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Astronomy News Explorer in Use of Curatorial Platform for Knowledge and Content Management of Science Education

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Abstract: Curators wonder if the research institution's news can be gathered efficiently, and how past news can be obtained more conveniently. The point is how to use a different perspective to search for news. To immediately read associated news with an easy browsing tool is necessary. This paper proposes a Curatorial Content Management System (CCMS) to structure news management activities for science museum curators. This system represents astronomy news collecting and news organized interactions in a way suitable for both technical oriented implementations and astronomy materials supporting. It is an interactive system that creates an interface between the curator's knowledge and the information of astronomical expertise. By this option, curators can acquire the information of the distances and quantities of the news. Moreover, the authors analyzed the presented drawbacks of some web-based news browsing environments and describe how the nature of the system can avoid the existing problems upon news implementation.

Key words: Information visualization, content management system, news, knowledge management, astronomy curator.

1. Introduction

A curator of a museum is a content specialist responsible for an institution's collection and involved with the interpretation of museum material. The curator necessarily makes decisions regarding what objects to collect, oversees their care and documentation, conducts research based on the collection, and shares that research with the public and scholarly community through exhibitions and publications. Specifically, the Nagoya city science museum houses one of Japan's largest planetariums in the astronomy section and has a lot of sections on modern technology. The astronomy curator, who works there, has the primary function of being a subject specialist, with the expectation that he will conduct original research on astronomical results and guide the new organization in astronomy information. For this reason, astronomy curators usually need to use the astronomy news website to obtain the up-to-date news. The existing astronomy website's search function only provides for one time period or one keyword. If we want to get news from different national research institutions, we must visit these institution websites separately to read all the available news, which is quite inconvenient and time-consuming. Users of news websites or applications require a mature function to obtain news smoothly and simply. We want to solve existing problems in traditional news websites, such as the browser only record news titles by lists. Consequently, we follow the needs of astronomy curators to build a

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system which we call “Astronomy News Explorer” (ANE) which shows all heavenly bodies’ indication and classification accurately, and guides the user to use the GUI (Graphical User Interface) by intuition. This system would certainly enhance the quality of the news browsing in respect of activities performed with maladaptive structure. The subject used to name astronomy objects should be chosen carefully. It determines the clarity of the astronomy objects for existing astronomy news websites [1-2]. Thus, solving problems of the content of the collaboration between technical experts and curators is not settled. The ANE provides a frame for the bridge of different news sources. The element of the astronomical proper noun depends on the experts gathered to define them. Astronomical knowledge, science museum employment and curatorial differences would probably lead to different interpretations of the curator’s requirement in this system. There is a standardization effort to develop metadata that “aims at being pedagogically neutral or unspecific to theories and systems” [3-4]. Therefore, this approach can be questioned as the curator’s situations which are specific. Thus, the support of several metadata approaches can be seen as a positive feature of the Curatorial Content Management System (See Fig. 1).

Section 2 gives related work within the context of using data browsing technologies to align different news sources or astronomy information. In section 3, we elaborate on the created news browsing applications. Subsequently, in section 4, we discuss the evaluation with our application functions by astronomy curators who work in the Nagoya city science museum. Accordingly, a layered approach is presented that builds upon and combines formal representations of existing browsing system, and presents the metadata service that is built around our system and discusses the used technologies. A use case is shown in section 5 to illustrate the new features of news management and news data re-construction in the ANE, and finally conclusions are drawn in section 6.

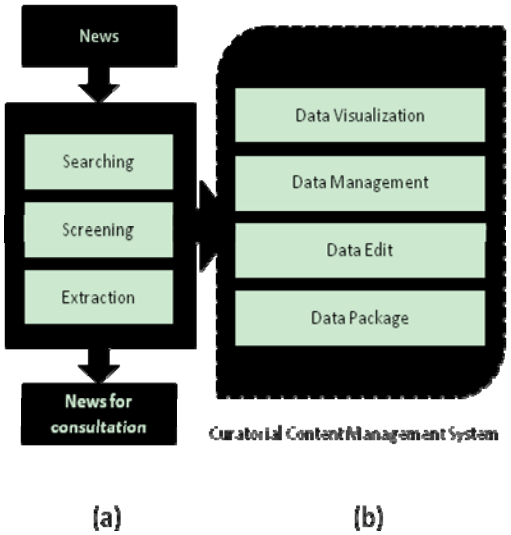

Fig. 1 Main characteristics of our proposed framework (b) set beside a traditional framework (a).

2. Background

This research focused on well-known global astronomy news websites and their characteristics and analyzed them. We referred to the essential factor of astronomy news display modes and chose 27 well-known astronomy websites as the survey objects. We investigated the news interfaces and determined their interactive problems. General astronomy websites mainly introduce astronomy knowledge and new information; institution websites mostly show research results or related messages. For example, NASA (the National Aeronautics and Space Administration) always takes down new discoveries on a regular time schedule, and introduces technology or information for activities all over the world. We conducted a survey of their application modes; moreover, we compared general astronomy homepages and found that almost 90% simultaneously offer functions that assist searching and education. Users receive help not only reading news but also getting other information from astronomical websites about constellations or eclipse navigators. In the news title linking page (See Table 1), they set five items: “Classification”, “News date”, “News title”, “Photo”, and “Abstract”. Regarding the linking pages, editor classified astronomy news based on news that occurred a year or a month ago by different

Table 1 Main news element for linking pages.

Function	News title linking pages					
	General websites		Institution websites		Magazine websites	
Classification	10	63%	5	71%	2	50%
News date	14	88%	7	100%	3	75%
News title	16	100%	7	100%	4	100%
Photo	4	25%	4	57%	2	40%
Abstract	5	31%	5	71%	2	50%

time links. Some are classified by astronomical object names, taking such astronomy objects as Mars or Jupiter as the subject, or by different astronomical objects to help users distinguish key subjects. In over 90% of the astronomy websites, the link function of news is indicated by news titles and times. This is the most popular way for news websites to show messages; users read the title or date and choose what they want to read. About 40% of the websites use news abstracts and photos to explain the news title. After reviewing 27 astronomy websites, we found three disadvantages of these news applications shown:

(1) It's hard to control what kind of news that are shown in these websites, thus making the user waste a lot of time in choosing and reading the appropriate articles;

(2) It appears that the user's choice is quite limited and there is no function to connect them with the curator's requirements;

(3) Since the massive amount of news and records are mixed up on the same news pages, the target news cannot be found easily. If we read the same news subjects, understanding the correlation is hard; finding the correct data via such applications on websites is confusing.

Matching the preceding results for the textual interface, convenient searching does not serve as a mediator for the familiar textual interface. Both interactive and ease of use have a strong influence on the usefulness of an application. Therefore, usefulness is the key determinant for the intention to use with respect to the graphical interface [5].

Cases of Visualization System:

For visualization systems, some researchers use the points of keywords, time, and 3D space to display visualization interfaces. For example, Nomata [6] proposed a novel visualization system for news articles that supports the exploring, the observation, and the supplying of visual summaries of news articles. Matsumoto [7] proposed a multi-channel dissemination system with a time dependent filter and an application technique for time-series documents on the Internet. He also took a push-based application method based on confidence and scoop levels to describe a prototype system. Many applications for information visualization have been developed; researchers already apply subjective measurements to accompany objective results. There are many familiar examples of timelines. The Wall Chart of World History [8] displays the reigns of rulers of the major countries in the world along with commentary about those reigns and important historical events. Visually, the timeline makes extensive use of color, shape and scale, and a few other familiar paper timelines show cultural and scientific advances [9]. Event relations are particularly important. Viewing event relations between the news with timelines has some similarities to viewing postulated relationships between propositions in hypertext argumentation systems [10-11]. Arranging data according to their relation has been widely used in other visual retrieval applications for the web. Matsumoto [7] offered a good overview of existing applications. The visual news interface represents a compromise between the magnitude of visualization techniques and the interactive application for astronomical web sites. We emphasized that time and special abstraction is one of the key factors to be considered for acceptance of novel visual interfaces. Subsequently, usability studies provided approximations of how the systems would respond in slightly more realistic task settings with people who more realistically represented the target users [12-13]. By these researches, we can specifically take the news changes, the news recording times, the news title keywords, and space performances for

astronomy; they are all extremely suitable, advantageous tools that can be displayed as visualization news interfaces. Therefore, this system defines a central element, concepts of time and space, representing a news background that has to be performed individually by the universal space and at the occurred time. Then, the news establishes what particular location and year (where and when) that has to perform what is defined.

3. Proposed Framework

Before constructing our system, we cooperated with the astronomy researchers from the Nagoya city science museum, who classified and analyzed all the astronomy news data in website ”NASA” (the National Aeronautics and Space Administration) using the news content of each astronomical object as the basic data. We invited the curator who frequently needs to search news information from different news websites, to instruct and advice on the design procedure. He mentioned that the curator needs a system which can get all the news from different astronomy websites and the curator needs to know all related news information during a certain time or in a certain area. In existing astronomy websites, it is hard to know all distribution and information about the news in every year. A convenient searching tool will become the most needed item for curators when they browse the news. Meanwhile, to fulfill the curators' demand, “Astronomy News Explorer” (ANE) is designed to integrate many astronomy research institutions, and solve the problems of one time period and one keyword searching, and the browsing system has to help them to reduce the searching time. Therefore, an identical application can clearly show the news information and makes it easy to understand the changes of the news every year. This is a much anticipated function for astronomy curators. We identified three basic astronomy news projects: Space, Time and Classification; these items are also precisely regarded as an important basis of news classification for related works. To strengthen the application of astronomy news, our system displays concrete space and a time menu to simplify news classification. We use an interactive animation menu to enhance the concept of the universe and to help users discover news about it. We also offer diverse search functions to increase reading convenience.

Proposition1: Space

In the universe, all heavenly bodies exist in the infinite domain, which continues to extend every day. Because astronomy news also has the same characteristics, the concepts of “Time” and “Space”, become the key factors between the universe interactive interface and the astronomy news information in our system. The present system used 2D application to show news from NASA, using punctual distribution to indicate the news position and the time information of them. But we kept in mind the expansion of content on ANE in the future. Therefore, to strengthen how users remember news, we emphasize the position of the astronomical object in the news by enhancing visual impressions to encourage interest in correlation news for users. ANE utilizes news elements for the position of astronomical objects in the universe and concretely displays astronomy news or other information about them (See Fig. 2).

Proposition2: Time

ANE sets the universe time and spatial concept as system with main integrant elements, combining the GUI to list all choice areas. In the interface of ANE, we present all news about the universe by identical year, and simultaneously present several choice areas in the interface such as “Space Scroll”, which represents the news position and the distance between heavenly bodies. With the time series as a foundation, we can build a time relation and an evolvement list for news. The time at which the news occurs is our foundation, and by the visualization time bar with dynamic performance, we supply support to understand astronomy developments. Users can determine the records of the changes of astronomical

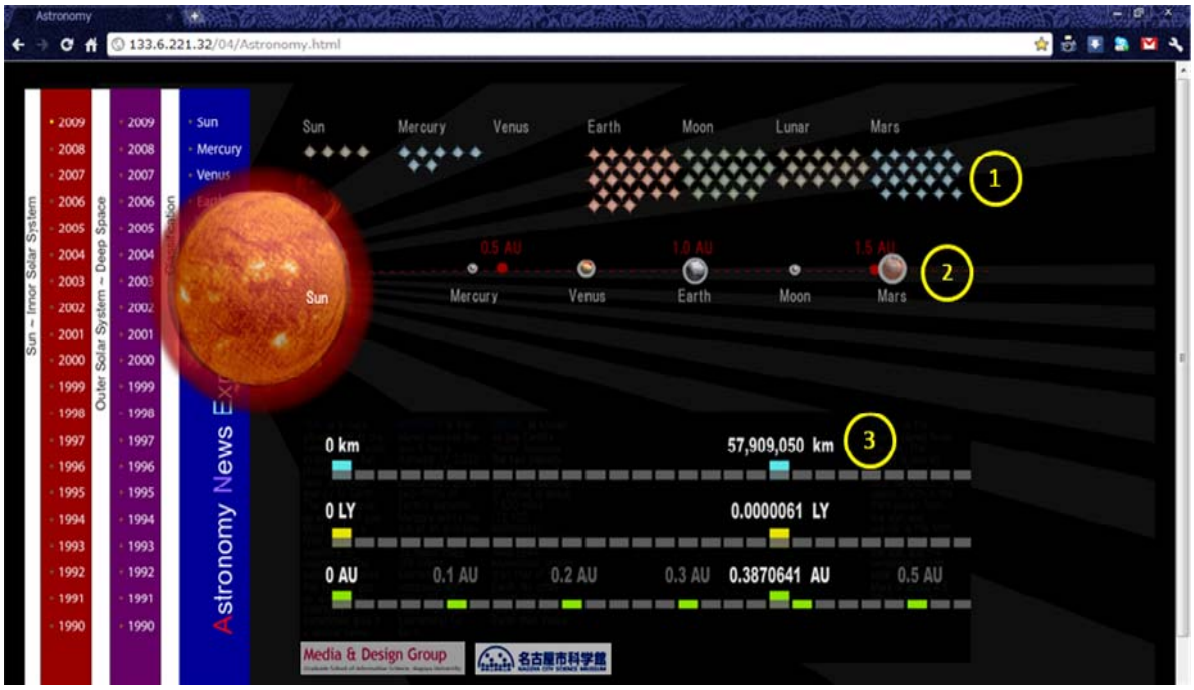

Fig. 2 Prototype of implication for space: (1) news; (2) news occurred place; (3) distance of heavenly body.

objects or what happened to the development of astronomy research based on the news timeline. This system will assist users who read news and will also significantly help them remember the news better. In accordance with the occurrence time, users may also obtain sub-time areas for related information by purchasing astronomy research, which is the focus for each research institution each year. In ANE, news of the result set is represented by a star icon; they are organized in a mark format. In the visualization shown in this application, the most recent news this year is placed at the end while the oldest news is arranged towards the top of the list. The news visualization is a graphical interface built with web news technology. It offers interaction features for exploring the underlying data. Fig. 3 shows a sample screenshot with the cursor centered on the heavenly bodies group. Different to the textual interface, the top of the screen shows the related news. We prototyped the user interface screens using web development tool based upon the results of the curators' requirement. The information included is identical to that of the textual baseline for the news date, title and content.

Proposition3: Classification

Using the interactive animation menu, we display astronomy knowledge in this system that is being diversified. By developing a set of news visualization systems to which the concept of the time and space of the universe is applied, users can exploit astronomy proper nouns or heavenly body information to get astronomy knowledge immediately. We desire a system that has both entertainment and education functions and subjects for astronomy news edutainment. We want to use different groups of astronomical objects to explain astronomy news by classifying astronomy objects, education, and searching auxiliaries. Following the progress of astronomical observation technology, users can obtain astronomy knowledge more rapidly and effectively. In our system, we set heavenly body searching and subject classification so that users can immediately absorb astronomy knowledge. Our interactive astronomy news explorer explains or annotates proper nouns to simplify the explanations of special astronomy knowledge to enhance user interest in astronomy news. In addition to these static features, the visualization offers an interactive element to

facilitate browsing the search results for the news and heavenly bodies. If the mouse cursor is placed over an icon, detailed information about the news is displayed in the same screen.

4. Evaluation by Astronomy Curators

Curators mentioned they usually use the astronomy websites or Twitter which can connect the site to read news directly. For instance, they frequently use the site "Star Information" (http://news.local-group.jp/"), which is a site records the daily astronomical information from famous astronomy institutions. Another site is the "APOD" (Astronomy Picture of the Day, http://apod.nasa.gov/apod/); it is a website that presents daily pictures concerning astronomy news or astronomical history. When curators use astronomy news sites, it is essentially easier to get the new information immediately, but it is still difficult to know all news from the current to the past. However, there are plenty of newspapers and magazines making, it really hard to read all the news data every day, although curators really need these data to assist them for education works and as research materials. Therefore, the curator commented that the representation of common news websites is not good enough till now. They disregard the concepts of combining the news occurred time and universe space. The problem of the existing system is the difficulty to command the relation between all astronomy news; even to search, the only way is to enter the keyword such as the month or the day and finally obtaining single news. It apparently took a lot of time to read and search for the news. Obviously the traditional searching is very inconvenient to curators. In this phase, an evaluation result was needed so three astronomy curators were recruited to participate in formative evaluation of the prototype user interface screens. The protocol was approved by the astronomy news, and we provided curators with a system introduction and asked them to perform news reading and news searching. They used the prototype of the ANE by internet (http://133.6.221.32/04/astronomy.html). The news was selected for relevance to the news browsing application that we developed. We applied graphic-based and curator-centered conception to elicit the curators' perceptions of functional requirements for an interactive astronomy news browsing. We designed the user interface screens to reflect the curators' perspectives, and assess curators' perceptions of the usability of the prototype user interface screens.

We used structured interview questions to facilitate the brainstorming. A questionnaire was used as the subjective measure for the study. It comprised items concerning perceived ease of use, perceived usefulness, and intention to use. Curators mentioned that this system displays the concepts of "Classification", "Time" and "Space" for the astronomy news, using these classifications to perform the news such as from NASA's website. This system is not only to display the news title but contend to classify them by keywords. It also directly illustrates the time button, the space button, the main subject classifications and the position of the heavenly body to transform the typical selection list. There are several opinions about the ANE applications from curators (See Table 2). The number and position of the news are understood transparently. In addition, the comparable and connected various information can be seen around each heavenly body, beside the overall condition is definite. Curators also mentioned that they are desirous of a system that can demonstrate the news or the new information from the different countries' institutions, and not only be limited to one area but include other regions. There are various astronomy institutions in research, about the number of news items they published that are essentially to be compared for the curators' needs. Moreover, according to the news distribution or the study obtaining its usefulness what is the balance and direction for the curators' next research. It is significant to emphasize the utilization of a visualization system which will be more convenient and efficient for curators.

Table 2 Advantages and disadvantages of ANE.

	Opinions of curators
Advantages	I can understand the quantities of news and it is very useful.
	It is very interesting to find what news changes between planets.
	The keyword list is a useful feature for searching.
	We can compare the quantities of interesting news; this is very convenient.
	It is a useful tool for news statistical procedures.
Disadvantages	I can't figure out the read and unread news.
	I wonder if the keyword addition and register features are also needed.
	It is difficult to define every astronomy keyword but it is necessary to manage them.
	It is better to provide some functions for individual news management.

Advice and Discussion:

We found requirement is the sole variable that determines the intention to use existing news websites. This might explain the popularity of news websites because the main media may look at and use instead of others. This is supported by the fact that usefulness has had no direct effect on the intention to use. This does not imply that the common news website is useless; other institution news (i.e., NASA, JAXA) are equally good. It has shown that the news browsing model can be applied to the astronomy curator's needs presented in this study. Since our findings are in line with many other studies that confirm the browsing model, we argue that it would work for other visual news interfaces as well. In addition, we have shown that user requirement is a very important factor for the acceptance of the visual and graphic interface. The main focus of this study lay on the evaluation of acceptance of novel visual interfaces. However, we collected subjective data on how users rated the news interfaces as well. In short, participants thought that the novel interface is easier to use and in their perception leads to results in less time. As for the visual interface, on the other hand, more participants felt to be more in control. Eventually, participants liked the visual time-space interface better than the textual one when asked for an overall assessment.

5. Improvement of ANE

The curator thought of a system interface for the astronomical expertise interested in structuring collaboration according to the curator's own knowledge. They also allow a system designer to match information management with a user's requirement. For administrative management, we created an instance of the CCMS (the Curatorial Content Management System) including the field of news management and news collecting in charge of different astronomy news websites. Administrative services also provide the news data to read into the system database. Thus, technical management would put forward the news management tools supported for the reading activities. The curator would choose some tools and complete the instance of the CCMS. These tools would be integrated in the organization of the news collection as required. By reference to the system instance, technical services would work the computing resources issues.

5.1 Knowledge and Content of News Management

"Content Management Systems" (CMS) are a software application for creating, publishing, editing and managing content.

They are widely used by the news and media organizations, e-commerce websites, libraries, broadcasting and film industry, and educational institutions to handle the content efficiently. The content used by a CMS is stored mostly in a content repository which is a hierarchical content store with support for structured and unstructured data. As the primary role of CMS is to organize content items to make them accessible through intuitive queries, metadata assignment mechanisms are an important feature of CMS [14-15]. In this context, the metadata has never had such an important impact on the capability of CMSs to manage, retrieve, and describe

content [16]. CMS has been used for several years. However, nowadays the user is becoming the producer of content, and there is a need to manage this personal content as well, hence the introduction of a Curatorial Content Management System (CCMS). In this case, the astronomy curator creates, annotates, organizes and shares the curatorial news content (See Fig. 3). We introduce an approach to build a CCMS, in which system a completely metadata construction is created. We propose a new metadata system, data management, news browsing, and reading history recording in the context of CCMS. To provide the ANE that can be used by curatorial experts without the help of technical experts, this development should be separated into "news management editor" and "news browsing application". The editor would be used to define news content format by way of a graphic user interface. The browsing application would set up the interaction structure and the news reading history according to the Information design (ID). These characteristics are covered by a CMS, which contains different resource systems, such as the VR (Virtual Reality) system [17]. It is a user interface that controls one or various databases, and its strength lies in its ability

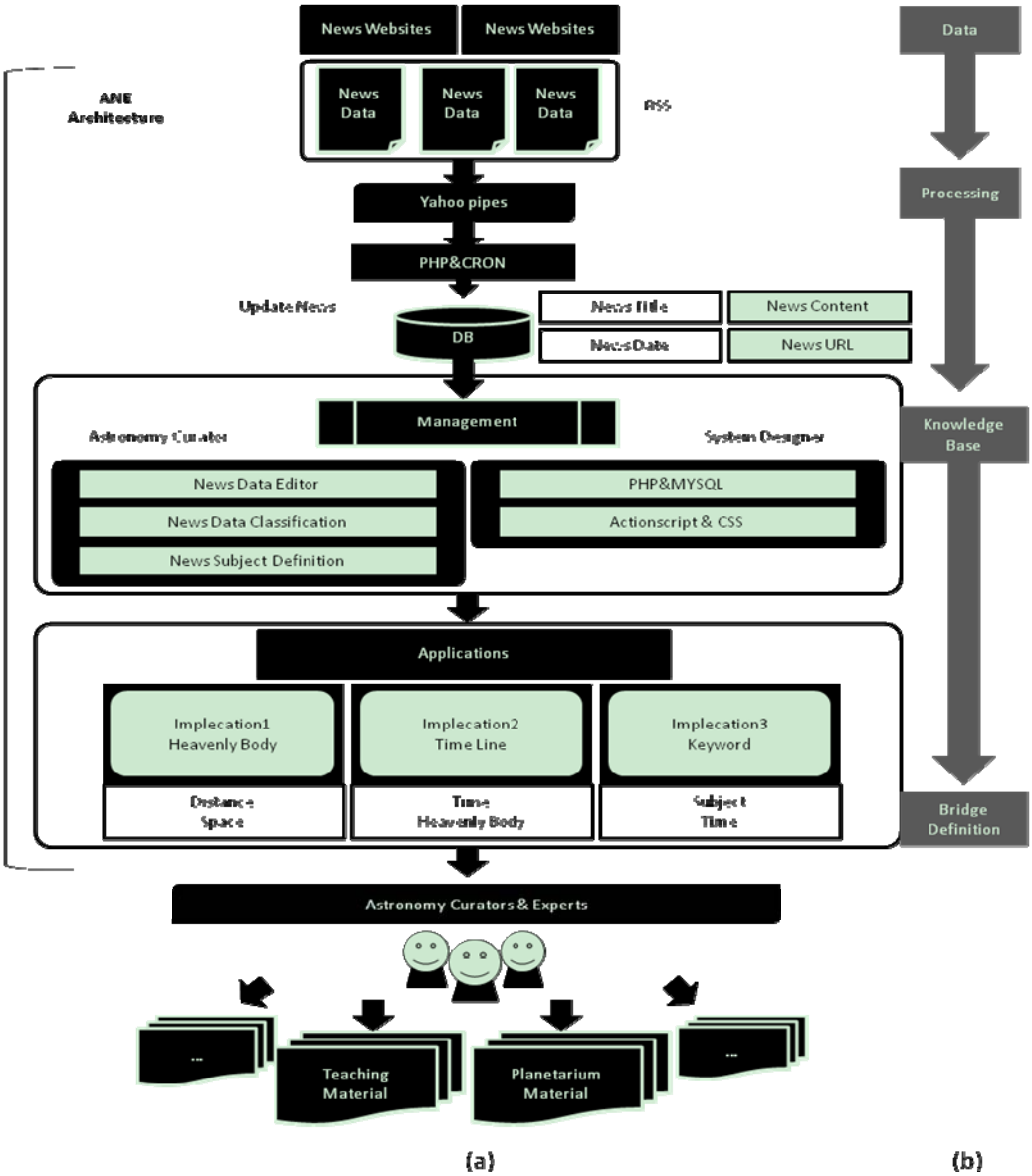

Fig. 3 Main architecture of our proposed framework (a) set by a knowledge and content management of (b).

to manage content independently according to the Web template that is chosen. The way in which this is achieved is through its front-end and back-end structure. The former is accessible to users, whether or not they are registered, and the latter can only be accessed by administrators and maintainers of the CMS [17]. This is a key concept to justify its use in this study, as the aim is to find a structured way of implementing the information from news websites into database system platform without the need for large-scale changes in the structure of its dissemination system. The ANE is organized in the classified items and the related items. The classified items represent the basic components used to define interaction and the news information of background (time and space). They define an access point for integration applicable to all news. The related items represent trends and the entire change structures reflecting astronomical research strategies in each institution. Continuing the analysis of the CMS, the management software has allowed us to implement the results into news collecting on the web. The result of this process is a CCMS tool, preferably hosted in the same Web server, with an appearance that can be modified according to the user through its own user manager. In addition, the appearance of the web portal can be changed totally with the creation of a new template, covering the need of the CCMS to adapt to the overall environment of the news browsing at any moment, without altering the contents. The news management solves the existing problems which are beneficial as technical implementations of users and tools can be modified without any impact on their description in the system, i.e., technical changes have no effect on the manipulation of the system by astronomical expertise. Technical and astronomical expertise is independent. The ANE supports news between them by interfacing their respective competence. Their independence is symbolized by the difference between user requirement and association. This difference defines a relationship that guarantees a certain level of influence for all experts. Upon implementation, educational expertise would be autonomous, i.e., they would be able to modify the management properties without technical assistance. These properties exist in curatorial environments, but they are still not available to curators until now.

5.2 Database Storage and News Collecting

In terms of computer science, one of the most significant developments is the storage of data. There are many studies that deal with interactions between the primary source of data and any type of final user [18]. Any news browsing system has two fundamental bases: data storage and the Database Management System (DBMS), which saves data while at the same time providing fast and structured access to the data, giving correct management of the news. The database is a dynamic storage system, which implies a complex structure of data with a logical system, which recovers files quickly through simple search patterns [19]. In this research, the outline of the conceptual map for the design of the database has been chosen. This shows how the database is structured into two large sets of data: the news set contains basic information about each element of news which is inventoried, and allows this data to be re-managed within the editor of this system. The first is to read the RSS from Japanese astronomy news data into Yahoo pipes. We use the pipes to make up the information relating to the astronomy description of RSS, general descriptive messages, the inclusion of the news title and news contents in other news data. After that we publish the results of RSS which are edited and put them into the ANE database automatically, as well as other RSS feedings dealing with news every day. The second subset deals with requirements by the curator's educational and research needs which make up the classification element in the management. Therefore, any user can consult the database or receive results by interacting with the DBMS. A necessary condition for this database is for there to be a standard, which in this

case uses CMS architecture. For the DBMS, MySQL has been chosen, as it is currently one of the most powerful tools, together with Microsoft SQL Server. This is multiplatform (Linux, Windows, MAC), which has certain essential characteristics such as the creation of applications in multiple programming languages (C++, PHP, among others). The structure of the database allows fast, logical and standardized access to the data, which has information about location, time and subject categorization among every data. In this way, complete reports can be generated. The news occurrence position is the necessity information of the geographical information obtained from the prior analysis of the astronomy curator. This classification for different astronomical documents has allowed us to obtain an initial inventory, which gives an insight into the distribution and expertise of universe knowledge. Thus, this inventory has been completed with searches in current astronomy news data from the news websites of AstroArts (http://www.astroarts.co.jp/rss/update-j.xml) and. National Astronomical Observatory of Japan (http://www.nao.ac.jp/rss.rdf).

5.3 Data Management and Editor

The editor manages the news related information, acquisition and reproduction of information for a collaboration tool. It focuses on the management of information transport between data and database. The system instances could be deployed automatically providing a browsing interface which is well defined between those components. The system coordination server would be started first and would load the news data. Then, each news data would contact the coordination server and retrieve the connection list to the application to be established. However, for the management of news browsing system, it is necessary for these services to have information about its contents. This information is contained in the metadata, written in database. The idea that the metadata should be governed by a standard arose to avoid problems is derived from the heterogeneity of the definitions provided for each news data. Therefore, it may seem contradictory to use specific vocabulary for a specific field of astronomical knowledge. The task is to include information describing the CMS, or any other Website, within the databases of the major news search, thereby achieving better search optimization. We divide the information relating to the description of the news browsing system into a series of tags known as Meta-Tags, which have information on “Title”, “Description”, “Time” and “Subject”. The Meta-Tags follow the classification and the vertical character of the astronomy expertise above. We developed a GUI, the user is provided with graphical management constructs as well as a graphical query mechanism. As the user drags and drops, indicating the correspondences between the selected repository item and item collections; the native content repository queries are automatically generated by the system, along with the bridge definitions in news classification. After retrieving the object types and processing them according to the mapping rules specified.

5.4 Summery

The news management of ANE presents a tool, which interacts with a multimedia database of astronomy news, and can be integrated into the platform of a news browsing system, with the possibility of obtainment between similar news sites and use by astronomy curators in the Nagoya city science museum. Creation of a complete technical and multimedia database dealing with the astronomy news of news websites (AstroArts and National Astronomical Observatory of Japan) in Japan: Search for a coherent means of interaction between results of different elements of the news; Obtain an information management tool for different news sources, which is attractive and up-to-date, as well as being easy to implement and maintain for astronomical curators. The aim is to contribute to widening knowledge of astronomy expertise, supporting news browsing as a platform for making information accessible, giving

their knowledge sharing on the internet, one of the most powerful channels of information.

6. Conclusions

The system aims to provide a news browsing interface for the astronomy curators. Elements of the system can be combined to reflect the specificities of the curator's request. Visual time and special interfaces are supposed to outperform list interfaces for such task types as nonspecific queries, because they make use of additional semantic information (i.e. place, date). But there are a lot of astronomy web sites like NASA (the National Aeronautics and Space Administration) or JAXA (Japan Aerospace eXploration Agency) which still use classical textual list interfaces. Many visual interfaces performed well on objective measures such as retrieval time, precision or recall. These interactions seek to make it possible for both expert and non-expert users to access the information of the database quickly, easily and securely, allowing them to filter data according to their needs: astronomical, educational, curatorial or technical, among others. Therefore, this study builds on the graphical interface for searching news model which measures curators' subjective needs towards using an interactive interface. Moreover, the ANE aims at being unspecific towards information architecture to foster creation of astronomical expertise value of the CCMS model. The only constraint towards information supporting and collaboration theory is that "the curator's knowledge with his information obtaining environment is not direct but instead mediated through the use of different tools". This describes the CCMS approach as an in between of the Computer Mediated Communication (CMC) and Information Design (ID). Nevertheless, compared to current environments, the implementation of the system would raise the organizational level of news receiving and improve curatorial material edit. As a continuity of this research, we are interested in implementing the system of news browsing. It would allow proposing a set of components that can be combined or use distinct news data directly. This set would constitute a toolbox that can be used to perform different curators' requirements. In order to provide a complete toolbox, it appears necessary to perform different types of news formats, in order to reflect different needs of experts and news searching requirements. Several surveys [20-21] would also allow identifying deeper relationship between information construction strategies and the elements in support. The ANE could thus be completed or modified to provide a better support of the astronomy news management and browsing. The interest of this development surpasses frames of news browsing and has implications in information design and database architecture; it would also be interesting to evaluate the system in more convenient situations. Finally, the novel interface yielded significantly better results for news browsing than the textual one.

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References

[1] Y. Chen, M. Kondo, K. Mouri, T. Yasuda, Astronomy news element analysis and visualization system for the web, in: The Fifth International Conference on Innovative Computing, Information and Control Processing, Taiwan, 2009, pp. 153-157.

[2] Y. Chen, M. Kondo, K. Mouri, T. Yasuda, A visualization web system of astronomy news based on time and space mechanism, in: Proceedings of the 25th Annual Conference of Japan Association for Social, Nagasaki, 2010, pp. 183-188.

[3] W.P. Eveland, K.J, Marton, M. Seo, Moving beyond 'just the facts': the influence of online news on the content and structure of public affairs knowledge, Communication Research 31 (1) (2004) 82-108.

[4] S. Sunder, S. Kalyanaraman, J. Brown, Explicating web site interactivity: impression formation effects in political

campaign sites, Communication Research 30 (1) (2003) 30-59.

[5] O. Thiele, G. Mau, Acceptance of visual search interfaces for the web, Working Paper, 2005, available online at: http://www.olafthiele.de.

[6] Y. Nomata, J .Hoshino, Visualization for information exploration and observation of news (in Japanese), IPSJ SIG Technical Report, Information Processing Society of Japan, 2007, pp. 53-57.

[7] K. Matsumoto, K. Sumiya, K. Uehara, A multi-channel dissemination system based on time-series, clustering mechanism for on-line news (in Japanese), Technical Report of IEICE, NII-Electronic Library Service, Japan, 2005, pp. 137-144.

[8] C.W. Deacon, The Wall Chart of World History, Bracken Books, London, Revised 1998.

[9] C. Scarre, Smithsonian Timelines of the Ancient World, Dorling Kindersley Inc, New York, 1993.

[10] J. Conklin, M.L. Begeman, gIBIS: a hypertext tool for exploratory policy discussion, ACM Transactions on Information Systems 6 (1988) 303-331.

[11] N. Streitz, et al., SEPIA: a cooperative hypermedia authoring environment, in: Proceedings ACM Hypertext, 1992, pp. 11-22.

[12] C.M. Karat, Cost-benefit analysis of iterative usability testing, in: Proceedings of the IFIP TC13 Third International Conference on Human-Computer Interaction, 1990.

[13] J. Nielsen, Usability Engineering, Academic Press, San Diego, 1993.

[14] S. Ottosson, L. Holmdahl, Web-based virtual reality, J. Eng. Design 18 (2007) 103-111.

[15] J. Becking, S. Course, G. Enk, H.T. Hangyi, J.J. Lahaye, M. Ockeloen, D.R. Peters, H. Rosbergen, R.V. Joode, MMBase: an open-source content management system, IBM Syst. J. 44 (2005) 381-397.

[16] H. Allert, C. Richter, W. Nejdl, Extending the scope of the current discussion on metadata: 2. Towards situated models, in: B. Wasson, S. Ludvigsen, U. Hoppe (Eds.), Designing for Change, Kluwer Academic Publishers, Netherlands, 2003, pp. 353-362.

[17] M. Gaeta, F. Orciuoli, P. Ritrovato, Advanced ontology management system for personalised e-learning, Knowledge-Based Systems 22 (4) (2009) 292-301.

[18] M. Gaio, C. Sallaberry, P. Etcheverry, C. Marquesuzaa, J. Lesbegueries, A global process to access documents' contents from a geographical point of view, J. Vis. Lang. Comput. 19 (2008) 3-23.

[19] S. Liu, C.A. McMahon, M.J. Darlington, S.J. Culley, P.J. Wild, A computational framework for retrieval of document fragments based on decomposition schemes in engineering information management, Adv. Eng. Inf. 20 (2006) 401-413.

[20] D. Aumueller, E. Rahm, Caravela: semantic content management with automatic information integration and categorization, Lecture Notes in Computer Science 4519 (2007) 729-738.

[21] H. Bast, A. Chitea, F. Suchanek, I. Weber, Ester: efficient search on text, entities, and relations, in: Proceedings of ACM SIGIR, 2007, pp. 671-678.