ABSTRACT
In this demo we introduce Coagmento, a tool for supporting interactive information seeking process of teams in various collaborative scenarios. Coagmento has been used in several laboratory and field studies to understand issues related to collaborative information seeking (CIS) and deriving lessons and guidelines for providing suitable support for people working in collaboration for information-intensive projects. From its initial design, Coagmento has evolved through the introduction of new features and the support for both web-based as well as mobile systems. Using appropriate research methodologies, Coagmento has proven to be a useful tool for collecting behavioral data of users enabling researchers to better understand different dimensions of the collaborative process of teams as well as single users while searching information online.

Keywords
Collaborative search, interactive search, CSCW.

INTRODUCTION
During the past decade there has been a particular interest for studying how people as part of teams search information online. Research in this regard has not only produced valuable scientific work, but also it has produced some useful research tools that in time have evolved and now provide supports for the general public. Some examples include Ariadne (Twidale & Nichols, 1996), SearchTogether (Morris & Horvitz, 2007), and Cerchiamo (Golovchinsky et al., 2008).

In this paper we report on the evolution of Coagmento, a system that supports the information search process of both teams and single users. The paper starts with an overview of early versions of Coagmento, followed by the description of the present version. We then present some relevant applications in which Coagmento has been used in the past, today, and how it is planned to be used in the future. Finally, we conclude with a brief explanation of our future work and the implications of Coagmento for research and for public usage.

COAGMENTO BEFORE
The early versions of Coagmento were designed as standalone specialized system. Through several pilot runs, we found that while the system was deemed to be very helpful in collaborative projects, it was outside of users’ typical comfort zone (Shah, 2008). The system was then redesigned to be implemented with a client-server architecture, where the client was integrated inside the Firefox browser. This made it quite accessible to almost anyone since most people are familiar with using web browsers. This version of Coagmento was used in several laboratory studies (Shah, 2010; Shah & Marchionini, 2010).

COAGMENTO TODAY
Since its last version, Coagmento has evolved at the presentation layer as well as at its back-end. The new version has been optimized and improved to support new features introduced with the Web 2.0. Although most of the former functionalities of Coagmento have been kept, the majority of them have been enhanced with the incorporation of new methods for capturing users’ action in online search.

Today Coagmento offers users three ways to access and manage the information collected. The first one consists on an online space in which users can access all the information collected in previous sessions. The second one is the Coagmento plugin for Firefox, which keeps track of users’ actions in online search; in addition, this extension provides rapid access to tools specifically designed for collecting, sharing, and visualizing information. Finally, the third one is a mobile app (currently supported for Android-based devices), which allows users to access their projects’ data through an Android app.
As a collaborative platform, Coagmento provides support for:

- **Information collection and sharing**: Users can bookmark pages or save specific passages (snippets) from Websites.

- **Information rating**: Either snippets or bookmarks can be rated by users on a 5-points scale; the rating is dynamic and varies as other users update it.

- **Communication**: Users can communicate with their team partners through a text-based channel implemented by integrating PHP Free Chat (http://www.phpfreechat.net/) and Coagmento.

- **Collaborative reporting**: Users can write reports into a synchronous collaborative environment. This was implemented through the integration of Etherpad (http://www.etherpad.com/) and Coagmento.

- **Resources management**: Users can visualize and organize the information collected during the search process. This includes a list of saved pages, snippets, queries, annotations, files, as well as ratings.

Both information rating and collaborative reporting are particularly new in Coagmento. While information rating was originally implemented to explore the notion of Group’s Affective Relevance (GAR) (González- Ibáñez & Shah, 2010), collaborative reporting was embedded into Coagmento for supporting the awareness of teams’ members.

**Figure 1**: Coagmento plugin for Firefox and collaborative editor.

Figure 1 depicts the components layout of the Coagmento plugin and the collaborative editor. The plugin provides two key components: the toolbar and the sidebar. The former is divided in three main areas: (1) a set of buttons that makes possible users to save, share, annotate, rate, and visualize information resources; in addition to one button that provides rapid access to the collaborative editor (Figure 2-a); (2) a summary of the project and the current page in terms of views, snippets, and annotations (Figure 2-b); and (3), a button that enable users to self-report how they feel at certain moment (Figure 2-c). The sidebar on the other hand, is divided in four main regions: (1) the chat area, which enables users to communicate with each other (this for collaborative settings) and also, for the case of experimental scenarios, to allow researchers to provide specific instructions to participants (Figure 3-a); (2) the resources area, where users can access the information collected or generated during the task (i.e., bookmarks, snippets, and queries) (Figure 3-b); (3) a notepad to add specific notes to the project (Figure 3-c); and (4), a notifications region in...
which users will receive the latest update in the project when working with someone else (Figure 3-d).

![Figure 3: Coagmento sidebar components.](image)

**APPLICATIONS**

Since its original version, Coagmento has been used in various experiments related to collaborative information seeking. Due to its versatility, Coagmento can be used as a data collection tool in the laboratory in conjunction to adequate research methods and experimental designs; it also can be used in real scenarios without any control.

Coagmento was formally applied for first time in Shah & Marchionini (2010), where 42 pairs of users used Coagmento to perform an exploratory search task. Due to the modularity of Coagmento, which allowed easy removal or addition of components, the experimental conditions in this study were addressed through specific resources of Coagmento for supporting the awareness of teams. The data collected from this study served to explore the information seeking process of teams (Shah & González-Ibáñez, 2010) and some affective implications of collaborative judgments when selecting relevant information (González-Ibáñez & Shah, 2010).

Later, Coagmento was applied in a large laboratory study in which 160 participants in 80 pairs performed exploratory search tasks in eight collaboration conditions. Moreover, 40 additional participants performed the same tasks individually using Coagmento as well. From this study we collected useful data to better understand why teams perform better than simply combining the outcomes of the individual parts (Shah & González-Ibáñez, 2011). For this particular study we augmented Coagmento with the use of additional tools for capturing behavioral data such as desktop activity, eye movements, and facial expressions. Our most recent work using such data is published in a separate track of ASIST 2011 (González-Ibáñez, Shah, & Córdova-Rubio, 2011).

In addition to the data related to the information seeking process of users, we also received valuable feedback about the user experience in Coagmento, this through surveys and interviews. We used this information to enhance various aspects of the front-end and back-end of the system. This resulted in an important performance improvement and the introduction of various new features.

After this Coagmento upgrade, our most recent application of the systems was in a semi-controlled study in which nearly 70 senior high-school students in teams of different sizes used Coagmento for their final project for a period of more than 4 weeks. This study allowed us to collect data from real projects with limited control over participants’ actions.

Thus, our research approach using Coagmento as a data collection tool has gone from very controlled settings to non-controlled scenarios. As shown in Figure 4, there are pros and cons of this approach; however, our objective is to first look at fine-grain aspects of the information seeking process of both single users and teams; and then look for possible generalizations using large-scale data collections.

![Figure 4: Research approach using Coagmento.](image)

**THE DEMO**

To demonstrate Coagmento at the conference, we will use two devices (two computers or one computer and one mobile device). We will show in real time how two collaborators could search, share, and synthesize information from online resources. The visitors will also have a chance to try these systems out at the demo, with a later access possible through Coagmento’s website at http://www.coagmento.org/.

**CONCLUSION**

In this paper we presented an overview of the evolution of Coagmento as a system and data collection tool. In addition we have described some of the applications and potential uses of this system in the research and public domain.
Coagmento has proven to be a powerful tool for collecting useful behavioral data during the information search process of users. Its versatility enables researchers to easily apply Coagmento in various scenarios. Moreover we believe that Coagmento may be useful for teams that require searching and organizing information in real scenarios.

We are currently working on extending Coagmento in order to provide support to users of different platforms. Our main focus is on web-based systems and mobile devices. Even though the Coagmento website works in any web browser, the Coagmento plugin was specifically implemented for Firefox. Now, a group of developers are working to produce new versions of the Coagmento plugin for different web browsers (e.g. Chrome, Safari, Internet Explorer, and Opera). Moreover, we are working on making Coagmento available for iPhones, iPads, and other mobile devices.

It is important to note that Coagmento is open source and the current version is available for non-commercial usage from http://www.coagmento.org/ under a Creative Commons License.

ACKNOWLEDGMENTS
Development of Coagmento was initially supported by NSF grant IIS 0812363.

REFERENCES