
AN ECOSYSTEM OF CORPORATE POLITICIANS DIGITAL COMPUTATIONAL

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Nowadays, with the increase of publicly available information on economic and social matters, visualization has targeted such themes in order to promote transparency and raise awareness for the interested audience. This paper describes the design and implementation of an interactive visualization that displays the relations between Portuguese politicians with government positions and companies. The aim of this visualization is to create awareness of these relations, and by using a highly figurative approach, captivate the targeted audience. The visualization was able to gather interest from a broad audience and is available at pmcruz.com/eco.



1. INTRODUCTION

The high availability of public information on the relations between highly ranked government members and the corporate world has been raising awareness on this matter all over the world. Several platforms have been developed in order to make this information reach to broader and global audience. Perhaps the most peremptory example is the *They Rule* (*theyrule.net*) website, which provides a glimpse of some of the relationships between the US most powerful companies, which share many of the same directors. On *They Rule*, the user can build and save maps of those connections. With a similar thematic, the wiki *Poderopedia* (*poderopedia.org*) maps the actors in businesses and politics in Chile, as a collaborative platform of data journalism. More on a visualization side, *Retórica* (*retoricaparlamentar.com*) is an interactive visualization that enables browsing Brazilian deputies and discovering the main thematics in their speeches.

This paper focuses on the relations between members of Portuguese governments and their involvement with companies, and nowadays in the Portuguese sphere, such theme does not lack infrastructure: for example, *Tretas* (*tretas.org*) that is a collaborative wiki that aggregates dossiers about important matters in politics and economics in Portugal as well as extensive curricula of public figures, and *Demo.cratia* (*demo.cratia.org*) which is a repository of information about deputies and parliamentary sessions in the Portuguese Assembly since 1976. We wanted to bring a more visualization focused approach to this theme, that could strongly engage a broad audience, create awareness of the theme and clarify the nature of each relation between politicians and companies. For this, we created an interactive visualization called *An ecosystem of corporate politicians* that takes an highly figurative approach to the subject: it depicts a set of organisms (politicians) that chase and frenetically jump between companies.

2. DATA

The main data source for this visualization came from the study about politicians and businesses in the book *Donos de Portugal* (Costa et al. 2010), which covers members of Portuguese governments between 1974 and 2010 that had prominent positions in important companies. In fact, such study focuses only in ministers and secretaries of state in strategic sectors (i.d. finances, economy and pub-

lic works) resulting in 115 collected politicians' *résumés*: describing each position in governments and companies, with the respective time period and political affiliation. The companies can be public or private, and are often corporate groups. Politicians usually participate in such companies as being part of the board of administrators. Our main contribution to this data is its extension to 2013, so for each politician we investigated if its position in 2010 was still effective for 2013 or if had new relevant positions since the last data entry. Unfortunately, this was not always possible to assert since the investigation was based in not always available public information, such as companies' governing bodies available online, companies' public reports, news from online and public *résumés*.

In addition we used another study (Bianchi and Viana 2012) about political connections in stock companies in Portugal to further extend the dataset with politicians that we deemed relevant given the importance of their government's positions and the intensity of connections with businesses – for example we added the current Prime Minister and current President of the Portuguese Republic. This way the dataset was extended to 130 politicians, and in its current state describes 906 corporate positions in public or private companies that date from as early as 1950 to 2013.

The data was transcribed to the JSON format and aggregated on a politician level and on a company level. In order to aggregate per company, company names had to be homogenized and sometimes merged into relevant corporate groups that are in full control of other companies. This resulted in 354 different companies that were frequented by an average of 2,09 unique politicians, with a median of 1 and a standard deviation of 3,26. Table 1 shows the top 10 companies that had more politicians.

Politicians have an average of 6,97 positions in companies each, with a median of 5 and a standard deviation of 6,27. The average of *unique companies* frequented by a politician is of 5,69 companies, with a median of 4 and a standard deviation of 5,58. It is important to notice that this average of companies is not much lower than the average of positions, giving room to imply that usually every position of a politician is scattered through different companies and is not usually concentrated on the same. For example, consider the table 2 that shows the top 10 politicians by number of positions and their corresponding number of unique companies.

Table 1 Top 10 companies with more politicians

Company or group	Politicians
CGD	26
Champalimaud	23
Banco de Portugal	23
PT	23
BCP	20
Mello	18
EDP	18
Galp	16
BES	13
BPI	11

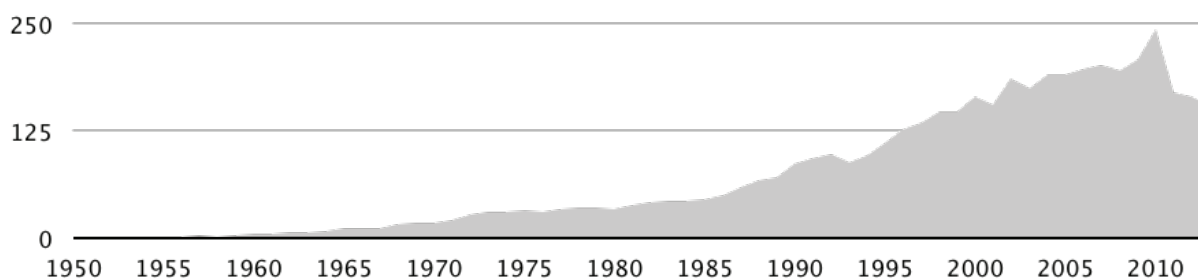
Table 2 Top 10 companies by positions and unique companies

Politician	Positions	Companies
Ângelo Correia	55	51
Luís Todo Bom	25	20
Daniel Proença de Carvalho	21	20
António Couto dos Santos	19	16
Fernando Faria de Oliveira	18	14
Álvaro Barreto	18	15
António Nogueira Leite	16	10
Artur Santos Silva	16	12
Carlos Tavares	15	11
António de Almeida	15	13

By investigating which was the ruling party affected to a politician's governmental position and also by considering party related positions that are also in the dataset, it is possible to determine a party affiliation for a politician. In some punctual cases, a politician had different party affiliations in the past – in these cases the affiliation was determined to be the most recent one. Having this, 58% of politicians are PSD, 34% are PS and 8% are CDS.¹ The remaining 13% could not be determined, either because they are independent or because such information is concealed.

When regarding the distribution in time of the politicians' positions in companies, it can be observed that information is clearly skewed towards more recent years (that is perhaps due to the increase of information availability in recent times), having its peak in 2010 when the study for *Donos de Portugal* was concluded (Figure 1). Nevertheless the amount of contributed information for 2010-2013 in this work is not negligible. Although the gathered data is only a sample of the real dimension of traffic between companies and governments in Portugal, we deem it as highly illustrative of this subject.

Fig. 1 Number of politicians' effective positions in companies per year captures



3. VISUALIZATION

The developed visualization is called *An ecosystem of corporate politicians* (in Portuguese *Um ecossistema político-empresarial*). The visualization is bilingual in Portuguese and English since its main target audience are the Portuguese. Every aspect in the interface is translated except the ones that directly derive from the data (such as positions' descriptions) – translating 906 positions and 354 companies names was not bearable for the return in reaching non-Portuguese. The name *ecosystem* is a metaphor for the visualization model that was built: it represents living organisms (politicians) that dynamically interact with nonliving components (companies) of the

¹ PSD – Social Democratic Party; PS – Socialist Party; CDS – Democratic and Social Center / People's Party (conservatives)

system. By using such strong metaphors, in order to better communicate a message and captivate the audience, we say that we are using a *figurative approach* to visualization. This section describes approaches in building such visualization, such as choosing narrative aspects, behavior, form, interaction and some technological aspects.

3.1. CHOOSING THE NARRATIVE

Determining the shape of the data (figure 1) is important to justify narrative aspects in the visualization. As was noticed before, politicians usually jump between different companies instead of remaining in the same or in a few. That is a fact that we wanted to emphasize with the visualization. That way, we did not opt for a strictly chronological visualization because we consider that the extreme difference between data concentration around the 70s versus the 90s onwards would not add much more to the story than that the data is biased due to recent increase of information availability. The story to convey is then: politicians jumping frenetically from company to company. Inside this story one can extract sub-narratives such as the jumps of each politician and the jumps in between a company and the companies that share the same politicians.

3.2. BEHAVIOR

Companies are depicted as circles with an area proportional to the number of different politicians that had a position at that company. That way, bigger circles represent companies had more politicians and are more interconnected with other companies. Since we wanted to distribute the companies in space in order to have the politicians interacting with them, we could not find a semantic aspect to dictate such positioning. That way we chose to create a behavior where the companies can organize themselves in space: they are circular rigid bodies that collide with each other and are laid out over a circumference with a fixed radius on the canvas. In order to keep this arrangement, they are constantly being attracted to the circumference's edge. This type of collision based interaction between companies adds more dynamism and graphical richness to the visualization, while serving other purposes related with the user's interaction that are described ahead. In addition, the companies also have a rotational speed around the center of the canvas (see figure 2).

A politician is, before any other metaphorical considerations, a particle. Each politician has a sequence of positions in companies that has to attain. In order to do so, it visits the company corresponding to each corporate position. Therefore the movement's simulation of the politician uses a particle that has to travel in between a set of companies. Although such set is chronologically sorted, the travel times are only dependent on the particle's behavior and are not chronologically synchronized with other politicians' movements. When iterating over the sequence of positions, the politician has the following behavior:

- Travels to the respective company following a trajectory described ahead.
- When a company is reached, the politician starts an encircling movement lasting an amount of time proportional to the chronological duration of the corresponding position.
- When the previous time is over, the politician promptly travels to another company or repeats the encircling behavior if the next position refers to the same company.
- When the sequence is completed, it repeats itself.

A politician's trajectory to the next company is influenced by two forces: one that attracts to the next company's position, and a second one that is perpendicular to the previous and points outwards the center of the canvas. This way, the particle can have trajectories that approximate the circumference of the canvas and avoid passing too close to its center, contributing to declutter the space and enabling a better distinction of a certain trajectory among others. Moreover, the traveling speed is inversely proportional to the distance of the target, diminishing as it approximates the targeted company. For example, if a politician has a set of 3 companies to visit, the followed trajectories would be like depicted in figure 3.

3.3. FORM

Beyond the behavioral patterns of the system, which already have metaphorical semantics (e.g. the jumping behavior), elaborating upon the representation of a politician can add much more to this type of metaphorical intent. More than sparingly emulating an organism's behavior, it can just look like one. That way we devised an abstract representation that in our opinion can in-

Fig. 2 The canvas' circumference towards which companies are attracted and the direction of the rotational speed. Companies lay out themselves differently each time the simulation is run.

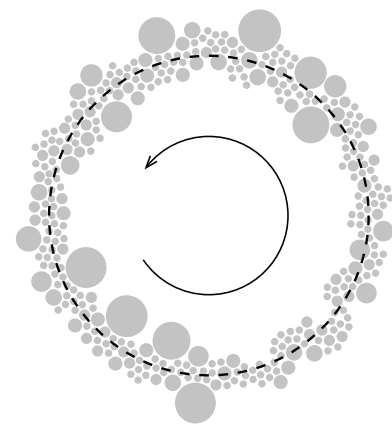
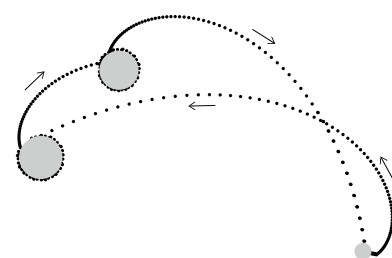
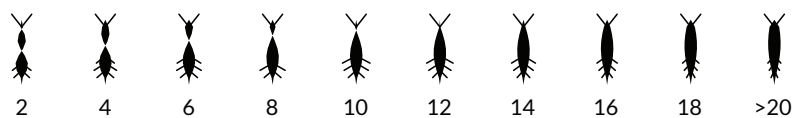


Fig. 3 The trajectory of particle's politician as it travels through a sequence of 3 companies.



voke an organism capable of a frenetic jumping behavior. The *anatomy of a politician* consists of a head, a body or tail, a pair of antennas and 3 pairs of legs or spikes. The silhouette of the head and body is drawn using a sine function that is mirrored on the x axis. The rest of the elements are drawn in relation to this axis (see figure 4). The form of the silhouette is also related with the number of unique companies that the politician has to visit in total. That way, by varying certain parameters of the sine function, we can have a silhouette that makes distinguishable the head from the body if the politician has a small number of companies to visit, or a less curved silhouette if they have a high number of companies to visit (see figure 5).



Each politician's particle leaves a trail that consists of its last 10 points in space. This trail is then used to map the body of a politician using the particle as the head, allowing to curve the politician's body on a certain path. Naturally, when the velocity of the particle is high the spanning of the trail is wider, and vice-versa. This enables to add more variation to the bodies' length, emphasizing the politician when speeding up by drawing a portion of the traveled trajectory and also conveying a more organic expression that relates to our metaphor of jumping organisms (see figure 6). In addition, the politician is also colored based on its latest political party affiliation: pink for socialists (PS), orange for social democrats (PSD), blue for conservatives (CDS) and gray for the remaining. A visual overview can be seen in figure 7 with the colored politicians browsing the space from company to company.

3.4. INTERACTION

Interacting with the system is of paramount importance since it contributes to engage the user and adds an exploratory functionality to the visualization. When hovering a company, it increases to certain size and displays the name of the company. This change in dimension

Fig. 4 The skeleton of a politician (head, body, antennas and legs)

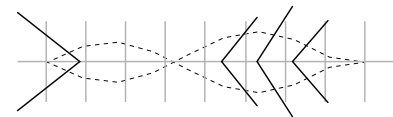


Fig. 5 The shape silhouette of a politician's silhouette accordingly with the number of companies that have to be visited

Fig. 6 Example of 3 different politicians curved on different paths and at different speeds; this approach conveys a more organic expression

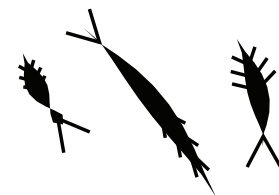
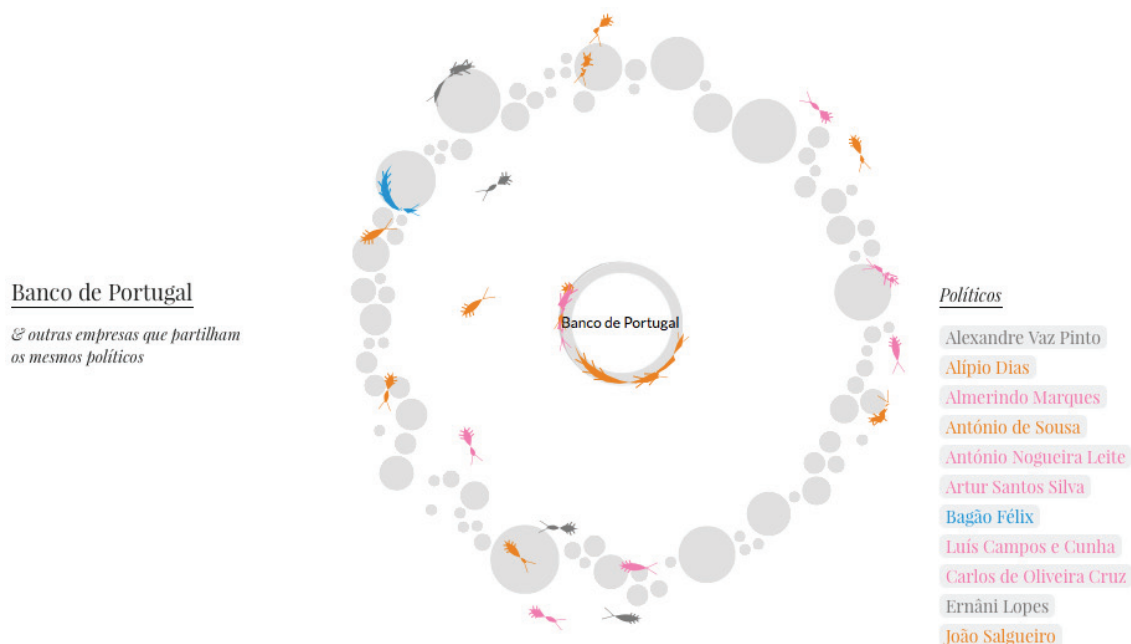


Fig. 7 Visual overview of the system of companies and politicians



forces the surrounding companies to re-organize in order to create spacial room for the hovered company. When a company is clicked it travels to the center of the visualization and all the companies that do not share politicians with the clicked one disappear together with the politicians that frequent none. This creates the sub-narrative of the universe of influence of a certain company and the affected politicians. In addition, it is also displayed a list of the correspondent politicians that is also clickable, and when hovered displays the exact description of the positions of the hovered politician at that company (see figure 8). Once a company is clicked it stays visually marked in order for the user to acknowledge that such company was already explored.

Fig. 8 The universe of influence of Banco de Portugal, displaying the companies that share the same politicians and also those politicians themselves. Explore the visualization at pmcruz.com/eco.



Another sub-narrative is the universe of a certain politician, that displays only one single organism traveling through its set of companies (see figure 9). This mode also displays: a list of every corporate position of the politician that can be used to browse the companies instead of clicking them; a non-interactive list of every position in governments and other political activities. One can either enter this universe by clicking on a list of companies, or by clicking directly over the politician's organism. Such task, though, is challenging since as described the politicians exhibit a frenetic jumping behavior. Neverthe-

less, it is the most ludic type of interaction that we have in this visualization and the following was done to facilitate it: when the mouse is near a certain set of politicians, the closest is selected to be attracted by the mouse and starts encircling the mouse pointer while also displaying that politician name. When the user moves away from that politician, the politician resumes to the next company that has to visit. Furthermore, when the mouse is being moved, every politician in the canvas tend to reduce its speed and in that way the user can better catch and visualize them.

Other more classic forms of interaction were also implemented. The user can browse to the next or the previous sub-narrative that was selected and can also type the name of a company or politician on a search box and jump directly to it.

Fig. 9 The universe of influence of *Pedro Passos Coelho* (current Prime-Minister of Portugal). On the right is displayed a list of his corporate positions that when hovered display a description with a time period. On the left, a list of every government position that he had with the corresponding party. Explore the visualization at pmcruz.com/eco.



3.5. TECHNOLOGY

The main purpose of this visualization is to create awareness by reaching to a large audience. Inspired by the ideas of openness and transparency we decided to use standard technologies, such as Javascript, HTML and CSS. Since this particular type of implementation takes a decent amount of computing power and can have a rather large graphical complexity we had to limit the availability of the visualization for clients that are capable of running it. Therefore, we used ECMA5 compliant Javascript, CSS 3 and the Canvas2d element of HTML5.

Other standard recent technologies such as WebGL could also be used to implement this visualization and enhance the performance, but they are not as available as Canvas2d that for example can easily be run on a mobile device. The visualization works in all recent versions of major browsers with the exception of Microsoft's Internet Explorer which is only compatible from version 10. The library *sketch.js*² was used for the usual routines of drawing and animating on a Canvas2d element, and the *Coffee Physics*³ library from the same author was used to implement the collisions.

When using physics simulation in a browser, performance is paramount due to the number of bodies in our system. That way, we used the *Improved Euler* method, that is a second-order *Runge-Kutta* method for integration since it is not as computationally intensive as the *Verlet* method (although with more accurate results) and not as coarse as the *Euler* method (Süli and Mayers 2003).

Although the visualization was not thought for small screens or touch-based interaction, it can be executed on mobile devices – in order to do so smoothly, and strictly for mobile devices, it hides the companies that were only visited by one politician at the initial point in the narrative (figure 7). Such companies are then made visible if they are related with a company or if a politician is currently selected, or they can also be directly accessed through the search box.

4. FINAL CONSIDERATIONS AND RESULTS

Here we described our *figurative approach* to the visualization of the relations between Portuguese 130 politicians with governments positions and 354 companies. We used the metaphor of an ecosystem with organisms (politicians) that frenetically jump between companies. The visualization went online on 23 December 2013 and can be explored at pmcruz.com/eco. Up to the date of this writing it received 117,245 visits in 112 days with an average of 1,047 visits per day, of which 53% are direct hits and 34% originated from social networks, mainly Facebook. It received positive reviews from the blogosphere and it was featured on the front page with two spreads on a major Portuguese newspaper.⁴ The visualization's website has a comments section that received 112 voluntary comments, of which 95% are positive and supporting.

² <http://soulwire.github.io/sketch.js/>

³ <https://github.com/soulwire/Coffee-Physics/>

⁴ *Os donos de Portugal*. Agora em versão ecossistema interactivo. *Jornal i*, year 5, n.º 1462, 4 January 2014, pp. 16-19

Given the dimension of involvement with the audience, we constantly receive suggestions to include other politicians and companies in our dataset, which are still being added as we conclude our research. In the future we plan to open the visualization's code to the public in order to see other data ecosystems visualized. On January 2014 we received the news that a new book is going to be released (Costa, Lopes, and Louçã 2014) in 2014 which further extends the initial dataset of 115 politicians to 776 politicians. Although our visualization model was not thought for such amount of information, it presents a new challenge in the visualization of this thematic that can naturally extend this research.

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