

Vox4All – The Voice at Your Fingertips

Secundino Correia, *secundino@imagina.pt*

Patrícia Correia, *patricia@imagina.pt*

Mafalda Mendes, *mafalda.mendes@imagina.pt*

Imagina, Coimbra, Portugal

Abstract

The increasing dissemination and wider access to mobile devices, as well as the spread of applications in several areas requires us to rethink the technologies for Augmentative and Alternative Communication (AAC). There are now over a hundred applications for AAC available on the market, at a considerably lower cost when compared to traditional communications systems. In this paper we present a benchmarking study of the most relevant and the results of an inquiry. Both lead us on the design and specification of the new app Vox4all® that will be iteratively refined and tuned to meet the end users needs using a case study methodology. Facing the challenges of a new era for AAC technology, we are combining theory and practice on the development process of a specific application.

Keywords

Augmentative and Alternative Communication (AAC), Multiplatform, Vox4All, mobile device, Widgit Literacy Symbols (WLS)

RESEARCH CONTEXTUALIZATION

Developing software only for computers is an exhausted paradigm due to on-going and already verified changes, both in terms of hardware, with the emergence of mobile devices, and in terms of access and interaction with the software and the contents.

Given the need to change paradigms and adjust to the new trends in emerging technologies, Imagina® brand working in the areas of inclusion and education, has an on-going research and development project called TOPQX (Everyone Can Learn Anytime, and Anywhere). The project aims to bring together a set of theoretical and empirical resources to form a scientific basis from which it will be possible to discuss and suggest new solutions, suitable to the needs and interests of our costumers. Our purpose is to develop a new generation of tools and resources for education and training throughout life, available on any platform or device, anytime, anywhere and in any language.

The project wants to respond to groups of people with different characteristics and needs, so it is necessary, from the methodological point of view, foresee and work on different strategies and approaches according to the segment of the target population.

Vox4All® being a sub project of TOPQX project, is a tool designed to minimize and overcome communication problems. It intends to provide people with sensorial, cognitive or motor deficit, with diseases, disorders or other limitations that somehow compromise the ability to communicate, a system of augmentative and alternative communication to meet their communication needs.

The planning and development of this solution entailed a structured research work, using the case study as an exploratory research strategy suggested by Yin (Yin, 2005). Research conducted followed closely the assumptions of this methodology.

Before starting the development of Vox4All® it was necessary to evaluate its relevance and understand which features set should be included so the product could enter and compete in the market. For this purpose it was conducted a benchmarking study, consisting on a research process "continuous and systematic to evaluate products and work processes of organizations that are recognized as representing best practices for the purpose of organizational improvement" (Spendolini, 1993). Thus, it has been done a review and analysis of several available applications on the targeted market for augmentative and alternative communication.

Then we prepared a quantitative study, resultant of a survey aiming to understand what were the real needs and expectations of the public that the solution is intended to attend.

Finally, we gather and organized all the collected information using different technical means, so we could respond to the guiding questions and critically filter the studied problem with the theoretical conceptual elements that supported the study.

AUGMENTATIVE AND ALTERNATIVE COMMUNICATION SYSTEMS

Communication is a basic but complex process for the development of the human relations. When communicating, the more used way of expression is to talk. Speech not only empowers human's interactions, but also develops cognitive skills and thought, allowing new and more elaborated learning (Ramos & Moraes, 2009). However, "a significant number of the population is unable to communicate through speech. These may be people totally unable to speak or cases in which speech is not enough to fill all the communicative functions (...)" (Tetzchner & Martinsen, 2000). The causes can be countless, from the bad use and vocal abuse, to hearing, cognitive, neurological, emotional and amnesic disorders, to cerebral injuries, cerebral palsy or strokes (Franco, Reis & Gil, 2003).

To override the need of communication, intrinsic to the human being, it is important to provide to these people, as early as possible, a System of Augmentative and Alternative Communication (AAC), in order to replace or supplement insufficient communication skills (Ganz & Simpson, 2004). Many times, the system of communication functions as a tool for fighting to the already mentioned disorders, constituting "a set of techniques, aids, strategies and skills that a person without oral communication needs to replace or minimize their inability to communicate through speech" (Nunes da Ponte & Azevedo, 1998) and also, in other cases, to promote the speak capability.

The AAC has arose and grown from the most basic desire to help individuals with Complex Communication Needs (CCN) to express themselves and interact with the community (Howard, 2012). The AAC was a field that was born in Canada in the 70s, but it was in the 80s that it expanded to the United States and achieved more notoriety as a result of a multidisciplinary approach that recognized the right of communication to all individuals without exception (Gava, 1999). In recent years there has been a major concern with this area and its consequent evolution.

Communication systems can be classified in several ways (Heller, 2004), the more common terminology is: no technology - the individual uses only his body to communicate, for example through gestures; low technology - these systems do not use electronics, but involve materials outside the body of the individual, such as books and cards with pictures and symbols; high technology - these systems "include the use of electronic communication boards and / or computerized speech synthesizers" (Hanline et al, 2007).

Until recently these systems of AAC were only available in paper, speech digitizers and computers, limiting communication to a particular place due to its size.

The widespread of mobile devices triggered a huge range of applications for various fields such as industry, entertainment, education and health. This influence is also extending to people with special needs, particularly in terms of communication. Apps developed especially for communication can be extremely attractive, both for people with communication problems, and for their families and professionals.

“The normalization of tablets or other mobile devices has taken the mystique out of AAC. AAC is likely to penetrate a much larger market, for example someone who has temporarily lost her ability to speak. Also these new tablets and communication Apps may appeal to families of very young children, individuals with autism and others who may not have traditionally thought about AAC. Also AAC may become an option sooner, because of the affordability and the accessibility of communication Apps” (AAC-RERC, 2011).

Furthermore, these devices are multi functional because they provide continuous access to information, social networking, entertainment, music and games. Smaller and therefore easier to transport, faster and simpler to use, they are an alternative economically cheaper in comparison to the equipment with the sole purpose of providing a communication system.

The Vox4All® is a tool for augmentative and alternative communication developed for tablet and smart phone whose main goal is to overcome and minimize communication problems. This tool is based on the principle of communication grids with symbols. These grids use a pictographic system enabling people with difficulties in communicating to express themselves, demonstrating their opinions, wishes, feelings and decisions. A pictographic system allows the representation of messages using symbols. There are various symbol systems specifically developed for AAC including Picture Communication Symbols (PCS), Widgit Literacy Symbols (WLS), Makaton, Bliss, among others.

However the use of such systems requires the knowledge of the symbols meaning and a high concentration by the communication partner. The introduction of voice output and recording in communication systems minimizes this problem. Appeal to the use of voice and sounds makes these systems more personal and approach communication to their natural form.

Thinking, planning and developing a communication system requires knowledge of the needs, expectations and characteristics of the audience you are addressing to. Concerning the use of augmentative and alternative communication, the target group is very heterogeneous, and it is therefore necessary to provide a response to different degrees of disability and age, providing access to the system, interaction and content appropriate to the skills and communicative needs of these different people.

METHOD

Several authors, such as Yin (2005) and Stake (2005), mention the case study methodology. A case can be something very definite and concrete, as a person, or a group of professionals, but it can also be something less defined or set on a abstract plane as a program or set of programs, implementation processes or other category that refers to a unit of analysis. It is always necessary to provide three sequential procedures: the definition of a case study, the option for a single case or multiple cases, and the depth of a theoretical problem justifying the protocol of collecting empirical information and lines of analysis of the collected data (Yin, 2005).

In the first phase of the project we performed a market analysis and a subsequent comparative study. This process is commonly referred as Benchmarking and

has as its main purpose to improve business performance and achieve superiority over the remaining offer in the market.

After the Benchmarking study and evaluation of the appropriateness of developing an application in the area of AAC for mobile devices, it was performed a quantitative study. We applied a structured questionnaire survey to understand the real needs of the end user of the application and to meet their expectations. The Vox4All® is intended for people with problems and communication difficulties. However these people are not always able to communicate what they expect to see in a communication system. So in most cases the rehabilitation professionals and family members are the ones who build and integrate systems for using AAC in their lives. So, we designed and structured the questionnaire to be answered by the rehabilitation professionals, from speech therapists, occupational therapists, special education teachers, psychologists and rehabilitation engineers.

Benchmarking

The starting point for the comparative study was an inventory of several applications for tablet and smart phone in the area of AAC, already existing in the market for Android and iOS operating systems.

We analysed about 40 available applications on the market, but only 8 (see Table 1) were subjected to an intensive analysis, because they gather a larger number of features, best practices and a higher level of innovation.

These findings were fundamental to the development of a better solution able to challenge the market competitors. However, a truly innovative new product should be designed to go beyond industry benchmarks and this is why we need end users feedback by the means of the questionnaire and data from direct observation using the case study methodology.

Inquiry: Questionnaire

In a complementary way, we developed a quantitative study, which had, as objectives to understand the extent to which potential customers are receptive to the migration of traditionally AAC systems available in paper, digitizers and computer to devices such as smart phones and tablets. We pretended as well to measure the preferred features that such software must have.

When designing the questionnaire we identified the main aspects to focus and grouped all the issues into five themes: the respondent's profile, product knowledge and general satisfaction, product features, distribution and product information, and purchase intent. In total 37 respondents answered, from around 400 questionnaires sent by email.

Regarding the respondent's profile, about 36% of respondents had jobs other than those specified, including psychologists and rehabilitation engineers.

Most people who responded to the survey were aged between 25 and 54 years. The questionnaire reached different groups of people, from people with many years of professional experience to people who have recently started working in the area of rehabilitation linked to communication.

In respect to the symbols systems, Picture Communication Symbols (PCS) were considered the most complete and intuitive, followed by the Widgit Literacy Symbols (WLS).

The suitability for different ages and the autonomy offered to AAC users are the characteristics that most satisfied the respondents. On the other hand, the organization of communication grids is the characteristic that is less satisfying.

Respondents also reported some characteristics why they like a particular product type, such as: the use of speech synthesis and word prediction, portability and touch screens, display of the contents appealing as well as simple and the intuitive use of images.

Most respondents said that the initiative to use these kind of products is uniquely from the professional and rarely from the patients/clients. However, the reaction of the users is generally positive

None of the respondents considered advantageous that the migration of traditional boards for augmentative and alternative communication is made exclusively to smart phones.

About 33% consider that migration should be done only for tablet, while the vast majority, 67%, believes that the ideal is that this application could be available on both platforms: smart phone and tablet. The Android and iOS operating systems are preferred for the majority of respondents supporting an application directed to AAC.

Table 1: Applications analysed in the Benchmarking study with coloured bars showing which features are present in different applications

Code	Application Name	Operating System		Platform
		Android	iOS	
A	Augie AAC			Tablet
B	AutisMate			Tablet
C	Expressive			Smartphone and Tablet
D	MetaTalk			Tablet
E	Livox			Tablet
F	Proloquo2Go			Smartphone and Tablet
G	Que-Fala!			Tablet
H	Talk Tablet			Tablet

		Features	A	B	C	D	E	F	G	H
Edition communication grids	Sound/Speech	Speech synthesis								
		Sound Recorder								
		Load audio files								
		Import Internet								
		Customize the voice								
		Regular speech velocity								
	Image	Symbol library								
		Clip-art								
		Upload files image								
		Import Internet								
	Cell/grid	Associate the cell text								
		Associate the audio cell								
		Create text-only cell								
		Change position of cell								
		Indication of selected cell								
		Create dynamic content cells								
		Allow cells of different sizes								
		Add categories								
		Message window								
		Access to keyboard								
	Appearance	Choose background color of the cell								
		Choose background color from page								
		Choose color contour								
		Customize font (type, color, size)								
		Edit message window								
		Edit Customize font (type, color, size)								
Configuration		Editable PC								
		Distinction between Admin mode. and user								
		Creating multiple user profiles								
		Share grids communication								
		Export grids to print								
Accessibility		System Scan								
		Set time click								

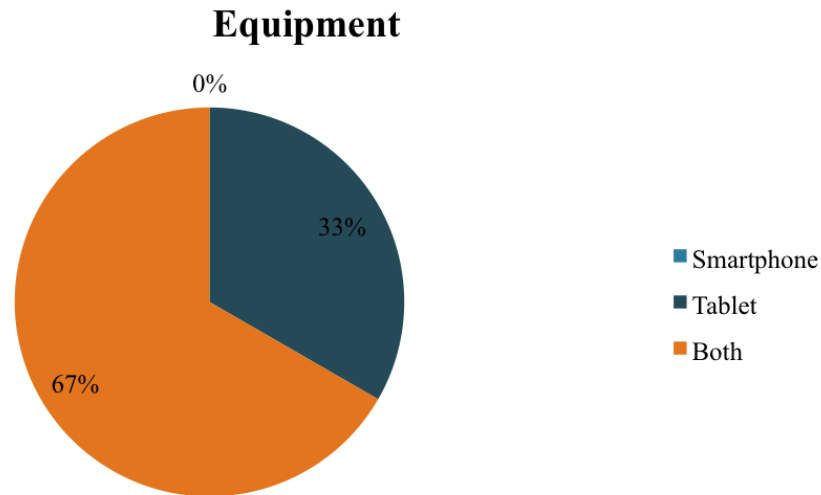


Figure 1: Equipment

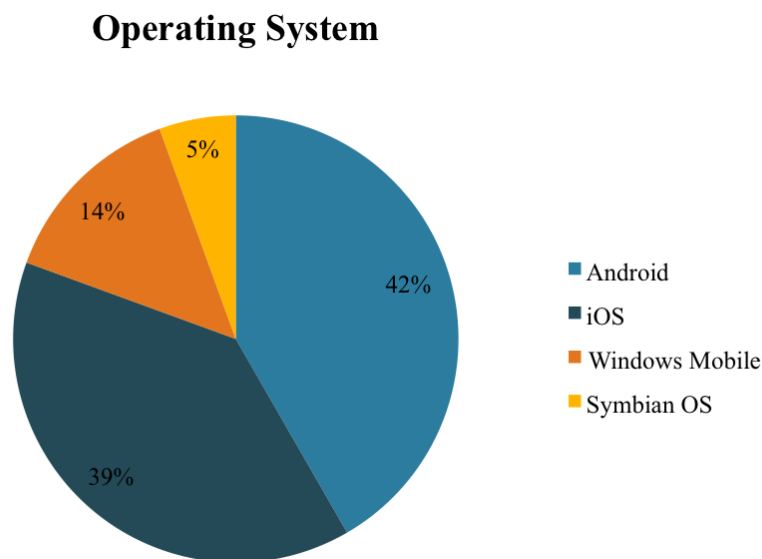


Figure 2: Operating System

When editing the communication grids, the most important feature for the majority of people is the use of a symbol system. Next, in descending order of importance are: ability to import audio, ability to write text for use with speech synthesis and finally, considered less important, the ability to import images.

In the opinion of most respondents, 72%, communication grids should be predefined but allowing changes in order to adapt them to the different needs of different users.

When choosing a product, the accessibility and functionality of the product are the factors that most influence the decision. On the other hand, the design and point of sale are the factors with less influence on the choice.

About 42% of respondents prefer to purchase products over the Internet, while 33% prefer to buy products in specialized companies. The remaining 25% consider that the best place to get this type of products is in large distribution networks for electronic products.

With regard to the intention of buying the vast majority of respondents revealed to be willing to pay for the product, only 14% of the respondents indicated that they were not willing to pay for this type of product.

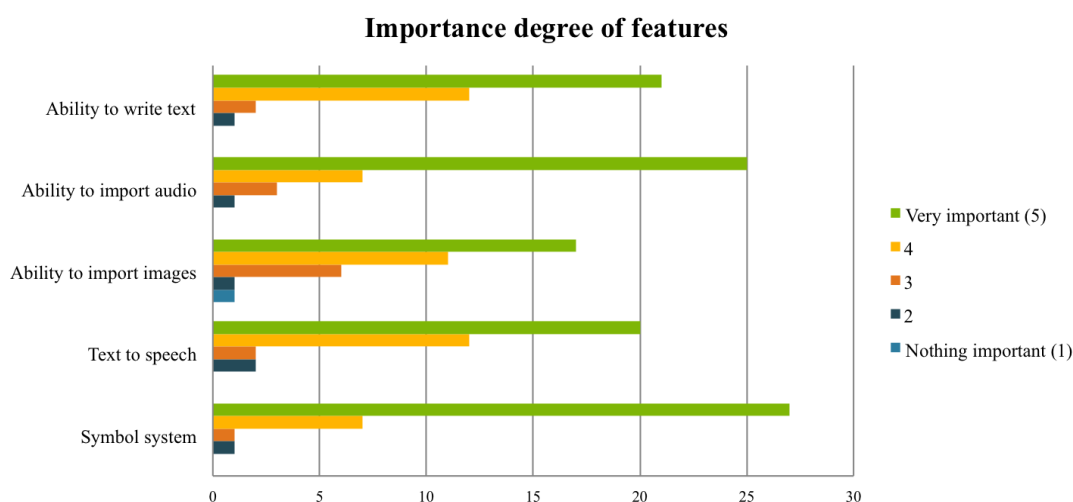


Figure 3: Importance degrees of features

SPECIFICATION AND IMPLEMENTATION

The specifications are the technical requirements that must be met by the product. They are obtained from the translation of customer needs into technical language, rules and other restrictions that must be met by the product. The specifications serve not only to guide the development of the product, but also to provide benchmarks for the tests to be performed on the prototype of the product.

Most AAC applications are not based on research tests. As a result, the expected benefits are not achieved, not because of the people who use the applications, but because of the poor design of AAC applications (Light, 2012).

Any software that was badly specified will surely disappoint the user and cause problems to the development team, that will have to modify it to suit customer needs.

Therefore, the conclusions of the benchmarking study and the questionnaire results support the specification of the first version of Vox4All.

The software is based on the principle of communication grids organized in rows and columns. Initially we implemented basic features such as the option to make cells with symbols or photos taken with the device's camera, as well as the possibility to record sounds and associate them to the cells. Whenever you touch a cell, you can hear its recorded sound and also open a new grid. The application Vox4all® initially included these set of features, however, by observing the user with CCN interaction, the therapists and the family, we perceive that new features should be tested and introduced into the application. The goal is to begin with a functional basic communication system and to extend it with new features supported by research, involving end users on the process of testing and evaluating. On one hand we are talking about features that facilitate the use of the equipment by users with CCN, for example the possibility to define the activation time of cell contents in situations where the user has the control of movements compromised, on the other hand we are also talking from the point of view of the professional regarding the easiness and consequent motivation to construct several communication grids. That is the customization of the communication grids should imply the minimum of effort and actions under penalty of discouraging people who build grids and consequently lead to a limited system that does not respond to the real needs of the users.

In this sense we realized that including photos on the cells only by capturing them directly from the built in camera was restricted because it did not allowed access to the files of the equipment and photographs taken at another moment. For example, the speech therapist wanted to build a "family" grid with photographs of the user's

relatives, however, for different reasons, could not take pictures of all member of the family. The alternative would be these familiars send the photos and later the therapist includes them in the cells, resulting in the need to implement this new functionality on the application.

Situations where the user has the control of movements compromised, on the other hand we are also talking from the point of view of the professional regarding the easiness and consequent motivation to construct several communication grids. That is the customization of the communication grids should imply the minimum of effort and actions under penalty of discouraging people who build grids and consequently lead to a limited system that does not respond to the real needs of the users.

In this sense we realized that including photos on the cells only by capturing them directly from the built in camera was restricted because it did not allowed access to the files of the equipment and photographs taken at another moment. For example, the speech therapist wanted to build a "family" grid with photographs of the user's relatives, however, for different reasons, could not take pictures of all member of the family. The alternative would be these familiars send the photos and later the therapist includes them in the cells, resulting in the need to implement this new functionality on the application.

CONCLUSION

Proper intervention in AAC area must identify a system that meets the communication needs of the person and at the same time is appropriate to their abilities. Therefore it's essential to perform an intensive research work by a multidisciplinary team that plans and develops these systems, with a special regard to the knowledge, experiences, needs and expectations of the intended public.

AAC systems can increase the capacity of existing communication or offer an alternative one, providing greater independence for its users and consequently a better quality of life.

The migration of AAC systems for mobile devices may exponentially increase the independence of people with special communication needs, allowing communication anywhere, in any context, bringing it closer to its natural form.

Currently there is a large supply of equipment such as smart phones and tablets with competitive prices, making them a more affordable and a more cost effective alternative to the use of computers or other equipment whose sole function is to provide an AAC system.

ACKNOWLEDEGEMENT

This project is co-funded by Imagina and Programa Operacional Regional do Centro: CENTRO-07-0202-FEDER-022839.

REFERENCES

- Franco M. G., Reis M. J., Gil T. S. (2003). *Comunicação, Linguagem e Fala. Perturbações específicas de linguagem em contexto escolar*. Fundamentos. Lisboa: Ministério da Educação. Accessed October 24, 2012. Available in: <http://www.slideshare.net/dulce910/23128537-comunicacaolinguagemfala>
- Ganz J., B & RL Simpson (2004). Effects on communicative requesting and speech development of the Picture Exchange Communication System in children with characteristics of autism. *Journal of Autism and Developmental Disorders* 34 (4): 395–409.
- Gava, M. L. (1999). AAC – Augmentative and alternative communication – como resposta às deficiências verbais. In: Tupy T M, Pravettoni D G ...e se falta a palavra, qual comunicação, qual linguagem? São Paulo: Memnon, 1999. p. 81-164.

- Hanline M., Nunes D., Worthy M. (2007). Augmentative and Alternative Communication in the early childhood years. *Young children on the web*.
- Heller K. W. H. (2004). Technology for assessment and intervention. In *Young children with special needs*, 4th ed., eds. S.R. Hooper & W. Umansky, 188–222. Upper Saddle River, NJ: Pearson, Merrill Prentice Hall.
- Howard C. et al (2012). Using AAC Technology to Access the World, *Assistive Technology: The Official Journal of RESNA*, 24:1, 3-13
- Light J., McNaughton D. (2012). Supporting the Communication, Language, and Literacy Development of Children with Complex Communication Needs: State of the Science and Future Research Priorities, *Assistive Technology: The Official Journal of RESNA*, 24:1, 34-44
- Nunes da Ponte M., Azevedo L. (1998) *Comunicação Aumentativa e Tecnologias de Apoio*. Edição CAPS/IST
- Pressman R. S. (1994). *Software Engineering: a practitioner's approach*. Euopean Edition
- Ramos M. G., Moraes R. A. (2009). Importância da fala na aprendizagem: os diálogos na reconstrução do conhecimento em aulas de Ciências. *VII Enpec — Encontro Nacional de Pesquisa em Educação em Ciências*. Florianópolis, Brasil, 8 de Novembro de 2009. Accessed October 24, 2012
- Spendolini M. J.(1993). *Benchmarking*, São Paulo: MaKron Books
- Stake R. E. (2005). *Investigación con estudio de casos*. Madrid: Morata, tradução do original de 1995, *The art of case study research*, Sage Publications.
- Tetzchner S., Martinsen H. (2000). *Introdução à Comunicação Aumentativa e Alternativa*. Portugal: Porto
- Rehabilitation Engineering Research Center on Communication Enhancement (AAC-RERC) (2011). *Mobile Devices and Communication Apps: An AAC-RERC White Paper*. Retrieved March 14, 2011 from <http://aacrerc.psu.edu/index.php/pages/show/id/46>
- Yin R. K. (2005) (ed). *Introducing the world of education. A case study reader*. Thousand Oaks: Sage Publications.

Biographies



Secundino Correia is Innovation Chief Officer at Imagina®, a brand name for educational and training tools from Cnotinfor. Currently is working on “Virtual e-Learning Companions”, “Serious Funny e-Learning Games” and “Multiplatform apps”. He is author and co-author of books and software tools in the field of ICT on Education and Special Needs.



Patrícia Correia is CEO of Cnotinfor with an Executive MBA by EGP Business School of University of Porto. She is researcher, software tester and writer for pedagogical manuals and textbooks for educational software. She is a credited trainer in Educational Technologies and Special Educational Needs. She also organizes and conceives classroom and on-line training courses.



Mafalda Mendes is doing a traineeship at Imagina® within a protocol with UTAD University. She is finishing a master degree in Engineering of Rehabilitation and Accessibility, a pioneer master at European level.

Copyright

This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivs 3.0 Unported License. To view a copy of this licence, visit <http://creativecommons.org/licenses/by-nc-nd/3.0/>