When you cannot augment your brain capacity augment the information system interface

Prof. Paul Seabright, researcher in the areas of microeconomic theory, development economics, industrial policy in transition economies and state aids to industry, came out with a provocative statement which unveils a concrete risk for the Web of the future ”the ultimate bottleneck technology is the human brain”.

The vast amount of information that we’ve been creating with an “information-intensive” technology, at some point needs “to be simplified down and aggregated again so that it appears in forms that are useful for us to absorb. That is to say, in forms that result in better decisions and ways of living”.

The information overload effect is being tremendously amplified by the user generated content irreversible trend. In Telecom Italia R&D we have developed a significant background in mobile contextual data collection and aggregation, we defined and can determine someone’s context in detail (location, activity, preferences), we can easily access his/her surrounding context via the Web, we can aggregate and perform a match between the two, but the real challenge is finding a way to present these results in such a way that they are useful and appealing for end users.

The lesson learned is that the more information you have the less it’ll be useful unless you provide novel human–machine interaction mechanisms. Beside information permeability the human brain is also bound to discovery mechanisms which are primarily sensorial.

Augmented reality applications can achieve in the meantime these two goals (context based) information aggregation and visual display.

Our experience

Previous works at Telecom Italia Lab lead to the specification and implementation of a context management framework for mobile networks. Our context management system has been designed to avoid vertical context-aware applications and offer context-awareness to any application; two examples are a Recommender system and a mobile Social Network enabler.

Based on the impressive amount of information that the system is able to collect we got a number of interesting ubiquitous service concepts but we were immediately stuck in the difficulty of finding the proper interactive system, the more information you want to show, the more it gets difficult to provide an effective consumer interface.

To give an example here’re the steps we went through for implementing a fairly trivial use case: “how to suggest points of interest based on user’s location, friends’ review/comments and to navigate users to them”.

Despite the platform’s design was aimed at building a system to be horizontal enough to serve different applications, we realized that the “verticalization” was happening again at presentation level, with one interface for the geolocalized recommendations of POIs, one for retrieving our social network’s comments (e.g. by means of a tag search) and a navigation system for the logistic details.

A user was able to find what she/he needed by switching between the interfaces but it could be time consuming, sometimes misleading and giving users the perception of having a marginal role in this discovery process.

These concerns brought us to invest in Augmented Reality (AR) new service propositions and we elaborated new ideas by scouting the some of the current AR solutions on the market (e.g. Layar, Wikitude, Google goggles, Nokia Point & Find, Presselite, Junaio, Mr. Photo).

We finally ended up with prototyping a first Augmented Reality application.

This novel user interface paradigm is extremely flexible, for example a camera view augmented by any or just contextualized Points Of Interest can compound the traditional map view and let users choose the preferred interface from time to time (we call it “Augmented Map”).

The application performs an aggregation of Point of Interests from several POI providers, geolocalized contents, such as pictures from a Social Network or events from Last.Fm, that
can enrich the user experience.
Given the high number of source feeds and formats, the implemented solution is a mixed client-server architecture. Apart from the mobile application, a new server component was developed to reduce the complexity of the mobile application which typically runs on an environment with limited resources. The Aggregator provides a REST interface to request a set of Point of Interest belonging to any category or provider. The Aggregator takes care of translating the request into the format required by each single POI provider, fetching the items and converting them in a single data structure which frees the mobile application developer from dealing with each provider's detail. This solution guarantees a greater modularity when adding new item providers, most of the work consists in defining on the Aggregator an interpreter for the provider's messages, while very few modifications are needed on the client. This also solves the problem of "information overload". Having to deal with dozens of categories, each of them providing dozens of items, the total number of elements to display on the map can easily grow beyond the point in which the map would be completely covered by place-marks thus useless. The Aggregator prevents it by applying a clustering algorithm to reduce the number of items sent to the application selecting only the ones that might have an higher interest for the user. The basic idea of the algorithm is to group a dense region of map item, representing it with a single item which "approximates" the most relevant to the user. The similarity is the result of a "distance" function. Density based clusters are regions in which the density of objects is above a given threshold. By definition a region is dense of objects when several points are close to each other. The "distance" function used by the Aggregator to determine the overlapping degree between two items, whether they would be superimposed on the map or not. In order to compute this "distance", it is necessary that the client sends together with the reference position, the geometry of the map displayed on the device, that is the width and height of the map in pixels and the latitude and longitude spans.

Figure 1- Augmented Maps: map view

Map is not the only possible view for Point of Interest. It is possible to browse all the POIs in the user's surrounding through a list. This view is not affected by the "information overload" issue since a high number of items does not decrease the usability of the list itself. Augmented Maps is also able to show a detailed page with all the information available for each item from which, depending on the provider's features, it is possible to rate or send a comment that is shared among the community.

Then it comes the rich reality paradigm, from the main map activity it's possible to enable the compass mode that highlights the portion of the map that is ahead of the user.

Figure 2 - Augmented Maps: direction view

The above is basically an Augmented Reality interface that overlays direction information on top of the real-time camera view. This activity uses the embedded digital compass to display an arrow pointing to the Point of Interest, the distance from the user's detected position and a small map view with the indication of the portion of the map that the user is facing.

Implementing this simple use case by an Augmented reality interface we basically went through the steps suggested by Seabright:

- Simplification of information (parsing and normalizing info provider information)
- Re-aggregation (applying a clustering algorithm to reduce information overload)
- Appearance and usability (visual navigator to the POI in camera mode)

and reached the desire goal: despite the vast amount of information behind an Augmented Reality browser, by this new interaction paradigm we came into something “that appears in forms that are useful for us to absorb. That is to say, in forms that result in better decisions and ways of living”

<u>Technological insight and Standardization</u>

Whether on not AR interaction paradigm could be integrated in the future Web platform has to be debated. AR is getting momentum and probably facing a critical growth. Needless to say that the risks of giving birth non interoperable walled gardens is high.

Telecom Italia thinks that interoperability and application portability have to be preserved; in our use case we targeted different mobile OSs and had to double the deployment effort as we were constrained to use native APIs.

Leaving apart the data semantics and structure perspectives where initiatives like ARML are filling the gap, from the user interface perspective we got the impression that HTML 5 would not be too far away. When evaluating the implementation technology for the Augmented Maps Direction View, HTML5 was not able to access the live stream from Device Camera and consequently to overlay information on top of it.

While we assume that Device API will soon provide the camera API specification, W3C Geolocation should quickly provide support for Accelerometer and Compass. With respect to the current specification of HTML5 video element, the capability of detecting user clicks over a video stream would be a useful nice to have.

For overlaying 3D objects W3C should foster the relationship between HTML5 and initiatives like WebGL and X3D.