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AraBoard: A Multiplatform Alternative and Augmentative Communication Tool

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Abstract

We present AraBoard: an Alternative and Augmentative Communication (AAC) tool developed to facilitate functional communication to people with complex communication needs. The tool is formed by two different applications: AraBoard Constructor, for the creation and edition of communication boards, and AraBoard Player, for the visualization of the boards previously generated. The main features that distinguish our tool are that it is multiplatform, it is low-cost, and it is highly configurable, adaptable to a wide range of users' needs by modifying different parameters like the number and size of the cells, inclusion or not of audio, etc. The development has been assessed through 295 enquiries done via web. The answers have been analyzed and shown the high acceptance of the users.

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1. Introduction

Many people face challenges when trying to communicate with others through speech. For some, this challenge is due to a lack of familiarity with the language. For others, the challenge can be attributed to medical conditions that limit their communicative abilities due to speech, language, or physical impairments. Regardless of the cause of communication challenges, many tools and strategies can be employed to support communication. They are called Alternative and Augmentative Communication (AAC). Aided AAC ranges from low-technology strategies, such as picture boards, to sophisticated information technology based voice output communication aids (VOCAs).

Historically, AAC devices used proprietary hardware but, nowadays, developers are increasingly adopting smartphone platforms providing designers with new opportunities. Considerable effort has been invested in developing computer assisted AAC, resulting in a number of commercial and non-commercial offerings. Though differing in complexity and the range of features offered, these devices typically provide language support in the form of words and phrases organized into categories. As AAC users have a range of communicative abilities, use varies with some users merely glancing at the device as a prompt, and others composing full sentences to have the device speak on their behalf. Regardless of how the device is used, a frequent challenge is efficiently navigating the hierarchy of categories to find needed words.

In fact, the challenges when designing this kind of applications are:

- Adaptability to several platforms, especially to those more economically and functionally accessible.
- The composition of the communication boards has to be quick and simple and has to allow to incorporate those resources that users are more familiar with (audio/images).
- Adaptability and accessibility to the greater number of potential users, designing the applications with the aim of taking in so many collectives as possible.

With these challenges in mind we have developed AraBoard, a shareware application aimed to facilitate the functional communication (by means of images, pictograms and sounds) to people with communication needs due to different causes: autism, aphasia, cerebral palsy, etc. The main features of AraBoard are:

- It has been designed to create communication boards with simple and/or anticipation routines, so that users can know in advance the steps to be followed to perform a specific task. Nevertheless, due to the high personalization level of the communication boards created with AraBoard, parents and educators are using AraBoard to create gaming boards and for storytelling.
- Due to its ease of use, AraBoard communication boards are specially suited for people with motor disabilities and very basic communication needs.
- AraBoard allows the creation, edition and use of communication boards with different devices (PCs, smartphones or tablets), making it possible to transfer the boards from one device to another one.
- For the creation of pictograms it searches in the online platform ARASAAC, a complete and continuously growing pictogram collection. Moreover, users can personalize the pictograms or create their own ones by using the camera and the microphone connected to the computer or mobile device.
- AraBoard expands functional communication to a varied range of possible environments due to its compatibility with mobile devices and, moreover, due to the possibility of directly printing the created boards, so that they can be used without any technological device.
- It is public domain software. No cost is demanded to the families of the users with complex communication needs.

The paper structure is: section 2 is devoted to the state of the art in AAC. Section 3 presents a description of our tool whereas in section 4 the results of an evaluation questionnaire filled in by AraBoard users via web are presented. Section 5 shows different applications and contexts of use, developed by AraBoard users. Finally, section 6 focuses in the conclusions and future work.

2. State of the art

Augmentative and Alternative Communication (AAC) describes strategies and techniques used to support communication for individuals who have little or no functional speech due to a physical and/or intellectual disability. Individuals who are unable to communicate due to such disabilities are said to have complex communication needs (CCN) and can benefit from AAC. Within the AAC systems, they are classified in Assistive and Non-Assistive, depending on the requirement of external elements for the user to communicate. The non-assistive systems don't require the use of external devices since they are based on user's gestures for the transmission of messages. They are characteristic of deaf users, and they require complex motor and cognitive skills for an effective communication. On the other hand, Assistive AAC systems are designed for users with motor or cognitive disabilities, giving them functional communication supported by visual elements (pictograms) and accessible interactive devices. The type of device giving access to the AAC system determines the accessibility of the communication tool to different kind of users, and the complexity of the transmitted messages.

Initially, assistive AAC was based on non-technological solutions (picto grids printed in paper sheets), or on proprietary hardware (communicator devices)^{1,2,3} capable of translate user touches on button pictos into spoken text. The high cost of such communicator devices limited the spread of AAC technologies, especially for families. Communicator devices are hardly adaptive⁴: as user communication requirements evolve, a new communicator device has to be purchased to replace the old one. Moreover, the design of communicator devices had a negative emotional impact on users, as their design drew attention to people's impairments⁵.

The recent expansion of portable computer devices (smartphones and tablets), has risen a new generation of AAC tools based on software applications. Since nowadays many people use these portable devices, the psychological impact of users of AAC tools is being significantly reduced⁶. However, they also present disadvantages compared with a communicator device: the accessibility of these devices can be reduced since it requires users' motor skills to hold the device and to select the pictograms. Also, depending on the device characteristics, it can require enough visual and hearing acumen for being used. The advantages rely mainly in the quick access to a large amount of vocabulary, and the flexibility to generate boards with vocabulary adapted to the communication context, giving access to the users' own pictograms or generated by the device camera or microphone.

The basic functionality of a smartphone or tablet AAC tool is to emulate a communicator device in any conventional smartphone or tablet⁷, including a pictos collection and a personalization tool to compose communication grids. The accessibility of these tools is granted by the inclusion in the device of alternative functionalities for the navigation, such as scanning⁸, possibility of connection to other accessibility devices (buttons, adapted mouse...) ⁹ or voice synthesis¹⁰.

Provided with high adaptive functionalities in the composition of communicator boards, more recent AAC software tools are also covering a wider range of communicative abilities by enabling the user to create hyperlinks between different communication boards^{11,12} and/or enabling to compose full syntactic sentences to be spoken by the device^{13,14,15}. However, as communication is becoming more complete, the use of the application is also becoming more challenging since it requires efficiently navigating the hierarchy of picto categories to find the needed words, conjugate them, and establish navigation between created boards. This, in principle, gives users the ability to create unique utterances, but ultimately requires literacy skills that are often absent in individuals with CCN¹⁶. In fact, the common problems of the existing tools are the difficulty for the users to use them, their limited platform adaptability and the lack of enough personalization to make them useful to a broad range of users.

Due to these detected shortcomings, we faced the development of AraBoard, a set of tools that are described in the next section.

3. AraBoard: Description

AraBoard is a software application that allows the creation and visualization of communication boards. It allows to translate the traditional concept of board to the different computer platforms like mobile devices, interactive whiteboards, tablets, and conventional computers. Nowadays AraBoard is available to be free downloaded for MS-

Windows and Android Operating Systems. AraBoard's environment is shown in Fig. 1. Users can interact with AraBoard through different devices (PC, mobile, tablets).

The tool is divided in two applications. The first application is AraBoard Constructor, developed for the construction and personalization of communication boards, and usually used by the users' tutor (relatives, teachers, therapists, or also the final user) for the creation and edition of the communication boards adapted to the specific needs of each person and each context of use. The second application is AraBoard Player, that allows to load and reproduce the boards created with the Constructor, and that will be used by the final users (usually children) that have any kind of communicative limitation.

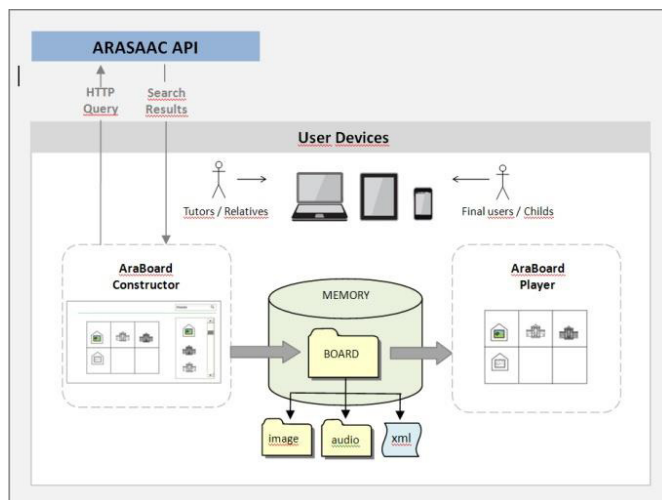


Fig. 1. AraBoard Architecture.

Both present the same interface and are used in the same way independently of the device. Moreover, the boards created with the Constructor in one device can be moved, edited and played with the Player in any other device that has AraBoard installed. Each communication board is stored in their own folder in the internal memory of the device, containing the images and audios of each pictogram, and an XML file with the board's specification.

3.1. AraBoard Constructor

The AraBoard Constructor application allows to create and edit communication boards adapted to the particular needs of each user. AraBoard Constructor is characterized by its ease of use in all aspects, since it has a graphical interface designed to make possible anyone to create and edit boards intuitively in a few minutes. Its interface lets define and configure all elements-visual, auditory, textual, appearance, etc. - that compose the communication board, and it lets change its size (number of rows and columns and arrangement of cells). With AraBoard Constructor it is possible to create boards from one to thirty-two cells, using different combinations: 1 row and 2 columns, 2 rows x 2 columns 4 rows x 8 columns, etc. This feature extends the range of users, from people with severe motor disabilities and very basic communication needs (see Fig. 2.a), offering boards with few cells but with large dimensions, to users with advanced communication needs up to boards with 32 cells (see Fig. 2.b).

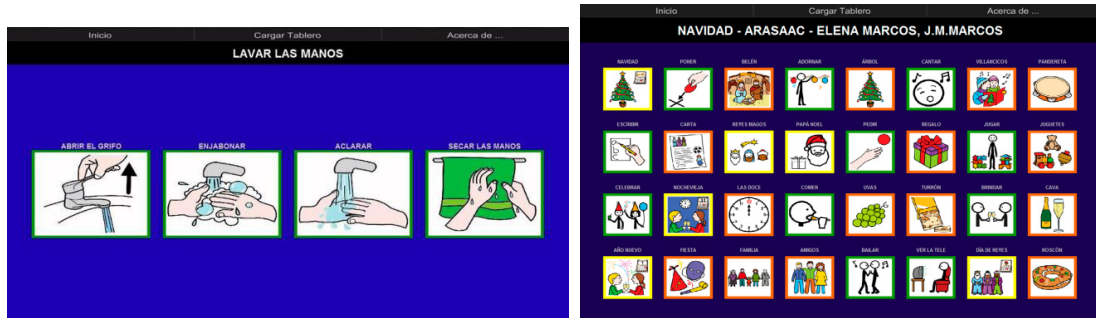
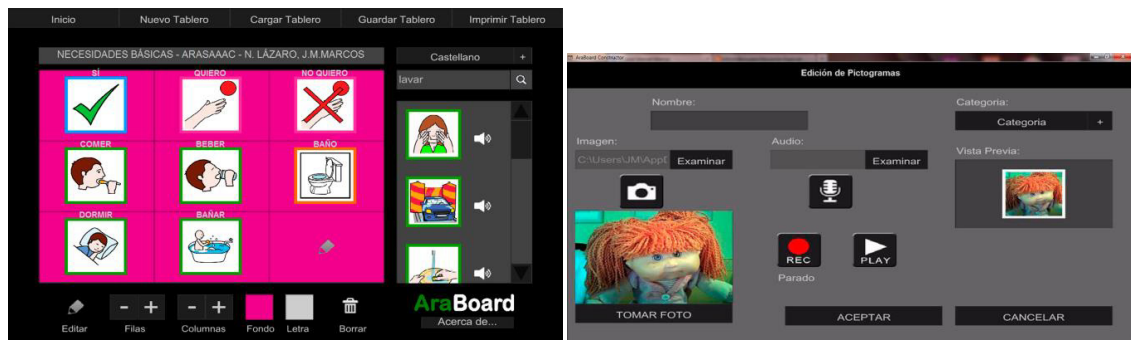


Fig. 2. (a): simple board for people with severe motor disabilities; (b) board for people with advanced communication needs.

In order to customize the elements (see Fig. 3.a) composing the board, the application allows the user to enter:

- Resources from the ARASAAC pictograms collection¹⁷: The user has a keyword pictogram browser from the ARASAAC pictogram collection. To obtain these pictograms, the application communicates the ARASAAC server portal through the Internet in order to obtain the pictograms results matching the word and the language that the user entered through the browser. This communication allows to retrieve any pictogram from the database and to download it instant along with its corresponding speech in the selected language.
- Personal resources: AraBoard Constructor has its own pictogram editor (see Fig. 3.b), which allows to create or modify pictograms, incorporating (images and audio) created by the user. In order to get this, it allows the load of images and audio stored in the internal memory of the device, and also provides access from the editor of pictograms to the camera and microphones connected to the device to generate on-site new images and audios, what opens new possibilities for contextualization of the boards produced.



Once the board has been built, the application allows: to export the board in PDF format ready to print and to be used as a communication board in paper, or to save the communication board project, creating a directory in the internal memory of the device for editing or to be used in AraBoard Player, by the user with communication needs.

3.2. AraBoard Player

AraBoard Player is an application that allows users with communication needs using communication boards previously generated with AraBoard Constructor. AraBoard Player shows the board in the full screen, and the user interacts with in by pressing the different cells that compose it. Once a cell has been marked, it plays the audio

associated with it (see Fig. 4). In order to be accessible to users with physical disabilities, the audio playback mechanism is designed so that although not stating exactly the desired cell, always run the audio associated with the closest cell to the area that has been pressed.



Fig. 4. AraBoard Player.

4. Evaluation

When the user exits AraBoard application, he/she is requested to participate in an online voluntary evaluation questionnaire. It consists of 15 closed and 2 open questions (questionnaire can be access at http://giga.cps.unizar.es/affectivelab/araboard_encuesta.html) and evaluates user satisfaction, user profile and user perception related to other AAC tools. During the first year of publication, 295 completed questionnaires have been collected.

4.1. Satisfaction

User satisfaction has been evaluated by a set of 5 questions Likert type, with a 1-to-5 rating scale (being 5 the highest grade). The questions were related with: satisfaction, attractiveness, appropriateness to users communication requirements, time saving, and easiness in the use. High marks have been obtained in all satisfaction aspects; half of the survey respondents have graded the application with the highest marks in all the questions (see Fig. 5).

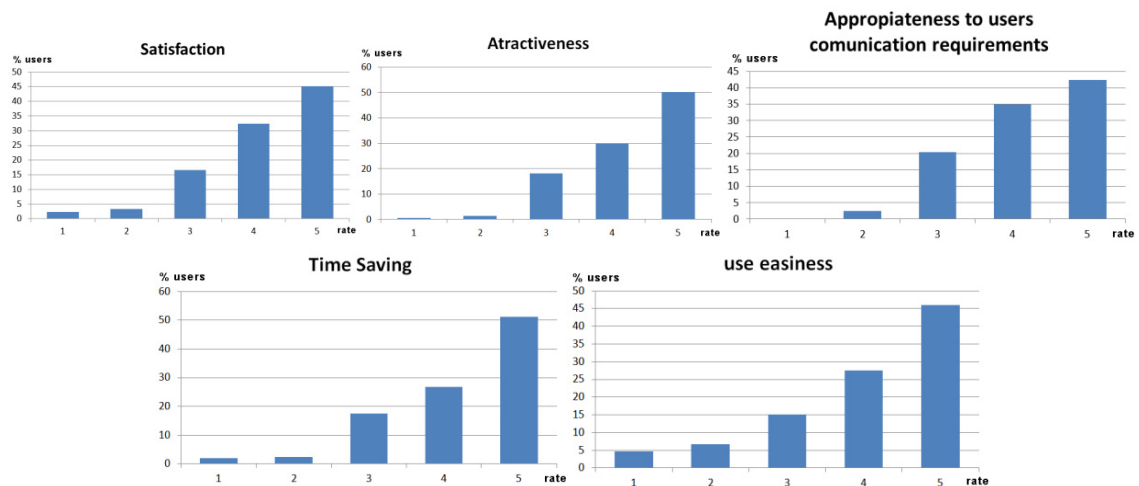


Fig. 5. Results of the AraBoard satisfaction test.

4.2. User profile and usage

As it can be observed in Fig. 6, AraBoard Player is mainly used (almost a 50%) by autistic persons. The rest of users present different types of impairment that affect their verbal and written expression ability. In the case of AraBoard Constructor, there is almost an equitable distribution between relatives, educators and therapists.

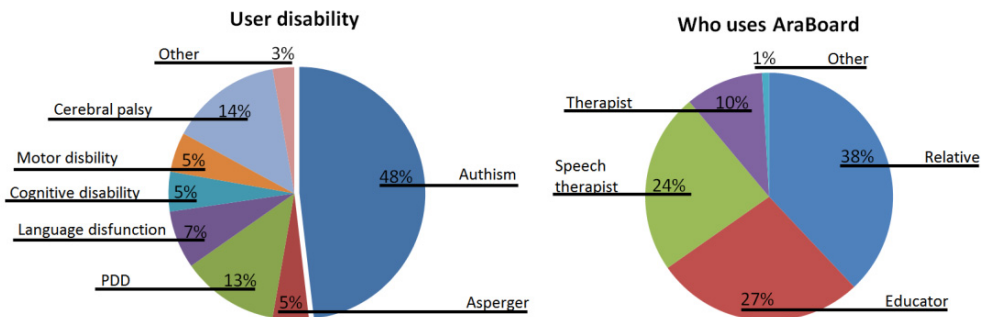


Fig. 6. User profile.

Regarding the type of device to use AraBoard, it can be observed the enormous impact of mobile devices (smartphones and tablets): they represent almost the 80% of the devices utilized by AraBoard users (see Fig. 7.a). Before using AraBoard, most of the users did not use any technological AAC tool. For almost a quarter of the users AraBoard has been their first AAC tool, whereas half of the users it has been their first technological AAC tool (see Fig. 7.b).

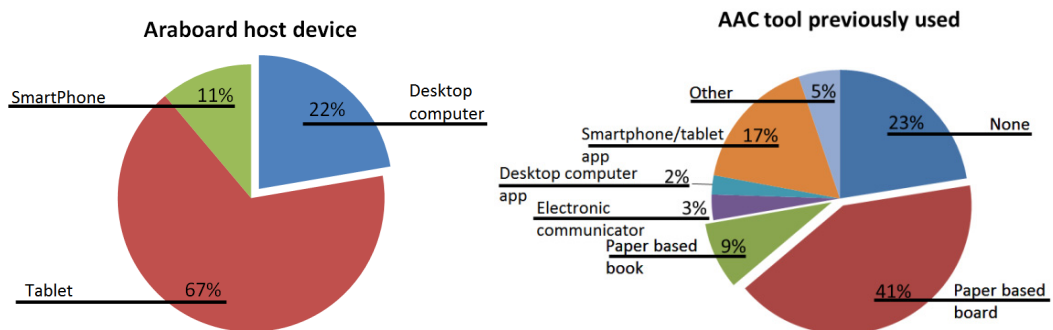


Fig. 7. (a) AraBoard host device; (b) Previous AAC tool used.

As far as custom use, Fig. 8 shows that more than a half of the users use AraBoard for communicating in a daily manner, a third of them at home, and another third at school. Almost the other third use it outside home. It has to be pointed out that one of the respondents expressed that he used it at work: this opens an interesting integration possibility for our tool.

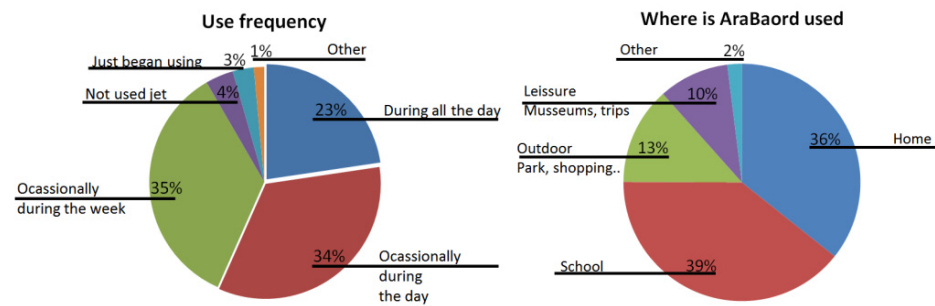


Fig. 8. Usage.

4.3. Perception compared to other AAC tools

As shown in Fig. 9, most of the users perceive that AraBoard fits their need better than other technological and non-technological tools. In both cases the percentage of people having a negative perception is similar and marginal. Results also show that there are still more users of printed AAC tools than based on a device or communication software.

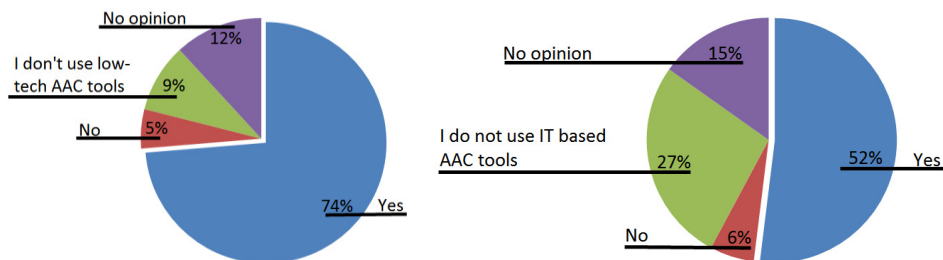


Fig. 9. (a) Answers to the question: Do you consider that AraBoard fits better user needs than the printed system?; (b) Answer to the question: Do you consider that AraBoard adjusts better to user needs and characteristics than the system used?

5. AraBoard: different contexts of use

At the same time that AraBoard was launched, a web platform was created for the users to download existing boards and to freely share their AraBoard creations. The boards generated initially corresponded to simple or anticipation routines that allow the users to know in advance the steps needed to carry out a specific task. Nevertheless, once the application was released and thanks to the high personalization level of AraBoard in creating boards, relatives, tutors and educators of impaired children have adopted AraBoard, developing applications not foreseen by its creators:

- Games: many users are creating with AraBoard game boards in which children have to identify objects as belonging to a specific category, for example distinguishing fruits from other types of food (see Fig. 10.a). To give children feedback the of utterances of the ARASAAC pictograms' audios are substituted by "well" or "wrong" ones or by sounds identified by the kid as corresponding to correct or incorrect.
- Tales: AraBoard boards are being used to support story-telling activities. Thanks to them, children may intervene and answer questions during the narration of popular fairy tales (see Fig. 10.b)

- Classroom activities: Educators are creating their own communication boards to support kids during diverse classroom activities (see Fig. 11.a). AraBoard allows the educator to create in-situ boards totally adapted to the activity context.
- Emotions: Several boards have been created to help children that are not able to do it orally, expressing emotions (see Fig. 11.b). This kind of boards is resulting especially effective in the resolution of conflicts.
- Songs: Replacing the pictogram utterances by audio files containing songs, many users are creating boards to play songs to the children (see Fig. 12). This way, children may associate certain images with their corresponding song.



Fig 10. (a) Game board to identify fruits; (b) Communication board of the goldilocks and the three bears tale



Fig. 11. (a) Communication board used to be used in music therapy; (b) Communication board to express emotions and wishes.



Fig. 12. Songs board.

6. Conclusions and future work

This paper presents AraBoard, a AAC shareware application developed to facilitate the functional communication to people with complex communication needs. The tool has been successfully accepted by the users, mainly because of its simplicity and its adaptability. The boards can be personalized and configured varying the number of cells, size, and inclusion or not of text, of audio, etc. In this way it makes possible to improve the communication to persons with severe motor or cognitive problems. One of the main features of the tool is that is multiplatform, allowing to transfer boards from one device to another.

The high acceptance of the users is shown, not only by the quantitative data obtained through the questionnaires carried out and analysed in this paper, but also by the number of downloads registered since its release in June, 2012. Since then, AraBoard has been downloaded more than 12500 times: more than 8550 its Windows version from SourceForge (<http://sourceforge.net/projects/ara-board/>) and almost 4000 its Android version from GooglePlay. Another indicator of AraBoard acceptance has been the appearance of different context of use, apart from the first original one, that is, to improve functional communication. Among these, pedagogical activities, games, story-telling, boards for expressing emotions or also, inclusion of songs, can be mentioned.

The next goals of the future work will be to improve the accessibility of users with important motor disabilities, including other navigation functionalities and to allow linked boards in order to allow the generation of more complex messages.

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