Informative Art for Energy Use Feedback

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Figure 1 Solar-vis1. A Graphic Abstraction of Solar Panels as Calendar Entries.

Figure 2 Solarvis2. A Non-photorealistic Rendering of an Apple Tree.

Figure 3 Excel Charts. Example of Pragmatic Visualization.

INTRODUCTION

Providing effective feedback on power and energy use is the first step to inform and encourage people to make efforts towards energy conservation. Our research explores the effectiveness of using non-traditional visualizations of power and energy use based on an informative art approach. We believe that their more attractive and rich displays will increase aesthetic interest and engage people in public environments. In our preliminary study, we compared the utility and appeal of two informative art visualizations (Figures 1 and 2) to a traditional pragmatic visualization (Figure 3).

USER STUDY

Our principal interest in this study was to examine the effectiveness of the two informative arts (Solar-Vis1 & 2) as feedback for energy use as compared to pragmatic visualizations (Excel Charts) in terms of three main factors – comprehension, appeal and relationship to locations.

Participants and Procedures

Fifteen participants were tested individually in a study session of about 60 minutes with three related activities.

1. A brief pre-session interview was conducted to determine if and how the participants understood power and energy use.

2. Six visualization screenshots were shown to the participants with which they were asked to answer 16 questions (11 content understanding questions and 5 power/energy comprehension questions).

3. The participants were asked to fill a questionnaire around user preferences for the three visualizations, both for their appeal and for where they would be preferred for public display: library, community centre, workplace, and schools.

Hypotheses

- H1: SolarVis1 & 2 have accuracy no less than Excel chart and take less completion time for basic content understanding questions.

- H2: SolarVis1 & 2 have accuracy no less than Excel chart and take less completion time for power/energy comprehension questions.

- H3: SolarVis1 & 2 are more appealing and more preferred in different locations than Excel chart.

Results

Results were analyzed using two-way analysis of variance, with two between group factors.

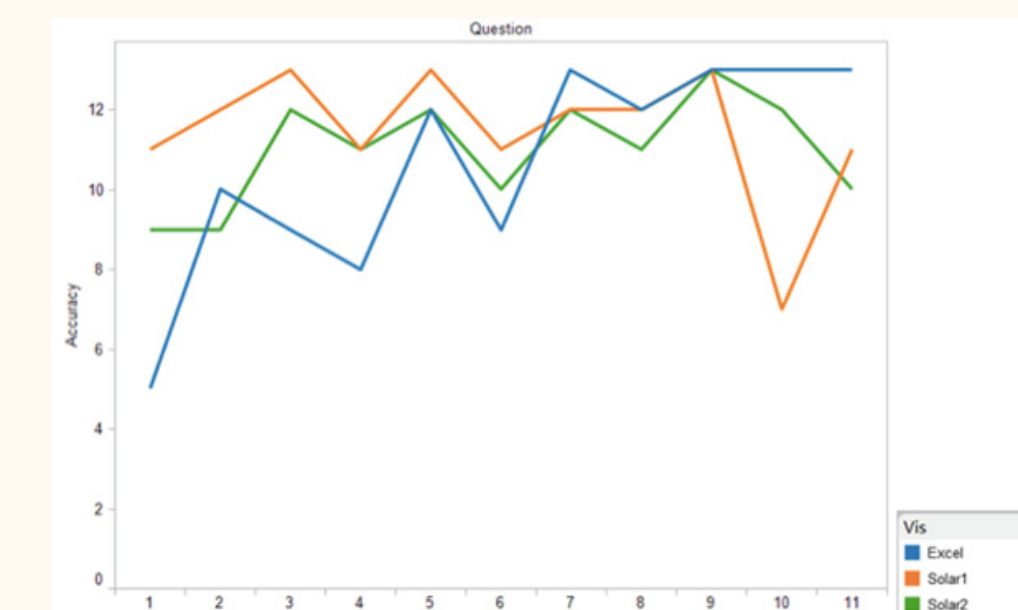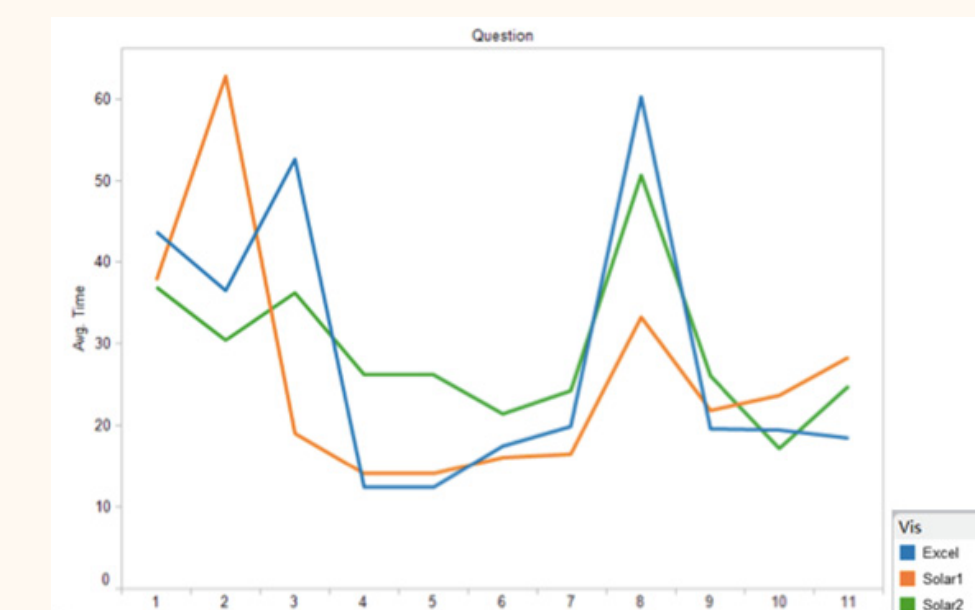- Accuracy and Completion Time for Basic Content Understanding Questions

Figure 4

Figure 5

SolarVis1 & 2 had close or higher accuracy than Excel charts in most content understanding questions. Completion time varied according to the question and was similar across all three visualizations.

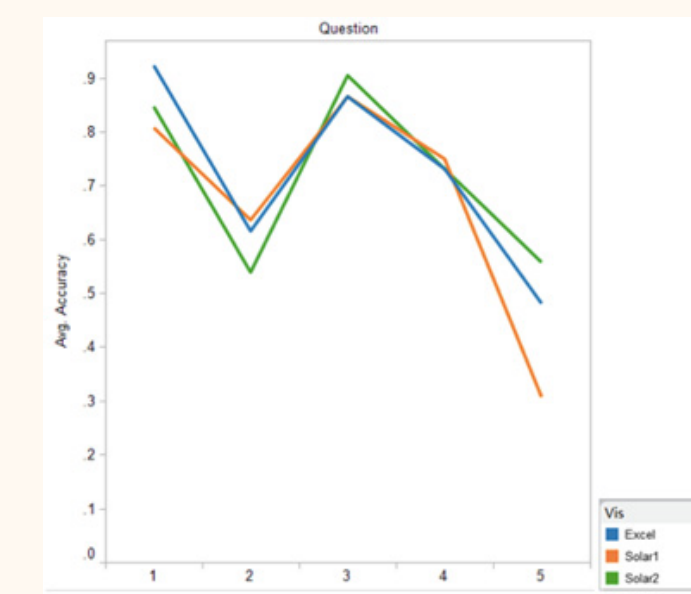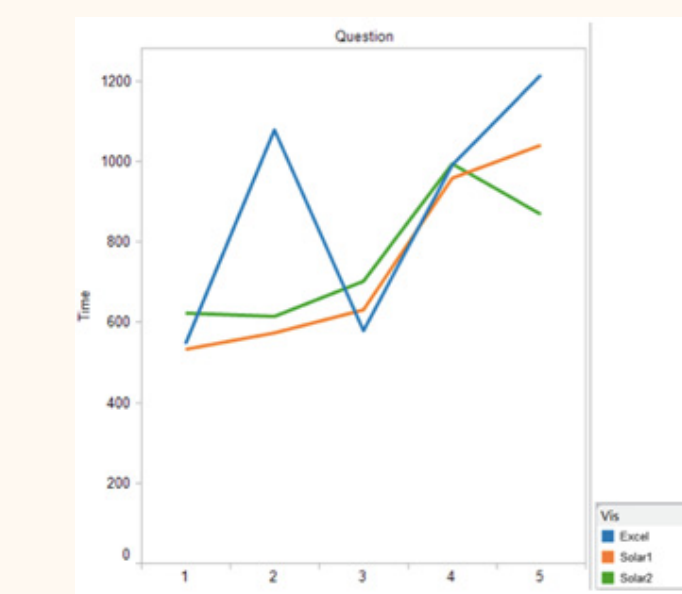- Accuracy and Completion Time for Power/Energy Comprehension Questions

Figure 6

Figure 7

All three visualizations had similar accuracy for the five power/energy comprehension questions. As expected, SolarVis1 & 2 took much less completion time than Excel except for question 2 and 5.

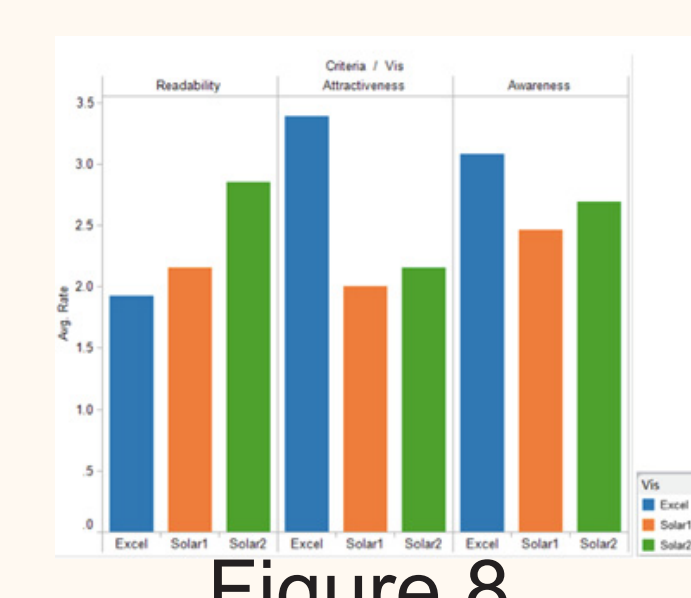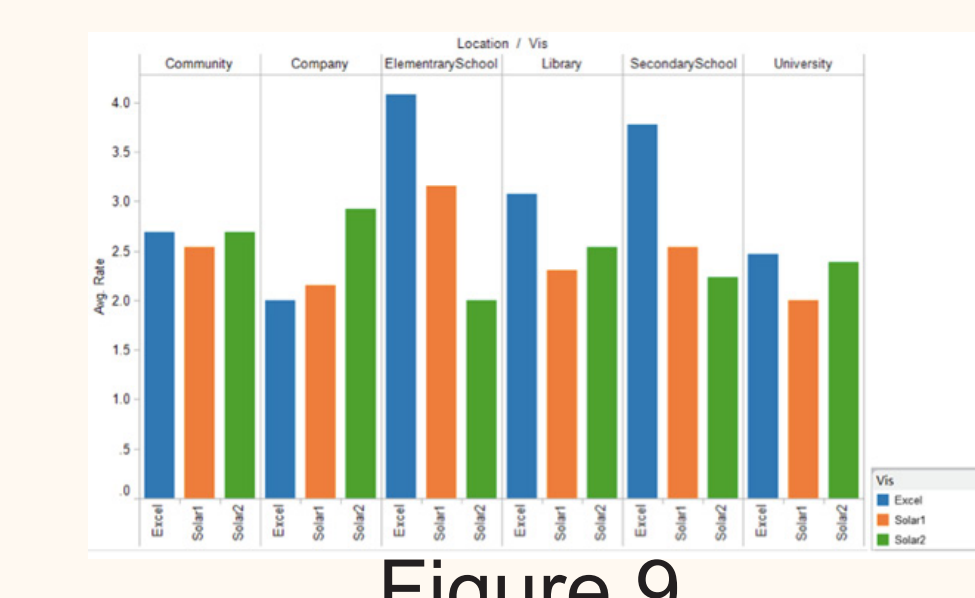- User Preferences on Appeal and Locations

Figure 8

Figure 9

The ratings for readability and at-a-glance awareness were very close across all three visualizations. However, SolarVis 1 & 2 were rated as more attractive than Excel charts. Also people would more like to see them than Excel chart in most public locations except for workplace.

CONCLUSIONS

The two informative art displays were as effective as pragmatic visualization tools in conveying energy usage information to the audience. They were generally considered more attractive and engaging than the pragmatic display. We believe these show the promise of this approach in engaging people in energy awareness.

FUTURE WORK

Our preliminary results showed the approach had good potential. However, as we discovered in the user study, there were some design flaws such as color and iconology that affected how people perceived and understood the information that was embedded in the aesthetic displays. Our next avenue is to work with professional designers to improve the perception and aesthetics of the informative art visualizations (Figure 10). Also we plan to integrate them with ambient displays and extend the study to more ecologically valid simulations.
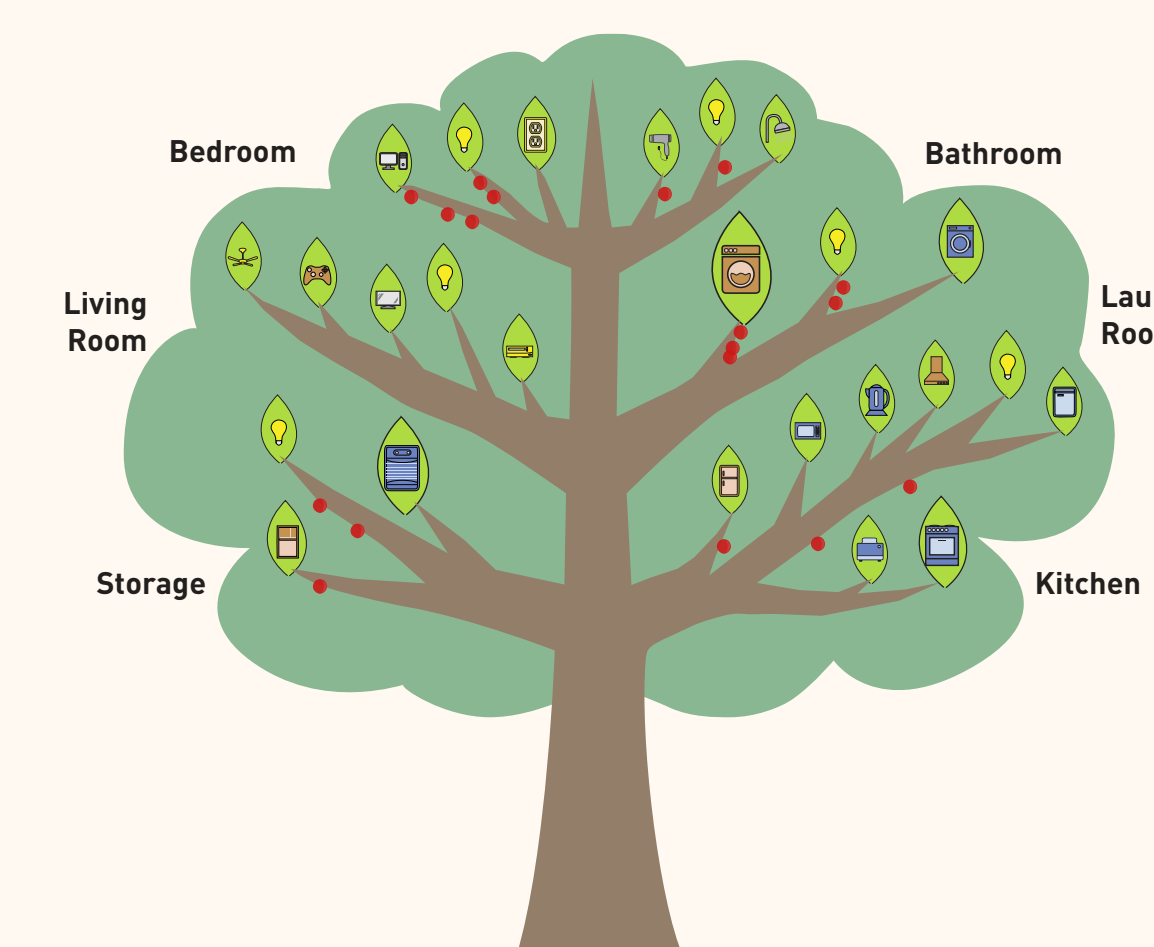

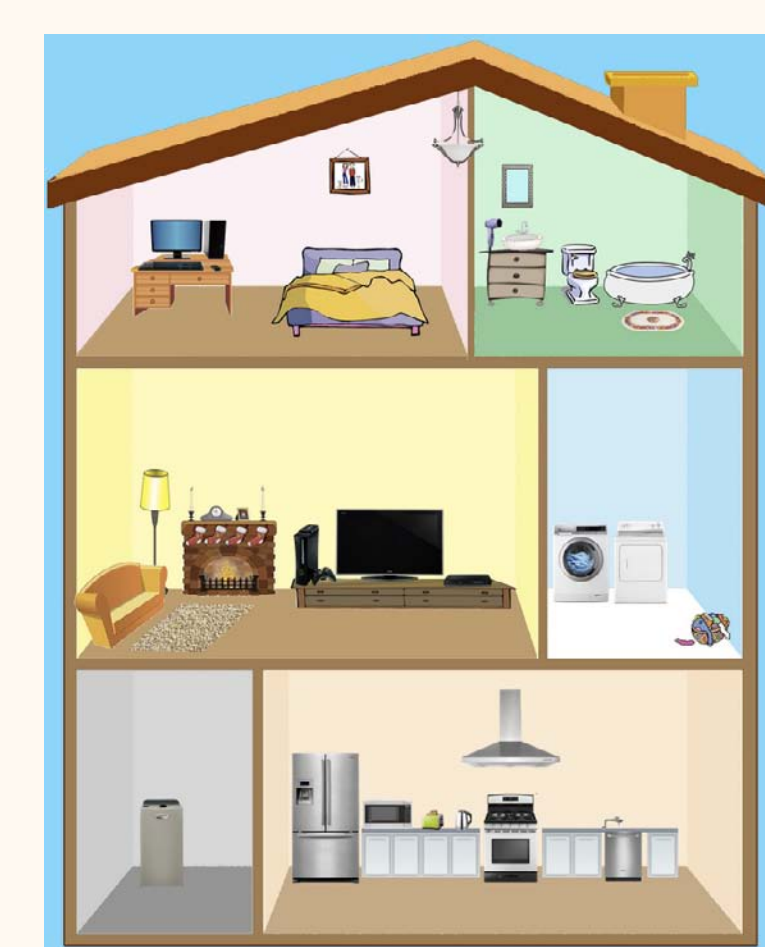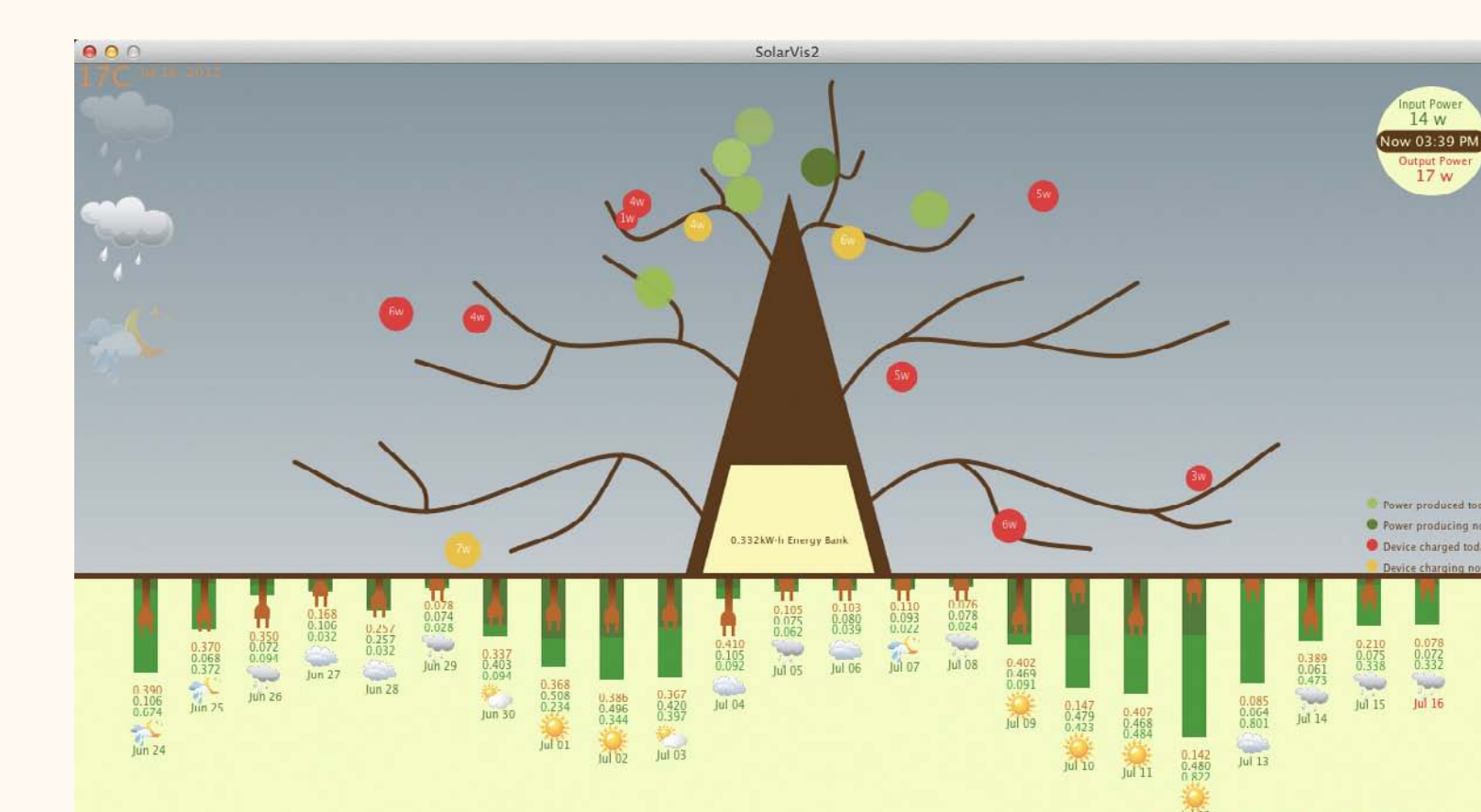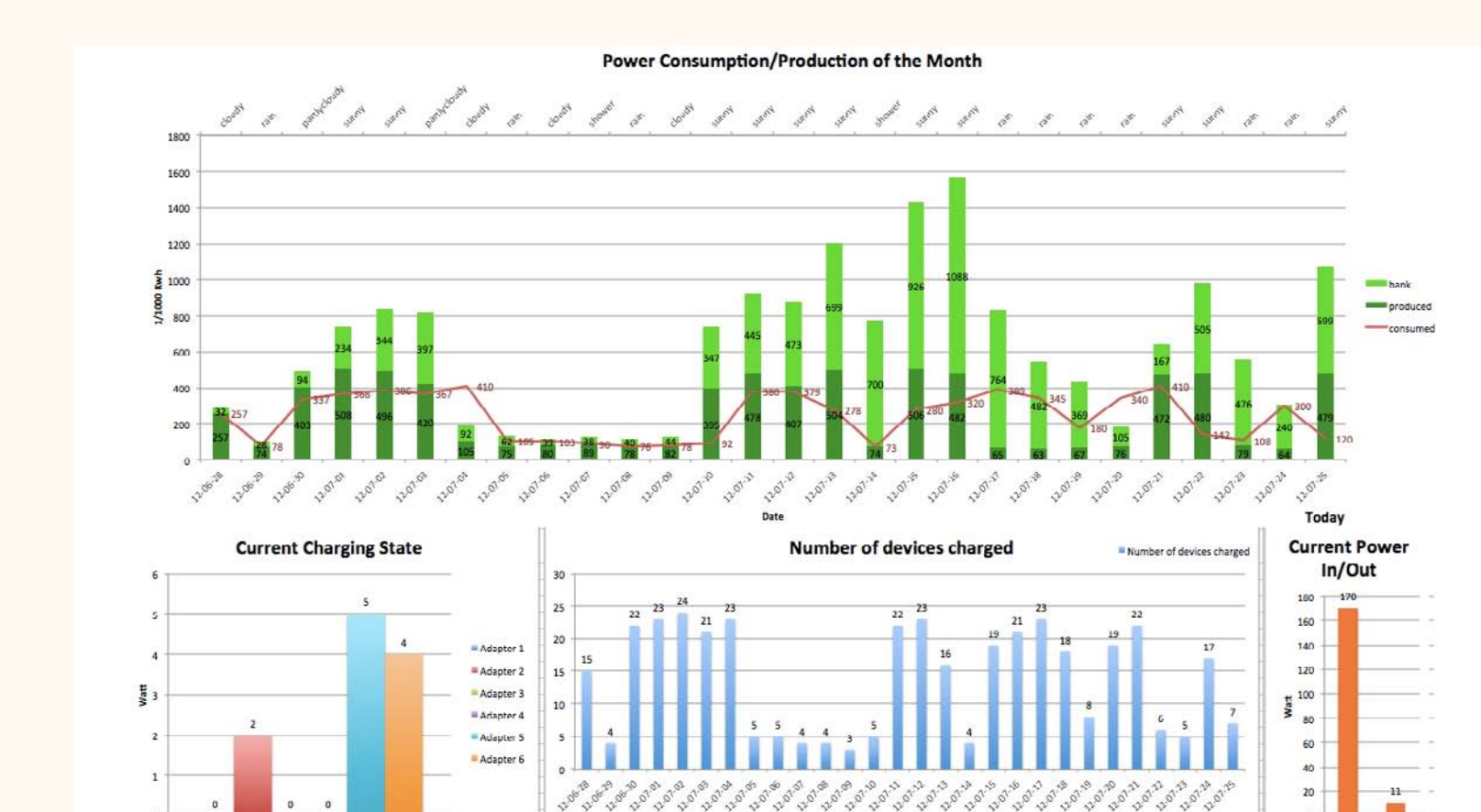Figure 10 Future design sketch of the visualization.

Figure 11 Dollhouse simulation interface for future user study.

Acknowledgements

SCHOOL OF INTERACTIVE ARTS + TECHNOLOGY