



TECHNICAL DOCUMENTATION

Project reference:

MYGEOSS Third Call For Innovative Apps in the environmental and social domains
(http://digitalearthlab.jrc.ec.europa.eu/mygeoss/info_thirdcall.cfm)

Name of the App:

MIGRATE – MIGRation pATterns in Europe



Responsible for the App:

Dr. Marco Minghini

via Boccioni 11, 22100 Como (Italy)

E-mail address: marco.minghini86@gmail.com

Expert contract number: CCR.IES.C393200.X0

1. Introduction: Description and purpose of the App

MIGRATE – MIGRation pATterns in Europe is a Web mapping application aimed at educating and raising awareness about the phenomenon of migration in Europe. This goal is achieved using a gamification approach, i.e. users interact with the application by playing a map-based game, where questions are asked, and answers are provided and explained, about a number of topics related to migration. Answers provided by the users will help to understand the current knowledge and perception of migration-related issues.

2. Data sources and licenses

A number of data sources are used within the MIGRATE application which are all available under the conditions of full and open access with with no restrictions for reuse except for the obligation to mention the source of the input data. A description of the data sources used together with their licenses is provided by the Data Management Plan, delivered in August 2016.

3. Architecture and installation manual

The MIGRATE application makes use of a number of open source software tools. The architecture of the system is depicted in Figure 1.

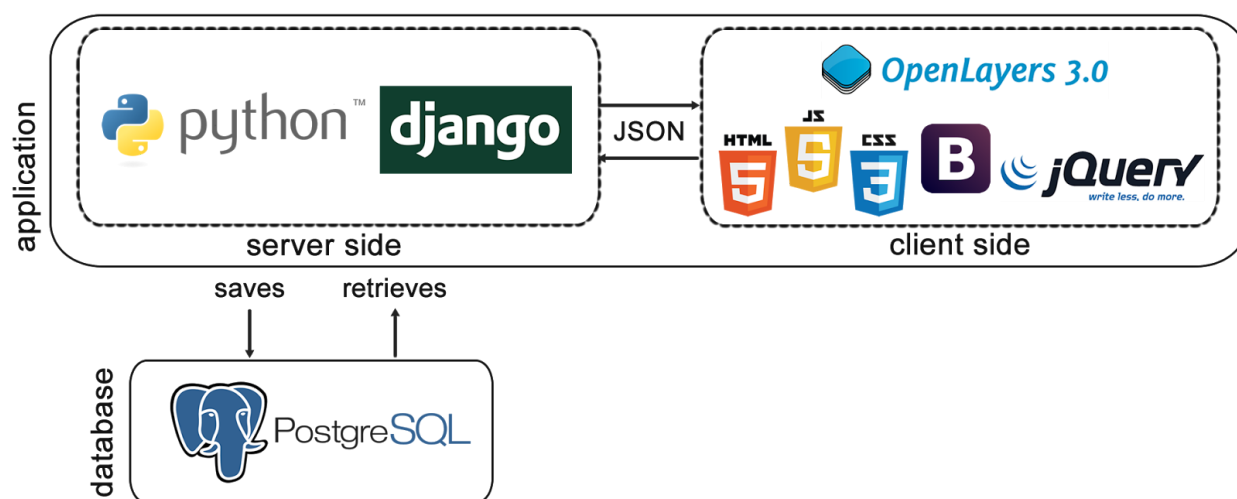


Figure 1. Architecture of the MIGRATE application.

On the server side, Django (<https://www.djangoproject.com>) 1.9 is used to define the models that handle all the data required by the application. These models are used to create the necessary tables in a PostgreSQL (<https://www.postgresql.org>) database. The behaviour of each request made by the client is also defined in Django that handles the different responses. The database stores the questions, answers, the user accounts and each game that is played. The sets of questions, together with the possible options and correct answer for each question is sent in JSON format from the server to the client. The GeoJSON layers sent from the server are rendered on the client using OpenLayers 3 (<http://openlayers.org>). Bootstrap (<http://getbootstrap.com>), HTML5 and CSS3 are used for responsive

design, while the jQuery library (<https://jquery.com>) is used to ease the JavaScript programming. Based on all these software components, the code required to appropriately operate the MIGRATE application is available on the following open Bitbucket repository: <https://bitbucket.org/kilsedar/migrate>, which includes all the installation instructions to replicate the application.

4. Operations manual

The MIGRATE application is publicly accessible at <http://geomobile.como.polimi.it/migrate>.

The home page briefly presents the application, describes how the game works, points users to the registration and the login page, and includes an acknowledgement to the MyGEOSS project as well as the logos of MyGEOSS and the European Commission (see Figure 2).

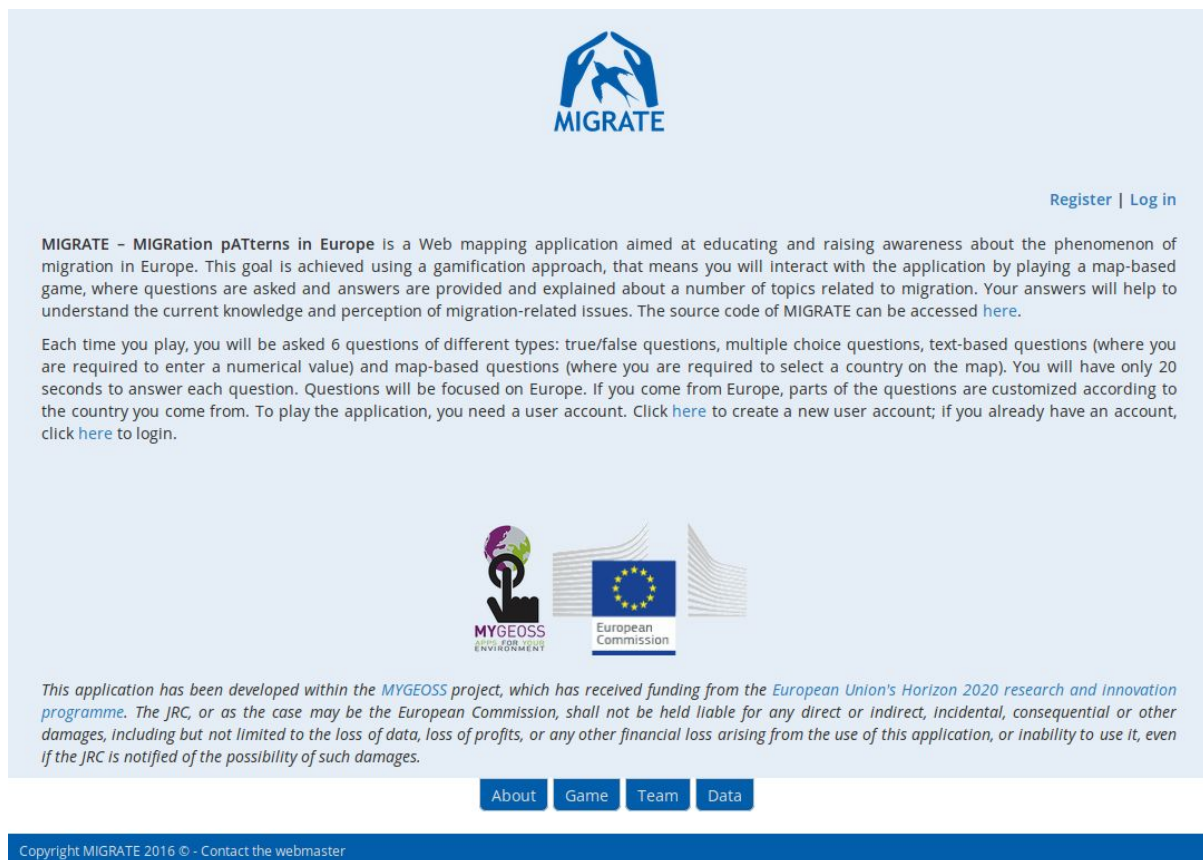



Figure 2. Home page of the MIGRATE application.

The registration page requires users to create an account by providing the following personal data: nickname and password; gender (female, male, not specified); age range in years (18-24, 25-34, 35-44, 45-54, 55-64, 65 or more); country of origin; and educational level (Primary School, Secondary School, College degree, Bachelor degree, Master degree, PhD degree, Other) (see Figure 3). After entering the required information and clicking the *Register* button, the user is automatically directed to the login page. Note that, in order to collect anonymous data and protect the user's privacy, the user e-mail is not required. This means that the user must remember the password chosen as there is no way to reset it later.



Registration

Nickname:

Required. 30 characters or fewer. Letters, digits and @/./+/-/_ only.

Password:

Gender:

Female

Age range (years):

18 - 24

I hereby certify that I am 18 years of age or older.

Country of origin:

Afghanistan

Education level:

Primary school


Register

*** Please note that your e-mail address is not required for the registration in order to protect your privacy. This means that there is no way for you to reset your password later, so please take note of your password now.

Have an account? [Login here.](#)

Figure 3. Registration page of the MIGRATE application.

The login page allows users who have already created an account to login, which is a required condition to play the MIGRATE game. After typing the username and password and clicking the *Log in* button (see Figure 4), the user is automatically directed to the game.



Login

Username:

Password:

Log In


Don't have an account? [Click here](#) to register.

Figure 4. Login page of the MIGRATE application.

The team page (accessible from the bottom menu by clicking the *Team* button) includes the names and bios of the people who contribute to the creation of the MIGRATE application (see Figure 5).




MIGRATE – MIGRation pATterns in Europe is created and maintained by a team of people from [Politecnico di Milano](#), Italy.



Dr. Marco Minghini

Dr. Marco Minghini obtained a BSc degree with honors in Environmental Engineering at Politecnico di Milano (2008) with a thesis on the ortho-rectification of satellite images using LIDAR DTM. In 2010 he obtained an MSc degree with honors in Environmental and Geomatic Engineering at Politecnico di Milano with a thesis on the georeferencing and WebGIS publishing of historical maps. In 2014 he obtained his PhD with merit in Environmental and Infrastructures Engineering with a thesis on the use of open source software, including mobile data collection and virtual globes for VGI and citizen science applications. Since 2014, he is a temporary research fellow at the GEOlab of the Como Campus of Politecnico di Milano. Driven by the use of open source software, his current research focuses on geoWeb services and geoWeb applications, citizen science and VGI. He is an active member of COST Action TD1202 "Mapping and the Citizen Sensor", a Charter Member of OSGeo and the Secretary of FOSS4G Europe 2015.




Prof. Marco Gianinetta

Degree in Engineering, PhD with honors in Geomatics. Currently Associate Professor of Remote Sensing and Photogrammetry at Politecnico di Milano. Since 2009 head the Laboratory of Remote Sensing of Politecnico di Milano. Co-Editor-in-Chief of the *European Journal of Remote Sensing* (AJR), Associate Editor of *International Journal of Remote Sensing* (Taylor & Francis), Associate Editor of *Journal of Applied Remote Sensing* (SPIE), Associate Editor of *International Journal of Navigation and Observation* (Hindawi). Evaluator and referee for national agencies (Italian Ministry of Education University and Research, Italian National Agency for the Evaluation of the University and Research Systems) and international agencies (French National Research Agency, Belgian Science Policy Office, Israel Science Foundation, National Research Council of Romania). Scientific advisory for the study "Space Market Uptake" commissioned by the Directorate General for Internal Policies-Policy Department A for the European Parliament.



Prof. Maria Antonia Brovelli

Degree with honors in Physics, PhD in Geodesy. Currently Professor of GIS at Politecnico di Milano. From 2006 to 2011 she lectured GIS at the ETH – Zurich. From 2001 to 2011 she was the Director of the Geomatics Laboratory of the Politecnico di Milano. Since 2011 she is Vice Rector of the Como Campus of Politecnico di Milano. She is Charter Member of OSGeo, Member of the Advisory Board of the GeoForAll network, co-chair of ISPRS WG IV/5 "Web and Cloud Based Geospatial Services and Applications", Associate Editor of *Applied Geomatics* (Springer) and Member of the Advisory Board of the Italian Photogrammetric and Surveying Society (SIFET). She organized in Como (Italy) in 2000 the First GRASS User Meeting and was in the Organizing Committee of the First International Open Source Free Software GIS – GRASS users conference held in 2002 in Trento (Italy). She is the Chair of FOSS4G Europe 2015.



Eng. Candan Eylül Kilsedar

Eng. Candan Eylül Kilsedar obtained her BSc degree in Computer Science and Engineering from Sabancı University-Istanbul/Turkey in 2012. She obtained MSc degree in Informatics Engineering from Politecnico di Milano in 2014. Her MSc thesis focused on deriving insightful data regarding user interactions on web through analyzing logs of web applications. She is strongly interested in web technologies and started working on geospatial data visualization on web during her Master of Science degree. Since November 2015, she is a PhD student in Environmental and Infrastructure Engineering and temporary research fellow at the GEOlab of the Como Campus at Politecnico di Milano.



Eng. Martina Aiello

Eng. Martina Aiello obtained a BSc degree in Environmental and Land Planning Engineering at Politecnico di Milano in 2011 with a thesis on the standards created by the Open Geospatial Consortium (OGC) to foster interoperability among the available geographic data. In 2014 she received a MSc degree in Environmental and Land Planning Engineering, specializing in Environmental Monitoring and Diagnostics, with a thesis about retrieving bottom coverage and bathymetry properties in marine shallow waters from high resolution satellite images through a bio-optical model. Since November 2014, she is a PhD student in Environmental and Infrastructure Engineering and a research assistant at the Laboratory of Remote Sensing of the Milano Leonardo Campus of Politecnico di Milano. Her research activity focuses on object based classification techniques for water environments through high and medium resolution satellite images.



Eng. Mayra Alejandra Zurbaran Nucci

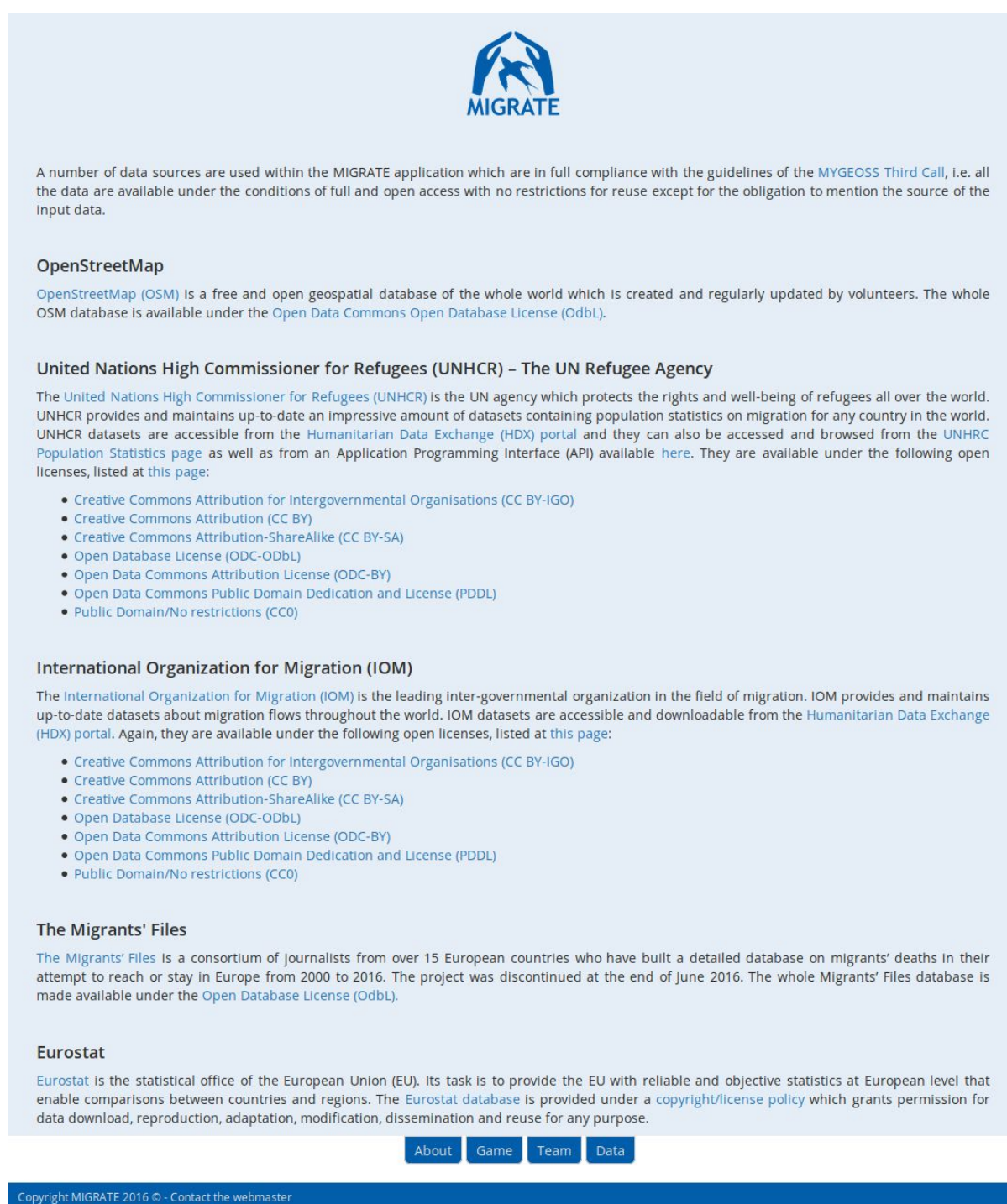
Eng. Mayra A. Zurbaran Nucci BSc degree in Computer Science at Universidad del Norte in 2006, she is currently a PhD student at the same university doing a research internship at Politecnico di Milano thanks to the awarded grant under the Erasmus Mundus program under the Sustain-T project. Her PhD thesis is about privacy on Location-Based Services (LBS) and location data protection mechanisms. She taught algorithm and programming I & II at Universidad del norte during 2013 and 2015. Since November of 2015 she is a PhD researcher at the GEOlab of the Como Campus of Politecnico di Milano. Her research activity is focused on Volunteer Geographic Information (VGI) and the privacy measures applicable to such data. She is also a python & django enthusiast and a contributor to FOSS community. On her PhD thesis she is focusing on exploring the impact of privacy preserving algorithms on spatial analysis. She is an active member of GRECIS.


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Figure 5. Team page of the MIGRATE application.

The data page (accessible from the bottom menu by clicking the *Data* button) describes all the data sources used by the MIGRATE application together with their licenses (see Figure 6).




MIGRATE

A number of data sources are used within the MIGRATE application which are in full compliance with the guidelines of the [MYGEOSS Third Call](#), i.e. all the data are available under the conditions of full and open access with no restrictions for reuse except for the obligation to mention the source of the input data.

OpenStreetMap

[OpenStreetMap \(OSM\)](#) is a free and open geospatial database of the whole world which is created and regularly updated by volunteers. The whole OSM database is available under the [Open Data Commons Open Database License \(OdbL\)](#).

United Nations High Commissioner for Refugees (UNHCR) – The UN Refugee Agency

The [United Nations High Commissioner for Refugees \(UNHCR\)](#) is the UN agency which protects the rights and well-being of refugees all over the world. UNHCR provides and maintains up-to-date an impressive amount of datasets containing population statistics on migration for any country in the world. UNHCR datasets are accessible from the [Humanitarian Data Exchange \(HDX\)](#) portal and they can also be accessed and browsed from the [UNHCR Population Statistics page](#) as well as from an Application Programming Interface (API) available [here](#). They are available under the following open licenses, listed at this page:

- Creative Commons Attribution for Intergovernmental Organisations (CC BY-IGO)
- Creative Commons Attribution (CC BY)
- Creative Commons Attribution-ShareAlike (CC BY-SA)
- Open Database License (ODC-ODbL)
- Open Data Commons Attribution License (ODC-BY)
- Open Data Commons Public Domain Dedication and License (PDDL)
- Public Domain/No restrictions (CC0)

International Organization for Migration (IOM)

The [International Organization for Migration \(IOM\)](#) is the leading inter-governmental organization in the field of migration. IOM provides and maintains up-to-date datasets about migration flows throughout the world. IOM datasets are accessible and downloadable from the [Humanitarian Data Exchange \(HDX\)](#) portal. Again, they are available under the following open licenses, listed at this page:

- Creative Commons Attribution for Intergovernmental Organisations (CC BY-IGO)
- Creative Commons Attribution (CC BY)
- Creative Commons Attribution-ShareAlike (CC BY-SA)
- Open Database License (ODC-ODbL)
- Open Data Commons Attribution License (ODC-BY)
- Open Data Commons Public Domain Dedication and License (PDDL)
- Public Domain/No restrictions (CC0)

The Migrants' Files

The [Migrants' Files](#) is a consortium of journalists from over 15 European countries who have built a detailed database on migrants' deaths in their attempt to reach or stay in Europe from 2000 to 2016. The project was discontinued at the end of June 2016. The whole Migrants' Files database is made available under the [Open Database License \(OdbL\)](#).

Eurostat

[Eurostat](#) is the statistical office of the European Union (EU). Its task is to provide the EU with reliable and objective statistics at European level that enable comparisons between countries and regions. The [Eurostat database](#) is provided under a [copyright/license policy](#) which grants permission for data download, reproduction, adaptation, modification, dissemination and reuse for any purpose.

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Figure 6. Data page of the MIGRATE application.

The game page (accessible directly after login as well as from the bottom menu by clicking the *Game* button) allows the user to play the MIGRATE game (see Figure 7).

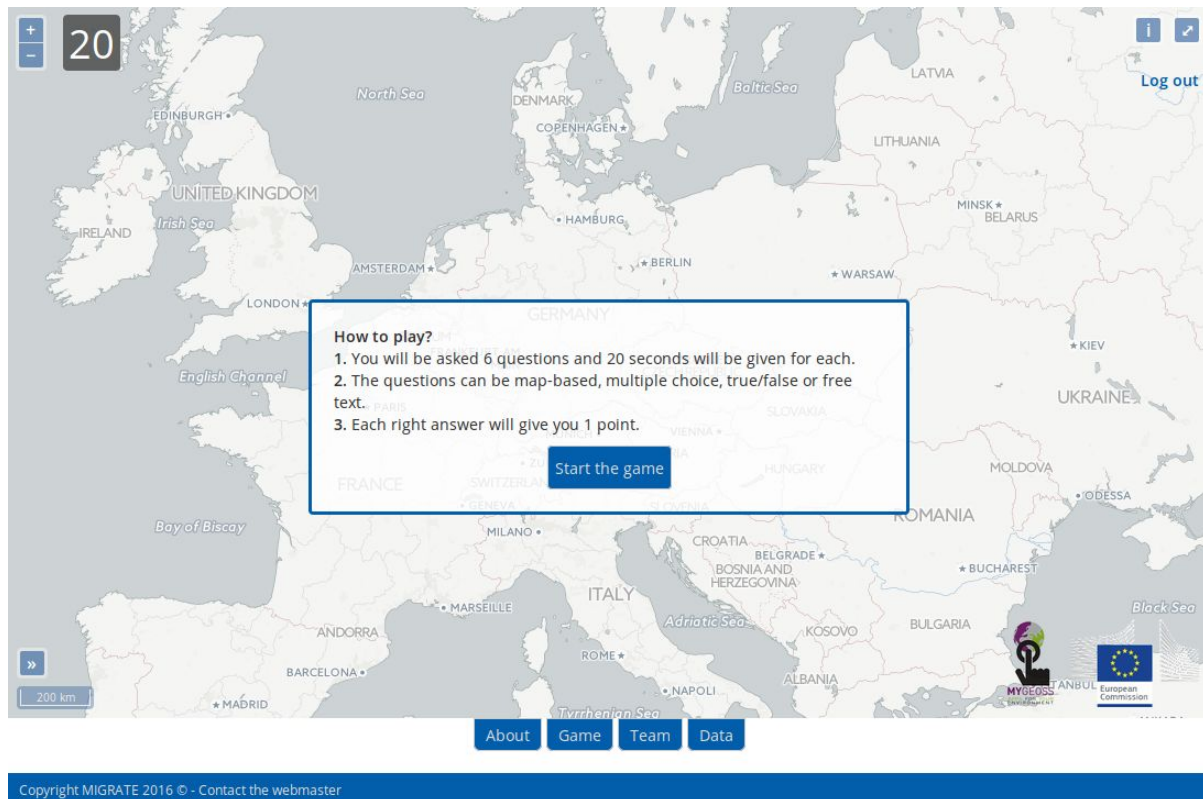


Figure 7. Game page of the MIGRATE application.

For each game, the user is asked a sequence of 6 questions of different types: 1 true/false question, 2 multiple choice questions, 2 map-based questions (where the user is required to select a country on the map), and 1 text-based question (where the user is required to enter a numerical value). The user has only 20 seconds to answer each question and gets 1 point for each question correctly answered. Questions are all focused on Europe and they are generated as follows:

- Two questions (one true/false question and one map-based question) focus on the phenomenon of migration in general. Each of these questions is randomly extracted among a set of 20 possible questions in order to decrease the chance that a user is asked the same question when playing the game multiple times.
- Two questions (one multiple choice question and one map-based question) focus on the phenomenon of migration in the Mediterranean area. Each of these questions is randomly extracted among a set of 20 possible questions in order to decrease the chance that a user is asked the same question when playing the game multiple times.
- Two questions (one multiple choice question and one text-based question) focus on the user's country of origin which is declared during the registration phase. In detail, the country of each user is associated to one among 7 macroregions: Italy; Greece; Spain; Bulgaria, Hungary and the Balkans; Turkey and Middle East; Europe; and Africa. As the focus of the application is on Europe, by hypothesis users whose country of origin is not among these 7 macroregions (e.g. users from North America, South America or Asia) are treated as users from Europe. Each of these questions is randomly extracted among a set of 20 possible questions in order to decrease the chance that a user is asked the same question when playing the game multiple times.

From the description above, it follows that a total of 360 questions were prepared. Considering that parts of the questions depend on the user's country of origin, for each user there are 20^6 possible combinations of 6 different questions, which means that the probability to get exactly the same sequence of 6 questions when playing the game multiple times is extremely low. When each question is displayed, the map is automatically zoomed and centered on the country/countries or the area (e.g. Mediterranean) that question is referred to. After the user answers each question, an animation shows whether the answer is correct or wrong, and a text is provided which explains the correct answer and provides the link to the source dataset(s) providing the correct answer.

The order the 6 questions are asked is determined randomly, but the number of true/false, multiple choice, map-based and text-based questions for each game is fixed (see above). An example of each type of question is presented in the following:

- True/false question: the user has to answer by checking the *TRUE* or *FALSE* radio buttons and clicking the *Submit* button (see Figure 8a). The success/unsuccess of the answer is shown together with an explanation of the correct answer and the link to the corresponding source dataset(s) (see Figure 8b). To jump to the next question, the user has to click the *Next* button.
- Multiple-choice question: the user has to answer by choosing one among 4 possible numerical answers and clicking the *Submit* button (see Figure 9a). For most of these questions, the 3 incorrect answers are numbers generated randomly in order to decrease the chance that a user is asked the same question when playing the game multiple times. The success/unsuccess of the answer is shown together with an explanation of the correct answer and the link to the corresponding source dataset(s) (see Figure 9b). To jump to the next question, the user has to click the *Next* button.
- Text-based question: the user has to answer by typing a numerical value in the text box provided and clicking the *Submit* button (see Figure 10a). The user's answer is evaluated as correct if the deviation from the correct answer is within a $\pm 20\%$ interval around the correct answer ($\pm 10\%$ if the required answer is a percentage). The success/unsuccess of the answer is shown together with an explanation of the correct answer and the link to the corresponding source dataset(s) (see Figure 10b). To jump to the next question, the user has to click the *Next* button.
- Map-based question: the user has to answer by clicking on the map on one of the 4 countries suggested and clicking the *Submit* button (see Figure 11a). For some of these questions, the 3 incorrect countries are generated randomly (within a predefined set of countries) in order to decrease the chance that a user is asked the same question when playing the game multiple times. The success/unsuccess of the answer is shown together with an explanation of the correct answer and the link to the corresponding source dataset(s) (see Figure 11b). To jump to the next question, the user has to click the *Next* button.

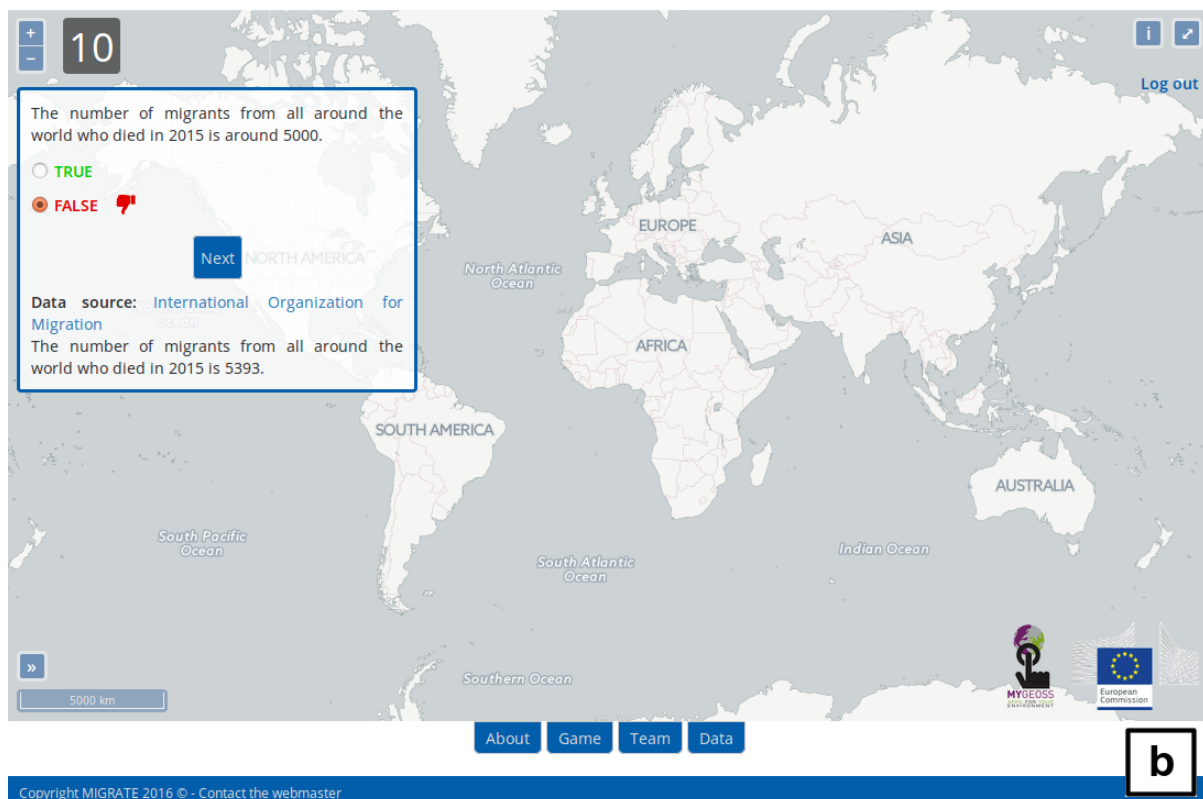
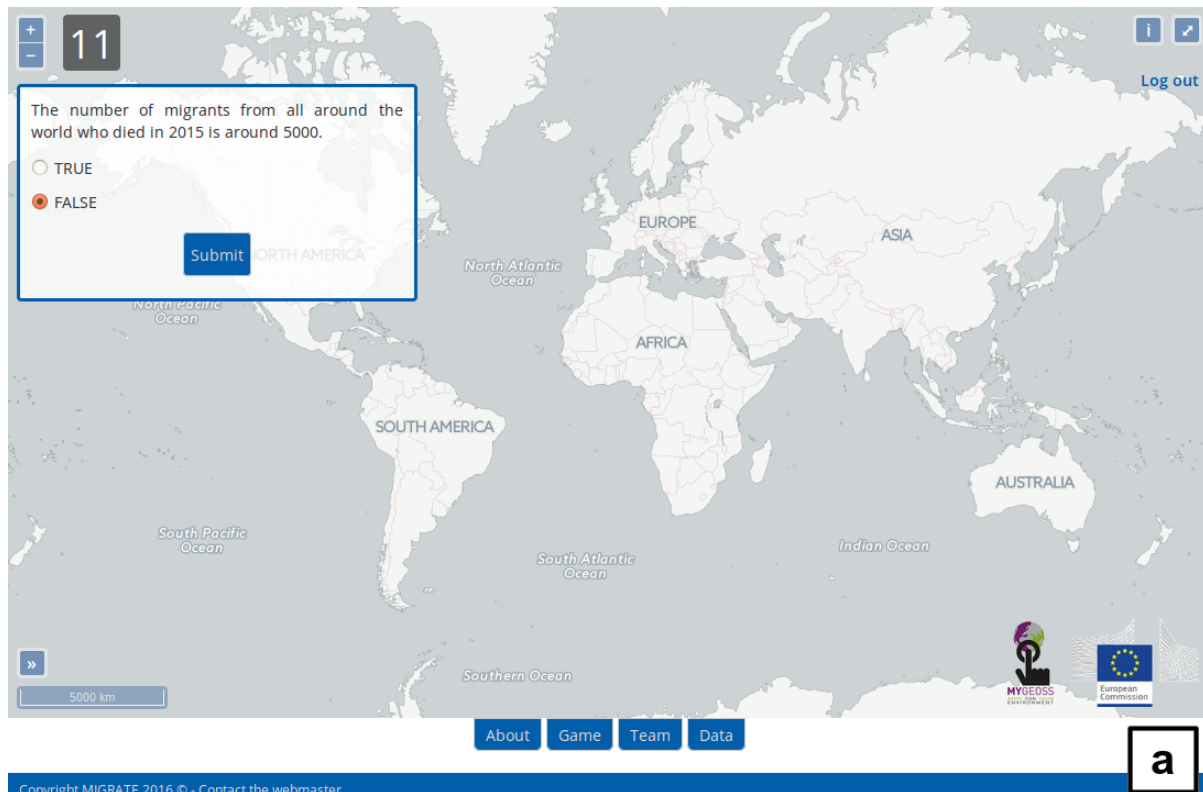


Figure 8. Example of a true/false question before (a) and after (b) the user's answer.

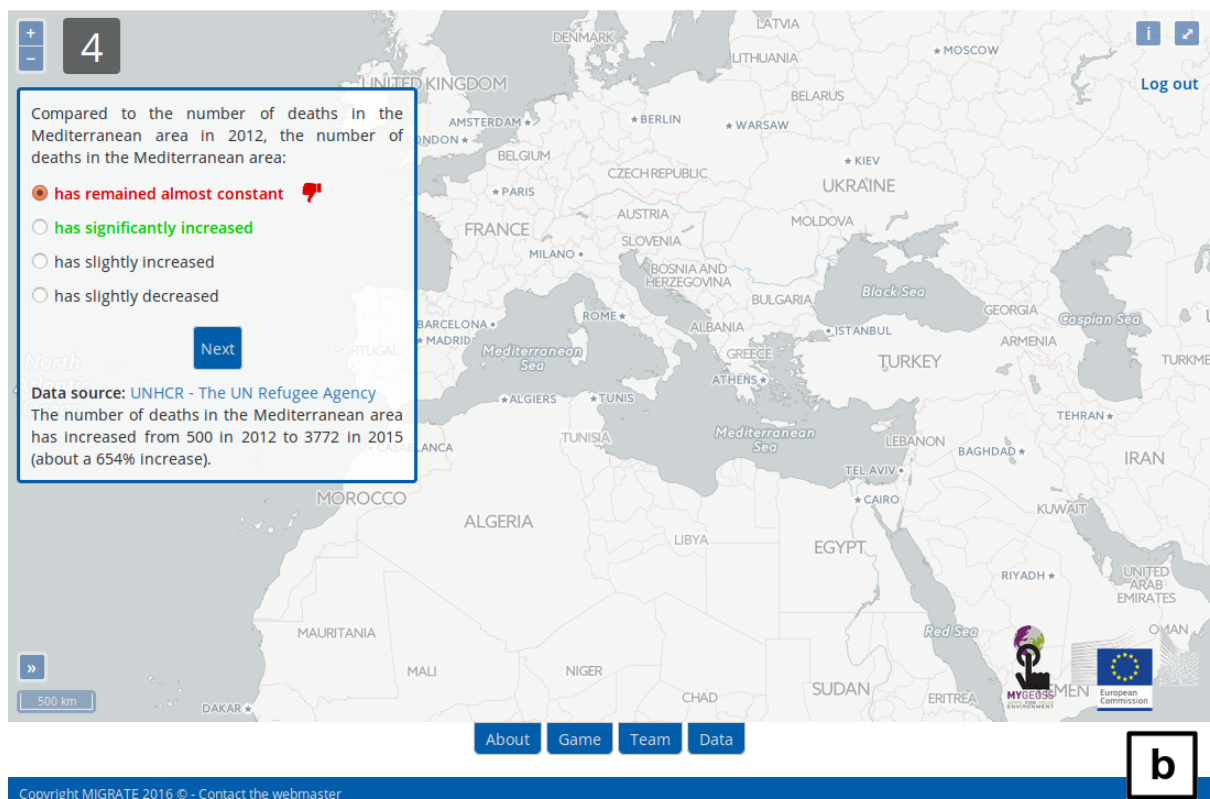
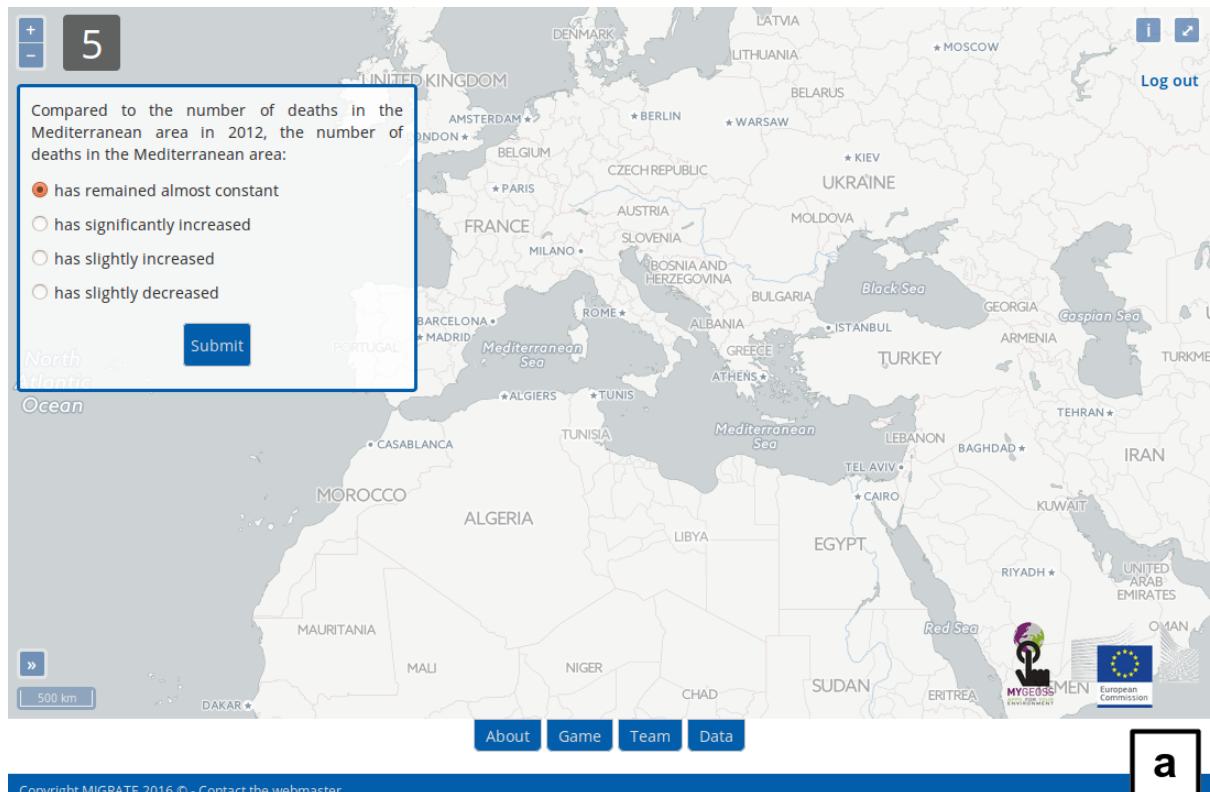


Figure 9. Example of a multiple choice question before (a) and after (b) the user's answer.

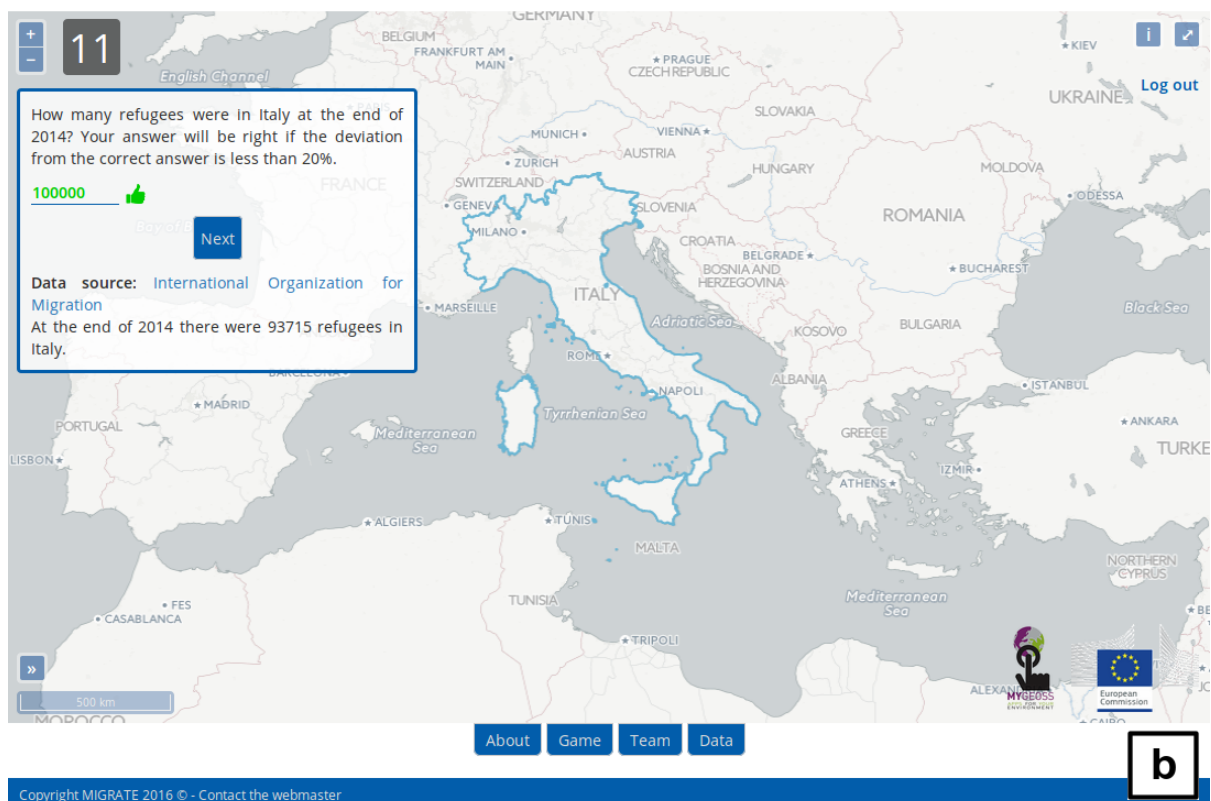
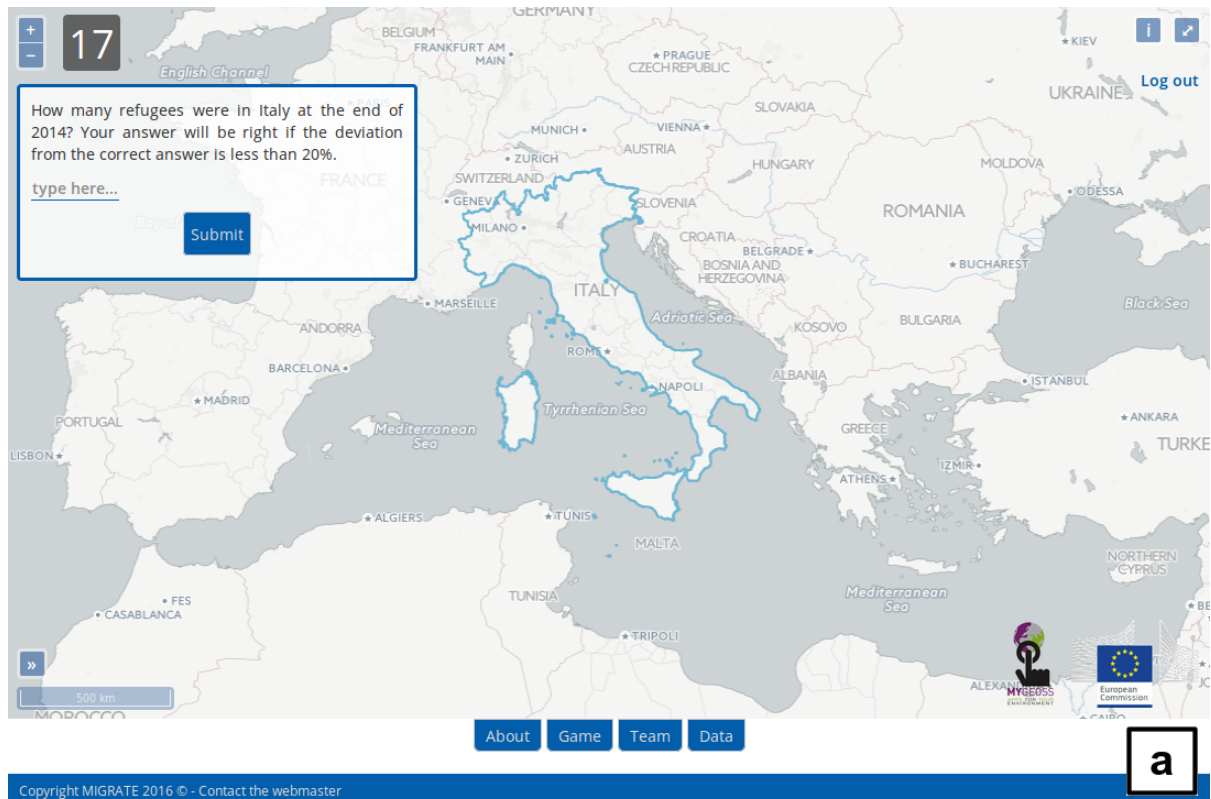


Figure 10. Example of a text-based question before (a) and after (b) the user's answer.

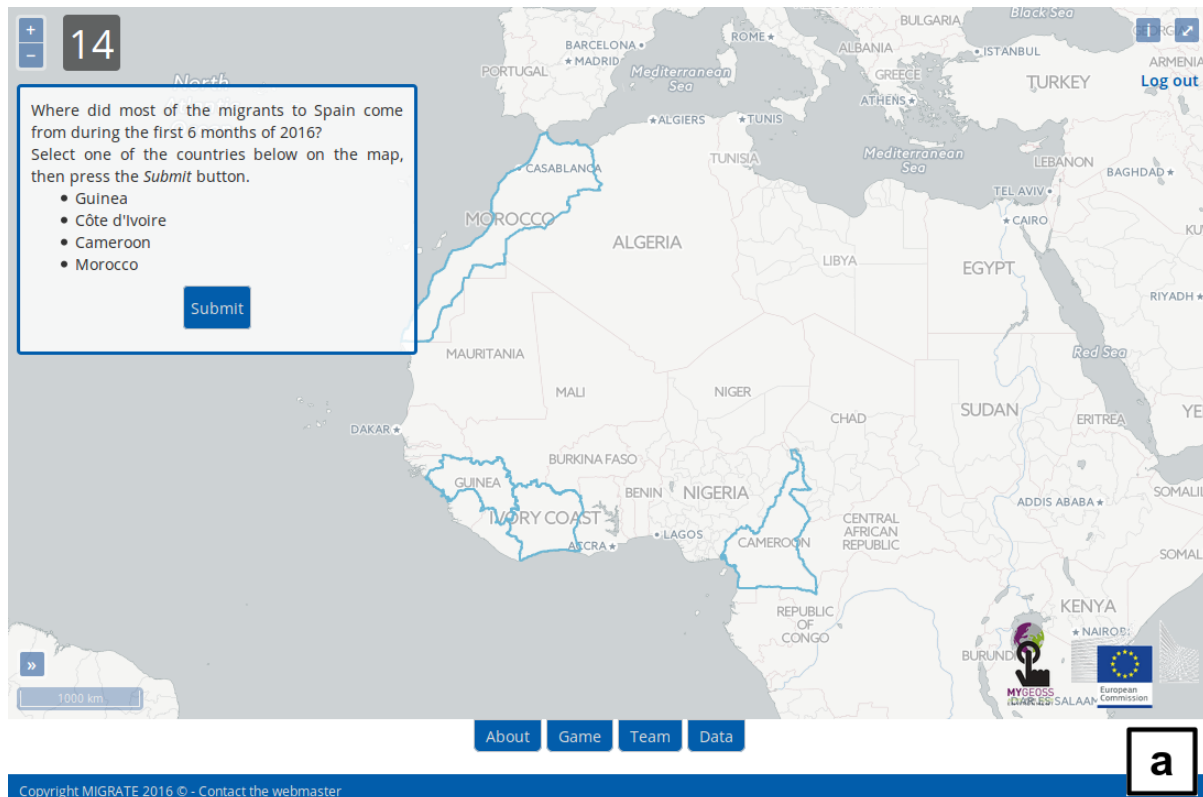


Figure 11. Example of a map-based question before (a) and after (b) the user's answer.

4. Future improvements

At the current stage, the MIGRATE application is fully operational, however it has not yet been tested on all possible operating systems, browsers and devices. Some bugs may exist and will need to be fixed. This is the matter of the testing phase which will be carried out in October 2016. The most up-to-date version of the code will be regularly posted on the project's Bitbucket repository (see above).

Moreover a number of improvements are already planned that will be implemented before the final release of the MIGRATE application and report (November 30, 2016). These improvements include at least:

- the refinement of the way the user's score is computed after each game played. This should take into account not only the number of correct answers given, but also the time taken to answer each question.
- the definition of an algorithm to compute and update the total user's score after more games are played. This should take into account not only the number of games played, but also the quality of the answers given (e.g. the average score) and the time taken to answer.
- the creation of badges to be assigned to users when specific outcomes are achieved, for instance after 10/20/50/100/200 games played, after a single game completed with 6 out of 6 questions answered correctly, etc. Each user will access his/her collection of badges from a user's profile page which will be created as well.
- the creation and updating of a user ranking, which will serve as the most important way to further motivate and engage users in playing the MIGRATE game.
- an optimization of the map performance when the country layers are displayed.

Como, September 30, 2016

Marco Minghini

