The Rhythm of Consumption

Catarina Maçãs and Penousal Machado

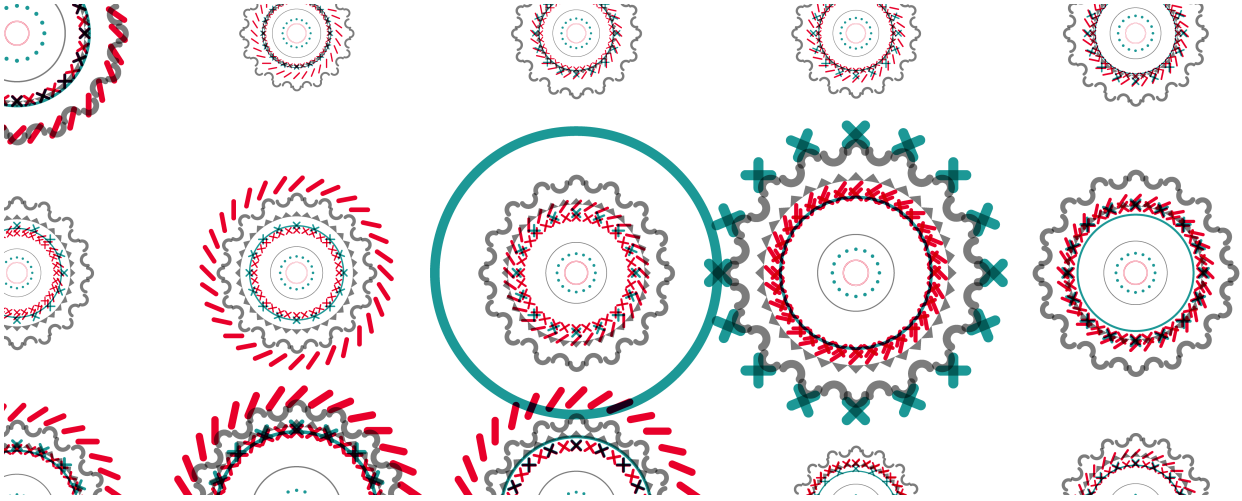

Fig. 1. Close-up of the small-multiples visualization

Abstract—The creation of appropriate new visual metaphors and the development of visualization models able to continuously readjust to the changes of dynamic data are fundamental challenges for Data Visualization. In this project, we create a visualization to represent the consumption characteristics in 729 Portuguese hypermarkets from the SONAE's chains over the course of two years. We explore how the visualization can change and morph depending on the data, while emphasising its transformative aspects, creating movement, so one can understand the differences and evolution of the general shape. We also aim to represent how costumers change their shopping habits over time. We focus on highlighting the rhythm of consumptions, and times of the year when there are disruptions in the normal consumption patterns.

Index Terms—Aesthetics in Visualization, Time-varying Data, Visualization for the Masses, Multimedia Visualization

1 INTRODUCTION

With the advance of technology, more information is being generated and stored. This burst of information has enabled the access to unprecedented amounts of data in new domains and increased the need to represent all the data. Furthermore, the creation of programming languages directed to the visual design communities, and the democratisations of data, expanded the conceptual boundary of Data Visualization to a more aesthetic practice. Creating new appropriate visual metaphors, new ways to manipulate big data sets of information, and developing visualization models able to continuously readjust to the changes of dynamic data are fundamental challenges for Data Visualization.

The data consists of the consumptions in 729 Portuguese supermarkets and hypermarkets of the SONAE's chains, which cover the entire country. When shopping in these chains, the costumers tend to use their client cards to accumulate discounts and other benefits. Currently, the number of active cards is above 6 million, which can be considered as an impressive number, specially if we take into consideration that the Portuguese population is below 11 million, and that the cards are issued by "household", and shared by the entire family. We choose this data set due to its richness, size, quality and nature. We believe that the data set is a valuable asset of the work, offering us the opportunity to transform the Portuguese consumption patterns into aesthetic artefacts.

In a previous project [1] we explored the use of swarm intelligence to visualise the consumption habits over time. To visualise the consumption habits over time, we implemented a Swarm System, which simulates the behaviour of multiple boids. Each boid was characterised by properties such as velocity, position, size, and colour. This last property identifies the type of the boid, corresponding to one of the seven departments of the products' hierarchy.

In this project, we explore how the visualization can change and morph between states; how the changes in the data change the visualization and its rhythm. We present a system that reacts to information changes and visually represents those changes, through two layers of visual variables: colour and size. We emphasise the transformative aspects of the data, and create movement, so one can understand the differences and evolution of the general shape.

We create a visualization of the consumption characteristics, and represent how the costumers change their shopping habits over time. We focus on highlighting the rhythm/pulse of consumptions and times of the year when there are disruptions in the normal consumption patterns.

We analyse all the transactions made in a Portuguese supermarket and hypermarket chain (SONAE) from May 2012 to April 2014. Each transaction corresponds to one product bought and it has properties such as price, date, and time of its purchase. The products of SONAE's hierarchy are characterised in three types of consumption — essential, non-essential, unknown — and are aggregated by day, so we can see the variation among different days. With this characterisation we intend to overview the consumption behaviour of the SONAE costumers, what type of shopping they tend to do, and if their priorities change over time.

We represent the type of consumption through colour, using red,

• *Catarina Maçãs and Penousal Machado are with the CISUC, Dep. Informatics Engineering, University of Coimbra, Coimbra 3030-290, Portugal (e-mail: cmacas@dei.uc.pt, machado@dei.uc.pt)*

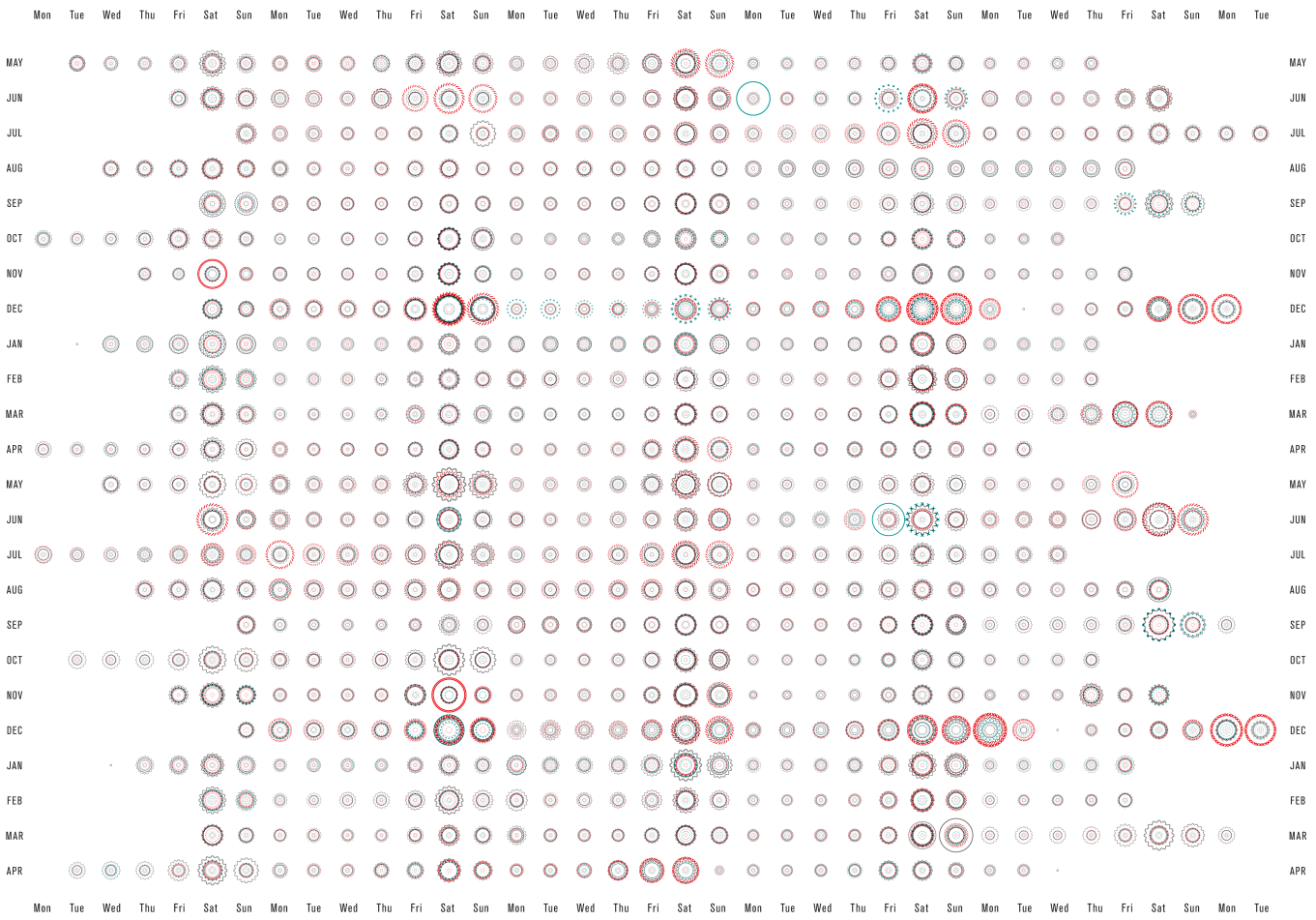

Fig. 3. Representations of the 24 months, from April 2012 (first row) to May 2014 (last row). All days are aligned by the week day and the values are normalised by the maximum value of the corresponding category.

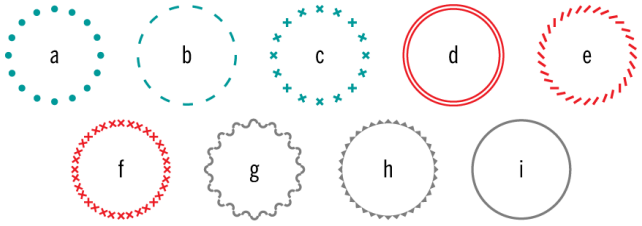

Fig. 2. Representation of each category (shape) and their types (colour): (a) Clothes, essential; (b) Health Care, essential; (c) Grocery, essential; (d) Culture & Leisure, non-essential; (e) Beauty, non-essential; (f) Alcohol & Sweets, non-essential; (g) Pets & Nature Care, unknown; (h) House Care, unknown; (i) Furniture, unknown.

green and grey for the non-essential, essential and unknown products, respectively. Then, to differentiate all the categories, and since this representation should have less emphasis on the visualization, but at the same time, be distinguishable, we define 9 different shapes, one for each category as depicted in Fig. 2.

For the representation of the data set, and in addiction to a classical small multiples representation (Fig. 1 and Fig. 3), we have generated a video (`http://cdv.dei.uc.pt/the-rythm-of-consumption/`). The representations have different objectives: while the first is mainly analytical, the second focuses on captivating and entertaining the users, highlighting differences among days and behavioural changes. In the static representation, we can see how the consumptions are affected by the special events and vacations, and easily compare different days that are distant from each other. In the video visualization, we can, above all else, perceive the rhythmic patterns of consumptions, marked by the weekends, and the disruptive effects caused special events.

In Fig. 3, we can see the representation of the 24 months of our data set. In this visualisation, we align all days of every month by week day. We can perceive that the type of consumption that has the highest consumptions is the non-essential, specially in the month of December of 2012 and 2013 (8^{th} and 20^{th} lines). We also can see that the highest consumption in the Grocery category occurs in June 2013 (14^{th} line).

This work was presented at Expressive 2016 and received with enthusiasm by the participants, who praised the intriguing and alluring nature of the temporal aspects of the artifacts, particularly the rhythms and disruptions of rhythmic patterns. They have also reacted with surprise when they discovered that the artifacts where based on real data and that, despite the aesthetics concerns, they where actually intelligible, once the encoding was revealed.

References

[1] C. Maçãs, P. Cruz, P. Martins, and P. Machado. Swarm systems in the visualization of consumption patterns. In Q. Yang and M. Wooldridge, eds., *Proceedings of the Twenty-Fourth International Joint Conference on Artificial Intelligence, IJCAI 2015, Buenos Aires, Argentina, July 25-31, 2015*, pp. 2466–2472. AAAI Press, 2015.