The Making of *Sixty-Nine Days of Close Encounters at the Science Gallery*

Wouter Van den Broeck[1], Marco Quaggiotto[1,3], Lorenzo Isella[1], Alain Barrat[2,1], Ciro Cattuto[1]

[1] ISI Foundation, Turin, Italy; [2] Centre de Physique Théorique, Marseille, France; [3] INDACO, Politecnico di Milano, Italy.

E-mail: <wouter.vandenbroeck@isi.it>.

See <www.mitpressjournals.org/toc/leon/45/3> for supplemental files associated with this issue.

Submitted: 10 October 2011

Abstract

The SocioPatterns sensing platform uses wearable electronic badges to sense close-range proximity among individuals. It was used in an experiential exhibit that simulated a virtual epidemic among the visitors of the INFECTIOUS: STAY AWAY exhibition in the Science Gallery in Dublin, Ireland. The collected data was used to generate a high-resolution visualization that illustrates the variation in contact activity over the course of the exhibition.

In Spring 2009, the Science Gallery in Dublin, Ireland, held the art-science exhibition *INFECTIOUS: STAY AWAY*. This event explored mechanisms of contagion and strategies of containment. Visitors were invited to participate in *INFECTIOUS SOCIO-PATTERNS*, an experiential exhibit that simulated an epidemic of a virtual infectious agent. This exhibit was built on top of the SocioPatterns sensing platform, which uses wearable electronic badges with wireless communication technology to sense close-range face-to-face proximity between individuals [1]. Over 30,000 visitors took part in the 3-month experiment.

The proximity and infection data were collected and processed in real time. They were used to drive live visualizations of the contact network and the spread of the virtual infection among the visitors, as well as to trigger various multi-media features in the environment.

After the exhibition the collected data were processed and analyzed in research on social contact patterns in high-flow settings [2]. Selected aspects of the result of this work were used to create *SIXTY-NINE DAYS OF CLOSE ENCOUNTERS AT THE SCIENCE GALLERY* [3], a high-resolution print meant to illustrate the variation of the contact activity over the course of the exhibition. The visualization is structured in a 6 x 12 grid of daily diagrams. The columns span Tuesdays to Sundays (on Mondays the venue was closed) while the rows span twelve consecutive weeks, a subset of which is shown in Fig. 1.

For each day, a cumulative contact graph is shown in which the nodes represent visitors, while the edges connect individuals who spent time in face-to-face close-range proximity. Nodes are color-coded according to their time of arrival at the venue, and the *diameter* of the contact graph (the maximal shortest path between node pairs) is highlighted.

The contact graph is wrapped by a circular bar chart that displays the recorded number of proximity events over two-minute intervals. The angular position of the bars is that of the hour hand of a 12-hour clock at the corresponding time of the day. The shades of grey of the bars match those used for the arrival time of nodes in the graph: as such, the bar chart also serves as the legend for the grey-scale coding of time.

The proximity sensing platform was developed in the context of the Socio-Patterns research project, in order to allow the collection of empirical data on dynamical networks of human contacts, at the finest scale in space and time and across a number of real-world scenarios.

Access to these novel datasets is relevant for scientific investigation on human mobility, social network analysis, epidemiology, ubiquitous social networking and in general for all those domains where a dynamical process unfolds over the network of human contact. The SocioPatterns platform was deployed in numerous settings that spanned conferences [1, 4], exhibitions [2], offices [1], schools [5], and hospitals [6], allowing us to conduct comparative studies of the contact patterns across widely different contexts. More details on the platform and the research it serves can be found in the listed references and on the Socio-Patterns.org website.

References and Notes

* This paper was presented as a contributed talk at Arts, Humanities, and Complex Networks – 2nd Leonardo satellite symposium at NetSci2011. See <http://artshumanities.netsci2011.net>.

* This project was realized by the SocioPatterns team <www.sociopatterns.org>, with support from the ISI Foundation in Turin, Italy <www.isi.it> and the Science Gallery in Dublin, Ireland <www.sciencegallery.com>.

1. C. Cattuto et al., "Dynamics of Person-to-Person Interactions from Distributed RFID Sensor Networks," *PLoS ONE* **5**(7): e11596 (July 2010).

2. L. Isella et al., "What's in a crowd? Analysis of face-to-face behavioral networks," *Journal of Theoretical Biology* **271** (Februari 2011) pp. 166-180.

3. Sixty-Nine Days of Close Encounters at the Science Gallery (2011), <http://www.sociopatterns.org/gallery/infectious-sociopatterns-poster/>, accessed 1 September 2011.

4. J. Stehlé et al., "Simulation of an SEIR infectious disease model on the dynamic contact network of conference attendees," *BMC Medicine* **9**(87) (July 2011).

5. J. Stehlé et al., "High-Resolution Measurements of Face-to-Face Contact Patterns in a Primary School," *PLoS ONE* **6**(8): e23176 (August 2011).

6. L. Isella et al., "Close Encounters in a Pediatric Ward: Measuring Face-to-Face Proximity and Mixing Patterns with Wearable Sensors," *PLoS ONE* **6**(2): e17144 (March 2011).
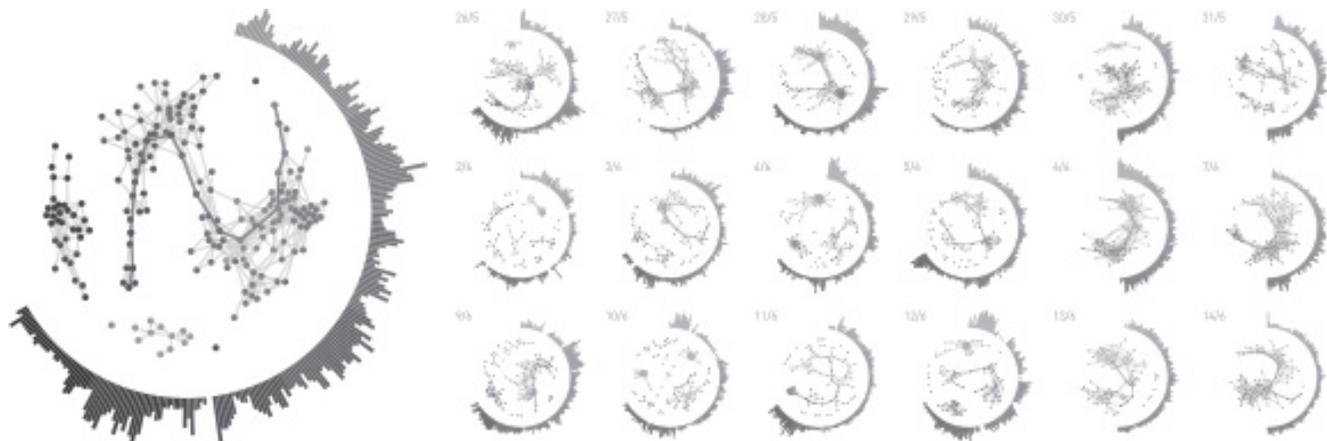
Fig. 1. *Left:* A daily chart, comprising a contact graph – showing the face-to-face interactions between visitors – and a surrounding activity bar chart. *Right:* Three weeks of daily charts, each row spanning one week of activity at the Science Gallery from Tuesday to Sunday. (© 2011, SocioPatterns.org)