
Spark: Visualizing Physical Activity Using Abstract, Ambient Art

Chloe Fan

Human-Computer Interaction Institute
Carnegie Mellon University
5000 Forbes Ave,
Pittsburgh, PA 15213
chloef@cs.cmu.edu

Jodi Forlizzi

Human-Computer Interaction Institute
Carnegie Mellon University
5000 Forbes Ave,
Pittsburgh, PA 15213
forlizzi@cs.cmu.edu

Anind Dey

Human-Computer Interaction Institute
Carnegie Mellon University
5000 Forbes Ave,
Pittsburgh, PA 15213
anind@cs.cmu.edu

Abstract

Many consumer personal informatics tools use charts to visualize complex data, help people better understand their behavior, and ultimately guide them to change their behavior. Informative art [5] as a form of visual representation has not been extensively explored in displaying personal information, but it has the potential to provide ambient, public, non-intrusive, playful, and interactive feedback that could be more engaging than reflecting on static charts. In this workshop paper, we describe Spark, an application that visualizes physical activity data as information art, and propose a study evaluating the effectiveness of such visualizations in the realm of personal informatics.

Author Keywords

Personal informatics; physical activity; data visualization; abstract art; ambient art

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms

Design



Figure 1. "Composition VIII," 1923, by Wassily Kandinsky.

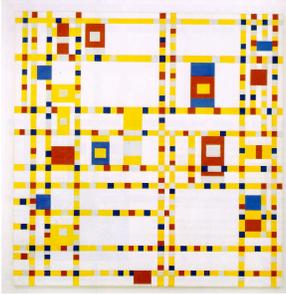


Figure 2. "Broadway Boogie Woogie," 1942-43, by Piet Mondrian.



Figure 3. Example of TODAY, a generative design that visualizes personal mobile communication.

Introduction

There is a huge increase in the number of personal informatics tools over the last few years that help us track various aspects of our daily lives. The majority of consumer tools on the market use visualizations, often in the form of charts (i.e., column graphs, line graphs, scatterplots), to help users grasp the dense, often complex, numerical data that they are collecting, and find meaning in their behavioral patterns. In this paper, we focus specifically on exploring new visualizations for physical activity, one of the many research areas related to personal informatics and behavior change.

In addition to charts, research tools have also used nature metaphors to represent physical activity, such as a garden [1] or a fish tank [4] that thrives on physically active users. While living metaphors are promising in motivating behavior change, we want to explore physical activity as a work of art that people generate and display in their homes. This idea is inspired by information art [5], which has mostly been used to visualize environmental (rather than personal) information. Reflecting on abstract artwork by Wassily Kandinsky (Fig. 1) and Piet Mondrian (Fig. 2), and generative artwork such as TODAY (Fig. 3), we created Spark [7], a system that uses abstract art in a dynamic ambient display for physical activity.

System Description

Spark is a web application hosted on Google App Engine. The backend is coded in Python, and the frontend coded in HTML, CSS, and JavaScript. It can be viewed on a computer, or more ideally, displayed on a surface in the home (e.g., a tablet computer mounted on the wall, or projected directly onto a wall). The data visualizations are created with Raphaël, a JavaScript

vector graphics library, and HTML5 Canvas. Spark uses OAuth and the Fitbit API to continuously pull step count data from the Fitbit tracker [2] and display them using one of three current abstract visualizations (more are planned).

Each of the visualizations is an animation that uses circles to represent physical activity performed over a five-minute period. We use factors of physical activity as design features of the visualization: 1) step count → size; 2) time → location; 3) elevation → color (Currently in progress. Step count is used in the meantime as a way to indicate intensity). The following screenshots show different visualizations for the same day.

Spiral

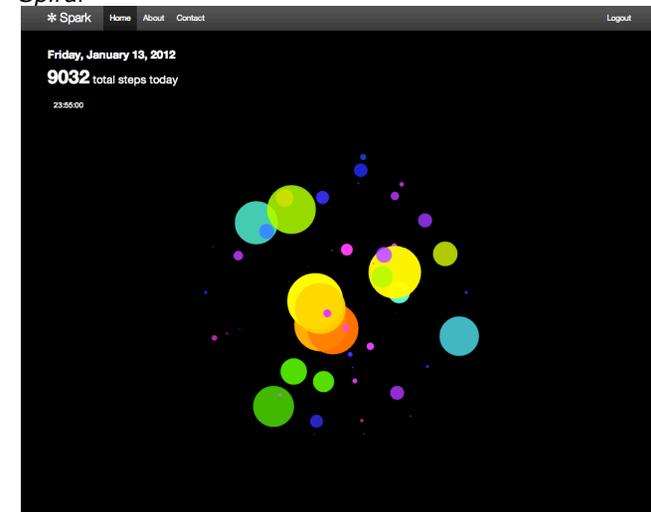


Figure 4. Spiral visualization.

Every five minutes, a circle appears in the middle of *Spiral* (Fig. 4) that represents the steps taken during that five-minute period. It pushes previous circles outward in a spiral, so steps taken earlier that day appear at the edge. If no steps are taken in that five-minute period, no circles appear.

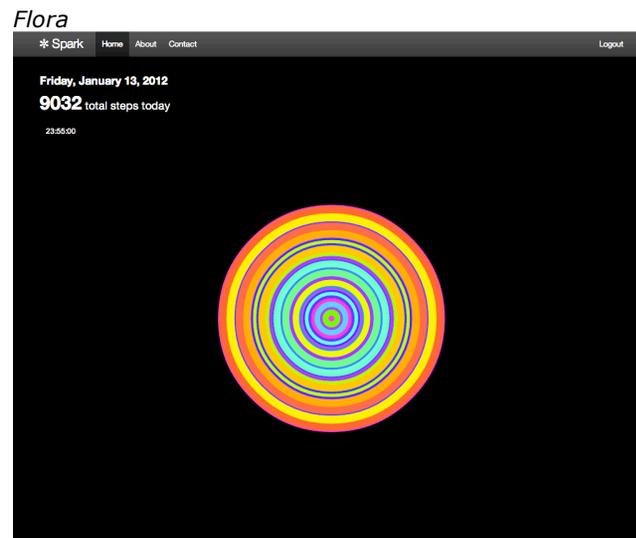


Figure 5. Flora visualization.

In *Flora* (Fig. 5), rings of color are added around a circle for every five-minute period with step counts. The result is a series of concentric circles showing periods of activity throughout the day, with the final size indicating the total step count for the day.

Bucket

In *Bucket* (Fig. 6), colorful circles fall from the top and fill up the screen to represent steps taken every five-

minutes. We found that the use of concentric circles made the visualization more aesthetically pleasing; however, the concentric circles do not yet represent anything meaningful.

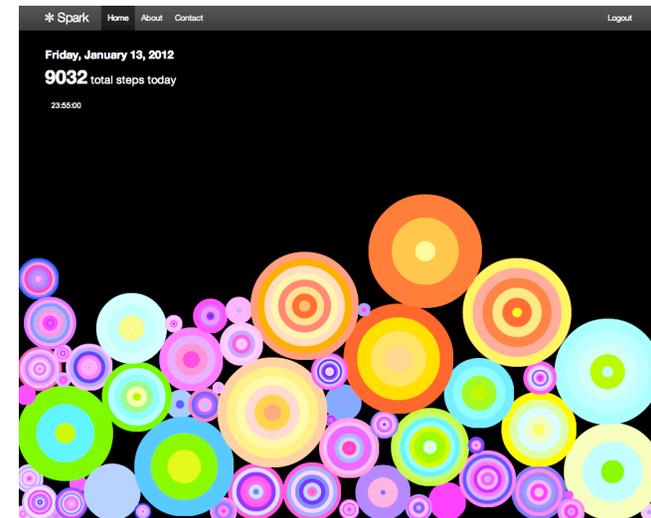


Figure 6. Bucket visualization.

Proposed Study

We are currently undergoing evaluations of the visualizations in Spark, from which we hope to answer the following research questions: 1) How compelling is abstract art as visualization for physical activity? 2) Can information art motivate people to become more physically active?

To answer the first question, we are conducting surveys to evaluate the aesthetics, understandability, and usefulness of each visualization. To answer the second question, we are planning one-month deployments in

Fitbit users' homes on Android tablets displayed in a common area such as the living room. We will compare physical activity before and after the deployment, as well as conduct qualitative interviews to understand their daily interactions and interactions with Spark over time.

Future Work

There are many planned features and design iterations for Spark, including:

- Weekly and monthly view showing the final visualization for each day
- Aggregate daily/weekly/monthly statistics
- Adding charts to compare with the abstract visualizations in another study
- Inclusion of other physical activity properties, such as speed, location, indoor/outdoor activity, and type of activity (*i.e.*, biking vs. swimming). Currently, the Fitbit tracker does not distinguish between activities, so this feature will need data streams from other sensors.

Conclusion

In this workshop paper, we presented Spark, an informative art piece with a collection of abstract, ambient visualizations as an alternative for displaying and reflecting on physical activity data. Although still in its early stages, our prototype is ready to undergo initial evaluations on the effectiveness of information art as visualization for personal informatics tools.

During the workshop, we hope to contribute to the discussion of various types of visualizations for personal informatics tools, describe our study findings, and also

gain valuable feedback to improve the visualizations and future studies.

Acknowledgements

We thank all the reviewers of this paper and project who contributed helpful feedback for improvement. We gratefully acknowledge funding from the Quality of Life Technology Center. This material is based upon work supported by ONR and the National Science Foundation under Cooperative Agreement EEC-0540865.

References

- [1] Consolvo, S., Klasnja, P., McDonald, D.W., *et al.* Flowers or a robot army?: encouraging awareness & activity with personal, mobile displays. *Proc. UbiComp 2008*, 54-63.
- [2] Fitbit Tracker. <http://www.fitbit.com>.
- [3] Jafarinaimi, N., Forlizzi, J., Hurst, A., and Zimmerman, J. Breakaway: an ambient display designed to change human behavior. *In CHI 2005 extended abstracts*.
- [4] Lin, J., Mamykina, L., Lindtner, S., *et al.* Fish'n'Steps: Encouraging physical activity with an interactive computer game. *Proc. UbiComp 2006*, 261-278.
- [5] Redström, J., Skog, T., & Hallnäs, L. (2000). Informative art: using amplified artworks as information displays. *Proc. of DARE 2000 on Designing augmented reality environments* (103-114).
- [6] Rogers, Y., Hazlewood, W., Dalton, N., and P. Ambient Influence: Can Twinkly Lights Lure and Abstract Representations Trigger Behavioral Change. *Proc. Ubicomp 2010*, 261-270.
- [7] Spark. <http://www.sparkvis.com>