Life Hacking on Time Management: Daily Life Visualization

Information Visualization (Fall 2020) - Final Project Report
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Abstract

"Did I organize my time properly?" Almost everybody has wondered upon such questions, and we always want to be better time managers. Considering the fact that most people merely have a vague sense of their time allocation and working efficiency, this project proposes a visualization system for daily events, which provides an intuitive and quantitative view to observe how we spent our time. By visualizing our time allocation in the past, we can easily adjust our time planning for the future. This will help us iterate and optimize the work-relax balance, and may finally increase our working efficiency.

1. Dataset & Preprocessing

This project creates a template to record daily events and collects my real-life data in preparation for the visualization task. The finalized self-collected dataset contains 1853 activity items from 84 days. Each activity item contains seven attributes ('Date', 'Start Time', 'Duration', 'Efficiency', 'Category', 'Tag', 'Remarks') that describes detailed time and type information about the activity. Attributes 'Date' and 'Start Time' contain the time data that range from September 14th to December 6th, where the former is mainly regarded as a categorical attribute for data binning, whereas the latter is used as an ordinal attribute to index the activity records. 'Duration' is a quantitative attribute that records the duration of each activity. 'Efficiency', 'Category', 'Tag', 'Remarks' are all categorical attributes that specify the activity type and other detailed information of the activities. Furthermore, I derived more data based on the raw data (e.g. accumulating the activity records that are of the same category).

Date	Start Time	Duration	Efficiency	Category	Tag	Remarks
2020-11-01	0:00	20		Rest	Rest	
	0:20	380		Sleep	Sleep	
	6:40	20		Neutral	Washing	
	7:00	20		Neutral	Commuting	
	7:20	20		Neutral	Meal	
	7:40	100	×1.5	Work	DM	midterm review
	9:20	100	×1.0	Work	DM	midterm
	11:00	20		Rest	Rest	
	11:20	40		Neutral	Meal	
	12:00	70		Rest	Rest	
	13:10	120	×1.0	Work	ML	hw2
	15:10	60		Rest	Rest	
	16:10	30		Neutral	Meal	
	16:40	60		Rest	Rest	
	17:40	60	×1.0	Work	PoH	workshop
	18:40	40	×1.0	Work	GPB	
	19:20	20		Rest	Game	炉石
	19:40	30		Neutral	Commuting	
	20:10	110		Neutral	Washing	
	22:00	30		Rest	Game	炉石
	22:30	30		Neutral	Washing	
	23:00	60		Rest	Rest	
2020-11-02	0:00	30		Rest	Rest	
	0:30	370		Sleep	Sleep	
	6:40	20		Neutral	Washing	
	7:00	30		Neutral	Commuting	
	7:30	20		Neutral	Meal	
	7:50	40	×1.0	Work	GPB	

Figure 1. Self-collected Dataset

I used the Pandas package in Python to preprocess the data, and I started by checking the validity of activity items, ensuring that the duration of all activities in a day adds up to 1440 minutes. Overall, the self-designed activity record template facilitates the preprocessing task to a great extent. Firstly, the 'Start Time' attribute of each item is automatically computed based on the previous item, so its format validity is ensured. Secondly, the 'Efficiency', 'Category' and 'Tag' attributes are restricted to a given set of values respectively, which evades the typo issues.

To reduce the time for loading the visualization pages, this project finishes all computations beforehand and exports the processed data to four CSV files, which can be loaded by the JavaScript code directly while initializing the visualization. Data file 'iv_event_all.csv' contains 1853 recorded activity data with complemented dates and filtered attributes (attribute 'Efficiency' is abandoned for this project due to its subjectivity of evaluation), and two derived attributes 'start_angle' and 'end_angle' are added, which

are used to draw the overview spiral chart. Data file 'iv_cat_all.csv' stores the accumulated time of four different categories (i.e. Sleep, Work, Rest, Neutral) on each day. Data file 'iv_balance_all_15.csv' contains the accumulated work/relaxation time every 15 minutes of each day, which is used to draw the scatter points in the balance chart. Data file 'iv_balance_ave_all_15.csv' contains the average work/relaxation time data of the previous data file, which is used to draw two average lines in the balance chart.

2. Goals & Tasks

Overall, this project mainly aims to answer a series of questions regarding time management and allocation by the created visualizations – "Where did I spend my time? Did I organize my time properly? Can I do it better?". By visualizing the time allocation of previous days, we can then adjust our time planning for the future accordingly. This will help us iterate and optimize our work-relax balance, and may finally increase our working efficiency.

In general, the visualization should have a 3-layer hierarchical structure, which contains overview, weekly view, and daily view that visualizes the information in the dataset. To start with, we need to show an overview of the data, where the users can intuitively observe their time allocations of the past and recognize some easily-distinguishable patterns for their time usage (e.g. approximate wake-up time, mealtime, etc.). Here, the overview should contain all the data from the dataset and present them with properly chosen marks and channels. As for the weekly and daily subviews, we need to derive more attributes that are useful for demonstrating details and further analysis. For example, we can accumulate the activities of the same category respectively and make cross-comparisons within a day and throughout the week, and this usually requires proper links and interactions between different views. Furthermore, the weekly and daily subviews should provide a convenient entrance for the users to revisit the time allocations of previous days and demonstrate their work-relaxation balance of the past, which may inspire potential changes and help the users manage their time better.

3. Visualization

3.1. Overview

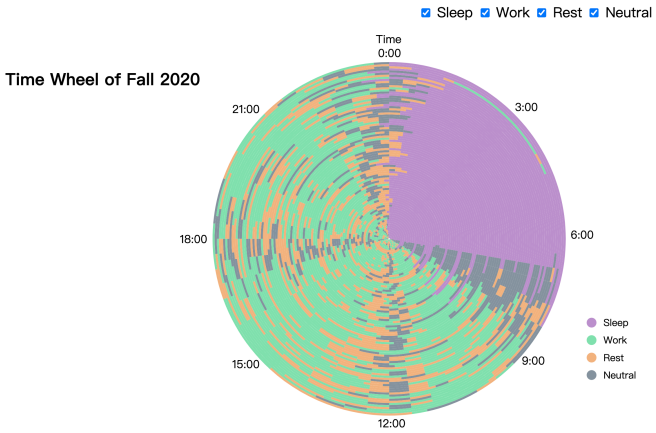

Figure 2. Overview: Time Wheel of Fall 2020

The overview is demonstrated by a time wheel chart, which visualizes all the activity records from the dataset. The time wheel consists of many rings with different radius sizes and each ring shows all the activity information of a single day. Here, the more recent the data is, the larger radius it will get. This design preserves the ordinal characteristics of the time series data and puts emphasis on the more recent data at a meanwhile. Besides, the encoding designs of the activities are also thoroughly considered. The 'category' is a categorical attribute, so I use the color hue channels to encode the activity categories (i.e. Sleep, Work, Rest, Neutral), whereas I use the angle channel to encode the 'duration' attribute since it is quantitative and the total time of each day all add up to 1440 minutes. Moreover, I also add the four check boxes corresponding to activity categories, and this enables users to filter the information and observe some patterns of their time allocations from a global perspective (e.g. approximate wake-up time, mealtime, etc.).

3.2. Weekly views

The weekly views consist of a stacked bar chart and a line chart and they allow the users to observe their time allocations on a single day and compare them with other days on the selected week.

The stacked bar chart consistently uses the color hue channel to encode the activity categories (i.e. Sleep, Neutral, Work, Rest). The length channel en-

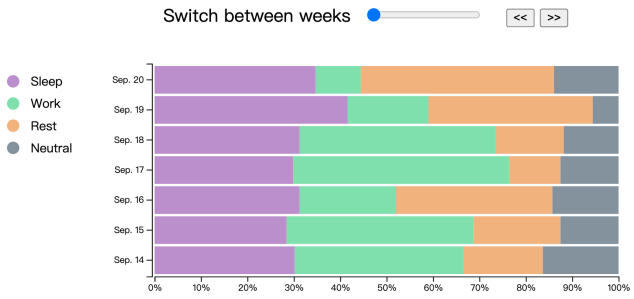

Figure 3. Weekly View: Stacked Bar Chart

codes the accumulated time for each category (derived attribute; quantitative type) and we can approximate the percentage of time used for each category by the horizontal axis. The vertical positions encode the attribute 'Date' (ordinal type). In this way, the users can observe their time allocations on the selected week. When the mouse hovers over a rectangular region in the stacked bar chart, there will be tooltips showing a set of details, including date, category, accumulated time, and its percentage of that day.

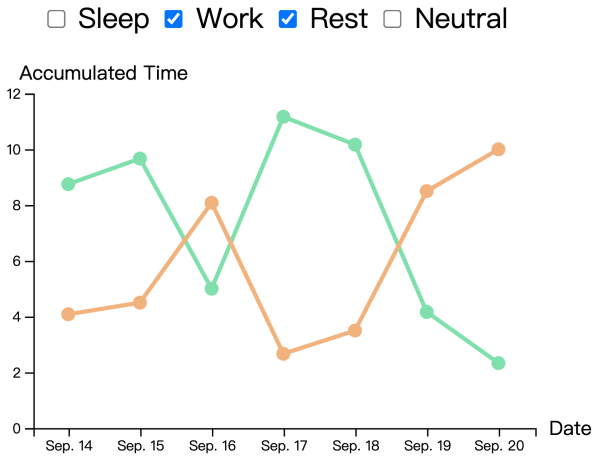

Figure 4. Weekly View: Line Chart

Both sliders and buttons are provided for the users to switch to visualize the data from other weeks. As the changes of the selected week in the stacked bar chart, the line chart will show consistent time allocation trends of the selected week accordingly by linking the views. In the line chart, I still use the color hue channel to encode the activity categories. Besides, the vertical positions of the point mark encode the accumulated time of a category, whereas the horizontal positions of the point mark encode the date. When the mouse hovers over a point mark, the details of date, category, and accumulated time will be shown in the popped up tooltip. Furthermore, all the point marks are linked with line marks that are encoded with the same color hue, which intuitively demonstrate the overall trend of how long the users spend on a particular activity category during the selected week. I also add the four check boxes corresponding to activity categories to facilitate the cross-comparisons within a week, and the chart will update the scales of the vertical axis when there are any changes of selections or filtering.

3.3. Daily views

The weekly views consist of a spiral chart and a balance chart, which provides a convenient entrance to revisit the time allocations and the work-relaxation balance of the past. This may inspire potential changes in the users' time management and allocations. The data of the demonstrated dates on these two charts will be changed when the user either clicks the bars or the points in the weekly views.

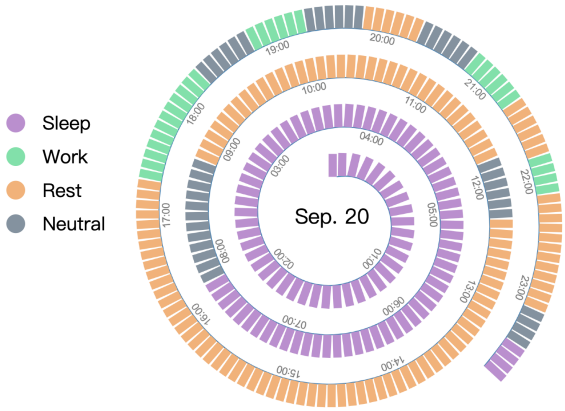

Figure 5. Daily View: Spiral Chart

The spiral chart intuitively visualizes the user's life of the selected day, and I still follow the same color hue encoding for the activity category. The rectangular regions in the chart are used as a point mark and each of them represents a span of five minutes. The poisons of rectangular regions in the spiral path encode a series of time data of that day. When the mouse hovers over a rectangular region, the popped up tooltips will show the detailed activity information at that time, including the 'Tag' and 'Remarks' attributes in the datasets.

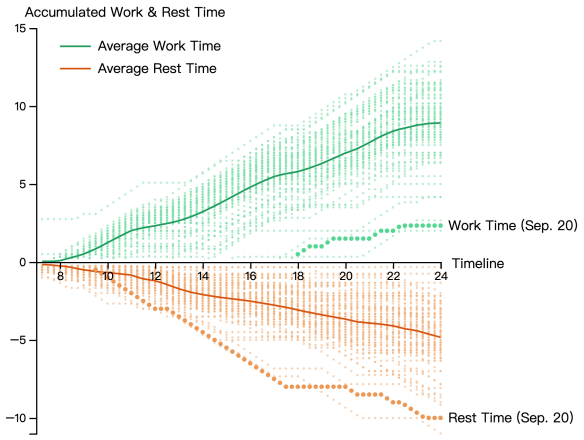

Figure 6. Daily View: Balance Chart

The balance chart clearly shows the work/relaxation balance by combining scatter plots, line charts, and dual views. The horizontal axis denotes the timeline, and the vertical position represents the accumulated work/relaxation time at different stages of the day. The larger point mark in the charts denotes the data on the selected day, whereas the smaller points behind denote all other accumulated time data in the whole dataset. In order to facilitate the comparisons of the work/relaxation, I use two line marks to plot the average time spent on work/relaxation at different stages of the day.

4. Reflection

Overall, the final product of this project lies beyond my previous imaginations and I implemented five views instead of three views proposed in the project proposal. The visualization design in the proposal only contains a 2-layer hierarchical view design and there wasn't an overview of the data to be visualized. I add this part to the final product and adjust some designs in the proposal to achieve a better visualization effect. For instance, I planned to create a sorted bar chart to show the time allocations on different kinds of activities, yet it is not intuitive enough for the users and also a bit lack interactions. Instead, I create a spiral chart to visualize the activity records on a single day and add pop up tooltips.

This project keeps a consistent set of visualization and technical goals, that is, to demonstrate the time allocations in the past in a convenient and intuitive way and therefore optimize my time plannings for the future. The final product of this project perfectly fulfills the given tasks and achieves those goals, and most technical issues I encountered are solved smoothly. In the process of doing this project, I witnessed my continuous optimization in managing my time allocations and work/relaxation balance, which is undoubtedly something amazing and meaningful.

Due to privacy concerns, I will not publicize the final product with my own data, but instead, I'll probably open source the activity recording template, data processing code, and the visualization code in this project soon. This report will not be the ending point of my explorations in the visualization field, and this project will still be updated from time to time (e.g. designing a real-time visualization in the activity recording template).

5. Acknowledgements

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