Appendix A: The ojoVoz software platform.

1. Overview.

The ojoVoz software platform consists of a mobile app and a web-based application, and was specifically designed as the technological component of the ERV Methodology. The platform allows groups of users to collaboratively create an online audiovisual knowledge commons by sharing mobile phones as devices for capturing images, recording sounds and publishing those contents to the web. Once published, the contents on the web may be browsed and edited using a web-based application. The following diagram offers an overview of the ojoVoz platform.

An overview of the ojoVoz software platform
The ojoVoz software platform may be divided into three layers:

- **The mobile layer.**
  In this layer, the ojoVoz mobile app may be used by groups of participants to capture audiovisual contents and send them to a web server.

- **The server layer.**
  This layer includes a relational database and a set of server-side scripts that receive, organize and manage the incoming contents.

- **The client layer.**
  The scripts that make up the client layer format and present the contents of the server-side database to web clients, so that anyone who accesses the platform's web page may browse and edit them.

2. **The mobile layer.**

2.1. **The mobile app.**

The ojoVoz mobile app allows the participants of the ERV Methodology to easily create audiovisual messages composed of pictures, sounds, keywords and geographical data (latitude and longitude), and publish them on a web page. The user interface of the ojoVoz mobile app was specifically designed for users with little or no experience with smartphone applications. Although several apps that perform similar tasks to those of the ojoVoz app already exist, they were considered to be too complicated during a usage trial. Therefore, the ojoVoz app features a very simple user interface and a straightforward operation. The following flowchart includes screenshots of the user interface, and describes the steps for configuring the ojoVoz app.

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1. At least two different applications similar to the ojoVoz mobile app were found during this study: the Ushahidi platform (http://www.ushahidi.com/, retrieved 20.05.2015) and OpenDataKit (https://opendatakit.org/, retrieved 20.05.2015)

2. In September 2012, I performed an informal usage trial of Ushahidi and OpenDataKit in Bagamoyo. The participants of this trial were Mr. Hamza and three of his colleagues at the agricultural office. After being asked to compose and publish audiovisual messages from those applications, the four participants concluded that they were too difficult for them. Considering that the participants of the trial were more experienced users of electronic devices than the small-scale farmers at Chambezi, I assumed that Ushahidi and OpenDataKit would prove too difficult also for them. Therefore, I decided to develop a much simpler application.
Tisselli 2015 mobile app, as well as for composing and publishing audiovisual messages.

Flowchart describing the usage of the ojoVoz mobile app.
The ojoVoz mobile app allows different groups of users to share a single phone. Each phone must be configured with a unique id, that identifies and differentiates it from other phones. However, when the phone changes hands, its new user may enter a personal name or alias, so that messages may be attributed to him or her.

The language of the user interface of the ojoVoz mobile app may be easily changed. Currently, the app is available in English, Spanish and Swahili.

Each audiovisual message composed with the ojoVoz mobile app is formed by a photo and its corresponding sound recording. Rather than using video, this combined format was preferred for two reasons. Firstly, because a video recording may easily become dispersive thanks to its inherent features, such as zooming or panning. In contrast, a photo may be focused on a specific subject, and its corresponding sound recording can add a narration to it. Secondly, because the file size of the combined format is significantly smaller than that of a video. In places where bandwidth is limited, reducing the size of the files that are sent over the network may become a critical factor.

The process of composing audiovisual messages may happen while offline. After composing each message, the user must save it to the phone’s memory. Once a WiFi or a 3G mobile Internet connection is available, the user can send all the saved messages.

The ojoVoz mobile app was written in Java, and works on most smartphones with an Android operating system version 2.2 or higher. The source code of the app was released under a the GPL v3.0 open source license and is available at https://github.com/ojovoz/ojoVoz_mobile/tree/master/alpha_2014 (retrieved 22.05.2015)

A video tutorial that shows how to download, install, configure and use the

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3 The GNU General Public License (GPL) is a free, copyleft license for software and other kinds of works. For details about version 3.0 of this license, please refer to http://www.gnu.org/licenses/quick-guide-gplv3.html (retrieved 22.05.2015)
The Hypertext Transfer Protocol (HTTP) is an application-level protocol for distributed, collaborative, hypermedia information systems. It may also be used for simple data exchange between applications through the World Wide Web. The Simple Mail Transfer Protocol is a communication protocol for exchanging email messages.
on the MySQL database engine. Each ojoVoz project has its own, separate database. The following diagram shows the tables that compose the database, as well as the relations that exist between them.

The tables are be described as follows:

- **channel**: defines the different groups of participants that collaborate in a project. As explained, the mobile layer allows the concurrent collaboration of different groups of users. Each of these groups publishes its audiovisual messages on its corresponding channel. For instance, the Juquila, Santa Ana and PMSL groups in Los ojos de la milpa each have their own specific, separate channel. Nevertheless,

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5 MySQL: https://www.mysql.com/ (retrieved 22.05.2015)
channels may be aggregated to display the combined activity of all groups.

- **message**: general information of the audiovisual messages published in a channel.

- **attachment**: information about the image and sound files that compose a message. The actual files are not stored in this table, but are saved to the folder of their corresponding channel.

- **comments**: information of the text comments associated to a message.

- **tag**: general information of all the different keywords used in the project.

- **tag_x_message**: list of keywords per message.

- **tag_group**: information about keyword groups. Keywords may be bundled together as groups in order to create large semantic units composed of tags that have similar meanings or have been misspelled. In Sauti ya wakulima, for example, all the different misspellings of the tag mahojiano were bundled into a group named mahojiano.

- **tag_x_language**: translations of the keywords into the different languages of a project.

- **global**: names and values of the global variables of a project.

In the server layer, a script written in the PHP language checks for incoming email. When email containing audiovisual messages coming from the mobile layer is received, this script extracts its information and attachments and stores them, respectively, in the database and the server's file system. The script also transforms audio files from their native format (AMR) into MP3, so that they may be played on

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6 This process is achieved thanks to FFMPEG, an open source application for managing and manipulating media files. Therefore, the FFMPEG application must be installed on the same server as ojoVoz. FFMPEG is available at https://www.ffmpeg.org/ (retrieved 26.05.2015)
a web interface. This script is activated whenever a web page of the client layer is accessed.

4. The client layer

The client layer consists of a series of web-based interfaces that allow Internet users to browse the audiovisual contents published by the users of the mobile layer and stored in the server-side database. It also allows registered users to edit those contents, and it features management tools for the project administrator.

4.1. The public section.

In the public section, Internet users may explore the audiovisual messages by following one or a combination of these filtering criteria:

- Date
- Keyword
- Channel
- Geographical location

The following screenshot shows the main web interface of the public section.
The main web interface has the following elements:

1. Main menu: Moving between the different parts of the public section.
2. Search bar: Searching for the appearance of a specific text string in the audiovisual messages.
3. Language selector: Selecting the language of the public section. Languages
may vary according to the project.

4. Tag cloud: Filtering audiovisual messages. When one or more keywords are selected, the messages described by them will be displayed.

5. Channels: Selecting a particular group or channel. When a channel is selected, only its corresponding messages will be shown.

6. Messages: Browsing audiovisual messages, each of which includes the following information:
   - Channel name
   - Date (may also include time)
   - Keywords
   - Image
   - Sound clip
   - Text description

7. Comments: Adding to a comment to a specific message. Only registered users may comment.

8. Date selectors: Selecting a specific date (month and day). Only messages that were composed on the selected date will be displayed.

The public section also features a geographical interface. It may be accessed by clicking on a specific image on the main web interface, or by choosing the option "Map" on the main menu. In the first case, the geographical interface will appear with the selected image highlighted in its corresponding location on a map. In the second, the geographical interface will display a map with all the georeferenced messages represented as markers.
In the geographical interface, a map provided by Google Maps is used to navigate the audiovisual messages with latitude and longitude data. These messages are represented by markers, whose colors correspond to the keywords used to describe them. The list of keywords, together with their corresponding marker, is shown as a selectable tag cloud above the map. When a tag is selected, the messages shown on the map will be only those described by that tag.

4.2. The editing section.

The editing section may be accessed exclusively by registered users, who may use it to perform the following functions:

- Modifying the geographical location of a message.
- Adding or modifying the keywords of a message.
- Adding a text description to a message.
- Rotating images.
- Deleting elements of a message, or deleting it entirely.

The following screenshot shows the different elements of the editing section:

1. Month selector, 2. Day selector: Filtering the messages to be edited by date.
3. Geographical location: Changing the geographical location of a message.
   When this element is selected, a special map interface will appear, allowing the user to choose the new location.
4. Keywords: Modifying or adding keywords. Multiple keywords must be separated by commas.
5. Text description: Adding a text description to a message.

6. Rotation: Rotating an image 90 degrees clockwise. Some mobile phones do not automatically adjust the image's orientation when taking a picture. This element allows users to correct this problem if it arises.


10. Save: Saving the changes applied to a message.

4.3. The control panel.

The control panel of the client layer may only be accessed by the project administrator. In the control panel, the following management tasks may be performed:

- Adding or editing channels.
- Grouping tags into bundles.
- Defining the tags that appear on the map, and their corresponding marker colors.
- Translating tags into the different languages of the project.
- Adding study tags.\(^7\)

5. The code of the server and client layers.

The source code of the server and client layers was written using a combination of HTML, CSS, JavaScript and PHP languages, and consists of a series of scripts that perform specific functions grouped by type of task. Together with the relational database described in the server layer, these scripts may be installed on any server. They have been released under a GPL v3.0 open source license, and are available at [https://github.com/ojovoz/ojoVoz_mobile/tree/master/ojovoz_webserver](https://github.com/ojovoz/ojoVoz_mobile/tree/master/ojovoz_webserver). The "README" file in that location provides precise instructions on how to install the database and scripts of the server and client layers of ojoVoz.

\(^7\) To learn about the purpose and usage of study tags, please refer to chapter 5.
Because the code of all layers of ojoVoz has been published under open source licenses, other artists and researchers have been able to download, modify and use it in their specific projects. A notable example is a project carried out by a group of environmental researchers who attempted to map the distribution of solid waste around Mexico City. In 2012 and 2013, these researchers used smartphones to gather audiovisual evidence and generate an online map of dump sites: an unprecedented research endeavor that was significantly facilitated by the capacities of ojoVoz.

The logo of the ojoVoz software platform.

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8 The project, Red Residuos Sólidos del Valle de México (Network of Solid Residues in the Valley of Mexico), was carried out by environmental and social researchers of the Colegio de Posgraduados (Postgraduate College) and the Instituto Politécnico Nacional (National Polytechnic Institute), and is available at http://redresiduossolidosmx.net (retrieved 26.05.2015)