

## Original Software Publication

## Decidim.viz: A data dashboard prototype for a digital democracy platform

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## ABSTRACT

In this work, we present Decidim.viz, a tool to display metrics and statistical information about Decidim instances. Decidim is a digital platform for political participation. We have created a Proof of Concept that analyses a participatory process launched by the European Commission in 2022. Decidim.viz was co-designed with the community of users and researchers of Decidim to guarantee the usefulness of the tool. Decidim.viz is designed as a client-server application that has a web application as a user interface. In addition, the tool provides a RESTful API to make its data reproducible and available to the community.

## Metadata

Nr	Code metadata description	Please fill in this column
C1	Current code version	v0.5.0.f (front-end) v0.5.0.b (back-end)
C2	Permanent link to code/ repository used for this code version	<a href="https://github.com/DataPolitik/decidim_viz_front">https://github.com/DataPolitik/ decidim_viz_front</a>
C3	Permanent link to reproducible capsule	
C4	Legal code license	GNU Affero General Public License version 3
C5	Code versioning system used	git
C6	Software code languages, tools and services used	Javascript, Typescript, Angular, Python, Django
C7	Compilation requirements, operating environments and dependencies	Django (with django-cors-headers) Pandas, scikit-learn, sklearn, numpy, networkx, plotly, kaleido, npm angular primeng, Apollo-angular, primeicons ag-grid ag-charts
C8	If available, link to developer documentation/manual	<a href="https://github.com/DataPolitik/decidim_viz_front/blob/main/Desarrollo%20de%20Decidim.Viz.pdf">https://github.com/DataPolitik/ decidim_viz_front/blob/main/Desarrollo%</a>

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C9	Support email for questions	<a href="mailto:tecnopolitica@uoc.edu">tecnopolitica@uoc.edu</a>

## 1. Motivation and significance

Decidim is a software designed to facilitate democratic processes. It is used by hundreds of institutions worldwide, like city halls and national governments, but also social organisations, cooperatives, and universities [1]. It is deployed in more than 30 countries and used by more than 1 500 000 people who have used Decidim until 2023 [2]. Decidim is open source and uses an AGPL license both for its software and for the public data generated by the platform.

Beyond the software, Decidim is also a community of technicians, activists, public servants, and citizens who participate in relevant decisions on the design of the software and the overall orientation of the project. SMEs are included in this community and collaborate with institutions to deploy and maintain their Decidim installations (named "instances"). This community is technopolitical in character, as it blends technical and political goals and practices [3]. It pivots around an association that controls the brand and the repositories and that organises

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meetings and workshops where people can learn about and debate topics related to Decidim, and digital democracy more broadly. It aims to advance beyond open source toward a model of democratic software [4].

Decidim is a knowledge-intensive project. Researcher-activists were at the core of its launch [4]. Research goes hand in hand with its development, and it has become an important object of study or source of information for social science. In that sense, we can find Decidim-based analyses of social discussion in online environments [5–7], reports analysing debates in a specific instance [8], as well as inquiries into the relations of the platform to collective intelligence [9], participatory optimization processes [10], or the reduction of the burden of decision making [11]. Also, new indicators of deliberative quality using time series analysis and social network analysis of data from an instance have been proposed [12]. The studies cover the three areas or actors of modern polity: civil society, political parties, and State or public institutions [13]. Also beyond politics are fields such as that knowledge and education [14]. They overview a variety of types of participatory processes, from participatory budgeting to strategic planning, addressing various steps or elements of democratic processes: idea and proposal generation, debate, selection and voting, implementation of proposals (in many cases, as public policies) and accountability of those implementations [6,15,16]. Ultimately, they provide a hint of the richness of Decidim-based participation.

Two of the most important research tools provided by Decidim are its API and its data files. Every Decidim instance has an API system where GraphQL queries can be executed to obtain all the publicly available information about participatory processes, assemblies, proposals, comments, or user interactions. Moreover, It's possible to download tabular files (csv) with that information. Notwithstanding, the update frequency and the amount of downloadable information depend on the specific configuration of each instance. Thanks to the API and the datafiles, it's possible to obtain data to perform analysis about the social dynamics in Decidim. This is aimed to contribute to forms of open and inclusive science as well as broader knowledge practices, which can in turn inform the community and broader dynamics of political participation.

At least since 2018, the Decidim community has recognized the need for tools to make it easier for non-technician profiles to explore and analyse the data without having programming skills.<sup>1</sup>

In that sense, during the Decidim Fest 2022, a yearly meeting of the Decidim community, we (the authors of this paper) led a workshop oriented to gathering ideas, and suggestions and listening to the problems and needs of different members of the Decidim community. Around 20 people, including users, social researchers, data scientists, and developers, attended, to debate and contribute to the design of a dashboard for Decidim.

After this meeting, we collected all the ideas posed by the community and started the development of a dashboard to help analyse data from Decidim. A few months later we launched Decidim.viz, a dashboard designed to visualise different data and statistics from a specific Decidim instance. Decidim.viz is intended to be used for different types of users: social researchers, data scientists, and developers. We have prepared the first version of Decidim.viz to display information about The Conference on the Future of Europe (futureu). This is an initiative from the European Parliament and the European Commission with the goal of giving European citizens the opportunity to debate European challenges and priorities. The Conference decided to install and launch a Decidim instance where every citizen from an EU country can participate, adding new proposals or discussing existing ones. This prototype of Decidim.viz is oriented to help the Decidim and the scientific community to analyse the results of the Conference. It is designed as a web application where

the user can enter from a web browser and navigate through different sections. In the future, we plan to display information about different Decidim instances. We are in continuous communication with the Decidim community so that we can incorporate its needs into new functions and designs. For that reason, Decidim.viz is more than a prototype, it is a community-based, ongoing process of development of a Decidim data dashboard. In that journey, Decidim.viz builds upon the principles of open and democratic software, data, knowledge, and science heralded by the Decidim project itself.

Some other prototypes of tools to visualise data and participatory processes in Decidim have been developed before but these tools were proof of concepts in very early stages of maturity that are currently discontinued and have not been developed in collaboration with the Decidim community. In addition, there is a dashboard, but only for administrators of instances<sup>2</sup>. Decidim.viz is the first dashboard tool that is actively developed, can be used by any person interested in downloading and visualising data from Decidim and providing tools and visualisations proposed by the Decidim Community.

Beyond Decidim, there are other participatory and open democratic platforms. Another relevant system is Consul, which is also an open source project. Consul counts with internal dashboards for admins and creators of content inside of the platform. In 2015, City Council of Madrid (Spain) launched *Decide Madrid*, a website to allow citizens to discuss and take decisions and published *DecideViz*, a dashboard for this platform. *DecideViz* introduced the visualisations of a user network that can help to identify the social interaction and structure of different debates. *DecideViz* was a source of inspiration for *Decidim Viz* [17]. Nevertheless, currently there is not a mature dashboard which provides the same functionality as *Decidim.viz*. So *Decidim.viz* can be also interesting for other platforms, which can adapt or reuse most parts of the code to create visualisations of their processes.

Finally, as we note below, *DecidimViz* implies a recursive and technopolitical approach, and integrates new metrics that give it a specific significance beyond usual dashboards and even community-designed dashboards.

This work is structured as follows:

- 2. Software description: Provide technical description of the dashboard prototype. Introducing the architecture and the front-end functionalities.
- 3. Illustrative examples: Introduce and describe the functionalities of *Decidim.viz*, attaching illustrative screenshots.
- 4. Impact: Describe the impact and the potential *Decidim.viz*.
- 5. Conclusions

## 2. Software description

*Decidim.viz* is a web application designed to retrieve data from Decidim instances and let users see key information to analyse the activity and dynamics within the instance. Typically, Decidim provides data by using two different sources: tabular data files and a GraphQL API. Before the existence of *Decidim.viz*, any person who wanted to get the key indicators of an instance should have to use a programming language to retrieve the information from these two data sources, process and extract it, and program a routine to perform the desired analysis. This process requires time, effort, and technical knowledge, a requirement that supposes an important limitation for researchers (for example, in the Decidim environment) and general users who don't have programming skills or statistical knowledge.

*Decidim.viz* provides the data needed for social researchers in different ways: 1) It displays the raw data in histograms, doughnut charts, and text. 2) *Decidim.viz* is also able to process the data and

<sup>1</sup> An early community lab on this matter was carried in 2018. More information available at <https://meta.decidim.org/assemblies/eix-lab/f/87/meetings/1011>

<sup>2</sup> <https://meta.decidim.org/processes/roadmap/f/122/proposals/14381>  
Accessed on 27 June 2023

display some statistical information involving users, proposals, and comments. 3) It computes the statistical significance of the associations between users or proposals by analysing co-commented or co-supported proposals, and generates a network visualisation to display the resulting associations, enabling the identification of significant communities [18]. 4) Also, the raw data used by Decidim.viz is also available for download, to help researchers to check the reproducibility of the information displayed in the web application.

Decidim.viz is free to use and is licensed under a GNU Affero General Public License v3.0. The source code is available on GitHub and there is also a Telegram Community for contributing to the development of the dashboard.

### 2.1. Software architecture

Decidim.viz is a distributed application that implements the client-server model. We have a back-end application and a front-end application. Communication between both sides is possible thanks to a RESTful API.

The back-end application is written in Python 3.10 and makes use of the Django framework. This application has the responsibility of reading data from a SQL database which contains a relational model of users, proposals, and comments. There are also some Django scripts defined to read from tabular data, clean and transform the information and store it in the database. The database is used mainly for storing the information provided by Decidim into raw files and needs preprocessing before use. This means that the data should be periodically updated when new raw data is available for download. There are two mechanisms to download the data: automatically, by using an implemented script, or manually. Nevertheless, the manual procedure is the recommended way to proceed, as each instance can have different data structure that is not easy to generalise. Another approach to avoid manual downloading of data can be adapting the generic downloader script to fit the needs of specific instances. It is important to note that our application is not only designed for reading data and storing it in a database. Some complex tasks require a lot of computing time that is performed in the back-end application. The results of this task are stored in a cache folder to be immediately available when required. An example of this type of task is computing the social network of an instance.

Thanks to the Django REST framework, the back-end application is also a RESTful API server that can transmit the information to other applications. This opens the door to having more applications connected to our data.

With regard to the front-end side, we developed a web application written in Angular/Typescript. This application is connected to the GraphQL API of a Decidim instance and to the RESTful API of the back-end side. The web application implements PrimeNG, a component library that allows the creation and reuse of web components. In addition, the front-end application uses Plotly, AG Charts, and AG Grid for rendering charts that we use to display the information. Fig. 1 shows a schematic representation of the architecture of Decidim.Viz.

The dashboard uses different Information Visualization techniques described in [19]. For example, as recommended by the authors: for the case of scatter plots, the graph generated always tries to be as close as possible to 45° of slope, also we use the family of colours recommended for displaying information and we take into consideration colour blindness. In addition, we follow recommended practices described by [20] for dashboards design: We try to make our visualisations scalable by displaying generic information that can be filtered if the user wishes to see detailed information, and we display ranged information as a box plot diagram.

Decidim is slightly different from a normal, pre-designed dashboard or even from a community developed dashboard designed externally to the user community because we add a community reflexive and recursive process: the community that generates the processes and the data also generates and uses the dashboard and can rethink itself and the

dashboard, iteratively, as a result. Furthermore, we have followed a technopolitical approach that takes into consideration the political preconditions, dimensions and implications of tech development.

Finally, it's relevant to mention that we use professional libraries like AG Grid, which is designed by a group of experts in user experience and front-end development<sup>3</sup>. Finally, DecidimViz integrates new metrics that are proposed by the authors to the research community [21].

### 2.2. Software functionalities

Decidim.viz is able to collect information, process it, and present it to the user in a visual way. The information is mainly displayed in different interactive components, listed below:

- Histograms,
- Bar charts
- Box plots diagrams.
- Network graphs.

All the functionalities were requested by the participants in the Decidim Fest so the goal of this application is to be useful for the core users and researchers from the Decidim community.

Another relevant capability of the application is the API Rest, which is public so that the back-end can be used as a server for other programs.

## 3. Illustrative examples

The user interface, is designed with two menus that are permanently visible during each dialog. The first menu introduces the different sections of the application (Activity, Community, Statistics, and a Help link), while the second menu changes its content depending on the selected dialog. Fig. 2 illustrates the Activity dialog. This dialog shows the evolution of comments and proposals and starts with a set of different metrics for the instance (number of users, proposals created, categories, number of participatory processes, and comments), and after that, a diagram showing the activity of comments and proposals over a specific period of time is presented. The user can interact with the diagram or continue exploring the dialog, which contains more information about the activity of the instance (more active proposals, more active comments, etc.).

Fig. 3 shows the Community dialog. In this section, we can see the social networks of users grouped into communities. For grouping users, we used the model proposed in [21]. This module works by using the Python library Networkx and is graphically generated by using Plotly. The network visualization is interactive in the sense that it is possible to use zoom-in and zoom-out options as well as select only a specific node or set of nodes to see its interactions. If the user scrolls down the windows, a table with more details about every community is shown.

Figs. 4 and 5 explain the Statistics section. In this dialog, a doughnut chart illustrating the number of languages used for commenting on proposals on futureu.europa.eu is shown. Scrolling down the windows, more statistics can be found, like, for example, the depth of comments (in Decidim, a comment can reply to a proposal or another comment, so it's possible to establish comment trees). We implemented doughnuts and boxplot diagrams in this section. All of them are interactive, so the user can receive additional information when moving the cursor through the diagram.

Finally, Fig. 6 presents an example of the API Rest built on the back-end side of the application.<sup>4</sup> The API is publicly available so that other applications can be built using it without having to use our user

<sup>3</sup> <https://www.ag-grid.com/about/> Accessed on 25 october 2023

<sup>4</sup> The back-end repository is located at [https://github.com/DataPolitik/decidim\\_viz\\_back](https://github.com/DataPolitik/decidim_viz_back) (accessed on 3 April 2024). This repository is also linked from the front-end repository.

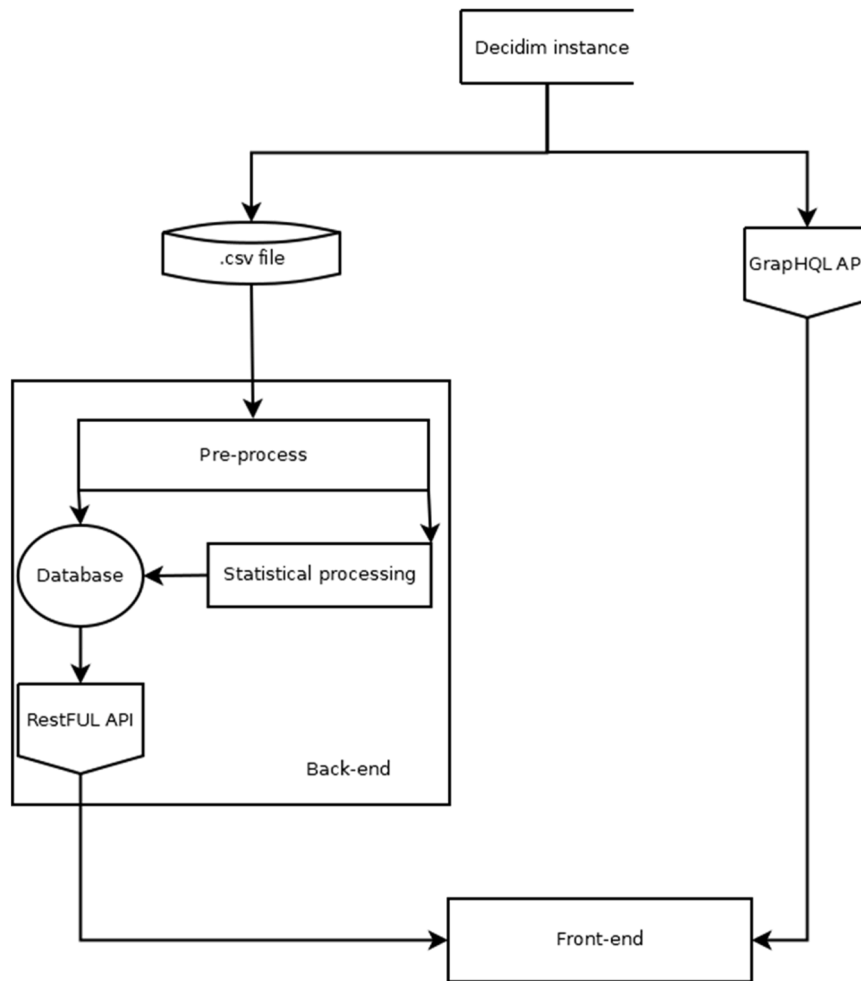


Fig. 1. Schematic architecture of Decidim.viz.

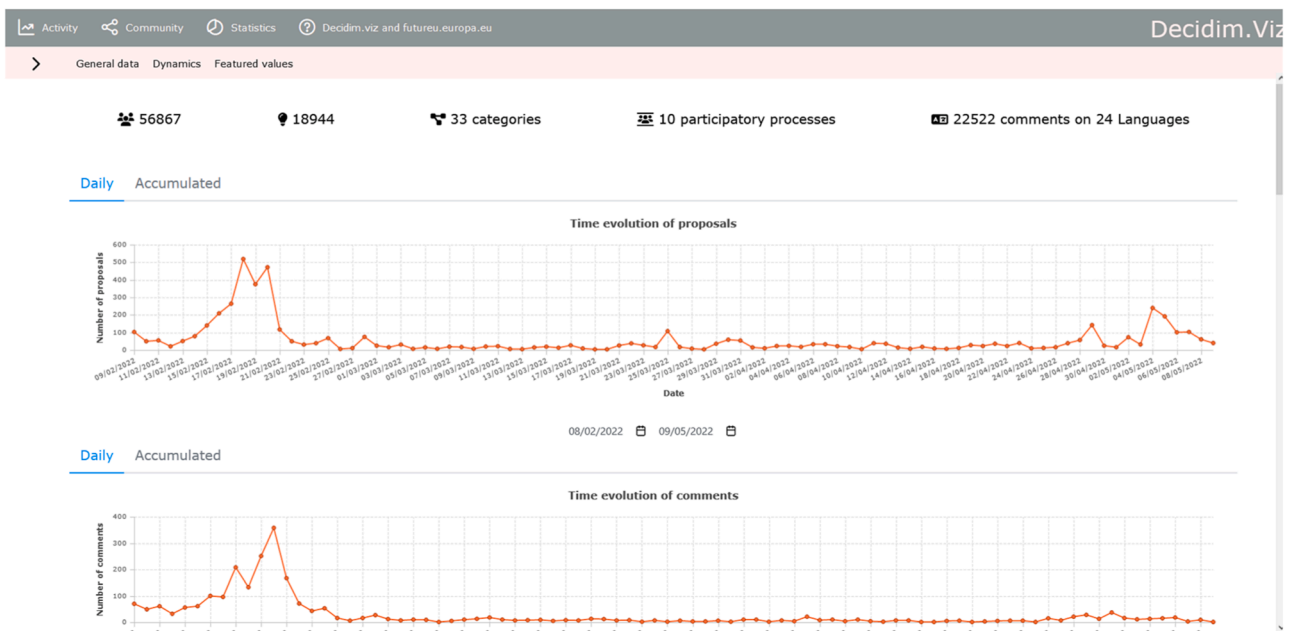


Fig. 2. Activity dialog.

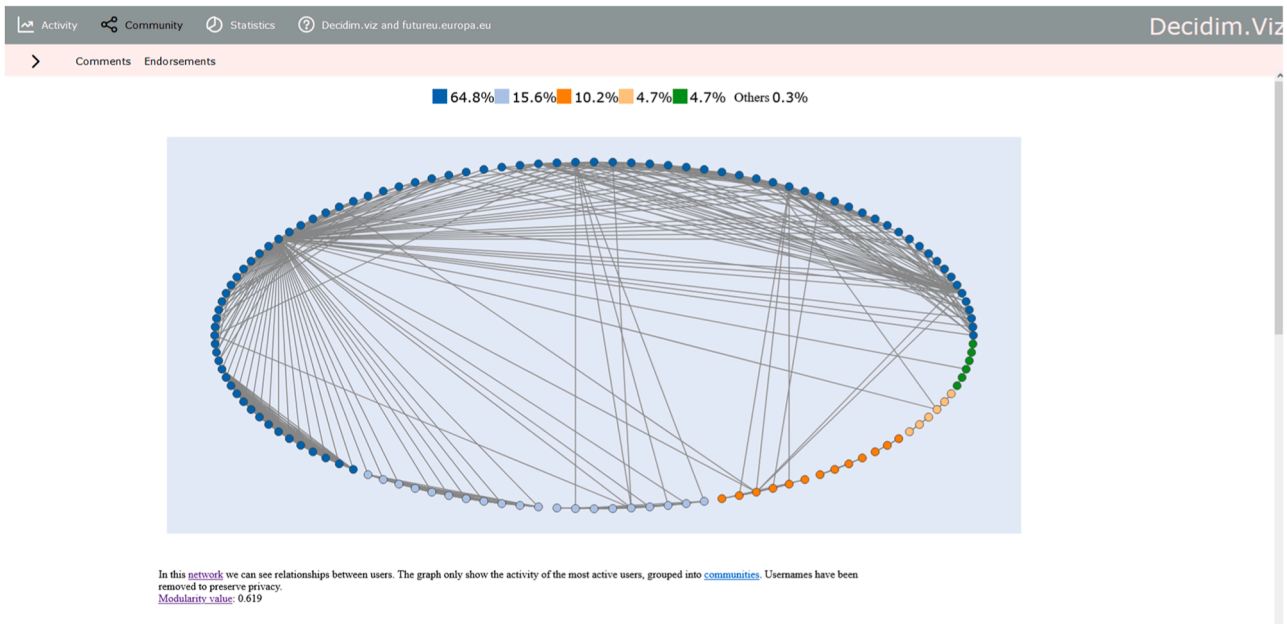


Fig. 3. Community dialog.

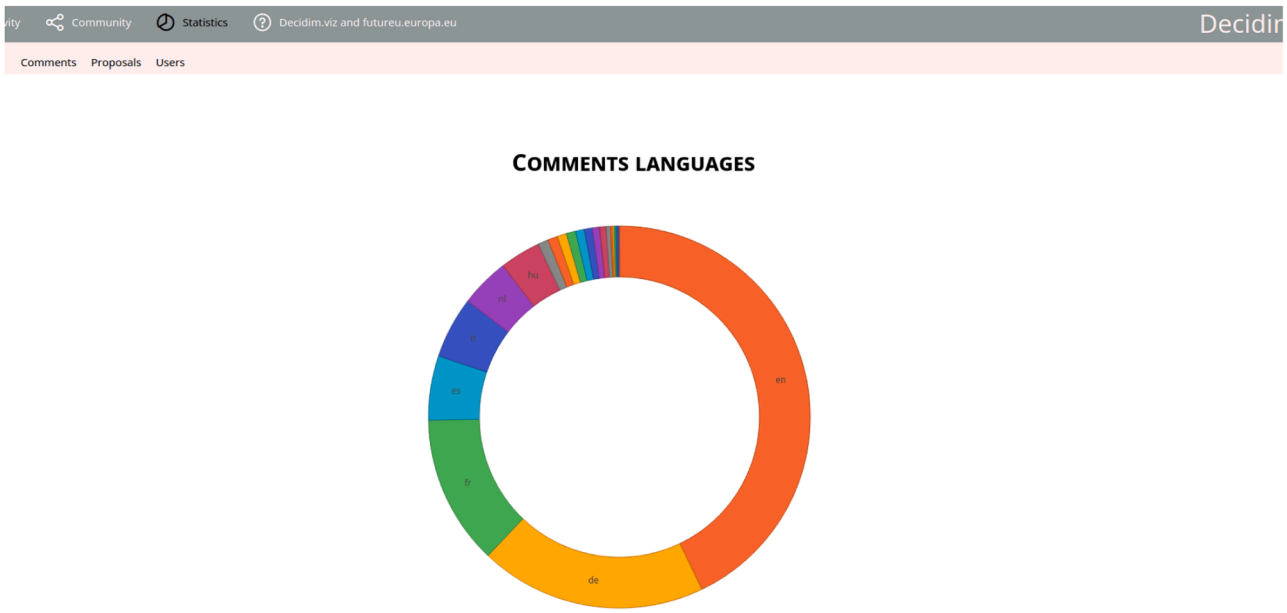


Fig. 4. Statistics dialog.

interface. It's important to note that not all the data can be retrieved from our API, some data needs to be taken directly from the Decidim API, which requires using a GraphQL client.

#### 4. Impact

Users of Decidim didn't have a simple way of seeing the overall metrics needed to determine the behaviour and the state of a Decidim instance. From now on, and thanks to Decidim.viz, every person involved in a Decidim instance can access this data easily. Moreover, social researchers don't need to deal with a GraphQL and other technical tools that add complexity to the research process. In that sense, it contributes to a democratisation of data-based knowledge around Decidim.

As noted above, we are in continuous communication with the

Decidim community so that we can incorporate its needs into new functions and designs. Decidim.viz builds upon the principles of open and democratic software, data, knowledge, and science heralded by the Decidim project itself. An initial proof of concept of Decidim.viz was released before the Decidim Workshop, before the event, participants and other stakeholders were informed regarding Decidim.viz, the community was also called to participation by using social networks of Twitter<sup>5</sup>. The idea of these promotions was to increase the number of users that tried the proof of concept and evaluate their usefulness. During the Workshop, the proof of concept were also tested and evaluated by participants with different roles (data scientists, computer scientists, user experience experts, political scientists and sociologists).

<sup>5</sup> <https://twitter.com/UOCuniversitat/status/973953189585326083>

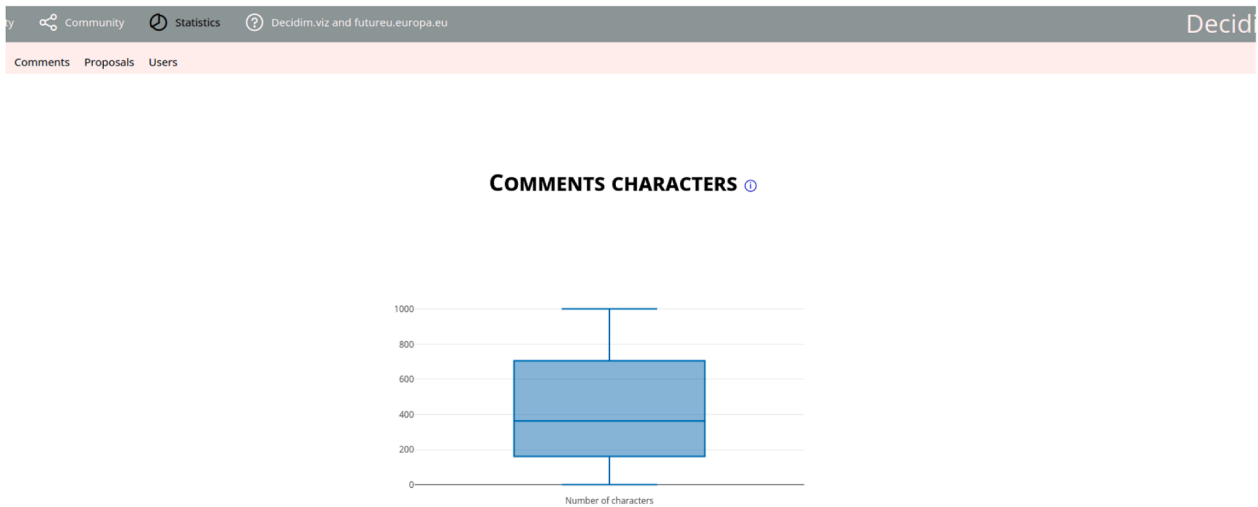


Fig. 5. This is an example of a box plot representation of the length of comments in the futureu.europa.eu instance. This type of information was requested during the Decidim Fest workshop, and it can help social researchers understand the activity and the user behaviors of a specific Decidim instance.

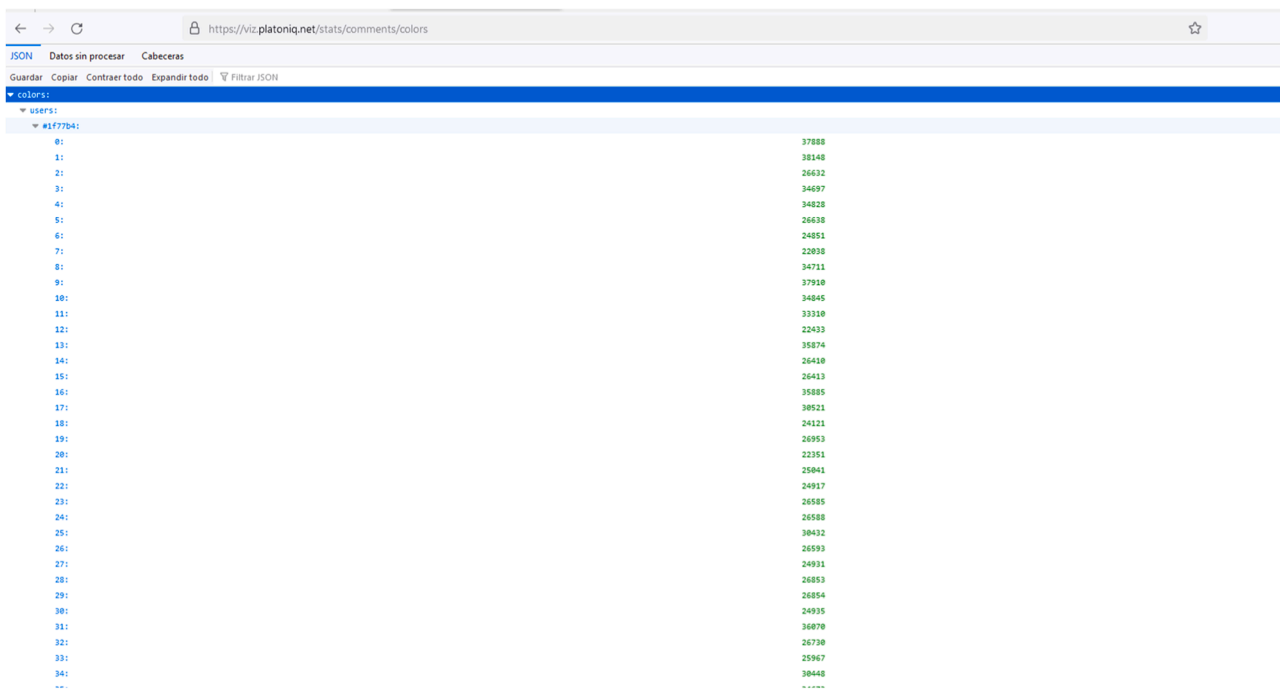


Fig. 6. An example of a direct call to the API endpoint to retrieve data.

After the workshop, once collected all evaluations and comments from the participants, we started to convert the proof of concept into Decidim.viz. During the development of the tool, an agile development methodology practices were adopted, having weekly meetings where the different new features were presented to experts and users of Decidim to get continuous feedback from them.

As Decidim, it aims to bring about more informed and democratic politics. Ultimately, it essays a redefinition of the relations between data and politics, in the form of a democratisation of data and a subsequent (virtuous) datification of democracy. Regarding the first point, making data more technically and cognitively accessible to non-experts is the first step for people to have an engaged and empowered relation to such data. The second point built upon the first puts the basis for various forms of data-informed reflection on participation that will contribute to iteratively improving democratic processes throughout society. Therefore, the potential impact of the dashboard is as extensive as the impact

of Decidim itself. It aims to contribute to a more enlightened and democratic digital society.

Further improvements of the dashboard are necessary and expected. A more appealing design, further metrics, incorporation of data from more than one instance, etc. are necessary features. They are expected as the direct connection with research communities around Decidim suggests autonomous developments are forthcoming.

## 5. Conclusions

Decidim is a tool used by institutions like political parties, universities, and city councils in order to run democratic processes. Decidim.viz is a web application designed to retrieve data from Decidim instances and let users see key information to analyse the activity and dynamics within the instance. It displays the raw data in histograms, doughnut charts, and text; is also able to process the data and display some



statistical information involving users, proposals, and comments; it computes the statistical significance of the associations between users or proposals by analysing co-commented or co-supported proposals, and generates a network visualisation to display the resulting associations, enabling the identification of significant communities; finally, the raw data used by Decidim.viz is also available for download, to help users to check the reproducibility of the information displayed in the web application.

The need for tools to analyse and interpret the social dynamics happening in the Decidim instances has been discussed on different Decidim community forums. In this paper, we have presented our design of a dashboard that helps data scientists, social researchers, and general users and participants to access data, metrics, and relevant information regarding participatory processes on Decidim without having to deal with technical issues. In the context of political participation, this is a contribution to data democratisation, participatory reflexivity, and the improvement of democracy itself. Much remains to be done: improvements in usability, aesthetic design, multi-instance data management, metrics deployed, and more aspects are necessary. As noted earlier, Decidim.viz is not just a prototype, it is a community-based, ongoing process for developing a Decidim data dashboard. In that journey, Decidim.viz builds upon the principles of open and democratic software, data, knowledge, and science heralded by the Decidim project itself. There is a long way to go, but the orientation and the compass are well set, and this is just a first step.

#### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

#### Data availability

Data used is publicly available from Decidim API and public files

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#### References

- [1] Russon Gilman H. Building civic power in crisis. Digit Gov; 2022 Sep 14. <https://doi.org/10.1145/3529164> [cited 2023 Mar 29] Available from.
- [2] Decidim Census. Decidim. <https://decidim-census.digideplab.org/>. Accessed on 03 march 2023.
- [3] Barandiaran X, Calleja-López A, Monerde A, Aragón P, Linares J, Romero C, Pereira A. Decidim: redes políticas y tecnopolíticas para la democracia en red. *Recer Rev Pensam I Anal* 2017;(21):137–50. <https://doi.org/10.6035/recerca.2017.21.8>. Available from.
- [4] Calleja-López A. Since 15 M. The Technopolitical Reassembling of Democracy in Spain Doctoral Thesis. Exeter: University of Exeter; 2017.
- [5] Aragón P, Kaltenbrunner A, Calleja-López A, Pereira A, Monerde A, Barandian X, Gómez V. Deliberative platform design: the case study of the online discussions in decidim barcelona. *International conference on social informatics*; 2017 Sep 13. Springer; 2017.
- [6] Borge R, Balcells J, Padró-Solanet A. Democratic disruption or continuity? Analysis of the Decidim platform in catalan municipalities. *Am Behav Sci* 2022. <https://doi.org/10.1177/00027642221092798> [cited 2023 Mar 29];000276422210927. Available from.
- [7] Borges Junior E, Ferreira BM. Informative architectures and citizen participation: a comparative study between the digital platforms Decidim and Rousseauv. *Liinc Em Rev* 2022;18(2):e6058. <https://doi.org/10.18617/liinc.v18i2.6058> [cited 2023 Mar 29] Available from.
- [8] Peña-López I. Shifting participation into sovereignty: the case of decidim. Huygens; 2019.
- [9] Collective intelligence and digital participatory platforms: learnings from Barcelona's DECIDIM. in *the routledge handbook of collective intelligence for democracy and governance*. Routledge; 2023.
- [10] Serrania M, López-Sánchez M, Rodríguez-Aguilar JA, Escobar P. Optimising participatory budget allocation: the decidim use case. *Front Artif Intell Appl* 2019; 193–202.
- [11] Deseriis M. Reducing the burden of decision in digital democracy applications: a comparative analysis of six decision-making software. *Sci Technol Amp Hum Values* [Internet] 2021. <https://doi.org/10.1177/01622439211054081> [cited 2023 Mar 29];016224392110540. Available from:.
- [12] Shin B, Rask M. Assessment of online deliberative quality: new indicators using network analysis and time-series analysis. *Sustainability* 2021;13(3):1187. <https://doi.org/10.3390/su13031187> [cited 2023 Mar 29] Available from:.
- [13] Li Vigni F, Blanchard E. «Partis plateforme» versus «partis en réseau». *Reseaux* 2023;236(6):57–93. <https://doi.org/10.3917/res.236.0057> [cited 2023 Mar 29]; N° Available from:.
- [14] Martín-Gómez A. [Master's Thesis]. Universitat Oberta de Catalunya; 2021.
- [15] Català-Abad O. [Master's Thesis]. Universitat Oberta de Catalunya; 2021.
- [16] Annunziata R. Digitalization of participatory budgeting in the context of the pandemic: the cases of san lorenzo and vicente lópez in argentina. *Local Dev Amp Soc* 2023;1–17. <https://doi.org/10.1080/26883597.2023.2181705> [cited 2023 Mar 30].
- [17] Aragón P, Gómez V, Kaltenbrunner A. Visualization tool for collective awareness in a platform of citizen proposals. In: *Proceedings of the Tenth International AAAI Conference on Web and Social Media*; 2016. <https://doi.org/10.1609/icwsm.v10i1.14707>. Available from:.
- [18] Clauset A, Newman ME, Moore C. Finding community structure in very large networks. *Phys Rev E* 2004;70(6). <https://doi.org/10.1103/physreve.70.066111> [cited 2023 Mar 29] Available from:.
- [19] Colin Ware. *Information visualization. perception for design*. 4th ed. Morgan Kaufmann; 2021.
- [20] Sedrakyan G, Mannens E, Verbert K. Guiding the choice of learning dashboard visualizations: linking dashboard design and data visualization concepts. *J Comput Lang* 2019;50:19–38. <https://doi.org/10.1016/j.jvlc.2018.11.002>. Available from: .
- [21] Cozzo E., Calleja-López A. Mapping the structure of an online deliberative assembly: A network analysis methodology of political participation on online platforms. arXiv; 2024.