



Mobile Applications, Augmented Reality, Gesture-Based Computing and more – Innovative Information Services for the Internet of the Future: the Case of the Bavarian State Library

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Abstract:

The more libraries integrate their services into the digital workflows and lifestyles of their users, the more they are confronted with an ever-growing range of innovative platforms, devices, tools, gadgets and networks. Providing a rich and unique digital “content experience” is only halfway to success – content needs to be contextualized in ways that facilitate new and fascinating user experiences in their respective environments. The Bavarian State Library has been experimenting for some years in the field of innovative “channels” for providing future-oriented user experiences with digital services and digital content, thus catching a glimpse of how libraries may be working ten years from now. With its collection of 9.7 million volumes, 57.500 current periodicals, 94.000 manuscripts and 22.000 incunabula, the Bavarian State Library at Munich in Germany is one of the largest European general and research libraries. It operates the “Munich Digitisation Centre”, a national competence centre for digitisation services and technologies. Because of its systematic utilisation of scan robotics and its public private partnership with Google, the Bavarian State Library has been able to build the largest collection of digitised content amongst all German libraries. Convinced that in the near future digital information will primarily, if not exclusively be provided as mobile services, enhanced by immersive Augmented Reality features and advanced gesture-based technologies, the Bavarian State Library is gradually providing its digital services within the framework of these innovative environments:

- *First the online-catalogue with approximately 10 million titles including all personalised functions, and the complete web site of the library were programmed and designed as generic mobile applications that run on all current smartphone browsers.*
- *In another well-received step, the library provided 50 digitised highlights of its collection as the native App “Famous Books – Treasures of the Bavarian State Library” for iPad and iPhone. Among other works users can read the complete digital Gutenberg Bible, the Song of the Nibelungs and the library’s contributions to the Unesco Memory of the World. The App combines high-ranking digital library content with the qualities of colour-brilliant, high-resolution mobile displays to form a unique user experience. It ranked among the most successful non-commercial Applications in*

the iPad-Store in 2010. The App "Islamic Books – Oriental treasures of the Bavarian State Library" will be launched in spring 2011.

- *Currently, the Bavarian State Library experiments with Augmented Reality applications, contextualizing digital information services in real world environments. In the App "Ludwig II", the library will provide multimedial library content on the famous "Swan King" via camera, compass and GPS functions of smartphones as an interactive Augmented Reality application, geo-referenced at prominent places of the king's life such as Neuschwanstein Castle.*
- *Aiming for an enhanced interactive user experience with digital cultural heritage, the Bavarian State Library is transforming a growing range of its digitized medieval manuscripts and incunabula into 3D E-Books that can be manipulated randomly on the screen. By rotating, zooming, flipping through the pages at every possible angle, the user gets an interactive experience of high-ranked objects of written cultural heritage as objects of art.*
- *Together with the Fraunhofer Heinrich-Hertz Institute at Berlin the Bavarian State Library developed the "BSB Explorer", an interactive presentation system that allows for the purely gesture-based, completely touchless manipulation of three-dimensional digital objects on the display. Without any intermediation of a computer mouse or a touchscreen the digital objects can be manipulated by mere gestures of the hand. The BSB Explorer provides for immersive user experiences in the context of library exhibitions and events, with the side-effect of attracting new user groups to the library on-site.*

The presentation will introduce these innovative services of the Bavarian State Library, take a quick look at their technical implementation and evaluate the challenges, opportunities, and limitations of library services in general in the digital environments of the future. Special emphasis is laid on the management of transformative innovation-processes and the implementation of a spirit of continuous change within the organizational design of the library that affects all its services.

Based on the case of the Bavarian State Library, it will be discussed how libraries can employ their services and their collections successfully in the digital landscape of tomorrow. It will be shown that the library of the future will be almost completely integrated and "contextualized" into the diverse and mostly mobile user environments. By this the library will become more and more "invisible", but will at the same time gain new and broader forms of visibility by providing immersive and fascinating user experiences that the new technologies entail.

The mobile Internet

The technologies of Internet use are currently undergoing a sea change: The classic web access route via desktop computers and laptops is no longer only supplemented, but is increasingly replaced by the use of mobile devices, and new services tailored to mobile use scenarios, such as for example augmented reality applications. The term "mobile devices" here primarily refers to so-called smart phones such as the iPhone, which have relatively large, high-resolution displays and, with inexpensive flat rates, allow for comfortable Internet access, as well as the new tablet devices, of which currently surely the Apple iPad is the most popular.

All current studies and trend reports on the development on the Internet agree that the mobile Internet is the future. The Gartner report "Top End User Predictions for 2010" says: "By 2013, mobile

phones will overtake PCs as the most common Web access device worldwide."¹ The annual HORIZON report, analysing web trends in particular in the fields of action of academic research and education, in its 2010 edition draws the conclusion: "For many people all over the world, but especially in developing countries, mobiles are increasingly the access point not only for common tools and communications, but also for information of all kinds, training materials, and more."² And the oft-quoted Morgan Stanley's Mobile Internet Report also forecasts: "Regarding pace of change, we believe more users will likely connect to the internet via mobile devices than desktop PCs within 5 years."³

Libraries as important service providers in the Internet have to adapt in time to this global trend towards a predominantly mobile Internet use, and make available their core services - the online catalogue, electronic resources such as data bases, e-journals and e-books, their digitised book collections and virtual reference services etc. - also in the form of mobile versions. Particularly younger library users, for whom the use of mobile devices is a matter of course, will equally naturally expect mobile variants of library Internet services and will no longer put up with "miniature images" of regular web sites on smart-phone displays. A study of the "Inside Higher Education" journal on "Challenges and Opportunities of the Small Screen" describes these changes in the users' expectations very concisely: "When we get to a point that a mobile version is expected of whatever content we want to interact with, not having a mobile version may cut off the desire to consume that content."⁴

The Bavarian State Library

The Bavarian State Library (www.bsb-muenchen.de) in spring 2010 started offering its central, net-based information services to its users successively also in the form of mobile applications. The Bavarian State Library, founded in 1558, is the central state and archival library of the Free State of Bavaria and one of the world's most important international universal libraries. Its collections currently comprise 9.7 million books and 57,500 current journal subscriptions. With 93,600 manuscripts it ranks among the four largest manuscript libraries of the world, its collection of 20,000

¹ Top End User Predictions for 2010: Coping with the New Balance of Power, 2010.

www.ihrim.org/Pubonline/Wire/MayJune10/Predicts2010_NewBalancePower.pdf (retrieved on: 05/05/2011)

² The Horizon Report, 2010. <http://wp.nmc.org/horizon2010/> (retrieved on: 05/05/2011)

³ Morgan Stanley, The Mobile Internet Report, 2009.

http://www.morganstanley.com/institutional/techresearch/mobile_internet_report122009.html (retrieved on: 05/05/2011)

⁴ Inside Higher Ed, Challenges and opportunities of the small screen, 2009.

http://www.insidehighered.com/blogs/technology_and_learning/challenges_and_opportunities_of_the_small_screen (retrieved on: 05/05/2011)

incunabula is the richest worldwide, and around 140,000 printed works of the 16th century represent Germany's largest library collection in this time segment.

The Munich Digitisation Centre (MDZ) was founded at the Bavarian State Library already in 1997 (www.digital-collections.de). Today the Munich Digitisation Centre is a national competence centre for innovative digitisation technology and services and Germany's leading institution of mass digitisation of written cultural material, among other things through the consistent use of scan robotics. Currently the Bavarian State Library can already offer 520,000 digitised books from its collections for free use. This is the largest digital data collection held by any German library. Almost 90% of the digital books contributed by German institutions to the European cultural and scientific portal "Europeana" are from the Bavarian State Library.

At the start of 2007 the Bavarian State Library was the first continental European library to enter into a public-private partnership with Google, initiating the digitisation of its complete copyright-free holdings from the 17th to the 19th century, comprising a total of over 1 million volumes. The joint venture will presumably be concluded already in 2014 and has become a role model for comparable partnerships of large European national and universal libraries with Google, among others for the Austrian National Library.

Basic services of the Bavarian State Library as mobile applications



Illustration 1: Mobile OPAC of the Bavarian State Library

The re-design of the most important and most frequently used services of the Bavarian State Library as mobile applications started with the library's online catalogue with around 10 million titles, as well as the Bavarian Union Catalogue maintained by the Bavarian State Library with 22 million searchable titles. These services had to be comprehensively redesigned so as to adapt them to the usability requirements of gesture-controlled touch screens of modern smart phones. Both applications were developed as generic applications which run on all currently relevant mobile platforms: on Apple's iOS operating system for iPhones and iPads and on Android or Symbian-based mobile devices.

The adaptation of the two online catalogues to the use environment of mobile devices required among other things

the enlargement of fonts and buttons, the filtering out of redundant information, the subdivision of information into smaller units, where required "hiding" such units behind a finger-stroke command of the gesture-based touch-screen control, as well as the GPS position finding, so that location functions such as displaying the nearest library holding the desired items can be used. A switch evaluating the user agent of the http protocol then controls automatically whether the mobile or the classic variant of the online catalogue is called up. In case the online catalogue of the Bavarian State Library is accessed via the web address *https://opacplus.bsb-muenchen.de* and the Bavarian union catalogue via the address *www.gateway-bayern.de* using a smart phone, the user thus accesses the mobile version of the services without any effort on his part. The adaptation to the specific characteristics of the smart phone takes place predominantly through loading specific Cascading Style Sheets (CSS).

The mobile versions of the online catalogue of the Bavarian State Library and of the Bavarian Union Catalogue do not only support the pure search functionalities, but in addition also all personalised services, such as the administration of the individual user accounts and the loan, reservation and interlibrary loan functions. Furthermore the direct access to licensed electronic journals and digitised collections is supported, which can then be read directly on the smart phone. Finally, also links to all relevant social networking sites have been implemented.

At the end of 2010 finally the mobile version of the complete web site of the Bavarian State Library was launched (*http://m.bsb-muenchen.de/*), now presenting the complete web offer of the library in a format that was optimised for all conventional smart-phone operating systems. When calling up the web site using a mobile device for the first time the user is asked whether he wishes to use the mobile or the "classic" version of the site. In case he opts for the mobile variant, this version is automatically selected by default upon all further accesses via the mobile device. With the mobile web site now *all* digital services of the Bavarian State Library can be used employing mobile devices.

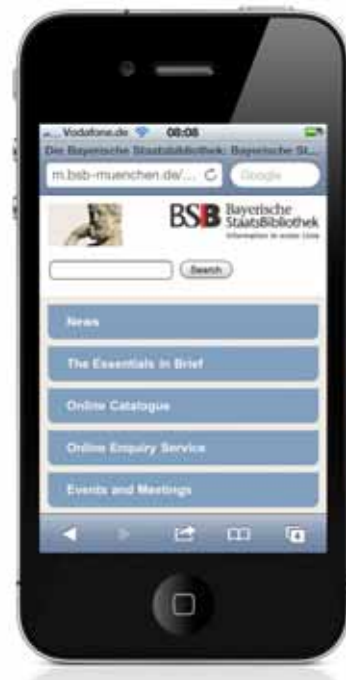


Illustration 2: Mobile web site of the Bavarian State Library

"Famous Books" and "Oriental Books": Outstanding specimens of written cultural heritage as iPad applications



Illustration 3: "Treasures of the Bavarian State Library" as iPad application

Parallel to launching its basic services (online catalogue, web site) in summer 2010 the Bavarian State Library ventured further into the mobile Internet, digitally presenting outstanding specimens of written cultural heritage and thus setting a paradigm both nationally and internationally, by offering over 50 select, digitised masterpieces from its collections in the form of a dedicated iPad application. The App bears the title "Famous Books - Treasures of the Bavarian State Library" and is available worldwide and free of charge via Apple's iTunes App Store. On the high-resolution, brilliant colour display of the iPad, which, regarding its design and usability, is predestined for presenting digital books, now the

frequently uniquely illuminated digital colour copies of the genealogies of the Fugger dynasty, the Ottheinrich bible, the Song of the Nibelungs, the gospel book from the Bamberg cathedral, the Babylonian Talmud, the Theuerdank, the Genji Kokogami and many others can be browsed from the first to the last page (!). All functionalities of the application, such as cover flow, thumbnail preview, zooming, etc. can be operated through mere finger movement on the iPad touch screen; a selectable video provides additional information about the 450-year history and the service profile of the Bavarian State Library. A somewhat slimmed version of the "*Treasures of the Bavarian State Library*" is also available as iPhone application. The application "*Famous Books*" in 2010 formed part of the most successful free apps in the Apple iPad App Store. It assumed top positions in the corresponding rankings of the store and is now viewed as one of the most paradigmatic mobile cultural apps of all.

In May 2011 the launch of a further iPad/ iPhone app of the Bavarian State Library took place: "*Oriental Treasures of the Bavarian State Library*", which presents the digital copies of 20 particularly valuable and very rare Koran manuscripts and further outstanding specimens of the Islamic cultural area and is also intended as a contribution to the current culture-political discussion. The application offers a representative overview of the collection of Islamic manuscripts of the Bavarian State Library, bringing together spectacular, particularly splendid objects of all acquisition phases. It

contains several Koran manuscripts, among them one extremely valuable manuscript from the 11th century, and one of only twelve surviving dated Korans from Islamic Spain.

Moreover, the application comprises select examples of Arabic, Persian and Ottoman book art, among other things a famous Arabic manuscript of the cosmography of al-Qazwini, which is also known under the title "The Miracles of Creation", a manuscript of the well-known Persian Book of Kings containing 215 miniatures, which represent one of the most comprehensive image cycles existing in connection with this work, as well as the sumptuously ornamental prayer book of the harem lady Düsdidil. A further highlight of the application is an Islamic manuscript from Indonesia, the country with the largest Muslim population. The adventures of the early Islamic hero of the faith Hamza, an uncle of the Prophet Muhammad, which are narrated in this manuscript, are very popular there. The application "*Oriental Treasures of the Bavarian State Library*" offers the same functionalities as "*Famous Books*" and is also available in an iPhone variant. Both apps were developed in cooperation with a marketing agency specialising in mobile web design.



Illustration 4: "Oriental Treasures of the Bavarian State Library" as iPad application

Now one might wonder: Why does the Bavarian State Library limit these offers to the Apple App Store and consequently to the owners of an iPad or an iPhone? There are at least three good reasons to do so. Firstly, the "apps" represent topically focussed application programmes, thus allowing for designing and "marketing" selected, specific content clusters (e.g. 20 digitised top works of the Islamic cultural area) as a "product" in their own right. The chosen content can thus be

made visible to the user directly, in contrast to integrating it in large presentation platforms such as for example "Europeana" or the "German Digital Library" that is currently under construction. Here the content "disappears" so to speak in a large collection pool of several million digital objects, in which the respective individual work can frequently be located only by means of sophisticated search strategies. Secondly, the Apple App Store is an internationally known and very intensively used distribution channel. Opting for this distribution channel ensures that one's own offer really "reaches" the user. And thirdly the iPad - besides its other functions - currently surely represents the most suitable e-book reader for presenting high-

resolution, colour digital media such as "Oriental Books". The Gartner Report "Forecast: Media Tablets by Operating System, Worldwide, 2008-2015" predicts that the iPad will dominate the tablet market up to at least the end of 2015.⁵

Augmented reality application „Ludwig II“

What are the next steps of the Bavarian State Library in the world of the mobile Internet? In summer 2011 the library will venture into the innovative field of "augmented reality" technology for smart phones. With release scheduled for the beginning of July 2011, the library is currently preparing the augmented reality application "Ludwig II" for smart phones in cooperation with an Internet agency experienced in the pertinent field. The application uses contents from the regional cultural portal run by the Bavarian State Library "Bayerische Landesbibliothek Online (BLO)" (*www.bayerische-landesbibliothek-online.de*). Further contents are provided by the Bavarian Department of State-owned Palaces, Gardens and Lakes, with whom the Bavarian State Library cooperates in designing the app.

"Augmented reality" refers to the computer-based augmentation of the visual perception of reality, primarily the enrichment of the camera images of mobile devices with digital additional information or virtual objects by means of insertion or overlay. In practice in augmented reality applications usually digital information is integrated in the image of reality recorded by means of a smart phone camera. Augmented reality applications are location-based services and as such depend on the GPS, camera and compass functionalities of modern smart phones. They consequently represent an important "driving force" for the transition from the stationary to the mobile Internet. In the HORIZON Report 2011 the relevance of augmented reality is stressed particularly for cultural and academic applications: "The layering of information over 3D space produces a new experience of the world, sometimes referred to as 'blended reality', and is fuelling the broader migration of computing from the desktop to the mobile device, bringing with it new expectations regarding access to information and new opportunities for learning."⁶

On the occasion of the 125th anniversary of the death of the king, the app "Ludwig II" is offered, providing the user with topic-specific multimedia-based information in a context-sensitive fashion at original locations which are connected with the live and work of the famous "Swan King". The camera of the smart phone is used to capture objects relating to Ludwig II, and information complementing the camera image (texts, videos, sound, 3D animations) is overlaid in real time.

⁵ Forecast: Media Tablets by Operating System, Worldwide, 2010-2015, 2011.

<http://www.gartner.com/DisplayDocument?id=1624614> (retrieved on: 05/05/2011)

⁶ The Horizon Report, 2011. <http://wp.nmc.org/horizon2011/> (retrieved on: 05/05/2011)

For example the camera image of the smart phone captures the outside view of castle Neuschwanstein. The geo-localisation and the compass of the smart phone simultaneously determine the exact location and the viewing direction of the viewer, and via real-time pattern recognition the virtual object to be overlaid (e.g. the donjon planned by Ludwig II, but never built, as a 3D reconstruction), which is stored in the app, is identified and inserted in the camera image in the appropriate place. The augmented reality application thus reconstructs virtually e.g. selected architectural designs planned by Ludwig II, but never realised, and integrates them in the camera image in their intended place. The app "Ludwig II" employs cutting-edge technology, giving an example how singular library content can be made available in the modern use scenarios of the digital world.



Illustration 5: Augmented reality app "Ludwig II." – castle Neuschwanstein



Illustration 6: Augmented reality app "Ludwig II." – Munich Residence

Furthermore in the app "Ludwig II" both brief information ("location-based teaser") and detailed information ("additional specific information") about the life and abodes of Ludwig II are stored, which can be used both in a location-independent fashion and in a location-dependent fashion, inserted in the respective camera image. Image materials processed as cover flow, which can also be contextualised in a location-dependent fashion (e.g. overlaying of historical photos of the building progress of castle Neuschwanstein on the camera image in real time), and audio- and video features (contemporary witnesses, expert statements) complement the service, with which, in its entirety, also an interesting virtual (tourist) guidebook about Ludwig II is being created in the form of a location-based app. The full version of the service is programmed specifically for the iPhone and is consequently available worldwide in German and English via the App Store. A slimmed, platform-independent version of the app is made available via the augmented-reality browser "junaio".

Image-based access & similarity-based image search for the written cultural heritage of the Bavarian State Library

In particular mobile devices such as smart phones and tablets, regarding their user interface design, increasingly follow the interaction paradigm of *gesture-based* computing: Mouse and keyboard are replaced by direct interaction with the device, in which the user's fingers and hand themselves become input instruments (e.g. the gesture-based control of the iPhone through finger movements on the touch display). In view of this, there is a trend for the text-based research and access form to increasingly take a back seat (shown e.g. by the virtual keyboard of the iPad which is provided only as an alternative). It is substituted by a primarily gesture-based, direct interaction with multimedia-based, predominantly visually conveyed digital contents. The HORIZON Report 2011 counts gesture-based computing among the prospectively decisive key technology trends: "While the full realization of the potential of gesture-based-computing remains several years away, ... it's significance cannot be underestimated, especially for a new generation of students accustomed to touching, tapping, swiping, jumping, and moving as a means of engaging with information."⁷

In particular for the purpose of exhibitions the Bavarian State Library developed a purely gesture-controlled presentation system already in the year 2008, with the goal of designing the virtual experience of digitised manuscripts and incunabula in such a fashion that it approaches the haptic experience of the originals as closely as possible. In cooperation with the Fraunhofer Heinrich-Hertz-Institute in Berlin an interactive presentation system - the so-called "BSB Explorer" - was developed for selected 3D digital copies of most valuable works of the Bavarian State Library. It consists of a large display and a sensor control unit, thus allowing for a purely gesture-based, completely contactless manipulation of the three-dimensionally animated digital copies on the display. Without the mouse or the touch screen as intermediate elements, here the digitised books processed to become 3D objects can be paged through, turned and zoomed by mere movements of the hand. A Youtube video shows how this new, highly innovative presentation form works: www.youtube.com/watch?v=6kMxgL712LE. When the BSB Explorer was introduced by the Bavarian State Library on the occasion of the renowned *International Archival Culture Exhibition 2010* in Seoul, South Korea, in 2010, it was a world novelty. It was one of the highlights of the exhibition, sometimes attracting so many people that queues up to 20 meters formed in front of the interactive presentation system.

⁷ The Horizon Report, 2011. <http://wp.nmc.org/horizon2011/> (retrieved on: 05/05/2011)

On the basis of the experience and competence gained by the Bavarian State Library in the course of its manifold projects regarding the digital library, the mobile Internet and gesture-based computing, it is currently preparing another experimental project regarding information services in tomorrow's Internet: the development and implementation of an almost *purely image-based access* to the digitised written cultural heritage and *similarity-based image search* in this digital data pool. Thereby an optimal way to access digitised content is to be created for the mobile, gesture-controlled user devices that are going to prevail in the future.

The image-based access, which in this form is an international innovation in the library sector, will first be realised step by step for the currently 60,000 digitised works from the period from the 6th to the 16th century (manuscripts, incunabula, early printed works) from the collections of the Bavarian State Library. These works form part of the absolute core and top stock of Germany's cultural heritage. The various digitisation projects of the Bavarian State Library supported by the German Research Foundation and the European Union furthermore make the digital holdings of this period grow continuously.

So far these digital copies have primarily been oriented towards access via desktop PC and are available via the classic distribution channels, such as for example search engines or the various local, regional and supra-regional reference systems and portals (i.a. Europeana and WorldCat). The user is normally shown the searched digitised work in a so-called "viewer". By clicking on the control elements, the user can page through the work or call up a certain image by clicking on the digital table of contents, zoom in, etc. Here the user must always carry out all necessary operations with the aid of the mouse.

The outlined changes of Internet use - particularly triggered by the new mobile technologies and the simplified usability of touch-screen-based gesture control - currently for the first time make innovative, image-oriented ways of access employable on a large scale (and will probably make them prevail in the future). For the selected 60,000 digital copies from the core stock of the written cultural heritage of the Bavarian State Library this paradigm shift is to be achieved through implementing a primarily image-oriented presentation platform, which is optimised cross-platform, particularly for the new ways of access and hardware devices (smart phones, iPad, Android tablets, multi-surface tables, notebooks with touch screens etc.).

Concretely, the user is to be put in a position to call up via a multi-touch interface - without the classic text-based inputting of search terms or navigating in the hierarchies of traditional web sites -

large data volumes on the basis of the image information via an image wall (3D wall), the image information being dynamically arranged as required. Similar image contents are to be locatable through an image-similarity search. It is intended to segment and arrange the digital media using topic categories and time-bar functions in such a fashion that classical text-based research is rendered largely superfluous. The user can thus comfortably browse the images of the works on the digital image wall, trigger an *image-similarity search*, and look more closely at the selected work using gesture-controlled, touch-based commands. By zooming in for example the high-resolution digitised details of individual images can be shown through very simple image-based control processes.



Illustration 7: Digitised manuscripts on a 3D image wall (prototype)

In particular the *similarity-based image search* allows the user to identify and compare thematically related images and image elements which are spread over various digital media. This feature can be used extremely efficiently particularly regarding the frequently richly illustrated digital copies of manuscripts, incunabula and early printed works, and promises to open up new research perspectives. The open-source tool "cooliris" will be

used - with the required adaptations - for the implementation of the 3D image wall (www.cooliris.com impressively shows the function principle of a primarily image-based information access). The similarity-based image research will be implemented with a software tool developed by the Fraunhofer Heinrich-Hertz Institute Berlin. (<http://www.hhi.fraunhofer.de/en/departments/interactive-media-human-factors/overview/image-retrieval/>)

The projected presentation platform offers the user a completely new use experience. The conventional text-based search and navigating through the hierarchy structures of classic web sites - intended for operation and inputting of commands by means of a mouse - will be replaced by intuitive, image-oriented, gesture-manipulated movement on a 3D image wall. This type of presentation and access is consequently ideally tailored to the requirements of the displays of smart phones and tablet devices regarding design, format and usability. The integration of unique cultural

content in the digital world of the future Internet is implemented in an exemplary fashion by this service.

Conclusion

The transition from the stationary to the mobile Internet is more than a technology change regarding the use of digital information. It basically represents the transition to the omnipresent Internet, penetrating all areas of life, the "all-pervasive Internet", which is fully integrated in our daily lives and social routines. Digital, usually multimedia-based information is no longer something that is retrieved or located by the user at an "Internet workstation", but surrounds the user wherever he goes and is available ubiquitously. Augmented reality, representing a combination of real-worldly and digital information is doubtlessly the paradigmatic use case of this new digital ecosystem.

This development is almost inevitably accompanied by the loss in importance of the large Internet portals and institutional web sites oriented towards "full service".⁸ There is at least a trend that they will be replaced by apps and app-like web service offers tailored to specific purposes and services, which are adapted to the very concrete and multifarious use scenarios of the digital world regarding their individual focus and design: The Internet will become as individual as the life of its users, being their permanent companion.

The mobile Internet, augmented reality and gesture-based computing are - insofar as foreseeable - the currently decisive trends sketching the outlines of the future Internet. They form the technological framework in which the generation, processing and distribution of information will take place, in which also libraries have to seek and co-design their future as information providers. In the process the library will be almost completely integrated into the diverse and heterogeneous living and working environments of its users and will be "contextualised". As a functional unit it will thus inevitably become largely "invisible". However, at the same time it can gain a new and more far-reaching visibility, in that its offers and services provide the fascinating and immersive use experiences made possible by the new technologies.

⁸ Beyond the mobile web by yiibu, 2011. <http://www.slideshare.net/yiibu/beyond-themobilewebbyyiibu> (retrieved on: 05/05/2011)

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