PROTON

Modelling the processes leading
to organised crime and terrorist networks

Co-funded by the
European Union

Development of PROTON Wizard

09/2019

D5.2: PROTON Wizard, Manual User Guide & Report

WP 5, T 5.2

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Modelling the PRocesses leading to Organised crime and TerrOrist Networks
FCT-16-2015

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Technical References

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[1] PU = Public
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RE = Restricted to a group specified by the consortium (including the Commission Services)
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0 Summary

The aim of this document is to present a technical overview of PROTON's Wizard for Organised Crime (OC) and radicalization and recruitment to Terrorism (TN) scenarios. Technologies used in the project as well as the purpose of working with them during the development process are described in the following chapters. The document shows the structure of the data that is presented in PROTON's Wizards which are introduced further in this document. The document also contains a User Manual guide, which contains an introduction to working with OC and TN Wizards.

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1 Introduction

PROTON wizard is a visualization tool which presents the results of PROTON's PROTON-S Agent-Based Modelling (ABM) simulation models, providing a user-friendly platform. PROTON Wizard is available under two addresses: one for radicalization and recruitment to terrorism simulations and another for recruitment to Organized Crime simulations. The visualization is displayed in form of a table, where users can choose the simulation they are interested in exploring, and conduct online analysis that is displayed clearly the use of charts and displays of associated output values. PROTON Wizard was developed using modern standards of technology and UX (User Experience) allowing to display all the information on the clear interface without the necessity of special expertise.

2 System Requirements

The goal of the PROTON Wizard is to develop a visualization tool providing a user-friendly environment for policy makers. The main functionalities of the Wizard are:

R1. Two different views. One for radicalization and recruitment to Terrorism scenarios, and another for Organized Crime scenarios. Those are available at the different addresses.
R2. Every view is suited on the common platform, allowing to share configuration, execution, visualization and analysis with minimal adjustments required by specific simulation type.
R3. Each of the views allow for choosing simulation model.
R4. Simulations available in each model are displayed in the table. User can filter and sort them to easily choose desired dataset.
R5. Procedure of choosing dataset are realized in form of wizard, which makes the process very intuitive and simple.
R6. Visualization of the output through graphs, tables and values. Possibility of choosing specific variables and the scale of the charts. User can also choose values to be compared.
R7. Database is prepared to contain all the necessary data obtained during the simulations.
R8. Simulation data are inserted into database using a script operated by the developers.
R9. Intuitive navigation between charts, datasets and simulations.

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3 Functional Design

The Main functions of the PROTON Wizard are presented in Figure 2, covered by functional modules briefly described below:

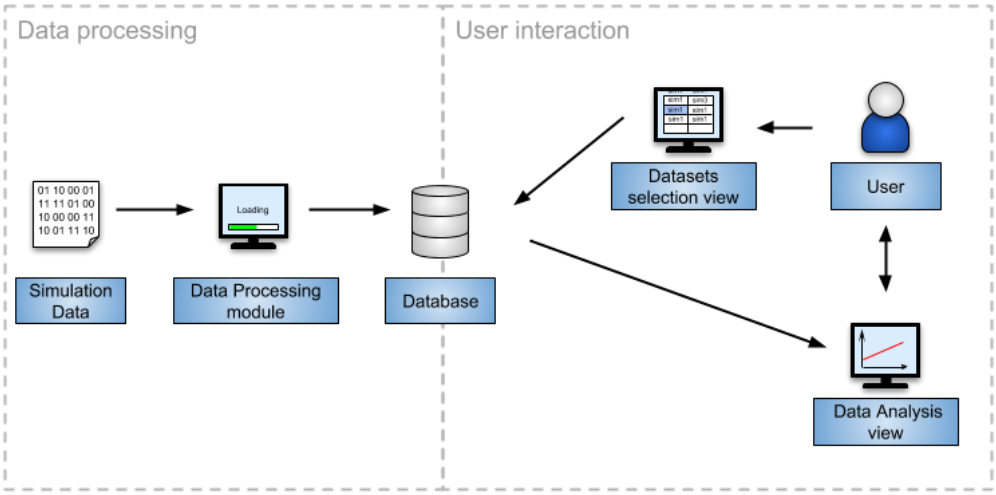

Figure 1 Wizard functional flow

The basic flow of the PROTON Wizard can be divided into two parts: uploading results and user interaction.
Data processing is a one-time process consisting of data gathering, computing and uploading it into the database. The data obtained from the simulations is uploaded into database through the data processing module. The data processing module is a set of scripts filtering and aggregating obtained values. This approach allows to reject data irrelevant from the analysing perspective, which makes them more compact. Data is uploaded and computed once and cannot be changed by the users. The only way to upload or delete data from the database is the manual work performed by the developer.
User interaction shows the flow from the user's perspective. User chooses data to be displayed in the dataset's selection view. This view consists of a table with datasets, which can be filtered. Selected datasets are translated into requests sent to the database, where specific data is displayed in the data analysis view. User is getting access to this data displayed in various views and can freely work on this data without the necessity to reload.

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3.1 Wizard components

The Proton Wizard is created for a user-friendly visualization of the results of PROTON simulation models. The main goal is to create a tool, that will enable users to configure, visualize and compare the results.

3.1.1 CONFIGURATION

User can configure the datasets according to his preferences. The PROTON simulations are performed using various scenarios. The PROTON Wizard is designed in the way allowing for easy selecting datasets, which are interesting from the user's perspective. The process of choosing specific scenario in the Organised Crime part is similar to the one in the radicalization and recruitment to Terrorism section. This task is divided into 3 steps:

3.1.1.1 FOR ORGANISED CRIME:

1. City choosing – in this step, the user chooses between two cities (South European city and North European city) to select the environment prepared for the simulation.
2. Scenario choosing – in this step the user chooses the scenario type. Those scenarios contain different starting conditions.

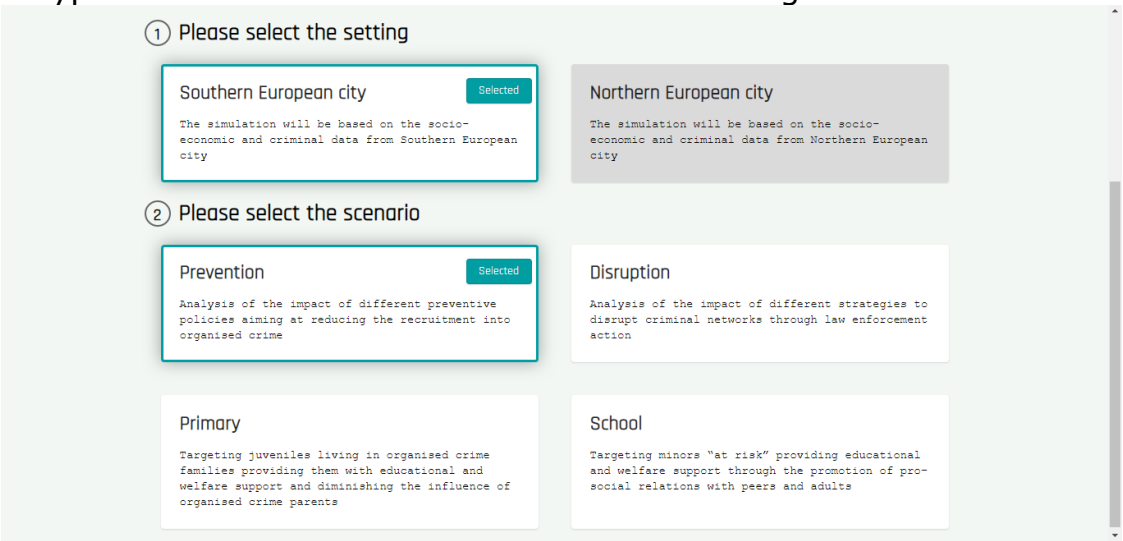

Figure 2 Choosing City and Scenario in PROTON's OC Wizard.

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3. Conditions choosing – the user can choose conditions of the simulation which will be presented in the analysing view.

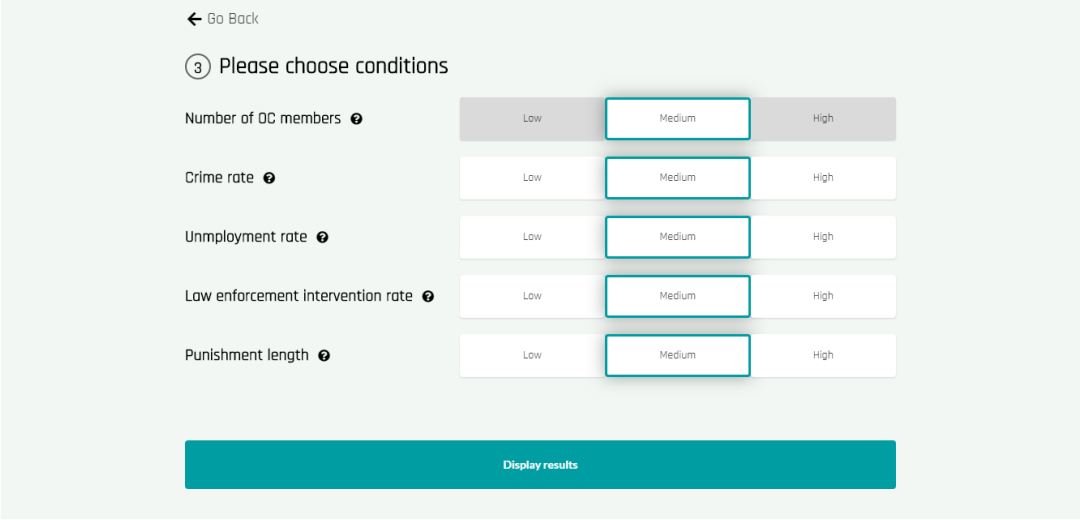

Figure 3 Choosing conditions of OC simulation

3.1.1.2 FOR RADICALIZATION AND RECRUITMENT TO TERRORISM:

1. Tailoring the environment according to the characteristics of the user's city – in this step the user chooses parameters to customize the environment to closely match their own city of interest.

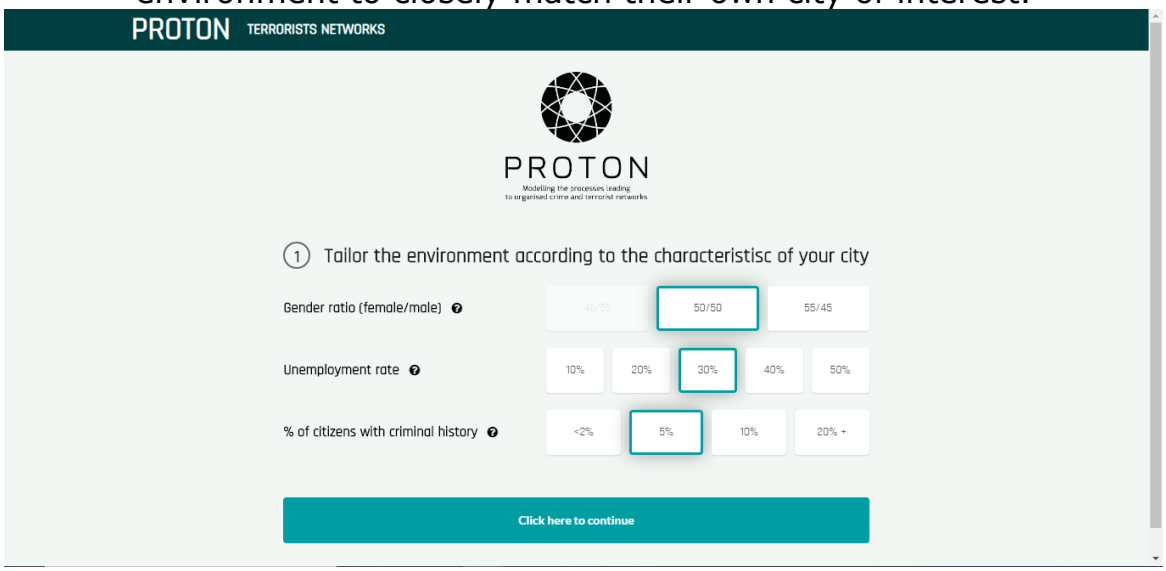

Figure 4 Tailoring the environment ins Step 1 in PROTON's TN Wizard.

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2. Intervention type choosing – this step enables the user to select one of three Intervention types (Figure 5).
3. Parameters for Intervention type – the user can choose specific parameters for selected Intervention type (Figure 5).

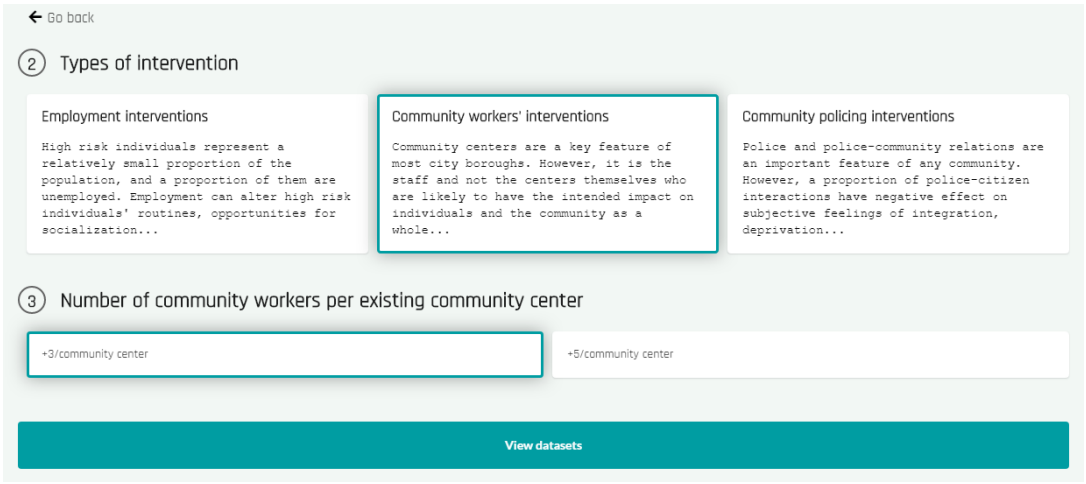

Figure 5 Choosing the intervention type and parameters for them

3.1.2 VISUALIZATION

3.1.2.1 ORGANISED CRIME SCENARIOS VISUALISATION

Data for these scenarios is presented in two horizontally separated parts:

- **Number of people** – contains a table and a chart presented in steps calculated numbers of OC members, recruited individuals, overall number of crimes and these committed by OC members.

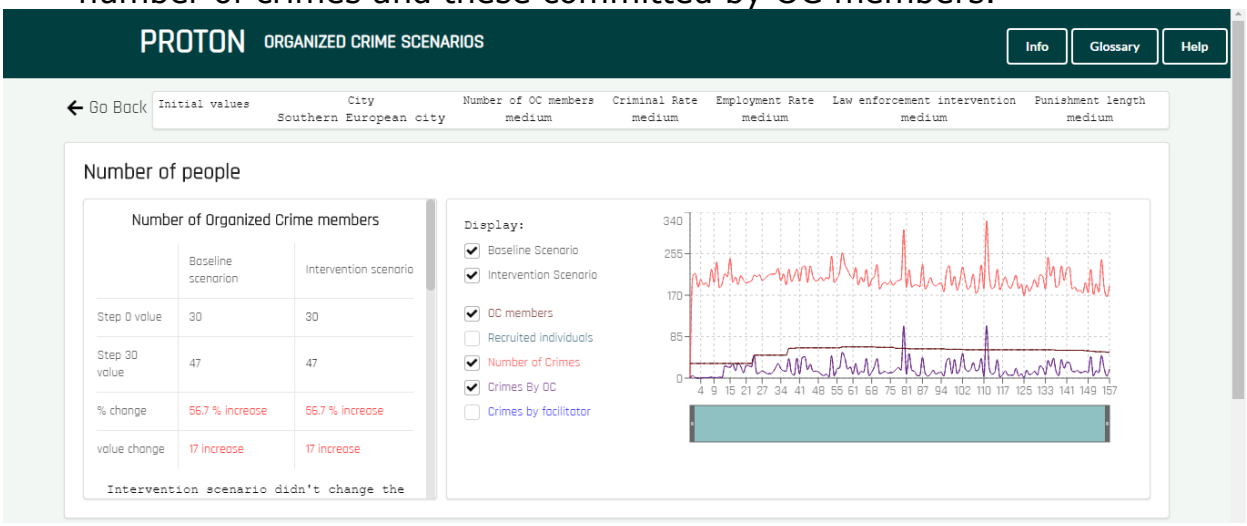

Figure 6 PROTON's OC charts view – Number of people.

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- **Distribution** – contains a graph with data about probability of committing a crime, embeddedness of overall community and distribution of regular citizens and crime groups. User can analyse the distribution of their wealth level, job level, education level and age in time and in each step.

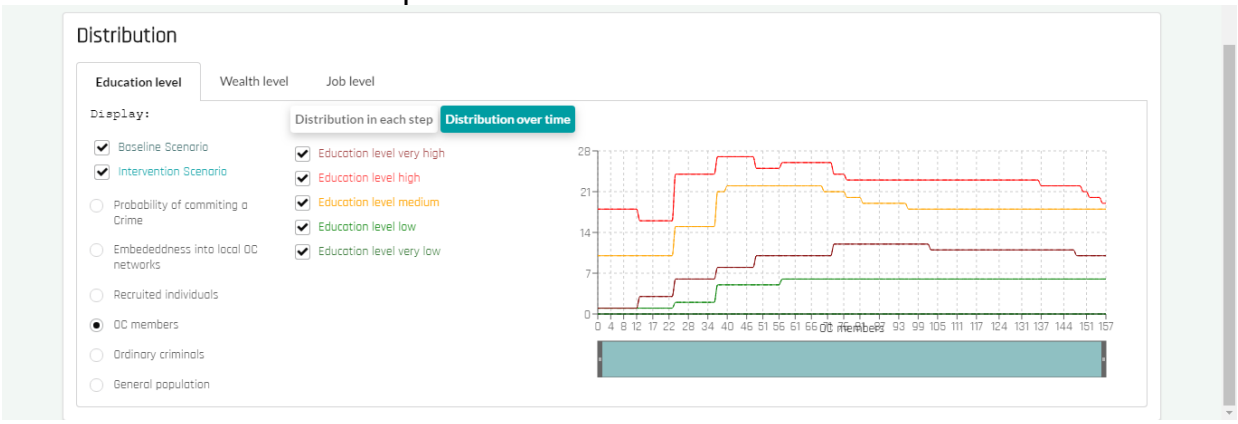

Figure 7 PROTON's OC charts view – Distribution.

3.1.2.2 RADICALIZATION AND RECRUITMENT TO TERRORISM

SCENARIOS VISUALISATION

The radicalization and recruitment to terrorism section enables user to choose between exploring results of experiments or seeing estimated results for customized simulation environment. These options are very similar. The only difference between them is the data that is being displayed.

The data for these scenarios is presented in two horizontally separated sections:

- **People** – consists of a table and a chart, both of which presents data concerning recruited citizens or the risk of radicalisation

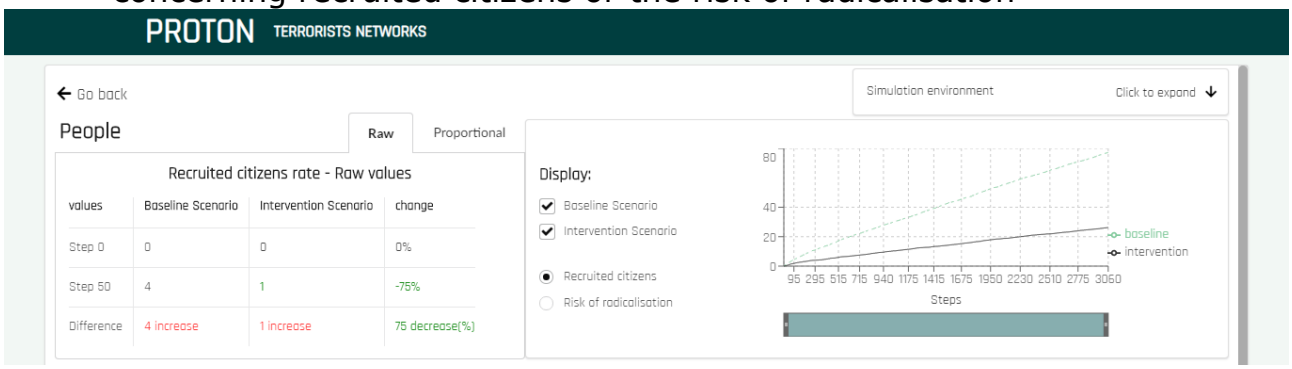

Figure 8 PROTON's TN charts view – People.

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- **Opinions** – this part contains a graph that shows the data concerning Integration/connectedness, Legitimacy/institutional trust and Subjective deprivation.

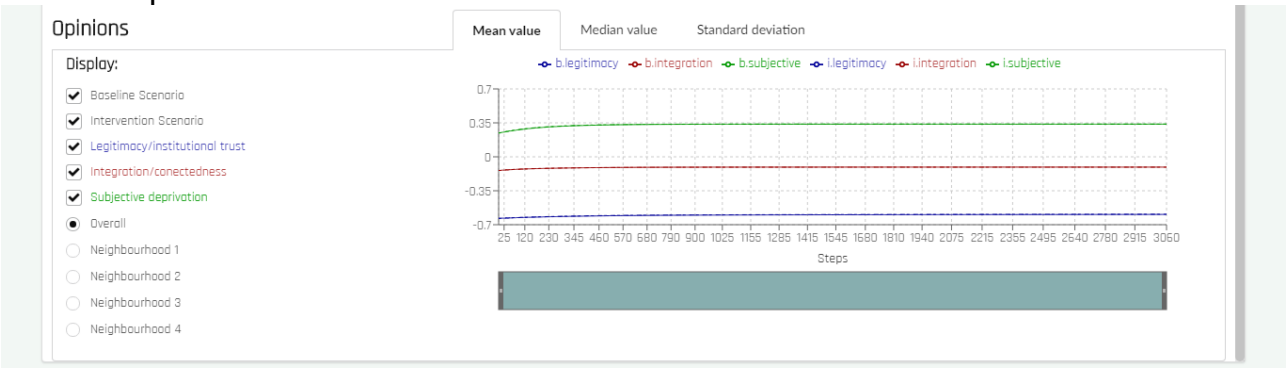

Figure 9 PROTON's TN charts view – People.

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4 Technical Design

4.1 PROTON Wizard data processing

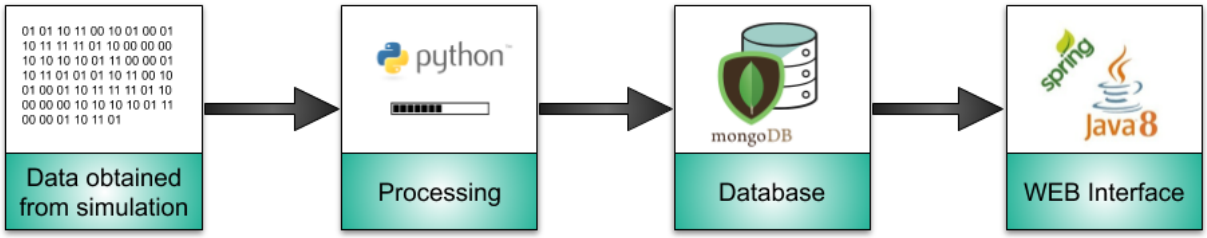

Figure 10 PROTON Wizard technology overview

The PROTON Wizard technology overview is presented in the Figure 4. The first step is the input of data obtained from the simulations. The data is obtained in the .csv file format and consists of thousands of rows of data. This kind of presentation cannot be displayed because of its' complexity and illegibility. Those datasets have to be processed in order to segregate, filter and aggregate them. This task is realized by the Python processing module which can do all the operations without overloading. The processed data are stored in the MongoDB database. Those data can be displayed on the WEB interface implemented in Java8 Spring framework. Web graphical user interface is transferring user's actions into API, which are connecting with the database to display values currently called by the user. This approach allows to display a lot of data aggregated into compact set, which avoids overloading of data in the web browser.
Each of these steps are described in the chapters below.

4.1.1 DATA OBTAINED FROM SIMULATION

Many different simulation outputs are visualized in the PROTON Wizard in various charts and tables. The data presented on the screen is acquired from simulations in form of a .csv file. There are two different sets of files, each representing one crime type (Radicalization and recruitment to Terrorism and Organized Crime). The data structure was discussed during teleconference meetings with consortium partners and it is presented below:

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4.1.1.1 ORGANIZED CRIME DATA STRUCTURE

The following table presents the data structure of ABMs results which are visualized by the PROTON Wizard.

Table1 Data structure of Organized Crime scenarios

NAME	TYPE	VALUE TYPE	COMMENTS
[run number]	id	integer	Run number
intervention	Intervention	string	Type of intervention
num-oc-persons	Initialized value	integer	Number of OC members
number-crimes-yearly-per10k	Initialized value	integer	Criminal rate
unemployment-multiplier	Initialized value	integer	Employment rate
number-arrests-per-year	Initialized value	integer	Law enforcement intervention rate
punishment-length	Initialized value	integer	Punishment length
[step]	id	integer	Step
o1	Result-base	integer	Number of OC members per time unit
o2	Result-base	integer	Number of recruited individuals into OC per time unit
o3	Result-base	integer	Number of crimes per time unit
o4	Result-base	integer	Number of crimes committed by OC members per time unit
o5	Result-stats	List of values	Distribution of individual propensity towards crime commission
o6	Result-stats	List of values	Distribution of individual embeddedness into OC-prone local networks

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o7a	Result-stats	List of values	Distribution of education level on new recruited individuals
o7b	Result-stats	List of values	Distribution of wealth level on new recruited individuals
o7c	Result-stats	List of values	Distribution of job level on new recruited individuals
o8a	Result-stats	List of values	Distribution of education level of OC members
o8b	Result-stats	List of values	Distribution of wealth level of OC members
o8c	Result-stats	List of values	Distribution of job level of OC members
o9a	Result-stats	List of values	Distribution of education level of "ordinary criminals"
o9b	Result-stats	List of values	Distribution of wealth level of "ordinary criminals"
o9c	Result-stats	List of values	Distribution of job level of "ordinary criminals"
o10a	Result-stats	List of values	Distribution of education level of the general population
o10b	Result-stats	List of values	Distribution of wealth level of the general population
o10c	Result-stats	List of values	Distribution of job level of the general population
o11	Result-stats	integer	Number of crimes committed by facilitator agents per time unit
o12	Result-stats	integer	Number of Law enforcement interventions per time unit

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4.1.1.2 RADICALIZATION AND RECRUITMENT TO TERRORISM DATA STRUCTURE

This table shows the structure of the data that represents the outcomes of the radicalization and recruitment to terrorism simulations.

Table 2 Data structure of radicalization and recruitment to terrorism scenarios

NAME	TYPE	VALUE TYPE	COMMENTS
[run number]	id	integer	Run number
male-ratio	Initialized value	integer	Gender ratio
population-employed-%	Initialized value	integer	Unemployment rate
criminal-history-percent	Initialized value	integer	Percentage of citizens with criminal history
high-risk-employed	Intervention	integer	Employment interventions
number-workers-per-community-center	Intervention	integer	Community workers interventions
cpo-%	Intervention	integer	Community policing interventions
[step]	id	integer	Step
t1	Result-stats	float	Recruited Citizens
t3 "mean" 0	Result-stats	float	Risk rate of citizens (Overall Mean)
t3 "median" 0	Result-stats	float	Risk rate of citizens (Overall Median)
t3 "standard-deviation" 0	Result-stats	float	Risk rate of citizens (Overall Standard deviation)
t3 "mean" 1	Result-stats	float	Risk rate of citizens (Neighbourhood 1 Mean)
t3 "median" 1	Result-stats	float	Risk rate of citizens (Neighbourhood 1 Median)
t3 "standard-deviation" 1	Result-stats	float	Risk rate of citizens (Neighbourhood 1

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			Standard deviation)
t3 "mean" 2	Result-stats	float	Risk rate of citizens (Neighbourhood 2 Mean)
t3 "median" 2	Result-stats	float	Risk rate of citizens (Neighbourhood 2 Median)
t3 "standard-deviation" 2	Result-stats	float	Risk rate of citizens (Neighbourhood 2 Standard deviation)
t3 "mean" 3	Result-stats	float	Risk rate of citizens (Neighbourhood 3 Mean)
t3 "median" 3	Result-stats	float	Risk rate of citizens (Neighbourhood 3 Median)
t3 "standard-deviation" 3	Result-stats	float	Risk rate of citizens (Neighbourhood 3 Standard deviation)
t3 "mean" 4	Result-stats	float	Risk rate of citizens (Neighbourhood 4 Mean)
t3 "median" 4	Result-stats	float	Risk rate of citizens (Neighbourhood 4 Median)
t3 "standard-deviation" 4	Result-stats	float	Risk rate of citizens (Neighbourhood 4 Standard deviation)
t5 "mean" "Non integration" 0	Result-stats	float	Integration/connectedness (Overall Mean)
t5 "mean" "Non integration" 1	Result-stats	float	Integration/connectedness (Neighbourhood 1 Mean)
t5 "mean" "Non integration" 2	Result-stats	float	Integration/connectedness (Neighbourhood 2 Mean)
t5 "mean" "Non integration" 3	Result-stats	float	Integration/connectedness (Neighbourhood 3 Mean)
t5 "mean" "Non integration" 4	Result-stats	float	Integration/connectedness (Neighbourhood 4 Mean)
t5 "median" "Non integration" 0	Result-stats	float	Integration/connectedness (Overall Median)
t5 "median" "Non integration" 1	Result-stats	float	Integration/connectedness (Neighbourhood 1 Median)
t5 "median" "Non integration" 2	Result-stats	float	Integration/connectedness (Neighbourhood 2 Median)

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t5 "median" "Non integration" 3	Result-stats	float	Integration/connectedness (Neighbourhood 3 Median)
t5 "median" "Non integration" 4	Result-stats	float	Integration/connectedness (Neighbourhood 4 Median)
t5 "standard-deviation" "Non integration" 0	Result-stats	float	Integration/connectedness (Overall Standard deviation)
t5 "standard-deviation" "Non integration" 1	Result-stats	float	Integration/connectedness (Neighbourhood 1 Standard deviation)
t5 "standard-deviation" "Non integration" 2	Result-stats	float	Integration/connectedness (Neighbourhood 2 Standard deviation)
t5 "standard-deviation" "Non integration" 3	Result-stats	float	Integration/connectedness (Neighbourhood 3 Standard deviation)
t5 "standard-deviation" "Non integration" 4	Result-stats	float	Integration/connectedness (Neighbourhood 4 Standard deviation)
t5 "mean" "Institutional distrust" 0	Result-stats	float	Legitimacy/institutional trust (Overall Mean)
t5 "mean" "Institutional distrust" 1	Result-stats	float	Legitimacy/institutional trust (Neighbourhood 1 Mean)
t5 "mean" "Institutional distrust" 2	Result-stats	float	Legitimacy/institutional trust (Neighbourhood 2 Mean)
t5 "mean" "Institutional distrust" 3	Result-stats	float	Legitimacy/institutional trust (Neighbourhood 3 Mean)
t5 "mean" "Institutional distrust" 4	Result-stats	float	Legitimacy/institutional trust (Neighbourhood 4 Mean)
t5 "median" "Institutional distrust" 0	Result-stats	float	Legitimacy/institutional trust (Overall Median)
t5 "median" "Institutional distrust" 1	Result-stats	float	Legitimacy/institutional trust (Neighbourhood 1 Median)
t5 "median"	Result-stats	float	Legitimacy/institutional

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"Institutional distrust" 2			trust (Neighbourhood 2 Median)
t5 "median" "Institutional distrust" 3	Result-stats	float	Legitimacy/institutional trust (Neighbourhood 3 Median)
t5 "median" "Institutional distrust" 4	Result-stats	float	Legitimacy/institutional trust (Neighbourhood 4 Median)
t5 " standard-deviation " "Institutional distrust" 0	Result-stats	float	Legitimacy/institutional trust (Overall Standard deviation)
t5 " standard-deviation " "Institutional distrust" 1	Result-stats	float	Legitimacy/institutional trust (Neighbourhood 1 Standard deviation)
t5 " standard-deviation " "Institutional distrust" 2	Result-stats	float	Legitimacy/institutional trust (Neighbourhood 2 Standard deviation)
t5 " standard-deviation " "Institutional distrust" 3	Result-stats	float	Legitimacy/institutional trust (Neighbourhood 3 Standard deviation)
t5 " standard-deviation " "Institutional distrust" 4	Result-stats	float	Legitimacy/institutional trust (Neighbourhood 4 Standard deviation)
t5 "mean" "Collective relative deprivation" 0	Result-stats	float	Subjective deprivation (Overall Mean)
t5 "mean" "Collective relative deprivation" 1	Result-stats	float	Subjective deprivation (Neighbourhood 1 Mean)
t5 "mean" "Collective relative deprivation" 2	Result-stats	float	Subjective deprivation (Neighbourhood 2 Mean)
t5 "mean" "Collective relative deprivation" 3	Result-stats	float	Subjective deprivation (Neighbourhood 3 Mean)
t5 "mean" "Collective relative deprivation" 4	Result-stats	float	Subjective deprivation (Neighbourhood 4 Mean)

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t5 "median" "Collective relative deprivation" 0	Result-stats	float	Subjective deprivation (Overall Median)
t5 "median" "Collective relative deprivation" 1	Result-stats	float	Subjective deprivation (Neighbourhood 1 Median)
t5 "median" "Collective relative deprivation" 2	Result-stats	float	Subjective deprivation (Neighbourhood 2 Median)
t5 "median" "Collective relative deprivation" 3	Result-stats	float	Subjective deprivation (Neighbourhood 3 Median)
t5 "median" "Collective relative deprivation" 4	Result-stats	float	Subjective deprivation (Neighbourhood 4 Median)
t5 "standard-deviation" "Collective relative deprivation" 0	Result-stats	float	Subjective deprivation (Overall Standard deviation)
t5 "standard-deviation" "Collective relative deprivation" 1	Result-stats	float	Subjective deprivation (Neighbourhood 1 Standard deviation)
t5 "standard-deviation" "Collective relative deprivation" 2	Result-stats	float	Subjective deprivation (Neighbourhood 2 Standard deviation)
t5 "standard-deviation" "Collective relative deprivation" 3	Result-stats	float	Subjective deprivation (Neighbourhood 3 Standard deviation)
t5 "standard-deviation" "Collective relative deprivation" 4	Result-stats	float	Subjective deprivation (Neighbourhood 4 Standard deviation)

4.1.2 PROCESSING

Data from simulations is processed using Python scripts. This enables us to segregate and place data properly in our databases. We used PyMongo driver

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that is the most recommended tool designed to work with MongoDB from Python.

4.1.3 DATABASE

The processed data is stored using MongoDB which provides a fast and scalable data storage service especially when data is non-relational. This enhances performance of data visualization in PROTON Wizard.

4.1.4 WEB INTERFACE

WEB interface was created using the React libraries based on JavaScript language. Currently it is one of the most effective and efficient methods to create User Interfaces. It is separated in two main parts, which are stated on different servers. One part is declared for presenting Organized Crime scenarios and the second one shows radicalization and recruitment to terrorism scenarios.

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5 User Manual

5.1 Overview

Wizards for Organized Crime scenarios and radicalization and recruitment to terrorism scenarios are placed separately on different addresses. They are created in Web technology so there is no need of installing them, one of these Web browsers is needed to get them working – Google Chrome, Mozilla Firefox, Opera or Microsoft Edge. The wizards are similar in most aspects, however due to some inconsiderable differences, two separate manuals were created.

5.2 Manual for OC Wizard

To access the OC Wizard, the user needs to enter this temporary address - http://193.142.112.125:8012/. Before the final review, the OC Wizard will be placed on a different address.

This is the first screen that is shown to user. On every view by clicking on "PROTON" inscription in the upper-left corner, the user will be guided to this screen. Also, on each of the screens in the top-left corner there are 3 buttons: "Info", "Glossary" and "Help". Each of them provides the user with more specific information about the PROTON's OC Wizard.

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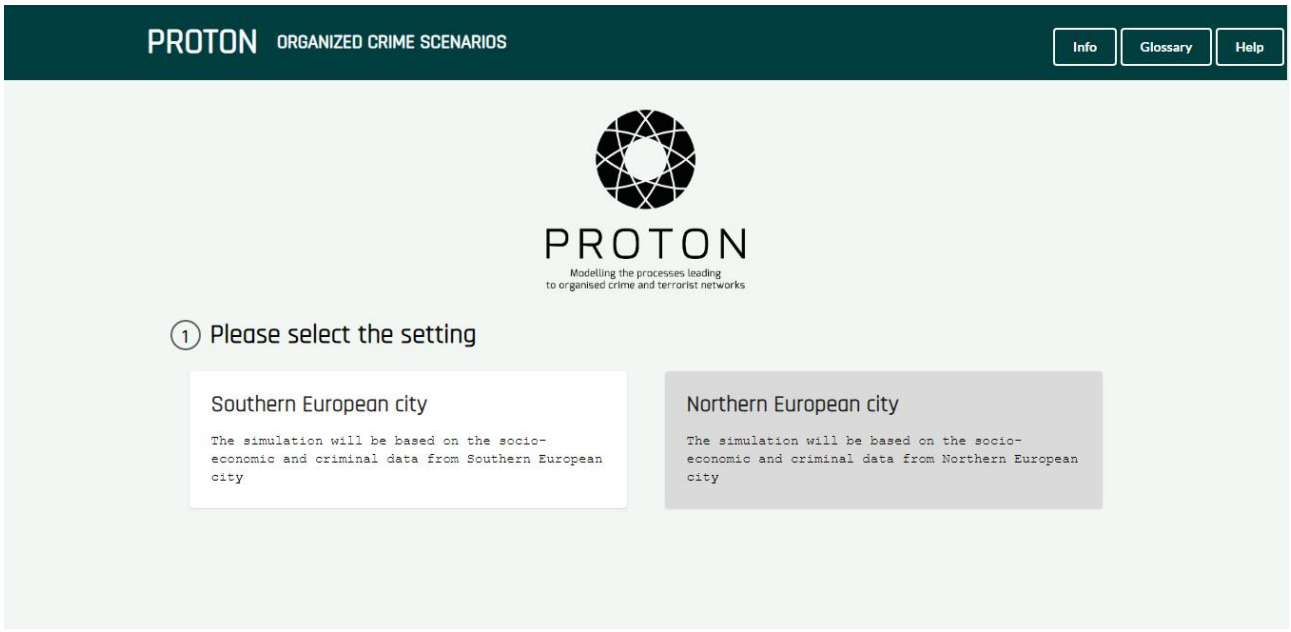

Figure 11 First screen of PROTON's OC Wizard.

When the user selects the city in Step 1, it unlocks Step 2 and brings the availability to choose the Intervention scenario.

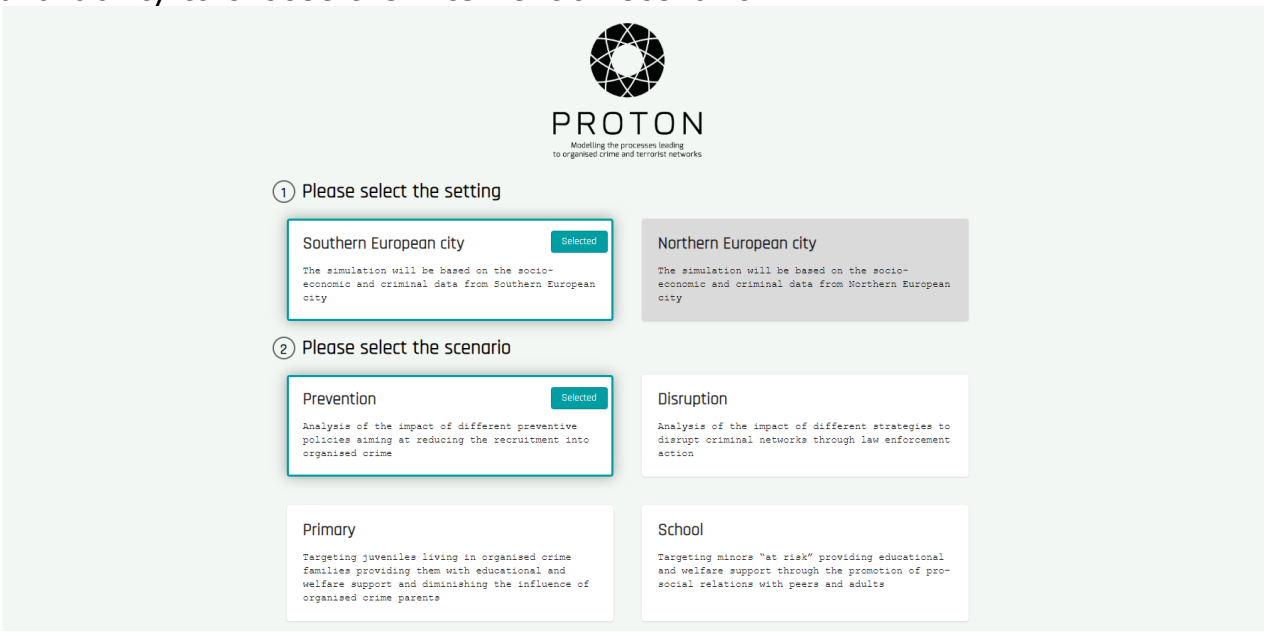

Figure 12 Choosing the Intervention scenario in Step 2.

If the Intervention is selected it guides the user to the screen with Step 3. On this view, the user selects the values of parameters according to the city which

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is meant to be tested. When all the conditions are chosen, the user can click the "Display results" button, which provides the view with the data charts.

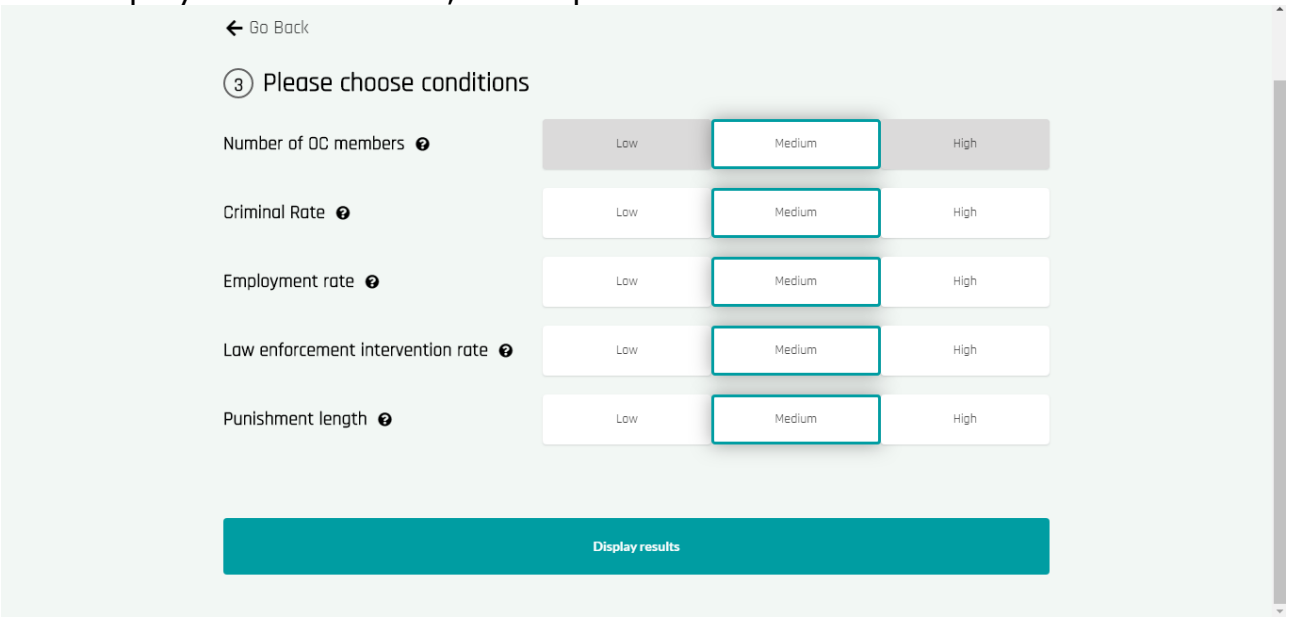

Figure 13 Choosing conditions in Step 3 of PROTON's OC Wizard.

The charts view presents the data received from the ABM simulations. Below the top bar there is a container displaying picked Initial values in Step 1, 2 and 3.
This screen is divided into 2 parts: Number of people and Distribution. User can choose which data he wants to explore, by selecting them with checkboxes. Under the charts there is a slider enabling to choose the steps which are meant to be displayed.
The table on the left side below "Input values" bar, presents the data on the first and the last step that is selected on slider below the graph. The type of the displayed data depends on which checkboxes User marked to present the chosen information on a chart.

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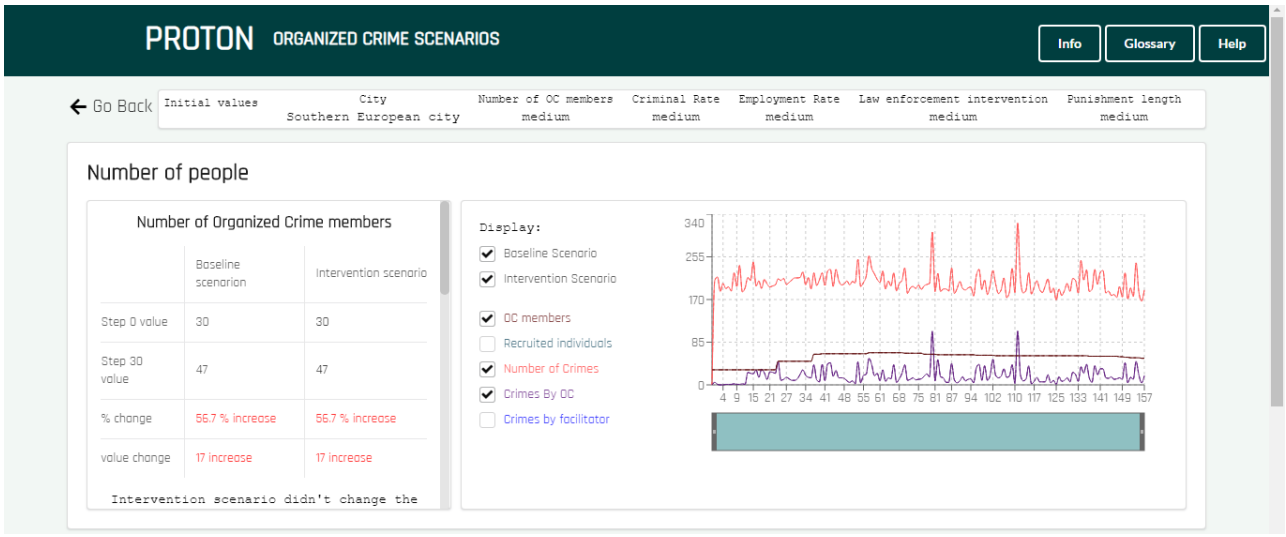

Figure 14 PROTON's OC charts view – Number of people.

The Distribution section can present the data in two ways. The first one is "Distribution in each step" which shows how specifically the data is spread according to the level of Education, Wealth or Job in every step. User can select one of these characteristics by clicking on specific tab on top of this section. The type of the data to display is being chosen on the left side of this part.

Figure 15 PROTON's OC charts view – Distribution in each step.

The second type is "Distribution over time" which presents how the data changes along with steps. Choosing the data and characteristics to display is very similar to that in the "Distribution in each step" part. Additionally, there is an availability to select specific levels of these characteristics.

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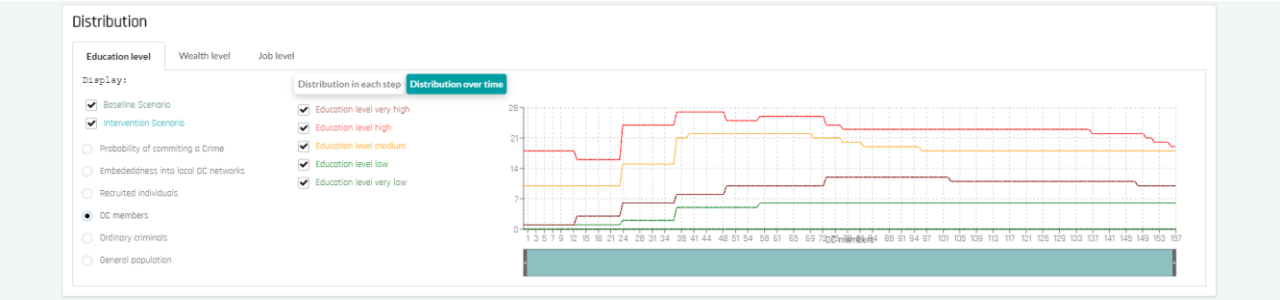

Figure 16 PROTON's OC charts view – Distribution over time.

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5.3 Manual for TN Wizard

Access to PROTON's TN Wizard is available under this address - http://193.142.112.115:8020/. It is temporary until the final review to enable us to update data from simulations. After that, this Wizard will be available under a different server.

The first screen provides an overview of the TN simulations. When user clicks on the "PROTON Wizard" button it leads to the second screen. The user can also click on the "PROTON" inscription in upper-left corner and will be guided to this screen.

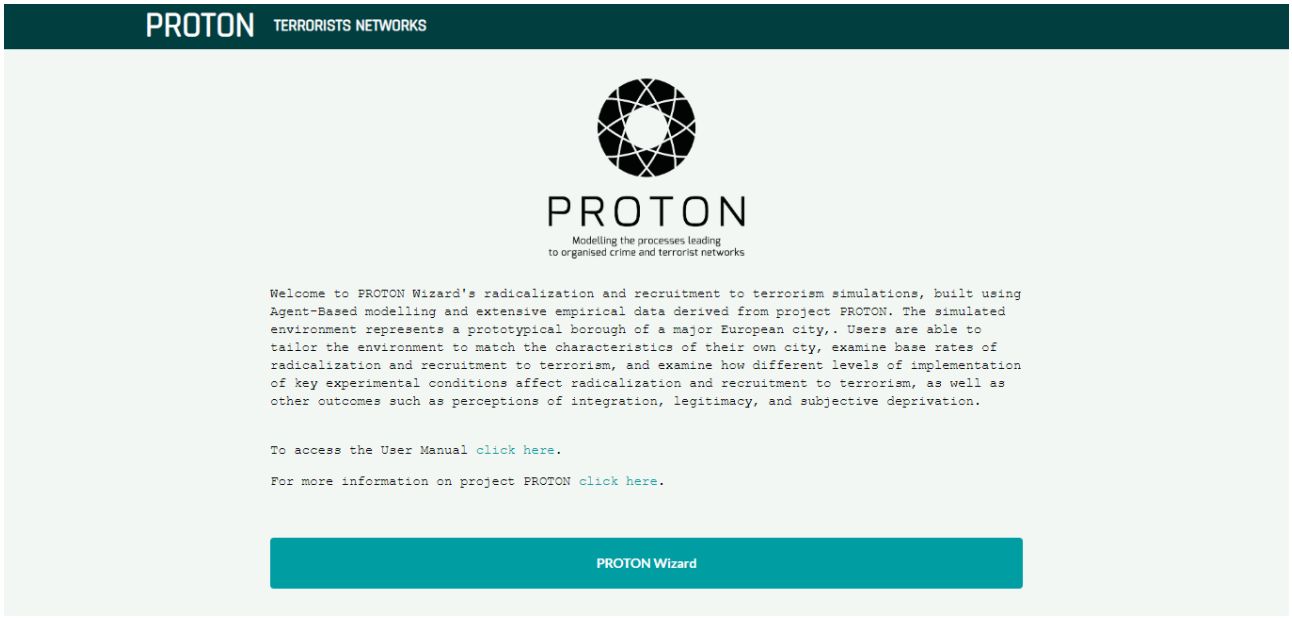

Figure 17 Intro to PROTON's TN Wizard.

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The second screen of PROTON's TN Wizard enables to choose between displaying the results of Interventions or defining simulation environment. It is done by clicking one of the two buttons in this view.

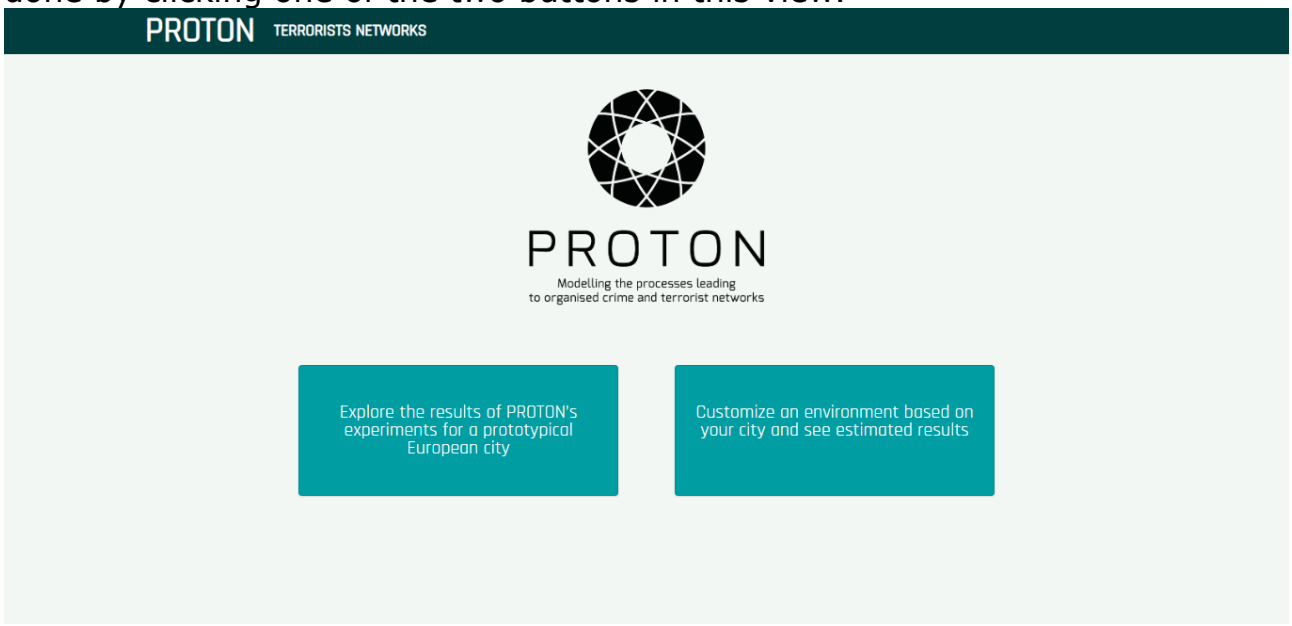

Figure 18 Second screen of PROTON's TN Wizard.

If user chooses to explore results for experiments, a screen with an option to pick one of the three Intervention scenarios is shown. By choosing one of them, the user is guided to the charts view.

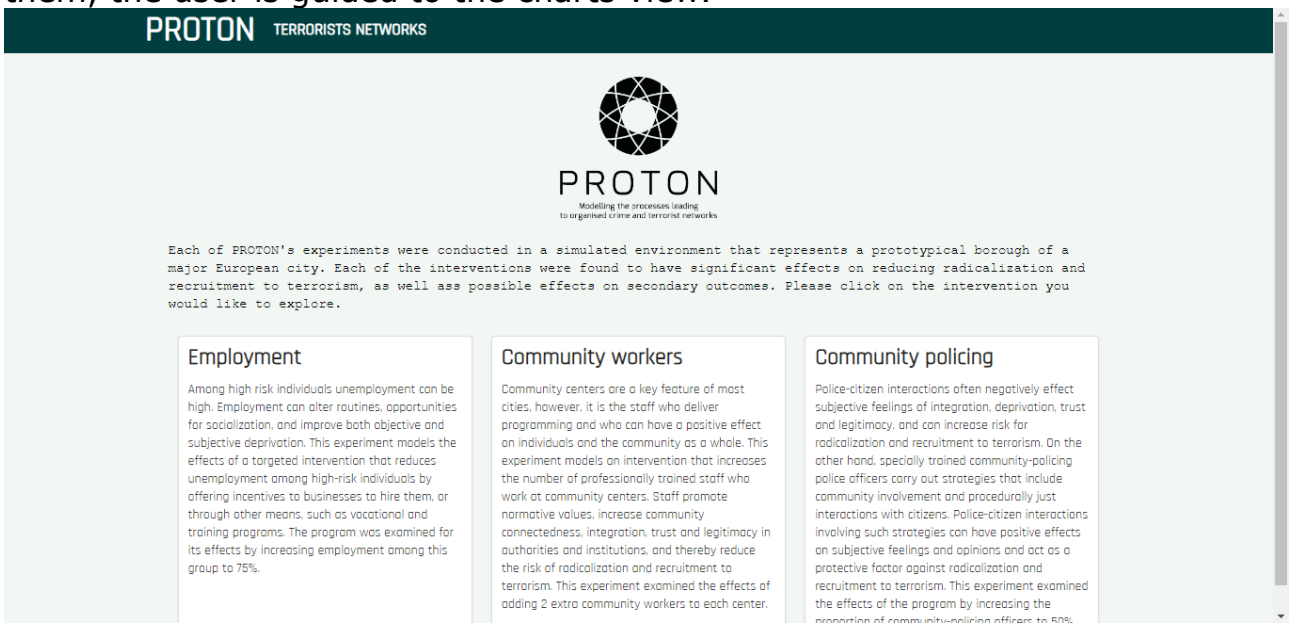

Figure 19 Picking Intervention results screen.

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The charts view is separated into 2 sections: People and Opinions. User is able to choose what data he wants to display by selecting checkboxes. The slider beneath the charts enables to show specific steps of simulation.
Section "People" contains table on the left side presenting data according to chosen steps. Diagram is placed to the right of the table, it shows how information change with steps. When "Risk of radicalisation" is selected, User can more characteristics like "Neighbourhood" or "Mean" / "Median" / "Standard deviation".

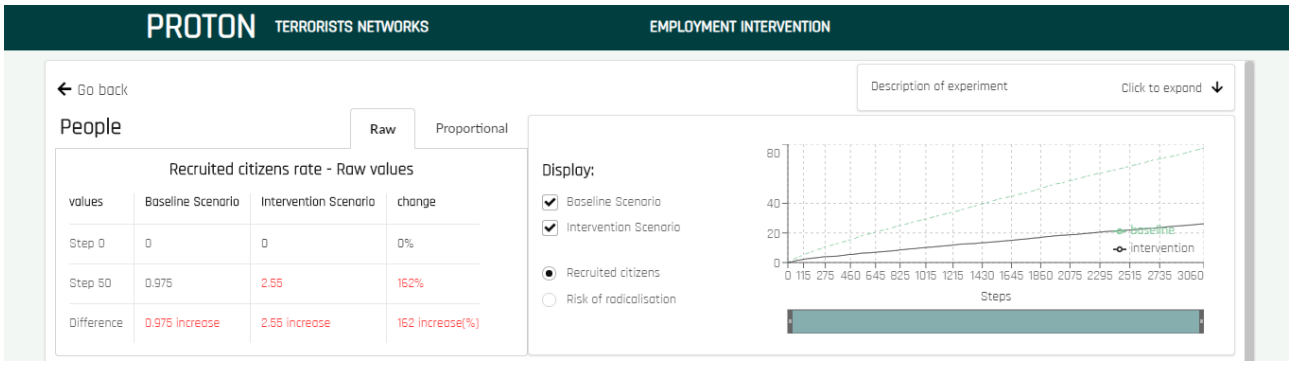

Figure 20 PROTON's TN results view – People.

Second part of charts view contains data about opinions. User can pick type of "Opinions" to be displayed by matching checkboxes. There is also availability to choose specific "Neighbourhood" or data characteristics from: "Mean", "Median" or "Standard deviation".

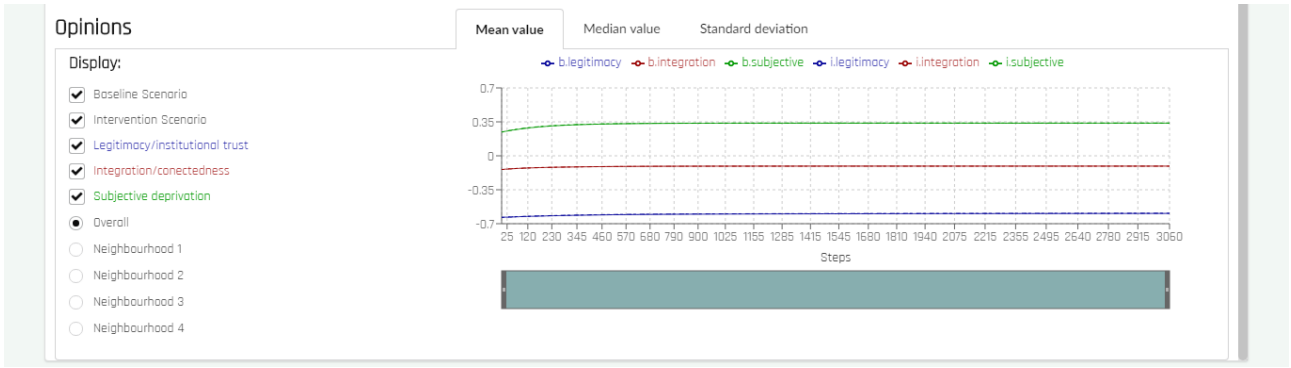

Figure 21 PROTON's TN results view – Opinions.

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If the user chose to define the simulation environment on the second screen, the Step 1 view will be displayed.

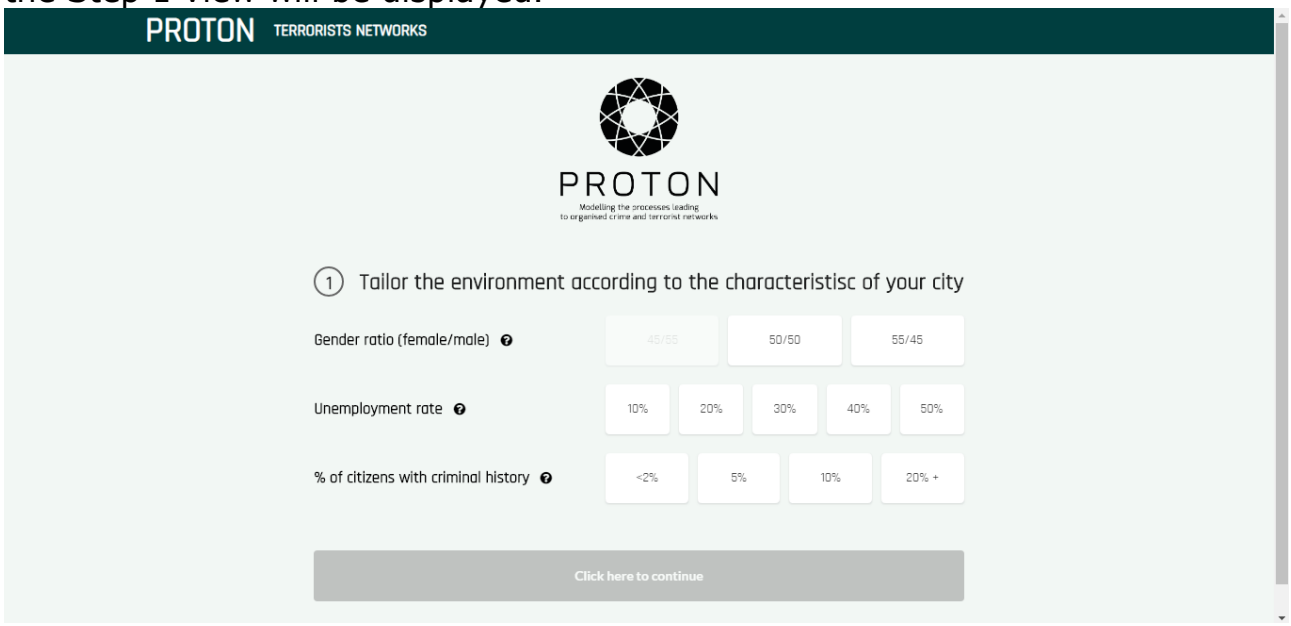

Figure 22 PROTON's TN Wizard Step 1 screen.

When all the conditions are chosen, the user can press the "Click here to continue" button, which displays the Step 2 & 3 screen.

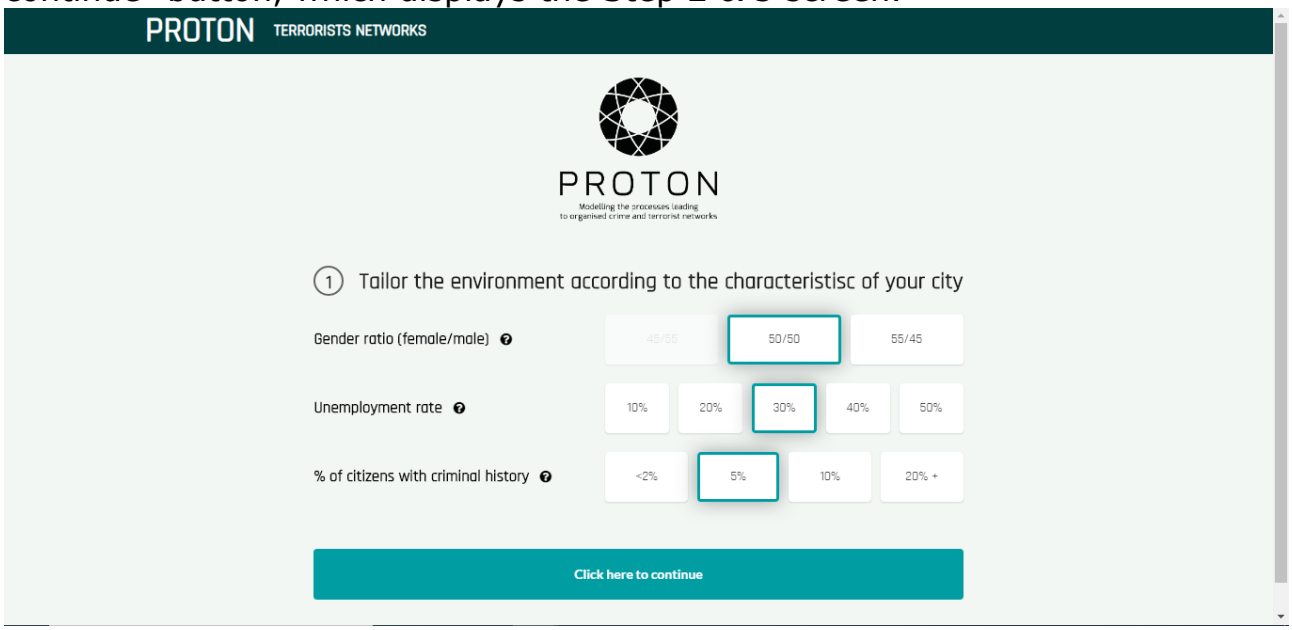

Figure 23 Selected conditions in Step 1 of PROTON's TN Wizard.

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In Step 2, the user chooses the Type of Intervention in which the data will be displayed. In Step 3, the degree of selected Intervention can be picked. Subsequently, the user can click the "View datasets" button, which provides the user with the charts view.

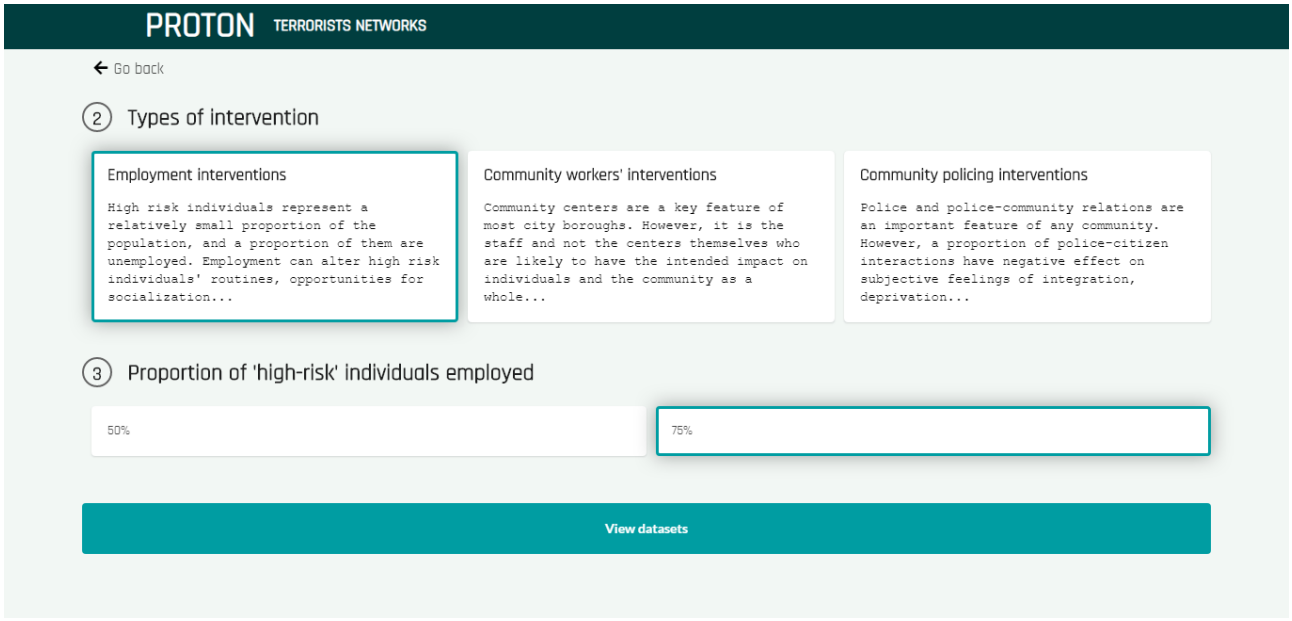

Figure 24 Step 2 and 3 in PROTON's TN Wizard.

The charts view presents the data according to the user's choices in Step 1,2 and 3. On this screen there is an ability to select a part of the data that is wanted to be showed. The user can also choose to display mean, median or standard deviation of the data. Desired neighbourhood is achievable by checking the determined checkboxes. By clicking the "Simulation environment" bar, the user can obtain an overview of what choices he made in Steps 1, 2 and 3.

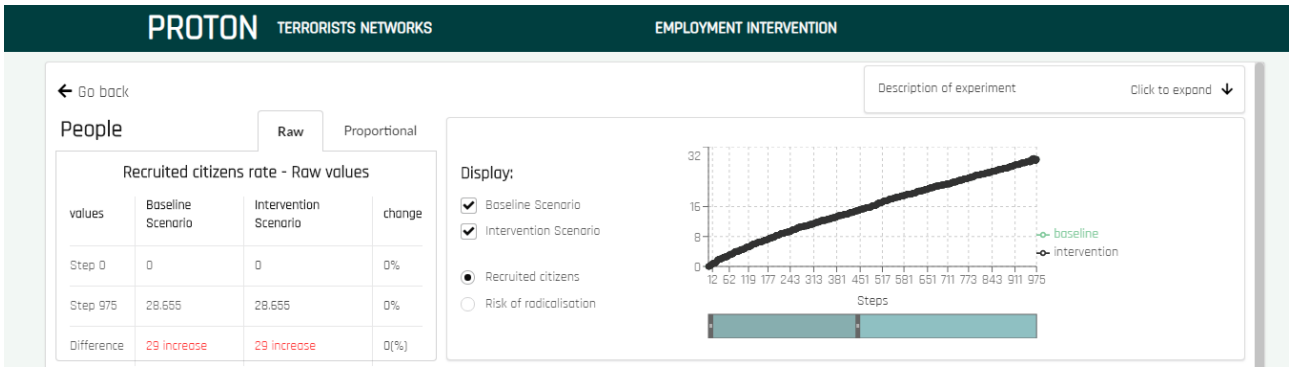

Figure 25 PROTON's TN charts view – People part.

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This section is the same as one in results view. Only difference is displaying other data.

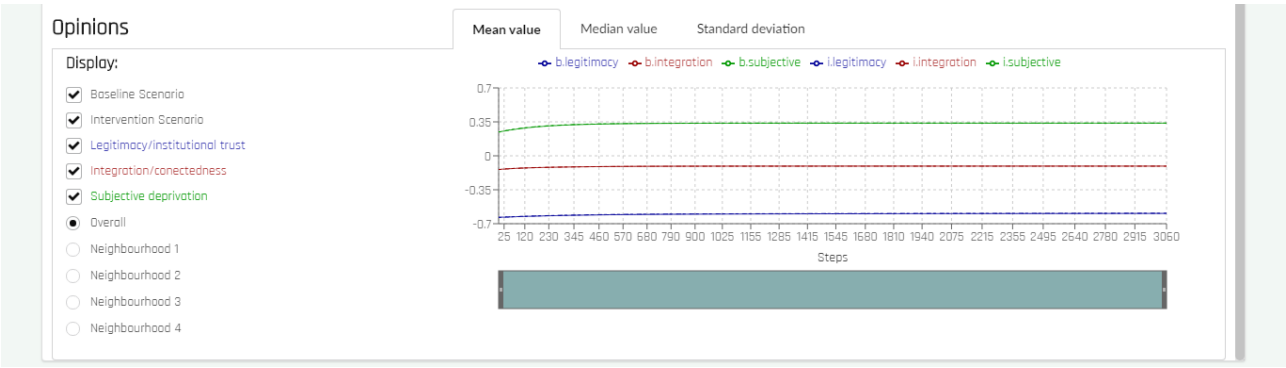

Figure 26 PROTON's TN charts view – Opinions part.

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6 Conclusions

The development of the PROTON Wizard was initially meant to be created as one Web application. This Wizard could enable the user to choose between exploring data from the radicalization and recruitment to terrorism or the Organised Crime simulations. In the process of obtaining desired results and gathering data it occurred that it would be better to create two separate Wizards. This decision resulted in the development of two Web applications similar to each other. They display different data with distinct structure.

The received outcomes the simulations were processed, aggregated and stored in two databases, from which the Wizards draw out the necessary data. Thanks to the visualisation of the radicalization and recruitment to terrorism, and Organised Crime scenarios, the results are presented in a user-friendly interface, providing the users with an easy access to them.

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