## Visualizing the Circulatory Problems of Lisbon

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**Figure 1** Snapshots of the two visualization models. (1) and (2) depict the clots in Lisbon at 9:00 am and 7:00 pm respectively. These are the aftermath of the morning/afternoon rush hours, conveying that traffic congestion problems diminish at the end of the day. (3) and (4) exhibit the blood vessels in Lisbon at 7:04 am and 8:44 am, right before and after the morning rush hour. It can be observed that at the beginning of the rush hour, the main vessels of Lisbon carry a high number of vehicles, but without traffic congestions problems, as the vessels are contracted. At 8:44 am the average speed in the main vessels decreases originating an expansion of vessels and of the entire city.

## 1 Introduction

The traffic of Lisbon is portrayed exploring metaphors of living organisms with circulatory problems. Rather than being an aesthetic essay or a set of decorative artifacts, our approach focuses on synthesizing and conveying meaning through data portrayal [Donath et al, 2010]. Our portrayal is embodied by two visualization models with related visual metaphors: the clots in the traffic of Lisbon and the blood vessels in the traffic of Lisbon. The former evolves from a direct mapping of the data, producing clotted areas where the traffic velocity is low. The latter uses an adaptive physics system to build and manipulate the road network – the thickness, the color and the length of the vessels are excited by the number of vehicles and average velocity in each road. With this system we distance ourselves from the strictness of contemporary visualizations that depict data accurately through direct mappings.

## 2 Implementation and results

The clots' visualization displays each vehicle's GPS trace persistently during 30 minutes in simulation time, meaning that a vehicle leaves a trail upon its passage. This is a technique that invests in building visual statistics from the data, rather than working with it directly through data mining. Clots in the traffic of Lisbon convey the city as an organism with circulatory problems. The vessels emerge visually from the black trails of the vehicles, with a mutable thicknesses that represents the traffic intensity of those vessels. Clots are represented by red circles, which are drawn when the speed of a vehicle is low with a diameter inversely proportional to speed (Fig 1).

The vessels' visualization follows a different approach. First, the road network of Lisbon was queried from OpenSreetMap, parsed and filtered. Using this information, a spring based physics system is built for the road network and the structure of each vessel determined (Fig. 2). The data is overlaid on the resultant structure to determine the road where each vehicle is at a given moment. This allows us to inject data at runtime and excite the system as follows: a bigger number of vehicles on a vessel tends to make it

Copyright is held by the author / owner(s). SIGGRAPH 2011, Vancouver, British Columbia, Canada, August 7 – 11, 2011. ISBN 978-1-4503-0921-9/11/0008 thicker, high speeds tend to contract its length (and vice-versa). The latter behavior was chosen in order to transmit a global impression of the perceived distances within the city. This behavior shrinks the city when the traffic velocities are high, and distends it in the rush hours when the city faces congestion problems. In what concerns coloring, low speeds imply the darkening of a vessel, expressing slow circulation and stagnant blood.



Figure 2 Detail of the springs' configuration used to build the structure of each vessel.

Analyzing the results (Fig. 1), the clots' visualization results in elegant artifacts, well accommodated with *de facto* aesthetics for traffic visualization. The clots tend to emphasize the spots where vehicles slow down and stop, being difficult to distinguish which of the vessels is more problematic in traffic intensity and speed. In contrast, the vessels' visualization, with crude aesthetics that are innate to our visual metaphor, pulsates for each rush hour and stresses which roads are congested.



Figure 3 Closeup of the blood vessels' visualization depicting the emphasis on problematic highways, namely *OCRIL*, *OSegunda Circular*, *Eixo* Norte-Sul and *OCREL*.

## References

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