Networked Models of Democracy

Decentralised Citizens ENgagement Technologies

Specific Targeted Research Project Collective Awareness Platforms

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Lead beneficiary:
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D2.5 Networked Models of Democracy

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D-CENT

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Collective Awareness Platforms

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Contents

Executive Summary

This document is the final D-CENT deliverable in *WP2: Network driven data analysis, modeling and visualisation*. The research presented here, grounded in findings from previous deliverables about collective intelligence, data analysis, and data visualization, examines networked models for democratic participatory processes. The deliverable is structured in two chapters:

- The first chapter contains the assessment of Decidim.Barcelona, the new online platform where citizens from Barcelona collectively decide the strategic city plan. First we discuss the technopolitical context that explains the development of this participatory process in Barcelona. We then describe the main functionalities of the platform as well as the principles and objectives of the process. These principles are evaluated by analysing and visualizing data from Decidim.Barcelona. In particular we present a comprehensive analysis of the online sphere (proposals within the platform), offline spaces (physical meetings), and the connection between both.

- The second chapter reflects on how collective behaviour on this kind of platform is affected by the way information is presented. Features such as web and interaction design will have an influence on the structure of arguments that build the dialectical debate. This structure is crucial since decision-making processes (e.g. voting a proposal under discussion) will be biased by the way in which people acquire information from the debate. This reflection motivates an experiment for a similar case study, which gave us the unique opportunity to analyse the effect of a change in the user interface in a similar platform to Decidim.Barcelona. Our findings, obtained through statistical data models, prove that the new interface for discussions, showing discussion threads in a hierarchical view, promoted rhizomatic structures and increased participation. Since this is the interface adopted in Decidim.Barcelona, our empirical results validate the platform design as ultimately favoring deliberative processes.

Part 1. Decidim.Barcelona assessment

Decidim Barcelona is the participatory platform launched by the City Council of Barcelona on February 1st, 2016. In its first deployment, Decidim Barcelona has served as a space for elaborating the strategic plan of the city (the so called "PAM"[1]) of Barcelona for the next three years but it is designed to host all the digital participatory processes elaborated during the present mandate. It is a platform based on free software, built on the code of Consul[2], developed by the Madrid City Council. It aims to increase and enrich participation via multilayered processes, putting the conditions for citizen empowerment and power redistribution in the city. It relies on three basic types of mechanisms: the classical bottom-up and top-down, between government and citizens, as well as new forms of rhizomatic, autonomous self-organization of the citizenry.

Figure 1: Homepage of Decidim.Barcelona

[1] See: http://governobert.bcn.cat/estrategiaifinances/es/programa-de-actuaci%C3%B3n-municipal-pam-2016-2019 (Spanish)
[2] See: https://github.com/AyuntamientoMadrid/consul

1.1 The technopolitical setting

Representative democracy has been in crisis, at least, for the last three decades (Rosanvallon, 2008; Tormey, 2015); to such extent that this crisis has been identified with the crisis of democracy itself (Keane 2011; Dellaporta 2013). Some authors have criticized the technocratic tendencies and the neoliberal hegemony operating in this period as signs of the rise of post-democracy (Crouch, 2004) or post-politics (Zizek, 1999; Rancière, 2001), while others, more precisely, have used the term "post-representation", to refer to the emptying out (of power and meaning) of representative institutions by dynamics ranging from globalization to growing citizen mistrust (Brito Vieira and Runciman, 2008; Keane, 2009; Rosanvallon, 2011; Tormey, 2015). The various attempts to foster participation have been insufficient to reverse these trends (Keane, 2011; Tormey, 2015).

This long term political crisis has combined with the financial and economic crisis opened in 2008, whose gestation cannot be separated from that earlier crisis. In Spain, from 2010 onwards, an EU-sponsored, governmental logics of austerity combined with permissiveness towards many of the actors responsible for the economic collapse (banks and financial institutions, real estate, etc.) and, more importantly, with an increasing public awareness of political corruption (leniently treated, as well), all of which directly contributed to the terrible, and worsening, situation of the country. In 2011, this situation had an unexpected answer from the people. Far from taking the path of retreat into post-political inaction or an acceptation of post-democratic technocracy, the citizenry initiated a process of radical democratization of politics, a re-politicization of their own lives, and of life in common. The key event, in this sense, was the so called "15M movement" (or "*Indignados* movement").

Millions of people were mobilized, many of them with the intention not only to ask for, but also to experiment and build, a real democracy. In the current context of technological hyper-mediation, information and communications technologies, used since the 80s and 90s to accelerate financial flows and globalization (Castells, 1996), became crucial spaces and devices for a multitudinous reappropriation of politics, as well as for democratic experimentation (Castells, 2012; Toret et al., 2015). After four years of numerous successes and failures, in May 2015, new citizen candidacies were able to seize power in some of the major cities of the country, including Barcelona. In doing so, they followed what had happened in countries like Iceland, where the economic crisis led to a period of citizen reappropriation of representative institutions and fertile democratic innovation, supported by an intensive and creative use of ICTs.

New forms of participatory and deliberative democracy are technologically mediated (Hague and Loader 1999; Fuchs 2008). Democratizing processes associated to citizen mobilization and empowerment

requires a technopolitical articulation (Rodotà 1997; Toret et al., 2015) in order to increase their richness and capacity; they require technopolitical innovations for democracy. In brief, technopolitics results from the political becoming of technologies and from the technological reassembling of politics, otherwise, from the coevolution and coproduction of politics and technologies. In technopolitical forms of participation and deliberation, digital and physical spaces and processes merge, acquiring a multi-layered dimension. Under the 15M model, these participatory assemblages are oriented to increase the number, variety, and parity between the actors that "take part" in the common government of the city, amplifying and enriching the spaces, modes, and periods in which this takes place, potentiating forms of collective action and intelligence (Levy, 1997) capable to face the contemporary urban complexity and conflictivity.

In short, the goal was to rethink and remake participation and democracy, that the citizenry---and, especially, its subaltern groups---explores (and to put the conditions for the exploration of) the various and ever new forms of the *pars capere*, the "taking part", the "taking part for", and to make it as equals (inter pares), with other citizens. To take part, as a conflicted collective, in and for the city and the common.

1.1.1 Participatory strategic planning

One of the first institutional instantiations of this wider democratizing process has been the participatory process initiated by the government of Barcelona en Comú for the development of the strategic plan of the city of Barcelona, in early 2016. The Strategic plan defines the main axes, objectives, and actions to be carried out by the local government during the legislature. The goal of the participatory process was to enroll the citizenry in a two month process of co-production, where citizens could evaluate and discuss the proposals made by the government, and also make their own proposals, discuss, and support them. During the elaboration of the strategic plan, the platform allowed to register, view, and interact with both institutional and citizen proposals, debates, and, relevantly, physical meetings, orienting users' activity to make, discuss and evaluate proposals.

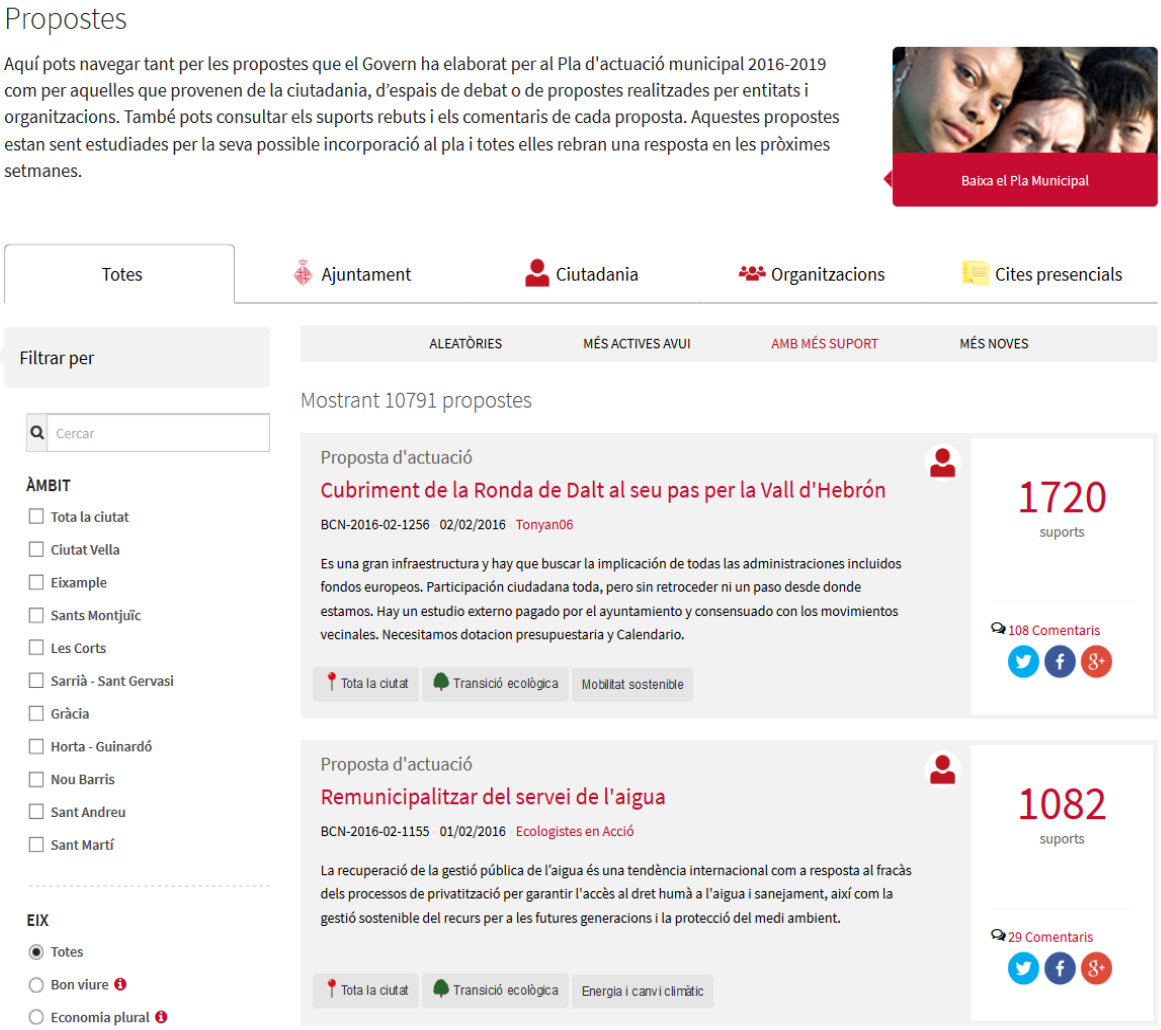

Figure 2: Proposals page in Decidim.Barcelona

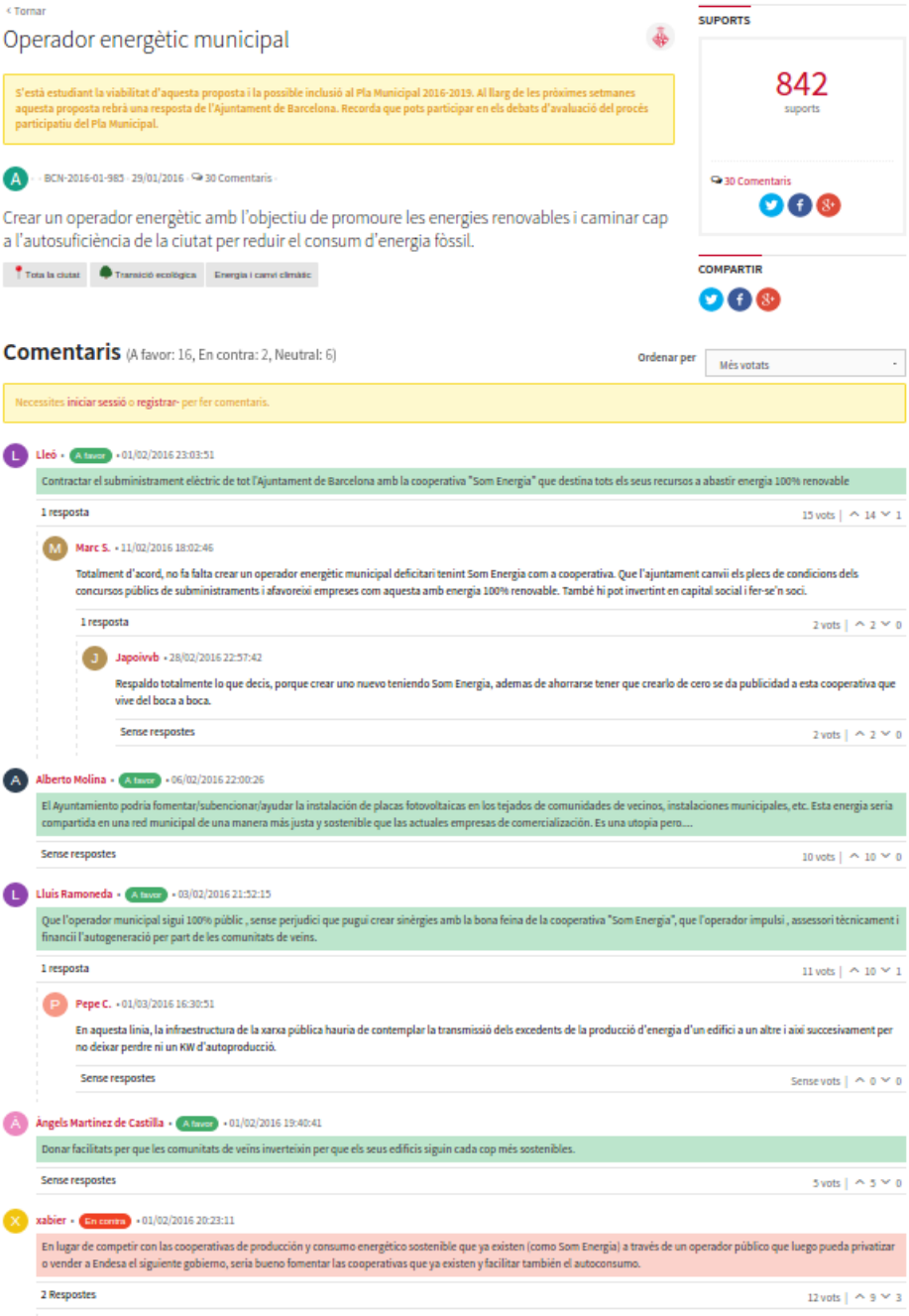

Figure 3: Discussion page of a proposal in Decidim.Barcelona

The process had a clear technopolitical ambition: it tried to hybridize physical and digital spaces and practices into a productive flow. For this purpose, Decidim.Barcelona was created, and more than 400 physical meetings were organized.

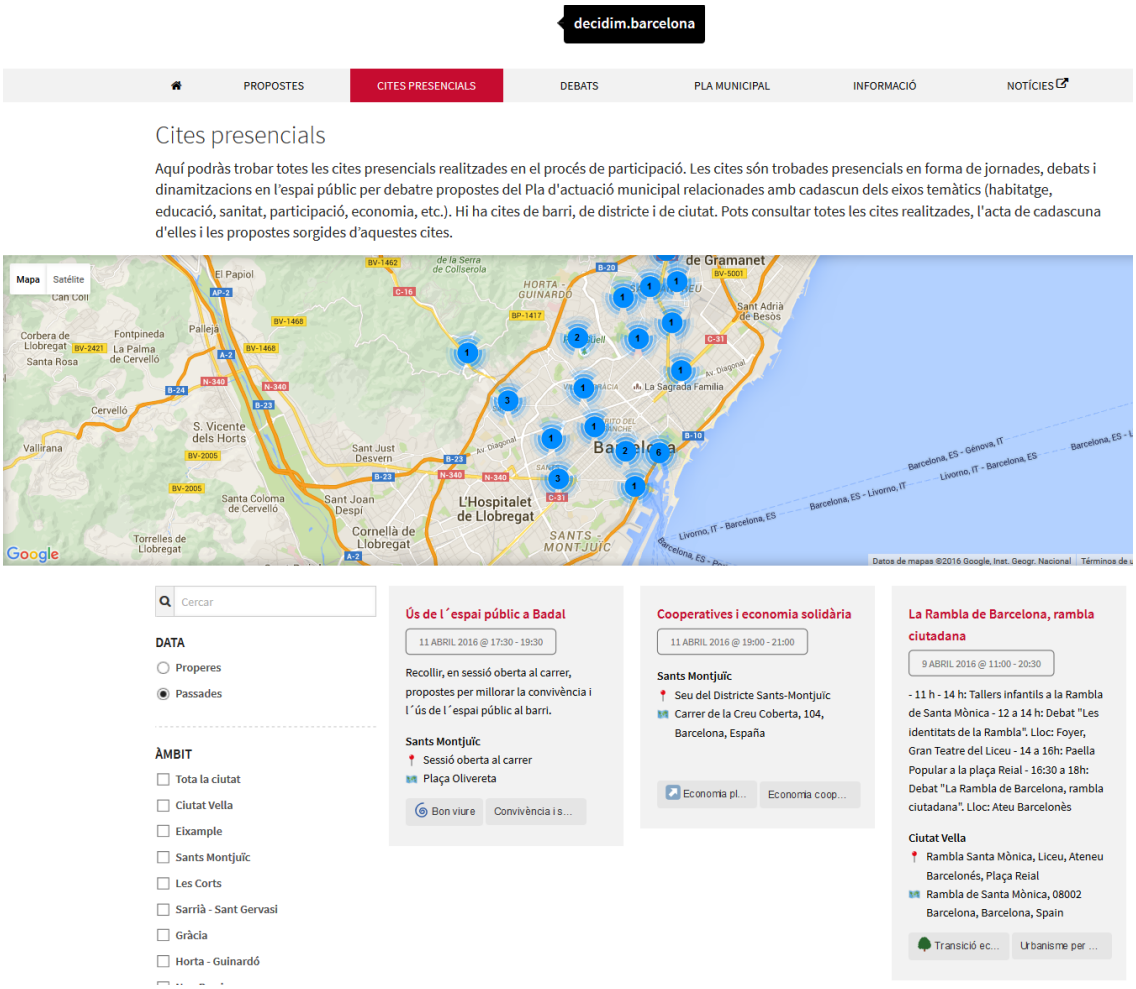

Figure 4: Meetings page in Decidim.Barcelona

Physical meetings were announced and geolocalized in the platform, helping people to find those nearest to them according to their topic or their location. On the other hand, the proposals and discussions generated offline were uploaded to the platform, so that users could keep the discussion going, share their proposals on social networks, etc. The City Council defined a taxonomy of categories in order to classify proposals, and the platform was designed to track the different stages of the participatory process. The platform operated as a registry of the whole process, increasing its transparency and trackability.

1.1.2 Principles and objectives

The construction of the platform, undertaken using very stringent conditions of time and resources, was guided by a number of heuristic design principles that combine political and technological criteria. Some

of them, already proposed and discussed in D-CENT deliverable “"D2.1 Collective intelligence framework”, were:

- Open and collaborative participation
- Transparency and trackability
- The hybridization of digital and analogical participation
- Citizen deliberation, multitudinous participation, and empowerment
- Combination of diversity and consensus
- Technological facilitation of collective intelligence
- Use and promotion of free software

In the following section we evaluate the extent to which some of these principles were accomplished, paying special attention to general participation levels on the digital and the physical spaces, diversity of topics addressed, different types of digital activity, and the connection between digital and analogical spaces and processes.

1.2 Data Analysis and Visualization

In D-CENT deliverables "D2.3 When a Movement becomes a Party" and "D2.4 From Citizen Data to the Wisdom of the Crowds" we presented a wide array of techniques for data analysis and visualization, e.g: data exploration through interactive Kibana dashboards, social network analysis and visualization through Gephi and Sigma.js, and data web visualization through D3.js . This section relies on these techniques for the assessment of Decidim.Barcelona by analysing and visualizing data from:

- The offline process: Physical meetings
- The online process: Online proposals
- The hybridization of online and offline participation: Online proposals that were discussed or emerged from physical meetings.

On the one hand, the participatory process in Decidim.Barcelona were designed to involve citizens in collective decision-making of stategic actions into five axes (aka. categories):

- Bon viure (Good Living)
- Transició ecològica (Ecological transition)
- Economia plural (Plural Economy)
- Bon govern (Good Government)
- Justícia global (Global Justice)

Therefore, some of the following analyses will distinguish proposals and meetings by the category to which they belong. On the other hand, the process was strongly bounded to geographical aspects of the city. Proposals were divided into city proposals (i.e. focused on a goal that affects the full city) and district proposals (i.e. focused on a goal related to a specific district issue). Moreover, physical meetings were also designed to discuss/propose either district proposals, or city proposals from a specific category (e.g. Bon viure). This link between Decidim.Barcelona and the geographical characteristics of Barcelona led us to include cartography technologies for this study. In particular, geographic analyses are powered by CartoDB[3], an open source cloud computing platform that offers functionalities of geographic information systems (GIS) for web browsers.

1.2.1 Offline process

The offline process consisted of 410 physical meetings held between January 28th and April 11th, 2016, which gathered 11,577 attendees and the assistance of 2,099 organizations, e.g. Fundació Pere Tarrés, Barcelona Activa, Creu Roja. In total, 13,614 interventions were recorded in these meetings. First, we explore in a Kibana panel the top 10 meetings by number of attendees (Figure 5), number of interventions (Figure 6), and number of organizations (Figure 7). The meeting "Consulta veinal Ciutat

[3] See: https://cartodb.com/

Meridiana" ruled by the Association of neighbors from Ciutat Meridiana was the one that gathered the largest number of attendees and interventions (over 1,000). The second most attended meeting (252 attendees) was "El Pla Municipal i l'Esport", focused on sport issues. Indeed, most meetings in Figure 5 are city meetings covering specific topics such as housing, elderly, welfare and education. The meeting that gathered the largest number of civic associations was "Jornada Ciutat Inclusiva" (48 organizations), a strategic session in favor of social inclusion and against social inequalities. Indeed, the physical meetings that brought a large number of organizations were commonly city meetings for core issues such as health, mobility, tourism, energy, immigration, culture and housing.

title	district_name	category_name	attendee_count	interventions	organizations_count	proposals_count	url
Consulta veinal Ciutat Meridiana	Nou Barris	Bon viure	1030	1030	0	13	
El Pla Municipal i l'Esport	Full city	Bon viure	252	600	0	0	
Debatent sobre el Barri amb els alumnes de...	Eixample	Bon viure	243	132	0	25	
Jornada de debat: l'habitatge com a dret	Full city	Bon viure	200	40	31	12	
Consell Assessor de la Gent Gran	Full city	Bon viure	123	150	0	102	
JORNADA DE TREBALL PER LA ELABORACIÓ DEL ...	Nou Barris	Bon viure	115	15	0	0	
Definició del model de pacificació del C. ...	Sant Andreu	Transició ecològica	110	25	6	10	
Consell Municipal de Benestar Social	Full city	Bon viure	105	262	0	3	
Definició del model de pacificació del C....	Sant Andreu	Transició ecològica	105	83	0	17	
El Pla Municipal i Educació	Full city	Bon viure	103	11	0	9	

Figure 5: Top 10 meetings by number of attendees

title	district_name	category_name	attendee_count	interventions	organizations_count	proposals_count	url
Consulta veinal Ciutat Meridiana	Nou Barris	Bon viure	1030	1030	0	13	
El Pla Municipal i l'Esport	Full city	Bon viure	252	600	0	0	
Jornada de ciutat de PAM sobre Economia Co...	Full city	Economia plural	96	288	0	0	
Consell Municipal de Benestar Social	Full city	Bon viure	105	262	0	3	
Convivència i intercultural, en el Consell...	Sant Martí	Bon viure	100	200	12	20	
Taller-debat del Pla d'Actuació Municipal ...	Full city	Bon govern	31	160	0	0	
Jornada participativa sobre transició ener...	Full city	Transició ecològica	53	159	35	24	
Consell Assessor de la Gent Gran	Full city	Bon viure	123	150	0	102	
Governar el turisme a la ciutat	Full city	Economia plural	55	150	25	18	
Debatent sobre el Barri amb els alumnes de...	Eixample	Bon viure	243	132	0	25	

Figure 6: Top 10 meetings by number of interventions

title	district_name	category_name	attendee_count	interventions	organizations_count	proposals_count	url
Jornada Ciutat Inclusiva	Full city	Bon viure	55	20	48	42	
La Sanitat a la ciutat de Barcelona (debat...	Full city	Bon viure	70	70	48	44	
Mobilitat turística	Full city	Economia plural	51	15	42	4	
Pacte per la Mobilitat - sessió de treball...	Full city	Transició ecològica	43	43	40	21	
Pla de lluita contra el sensellarisme	Gràcia	Bon viure	52	50	36	21	
Jornada participativa sobre transició ener...	Full city	Transició ecològica	53	159	35	24	
Una ciutat diversa. Migració i intercultur...	Full city	Bon viure	65	90	34	36	
Consell Sectorial de Cultura	Gràcia	Bon viure	37	0	31	10	
Jornada de debat: l'habitatge com a dret	Full city	Bon viure	200	40	31	12	
Com creem salut als barris per reduir desi...	Full city	Bon viure	55	80	30	23	

Figure 7: Top 10 meetings by number of organizations

We then aggregate the data by category and find Bon viure as the most popular one followed by Transició ecològica (see Table 1).

Category	Meetings	Total organizations	Total attendees	Total interventions
Bon viure	227	1148	6781	8244
Transició ecològica	100	445	2763	2257
Economia plural	54	437	1248	2198
Bon govern	25	63	745	875
Justícia global	4	6	40	40

Table 1: Meetings, total organizations, attendees and interventions for each category.

We perform a similar analysis by grouping district meetings by the corresponding district. We also compute ratios by dividing every district datum by its population (Table 2). These ratios show Ciutat Vella as the leading district in terms of meetings, attendees and interventions per inhabitant.

District	Population	Meetings	Meetings per inhabitant	Total organizations	Organizations per inhabitant	Total attendees	Ratio attendees	Total interventions	Interventions per inhabitant
Ciutat Vella	100685	32	0,00032	108	0,001	1331	0,013	1086	0,011
Les Corts	81200	22	0,00027	7	0,000	415	0,005	250	0,003
Gràcia	120273	32	0,00027	297	0,002	947	0,008	880	0,007
Sarrià - Sant Gervasi	145761	31	0,00021	88	0,001	296	0,002	442	0,003
Sant Andreu	145983	27	0,00018	127	0,001	611	0,004	495	0,003
Sants Montjuïc	180824	33	0,00018	161	0,001	622	0,003	1072	0,006
Nou Barris	164516	22	0,00013	92	0,001	1488	0,009	1807	0,011
Horta - Guinardó	166950	21	0,00013	4	0,000	424	0,003	326	0,002
Eixample	263565	28	0,00011	117	0,000	906	0,003	740	0,003
Sant Martí	232629	22	0,00009	166	0,001	677	0,003	1091	0,005

Table 2: Meetings, total organizations, attendees and interventions for each district.

To summarize the distribution of meetings in relation to districts and categories, we built a sunburst diagram (see Figure 8) powered by D3.js[4]. The hierarchy of the visualization also includes the subcategories existing for every category in Decidim.Barcelona. This interactive chart provides a clear overview of the volume of meetings by district and the most popular categories and subcategories in terms of physical meetings. Moreover, the visualization has been customized to display the number and percentage of meetings when the user moves the mouse pointer over areas.

[4] The source code is based on: https://bl.ocks.org/kerryrodden/7090426

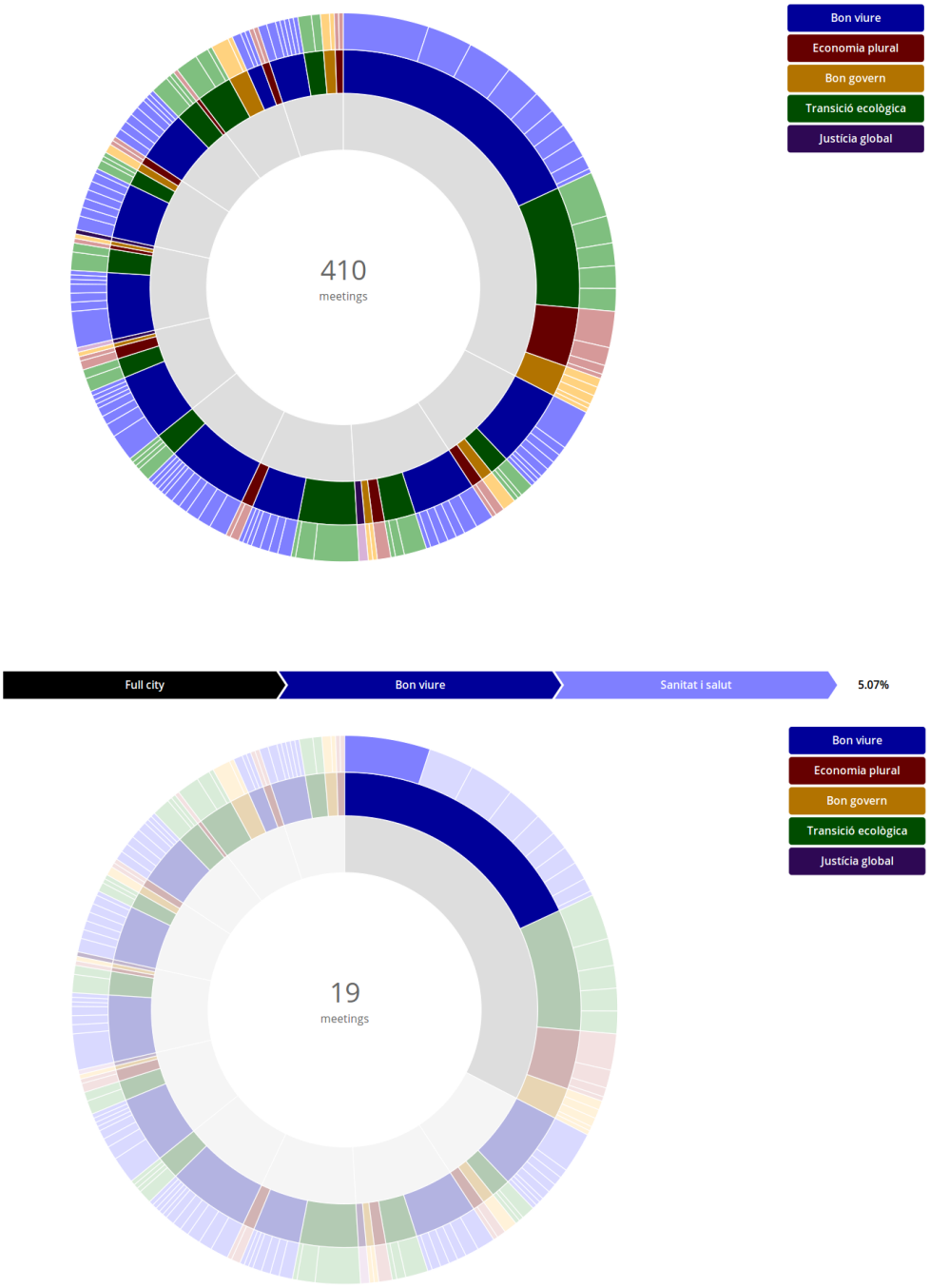

Figure 8: Sunburst visualization of meetings in the hierarchy: districts → categories → subcategories.

The maps in Figure 9 represent respectively the distribution of district meetings and city meetings by category performed in each district of Barcelona.

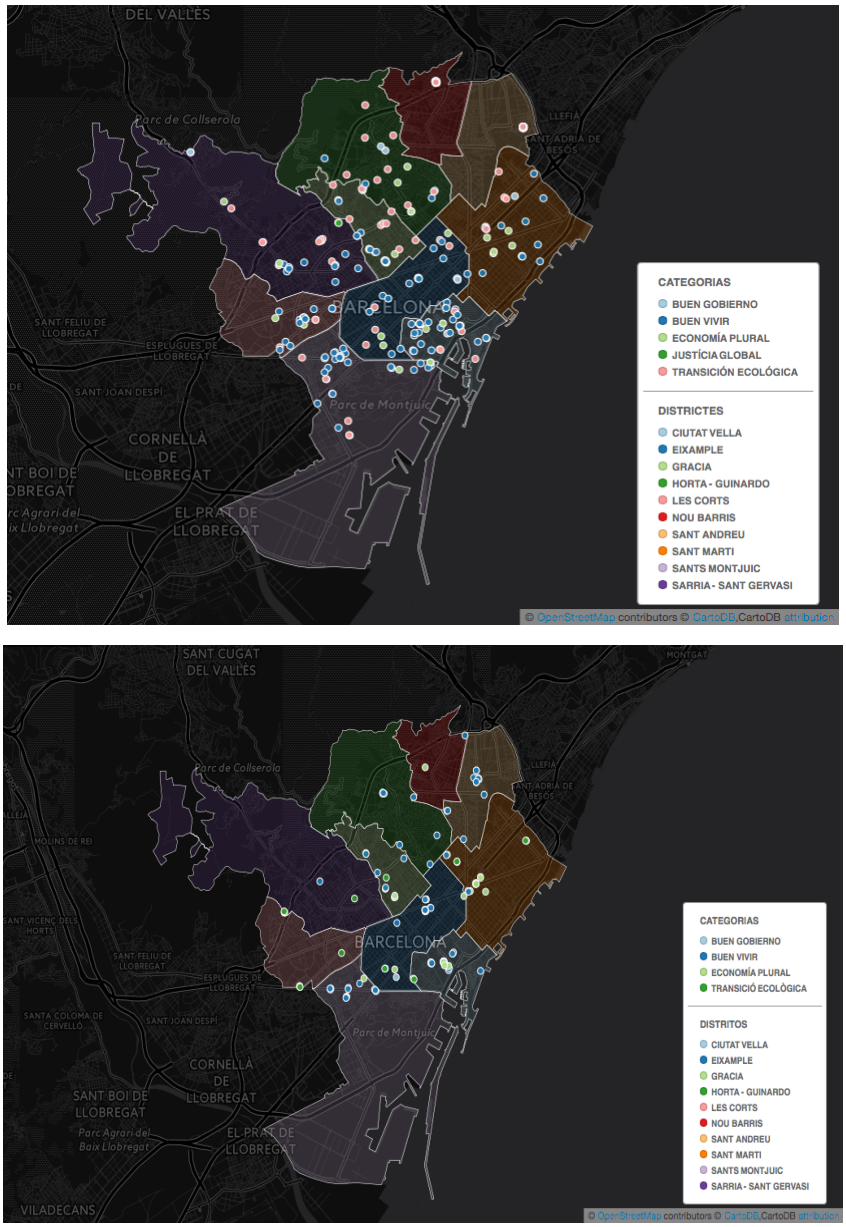

Figure 9: District meetings (above) and city meetings (below) by category in each district
https://urbis.cartodb.com/u/dep-internet/viz/fa6a4f2f-64b0-4014-af3a-33a42e86245d/public_map
https://urbis.cartodb.com/u/dep-internet/viz/be06e7c6-972a-454d-964d-9a04f3278d03/public_map

Comparing the above maps we observe that the total number of district meetings is significantly higher than the number of city meetings. Despite that, the city meetings are spread in all districts of the city.

This finding might be explained by the effort during the development of the participatory process of covering the different territories of the city. We also note that while the district meetings cover all possible categories, in city meetings the category "Justícia global" is missing. Figure 10 represents a stop-motion of an animated heatmap that allows to have spatio-temporal information about both, city and district meetings. The figure shows that at the end of the process, on April 11 2016, almost all the areas of town had been covered by some physical meeting, with many areas highly covered (areas in red).

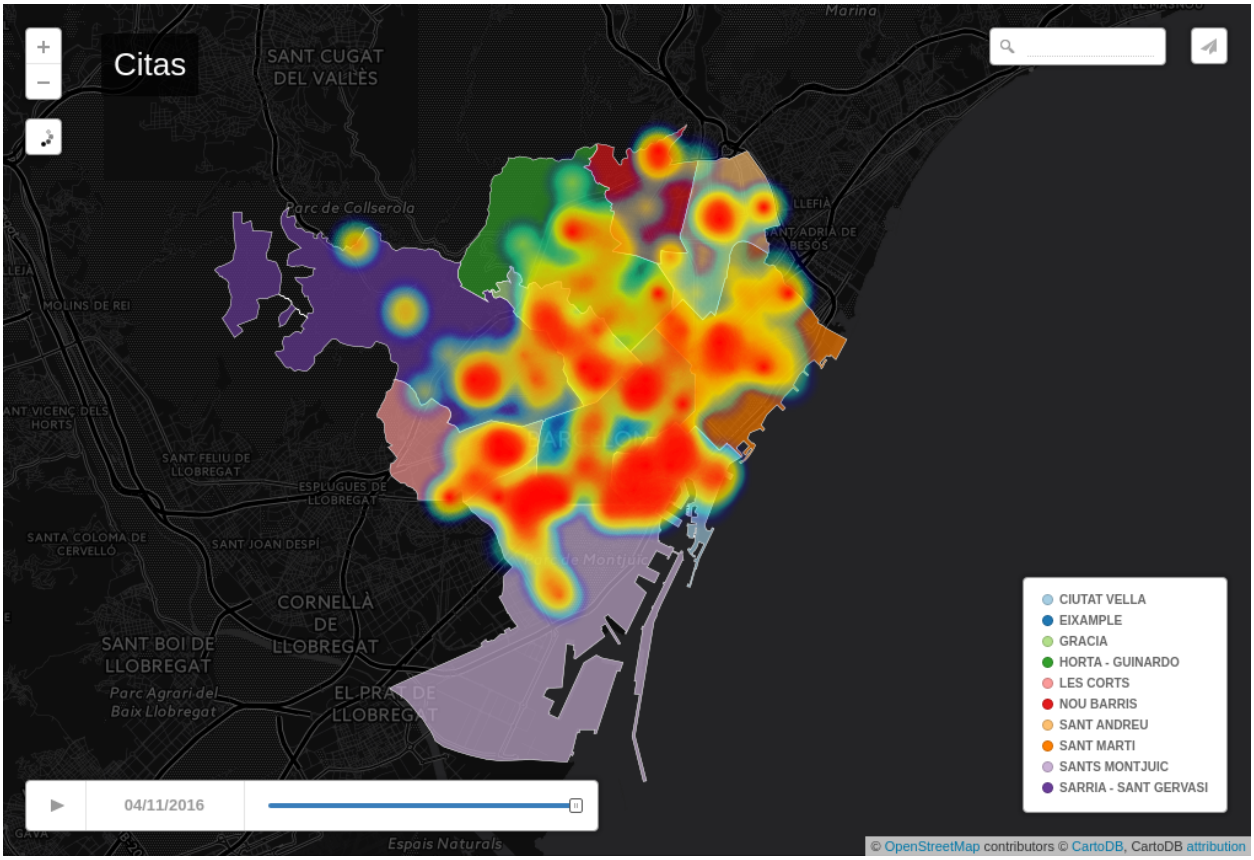

Figure 10: City meetings by category in each district
https://urbis.cartodb.com/u/dep-internet/viz/dfe8d849-e47e-40f6-88ee-f13dc256a2de/public_map

1.2.2 Online process

This subsection explores the online participation dynamics in Decidim.Barcelona. Analyses and visualizations here focus on online proposals. In comparison to offline meetings, online proposals include a new attribute: the source, i.e. who originated the proposal. This attribute can have the following values:

- Official Proposals by the City Government of Barcelona.
- Citizen Proposals by individual citizens.
- Organization Proposals by civic organizations.
- Meeting Proposals resulted from offline meetings.

We should note that official proposals come from a previous on/offline bottom-up process which was detailed in the first chapter of D-CENT deliverable "D2.3 When a Movement becomes a Party". The online process consisted of 10,859 proposals, which received 165,088 votes and 18,191 comments. First, we identify the top 10 most voted proposals (Figure 11). Most of them concern the whole town (as it could be expected), and the "Ecological transition" category. However, a few district proposals at the also appear in the top 10, such as a proposal about extending tramway paths in Diagonal Avenue (Eixample)[5], or removing Francoist plaques from the facades of buildings in the district of Horta-Guinardó[6].

title	district_name	category_name	total_votes	total_comments	url
Cubriment de la Ronda de Dalt al seu pas per la Vall d'Hebr...	Full city	Transició ecològica	1720	108	
Remunicipalitzar del servei de l'aigua	Full city	Transició ecològica	1082	29	
RECONVERTIM EL ZOO DE BARCELONA: ZOOXXI	Full city	Transició ecològica	896	56	
Operador energètic municipal	Full city	Transició ecològica	842	30	
Regulació del mercat de lloguer	Full city	Bon viure	804	77	
Implantar el tramvia a la Diagonal	Eixample	Transició ecològica	705	111	
Crear mes carrils bici	Full city	Transició ecològica	704	62	
Telefon gratuit d'informació del Ajuntament de Barcelona	Full city	Bon govern	685	13	
Retirada de plaques franquistes a tot el districte	Horta - Guinardó	Bon viure	669	16	
Límites contaminantes más restrictivos en línea de la OMS	Full city	Transició ecològica	645	23	

Figure 11: Top ten proposals by number of votes

In Figure 12 we see the top 10 proposals by number of comments. While the most voted proposals represent the ones that received the highest support, the most commented proposals represent the

[5] See: https://decidim.barcelona/proposals/implantar-el-tramvia-a-la-diagonal
[6] See: https://decidim.barcelona/proposals/retirada-de-plaques-franquistes-a-tot-el-districte-f124234c-d3af-4fb2-a493-1ce877c254db

ones that generated most discussion. So, in this case we find again some of the most voted proposals, but also some other proposals about controversial and/or trending topics, such as "limiting dog invasion in public spaces"[7].

title	district_name	category_name	total_votes	total_comments	url
Noves llicències per a pisos turístics	Full city	Economia plural	196	337	
Implantar el tramvia a la Diagonal	Eixample	Transició ecològica	705	111	
Cubriment de la Ronda de Dalt al seu pas per la Vall d'Hebr...	Full city	Transició ecològica	1720	108	
Promoció de l'ús de la bicicleta, i millora i ampliació dels...	Full city	Transició ecològica	325	80	
Regulació del mercat de lloguer	Full city	Bon viure	804	77	
Pla de salut mental	Full city	Bon viure	16	75	
Expropiació i demolició de la parròquia de Santa Maria de Gr...	Gràcia	Bon viure	61	74	
Acotar la invasió de gossos en espais públics	Full city	Transició ecològica	141	68	
Pla estratègic de turisme 2016-2020	Full city	Economia plural	56	66	
Estratègia per garantir una sanitat pública, universal i de ...	Full city	Bon viure	32	63	

Figure 12: Top 10 proposals by number of comments

We explore better the relationship between votes and comments in Figure 13, that shows all the proposals by their number of comments, and number of votes. While in general the two variables tend to grow together, i.e. proposals with many votes tend to have also many comments, there are also some proposals that obtained many votes without much discussion. These are commonly proposals related to basic needs generally accepted by the citizenry, such as actions plans against poverty. In contrast, others proposals generated big discussions and did not receive much support. A remarkable outlier in this sense, at the right end of the figure, is a proposal about new licences for touristic apartments[8], that generated the biggest discussion (337 comments) but received only a limited number of votes (196).

[7] See: https://decidim.barcelona/proposals/acotar-la-invassio-de-gossos-en-espais-publics
[8] See: https://decidim.barcelona/proposals/noves-llicencies-per-a-pisos-turistics

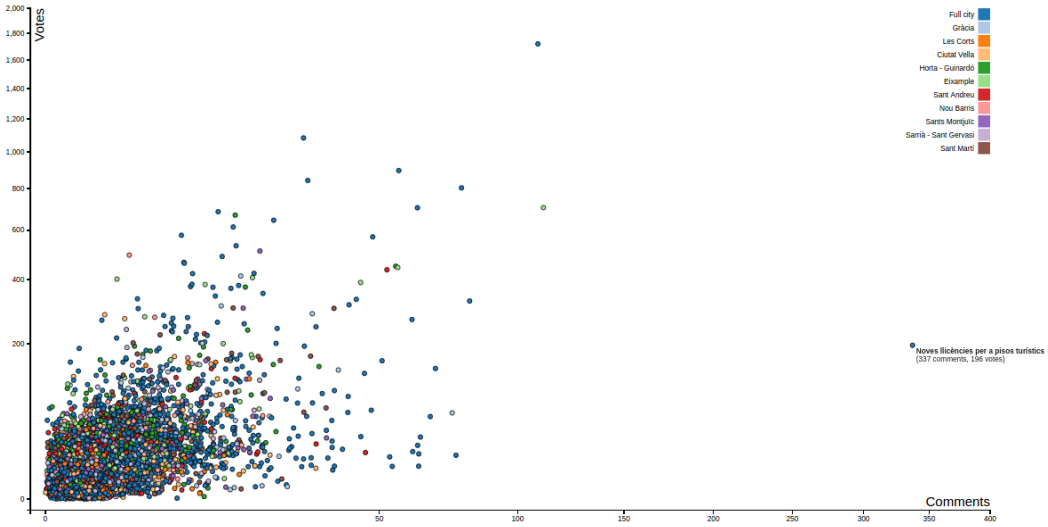

Figure 13: Scatter plot of proposals based on the number of comments (horizontal axis) and votes (vertical axis).

While until here we have just counted the overall number of comments, we now distinguish between positive and negative comments (as marked by the user when posting a comment). In Figure 14 we observe a different shape with respect to the previous one, indicating that the two variables are not much correlated. In other words, we observe that many proposals tend to have only (or mostly) positive or negative comments. For example, we see only positive comments for two proposals about building public schools in two neighborhoods[9], while we see mostly negative comments for a proposal about forbidding access to dogs in the subway[10], or for one about demolishing a parish[11]. The only two proposals receiving both a very high number of positive and negative comments are the one about the historical issue of reforming Diagonal Avenue for connecting tramway paths, and the one about increasing the number of touristic licenses, related to the controversial issue of mass tourism in the city.

[9] See: https://decidim.barcelona/proposals/instituts-viladomat-i-angeleta-ferrer
[10] See: https://decidim.barcelona/proposals/prohibir-l-entrada-de-gossos-al-metro
[11] See: https://decidim.barcelona/proposals/expropiacio-i-demolicio-de-la-parroquia-de-santa-maria-de-gracia

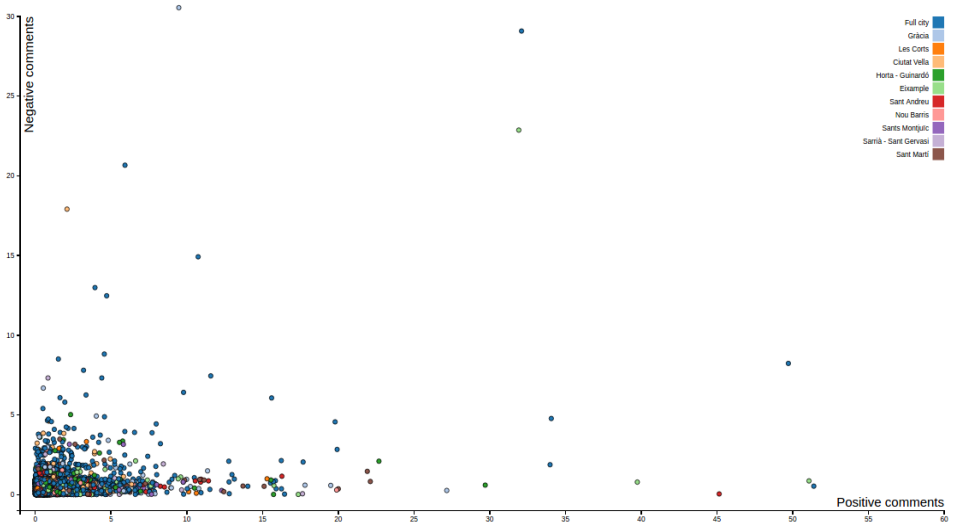

Figure 14: Scatter plot of proposals based on the number of positive comments (horizontal axis) and the number of negative (vertical axis).

We then analyse the volume of proposals, votes and comments for each type of source (Table 3), category (Table 4) and district (Table 5). It is interesting to note that, despite the initial dump of 1300 proposals from the City Government, the number of proposals from meetings, citizens and organizations is higher. Nevertheless, the official proposals received on average a greater number of votes and comments, which might reflect the interest from citizens in the Government action plan. Regarding categories, Bon viure and Transició ecológica emerge as the most popular ones according to the number of proposals, votes and comments. In relation to districts, we also computed ratios with respect to the district population. Results show that the greatest engagement occurred in the district Ciutat Vella.

Source	Proposals	Total votes	Total comments
Meeting	4498	16401	2602
Citizen	3444	79504	7239
Organization	1617	24157	1891
Official	1300	45026	6459

Table 3: Number of proposals, votes and comments for each type of source.

Category	Proposals	Total votes	Total comments
Bon viure	4847	64572	7262
Transició ecològica	3686	74720	7500
Economia plural	1360	14721	2246
Bon govern	897	10118	1111
Justícia global	69	957	72

Table 4: Number of proposals, votes and comments for each category.

District	Population	Proposals	Proposals per inhabitant	Total votes	Votes per inhabitant	Total comments	Comments per inhabitant
Ciutat Vella	100685	976	0,010	9207	0,091	1191	0,012
Les Corts	81200	580	0,007	3932	0,048	579	0,007
Gràcia	120273	707	0,006	10279	0,085	1277	0,011
Sants Montjuïc	180824	676	0,004	8784	0,049	894	0,005
Horta - Guinardó	166950	611	0,004	13623	0,082	1046	0,006
Sant Andreu	145983	514	0,004	7507	0,051	755	0,005
Sant Martí	232629	819	0,004	12764	0,055	1212	0,005
Sarrià - Sant Gervasi	145761	465	0,003	6656	0,046	644	0,004
Nou Barris	164516	444	0,003	6014	0,037	463	0,003
Eixample	263565	531	0,002	12504	0,047	1023	0,004

Table 5: Population and number of proposals, votes and comments for each district. Ratios are computed by dividing dimensions by population.

Following the same methodology as for offline meetings, we also built a D3.js sunburst diagram for proposals (see Figure 15).

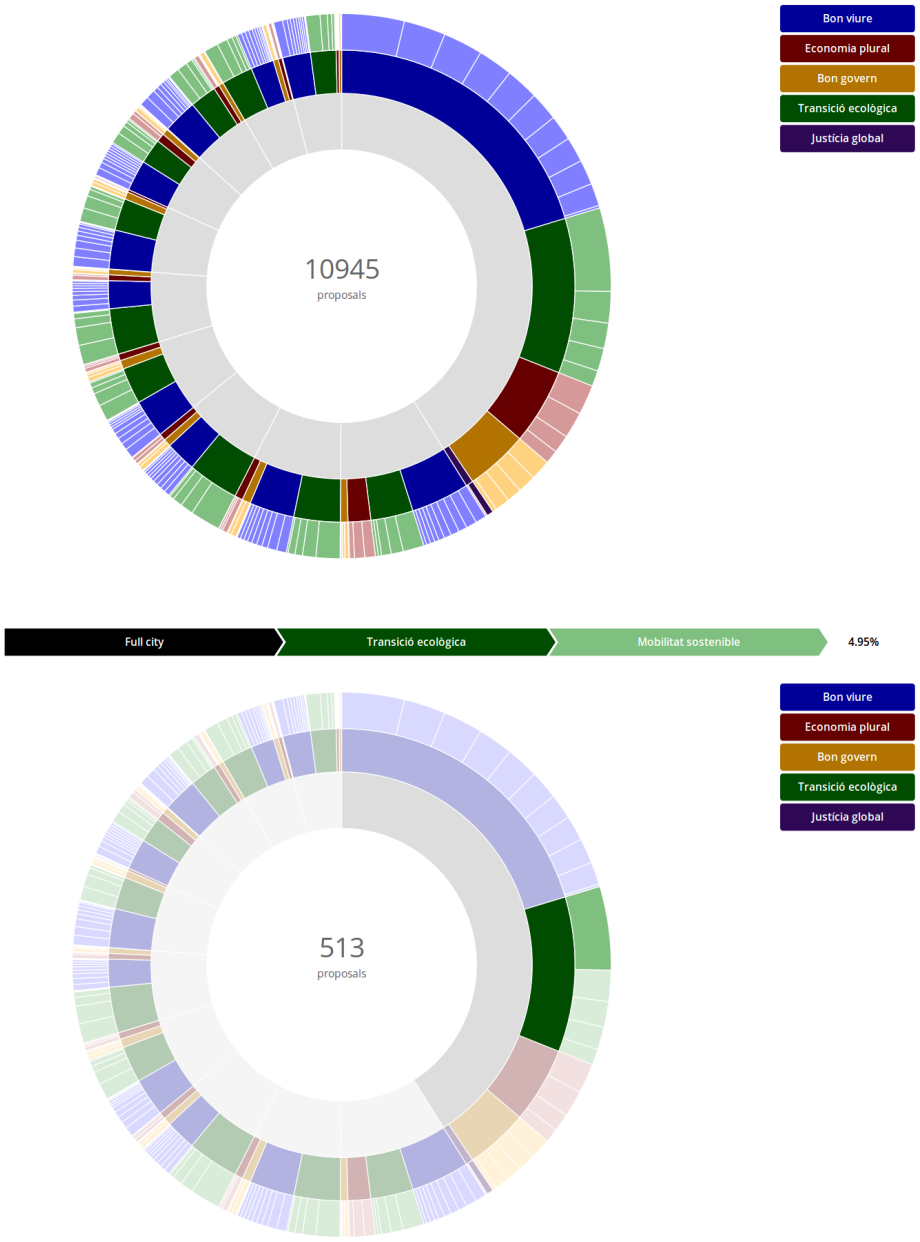

Figure 15: Sunburst visualization of proposals in the hierarchy: source → districts → categories → subcategories.

In D-CENT deliverable "D2.4 From Citizen Data to the Wisdom of the Crowds" we examined the community structure of Decide Madrid by analysing the network of replies between users. In Madrid, we noted that, although cyberbalkanization is a common pattern of online social networks (Sunstein, 2009), the network visualisation did not show patterns of polarization. In contrast, online communities

are more distinguishable in Decidim.Barcelona (see Figure 16). One of the most relevant communities (dark red) is formed by the official account of the City Government, the most central node of the network, and citizens who mainly replied to official proposals. However, the largest community (light red) is made of citizens commenting official proposals, but mainly discussing with one another, who did build a self-organized and decentralized cluster. The periphery of the network shows partially isolated and centralized clusters, each of them formed by (1) an organization account and (2) citizens accounts who mostly commented proposals from such organization.

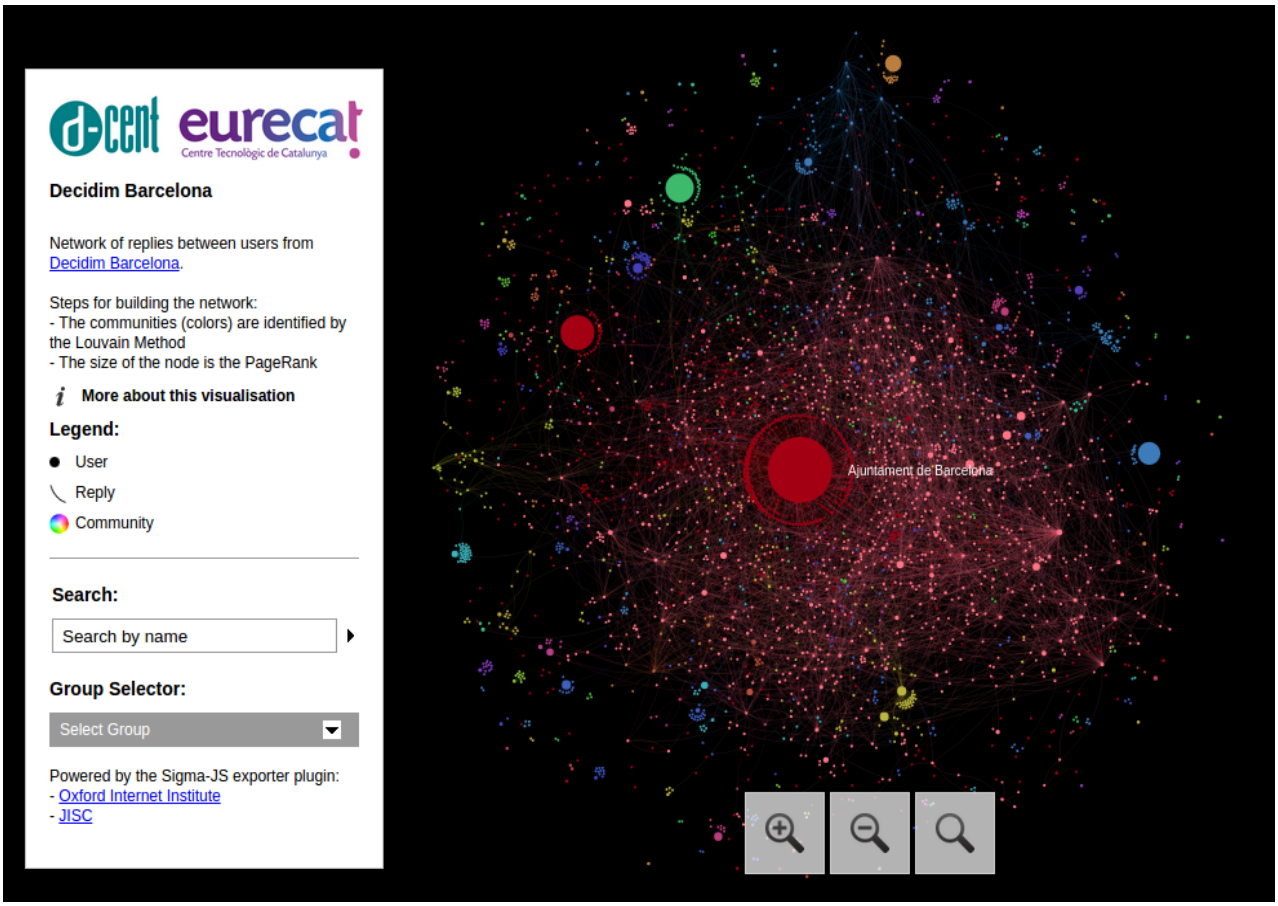

Figure 16: Network of replies between users.

We also adapted the tree visualization tool from D-CENT deliverable D2.4 for the threads of Decidim.Barcelona. Figure 17 shows the discussion thread of a popular proposal for regulating the housing rental market[12]. The visualization shows many large green nodes close to the root, that is to say

[12] See: https://decidim.barcelona/proposals/regulacio-del-mercat-de-lloguer

supporting comments that citizens voted positively. We can also easily identify a large red node, i.e. a comment negatively voted by many users. The message, that can be displayed in the interactive visualization by moving the mouse pointer over it, was against the proposal and suggested that citizens should live in areas where they can afford house renting. This comment originated a discussion cascade of replies from other citizens arguing that they were evicted from their neighborhoods because of market speculation. In summary, the exploration of the discussion of popular proposals according to the number of comments confirmed that some patterns are recurrent:

- Many citizens commented proposals to provide public endorsement (votes are anonymous).
- Citizens also commented proposals to show their displeasure.
- Opposing comments tend to generate discussions with supporters of that specific proposal.
- Some citizens were engaged in discussion between pairs (chains of replies).

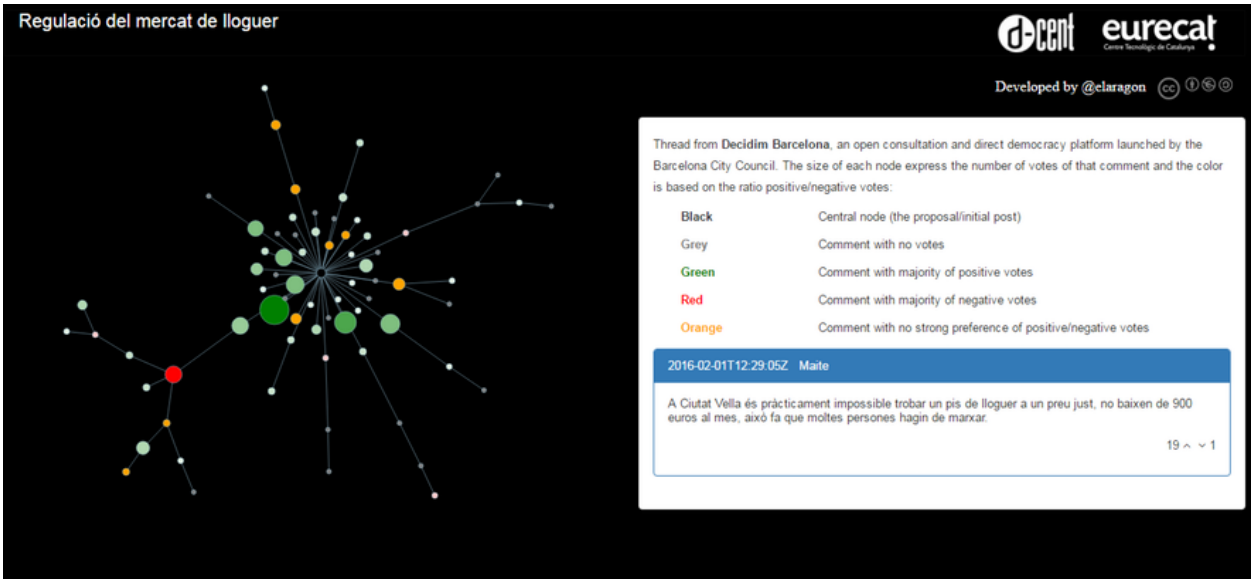

Figure 17: Visualization of the discussion of proposal for regulating the housing rental market.

1.2.3 Hybrid space between online and offline processes

In this subsection we examine the relation between online proposals and offline meetings. Specifically, 5,179 proposals were originated in physical meetings. Figure 18 shows the top 10 meetings by number of proposals. As one could expect, many of them are city meetings, however some districts also appear, such as Sant Martí, Gràcia and Ciutat Vella. The meeting that discussed the largest volume of proposals was "Consell Assessor de la Gent Gran" (Advisory Council for the Elderly) a local institution that promotes initiatives to improve the quality of life and civic role of older people. The second most productive hybrid space was the event Procomuns.net[13] boosted by the EU project P2Pvalue[14] focused on commons-based peer production.

title	district_name	attendee_count	interventions	organizations_count	proposals_count	url
Consell Assessor de la Gent Gran	Full city	123	150	0	102	
Economies col·laboratives procomuns: politiques, t...	Full city	13	39	9	68	
Plans de desenvolupament econòmic de proximitat de...	Sant Martí	19	42	16	51	
La Sanitat a la ciutat de Barcelona (debat conjunt...	Full city	70	70	48	44	
Consell de Barri La Salut	Gràcia	77	60	0	44	
Cooperant fem les altres economies.	Full city	46	120	30	43	
Jornada Ciutat Inclusiva	Full city	55	20	48	42	
Consell Salut de Districte de Ciutat Vella	Ciutat Vella	20	43	0	42	
El consum conscient i transformador: El pla d'impu...	Full city	31	93	19	40	
Temps i persones, pactem la ciutat	Full city	24	120	14	40	

Figure 18: Top 10 meetings by the number of proposals that emerged / were discussed.

The maps reported in Figures 19 and 20 show respectively the number of proposals by district, for districts and city meetings. The highest number of proposals in district meetings comes from Ciutat Vella; however, Figure 20 highlights that the district of Ciutat Vella is also very active in the case of city meetings. The most active district from the point of view of city meetings proposals is Eixample; this could depend on the strategic geographical position since it is in the center of the city. Another aspect highlighted by the maps is the prevalence of district meetings with respect to city meetings in Gracia and Nou Barris, two less centric districts characterized by strong neighbourhood identities.

[13] See: http://procomuns.net/en/
[14] See: http://p2pvalue.eu/

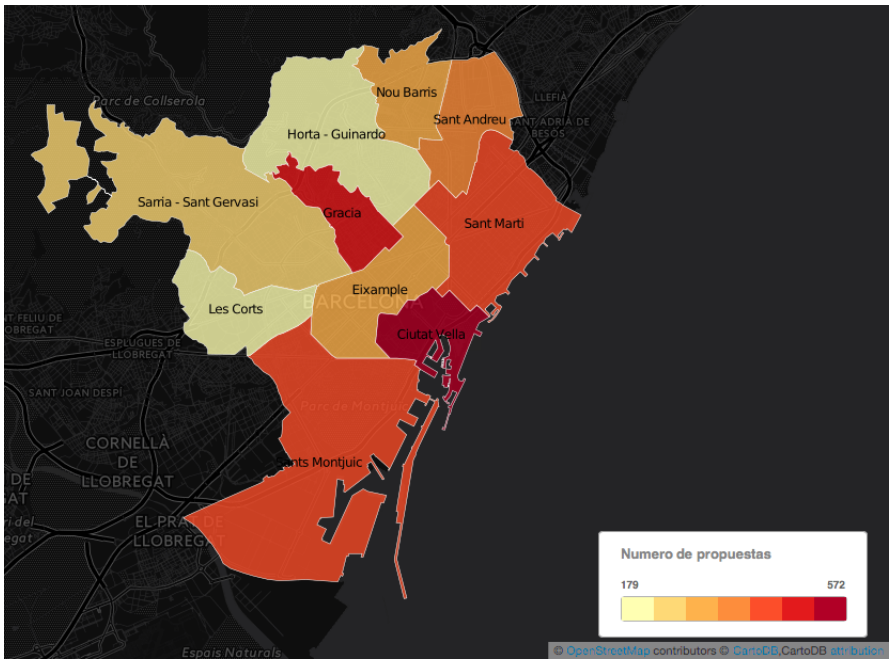

Figure 19: Number of proposals in district meetings

https://urbis.cartodb.com/u/dep-internet/viz/e4793667-134f-4f00-ab73-e21f66abbe4e/public_map

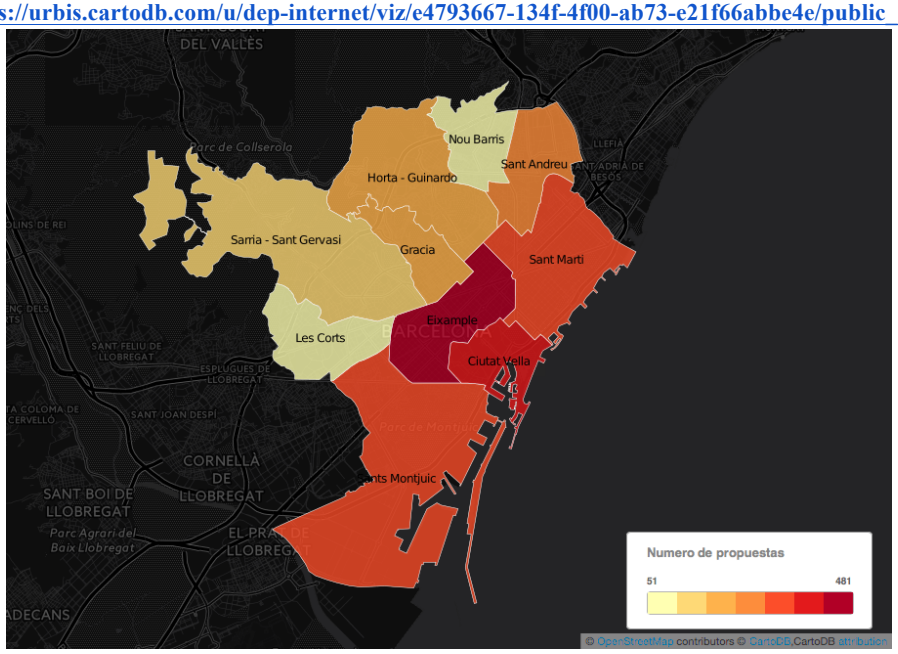

Figure 20: Number of proposals in city meetings

https://urbis.cartodb.com/u/dep-internet/viz/c6367253-5b0d-47a8-8b12-19d52dcc57bf/public_map

1.3 Conclusions

In this chapter we have presented a comprehensive analysis of the citizen participatory process of Decidim.Barcelona from a technopolitical perspective. One of the main objectives of this process was the hybridization of digital and analogical participation in order to foster citizen deliberation, multitudinous participation and empowerment. The general key performance indicators (e.g. number of proposals, comments, votes, meetings, attendees) prove Decidim.Barcelona as an extraordinary citizen experiment of collective intelligence and decision-making which effectively combines online and offline practices.

The identification of the most popular proposals and categories reveals the main topics that concern the citizenry of Barcelona: housing, elderly, welfare, education, health, mobility, tourism, energy, immigration and culture. We find of interest that, although the official proposals already defined action plans for these areas and hence received many votes, citizens were also engaged in posting new proposals for the strategic plan of Barcelona ("PAM"). This conjugation of top-down and bottom-up approaches within the same platform was also observed in the community structure of the network of interactions (replies). The network analysis shows that in Decidim.Barcelona two major well-defined groups co-exist: a centralized cluster around the official city government account, and a decentralized cluster of self-organized citizens. This finding is notably similar to the ones presented in D-CENT deliverable D2.4 for the Twitter structure of Barcelona en Comú during the election campaign.

Regarding geographical patterns, we observed that the district Ciutat Vella is the most active one with respect to almost every indicator. This finding is not surprising because of the recent history of the district, transformed by mass tourism, and demanding a new and more sustainable city model[15]. We also saw that the centric district Eixample played an important role for meetings while district meetings acquired special importance in less centric districts like Gracia and Nou Barris, both characterized by strong neighbourhood identities. In the case of Gracia, many meetings and proposals belonged to the category Transició ecològica which might be related to the interest of this district in the collaborative economy[16]. We also find of interest the relevant role of the district Les Corts in the online sphere of Decidim.Barcelona. The importance of this activity is not trivial because of the low rate of Internet access in this district, as pointed in a report recently published by the City Council[17].

[15] See: http://www.theguardian.com/commentisfree/2014/sep/02/mass-tourism-kill-city-barcelona

[16] See: http://www.lavanguardia.com/local/barcelona/20160217/302235517450/brecha-digital-barcelona-estudio-mwc.html

[17] See: http://mobileworldcapital.com/barcelona-advances-toward-equality-in-the-use-of-the-internet-across-its-different-districts/

Finally we should note that this analysis has been made with data obtained from the open API of Decidim.Barcelona and open source technologies for data analysis and visualization. The API does not exist in the original version of Consul and, therefore, in Decide Madrid. For this reason, we consider that the goals of transparency, trackability and use and promotion of free software have been certainly achieved by developing access points to open data. Furthermore, some of the data visualizations presented here will be integrated in Decidim.Barcelona to democratize the usage of analytical tools by citizens. In conclusion, this transition from citizen data to the wisdom of the crowds makes Decidim.Barcelona a paradimatic example of collective awareness platforms for sustainability and social innovation.

2 The effects of user interfaces in online discussion

Online deliberation is the ultimate goal of citizen participation and open government platforms. To that end, many platforms, e.g. Decidim.Barcelona, incorporate online discussion in every part of the political process. Conversations in online forums are traditionally presented in a hierarchical structure, following the threaded interface design of e-mail clients or news clients. Decidim.Barcelona and Decide Madrid use this specific interface, inspired by the Reddit[18] instance for Plaza Podemos[19]. In contrast, online social networks usually show discussions linearly by sorting messages in a chronological order. This type of interface is the one adopted in other platforms like DemocracyOS[20]. A priori, it is not obvious which of both interfaces is more likely to promote deliberative democracy based on "decision making by discussion among free and equal citizens" (Elster, 1998). Prior research has examined the impact of message threading in cognitive processes. A study of forums in a learning environment reported that threaded discussions build the community required for the construction of knowledge (McVerry, 2007). The work by Whitettaker et al (2011) on mail threads concluded that "threads potentially help people more easily access related messages". These conclusions are consistent with Venolia et al, (2003) who assert that threads give users the context for interpreting individual messages. In the context of chat sessions, some studies (Fuks et al, 2006) identified the potential of message threading for solving the problem of "co-text", i.e. the inability of readers to "identify which of the previous messages provides the elements that are necessary to understand the message that is being read" (Pimentel et al, 2003). Nevertheless, an experimental study of chat interfaces found that threaded views received lower subjective ratings than standard views (Smith et al, 2000).

Regarding popular online social networks, platforms like Facebook or Twitter have been performing significant changes in conversations views. For many years Facebook presented comments in a linear view disallowing direct replies to comments. The interface was modified in March 2013[21] when users were able to reply directly to comments and start conversation threads. The team responsible of this feature expected that conversation threading would improve conversations and would be used to start open dialogues with the community. A survey of this specific Facebook feature concluded that conversation threading favoured participation giving the conversation a rhizomatic structure.

[18] See: https://www.reddit.com/
[19] See: https://www.reddit.com/r/podemos/
[20] DemocracyOS does accept discussion of two levels of indentation but, in essence, conversations are linear.
[21] See: https://www.facebook.com/notes/journalists-on-facebook/improving-conversations-on-facebook-with-replies/578890718789613/

However, this survey indicated that threading reduced the exposure of messages and therefore decreased opportunities for deep conversations. Regarding Twitter, the interface of discussions was also modified in 2013[22] in order to present, in a linear view, tweets from the same conversation. Indeed, a study of user behavior on Twitter found that conversationalist behaviour decreased from 2011 to 2013 (García-Gavilanes et al, 2014). Besides examining user behaviour, conversation threading has been also exploited for different purposes, e.g. visualization of online interactions (Levin et al, 1990; Pascual et al, 2009, Aragón et al, 2016), refinement of graphical interfaces for e-mail clients (Rohal et al, 2001), online community search (Seo et al, 2011), or development of information retrieval test collections (Elsas, 2011).

The articles from the review of the state-of-the-art are favourably disposed towards hierarchical view of conversations threading. However, none of them formally quantify the effect of each interface within a real platform. The overall strategy of this study is to fill this research gap by analysing the effect of a change in the thread interface. We found an ideal scenario of social news platform that turned its linear conversation view into a hierarchical one in January 2015. We believe that the results, obtained through modelling the way discussions grow before and after the interface change, and how deliberation is affected, will be helpful in the development/refinement of D-CENT tools.

2.1 Menéame: Description of the dataset

The present analysis relies on a dataset from Meneame[23], the most popular Spanish social news networking service being the 154th most visited site in Spain according to Alexa[24]. Social news websites, as Reddit, Slashdot[25] or the earlier version of Digg, feature user-posted stories which are ranked according to their popularity within the community. Indeed, the original version of Meneame was a clone of the Digg source code. The choice of this platform for our study is motivated by multiple reasons:

- The community of Meneame consists of thousands of users who daily debate hundreds of links to news / blog posts in order to collectively decide which of them will appear in the front page. The selection process is made by an open source collaborative filtering algorithm.

[22] See: https://blog.twitter.com/2013/keep-up-with-conversations-on-twitter
[23] See: https://www.meneame.net/
[24] See; http://www.alexa.com/siteinfo/meneame.net
[25] See: https://slashdot.org/

- The platform was released in 2005 and therefore Meneame is a mature community of users which have developed their own culture of practices. For instance, users exclude links to the mass media outlets that promoted a law for demanding copyright fees for incoming links from news aggregators[26].
- Although many links in early years were related to science and technology, the irruption of the Spanish 15M movement in May 2011 (also known as the Indignados movement) turned Meneame into one of the most relevant online platforms in Spain about social and political issues.
- The conversation view of discussions on Meneame was modified in January 2015[27]. Although comments had always to reply to posts or comments, the thread view originally presented messages linearly in a chronological order. This design changed in January 2015 and now messages are displayed hierarchically following the tree structure of the discussion. Figure 21 shows the same story for both interfaces: hierarchical (left) and linear (right).

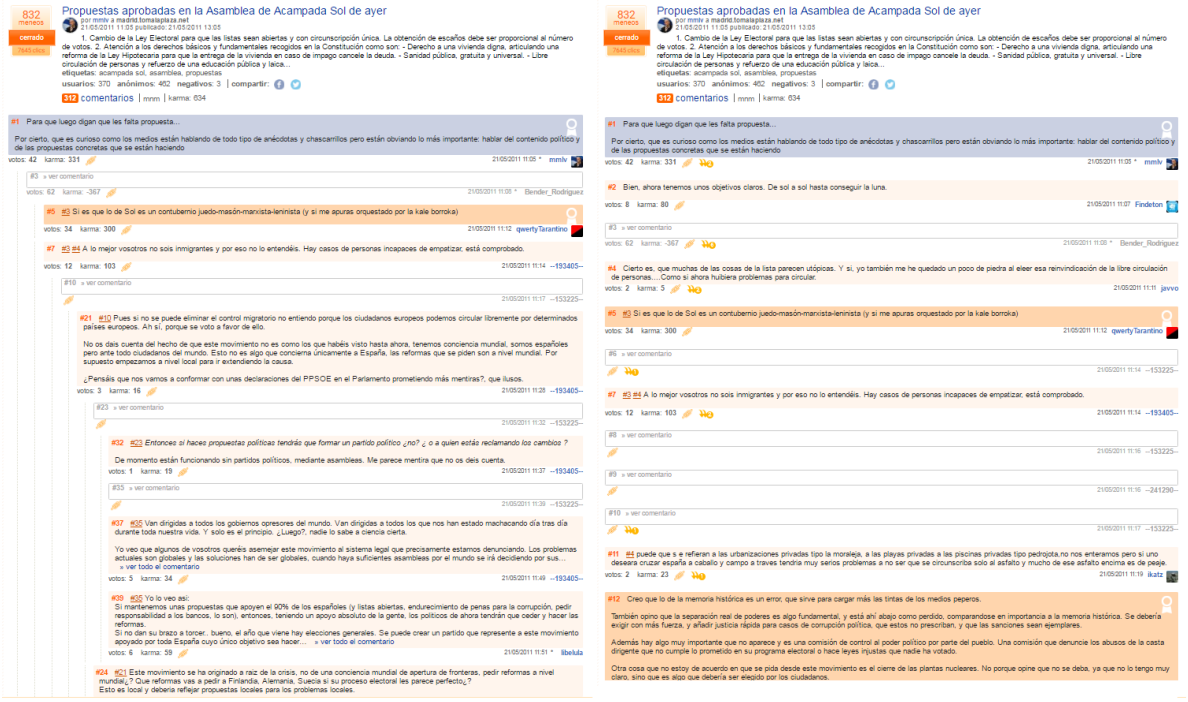

Figure 21: Hierarchical conversation view (left) and linear conversation view (right) for the same story in Menéame.

[26] See: https://medium.com/@JulioAlonso/the-story-of-spains-google-tax-5434d746df48#.qiu8ba27q
[27] See: https://www.meneame.net/notame/2002914/

The last reason makes Meneame a perfect choice as case study for examining the problem exposed in the introduction. For this reason, we run a crawling process to collect all the stories in the front page from 2011 to 2015 (both years included). We then performed a second crawling process to collect every comment from each story. From both crawling processes we obtained 72,003 posts and 5,385,324 comments. For each of them we kept associated metadata such as the id, url, username, timestamp, text message and number votes that the message/story received. Also, we included the parent id for each comment in order to generate the tree structure of every thread.

After building the dataset, we made a preliminary exploration of the data in order to examine basic patterns and better refine the analytical methods of this study. We first examined the daily activity in terms of posting and voting actions. Figure 22 presents a scatter plot of number of stories and number of votes to stories for every day in the dataset. The plot shows a strong correlation between both variables (Pearson coefficient=0.821) and we identify some days (red markers) with abnormally higher activity than the rest of the days, especially in the number of votes. We inspected these days and found that these were relevant days in the Spanish 15M movement:

- **17-19/05/2011** Acampadas (Occupation of the main squares of the Spain)
- **27/05/2011** Violent police charge to evict the 15M acampada in Barcelona
- **25-27/09/2012** Rodea el Congreso (Encirclement of the Spanish Congress)
- **31/01/2013** Marcha del Cambio (Podemos event)
- **21/02/2012** Primavera Valenciana (15M Outbreak in Valencia)
- **11/07/2012** Marcha minera (Asturian miners' strike)

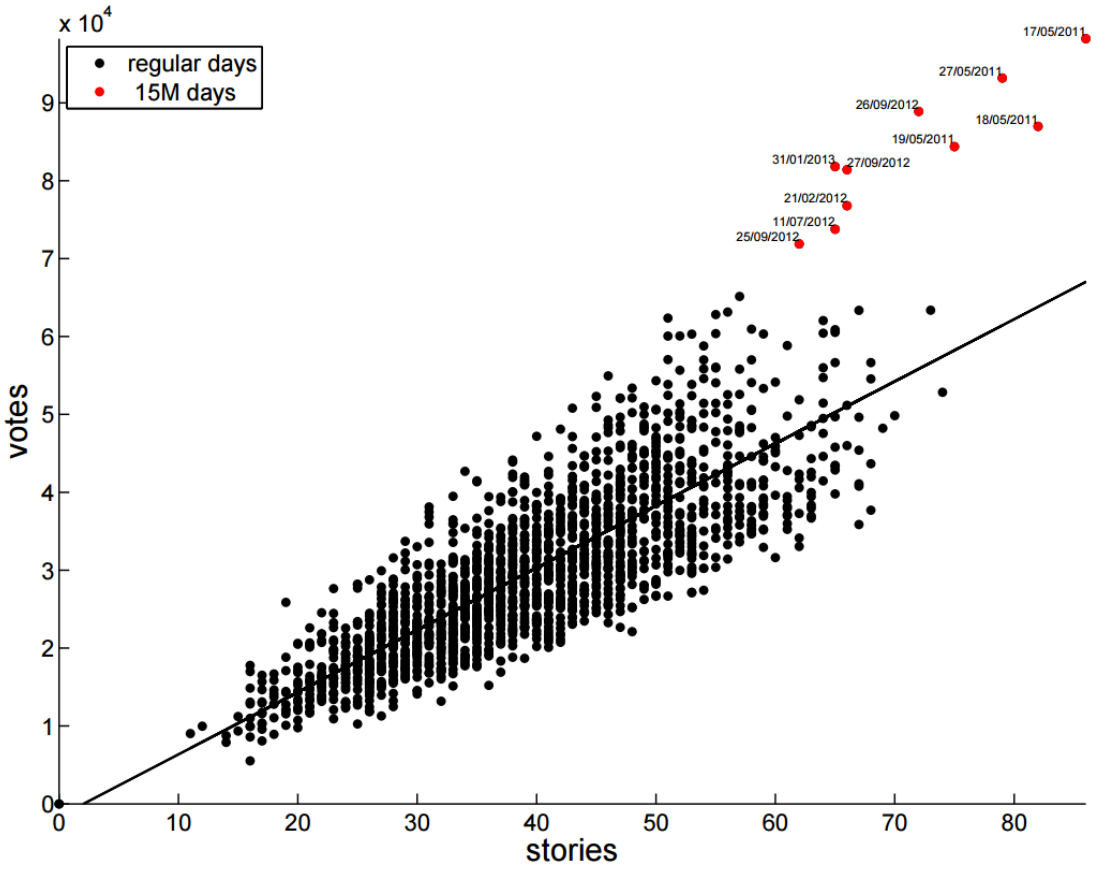

Figure 22: Number of stories and votes in the front page of Meneame for every day in 2011-2015.

We then examine the length of messages measured by the number of characters. Figure 23 and 24 show the percentage distribution and cumulative percentage distribution of messages by length for every year. We observe a similar distribution for the first four years of the dataset with an exponential average length between 158.68 and 163.73. However, the messages in 2015 were notably shorter than every past year. It seems interesting to us that this decrease occurs once the new conversation view was released. The old interface showed replies to messages according to a chronological order while the new interface brings together comments and their corresponding replies. Therefore, such decrease of the message length might be related to the fact that the new interface does not require an effort from the user to contextualize the message that is being replied to.

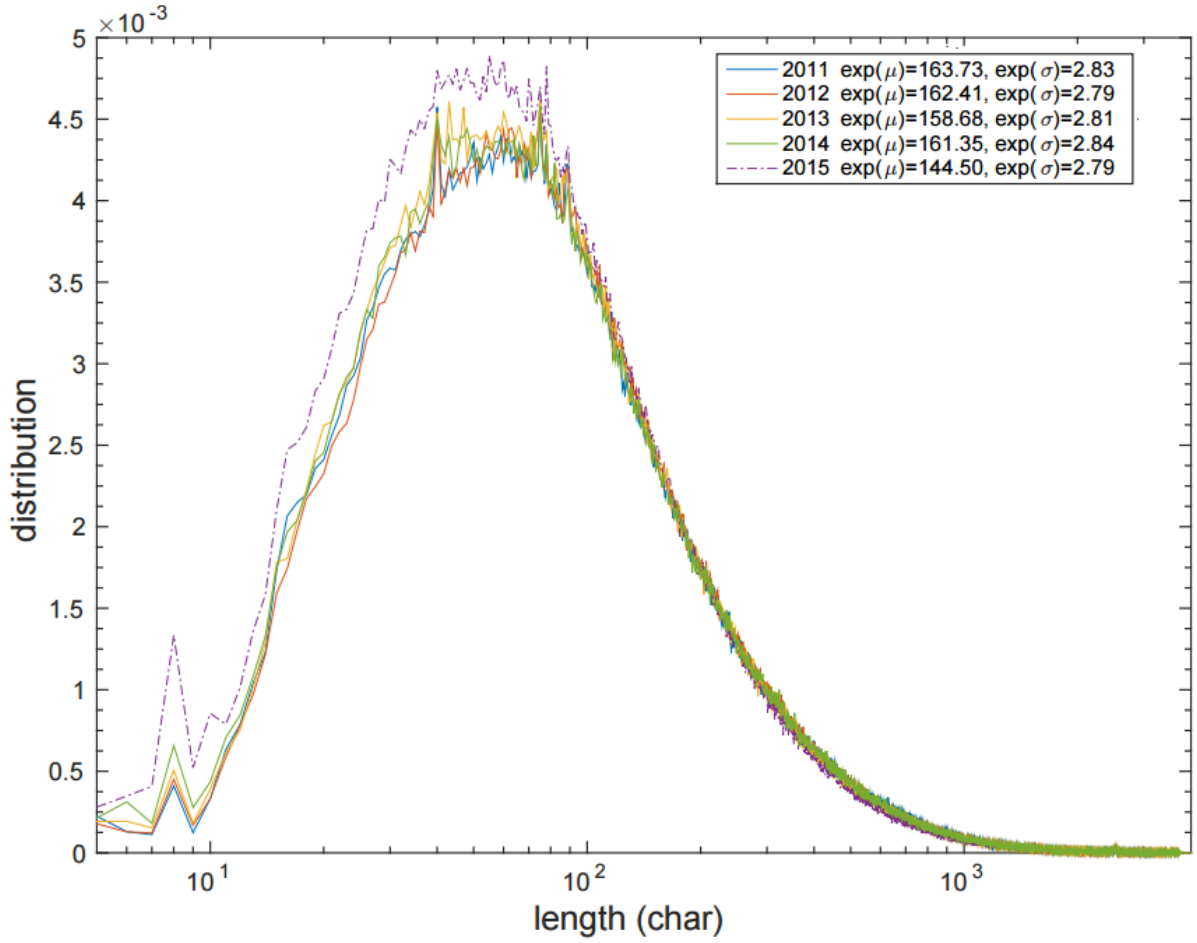

Figure 23: Percentage distribution of messages per length (number of characters) for every year.

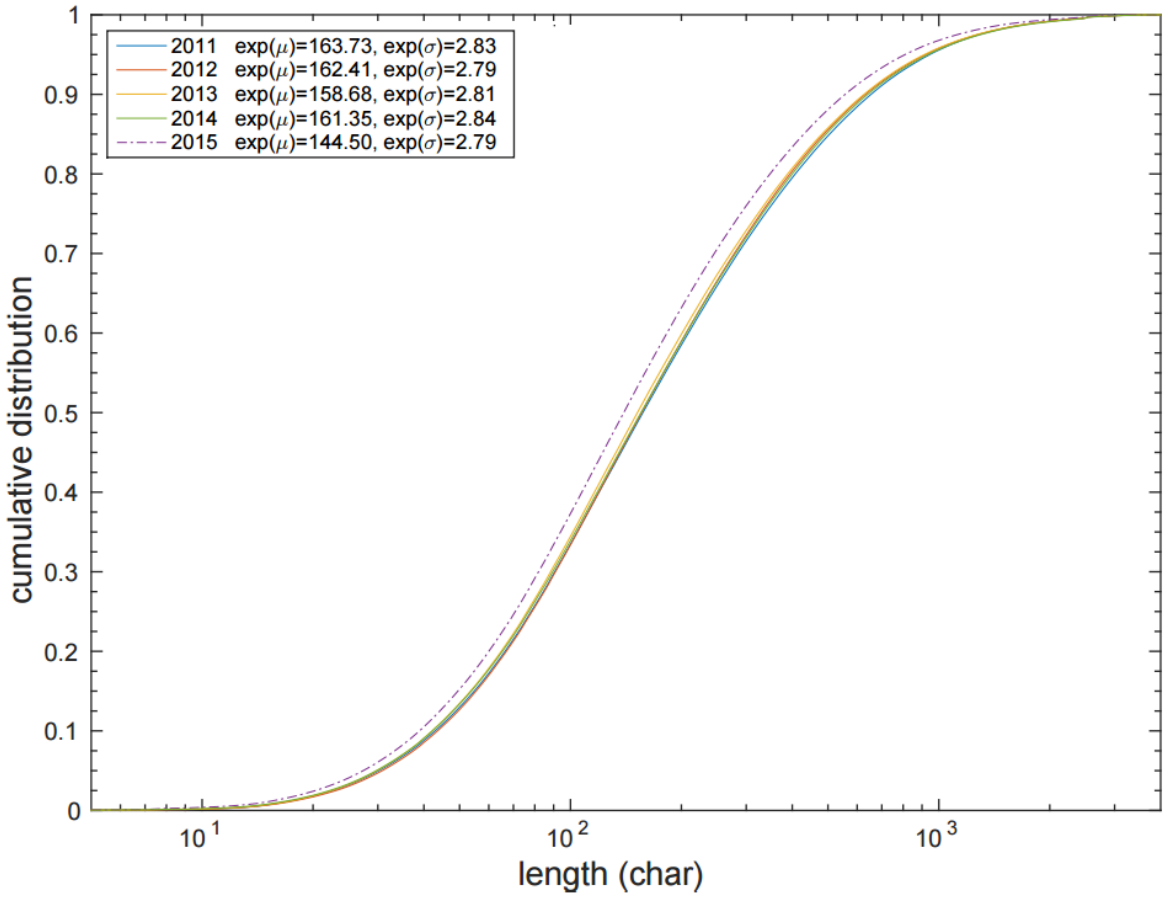

Figure 24: Cumulative percentage distribution of messages per length (number of characters) for every year.

Furthermore, we note that, despite every curve follows a log-normal distribution, each series presents a peak at length equals to 8. We examined a sample of messages for that length and observed that many of them follow the pattern:

#xx edit

where *x* is a cypher. Comments in Meneame starts with a hash symbol and the id of the comment that is being replied to. That is to say that many comments in Meneame are just the word "edit". We interviewed an expert user from Meneame who explained that once a user posts a comment, the user is able to edit the message for a few minutes but he can never delete it. Therefore, if a user wants to erase the content of his new message (e.g. because a second user posts immediately another message proving that the first one was wrong), the common practice is to substitute the original content by the term

"edit". From this explanation, we find of interest that this practice of self-censorship increased when the new interface was released.

Finally, we explored discussion networks to better understand the typical structure of threads in Meneame before and after the conversation view was modified. To this end we adapted the thread visualization tool implemented in the D-CENT deliverable D2.4. The new version of the tool assigns the size of each comment according to the number of responses, and the color of the node is:

- **Black** Root of the thread, i.e. the story.
- **Grey** First level comments.
- **Random** Comments to another comment.

We should note that every comment written by a user gets the same random color. As an example, we present the visualization of a popular thread from 2013[28] in Figure 25 and a popular thread from 2015[29] in Figure 26. We observe that there are many comments who directly reply to the post in the thread of 2013 while this pattern is not so sharp in the one from 2015. To evaluate this behaviour we plotted the percentage of posts, comments to posts and comments to comments for every year in Figure 27. The plot shows an increasing percentage of comments to comments rather than posting comments directly to the post. This might be explained by the long chains of messages between pair of users (two nodes of the same color in the visualizations). To validate this hypothesis, we examined the network of replies between users of every week and computed the reciprocity for each network. The results, showed in Figure 28, reveal an notable increase of mutual interactions among users.

[28] See: https://www.meneame.net/story/nicolas-maduro-anuncia-muerte-hugo-chavez
[29] See: https://www.meneame.net/story/cup-dice-plebiscito-no-ha-ganado-descarta-declaracion-unilateral

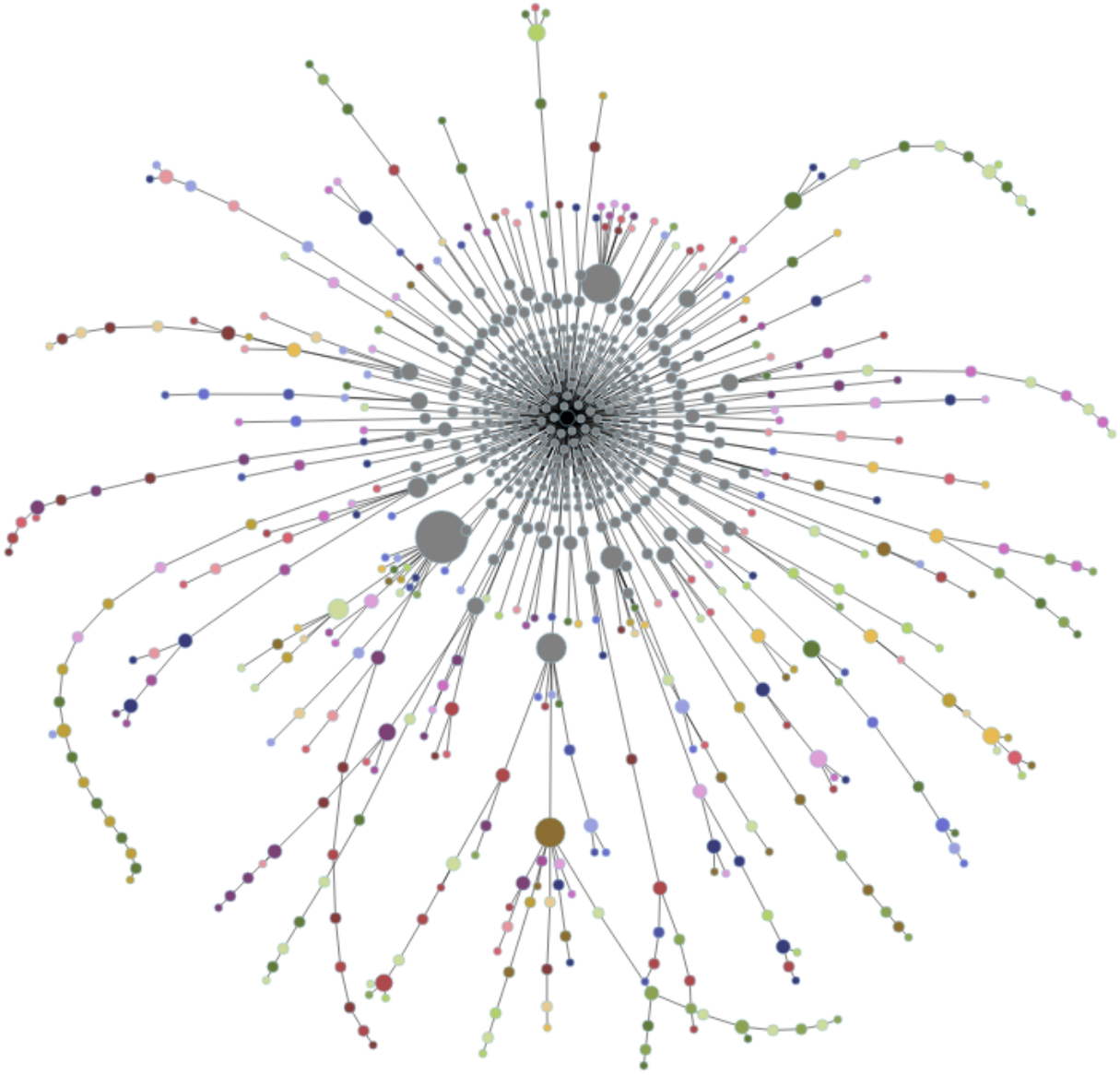

Figure 25: Visualization of a typical popular discussion thread from 2013 (old interface).

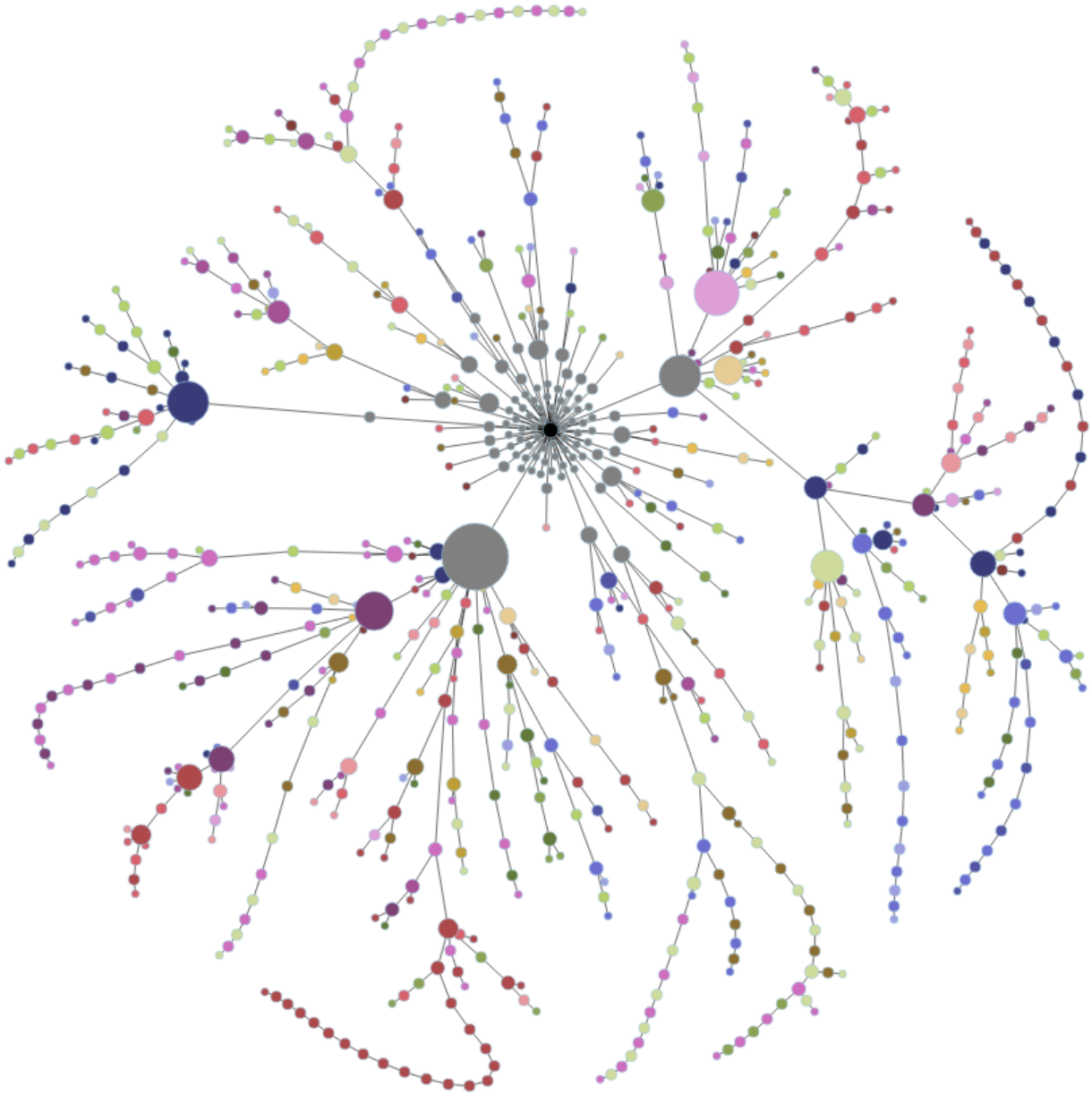

Figure 26: Visualization of a typical popular discussion thread from 2015 (new interface).

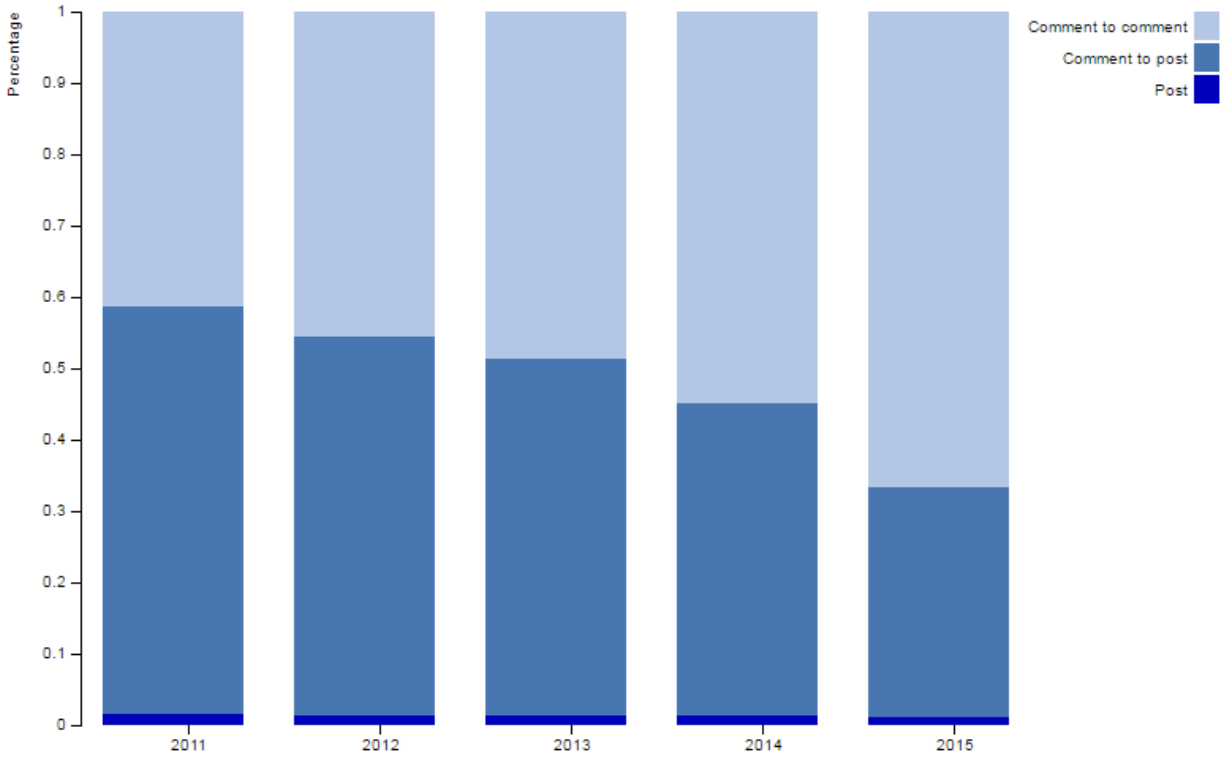

Figure 27: Percentage of the type of messages (posts, comments to posts, and comments to comments).

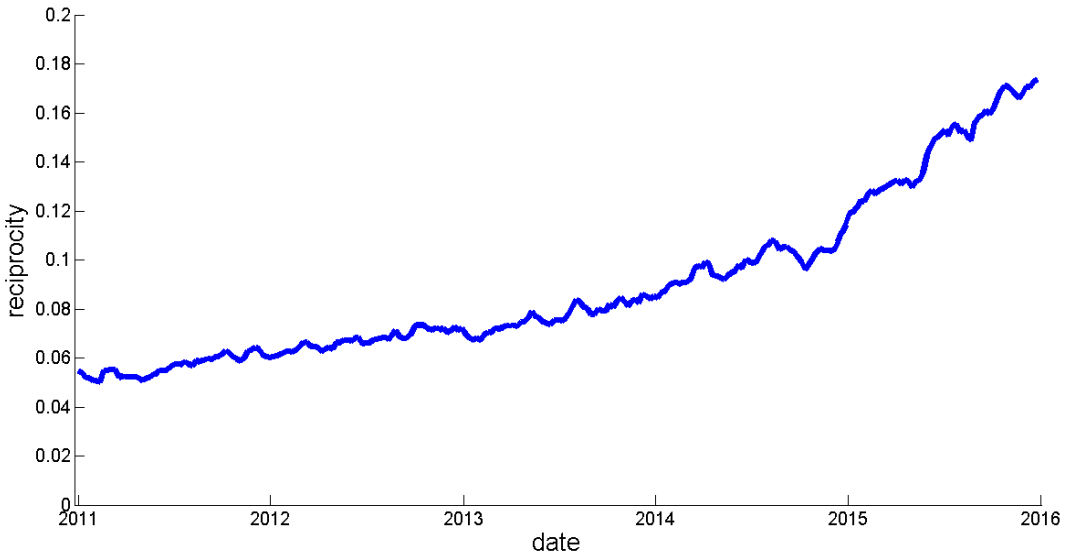

Figure 28: Reciprocity of the network of replies between users for every week

2.2 Statistical Models for Network Analysis

The preliminary data exploration exposed above motivated us to model how the topology of the discussion threads on Meneame did change. In this section we first present the analysis of the dataset in relation to network structures that promote online deliberation and we then propose and assess a stochastic growing tree model for discussion cascades.

2.2.1 Online deliberation

The structure of political discussion networks might provide hints about the level of deliberation within a conversation. We may define online deliberation as "the emerging field of practice and research related to the design, implementation and study of deliberative processes that rely on the use of ICT"[30], then it means that after the political discussion, a decision has been taken and a policy begins to be implemented. A study from González-Bailón et al, (2010) concluded that deliberation in online discussions is based on two prerequisites:

- **Representation** Quantifiable through the width of the discussion tree.
- **Argumentation** Quantifiable through the depth of the discussion tree.

Such study then proposed that deliberation of online threads can be quantified by its h-index[31]. The h-index is a metric originally defined to rank researchers by their scientific performance, and considers that a scholar with an index of *h* has published *h* articles with at least *h* citations each (Hirsch, 2005). In our context, the h-index of a thread is defined by the maximal number *h* such that there are at least *h* comments at level *h*, but not *h+1* comments at level *h+1*, as suggested in (Gómez et al, 2008). Therefore, this metric effectively balances both width and depth of a given discussion thread.

Inspired by this the experiments conducted in (Malik et al, 2016) to identify platform effects in social media data, we use regression discontinuity (RD) analysis. RD is a statistical technique commonly applied to measure causal effects in cases where an arbitrarily strict cutoff along one covariate exists. This was designed for contexts in which candidates are selected for intervention based on whether their value for a numeric rating is lower or higher than certain cutoff, e.g. measuring the performance of scholarship awards. Among the different methodologies in regression discontinuity, we followed the parametric

[30] See; https://en.wikipedia.org/wiki/Online_deliberation

[31] This technique was already tested for Decide Madrid and the results are reported in the D-CENT deliverable "D2.4 From Citizen Data to the Wisdom of the Crowds"

strategy where the rating is the temporal axis and the outcome is the average h-index of threads at that time (i.e. online deliberation). In the linear case, the equation of the regression is:

$$Yi = \beta 0 + \beta 1 \cdot xi + \beta 2 \cdot I\,(xi > c) + \beta 3\, xi \cdot I\,(xi > c) + \mathcal{E}i$$

where *i* is a seven days bin, *xi* is the timestamp of bin *i*, *Yi* is the average h-index of bin *i*, βi are the coefficients of the regression, *c* is the cutoff (the day that conversation view was modified) and $\mathcal{E}i$ is a random error term. This analysis fits two different curves, before and after the cutoff, and allows to quantify the difference between both fitted lines at the cutoff. The null hypothesis is that the there is no discontinuity at the cutoff and, therefore, $\beta 2 = \beta 3 = 0$. As suggested in (Imbens et al, 2008), we also used the F-test to validate the significance of our results.

First we examine each possible bin as cutoff by calculating their F-statistic values. Figure 29 (left) presents 17/01/2015 as the best cutoff, ie. the week after the new interface was released (F-statistic=479.7284). For that cutoff, we then plot the local linear regression in Figure 29 (right) and observed that the average h-index increases over time. In particular, the slope of the discontinuous linear regression increases notably at the cutoff ($\beta 1$=0.0028, $\beta 3$=0.0127), while the slope of the null hypothesis ($\beta 1$=0.0049, $\beta 3$=0) does not capture such effect. Finally, we compared these results by computing the median h-index of every bin instead of the average value. Figure 30 (left) shows that for the median values the best cutoff is identical to the one found for the average h-index. Regarding the linear discontinuous regression, Figure 30 (right) shows that the median h-index was stable at 3 for almost every week from 2011 until the cutoff. Then, the week after the release of the new interface, the median h-index value of every bin is stable at value of 4.

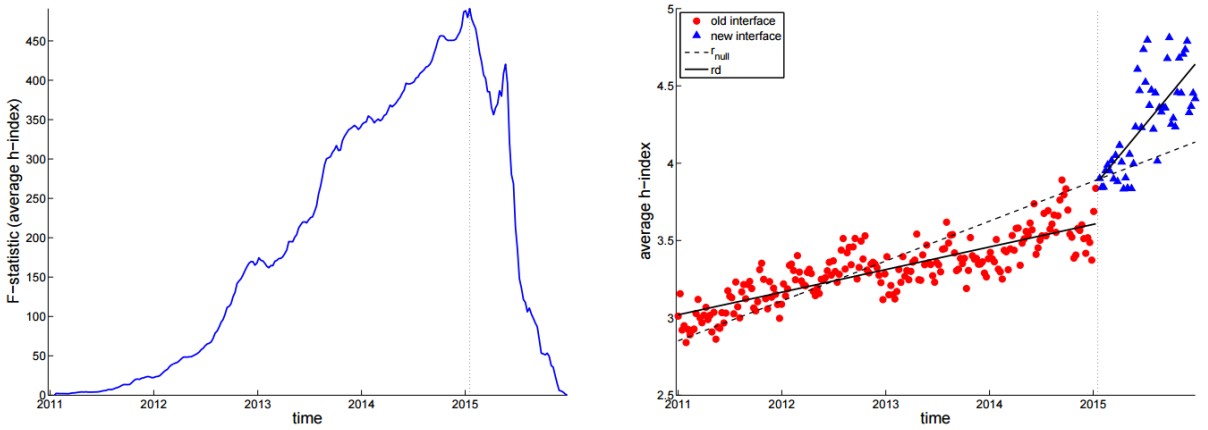

Figure 29: Regression discontinuity (RD) analysis for the average h-index. Left: F-statistic values in the RD analysis for each bin as cutoff. Right: Average h-index of the threads for every seven days. Red circles and blue triangles are the bins before and after the cutoff. The solid line is the discontinuous linear regression and the dashed line is the continuous linear regression of the null model.

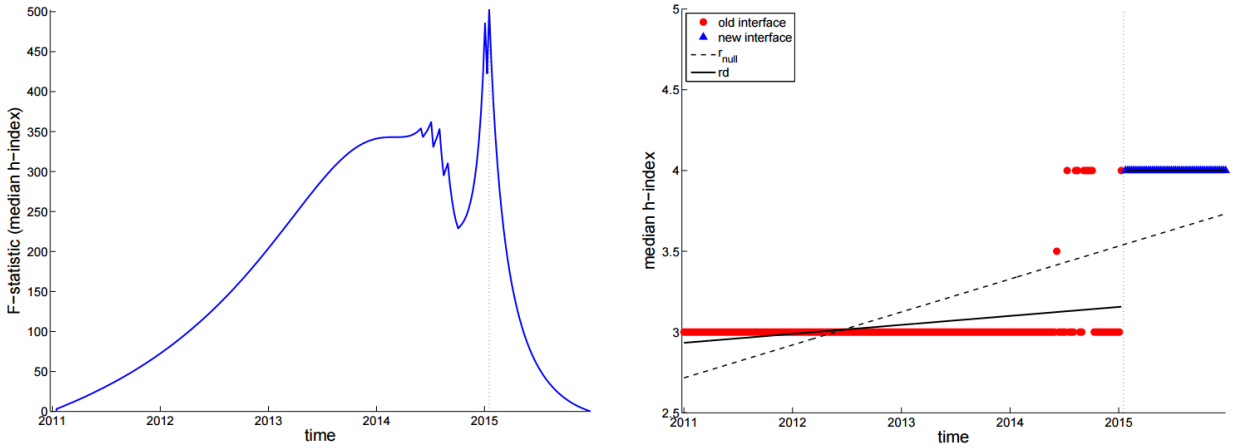

Figure 30: Regression discontinuity (RD) analysis for the median h-index. Left: F-statistic values in the RD analysis for each bin as cutoff. Right: Average h-index of the threads for every seven days. Red circles and blue triangles are the bins before and after the cutoff. The solid line is the discontinuous linear regression and the dashed line is the continuous linear regression of the null model.

2.2.2 Model for the growth of discussion trees

Some models have been proposed in the state-of-the-art to model how discussion threads are formed from a longitudinal perspective (Kumar et al, 2010; Backstrom et al, 2013; Balali et al, 2014). In this analysis we have extended and evaluated the one defined in (Gómez et al, 2013) which was originally assessed on a dump of Meneame. In this model, discussion threads are represented as graphs formed by nodes (the story and comments) and edges (replies between comments). The model, defined when the new version of the interface did not exist, gives special importance to the story node because of its role as triggering event of the discussion. Nodes are added to the graph sequentially at discrete time-steps following the tree structure, i.e. one comment can only reply to the story or to another single comment. The characterisation of the growth of the discussion is based on the idea that existing nodes attract new ones. Figure 31 shows an example of a thread of 8 comments (plus the story) when a new comment arrives at *t=9*. The parent of this upcoming node will be decided by computing the probability of every existing node.

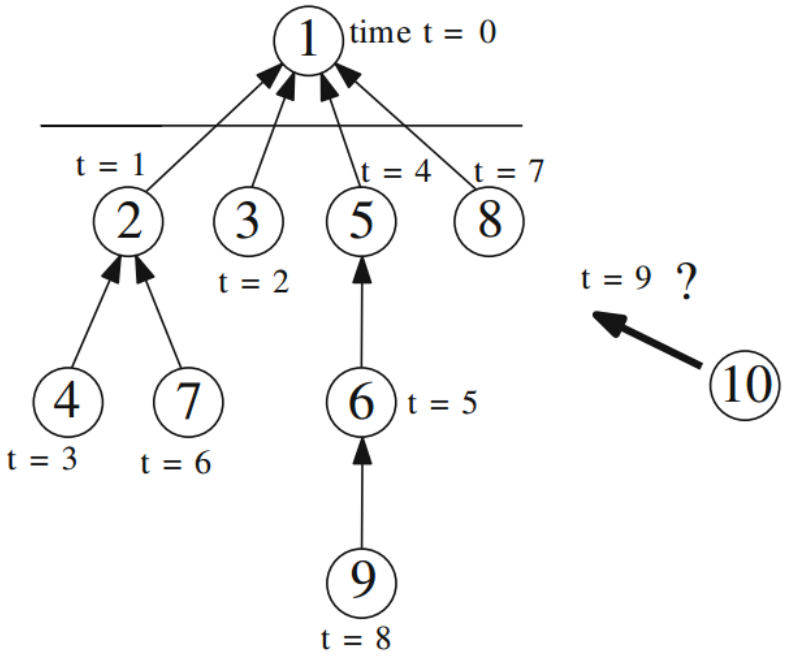

Figure 31: Example of a discussion thread represented as a tree: at time-step t = 9, node (comment) 10th is added to the thread. Each node attracts the new comment with different probability according to the model. Source: (Gómez et al, 2013).

The probability of each candidate parent for every arriving node at a timestamp *t* is computed through an attractiveness function that considers three features[32]:

- **Popularity (α)**
  Comments get new replies according to how many replies they already got. This behaviour is also known as preferential attachment (Barabási et al, 1999) and has been proved as common in complex social networks.

- **Root bias ($ß$)**
  Distinction between the story (the initial node) and the comments. Although the story and the comments are all modelled as nodes, it is convenient to establish a parameter that differentiates the two types as attractors for arriving comments.

- **Novelty (τ)**
  Old comments gradually become less attractive than new ones, therefore, this feature introduces an exponentially decaying factor.

Inspired by our results in the exploration of the dataset, which indicated chains of messages between pairs of users as well as the increase of reciprocity, we introduced a fourth parameter to the original model:

- **Reciprocity (κ)**
  Distinction between the nodes who replied a comment from the author of the upcoming node and the ones who don't. That is to say that there might be an emphasis on continuing a discussion of the thread where the author of the new comment has been involved.

We estimated the four parameters of the model for every seven days bin and plotted the evolution over time in Figure 32. With the exception of the bias root which might be considered as not stable, the new interface generated an immediate and notable increase of the popularity, novelty decay and reciprocity. That is to say that the new interface, which explicitly shows the replies to every message, made popular comments even more popular ("*the rich get richer*"). This might also explain the increase of the novelty decay, i.e. old comments are still attractive in the new interface if they are popular. Finally, reciprocity gets more importance in the new interface which is consistent with the increase of the reciprocity observed in the data exploration process.

[32] The mathematical formulas and terminology of the model can be found in (Gómez et al, 2013).

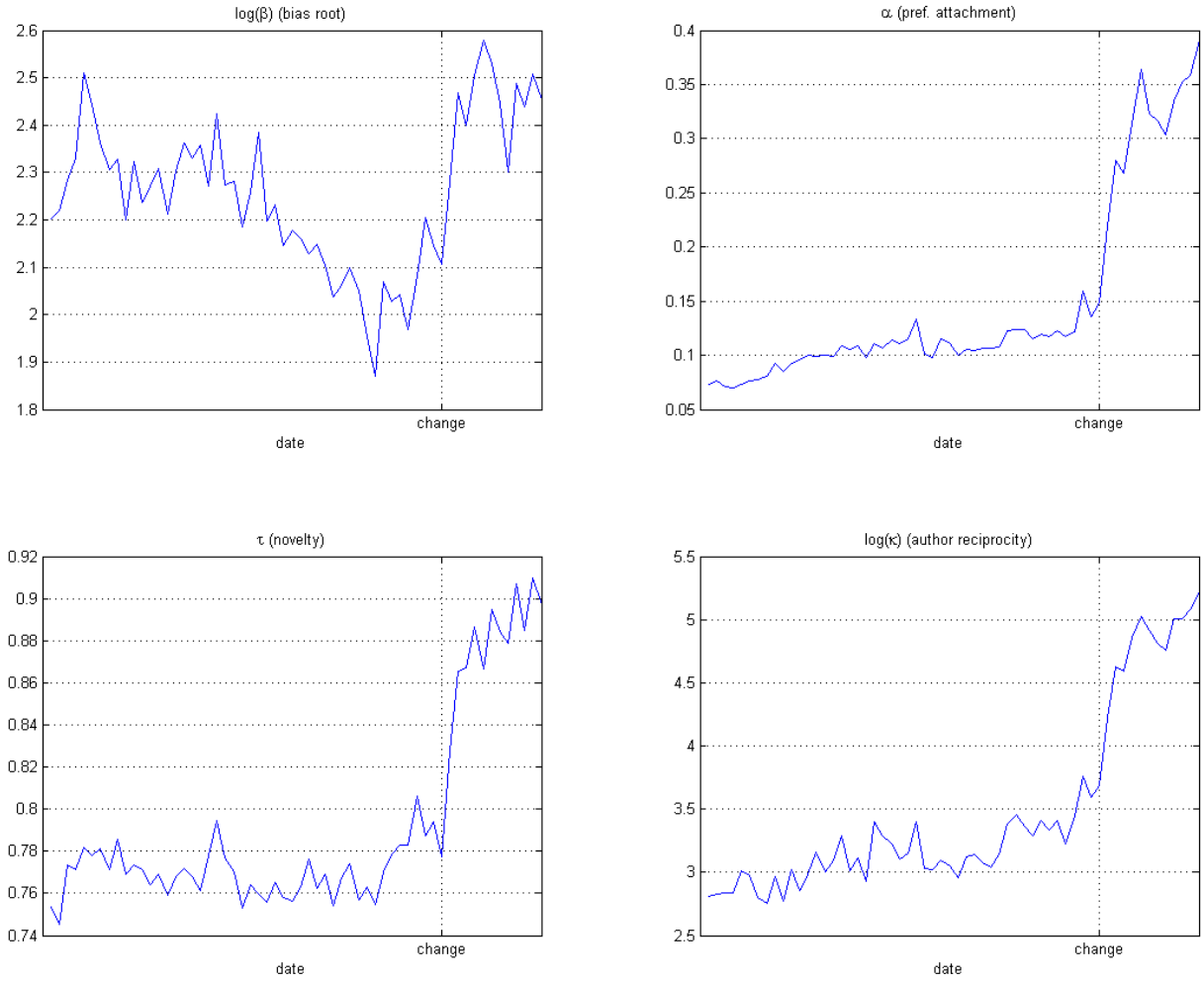

Figure 32: Estimation of the four parameters of the model for the threads of every week.

2.3 Conclusions

The findings of this study have relevant social and political implications. If political participatory processes are run in digital spheres, technical decisions, e.g. interface of conversation threads, might influence the results of such processes. In this case study we observed that changing the interface of conversations from a linear to hierarchical view affected the average length of messages and the structure of the discussion. When the new interface was released (i.e. comments were presented together with the message that is being replied to) messages got shorter solving the problem of "co-text" (Pimentel et al, 2003) exposed in the introduction of the chapter. This finding is also important in relation to user engagement since shorter messages require less effort from citizens to participate in digital processes. Indeed, microblogging online networks (e.g. Twitter), that promote short messages, have been proved as one of the most effective channels for collective action and political discussion (Bennett, 2012; Castells, 2015). The change of the interface was also the cause of a significant increase of online deliberation, quantified through the average h-index. While the linear interface promoted structures focused on direct replies to the post, the hierarchical interface decentralized such pattern and promoted rhizomatic and complex structures. In this new interface, users can easily find popular comments which increased the preferential attachment. We find of interest to discuss the increasing attraction of older comments. Comments are presented in branches (and sub-branches) which are sorted chronologically. In other words, new messages in large discussions may encounter difficulties in being visible if they do not reply to messages from the first branches of the discussion tree. This consequence is crucial for bringing innovation to discussion platforms because new contributions with no connection with previous arguments will be nearly invisible to the community. Future work aims to apply the above methodology on the platforms Decidim.Barcelona and Decide Madrid. Although discussions have always been presented in a hierarchical thread view, the sorting criteria of for branches in Decide Madrid did change: branches were originally sorted by the date of the initial comment but now branches are sorted by the number of votes to the initial comment (the second criteria is the one applied in Decidim.Barcelona since its release). We believe that in this new context, our framework will bring complementary insights on how platform design and sorting algorithms influence the performance of online democracy.

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