

# Search, Explore and Navigate - Designing a Next Generation Knowledge Media Workbench

Mathias Heilig<sup>1</sup>, Mischa Demarmels<sup>1</sup>, Sebastian Rexhausen<sup>1</sup>,  
Stephan Huber<sup>1</sup> and Oliver Runge<sup>1</sup>

<sup>1</sup> University of Konstanz, HCI Group,  
Box D-73, 78457 Konstanz, Germany  
+49 7531 88 3113

{Mathias.Heilig, Mischa.Demarmels, Sebastian.Rexhausen,  
Stephan.Huber, Oliver.Runge}@uni-konstanz.de

## Abstract

Information work is a demanding activity caused by the increasing complexity of today's information spaces. Besides, information workers are acting correspondingly to their creative workflow, which involves multifaceted characteristics like diverse activities, locations and environments. Although it is important to find solutions to specific aspects of information work (information-seeking, information-management, media-warehousing, etc.) our design approach – MedioVis 2.0 – tries to support the entire workflow in one coalescing Knowledge Media Workbench, showcased in the context of digital libraries. To achieve this goal, we apply the concept of zoomable user interfaces, different visualization techniques and investigate additional considerations to provide a satisfying user experience.

## Keywords

Zoomable User Interface, User Experience, Semantic Zooming, Information Landscape, Information Visualization.

## Introduction

Nowadays, accessing digital information spaces such as personal data, online databases or the World Wide Web is a daily activity of nearly every individual. However, information work like “writing a scientific paper” or “investigating for a news article” is a very demanding task. One reason for this is the continuously growing complexity of information spaces, resulting from the increasing quantity and heterogeneity of information objects and relations between them. Another cause is the difficulty in execution within a multifaceted individual creative workflow [1] [2] within today's digital information-systems. Such a workflow contains diverse activities like information-seeking, information-management or archiving of information objects. The majority of tools focus on assisting in single aspects of such a workflow like the very important task of information-seeking (e.g. MedioVis, <http://hci.uni-konstanz.de/research/projects/MedioVis>). Nevertheless, most of them are isolated applications that are hard to integrate into a creative workflow of a person. Content and functionalities are scattered over dozens of applications, websites, storage formats, interaction models and devices – challenging the user's cognitive skills respectively. This often leads to the necessity for workarounds, resulting in a destructive degree of complexity and “information fragmentation” [3].

## Design Arguments

Based on these requirements for creative information work, we designed a “Knowledge Media Workbench” that supports the entire workflow in one unifying workspace [4]. Our approach, called MedioVis 2.0, tries to offer comprehensive visual support for all activities of creative work with digital libraries such as searching and browsing different information spaces (e.g. digital libraries, the web) or keeping and managing of information objects and knowledge artifacts for later use. As a data source we use the media specific part of the library of the University of Konstanz, consisting primarily of DVDs or VHS tapes. Additionally, we augmented this database with different online services like Google Maps (<http://maps.google.com/>) or the IMDb (<http://www.imdb.com/>).

MedioVis 2.0 relies primarily on the paradigm of zoomable user interfaces and object-orientation. In consequence, no windows, icons, menus, files or dialogs are used. To accommodate the various activities of information workers, we integrated different techniques to search and explore the information space via different visualizations. To keep and manage information objects, MedioVis 2.0 offers personalization functionalities. Finally, the concept has been designed to work on various devices like PCs, mobile devices or multitouch tables, presented with one consistent user experience.

### *Zoomable Object-Oriented Information Landscape (ZOIL)*

The fundamental visualization and interaction paradigm of MedioVis 2.0 is the idea of a Zoomable Object-Oriented Information Landscape (ZOIL) [5]. Within this paradigm, an information landscape of virtually infinite size serves as basic starting point for exploration of the information space (see fig. 1a). MedioVis 2.0 arranges each media object, corresponding to its primary genre on the landscape. Users are able to navigate in this landscape with zooming and panning operations [6]. This navigation technique takes advantage of the human abilities of visual-spatial orientation and remembering visual “landmarks” [7]. By employing this concept, users are able to utilize natural and intuitive operations as search strategy in media collections (see fig. 1a-c).

The more the user zooms into the content, the more details and functionalities are revealed by a “semantic zooming” approach (see fig. 1a-c), following the visual information-seeking mantra of Shneiderman [8]: “Overview first, zoom and filter, then details-on-demand”. Thus, the available functionalities such as playing a video (see fig. 1c) or accessing a website (see fig. 2a) are always coupled with the information object itself, as it is proposed by object-oriented user interfaces [9].



Figure 1. (a) Initial screen of MedioVis 2.0 (b) Zoomed into the action region (c) Most detailed semantic zoom level of a movie object (d) Query “batman begins” entered into the search field on the upper right.

### Search, Filter and Explore

Analytical search methods are supported by MedioVis 2.0 as another way to formulate information needs. Users are able to enter text queries into a search field on the upper right corner of the screen (see fig. 1d). With each key press, the visual representation of matching objects expands. We applied the concept of Dynamic Queries and Sensitivity [10] for direct highlighting of objects, which still match the current query instead of removing all non matching objects. With this technique, the attention of the user is automatically directed towards media objects of current interest.



Figure 2. Portal containing all action movies. The user can choose between (a) the HyperGrid, (b) the HyperScatter and (c) a rapid serial visual presentation inspired by Apple’s Cover Flow (<http://www.apple.com/itunes/>).

### Portals and Visualizations

Portals [7] provide a supplementary way of exploration. By selecting an arbitrary region of the information landscape via a bounding box, the user creates a portal, providing a special view on the underlying media objects. Within portals, MedioVis 2.0 offers multiple visualization techniques – for understanding, filtering and querying – ranging from a rapid serial visual presentation (see fig. 2c) [11] over a scatter plot visualization called HyperScatter (see fig. 2b) [12] to a table-based visualization called HyperGrid (see fig. 2a) [13].

The HyperGrid is a novel visualization integrating zooming concepts and an internet browser into the well-known spreadsheet visualization. Every row, representing one media object, can be zoomed to access further information. By integrating the hyperlink-concept and an embedded internet browser, users can immerse into the information space without losing their context.

Furthermore, portals provide visualization-independent filter mechanisms. These filters are preserved even if the user switches the visualization. By moving and scaling portals in the landscape, MedioVis 2.0 allows to visually formulate complex queries in a direct-manipulative manner [10] as proposed with the concept of magic lenses [14].

### Personalization

To retain the state of a portal – with its filters and visualizations – for later use, MedioVis 2.0 provides the possibility to “lock” and assign a name to portals. Furthermore, users can reach their personal region of the information landscape (see fig. 3) by logging in via the circular region at the center of the landscape, revealing space to store and manage individual information artifacts. Drag & drop operations allow adding previously “locked” portals or copies of single media objects into this region. A search task is therefore no longer a transient action that is often difficult to repeat but rather a persistent object of a creative work process. Furthermore, the personal region can be organized individually by annotating, labeling and arranging artifacts the way that fits best to the user’s needs.

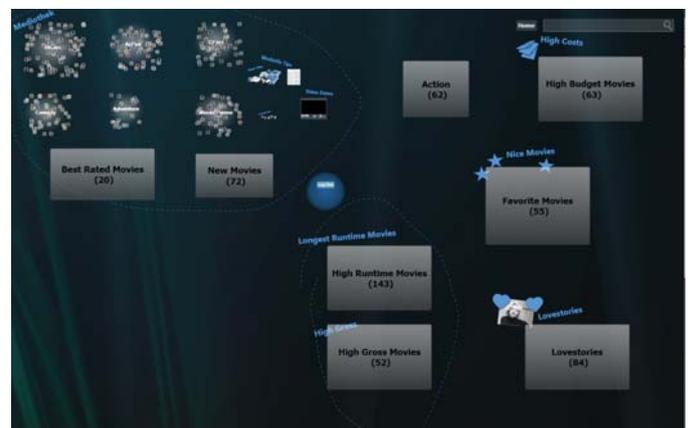


Figure 3. Users reach their personal region of the information landscape by logging in via the circular region at the center of the landscape. The portals are represented in different semantic stages, depending on the zoom level of the landscape.

### 2.5 Multiple Environments and Devices

Creative information work is a complex activity, usually executed in varying physical and social situations and environments. Therefore, one goal of MedioVis 2.0 is to develop an interface concept suitable for many different devices, which unifies all kinds of content and functionality with one consistent interaction model, while leaving the user the possibilities to establish own workflows, data structures or views on the information space.

Due to the nature of zoomable user interfaces, information presentation scales implicitly to a certain extent to different display sizes and is therefore applicable on very different hardware platforms. We currently run MedioVis 2.0 on standard desktop PCs as single user workstations, on large high resolution displays which are used as public walls to enable the work in groups or project teams and on multitouch tables to further improve simultaneous multiuser interaction (see fig. 4).



Figure 4. MedioVis 2.0 on different devices: (a) large high resolution display (3840x1080 pixel) (b) Microsoft Surface (<http://www.microsoft.com/SURFACE>) multitouch table.

### User Experience

An additional design goal of MedioVis 2.0 is to unite all techniques and features described above in one consistent and positive user experience [15]. Besides a satisfying usability we also considered several soft factors like joy of use or attractive visual design.

As every visual design communicates associations of values and functionalities [16], we used a semi-transparent background for portals, so that contained objects are still perceptible. We also placed premeditatedly sized halos behind the genre clusters to generate visual landmarks. To improve the joy of use we chose animated zooming as interaction technique, using a sinusoidal instead of linear animation, to imitate a real world movement. The transition between different stages within semantic zooming is accomplished by a cross-fading morphing animation. Furthermore, a parallax background layer is placed behind the information landscape that zooms with a smaller factor to arouse the feeling of depth and speed.

Eventually, the design of MedioVis 2.0 encourages the explorative and playful discovery of information objects or novel functionalities during the overall navigation process in the information landscape.

## Outlook and Conclusion

MedioVis 2.0 represents a novel perspective on how to implement a comprehensive Knowledge Media Workbench through the use of the zoomable user interface paradigm and object-oriented user interfaces. Thereby, information workers are able to accomplish activities within one consistent system. MedioVis 2.0 provides an unified user experience, not only on a desktop PC, but also on different devices such as multitouch tables and large high resolution displays. To further evaluate the potential of the concept, we will also transfer MedioVis 2.0 to other complementary devices like mobile gadgets (e.g. smart phones, netbooks), which already play an increasing role in creative workflows of many information workers. Reality based interaction [17] and the combination or “blending” of real world artifacts with digital information objects will also be of particular importance in our future research.

The evaluation of MedioVis 2.0’s user experience will be a further important component of the development. Therefore, we intend to organize focus groups and employ empirical studies to measure aspects such as hedonic quality and appeal.

Despite of open issues regarding the creation of knowledge artifacts or collaboration, which we want to approach in future work, we believe that our Knowledge Media Workbench – MedioVis 2.0 – offers reasonable possibilities to support an individual creative workflow.

## Acknowledgments

This work is supported by Prof. Dr. Harald Reiterer (supervisor), Hans-Christian Jetter, Andreas Engl, Katharina Schätzle and the DFG-GK 1042.

## References

- [1] Kuhlthau, C. C. 2004. Seeking meaning: a process approach to library and information services, volume 2nd Edition. Libraries Unlimited.
- [2] Shneiderman, B. 2002. Leonardo’s Laptop: Human Needs and the New Computing Technologies. The MIT Press.
- [3] Karger, D. R. and Jones W. 2006. Data unification in personal information management. *Commun. ACM*, 49(1): 77-82.
- [4] Eibl, M.; Reiterer, H.; Friedrich, Stephan, P. F.; Thissen, F. 2006: Knowledge Media Design: Theorie, Methodik, Praxis. Oldenbourg; Auflage: 2.
- [5] Jetter, H.-C.; König, W. A.; Gerken, J.; Reiterer, H. 2008. ZOIL - A Cross-Platform User Interface Paradigm for Personal Information Management. *Personal Information Management 2008: The disappearing desktop*.
- [6] Lindell, R. and Larsson, T. 2005. The Data Surface Interaction Paradigm, Theory and Practice in Computer Science, Eurographics Association.
- [7] Perlin, K. and Fox, D. 1993. Pad: an alternative approach to the computer interface. In *SIGGRAPH ‘93: Proceedings of the 20th annual conference on Computer graphics and interactive techniques*, ACM Press.
- [8] Shneiderman, B. 1996. The Eyes Have It: A Task by Data Type Taxonomy for Information Visualizations. In *Proceedings of the IEEE Symposium on Visual Languages*, Washington. IEEE Computer Society Press.
- [9] Collins, D. 1994. *Designing Object-Oriented User Interfaces*. Benjamin-Cummings Publishing Co., Inc.
- [10] Ahlberg, C.; Williamson, C.; Shneiderman, B. 1992: Dynamic queries for information exploration: an implementation and evaluation. *CHI ‘92: Proceedings of the SIGCHI conference on Human factors in computing systems*. ACM Press.
- [11] de Bruijn, O. and Spence, R. 2000. Rapid serial visual presentation: a space-time trade-off in information presentation. In *Proceedings of the Working Conference on Advanced Visual Interfaces*.
- [12] Gerken, J.; Demarmels, M.; Dierdorf, S.; Reiterer, H. 2008. HyperScatter – Modellierungs- und Zoomtechniken für Punktdiagramme. *M&C 2008*, Oldenbourg Verlag, München.
- [13] Jetter, H.-C.; Gerken, J.; König, W.; Grün, C.; Reiterer, H. 2005: HyperGrid - Accessing Complex Information Spaces. *People and Computers XIX - The Bigger Picture*, HCI 2005, Springer Verlag.
- [14] Bier, E. A.; Stone, M. C.; Pier, K.; Buxton, W.; DeRose, Tony D. 1993: Toolglass and magic lenses: the see-through interface.

SIGGRAPH '93: Proceedings of the 20th annual conference on Computer graphics and interactive techniques.

[15] Kuniavsky, M. 2003. Observing the User Experience: A Practitioner's Guide to User Research. Morgan Kaufmann.

[16] Crow, D. 2003. Visible Signs: An Introduction to Semiotics. AVA Publishing SA, Lausanne.

[17] Jacob, R. J. K.; Girouard, A.; Hirshfield, L.M.; Horn, M.S.; Shaer, O.; Solovey, E.T.; Zigelbaum, J. 2003. Reality-Based Interaction: A Framework for Post-WIMP Interfaces. CHI '08. ACM, New York.