PerTabVIS

CPSC 533C 2011/W1 Project Proposal

Chuan Zhu
chzh.austin@gmail.com

---

1. Abstract

This project proposal presents an application named PerTabVIS, a tool using a visualization approach to explore Periodic Table for general users. The purpose of PerTabVIS is to provide people with a visualized and interactive approach to learn element properties and compare the relationship between them, and to show a regular pattern for certain properties such as PH value (pondus hydrogenii value), metallicity, boiling point and so on.

2. Background and Previous Work

Substances around us constitute such a miracle and splendid world. If exploring deeper in what we see every day, we will know these colorful and variant substances consist of different elements as a most intrinsic combination. Scientists recognized there must be some laws to organize them together and corresponding disciplines to distinguish them. Thus, [Dmitri Mendeleev, 1869][1] presented his assumption of pattern of elements, which is the prototype of Periodic Table we see nowadays, like in Figure 1. In this project, I will still use the traditional Periodic Table in Figure 1 although there are lots of modern versions.

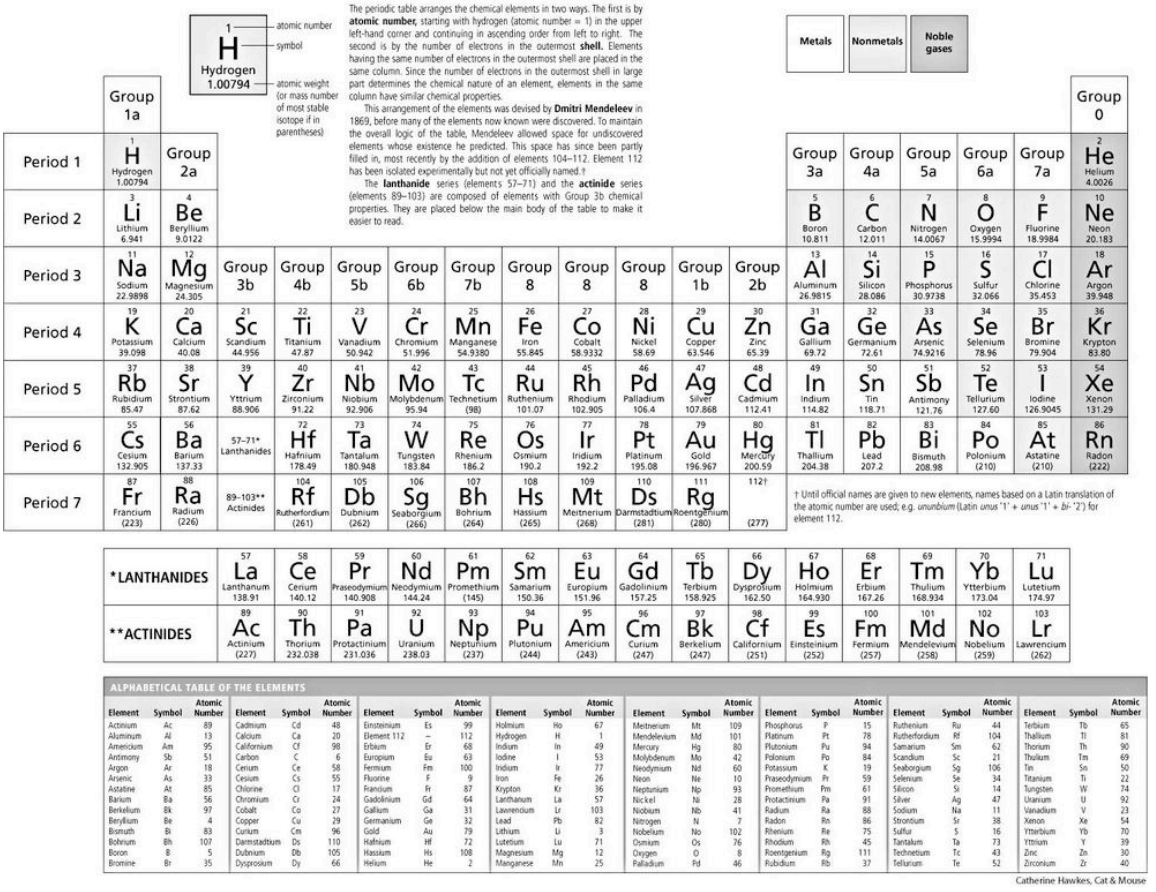

Figure 1 Periodic Table

However, whether with any relative chemistry background or not, it is hard to figure out any relationship at first sight from Periodic Table shown above. Thus, if we could design a visualized tool to show the potential relationship in a direct way, it might be very helpful for people to learn and grasp elements, or even discover new elements.

Realizing this problem, during the past few decades, developers have developed kinds of visualized tool to better reveal Periodic Table. For instance, [Christopher Ahlberg 1992][2] devised a *dynamics queries* to search and show the elements in the table. More implementations are used in the industrial and educational field. There are lots of applications for Periodic Table available on the website. However, the existed tools all have pros and cons. Some of them focus on the history and the background of element. *How does an element look like? Who, when and where discover it?* i.e., *The visual Elements Periodic Table*[3]. In addition, some others only care about each element itself but ignore the relation between elements, i.e. *David's Whizzy Periodic Table*[4] & *Periodic Table Live*[5]. Some other implementations like *The Pictorial Periodic Table*[6] , *Periodic Table of the Elements*[7] and *Interactives: Periodic Table*[8] reveal some relations but don't allow users to select elements used to compare according to own willing. On the other hand, some advanced tools do reveal complex relationships but it seems more like to design for an expert but not for general users, i.e., *elements*[9] on the *Improvise* website.

Thus, I want to develop a visualization tool which can well show both information of each element and connections between different properties. And above all, this tool is toward general users.

The following sections of this proposal will be organized as this way. Section 3 describes the problem domain, task and dataset used and then section 4 is a further illustration combined with personal experience. The scenario of use is exemplified in section 5. In the next two following sections 6 and 7, possible solution and implementation approach will be proposed and described, respectively. At last, section 8 lists my project schedule.

3. Domain, Task and Dataset

PerTabVIS is intended to reveal the relationship between elements in visualization way. The domain and task of this application is naturally to provide a visualized and interactive approach for general users who is in or interested in chemical field. The dataset can be easily found on the website such as Wikipedia. The data I will use here is mainly from one example named *elements*[9] on the *Improvise* website. This dataset includes such amount of basic information about elements like isotope, acidity and alkaline, radius of atom, boil point, spatial structure that it is enough for general users.

4. Personal Experience

When in senior school, I once learned Chemistry as a compulsory course. The Periodic Table of Elements is one of most basic and important knowledge for students who first stepping into chemical field. But unfortunately, most of students might be confused by the complex relationship between elements. What I did at that time is just to remember all of them in heart. After realizing that visualization is a powerful approach to reveal the numerical and abstract concept visually, I think I can make some efforts to help senior students easily grasp Periodic Table. And with regard of some chemical background, I have a concept what general users interest in.

5. Scenario of Use

Considering PerTabVIS is for general users such as students in senior school, the scenario of use should focus on the basic concept in the Periodic Table. Suppose Austin is a senior school student. A typical scenario of use for PerTabVIS is that midterm will come soon, but Austin still has no idea about how Na exists and looks like in the real world, as an elementary

substance or compound? Then he right clicks Na element by using mouse. PerTabVIS then shows a menu besides the element including many options. Austin finds there is an option called “look like”. Then he clicks it and PerTabVIS shows some most common existing states of Na in the world and the spatial structure. Then Austin knows Na usually exists as a compound such as NaCl.

Another likely scenario of use for PerTabVIS is to compare multiple properties between elements. User selects elements by clicking them in the table and then selects which properties to compare. PerTabVIS will show the outcome in a most popular way. That is to say, display relies on physiological perception. In addition, user can also choose own preferred display method. For example, Austin wants to compare the PH value for some elements. Then he selects several elements in the Periodic Table by combination of ‘ctrl’ button and left-click and chooses “PH value”. PerTabVIS then shows the PH value in other window from low to high, from acidity to alkaline, with a rainbow color encoding. Here, PerTabVIS also provides Austin with an option to see the PH value numerical way or histogram way. Besides, Austin also wants to see the relationship between boiling point and radius, namely multiple properties comparison. Then he selects “radius” and “boiling point” in the option menu and gets outcome with line chart in a 2D coordinate frame.

6. Proposed Solution

The constant number of elements in Periodic Table indicates limited size of dataset. So the abstraction of data should be focused on category. Which elements are metal? Which group has similar property? Such kind of questions should be well devised. Furthermore, one element might have lots of attributes, such as proton number, isotope. All of its attributes should be bounded together as member variable of this element object. So I derive the general hierarchy of data seen in Figure 2.

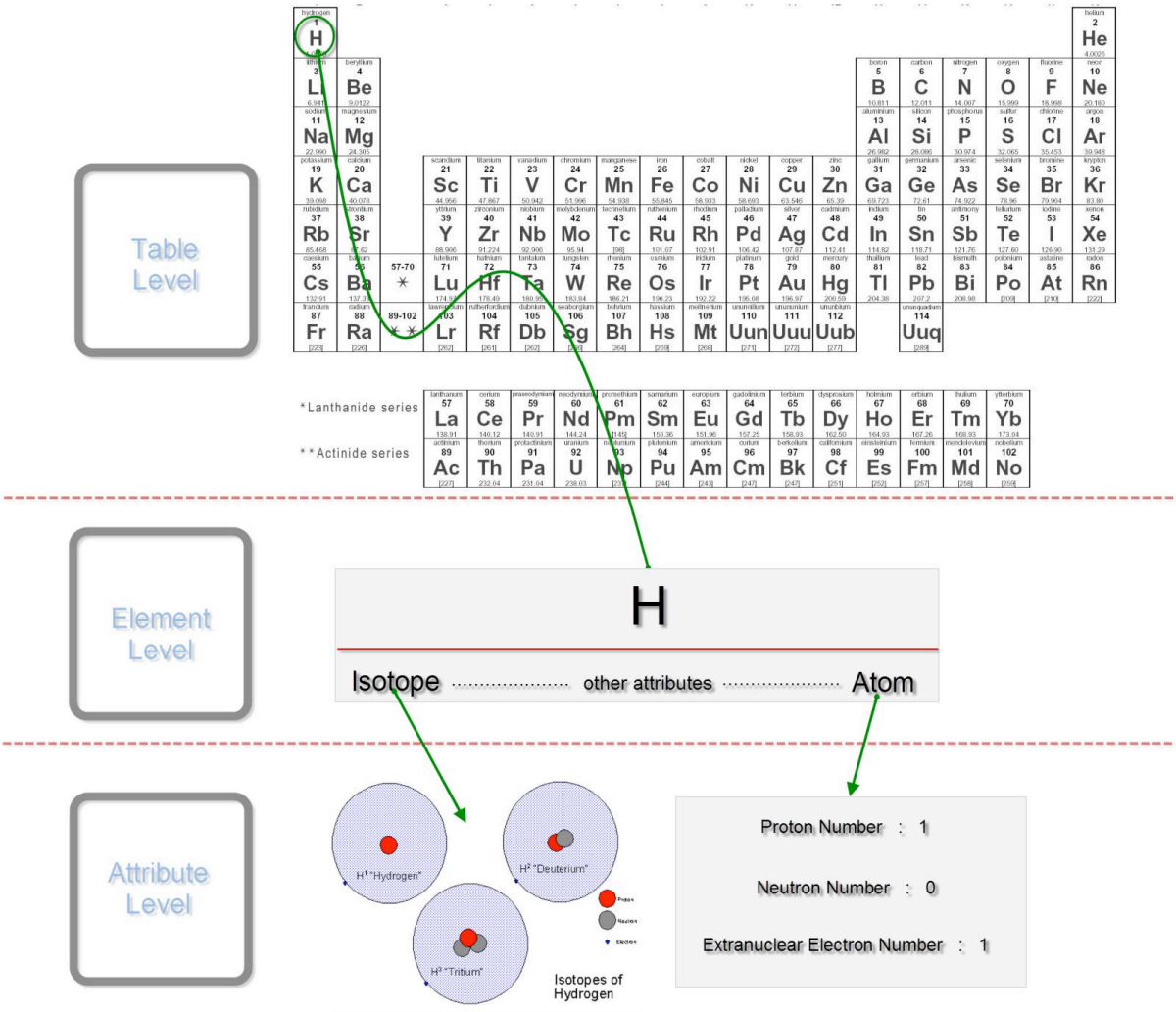

Figure 2 Data Hierarchy

PerTabVIS is a user-driven platform, which means PerTabVIS displays whatever user is willing to see, unless the meta-data is in the dataset. This feature might be the most different part compared with current tools which I mentioned above. To reach this purpose, a well-designed encoding system and a user-oriented interface can't be more significant. For the encoding method, I plan to use color, chart and size as mainly encoding approach. Color has lots of usage in PerTabVIS. For example, each row (period) and each column (group or family) will be easily recognized by different color. The scale of PH value can also be perceived easily in terms of saturation. As for the spatial structure for a compound, different element used to organize it can be well distinguished by different color. Chart is also a powerful method to reveal potential relationship of compared properties. For example, when measuring connection between boiling point and radius, a line chart might be very useful. When comparing radius, using circle to indicate relative size will be also very helpful.

As for interface techniques, multiple view approach does first come into my mind. For example, using linked view allow user to see different attributes at the same time. If a view displays mass of elements and the other view shows the density, user can choose one subregion from mass view and the corresponding density will be automatically highlighted in another view. Another technique worth to use is dynamic interaction. Suddenly popping out the outcome is suffering to the bad user experience. One more thing about interface is that about friendly UI. First, a friendly UI must be easy to understand. Here, I mean user must easily recognize the property he queries from mass of data. Second, a good interaction must be easy to handle. That is to say, user with little computer experience should also control it easily.

7. Implementation Approach

I prefer to use *HTML* combining with *D3. Js*[10] as my implementation toolkit. *HTML* is well used nowadays. And *D3 .js* is a brand-new toolkit released on 2011 given strengthens of object-oriented model and dynamic interface.

8. Mile Stones

Deadline	Event Must be Done
Nov. 10	Categorize dataset and Abstract task
Nov. 15	Design interface and Draw an elementary frame
Nov. 20	Learn *D3 js* and relative knowledge
Nov. 30	Implement PerTabVIS
Dec. 05	Debug
Dec. 10	Complete project write-up

Reference

1. Introduction of *Dmitri Mendeleev*, http://en.wikipedia.org/wiki/Dmitri_Mendeleev
2. Christopher Ahlberg , Christopher Williamson , Ben Shneiderman, *Dynamic queries for information exploration: an implementation and evaluation*, Proceedings of the SIGCHI conference on Human factors in computing systems, p.619-626, May 03-07, 1992, Monterey, California, United States
3. *The visual Elements Periodic Table*, http://www.rsc.org/chemsoc/visualelements/pages/pertable_fla.htm
4. *David's Whizzy Periodic Table*, http://www.colorado.edu/physics/2000/applets/a2.html
5. *Periodic Table Live*, http://www.chemeddl.org/resources/ptl/
6. *The Pictorial Periodic Table*, http://dwb.unl.edu/Teacher/NSF/C04/C04Links/chemlab.pc.maricopa.edu/periodic/periodic.html
7. *Periodic Table of the Elements*, http://www.periodni.com/en/index.html#

8. *Interactives: Periodic Table*, http://www.learner.org/interactives/periodic/periodic_table.html
9. *Elements*, an example of Improvise, http://www.cs.ou.edu/~weaver/improvise/examples/elements/index.html
10. *D3. js*, http://mbostock.github.com/d3/