. best therapeutic plan and address the difficulties/deficiencies presented (JADE AUTISM). This game that was designed by Ronaldo Cohin, father of an Autistic child, and a student of Computer Science, from the University of Vila Velha - ES, had the validation and collaboration of APAE-ES speech therapist, Adriana Mallini. The idea for the creation of JADE came from his experience as a parent of a child with autism and immersions made at the Association of Parents and Friends of the Exceptional (APAE-ES), to elaborate the concept of the application. Any child can use Jade as long as they need cognitive stimulation. The example of: Neurotypic children; Autistic Children (ASD); Children with Down Syndrome (T21); Children with Attention Deficit Disorder, with or without Hyperactivity Disorder (ADHD and ADHD); Children with any unspecified syndrome with cognitive comorbidities (JADE AUTISM).

The following figure (Fig. 4) shows the Jade Autism application home screen. Note that for a better assessment by professionals who help autistic, for example, has the option of "results", thus, it is possible to have a better analysis of user development against the application.



**Fig. 3.** Jade home screen. Source: Google Play - Jade Autism

Finally, the "ABoard" Software (or Portuguese "Prancha Assistive") is an Augmentative and Alternative Communication (CAA) application for tablet (Fig. 5), whose differential is its ability to give suggestions, which speed up the production of meaningful sentences (ASSISTIVE GROUP). It was developed by researchers from the education and computer centers of the Federal University of Pernambuco - UFPE, in order to benefit people with some speech limitation. With the use of this app, people with stroke

sequelae; head trauma; children with cerebral palsy; autism; people with intellectual disabilities; Down's syndrome; are having the ability to communicate better (ASSISTIVE GROUP - <https://www.facebook.com/AssistiveCAA/>).



**Fig. 4.** Aboard. Source: Assistive CAA

“The app is based on the use of symbols, images, which are easier to understand. Therefore, when choosing a symbol or image, he or she is choosing a word or set of words that will express that person’s desire and interest. And the set of these symbols form a sentence, where this sentence will express what he wants to communicate.” Robson Fidalgo (ABorad Project Coordinator).

The high technology of the vocalizers (boards with voice production) or the computer with specific software, guarantee the communicative function great efficiency (Promines Institute 2017). This is how applications today seek to adapt their settings to this type of feature, aiming at the development of user speech, such as LetMeTalk, Aboard and Jade Autism.

## 4 Analysis

There are several types of product usability assessment that can be classified by subject, data collected, and purpose. For this research, the following methods were selected: Interviews Observation, Thinking Out Loud, Cognitive Walkthroughs Method, Questionnaires, that fit the methodology of Leventhal and Barnes (1998).

### 4.1 Interviews

Initially, 5 autistic parents and/or family members were asked to participate - direct users of the applications mentioned here. These volunteer family members were interviewed informally to find out: 1) the age of the autistic child, 2) the degree of autism, 3) other characteristics of autism that this child could have, 4) when diagnosed, 5) if you use medication, 6) if you have professional supervision, 7) if you go to school, and 8) if you use some method of training/speech development and skills. All interviews were conducted with the responsible parents of the autistic child, where they have direct

contact with the child; which is included in the research as an inclusion factor for this method. In addition, both parents and autistic children conducted interviews at their homes, without the need for movement or distance from their usual place, which helped in the development of the task. All parents reported that their children have professional supervision; This corresponds to 100% of the autists observed. This same totality goes to school, however, an important point to note is that only 70% have this same monitoring in schools. That is, the child has access to education but, in the classroom, does not have adequate help for daily activities. Regarding the use of assistive technologies, to aid in the development of speech, skills and socialization of children, 90% answered that their children have the habit of using smartphones for games and other applications that help in this process.

## 4.2 Observation

According to Gil (2006) the observation “constitutes a fundamental element for the research”, because it is from this that it is possible to delineate the stages of a study: formulate the problem, construct the hypothesis, define variables, collect data and so on. It was following this line of reasoning that the field observation method was one of the first to be performed. On the same day that interviews were conducted with relatives of autistic children, these users were observed with the applications under analysis in this study. It is noteworthy that there are different levels of participation, and the researcher can, from just watching, to acting in the situation object of observation. Thus, the observation presented here was semi-structured, given that the researcher has already arrived at the site with a table, previously prepared, about the methodology of Leventhal and Barnes (1998), in order to make the observations. Based on the same, where the observations were made 100% at the usual place of the autistic, that is, in their homes, with the prior permission of the parents. During the presentations or parent responsible for the child, each application and its functions are displayed, so that a child familiar with a technology and an interest in showing their emotions and uses it on the spot. I have always followed the same order: LetMeTalk, Aboard and Jade Autism. It was requested to register images of the child manipulating the applications, however, without showing the face, as shown in the following images.

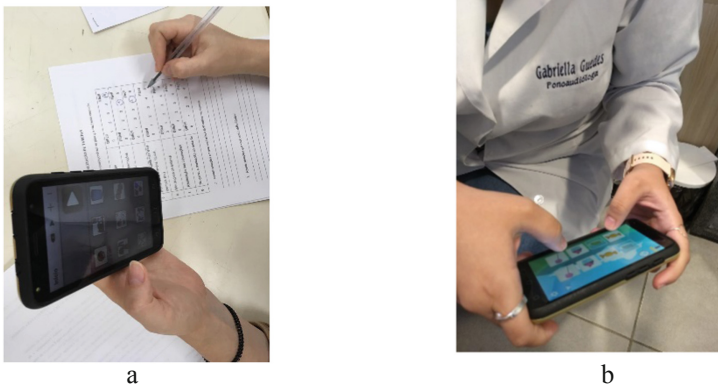
## 4.3 Thinking Out Loud Method

The Thinking Out Loud Method was performed with all 10 (ten) volunteer professionals: 5 (five) Occupational Therapy and 5 (five) Speech Therapy. For inclusion criteria in the accomplishment of the methods it was necessary that the professionals had at least some experience with training methods and/or applications to aid in the communication of people with speech difficulties. For this method, each participant was asked, while handling the application (Fig. 6a, b), to report their experience and actions, in order for the researcher to acquire more information.

At the professionals' first contact with the LetMeTalk and Aboard applications, they all referred to the PECS training method. For those who had not handled the PECS, but had visual memory made by studies in their profession, they also found the application



**Fig. 5.** a: autistic 1, b: autistic 2, c: autistic 3, d: autistic 4, e: autistic 5. source: Author



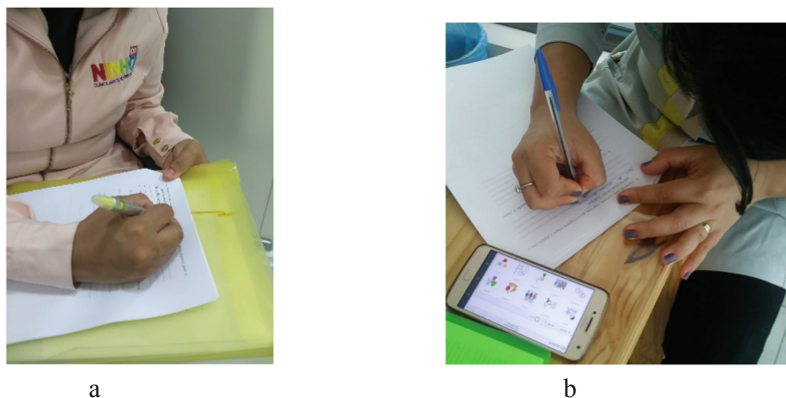
**Fig. 6.** Professionals handling applications for comparative analysis. Source: Author

very similar to the method. What they also didn't like about the app was the robotic voice that the app emits when clicking on an image or forming phrases.



#### 4.4 Cognitive Walkthroughs Method

This technique was performed in conjunction with the Thinking Out Loud Method. An evaluator or group of evaluators inspects the interface of a product and/or system to assess the ease of understanding and direct user learning of that product which, in this case, it's autistic (Fig. 7).



**Fig. 7.** Professionals handling applications for comparative analysis. Source: Author

Faced with the combination of two methods: Thinking Aloud and Cognitive Walkthroughs Method, as occupational therapy professionals, who responded to research, concluded 100% of autistic children, when the LetMeTalk manuscript is very easy to use. app. Thus, an assimilation of information contained in the application, very easily. One variable that questioned professionals a little more was the Nomenclature used. They explain that the application is very good, has a lot of information, but the terms used are not entirely allowed for children, with words that are difficult to pronounce.

#### 4.5 Questionnaires

A questionnaire is not an official type of form, nor is it a list of questions gathered without prior planning. Rea and Parker (2000) define a questionnaire as a series of unstructured and well-structured questions that will systematically obtain the information sought by the researcher. Thus, this method gathered 4 opens questions for each professional, occupational therapy and speech therapy, in order to, together with the other methods already performed, better evaluate the LetMeTalk, Aboard and Jade Autism applications, against Assistive Technology and the development of speaks of autistic children. They were:

1. "Point out situations where you found the system easy to use"
2. "Point out situations where you had difficulties"
3. "Given the test, do you think the program has achieved the goal for which it was developed?"

4. “The space below is reserved for you to express your opinion and suggest system improvements”

As it was possible to observe while asking all the questions, the LetMeTalk and Aboard applications have a lot of similarities between them. Both reach their goals of helping in the speech development of autistic children, but, a pertinent characteristic is, as most professionals said, the use of robotic speech. As the intention is to distance the autistic person from this characteristic, applications aimed at communication should emit a more personified voice. The Jade Autism application, which was initially developed for the communication of people with limited speech, did not meet this need in this regard. As the professionals already mentioned, if it is to develop skills, environmental perception, etc., that’s fine; another function would not fit the application.

## 5 Results and Discussions

As it was possible to observe during the realization of all the methods, the LetMeTalk and Aboard applications have a lot of similarities between them. According to the professionals who participated in this study both achieve their goals of helping in the speech development of autistic children, but a relevant feature is the use of robotic speech. As the intention is to distance the autistic person from this characteristic, applications aimed at communication should emit a more personified voice.

An important point in the Cognitive Walkthroughs Method that was made by one of the professionals was the need to include images and words with the way of speaking in some regions. It is understood that the applications are for worldwide use, anyone, from anywhere in the world can download and use perfectly, but this idea of getting closer to the environment in which the child is inserted helps even more in the development of communication.

A relevant fact about the layout of the applications is the size of the images and the way they are arranged on the device. As well as, the rotation of the screens. According to the Thinking Out Loud Method, performed by professionals, the LetMeTalk can be handled vertically or horizontally, but Aboard cannot. And this is a factor that makes it difficult at times when teaching autistic children, as some speech The Jade Autism application, which was initially developed for the communication of people with limited speech, did not meet this need in this regard. As the professionals have already mentioned in the questionnaires, if it is to develop skills, environmental perception, etc., that’s fine; another function would not fit the application. It has different types of game categories, but it does not have many levels, which makes it a repetitive and tiring task. It draws the user’s attention due to colors, animals, etc., but does not have the corresponding sound. So, some details that can be easily adjusted, are the ones that can make the application a very good tool for autistic children to develop a better perception of the things around them.

## 6 Conclusions

When it comes to Assistive Technology and Augmented Communication, it is very difficult not to encompass design. He is the one who will be part, from the creation of

platforms that will help in the development of people with speech limitations, to the environment that the user will be inserted. An example of this is the participation of one of the applications analyzed here at the REC'n'Play Festival, held in the city of Recife, in 2018. "Held by Porto Digital", the Festival aims to transform and connect people of different backgrounds and intellectual backgrounds. to think about solutions to city and society problems.

Because the issues covered about autism are so intense and there are several communication failures between parents and schools, government, etc., graphic design is becoming a part of this world as it begins to bring information to everyone, whether through social networks, that are full of content, whether by books. And one of those very helpful books is, "Ten Things Every Child with Autism Wishes You Knew," by Ellen Notbohm. The version released in 2012 comes with in-depth updates and analysis on communication and social skills issues (Focus Intervention 2019).

Another major contribution to design is the awards apps have won, such as Jade Autism, which won first place in the BioInnovation Challenge 2019 (JADE AUTISM).

When talking about universal design care must be taken when referring to products and/or objects that can be used by all types of people. What is not true. What will exist is a series of criteria to be analyzed when developing a certain product so that it is cheaper to develop it with characteristics to accompany certain groups of people, with limitations or not, than, over time, adding special apparatuses to shape the object for use by this same segment of the population. Each person has their specific characteristics and when joining a group of people with similarities in these characteristics, such as intellectual disabilities, we need to analyze their daily life and how this user will deal with the product in which they are inserted.

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