Personal Information Dashboard - Me, At a Glance

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ABSTRACT

Our use and interaction with computers creates a lot of information about our activities, interactions with others and, ultimately, about ourselves. However, this personal information is often spread over many different places making it difficult to visualize and control. Personal Information is not usually processed nor cross-referenced with information from other sources. We present Personal Information Dashboard, a web application that allows users to see, at a glance, various facets of their lives. We show people's life patterns using and combining several sources of personal information in a more natural and graphical way. Imagine waking up in the morning and, just by looking at the computer, immediately know, not only how many emails you have on your incoming box, but also which ones are of most interest to you based on several aspects of yourself and the email itself. User tests show that the interface has hood usability and that, indeed, the users can find meaningful personal patterns in the visualizations, proviting them with unexpected insights.

Author Keywords

Personal Information Management, Awareness, Information Visualization, Dashboard, Human-Computer Interaction

ACM Classification Keywords

H.5.m. Information Interfaces and Presentation (e.g. HCI): Miscellaneous

General Terms

Design, Experimentation

INTRODUCTION

Nowadays the use of computers (in their many forms) has become commonplace in our lives for many different reasons: to work, for pleasure, to communicate, etc. As a result, our interaction with these devices and often, by extension, with others creates an enormous amount of information about us and what we do: the files we create, the emails we send, etc. These kind of artifacts are part of a kind of information widely known as *personal information*: information from or to someone not always owned or controlled by the subject.

This information is part of us, a piece of our history that can help us understand who we are and what we do. It's our "reflection" in this digital river we all live in.

However, and thanks to the proliferation of things like the Internet and social networks, this information about us can be virtually anywhere: in our brand new laptop, in our email archive, in that old newsgroups that we no longer attend, in that forgotten social network we thought extinct, etc. This high level of dispersion makes it difficult, and sometimes impossible, to keep track of all that information and see everything as a whole. For instance, the things I say and discuss via email might be related to the ones I write via instant messenger, but that information is often broken into two different sets of information, not reflecting this. Moreover, these sets might complement each other, making more sense when analyzed together. Finally, the level of dispersion tends to increase with the number of platforms, application or services we use: online social networks are a striking example of such fact. Through it all, managing all our personal information might just become a terrible nightmare and, therefore, we tend to ignore the management and value of such information, until the day we either need it or lose it (or both).

To deal with such problems and limitations, we developed a dashboard-like application we called *Personal Information Dashboard*. The main objective of our work is to, **using and combining several sources of our personal information, show interesting facets and patterns of our lives giving an idea, at-a-glance, of what's important at the moment**. The idea is having all our information is just one place and treated as just one set, and not like a set of sets. This is a new way of looking at personal information, a cohesive way of dealing with the information we produce in a daily basis.

Personal Information Dashboard is a web application that follows a plugin-based approach. Each plugin manages a visualization and the visualizations are the entities that ultimately show the user's personal information. The idea is that the visualizations should display the information in a more graphical and glanceable way, providing a new way of looking at the information. The number of possible visualizations is immense and one of the first challenges was trying to understanding which ones were the most interesting to start with. During our work, we have implemented a total of 11 plugins for *Personal Information Dashboard* and these plugins are just a small sample of what can be done: it was not our intend to fully explore all the possibilities on this regard. Based on information retrieved by several sources of personal information (emails, instant messaging, visited pages, documents, etc.) it should be possible to create several visualizations that show statistics and interesting patterns about our lives at any

given point. The system's architecture is prepared to easily support either new plugins and new sources of personal information.

Imagine waking up in the morning and, just by looking at the computer, immediately know what's happening. Does anyone sent you an email while you're sleeping? What are the last news on Facebook? Do the emails you receive have something to do with the tweets of your friends? These are just some of the things that a well organized plugin can answer in a very glanceabale way.

At first sight it can be argued that some applications already do something like this. Some of those applications can probably be found in section . In fact, some applications were able to join information from several sources and some others presented new forms for the user to observe and relate with his/her own personal information but none of them was able to combine these two ideas as *Personal Information Dashboard* promises to. There's no cohesion, the information from one source is seen isolated from everything else. The personal information is not treated as a whole nowadays, changing this is the goal of *Personal Information Dashboard*.

In this paper we start by analyzing all the existing solutions that, somehow, can contribute or are related to our work. Next we'll describe *Personal Information Dashboard* and then discuss the results from the user tests we conducted in order to test our solution.The primary contribution of our work is the definition of a framework that allows a more cohesive and centralized way of looking at our personal information.

RELATED WORK
The visualization of our patterns, us and our lives has been the subject of various proposals and solutions over the years. One of the more distinguish works on this regard is Themail [9]. This work proposes a visualization of our personal information based on piles of important words that describe our relationships with others. However, we can only examine our relationship with a friend at a time: there's no general view of our relationships with all our friends. Moreover, only one source of information is used (email) what might be too little to effectively describe something as complex as a human relationship. Works as the one described in [8] also use email to mirror our relationships with other, but the visualizations are too high level, not allowing the users to track down the information until the email level. This flaw is also shared by Newgroup Crowds and Author Lines, described in [10] that uses newsgroups as a source of personal information.

Other works have been focus on keeping the user aware of his/her transient information. Works such as Scope [7] or SpiraClock [3] are just some of many examples of this kind of approach. One interesting aspect of this kind of work is the fact that they require little space to keep users aware of what's important at the moment. Other works like InfoCanvas [5] and Bloom [4] are more abstract in the way that the information is shown and require a little more space to make it work. As a consequence of their nature, these works show provide little insight to the user as only transient information

is shown: it's not possible to explore our information and, most of the times, the interactions with the application are quite limited.

There are already some personalized frameworks for collecting information from distinct sources. Works as iGoogle[1] and Rainmeter[2] are two well know example of this. These works were capable of gathering, in one place, information from more than one source however, the information is not correlated. The information from several sources is indeed closer, but it continues separated. It's not possible to the see the information as a whole.

SOLUTION
Personal Information Dashboard is a web application that uses the dashboard metaphor to express a user's personal information in a more graphical and glanceable way. On our interpretation of this metaphor, the dashboard is populated by several, possibly distinct, visualizations of the user's personal information. The visualizations can me moved from place to place and even resized at user's will. In order to add a new visualization, we implemented a simple catalog where all the plugins are listed.

Each visualization is associated to a plugin instance, the entity responsible of processing personal information and generating the correspondent visualization. The plugins can be configurable in order to show different aspects of the personal information. The user can, for instance, configure the time range to consider. The information is typically show in a very succint form but the user can request for more details by holding the mouse over the intended item. The visualizations are linked to each other as an action in one visualization can affect others visualization: for instance, clicking on a word in one visualization will fade-out all the other words on all other plugins. This last mechanism is known as plugin intercommunication and we'll explain it later on in this paper.

The information used by the plugins is fetched from several sources of personal information. We currently support Gmail, Facebook, Twitter, Flickr and Panoramio but the architecture is prepared to allow an easy addition of new sources of personal information. An important aspect of our personal information is the people who we communicate to. On our solution we simple call them *contacts*. We support the fetching, from personal information sources, and management of such entities. Associated to the concept of contact is the concept of *group*. We also support this concept. Moreover, one of our solution main objectives is to show the information as a whole.

Figure 1 is a screen shot of an user's dashboard.

Architecture and Extensibility
One of our major concerns was creating an easily extensible solution. We wanted our work to be able to grow gradually as new ideas and resources appear. In short, it should be possible

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[1]http://www.google.pt/ig
[2]http://rainmeter.net/RainCMS/
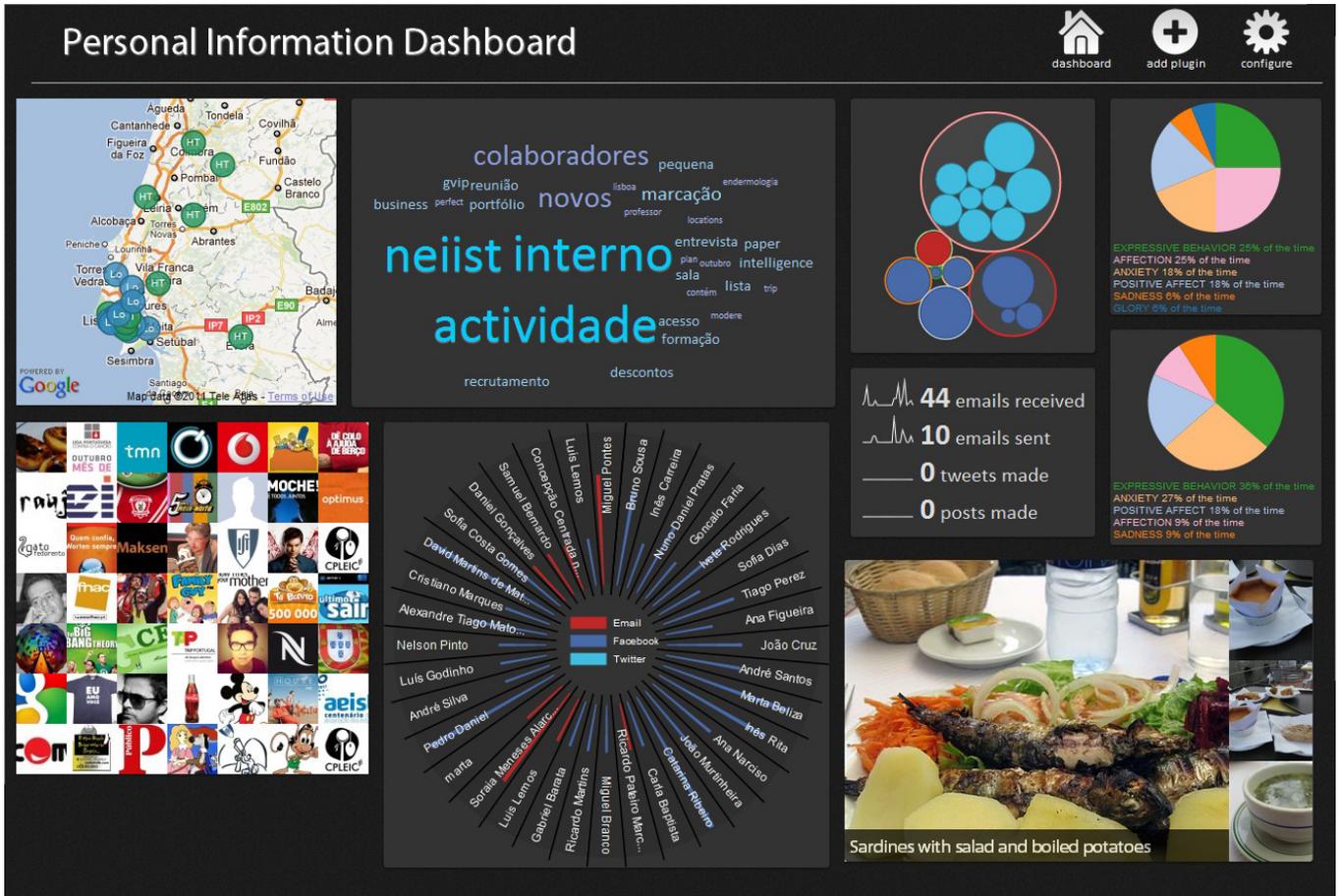
Figure 1. Screen shot of an user's dashboard.

to easily add new visualizations, sources of personal information, etc. This major requirement ultimately shaped most of our work's architecture.

Our architecture is based on a flexible structure composed by two main types of entities: the dynamic entities and the static entities. The dynamic entities are those that can be added and removed from the system in order to add or remove some behavior. These are the entities that allow and support the addition of new sources of personal information, new plugins, etc. They are, in short, the extensible part of the application playing a fundamental role in the achievement the extensibility requirement. The static entities are those whose job is to manage all the flow of the system. They work just like glue between the dynamic entities or as common interface for the dynamic entities.

Visualizations

Visualization plugins are a core concept of Personal Information Dashboard. The implemented plugins do not exhaust Personal Information Dashboard's potential, but serve as a showcase of what can be accomplished. For the visualizations we typically use Protovis [1], a visualization toolkit that uses JavaScript and SVG for web-native visualizations. It's however possible to use other resources.

Keywords Cloud is a tag cloud-like visualization that shows the most important words from a set of emails, posts and/or tweets (2). To calculate the important words, we use the Salton's TF-IDF Algorithm [6]. As in the case of the most of the implemented plugins, Keywords Cloud can be configured to show data from a specific time period. This feature can be useful to compare the discussed topics within two different periods of time.
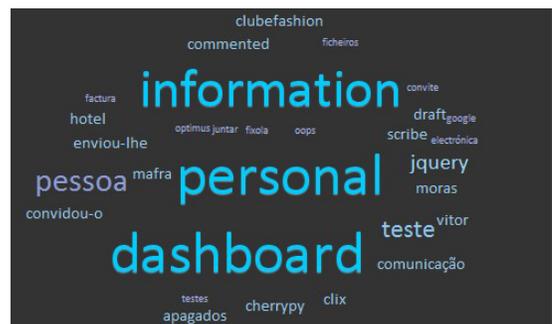
Figure 2. Keywords Cloud

My E-Emotions (see figure 3) has a very unique approach by trying to infer emotion on people's writings based on the Regressive Imagery Dictionary (hereafter referred to by RID) [**?**] coding scheme. RID contains a few thousand words grouped into categories and subcategories. One of those categories is emotions that is then divided into several subcategories for distinct common emotions. For instance, words like "mate" and "sorry" would indicate affective and sadness emotions, respectively. With this information at hand, we can infer the emotions from text and create simple pie charts that reveal the emotions detected for a specific period and set of sources of personal information.
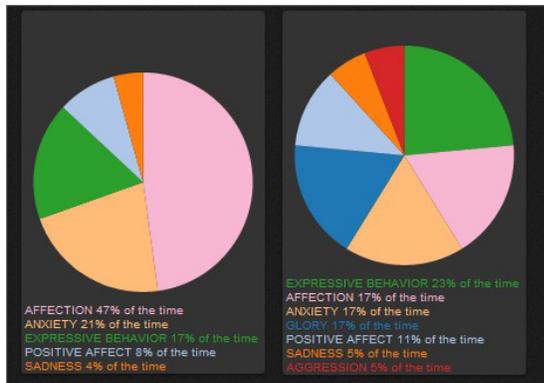
Figure 3. My E-Emotions

My Feeds gathers in just one place events from multiple sources. Each outer circle represents the contact associated with that circle's border color and each inner circle an "event" from that contact: email (red), facebook post (facebook's blue) or tweet (twitter's blue). This way, all events from a contact are located inside the same outer circle making it easy to follow a contact's activity. As events become older and older, they shrink until they finally disappear. This way, more recent things appear bigger, getting user's attention.

On the other hand, You've Got Bubbles is dedicated to email only. Here, each email is a bubble and it's possible to configure what some of the visual dimensions mean: it's possible, for instance, to assign a value to the bubble's color or size. It's also possible to define what emails to see (email box/label, state, etc).


(a) You've Got Bubbles   (b) My Feeds
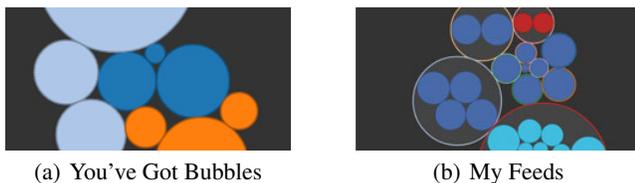
Figure 4. You've Got Bubbles and My Feeds

Using the Google Maps API we created the FriendsMap, that marks places based on Gmail's and Facebook's information. From Facebook, we can get the location and hometown of each one of user's friends. From the received emails, using the "received" field from the email's header and a geolocation service[3], we can infer the location of the contact when he/she sent an email. With this information, we can then mark those places with distinct markers (blue for location, green for hometown, yellow for location and hometown and red for email sent). Users can then find out where are their friends from, where have they been lately and where are they right now. This visualization can also lead to interesting and unexpected findings: a friend who recently moved to another country, a friend who was born in a distant city, etc.

Keeping track of your activities with each one of your contacts can be difficult when the amount of data is just too much to handle. Who&How is a solution for such problem. This visualization is based on several concentric areas arranged on the edges of a central circle. Each one of these areas is associated to one contact. Then, inside that areas, we can find a bar for each kind of source activity: one bar for the amount of emails sent from that contact, one bar for the amount posts on Facebook made by that contact and one bar for amount of Tweets. With this visualization, the user can observe several patterns: am I receiving many emails from many contacts, or are the emails from a restrict group of contacts? Are the people who sent me emails the same ones who post on Facebook? etc.
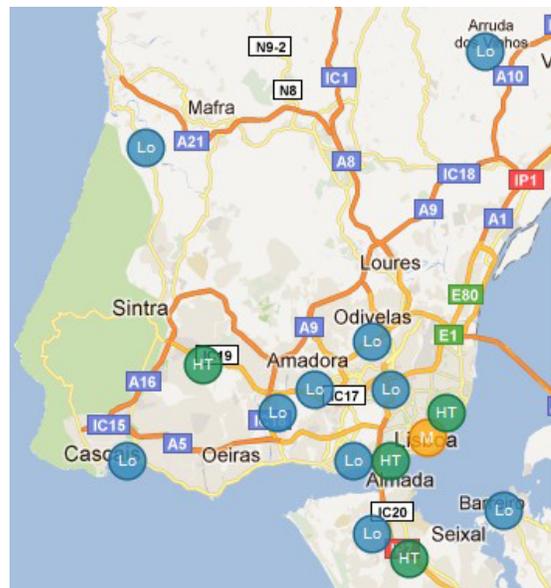

Figure 5. FriendsMap

Knowing what our friends like is not only a self-knowledge experience but also a funny way of finding out things you might just like. Facebook tells you what each one of your friends like but no general view is available. Our Favorite Stuff is that forgotten general view. The visualization is presented as a mosaic with the images of the things user's friends like ordered (from left to right and from top to bottom) by the

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[3]Freegeoip is a free IP geolocation web service that can be found at http://freegeoip.net
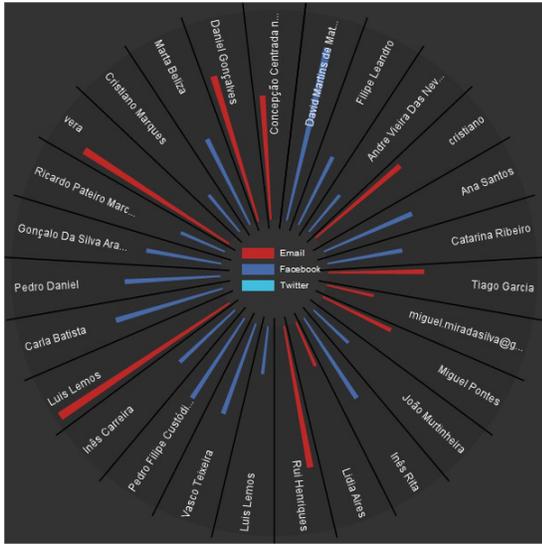
Figure 6. Who&How

number of likes. Holding the mouse over an image will display a tip with information about that item.

Spark Stats is a simple visualization that uses the concept of Spark Line. A sparkline is a type of information graphic characterized by its small size while presenting trends and variations associated with some measurement over a period of time. This plugin uses this lines to show measures such as emails sent and received, posts made, etc. Sparklines are the perfect way of revealing such measure's evolution without requiring too much space. Figure 7 shows two instances of this plugin with slightly different configurations. The left most instance simply shows the measures and its evolution for the last month. The right most instance is configured to highlight the two weeks in the middle of that month, showing the values of the measures for that period.

Figure 7. Spark Stats

Another visualization is Stacked Memories, that organizes the user's photos in scattered piles of nostalgic Polaroid-like photos. We used the photos from Facebook, where the user is tagged, maximizing the chances of that photo actually mean something: the user was there, he/she will probably associate that photo to an event, resulting in a nostalgic moment.

Finally, we have The Surroundings and Photo Search, two photo slider visualization. The Surroundings uses the user's location and the Panoramio source on obtain photos of possible nearby places. This plugin can be particularly useful for

users that travel from time to time to always being aware of nearby places. Photo Search performs automatic search for photos on Flickr that meat a given criteria. As depicted before, the implemented plugin are just some example of what is possible to implement on Personal Information Dashboard.

Details-on-demand

Details-on-demand is a common mechanism implemented in most PIM visualization-based applications. Such mechanism can help users to better understand their own information and have a more enjoyable experience. Moreover, it allows the application to show top patterns created by the information without compromising the user's need for more detailed information. On Personal Information Dashboard this mechanism was implemented using ballon-like tool-tips. With this mechanism the user can easily traceback all the information on the dashboard and understand where that information came from.

Plugin Intercommunication

Another common mechanism in PIM application is the filtering mechanism. This mechanism help users filtering unimportant things and focus in more relevant aspects of the information. As our solution holds many visualization on the dashboard, we've created a dashboard level filtering mechanism. This means that all the visualization on the dashboard are filtered for the same criteria, making it more easy to correlate information among different plugins. To filter information, the user only needs to click on the intended element: the user can, for instance, filter by a word contained in a visualization. In order to filter things, we opted by dramatically fade-out unselected things, highlighting the important ones by contrast. Each plugin can send events to a shared bus, from where other plugins can listen and act accordingly.

Contact and Group Management

Contacts and groups of contacts are two very important dimensions of one's personal information: much of the information we produce is, one way or another, related to the persons we know and the persons we talk to. Therefore, supporting these dimensions became a fundamental goal to our project. Currently, our prototype automatically imports the contacts from Gmail, Facebook, Twitter and Flickr. We also automatically import the groups from Gmail, Facebook and Flickr. We created mechanisms for merging contacts from different sources belonging to the same person. The first method is an automatic one that merges contacts based on their email. This is possible for some sources but not for Twitter for instance. To solve the cases that the automatic merge does not help, we've also created a manual one. On this approach, the user should use the Merge Panel on the contacts list

Another concept present in some sources of personal information is the concept of "group". This concept is useful to group contacts with something in common and deal with related people as they were only one entity. Thus, it will be possible for the user to see, at a glance, things like the volume

of messages from work and personal life, without having to piece it together from information about different individuals.

EVALUATION

In this section we will present the evaluation methodology used to evaluate our prototype and the main results.

Evaluation Methodology

To evaluate our prototype, we have performed two different user tests: Usability Tests and Case Studies. In both tests, users performed a pre-selected set of tasks intended to test different aspects of our prototype. For the Usability Tests, the users did not use their own personal information but rather a set of information supplied by us: the idea was to evaluate the intrinsic quality of the interface to transmit information unknown to the user. For the Case Studies, the users used their own personal information. These tests were much more difficult to assess from an objective point of view but were essential to correctly evaluate our solution since it's what Personal Information Dashboard is all about, personal information. Moreover, we were also interested in observing how the users would react to their own personal information.

The users were asked to perform 18 tasks, in both studies. Different groups of tasks aimed to test different aspects of our solution:

- **Tasks 1, 9, 17** - Evaluate the understanding of the visualization and the details-on-demand mechanism.

- **Task 2, 5, 10:** Evaluate the plugin's configuration process.

- **Tasks 3, 12, 13, 16:** Evaluate the understanding of the visualization.

- **Tasks 4, 6, 8, 11, 14, 15, 18:** Evaluate the plugin intercommunication mechanism.

- **Task 7:** Evaluate the usage of two instances of the same plugin.

Here are some examples of actual tasks:

- Do you have any unread email on you inbox? If so, can you identify the senders of some of those emails?

- Did someone sent you an email, posted on facebook or made a tweet for the last 6 hours?

- Add two instance of My E-emotions. Configure the first instance in order to only display Gmails data and the second instance to only display Facebook data. Can you notice any difference?

All tests were performed in a controlled environment, a lab at our university. The system was used in the researcher's laptop. For the case studies, the system was configured with each of the users' credentials for email and other sources. All collected personal information was deleted after the tests.

Sixteen users performed the Usability Tests (12 male, 4 female) and five of those users also participated in the Case Studies (4 male, 1 female). Their age averaged 25.8 (stdev 8.13), and were students or newly graduates (63% had some kind of academic degree). All used their computer on a daily basis. During the Usability tests we were measuring the number of errors, time spent and number of assist for help. Our idea was to get objective performance measures to better understand what tasks might be difficult for the users.

During the Case Studies we adopted a more interactive posture, constantly asking for the users feedback regarding what was happening. In fact, we encouraged the users to keep talking about what they were doing and about their findings.

At the end of each test session the users were asked to answer a satisfaction questionnaire. This questionnaire was divided in two parts. The first one was the System Usability Scale (SUS) [2], which is a standard usability set of questions that is associated with a method that assigns the system a usability grade according to a user's answers. The second part consisted of three essay questions where the users could enumerate the main advantages, disadvantages and comments that the user felt could help improve the prototype.

Results

The results were divided into three different sub-sections: the results from the tasks performed by the users, the results from the SUS set of questions and the results from the open answer questions of the second part of the questionnaire.

Usability Test Results

The results for the Usability Tests are displayed on table 1. As depicted before, the tasks were divided into groups meant to test different things. For instance, tasks 2, 5 and 10 were plugin configuration tasks and, by examining table 1, we can observe that the mean time to perform the tasks is decreasing from task to task, what might indicate that users become quite proficient very quickly in this type of tasks.

We found another interesting result regarding the tasks focusing on testing the effectiveness of the visualizations (tasks 3,12, 13 and 16). The first three tasks were quite obvious and only required minimal attention. As a consequence, the results for these three tests are quite similar. On the other hand, task 16 took considerably longer, and required more errors and assists to be completed. This difference can be explained by the fact that task 16 required the user to interact and look for the information: the information was not immediately available, the user had to look for it.

In order to study this group of tasks, we performed an ANOVA test and found the existence of statistically significant differences (for $p<0.05$) among the group. Further Tukey's tests allowed us to conclude that this difference only exists due to task 16: this task has significant differences (for $p<0.05$) when compared to any other of the tasks in this group. This result led us to the conclusion that a visualization that requires interaction may have an extra cost. It might hold much more information than a static one but that might affect the usability of that visualization. This is an important fact to take into consideration at the moment of choosing the visualization technique to use. Nevertheless further tests, with more tasks involved, may be necessary to prove this theory.

Table 1. Usability Tests results

Tasks	Time				Errors				Assists			
	x̄	σ	Max	Min	x̄	σ	Max	Min	x̄	σ	Max	Min
Visualization Tasks												
Task 1	35.25	12.64	60.00	10.00	0.00	0.00	0.00	0.00	0.06	0.00	1.00	0.00
Task 2	34.81	11.87	52.00	14.00	0.00	0.00	0.00	0.00	0.19	0.40	1.00	0.00
Task 3	18.81	15.26	74.00	5.00	0.19	0.40	1.00	0.00	0.13	0.34	1.00	0.00
Task 4	19.44	9.28	48.00	10.00	0.13	0.34	1.00	0.00	0.06	0.25	1.00	0.00
Task 5	18.13	3.98	24.00	10.00	0.13	0.34	1.00	0.00	0.00	0.00	0.00	0.00
Task 6	28.50	9.41	49.00	17.00	0.13	0.34	1.00	0.00	0.13	0.34	1.00	0.00
Task 7	20.50	3.39	28.00	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Task 8	26.31	8.11	44.00	15.00	0.00	0.00	0.00	0.00	0.13	0.34	1.00	0.00
Task 9	24.31	8.27	40.00	12.00	0.06	0.25	1.00	0.00	0.00	0.00	0.00	0.00
Task 10	7.00	3.08	15.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Task 11	21.94	5.73	34.00	15.00	0.06	0.25	1.00	0.00	0.13	0.34	1.00	0.00
Task 12	21.63	4.96	34.00	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Task 13	24.38	10.33	50.00	12.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Task 14	64.38	45.28	136.00	15.00	0.19	0.75	3.00	0.00	0.19	0.71	2.00	0.00
Task 15	25.50	21.62	76.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Task 16	36.06	8.64	80.00	20.00	0.13	0.34	2.00	0.00	0.06	0.25	1.00	0.00
Task 17	32.56	10.47	50.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Task 18	45.38	37.39	150.00	12.00	0.13	0.34	2.00	0.00	0.19	0.71	1.00	0.00

Case Study Results

During the Case Studies, the users were able to find personally relevant information and we dicovered some interesting situations. One user for instance, had just commemorated his birthday the day before. When he added the Who&How plugin he immediately noticed this fact on the visualization he had just added: as this plugin shows user's interaction with friends via Gmail, Facebook and Twitter, this user had a lot off small contributions via Facebook: these were the "happy birthday" posts from the day before. Figure 8 is a screenshot of the resulting visualization. Compare it with figure 6. Notice that the figure 8 has a lot more contacts represented, due to the abnormal amount of wall comments that a user receives in his/her birthday. Notice the pattern created in each case, notice how different they are and what that difference means. This is exactly the kind of thing that *Personal Information Dashboard* aims to reveal.

Another interesting situation occurred while using FriendsMap. One of our users noticed that one of his friends had missconfigured its current living place. As a consequence of existing different locations with the same name, his friend had configured its location to the wrong one. This situations highlights an important idea of our work: a visual representation of data is much more effective than a text one. Notice that the information provided by FriendsMap is easily accessible via the Facebook website but with two limitations: first, the locations are not shown on a map, they are just text; and second, the user cannot see all his/her friends in just one map/place. In both situations the information is there, but the way it's shown makes all the difference. The use of information visualization techniques was able to make apparent something the user already had access to in the past, but never noticed.
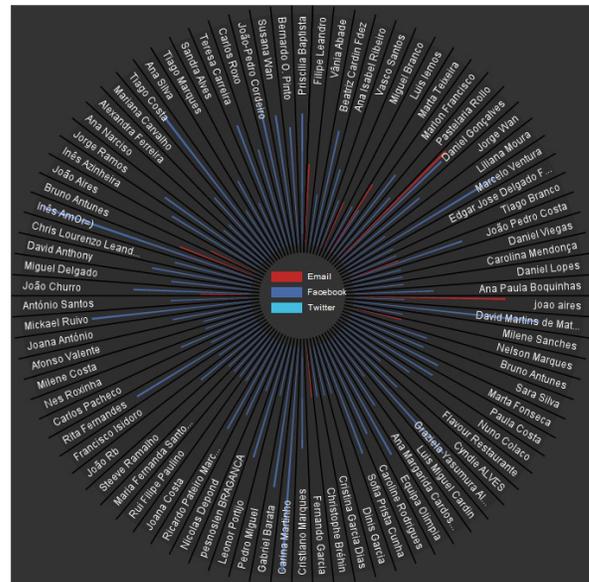

Figure 8. The Who&How of a user that just recently commemorated his birthday.

User Feedback

User feedback was extremely positive. Users mentioned that the prototype was easy and fun to use. As positive aspects, most of the users mentioned the ability to have all their information in just one place. Some users also mentioned the ability to cross-referencing information from two or more sources making all the information more cohesive:

> I can obtain a "big picture" of the use of multiple platforms and contact with several people.

The users also really liked the plugin intercommunication mechanism as a way of filtering and cross-referencing information among several plugins. The following quote is from a user that considered this mechanism as one of the most positive aspects of our solution.

The communication between plugins. I can see how the information from different origins is connected. I can click on an email and see where that person lives. It's pretty cool.

Users seemed pleased with the sources of personal information that our project currently supports but a couple of then mentioned that *Personal Information Dashboard* could also be a place to create information that would be propagated to the other sources:

I see that I received an email from a person and I want to reply. It would be nice to reply directly from the dashboard without having to go to my email.

This is a great idea, it's however currently, a little out of the context of our project.*Personal Information Dashboard* is all about showing information. Therefore, creating new information is not a top priority.

Finally, following the scoring method described in [2] we were able to calculate the SUS score for each user and then obtain the average SUS score and it's standard deviation. We obtained an average SUS score of 74,84, which indicates a very good usability degree perceived by the users. The obtained standard deviation was a small 6,09, which indicates that each user's scores are clustered closely around the mean meaning that there's no big discrepancy between user's scores.

CONCLUSIONS

In this paper we've presented Personal Information Dashboard, a dashboard like application that show user's personal information from several perspectives and in more cohesive way. Currently, the information is retrieved from five different sources of personal information (Gmail, Facebook, Twitter, Flickr and Panoramio) but the architecture is prepared to support new sources in the future.

Our tests showed that users had no major problems learning and using *Personal Information Dashboard*. The Usability Tests were important to detect potential problems (or room for improvement) and to get a sense of the system's real effectiveness to transmit the information. The Case Studies were also fundamental to have a better idea of how the real user will use the system in the "real world". The tests results were positive with users being able to find interesting things and getting pleased about using the system.

ACKNOWLEDGEMENTS

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