

## An Experience on Leadership Identification in Social Cognocracy Network

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**Abstract**—In this work we show the results of a decision making experience conducted through the Social Cognocracy Network. This collaborative social network, developed by the Zaragoza Multicriteria Decision Making Group (GDMZ), is based on the principles that support the cognitive democracy known as e-cognocracy. The network considers three levels of interaction: information, content creation and decision making. E-cognocracy uses two rounds in order to incorporate preferences through an e-voting module and an intermediate round of discussion in which the arguments that support the individual positions and decisions are added by means of a forum. In addition, the forum provides quantitative measures that reflect the reputation of the actors and the relevance of topics and comments. This quantitative information is used to propose a procedure for the identification of the social leaders, the persons whose opinions influence the preferences of others.

**Keywords**—Policy Making, Social Cognocracy Network, Reputation, Influence, Leadership Identification.

### I. INTRODUCTION

E-cognocracy [1][2] is a cognitive democracy oriented to the extraction and sharing of knowledge associated with the scientific resolution of public decision making problems related with the governance of society. It uses two rounds in order to incorporate preferences through an e-voting module and an intermediate round of discussion in which the arguments that support the individual positions are added by means of a forum.

In the voting round the priorities associated to the alternatives are compared on two separate occasions; in the discussion step, the arguments for and against these alternatives, which are defended by the decision makers, are incorporated by posting messages and comments to the messages. In addition to the text that contains the decision makers' arguments, each post includes the information about three quantitative measures that reflect the importance given by the author and the reader to the post and the extent of their agreement with it. All this quantitative information and the relationships and influence indicators within the discussion network are used to propose a procedure for the

identification of the social leaders –the persons whose opinions influence the preferences of others.

To do so, it is necessary to measure how an actor's vote is influenced by the opinions of the other actors.

### II. BACKGROUND

The experience involved a citizen's participation process based on the use of a social network, Social Cognocracy Network, that integrates the voting and discussion processes and provides tools to analyze the resulting preference structures.

#### A. The Social Cognocracy Network

Social Cognocracy Network (SCN) is a social network designed by the Zaragoza Multicriteria Decision Making Group (GDMZ). Based on the e-cognocracy, SCN promotes the citizen participation. Three participation levels are possible: (i) information (ii) content creation (iii) decision making. The citizens can achieve one of those participation levels depending on their involvement and their responsibility.

#### B. Reputation, Relevance and Influence

From the point of view of Social Cognocracy Network, three different types of nodes can be defined, according to their role in the process:

- Persons: individuals that take part in the voting and discussion processes, either decision makers or guests.
- Topics: discussion threads proposed, grouped into categories defined during the problem-design stage.
- Comments: any of the messages, arguments... expressed by the participants as messages published in the forum.

Each comment comes with the identification (nickname) of its author. All comments about a topic are grouped in a page under a header containing the topic title.

Two basic indicators of influence are defined:

- Reputation of an actor: measurement of the prestige the actor has among the participants.

- Relevance of a topic or a comment: measurement of the capability of the topic or comment to shape the actors' opinions.

A person  $P_j$  can give his/her opinion about other persons, topics and comments, by giving values from 0 to 10 to three quantitative indices:

Index	Rates
Confidence $C_{ij}$	The author $P_i$ of a comment
$T$ -Importance $I_{ij}^T$	A topic $T_i$
$C$ -Importance $I_{ij}^C$	A comment $C_i$

Persons can also assess the importance of their own topics and comments and even to themselves (*self-trust*).

From these indices, the reputation  $R_i^P$  of persons and the relevance of topics ( $R_i^T$ ) and comments ( $R_i^C$ ) are obtained using the expressions:

$$R_i^P = \frac{\sum_{j=1}^n R_j^P C_{ij}}{\sum_{j=1}^n R_j^P} \quad (1)$$

$$R_i^T = \frac{\sum_{j=1}^n R_j^P I_{ij}^T}{\sum_{j=1}^n R_j^P} \quad (2)$$

$$R_i^C = \left(1 + \frac{n_c}{N}\right) \frac{\sum_{j=1}^n R_j^P I_{ij}^C}{\sum_{j=1}^n R_j^P} \quad (3)$$

being  $N$  the total number of comments that a topic has received and  $n_c$  the number of answers to a specific comment in that topic.

A person's reputation, as well as the importance the community gives to a topic or a message, can influence the preferences of other persons. Under the e-cognocracy, this influence will result in changes in the preference structures of these other persons from one round to another.

### III. CASE STUDY

Social Cognocracy Network was used in an experience related to the design of the metropolitan public transport network of the city of Zaragoza (Spain). Four alternatives were proposed. Representatives of political parties defended their proposals in a classroom with students of E-government and Public Decision Making (4<sup>th</sup> course of the Degree in Economy at University of Zaragoza). After a first voting round, in which only the students were allowed to participate, a discussion was developed in the forum, with the participation of the students and the political

representatives. In the forum, the participants could value the reputation of the others, as well as the importance of the comments posted (Figure 1). Then, a second voting round was performed. The voters' preferences were expressed by using Analytic Hierarchy Process [3].

### IV. CONCLUSIONS

Numerical and visual analyses show the influence of the opinions in the change of the actors' preference structures. The quantitative valuations of the posts allow calculating the influence of the different participants and their comments. An interactive 3D visualization tool is used to explore the results (Figure 2). Individual preference structures are represented on the simplex  $x_1+x_2+x_3+x_4=1$ , being  $x_i$  the preferences given by each voter to each alternative  $A_i$ ,  $i=1,\dots,4$ . From the visual analysis some relevant facts stand out: 24 zones define the different positions of the voters with respect to the four alternatives; although the results of the two rounds offer few significant differences, only an inversion in the preferences of the alternatives chosen in second and third places, it seems clear that the participants with greater reputation persuaded to take their opinion (influenced) voters who, in the first round, had favored other alternatives. Analyzing specifically the behavior of these voters, it can be observed that the change in their opinion is in line with the opinions expressed by the four best valued voters. The importance of the comments in which these opinions have been exposed is also high.

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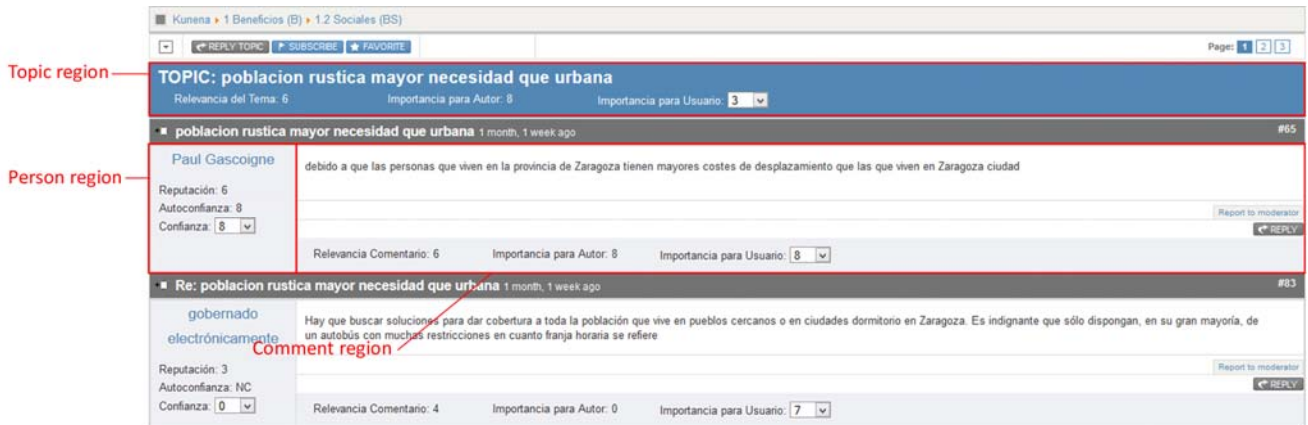


Figure 1. Discussion window with the thread of comments of a topic, showing the input fields used for assessing the reputation of the actors (persons) and the relevance of the topics and comments.

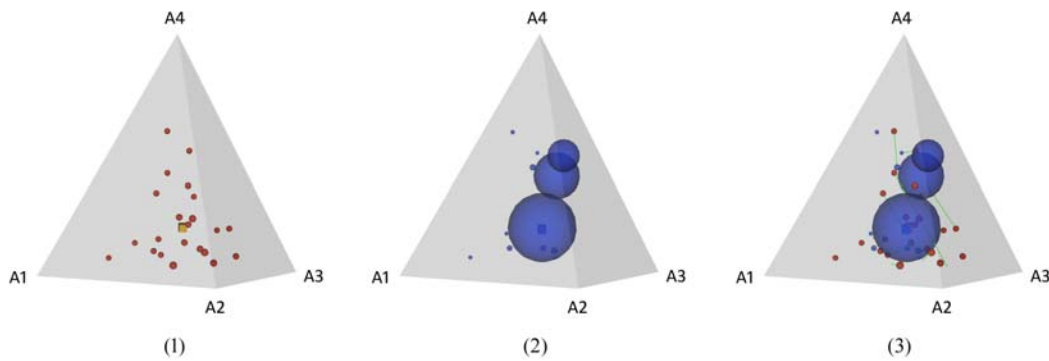


Figure 2. Several 3D views of the simplex showing the voters' preference structures: (1) after the first round (2); after the second round, being the size of each point proportional to the reputation of the voter; (3) changes in the preference structures of each voter. The box represents the overall (group) preference structure.