D6.3

Visualisation and Interaction Recommendations

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WP6 focuses on the development of technologies that assist users to perceive and control their online presence. Part of these technologies is the disclosure-scoring framework, which summarizes in a quantitative manner different aspects of the presence of a user in the OSN. This allows the user to see the current 'disclosure state' of her OSN profile. Building on this, WP 6 also provides a set of tools that enable users to more easily tailor their disclosure settings as well as a set of visualization tools that enhance online presence awareness.

The goal of the work carried out in task 6.3 in particular, is to develop front-end visualisations of a user's online presence, generated based on output from the developed tools for various functionalities of the USEMP web application. In WP4, a number of initial visualisations were developed and tested with potential users of the DataBait system. From this testing, a preferred visualisation was chosen for subsequent development in T6.3. During the course of WP6, the selected visualisation will be further developed and iteratively refined and evaluated with the aim of ultimately producing a set of recommendations or guidelines for other practitioners in the field. This deliverable describes some of the background and motivation for this work and presents the planning for the remainder of task 6.3.

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1.Introduction

As the main connection between the user of the DataBait system and the complex network of systems and tools underlying it, front-end interfaces play an important role in the overall user experience. They ultimately guide the users towards not only a more detailed understanding of their online presence and the information that they disclose, but also provide them with a deeper sense of control over this information. It is essential then that the visualisations employed for the different parts of the USEMP web application act in a way that both supports the users and at the same time inspires them to take a more active role in the monitoring and control of their online profile.

In order to achieve this, emphasis must be placed on the development and analysis of the appropriate visualisations and the subsequent derivation of a number of relevant design recommendations.

In D4.3 we developed a number of visualisations before testing them and finally choosing a visualisation for subsequent analysis and development, presented in this document. This work begins by first reviewing the relationship between the fields of visualisation and interaction and their crossover with the domain of personal information disclosure and how any complementarities can be used to our advantage.

Some emphasis will also be placed on the composition of the so-called 'disclosure scoring' framework, with an explanation of how the set of scores is composed and generated and how this links to the presentation of the visualisation developed in D4.3. The first version of this deliverable will place more emphasis on the design of an iterative process of evaluation for our visualisation that will both enable the development of recommendations and help to refine the design and increase its overall effectiveness. This will first require a description of the iterative design process that will ultimately lead to the production of a set of visualisation recommendations for other practitioners in this field. The actual iterative design process and its results will be described in the second version of this deliverable (D6.6).

2.Background

Visualisation as a research topic has grown increasingly popular in recent years, since it is a way to present potentially complex ideas and large data sets in a more accessible manner. In D4.3 we reviewed the areas of visualisation and interaction and discussed the crossover between the two. In what follows, we are also concerned with the crossover between the two fields and in particular how this links to the field of online social networks.

Information visualisation and the associated tools have been investigated and used in a wide range of fields. In the academic HCI field, the main aim, as stated by (Card, Mackinlay, & Shneiderman, 1999) is to "augment human cognition by leveraging human visual capabilities to make sense of large collections of abstract information". Similarly (Heer, Card, & Landay, 2005) state that it "provides a means by which humans with constant perceptual abilities can grapple with increasing hordes of data". For (Card et al., 1999), the key benefits of their implemented visualisation tools are: to facilitate awareness and understanding, to help raise new questions and supply answers, to generate insights or to tell a story and make a point.

In the world of product marketing, we observe similar motives for the use of information visualisation tools, such as for the acceleration of a user's perception of a product, for the comparison of data from different sources and measurement units or to rapidly inform and communicate on the essentials of a particular product (Laethem & Body, 2008). In this field a number of tools have been produced, for example, the mapping of "expectations/satisfaction" for a particular product or competitive positioning.

The idea of using a privacy score to indicate the potential privacy risk to users of social networks was investigated by (Liu & Terzi, 2010). They argue that even sophisticated/expert users who do value privacy will often compromise their privacy in order to improve their online presence and comment that even if users know this is happening in the long term, they cannot assess the risk accurately. The authors propose a framework that estimates a privacy score with the ultimate objective of enhancing public awareness of privacy and to help the management of personal information. The privacy score is computed using a mathematical model that calculates a score for both the sensitivity and visibility of the revealed information. These individual scores are then combined to compute a final privacy score. The kinds of information that are taken into account for this computation include the user's real name, email, home town, mobile phone number, relationship status and sexual orientation. Within WP6 (T6.1) we have extended the original work of (Liu & Terzi, 2010) and have formulated a much more expressive framework for quantifying the different aspects of information disclosure in OSNs. More specifically, the scoring framework provides a significant number of scores related to different aspects of information disclosure (e.g. sensitivity, visibility, level of control, etc.). Additionally, the USEMP scoring framework organizes the disclosed information in hierarchical and semantic manner. Effectively, the scoring framework generates a wealth of structured quantitative data about information disclosure. One of the central themes of this deliverable is the visualization of the information produced by the scoring framework. Later in this document we provide a brief reminder of the inner workings of the scoring framework; for more details though, please see D6.1 and D6.4.

Exactly how to present this privacy scoring framework is an important consideration and many parameters exist, which can be used to investigate this. Freeman (Freeman, 2000) in his work on the visualisation of social networks in the sociological research field provides examples of

how it is possible to encode information using spatial position, color, size and shape. The authors argue that this approach supports visual search and analysis of a social network, finding, via a public installation and controlled studies of the system, that it is usable and "facilitates discovery, and the potential for fun and engaged social activity". This supports the view of (Tufte & Graves-Morris, 1983) who state that a visualisation should encourage the eye to compare different pieces of data and, if possible, reveal the data at several levels of detail from a broad overview down to fine detail. A natural way of revealing these several layers of detail then would be via a process of interaction with the visualisation. This is an aspect which must be directly integrated into the Data Bait privacy dimensions visualisation.

2.1. Interaction and Visualisation

The study of interaction in conjunction with information visualisation has, according to (Yi & Kang, 2007), been somewhat neglected. The two fields are complimentary in nature and it is not difficult to imagine a visualisation that reacts to or is altered depending on the user's interaction with that visualisation. The authors argue that a kind of dialogue between the user and the system can provide benefits over traditional information visualisation techniques since it becomes possible to dynamically interact and investigate or offer multiple perspectives of the data that is being visualized.

(Yi & Kang, 2007) argue that it is necessary to refine what constitutes interaction for this kind of task and seek to identify the fundamental ways that interaction is currently used in information visualisation systems and the benefits it brings. After an extensive review of the interaction and data visualisation literature the authors find that there are seven generally used interaction techniques that provide users with the ability to directly or indirectly manipulate and interpret representations and are based around 'user intent'. The defined techniques are:

- **Select**: users can mark something as interesting in a potentially large set of data, making it stand out from the rest.
- **Explore**: users can see 'something else' by interacting or moving around within the data in order to expose other views of the data that may otherwise have been hidden.
- **Reconfigure**: Again, based around providing different perspectives of the data, other views/arrangements are generated according to the interaction.
- **Encode**: different representations can be displayed to the user. The user is provided with the ability to change the colour coding or overall representation of the data.
- **Abstract/Elaborate**: Reveal more or less detail from visualisation via simple controls, for example via simple mouse hovers over areas of interest or zooming.
- **Filter**: show something based on certain filtering conditions. Users have the ability to specify different criteria that alter the visualisation in some way.
- **Connect**: users can highlight associations and relationships between different data items via clicking etc.

(Elmqvist et al., 2011) discuss the relationship between interaction design and visualisation, arguing, similarly to (Yi & Kang, 2007), that not enough emphasis has been placed on the interaction aspects of visualisation, particularly in the information visualisation research community. They believe that interaction in the field of information visualisation is the catalyst for the user's dialog with the data, and, ultimately, the user's actual understanding and insight into that data. They review the existing literature in order to formalize this relationship between interaction and visualisation with the ultimate goal of producing a number of guidelines that will aid practitioners in this young field.

As there is a lack of interaction design in the information visualisation field, the authors put more emphasis on the Human Computer Interaction field and some of the more common themes, such as the direct manipulation paradigm or Norman's gulfs of execution and evaluation, or the more cognitively based embodied interaction field. They attempt to tie together the related work, theories and frameworks into a concept of 'fluid interaction' and how this may be applied to information visualisation. Fluid interaction is defined using a number of different characterisations including "the promotion of flow", the support for direct manipulation and minimization of the gulfs of action.

A number of example interactive visualisations are then presented and, from these, eight design guidelines are deduced:

- DG1: Use smooth animated transitions between states.
- DG2: Provide immediate visual feedback on interaction.
- DG3: Minimize indirection in the interface.
- DG4: Integrate user interface components in the visual representation
- DG5: Reward interaction
- DG6: Ensure that interaction never 'ends.'
- DG7: Reinforce a clear conceptual model.
- DG8: Avoid explicit mode changes

The kind of interactive visualisations developed for the DataBait application must take as many of these design guidelines described above into account as possible. Similarly for Yi and Kang's interaction techniques some emphasis will be placed on the 'explore' and 'connect' techniques. The explore technique is particularly important since we desire users to actively explore their privacy score profile and discover information that could otherwise be obscured. The 'connect' interaction is important in the DataBait context since one of the main aims of the visualisation is to provide the user with an understanding of why one privacy dimension may be over exposed. It must be possible for the user to connect this over exposure to a particular set of data. By attempting to take these interaction techniques and design guidelines into account we provide the user with the ability to explore their privacy profiles and reveal more information about specific privacy dimensions by simply interacting with them in a way which is both natural and engaging.

3. Disclosure Scoring Framework

As mentioned, work conducted for T6.1 involves the derivation of a *disclosure scoring framework*[1], which defines a structure suitable for compact presentation of a user's disclosed information. This information is organized in a hierarchical and semantic manner. In particular, it condensed into a set of eight *disclosure dimensions* at the top level (listed in Figure 3) that summarize the different aspects of a user's privacy profile. Each dimension have a corresponding set of attributes and each attribute has a *value*. For instance, the dimension "demographics" may have the attributes, age, gender, nationality, etc., and the gender attribute can take the values "male" or "female".

Within the disclosure scoring framework there are a number of different scores that express different aspects of information disclosure and may potentially be used for the purposes of visualisation. For instance, there is a score that expresses some dimension's, attribute's or value's visibility to other OSN users or to the public. There is another score that expresses the level of control that the user has over the disclosure of some dimension, attribute or value. Importantly, there is also a privacy score that puts together the most important of the other computed scores and that summarizes the overall disclosure risk associated with some node in the hierarchy. The set of scores is computed based on input from a number of different sources and reflects the inferences made from our inference mechanisms, developed within WP5 and WP6, which attempt to reveal the values of different user attributes. A number of different inference mechanisms are being developed, based for example on the media that they have previously shared on OSNs or based on digital trails that people leave behind when using OSNs. These trails can take the form of a set of 'likes' from the user's Facebook activity or other data that trackers picked up from visited websites. For more detail on how these scores are computed the reader is referred to D6.1.

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[1] Please note that the disclosure scoring framework was previously (in D6.1) referred to as the privacy scoring framework. Nevertheless, due to remarks about the legal definition of the term privacy, it was decided to use the term disclosure scoring framework instead. So, please keep in mind that the terms privacy and disclosure may often be used interchangeably in different deliverables and that the term disclosure expresses more accurately the scenarios that we are dealing with here. For more details on this issue please see D6.4.

While each of the scores of the scoring framework is potentially useful for the visualisation development, it is the ***privacy score*** that formed the bases for the development in D4.3. Each privacy dimension (depicted in Figure 1) can be ranked with respect to the privacy score, which can takes values between 0 and 1, giving an effective 'exposure' level for each dimension. For example, if a user's *Location* privacy dimension has a privacy score of 1.0 and their *psychological traits* dimension has a privacy score of 0.3, this means that their Location is much more exposed than their psychological profile.
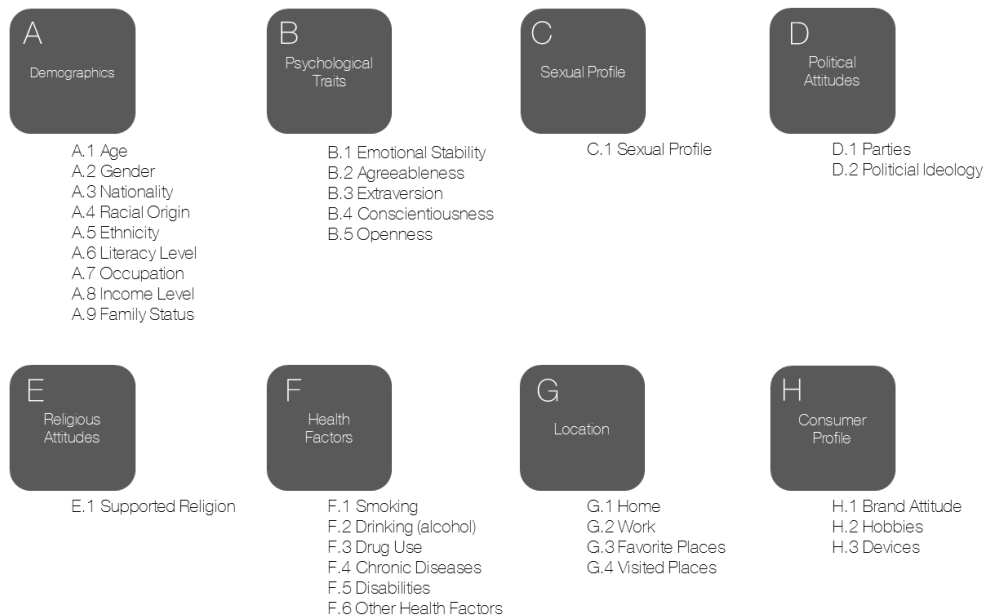
A Demographics	B Psychological Traits	C Sexual Profile	D Political Attitudes
A.1 Age A.2 Gender A.3 Nationality A.4 Racial Origin A.5 Ethnicity A.6 Literacy Level A.7 Occupation A.8 Income Level A.9 Family Status	B.1 Emotional Stability B.2 Agreeableness B.3 Extraversion B.4 Conscientiousness B.5 Openness	C.1 Sexual Profile	D.1 Parties D.2 Politicial Ideology

E Religious Attitudes	F Health Factors	G Location	H Consumer Profile
E.1 Supported Religion	F.1 Smoking F.2 Drinking (alcohol) F.3 Drug Use F.4 Chronic Diseases F.5 Disabilities F.6 Other Health Factors	G.1 Home G.2 Work G.3 Favorite Places G.4 Visited Places	H.1 Brand Attitude H.2 Hobbies H.3 Devices

Figure 1: The privacy dimensions derived in WP6, with a list of example representative attributes to be used for the USEMP field trials.

In addition, other scores, for instance, the confidence level of a value or its sensitivity, hold potential to be exploited by the visualization It should also be noted that - as demonstrated in D6.1 - even when a user shares little information, inferences can be made about their disclosed information, e.g. based on the behaviour of their connections from a user's social graph. It is important for the user to understand that this *inference* has taken place. With all of these influences on a user's privacy profile, it is important that it is represented to in a way that is both coherent and accessible. The overall privacy scoring framework provides us with a potentially rich design space for the visualisation development to be carried out for the remainder of T6.3.

4. The USEMP Visualisation Approach

In D4.3, work was presented on the design of a visualisation for the disclosure scores of a user. After a User Centered process of design and discovery, three different visualisations of the privacy vector were generated as illustrated in Figure 2.

Figure 2: The three potential visualisation approaches that were investigated in D4.3. Top: 'bubbles' overview, Bottom-Left: 'Flower' overview, Bottom-Right: 'Angles' overview.

These visualisations were initially tested with potential users of the DataBait system via a questionnaire designed to glean from the users some of their privacy concerns and how these related to the three visualisations. They were then asked to rate the visualisation based on eight different criteria, listed below.

- *Impact on behaviour* – *"This visualisation could cause me to change my behaviour on social networks."*
- *Control tool* – *"This visualisation could help me to control the exposure of my private life on social networks."*
- *Perception tool* – *"This visualisation improves my perception of my degree of exposure of my private life on social media"*
- *Utility* – *"This visualisation is useful"*
- *Attractiveness* – *"This visualisation is attractive"*

- *Intuitiveness* – *"This mode of visualisation is intuitive"*
- *Relevance* – *"The information is short and relevant"*
- *Readability and Understanding* – *"The visualisation is readable and easy to understand"*

For all of these criteria, the results showed a preference for the 'bubble' visualisation as illustrated in Table 1.

	Bubbles	Flower	Angles
Readability and Understanding	84%	39%	70%
Relevance	79%	35%	72%
Intuitiveness	72%	19%	67%
Attractiveness	72%	26%	69%
Utility	76%	40%	70%
Perception tool	80%	29%	71%
Control tool	73%	31%	59%
Impact on behaviour	86%	53%	66%

Table 1: Results from a questionnaire showed a preference in all of the categories for the 'bubbles' visualisation. Percentages represent the proportion of people who positively agreed with the statement.

This visualisation will now be further developed to fully represent the DataBait system. As well as development of the visualisation itself, this will also require further development and testing of the interaction mechanisms that will eventually be employed. An example of a potential interaction schema is illustrated in Figure 3, whereby a user simply clicks on the disclosure dimension that they feel is 'over exposed', in order to display more information about it. Eventually the user is confronted with the media that caused this overexposure.
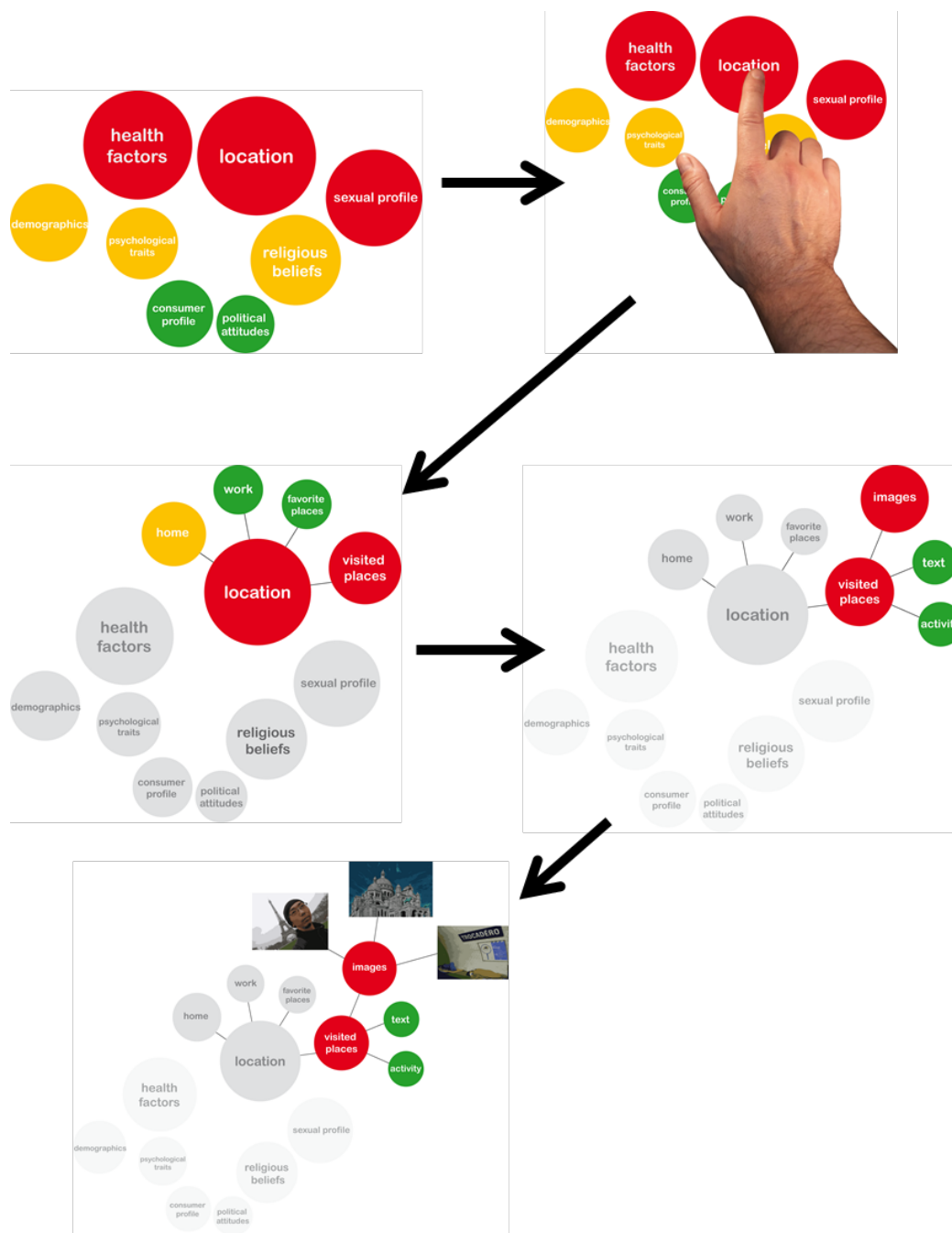
Figure 3 : An example of how interaction with the bubbles visualisation may progress. This example was used during the course of the work conducted for D4.3.

5. USEMP Web Application

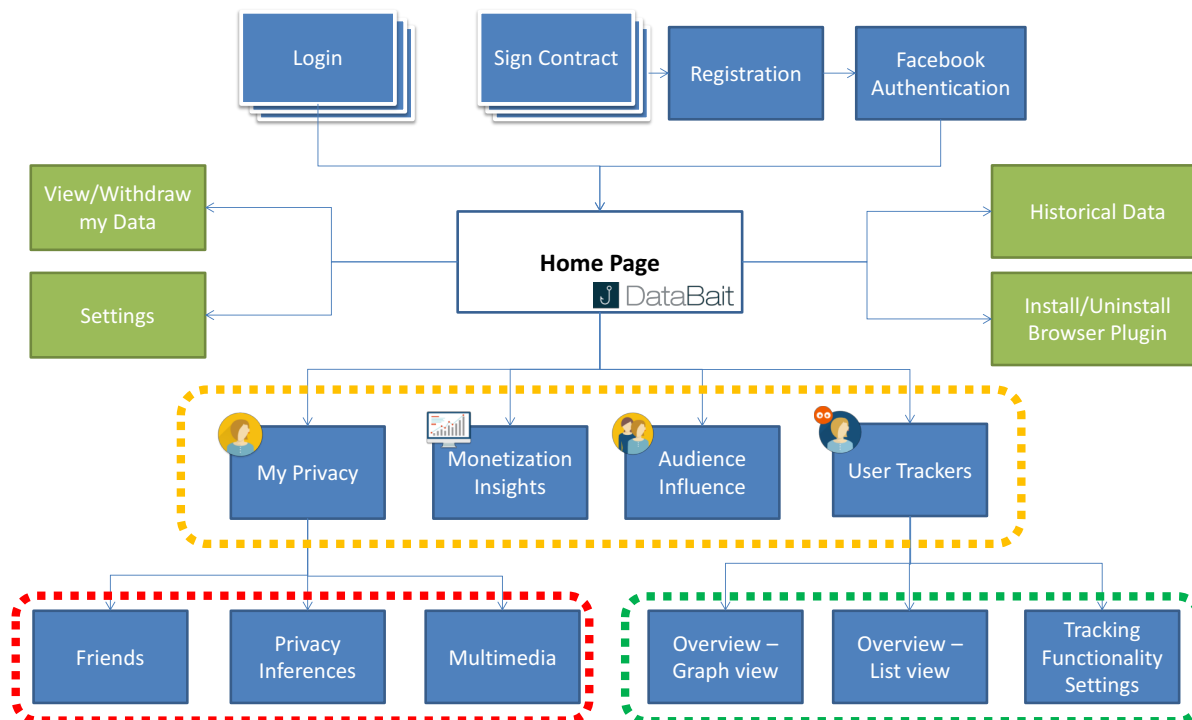The USEMP web application takes the form indicated in Figure 4 and is described in detail in D7.2.

Figure 4: DataBait High-Level UX Flow. From D7.2

The web application is based around a central home page, which has four different sets of functionality as circled in orange in *Figure 4*. In terms of visualisation there are two main sections that concern the work conducted in D6.3. The first is 'My Privacy' (most likely this will be renamed to something like 'My disclosed information', or something similar, in future versions of DataBait) and contains three subsections (circled in red), each of which will require a separate visualisation development. The second set of functionalities is 'User Trackers' (circled in green), which provides different views of how a user is being tracked online. Both sections are described in more detail below.

5.1. Visualisation Modes – "My Privacy"

The My Privacy section of the DataBait user interface contains three sub-sections, each of which requires a slightly different scenario to be devised in order to better understand the different interactive steps that need to take place and the different aspects of the interface that must be developed. The current description is the initial conceptualisation that will grow and evolve as the design process progresses, based on a combination of user feedback and expansion/limitations of the developed technologies elsewhere in the project.

• **Privacy Inferences** – This sub-section will provide the user with a general overview of their online presence, as was developed in D4.3, which is both interactive and reactive,

enabling the user to explore their disclosed information – as represented by the disclosure scoring framework - in a way that supports their view and offers a greater sense of control.

- **Friends** - Initial conceptualisation surrounding this sub-section involved showing a user a list of their friends and which friends have an influence on their OSN presence. This would also be interactive, providing users with the ability to find aspects of their friends' behaviour, which have had an effect on their OSN presence. It is envisaged that this will help the user to better understand the effect that e.g. allowing friends to tag them in photos or check them in at specific locations will have on their disclosed information.

- **Multimedia** - This sub-section will contain a view of a user's shared media and information that it discloses. For example, there might be a specific photo that gives too much information about a DataBait user's location that they might want to consider removing. Or there may be some photos showing the user drinking alcohol or smoking that they do not want to be visible. This functionality should provide the user with specific information about what is affecting their profile.

The combined effect of each of these features should provide the user an overall view of their disclosed information and the various factors that influence it, including their media and their connections. This, it is envisioned, should help with the subsequent disclosure policy rule setting described in detail in D6.2.

Below we provide the initial mini-scenarios for each aspect of the 'My Privacy' section of the DataBait user interface along with their initial design. These initial designs will be further researched, refined and evaluated for the remainder of T6.3.

5.1.1. Visualisation Mode Scenarios

The scenarios for our three sub-sections are rather simple in nature. We might imagine a user who is exploring the DataBait user interface, as they click each section they are presented with the corresponding functionality. What we would like to examine here is this user's interaction with the visualisation that they are presented with and how this could potentially be made more intuitive or coherent.

Privacy Inferences

The privacy inferences tab represents the most general overview of a DataBait user's disclosed information. As mentioned, here the user's disclosure scores are represented using the 'bubble' visualisation presented below. Figure 5 shows the first version of this representation in the context of the first DataBait user interface designs.

Figure 5: A basic bubble visualisation of a DataBait user's disclosure scores.

The user sees that their location bubble is large and red and they wonder why this is the case. The user touches the location button to reveal another layer of information. Interaction at this level involves simple clicking on the disclosure dimension of interest to reveal more detailed information, as illustrated in Figure 6, where several layers of expansion have been revealed.
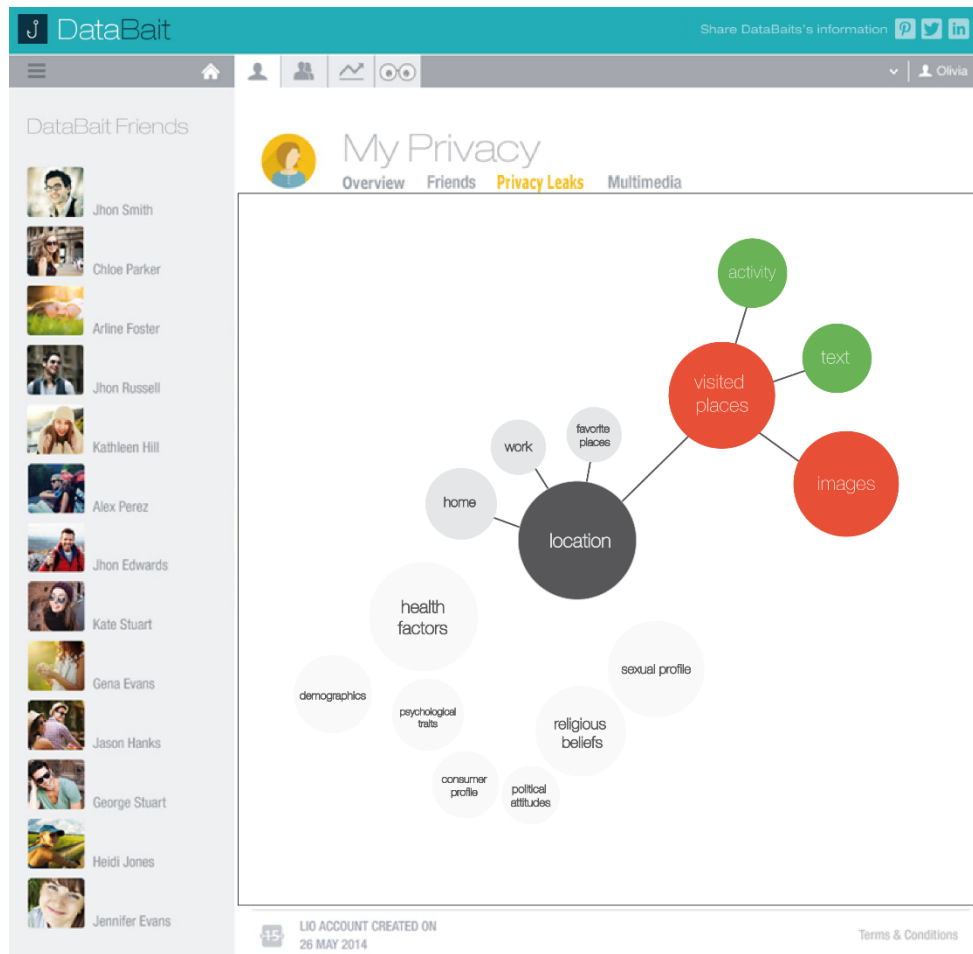
Figure 6: An expanded view of a user's disclosure profile after several layers of interaction.

The user finds that his location is being revealed by some of the images that he has shared. Those specific images can be revealed to the user and he can take actions such as removing tags or deleting the photo from his profile, for example.

Friends

Our DataBait user then clicks on the friends tab to reveal a list of disclosure dimensions as illustrated in Figure 7. The user clicks one of the dimensions to reveal which of their friends are influencing it.
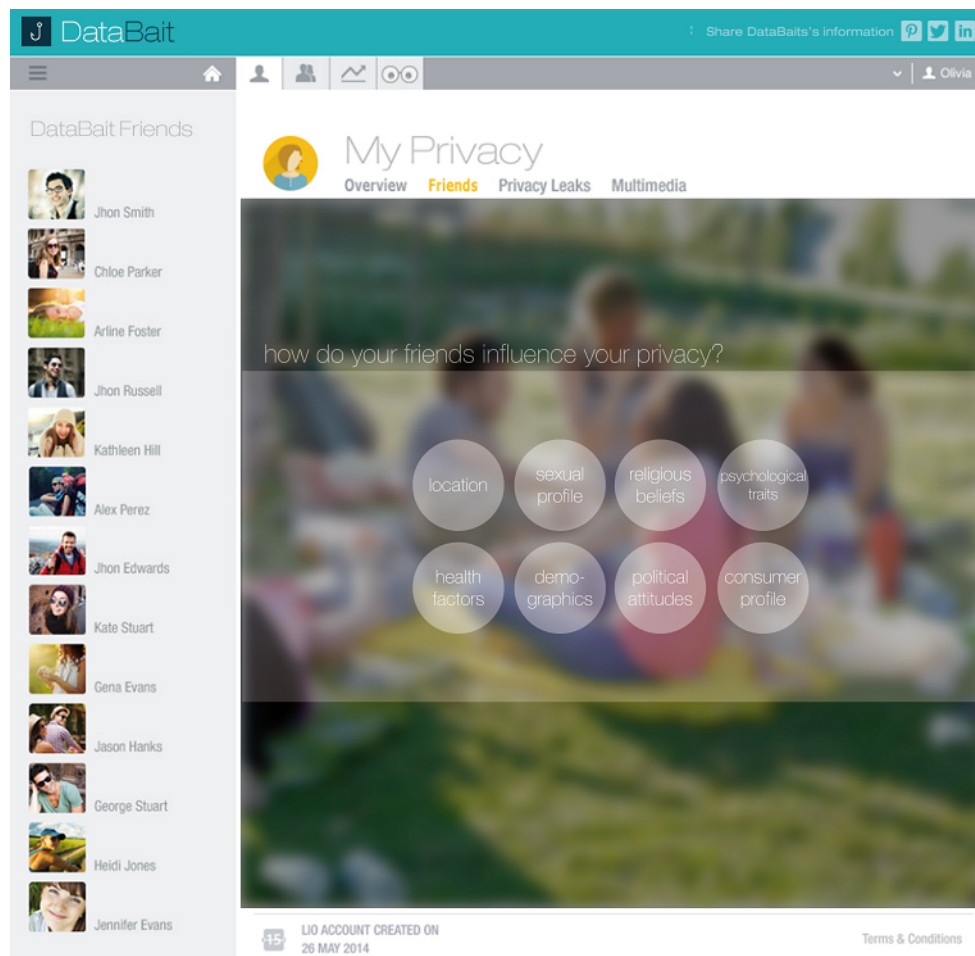
Figure 7: A list of disclosure dimensions are offered to the user. She may click on one of them to find out which friends have some influence on that dimension.

Our user would like to see some information about who is exposing his location so he taps the location bubble, which reveals the view shown in Figure 8. They can now see which friends are having a direct effect on the exposure of their location and what this particular friend has done to cause this, which will then help our user take action to change this by changing their sharing settings. A further iteration of this interaction could also involve selecting a specific friend to receive a report of how that friend is influencing their disclosed information.
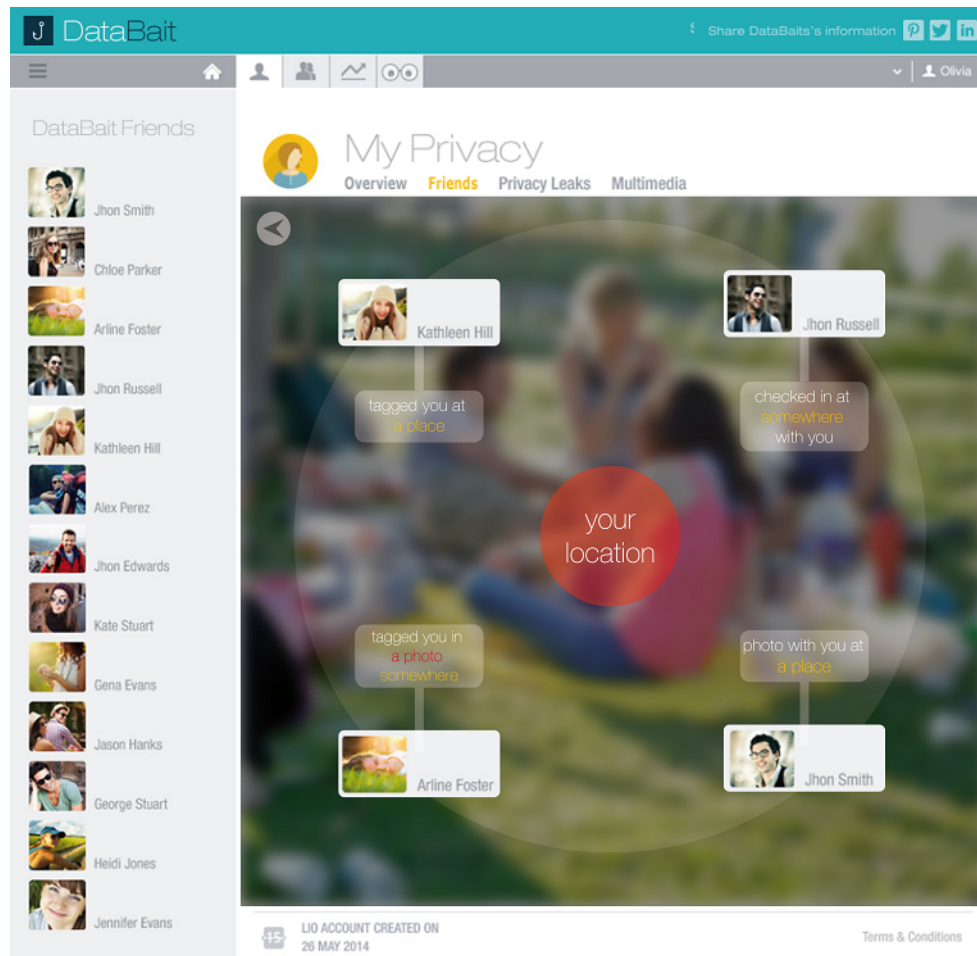
Figure 8: After clicking on the location dimension in Figure 7 the user might be presented with a view of which friends have an influence on that dimension and what causes this.

Multimedia

The user then clicks on the multimedia tab to reveal a list of their shared media, such as videos and photos. In this case we display a list of their shared photo albums, as illustrated in Figure 9. They select a particular album and the photos are displayed with a coloured outline that provides some information about the influence of that photo on the user's disclosed information.
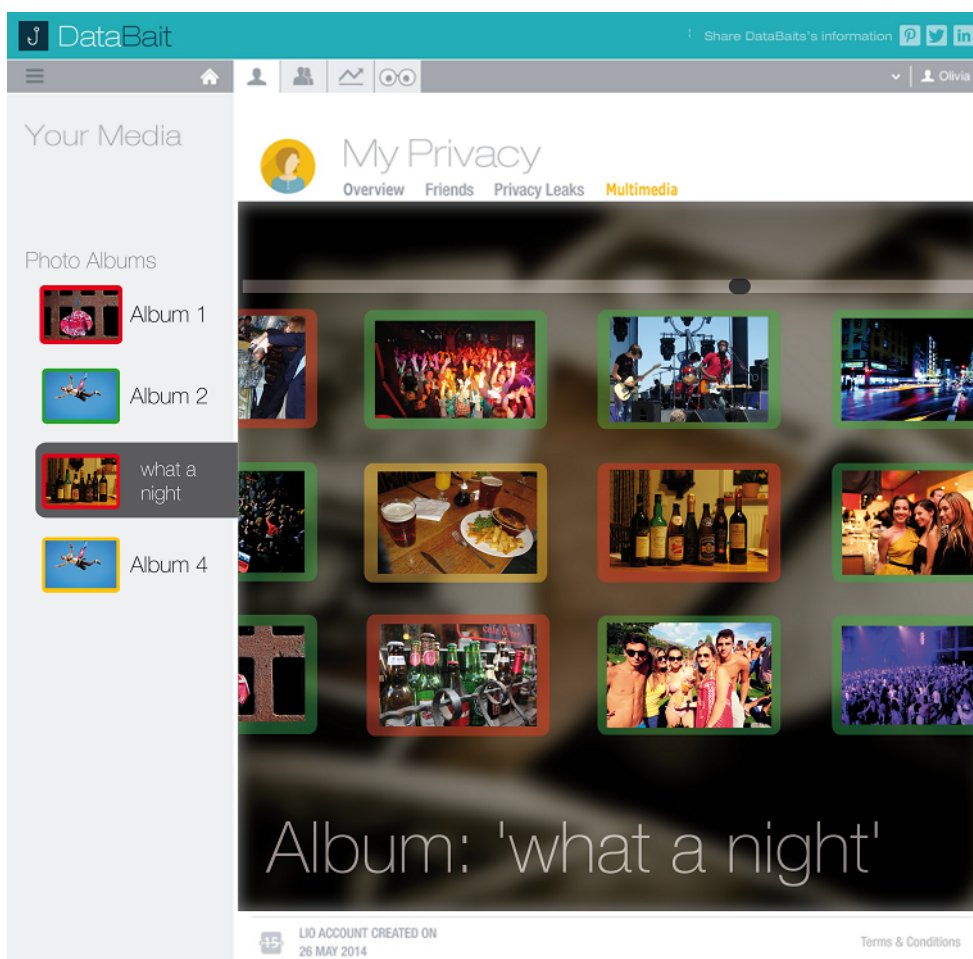
Figure 9: A list of shared photo albums is displayed. Each photo is highlighted with a color corresponding to its influence on the user's disclosed information.

Our user clicks on a photo outlined in red in order to find out why this photo is causing information disclosure. Figure 10 shows the selected photo along with the disclosure dimensions that are affected and the terms that were extracted from the photo. The user now has a clear idea about the effect of this photo on their disclosed information.
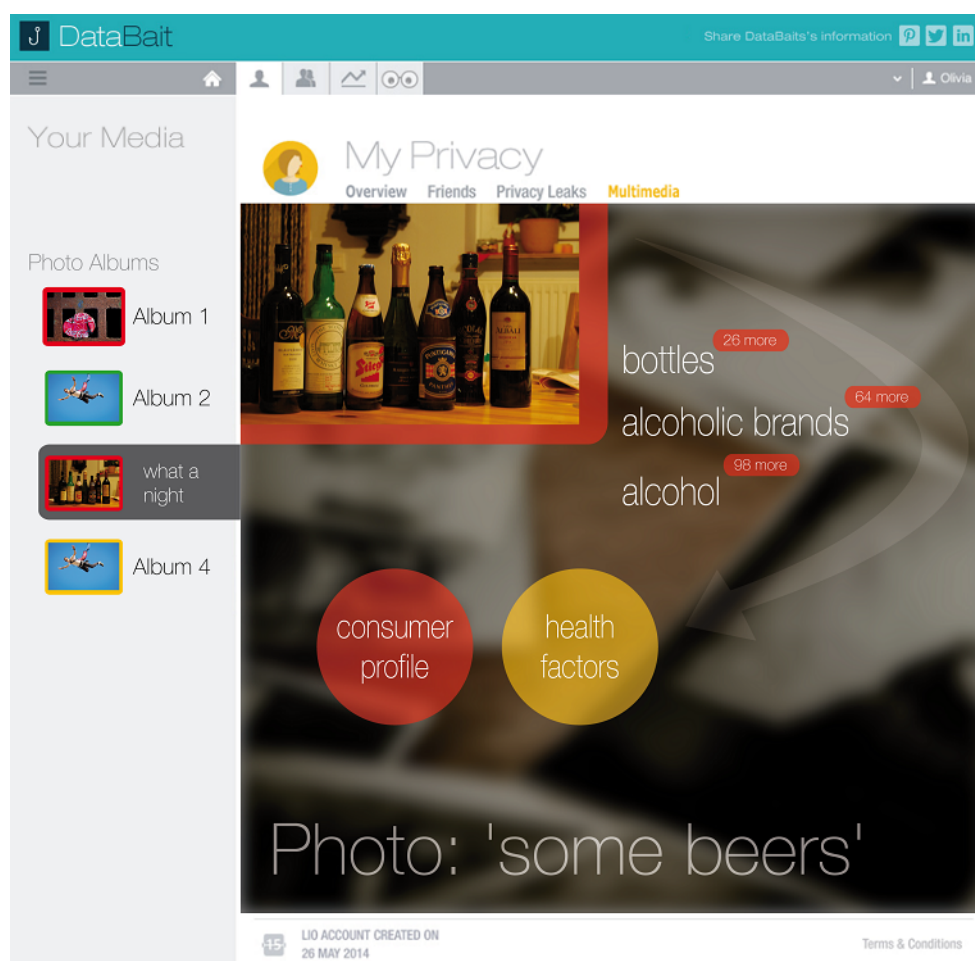
Figure 10 : The user clicks a particular photo to see what disclosure dimensions are being exposed by that photo.

5.2. User Trackers Visualisation

The User experience related to USEMP "User Trackers" functionality is provided to USEMP end-users through two basic components: a) USEMP web browser plugin, a) USEMP web application related section "User Tackers".

The following user flows are supported for the interaction of the USEMP frontend user with these two components:

- WEB users install in their WEB browser the USEMP web browser plugin (USEMP plugin)

- **USEMP plugin**:

    o detects all the web pages components which are responsible for tracking user web behaviour and send these data to the USEMP backend systems.

    o can perform blocking/unblocking actions on these components as selected by USEMP plugin or USEMP GUI once the user has successfully logged in.

- o   users can use the USEMP plugin to view an overview of tracking information and perform actions (enable/disable tracking) on trackers for each individual web page.

- **USEMP web application**

  - o   after users have registered they can   view information about tracking information for each web page they have visited and perform blocking/unblocking actions on these components, these actions are enforced by the USEMP plugin

For USEMP purposes trackers are identified in web browsing behaviour as HTTP cookies set in the WEB browser by 3rd parties (organizations which web pages do not belong to and are identified by different domain names than the ones used in the corresponding web pages). Trackers related information is depicted in suggested visualizations described in the rest of the section. The related functionality for identifying trackers (pieces of code responsible for tracking) and related challenges are described in detail in D6.2.

5.2.1. USEMP Plugin for Web Tracking

The USEMP plugin has the form of a web browser addon that is installed by USEMP users to their browser. Once installed, the WEB plugin provides quick access to its functionality through an icon installed in the browser URL address bar: Since USEMP plugin takes the form of web addon a different set of best practices for its UI are applied (see for example guidelines for Chrome   WEB   browser   &   additional   restrictions   applied http://developer.chrome.com/extensions/faq,http://developer.chrome.com/extensions/single_ purpose)
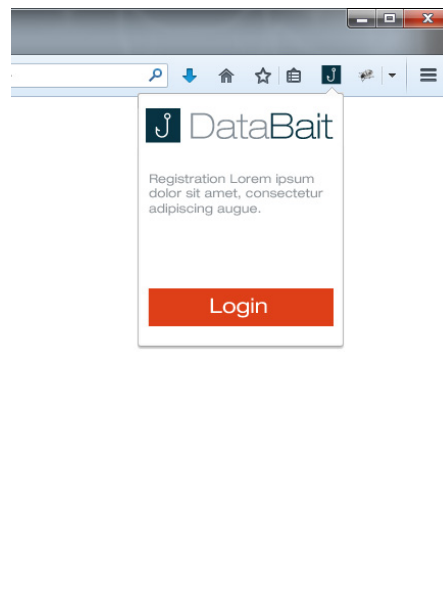

Figure 11: USEMP plugin icon for quick access from end-users through WEB browser address bar (Chrome browser look & feel)

The USEMP plugin requires that the user logins with the provided user credentials (user/password) that he/she has received from registration through the USEMP web

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application. Once the user is successfully authenticated he is provided access to the USEMP plugin functionality in two alternative views: graph view and list view. Both views support the functionality for end-users: a) to be able to view a summary piece of information related to tracking, b) to block/unblock tracking of information from an identified tracker

Graph View

Once the USEMP user has authenticated, USEMP plugin Graph View visualizes identified trackers as nodes of a graph, part of which are also web pages that the user has visited. In this view, a web page node and a tracker node are connected if a tracker has been included for tracking purposes in the web page. The user can perform actions on the trackers/web pages by selecting them. The overall view has a constrained window size that is limited in order to provide users with quick overview information for the current web page. It is also possible to change the view (visualization) to that of List visualization described below through a corresponding button element.
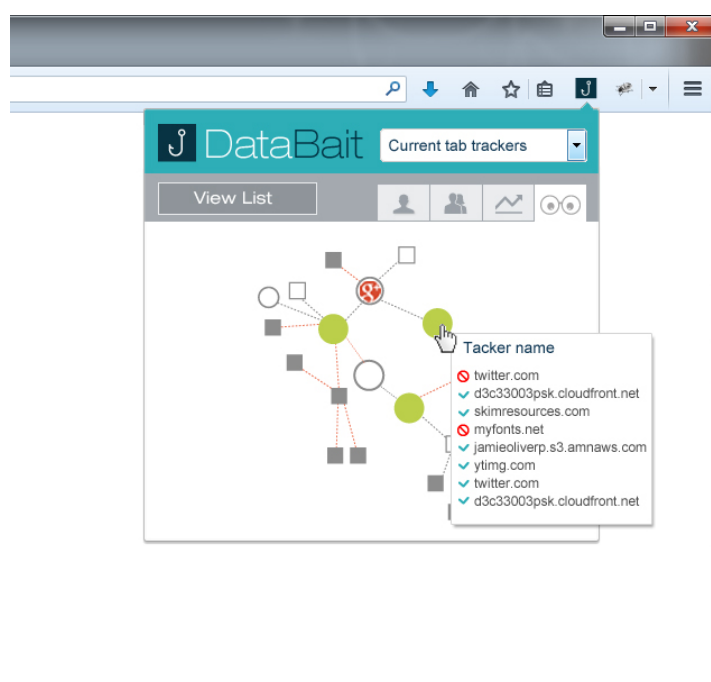

Figure 12: USEMP plugin graph view provides USEMP end-users a graph representation of current web page visited and corresponding tracking information

List View

In this view, trackers for the current web page are depicted as members of a list. Each member of the list includes a short title for the tracker for the currently visited page and the related info. The user can perform actions on the trackers/web pages by selecting them in the list. The overall view has a constrained window size that is limited in order to provide users with quick overview information. It is also possible to change the view (visualization) to that of the graph visualization described above through a corresponding button element.
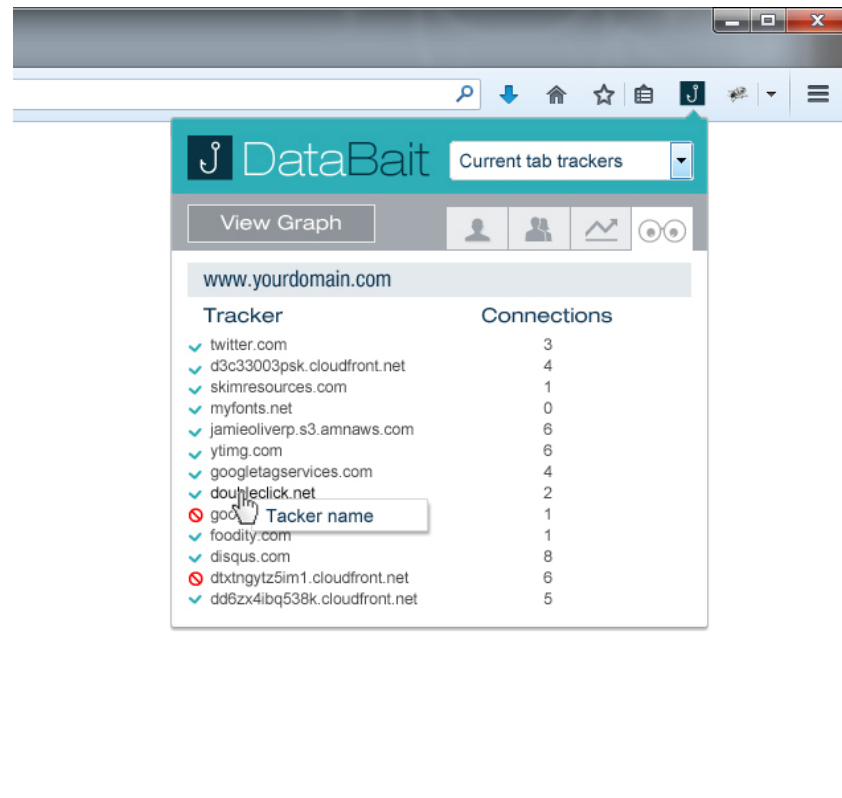
Figure 13: USEMP plugin list view provides USEMP end-users a list representation of current web page visited and corresponding tracking information

5.2.2. USEMP Web Application Views for Web Tracking

The USEMP web application views related to web tracking plugin has the form of web pages that are part of the overall USEMP web application. Once the user has authenticated with USEMP he/she is able to access these pages that provide him with a more detailed view for tracking information for all his recently visited web pages, contrary to the USEMP plugin views, which are limited only to the currently visited page. The available information and actions are also organized in two views: Graph view and List view. Additionally a Settings view is proposed that allows the USEMP user to define global white/black lists for actions (unblocking/blocking) that apply to trackers for all visited sites. The proposed visualizations are described in more details in the paragraphs below.

Graph View

The Graph View visualizes identified trackers as nodes of a graph part of which are also user visited web pages, similarly to the USEMP plugin graph view. Contrary to the USEMP plugin view this graph includes all the recently visited web pages and the related tracking information. User can perform actions on the trackers/web pages by selecting them. It is also possible to change the view (visualization) to that of List visualization described below through a corresponding button element and to access the Global settings for managing trackers white/black lists (unblocking/blocking).
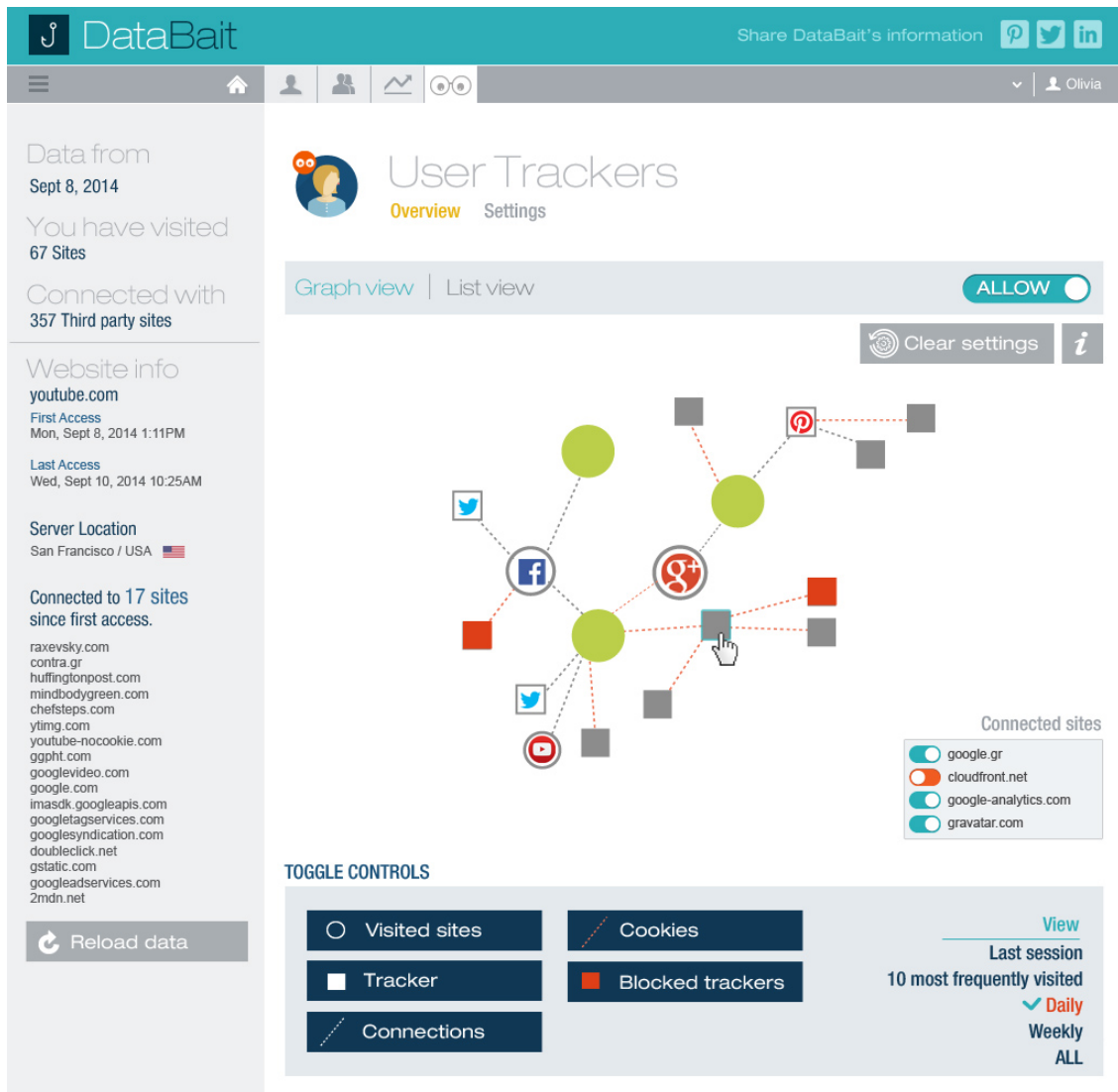
Figure 14: USEMP web application graph view provides USEMP end-users graph representation of all visited WEB pages and corresponding tracking information

List View

The List View visualizes identified trackers as members of a list which have been visited recently from the user. In this view each member of the list includes a short title for the tracker for one of the visited pages and their related info. The user can perform actions on the trackers/web pages by selecting them in the list.　It is also possible to change the view (visualization) to that of Graph visualization described above through a corresponding button element and to access the Global settings for managing trackers white/black lists (unblocking/blocking).

Figure 15: USEMP web application list view provides USEMP end-users list representation of all visited WEB pages and corresponding tracking information

Global Action Settings view

The USEMP web application allows the user to perform actions (unblocking/blocking) at two levels: a) each individual visited page, b) all visited pages (global actions). For the former, the user can utilize USEMP web application graph and list views and the corresponding UI elements for applying unblock/block actions.

For the later, a separate page is proposed in the USEMP web application. This additional page allows the end-user to manage two global lists that dictate behaviour with respect to blocking trackers without any additional actions from the user:

- **white list:** trackers that are added to the USEMP white list **are not blocked** by default with respect to tracking in visited web pages from USEMP users that have installed the USEMP plugin. Users can still modify this behaviour for individual pages.

- **black list:** trackers that are added to the USEMP black list **are blocked** by default with respect to tracking in visited web pages from USEMP users that have installed the USEMP plugin. Users can still modify this behaviour for individual pages.

In the proposed design these two lists are represented in the Global Actions Settings page and user is allowed to perform management actions to member items of these list (trackers).

Figure 16: USEMP web application Settings view provides USEMP end-users with list representation of Global Action lists (black/white) for all WEB pages and related actions

5.3. Audience Influence and Personal Data Value Insights

The 'Audience Influence" section will provide the DataBait user with a view of his/her audience for his/her actions on the Online Social Network and the influence they exert on that audience, both of which provide shared Personal Data value insights. Two views are proposed to allow the USEMP end-user to get Personal Data value insights:

- **audience overview:** this set of visualizations provide the end-user an understanding of what is his/her OSN actions' audience in statistical terms

- **social influence insights:** this set of visualizations provide the end-user with an understanding of how much influence he/she exerts on parts of the audience that may be grouped into communities as discussed in D6.2.

Audience Overview

In this set of visualizations a set of summary plots with respect to user's last OSN actions is proposed. There are four visualizations proposed: a) Gender distribution, b) Age distribution, c) Geographical distribution, d) Preferences distribution. These are overview visualizations can quickly provide the end user an insight of what is his audience.

Figure 17: USEMP Audience overview visualizations

Social Influence Insights

In this set of visualizations a graph plot is proposed that allow USEMP users to understand which of their social graph members ("friends") are more influenced and by which actions. The influence metric through which these insights are computer are described in D6.1. The

influenced members of a USEMP user social graph are visualized using a graph representation.
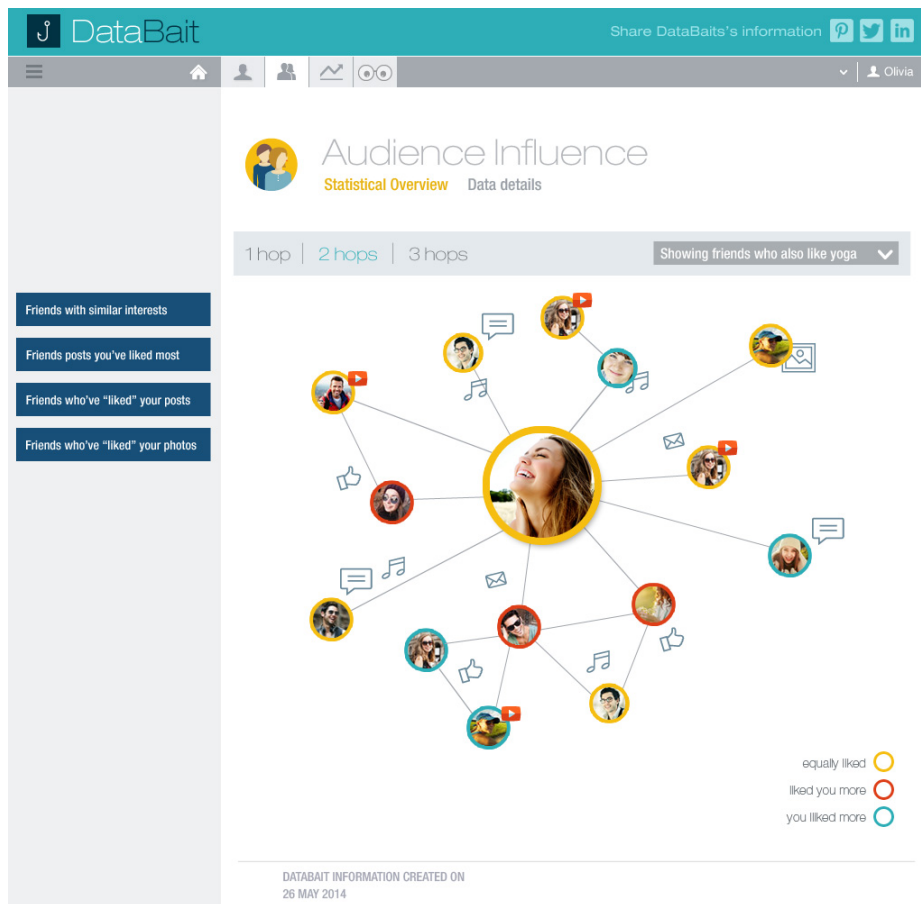

Figure 18: USEMP Social Influence Insights visualizations

6. Planned Evaluation Process

6.1. An Iterative Human-Centered and Participatory Design Approach

The involvement of potential users of the DataBait system from the beginning of the design process guarantees, to a certain extent, the acceptance of our visualisations by the users as a means of finding information. It enables the targeting of the real needs and expectations of users and thus enables us to highlight the key elements of a useful and intuitive visualisation tool. The aim of the evaluation phase is: (1) To obtain a better understanding of how people understand, interpret, and use the visualisation elements; (2) To assess the overall impact of the visualisation tool on perception and understanding of the disclosure level; (3) To deliver a process oriented feedback of information about the visualisation tool in order to improve the design after each iteration.

The evaluation phase covers the design and development of evaluation tools through scientific methods for acceptability, usefulness and usability applications. This consists of defining the relevant indicators for the key aspects of the visualisation application, developing the most adequate tools to obtain them, i.e.: (1) Relevance and adequacy of the content and outcomes of the visualisation application; (2) Impact of the visualisation application on the users and how that increases their perception/understanding; (3) Usability and usefulness of the visualisation application; (4) User acceptance, interest and willingness to use such a tool.

The conducted design process will be iterative, meaning that a repeated set of tools and techniques will be employed in order to refine and improve our scenarios at each step of the iteration process. The principal tools used and the reasons behind using them are described below. These tools will be applied to a high fidelity prototype (a mock-up with some functionality implemented) of the "My Privacy" section of the DataBait website, similar to that displayed in Section 5.1.

6.2. Expert Reviews

Expert reviews are reviews of an interface design that are carried out with a usability expert in order to apply a number of standard inspection methods such as heuristic evaluation or cognitive walkthroughs. Using our described scenarios the expert user will be able to provide feedback on and evaluate the heuristics and components of both the interface and the scenario at hand. The recommendations picked up at this phase can then be integrated to the current interface design before the next tool is applied.

6.3. User Interviews and Usability Testing

Semi-structured interviews with end-users will take place in each iteration with the goal of gathering focused, qualitative textual data. This offers a balance between the flexibility of an open-ended interview and the more focused nature of a fully structured ethnographic survey. The participants will be presented with our scenarios and asked their thoughts about the designs. They will then be asked to answer some questions relating to the design, the potential

for interaction with it and how this might be improved. This feedback will again help to refine the data design. The questionnaire created for this purpose is described in more detail below.

6.3.1. Questionnaire

The questionnaire consists of five questions and two evaluations designed to draw out information from the potential users of the DataBait system in a way that will help the subsequent refinement of the designs.

- **Question 1** asks the user to rank the disclosure dimensions that are most important to them with the aim of possibly re-focusing the attention on specific dimensions if there is a clear tendency towards this.
- **Question 2** focuses on the colouring and the size of the bubbles. Interviewees will be asked how they feel about these two coding aspects and how they might be improved.
- **Question 3** is an attempt to understand whether the interviewee has understood the visualisation by asking them to state which media has caused the increased exposure level of the location dimension.
- **Question 4** focuses on the 'Friends' visualisation and is a simple attempt to see whether the interviewee has understood the visualisation presented to them. The interviewee will describe their understanding and the interviewer will note any interesting comments.
- **Question 5** relates to the media tab of the 'My Privacy' interface. The interviewee will be asked to describe what he understands from the presented visualisation. Any useful comments or insights will be noted by the interviewer and used for subsequent improvements to the design.
- **User Interface Evaluation**: This section is designed to directly measure the interviewee's feelings towards each of the visualisations. They will be presented with questions pertaining to the ease of use of the interface, the quality of the graphical interface and the system reactivity. Each question is marked on a scale of 1 to 7.
- **Benefit of Visualisation Elements Evaluation**: This section is again designed to measure the interviewee's feelings, this time about the visualisations elements themselves. This includes the motivational impact of the elements, the adaptability of the application to the user's needs and the added value of the visualisation elements.

The full questionnaire can be examined in Annex 1.

7.Conclusions

This deliverable has introduced the first phase of the work conducted on the design of visualisations for the display of a user's disclosed information, how this relates to the work conducted in several other USEMP work packages, notably WPs 4 and 7 and how the next phase of this work will take place for the remainder of task 6.3. We introduced the general background, focussing on the overlap between interaction design and information disclosure in online social networks and how this interaction works alongside the visualisation developed in T4.3.

The most important aspects of the work conducted elsewhere in WP6 and how they relate to the visualisation designs was explained along the further development of the selected visualisation from T4.3 that took place as part of T6.3. This initial 'bubble' visualisation was adapted to work alongside the DataBait web application described in WP 7 and now consists of three separate visualisation applications, i.e. Privacy Inferences, Friends and Multimedia, which all stem from the initial bubble design. The work conducted on the 'user trackers' section of the web application was also described that will ultimately enable a user to both visualise how they are being tracked and by who and enable them to take control by providing tools that make this process more tangible.

An important aspect of this first phase of D6.3 was the introduction of the evaluation plan that will take place for the remainder of T6.3. An iterative process for the further development of our visualisation and the corresponding interaction was described that will eventually lead to the goal of producing a set of guidelines which will aid the design and development of future online presence awareness technologies.

8.Annex I: Evaluation Questionnaire

Application "My Privacy"evaluation

Part 1. User's description

☐ Male　　　☐ Female

Date of birth: ☐ / ☐ / ☐　　　Age: ☐

Educational background and level: ☐

Job title: ☐

Years of experience in the current job title: ☐

Years of experience in the field of social Media: ☐

Used social Media: ☐

Visual problems (specify): ☐

Part 2. User tests

Question 1: *Look at the application « My Privacy » and rank the privacy dimensions from 1 to 8 in order of their importance to you.*

☐ Location
☐ Sexual Profile
☐ Religious Attitudes
☐ Psychological traits
☐ Demographics
☐ Political Attitudes
☐ Health Factors
☐ Consumer profile

Question 2: *In your opinion, what is the utility/meaning of the:*

- Bubble color?   *- Bubble size?*

Question 3: *Which media is responsible for revealing the user's location?*

☐ Activity   ☐ Text   ☐ Images

Question 4: *Which of the user's friends are influencing the "location" privacy dimension?*

(blank answer box)

Question 5: *Look at the shared photo albums and select a particular album. The photos are displayed with a coloured outline. In your opinion, what is the utility/meaning of the colours?*

(blank answer box)

User interface evaluation
1 (Strongly agree); 7 (Strongly disagree); N/A (Not applicable)

Ease of use	1	2	3	4	5	6	7	N/A
Learning to operate the application "My privacy" is intuitive and easy for me. If it is perceived to be difficult, please explain why:								
I feel comfortable using the application "My privacy". Some information is missing to help use of the application. Please specify:								
I find the application "My privacy" unnecessarily complex. Please specify:								
The learning is mentally demanding.								

Quality of the graphical interface	1	2	3	4	5	6	7	N/A
The interface of the application is pleasant.								
The visual information is easy to understand.								
The organization of information on the application screens is clear.								
Information is short and effective in helping me visualize my privacy exposure level.								
It is easy to find the information I need.								
I find some essential information is hidden or filtered out.								
I can easily adapt the size of text/images (*i.e.* zoom).								

The colour contrast is appropriate.								

System reactivity	1	2	3	4	5	6	7	N/A
This application has all the functions and capabilities I expect it to have.								
Some actions are not acknowledged the way I expected. Please specify:								
I have confidence in the application.								

Benefit evaluation of visualisation elements
1 (Strongly agree); 7 (Strongly disagree); N/A (Not applicable)

Motivational impact	1	2	3	4	5	6	7	N/A
I would enjoy using the application very much.								
The application improves my interest in my privacy management.								
The application promotes my self-efficacy in my privacy management.								
The engagement is low or nil.								
Interacting with the application is fun to do.								
I can effectively manage the privacy exposure level using the application.								
I am able to manage the privacy exposure level quickly using the application.								
The application is a motivating support for visualisation and understanding of my privacy exposure level.								
The bubbles are frustrating/annoying elements. Please specify:								

Adaptability of the application in needs	1	2	3	4	5	6	7	N/A
The application match with the informational objectives.								
The understanding of the visualisation elements when using the application is mentally demanding.								
The visualisation elements improve understanding the privacy exposure level.								

Added value of visualisation elements	1	2	3	4	5	6	7	N/A
Using the application is a good method to know the elements that I shared.								
Using the application is a good method to know the dimensions revealed by others (e.g. friends).								
The application makes privacy management more interesting.								
The visualisations elements are relevant and helpful.								
A good support is provided for correcting/reducing the privacy exposure level.								

Overall, I am satisfied with the application. If not, please specify:								33

Comments or suggestions

Would you like the system to provide other types of information?

9. References

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