AUGMENTED REALITY FOR REAL ESTATE

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ABSTRACT

Our project deals with the yet unchartered topic of the use of augmented reality (AR) in the field of real estate. Augmented reality means that the reality of the display by camera images is enhanced with the GPS and compass information on the smartphone and combined with supplementary data from external knowledge bases, social media networks or real estate search engines. So a value for the user will be created that turns the real and the virtual objects in a multi-dimensional relationship to each another.

Market analyses assume a rapid growth of the number of augmented reality applications. One field of application is searching for property via smartphone. On the other hand there are several real estate applications concerning architecture, buildings, refurbishment and housing renewal and even orientating in shopping centers. The field of augmented reality applications for real estate is wide, but not explored. Our paper presented at the ERES conference 2011 shows that only a few real estate search applications on the German speaking market supports AR.

The aim of the project is to analyse the quantity and usage of real estate augmented reality applications with special focus on German-speaking regions. Using qualitative methodology and literature research provides a methodical comparison of applications available. Based on the results of our research, the project covers the structural, technological and user related factors that facilitate or impede dissemination of augmented reality applications for real estate. As a result it should be given a smart overview of the existing applications and the market potential of AR-applications for real estate with a visionary conclusion of expected future developments.

Keywords: Augmented Reality, Augmented Virtuality, Smartphones, New Technologies, New Media, Applications, Apps, Real Estate Search, AR Browser, Living Architecture, Indoor Mapping Service

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INTRODUCTION

During the last year, the word App was nominated by the American Dialect Society as the word of 2010. App is the abbreviation for application. The main characteristics of an app are its simple usage and the flat training curve in usage in a short life cycle. It is a cheap product, created for consumers and distributed via virtual markets. Applications for smartphones, which can be downloaded in an application store, have been available since 2008. Apple can be regarded a pioneer with its foundation of the App Store.

According to Gartner (2011) the worldwide sales of mobile devices to end users is 1.6 billion units in 2010, which means a 32 percent increase from 2009. The smartphone sales to end users went up 72 percent from 2009 and accounted for 19 percent of total mobile communications device sales in 2010. With this rapid growth the report from Juniper Research (2009) found out that the market for mobile augmented reality (AR) services is expected to reach $732 million by 2014. The Whitepaper [Juniper Research 2009a] points out that mobile applications are achieving unprecedented download levels driven by the success of the Apple App Store. So the opportunities for mobile applications with augmented reality are strongly increasing.

In connection with the rapid growth of the smartphone market, mobile phones are becoming more and more a status symbol. The development of the additional value of mobile phones shows a plus of 7% within one year. This is mainly due to the fact that mobile phones are seen as an indispensable feature in business and private life. Mobile phones influence our lives in a positive and sustainable way. By now mobile phones have become an essential part of daily life for Austrians. Every fourth person in Austria says that he/she would rather abstain from coffee, car and television, than from the use of their mobile phone. [A1 Telekom Austria 2010] The consultant Arthur D. Little [Little 2010] published a study of the use of smartphones and apps in Germany. 32% of the respondents from the age of 18 up to 29 are owners of a smartphone with an increasing tendency. For 2012/2013 it is expected that the amount of smartphone users will be more than 50%, rising up to 70% by 2014/2015. This development cannot only be noticed in Germany and Austria, it can also be observed throughout Europe.

Using the Gartner hype cycle gives a graphic representation of the maturity and future direction of technologies and applications, showing emerging technologies and providing a cross-industry perspective. Augmented Reality has reached the peak of inflated expectations and is reaching the trough of disillusionment. [Gartner 2011a]

## Hype cycle of emerging technology
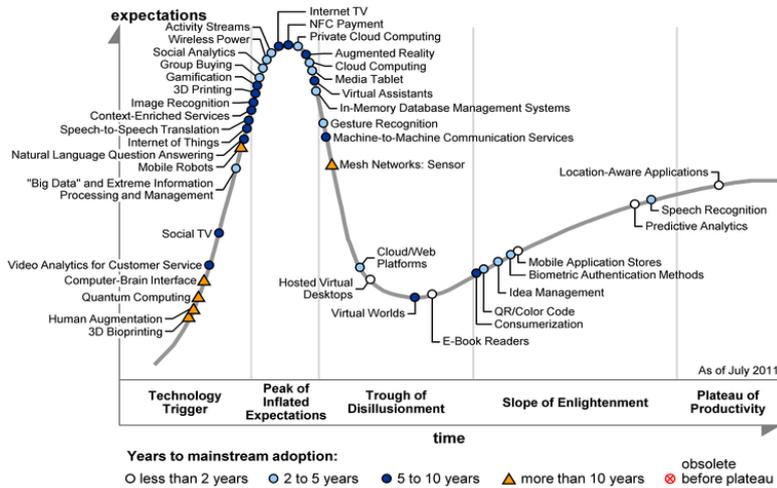
[Gartner 2011a]

Wagner (2007) points out that augmented reality research aims at developing new human computer interfaces. Augmented reality is able to extend the real-life image of e.g. the smartphone-camera image with additional information through GPS and compass information as well as e.g. with data from real estate search engines. This creates additional benefits for the user. At the same time, reality and virtual objects correlate in a three dimensional way.

Following the definition of Azuma (2007) an AR system has to fulfill following three requirements:

1) Combines real and virtual

2) Interactive in real time

3) Registered in 3-D

As it can be seen in the figure the real environment is enhance with the data of additional databases and external information within a single display for augmented reality. Wagner (2007) points out that the virtuality continuum juxtaposes AR and augmented virtuality (AV). AR is based in the real world, with a limited set of virtual objects mixed in. Within augmented virtuality a virtual environment with some real aspects is shown. While AR shows the real world, AV shows a virtual reality based on a computer-generated world. The boundary between AR and AV is not strictly defined.

Milgram continuum of reality and virtuality
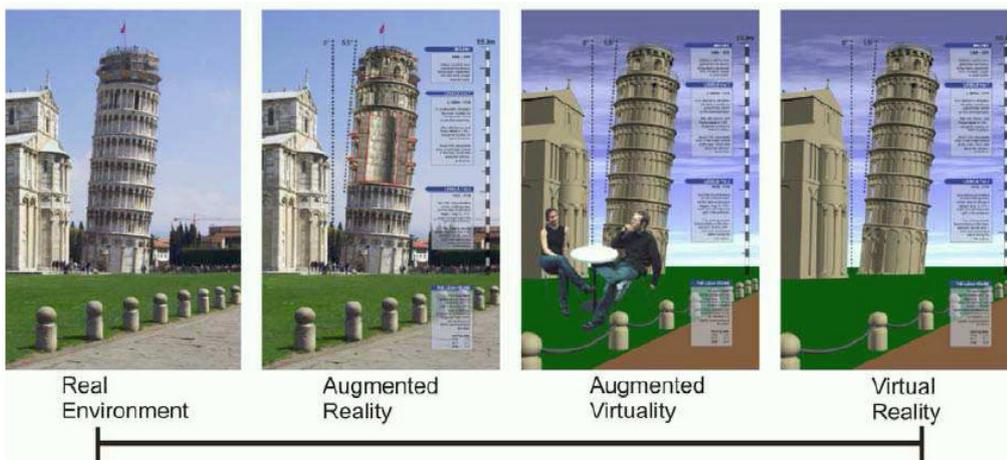
[Siegler Wietzel 2009]

The three main AR Browsers for smartphone platforms are Layar, Wikitude and Junaio. All platforms offer a similar functionality as shown in the graphic as follows.

Anatomy of a browser
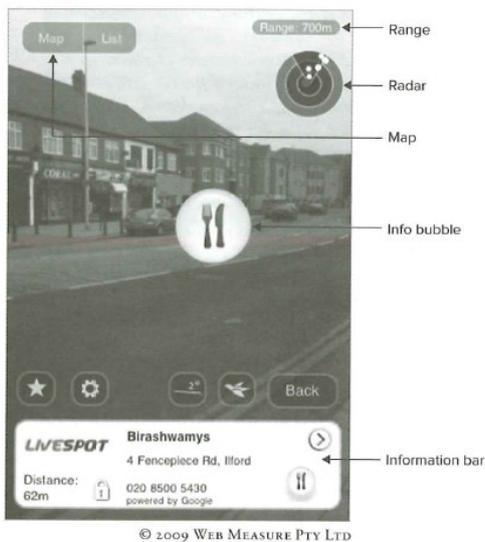
[Madden 2011]

The radar provides a visual location of the directions where points of interests (POI) or other relevant information is located. The info bubbles visually indicate POI with icons. The information bar shows additional information of the POI. The range gives the distance to the POIs or can be limited for special searches. The map is the traditional method of navigation to the POI, while AR could be a handicap for turn-by-turn instructions to the destination.

Layar was the first AR browser and is a product of Layar[1]. It has an international focus and popularity. It was first launched for Googles Android platform but is meanwhile also available for Apples iOS. Layar works with virtual layers for customized applications. Wikitude[2] comes from the Austrian firm Mobilizy and is focused on European regions. It is available for Android, iOS and Nokias Symbian. Junaio[3] is developed by the German firm Metaio. It is the youngest AR browser. The services of companies are called channels. It is available for Android and iOS.
[Jánszky Schildhauer 2010] [Madden 2011]

FIELDS OF AUGMENTED REALITY REAL ESTATE APPLICATIONS

The real estate sector has already adopted this development achieving apps and AR. So far, several real estate applications have been established. While there is only few literature concerning AR in the field of real estate the mentioned applications are the result of an extensive internet and literature research. In several publications AR applications for real estate are partially mentioned. Jánszky/Schildhauer (2010) describe the AR search of property regarding the app of the real estate search engine Immonet[4]. The search of property is the best known and most distributed AR application in the field of real estate. Sutau (2006) offers a classification which does not include real estate applications. This is an often seen fact in the literature that real estate applications are mixed with architecture and other fields of applications. But real estate is still an enormous economic factor. Additionally Mehler-Bicher et.al. (2011) offer a classification based on fields of communication consisting of the sectors education, collaboration, simulation, orientation and visualization in general and a role based classification by which the fields of living environment and living architecture are corresponding to fields of applications in real estate. Hayes (2009) classifies 16 AR models. These models also cover a variety of real estate applications.

16 Augmented reality business models

16 AUGMENTED REALITY BUSINESS MODELS by Gary Hayes 2009
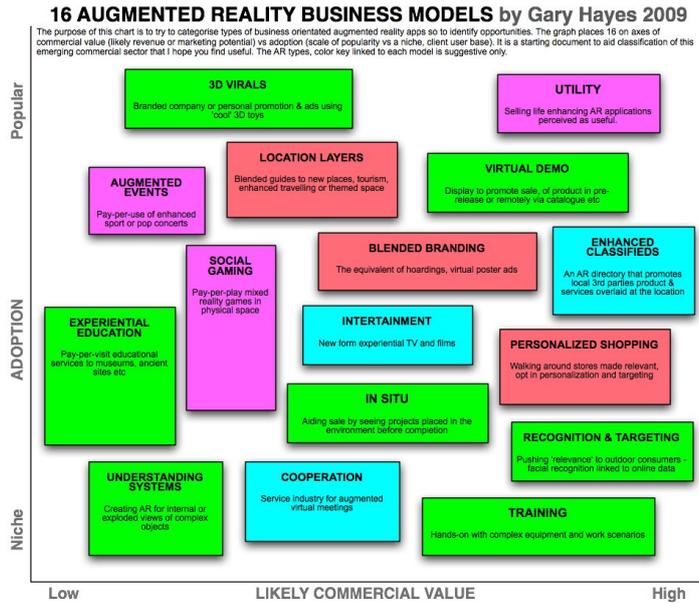
[Hayes 2009]

So it can be seen that a special classification for real estate is not given. We suggest the following figure for real estate applications.

Classification of the real estate apps and AR real estate applications

Augmented reality applications (as a subset)

- **Real estate search/Information on surrounding area**
- Functions oft the cadastral register
- Tools (for flats)
- **Information on real estate/Infotainment**
- **Architecture/Interior design**
- **Dimensions/Plannings**
- **Lexicon/Languages**
- Tools for calculation/financial calculation
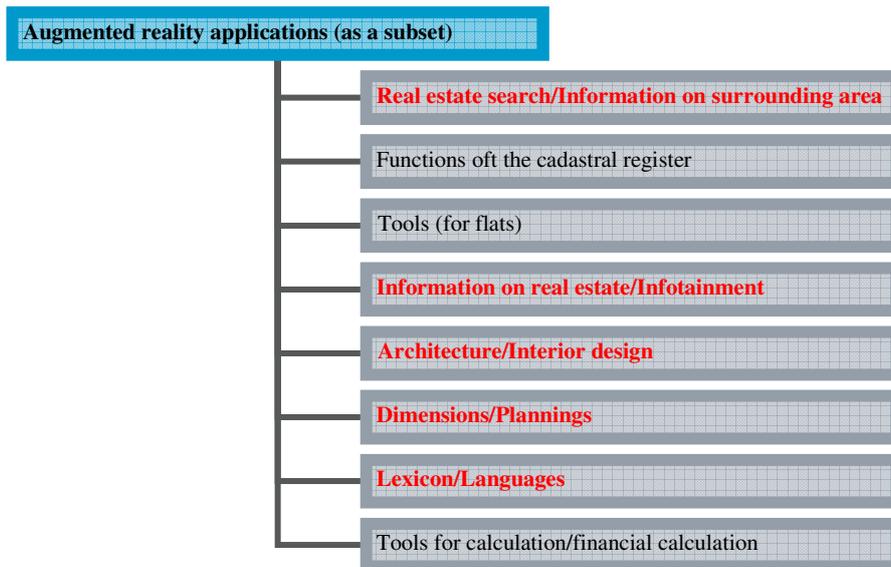
[Lang Sittler 2011]

The classification of smartphone applications are corresponding to AR applications. The AR applications are a subset of real estate apps and can be divided into the red marked fields of application. As a field of research we collected a wide range of real estate apps (with and without AR) for smartphones. This applications are mostly national for the Austrian market. Some of them are international and some partly feature AR in the field of real estate search an architecture/interior design. Following the individual areas of applications are shown with examples and discussed with respect to AR applications for real estate.

Real estate search/Information on surrounding area

In our past paper [Lang Sittler 2011] we tested the main applications in the German speaking region from November 2010 until March 2011 and defined the possible features of applications. For the Austrian Market there is currently one AR real estate search application (Immobilien.net[5]) available for download. The application immobilen.net was the first AR application available in the German speaking region. At this stage, immobilien.net offers about 55,000 objects in its application and is therefore the largest app in Austria. Together with the German platform Immonet these two are the only applications that supports AR.

Expert classification for AR real estate search

	Sven Gábor Jánszky	Prof. Dr.Dr. Thomas Schildhauer	Marc René Gardeya	Benjamin Thym	Matthias Greiner
Technological advantage?	2	3	1	2	2
Use of innovation for customers?	4	4	2	2	3
Profits of revenue models?	4	3	2	2	3
Influence on social marketing strategies?	2	2	2	2	2
Influence on Enterprise 2.0 strategies?	3	3	2	2	3

[Jánszky Schildhauer 2010]

According to the real estate experts interviewed in Jánszky/Schildhauer (2010) which classify several questions with grades of 1 to 5, meaning 5 is best, they additionally quote that the use of real estate search apps is low because of the absence of geo-coded objects in Germany. [Jánszky Schildhauer 2010] We [Lang Sittler 2011] also mentioned this problem in this search of real estate. Exact spatial positioning can only occur when the total data of the object is known and has been registered. This is where the problem with real estate search engines begins is Austria. Only 10% of all real estate on offer are currently geo-coded. Although real estate agents can use the app for free, the problem lies in the fact that purchasers, lessees and vendors are trying to avoid paying commissions by cutting out the agents. Therefore the agents hold back information on address when registering the real estate in the app. Another aspect is discretion in cases when a vendor or owner is against publishing data or when security is an issue with empty objects. In practice geo-coded objects that display full address information are 40% shorter on the market. In the Swiss market and in the English speaking region this problem is not dominant because the agents offer geo-coded data. [Macintosh 2010]

The application of Immobilien.net is shown in the following figure.

Real estate search application Immobilien.net
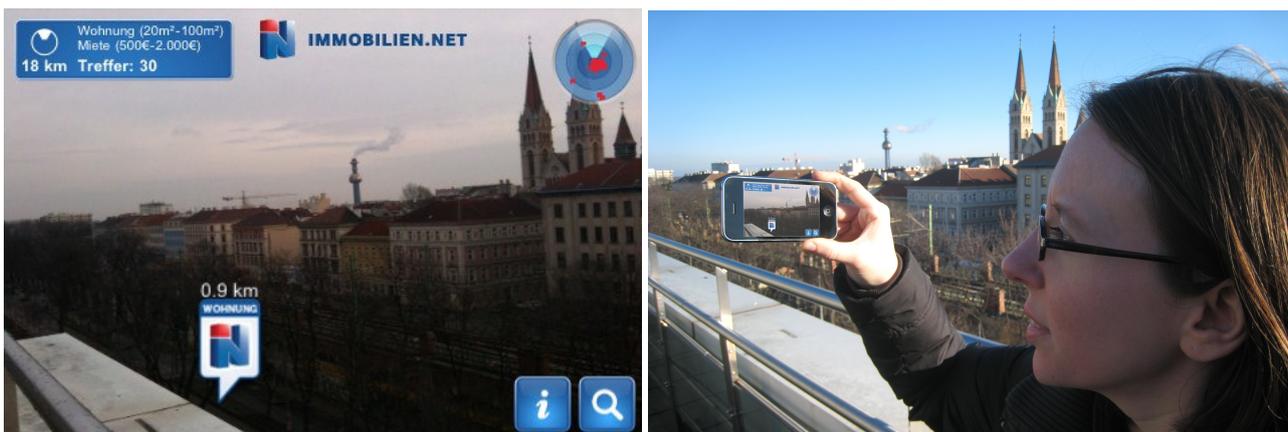
[Lang Sittler 2011a] [Lang Sittler 2011b]

Another field of application is information on surrounding areas. Without AR there is (as an example) the app Tupalo[6] which shows information on the surrounding offices, restaurants, educational infrastructure, etc. Combined with AR there are the above mentioned AR browsers which support the additional information shown in the camera picture of a smartphone. [Lang Sittler 2011c]

Layar AR search

[Hamburger 2011]

Information on real estate/Infotainment

On the other hand there are applications that give infotainment and entertainment to prospective customers. The Commonwealth Bank has been using AR in its property app for almost a year now. But non technical users are to be picked up with additional features do not requiring technical know-how. Working off a full page newspaper ad, the new AR app let discover the property market in the fictional town of Cherryford Hill with voice guidance. [Broughall 2011]

Commonwealth bank infotainment AR app

[Broughall 2011]

Smartphone maps can guide people through streets. But when you step into a sprawling building, no GPS data can be retrieved. A number of companies are charting the interiors of shopping malls, convention centers and airports to keep users from getting lost as they walk e.g. from the food court to the restroom. [Kopytoff 2010] Hoffmann (2010) points out that the German market has no such application though there is an increasing demand for orientation features.

## Indoor mapping service with AR functionality

[Kopytoff 2010]

Architecture/Interior design

The application iLiving[7] has announced a new area of architectural features. This app is only a static viewer that allows users to handle with virtual furniture. The company Ikea experienced with several AR tools for interior design. [Frey 2009] [Mehler-Bicher et.al. 2011]

Ikea living architecture
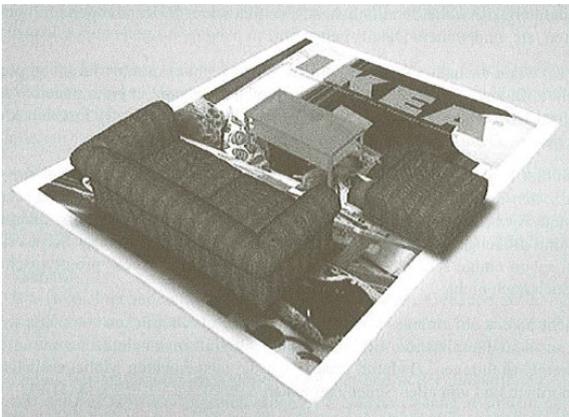
[Mehler-Bicher et.al. 2011]

In the field of planning and architecture AR applications are rapidly growing. With this technique prospective customers can be shown the future building through his individual view. AR can be helpful getting people a feel for a building or object. Even big scale buildings could be arranged. As you can see in the following pictures a virtual object can be placed by the help of real markers in the landscape.
[Mehler-Bicher et.al. 2011] [Beuchert 2010] [Woodward 2010] [Siegler Wietzel 2009] [Vahed 2010]

Augmented building model

[Woodward 2010]

Augmented reality on a very big scale

[Vahed, 2010]

The first visualization of a development in Vienna was the urban development area Aspern in the north of the city. A large area will be developed in future years. For prospective customers a new application of the Austrian company Ovos was set up as a layer of Layar.com. So you can see future buildings and architecture live on the construction site. [Ovos 2011]

AR app for large development area – Vienna Seestadt Aspern
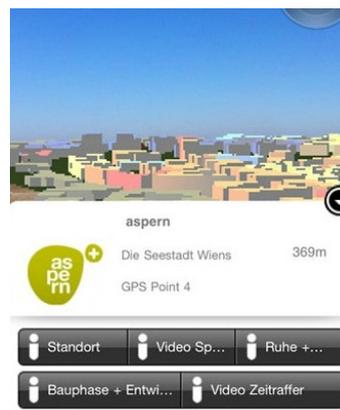
[Ovos 2011]

Dimensions/Plannings

Another field of application are planning tools. One is SOLight[8] from the Austrian company Anvartec. It shows the sun path throughout the whole year. SOLight calculates the exact sun path for the current GPS position. Through a live view the information of sun path overlays about the surroundings (houses, trees, mountains, etc.) can be calculated. Also the difference between the summer and the winter sun positions could be helpful for visiting an object and detecting several lightning problems e.g. with new or prospective condominiums.

SOLight sun path
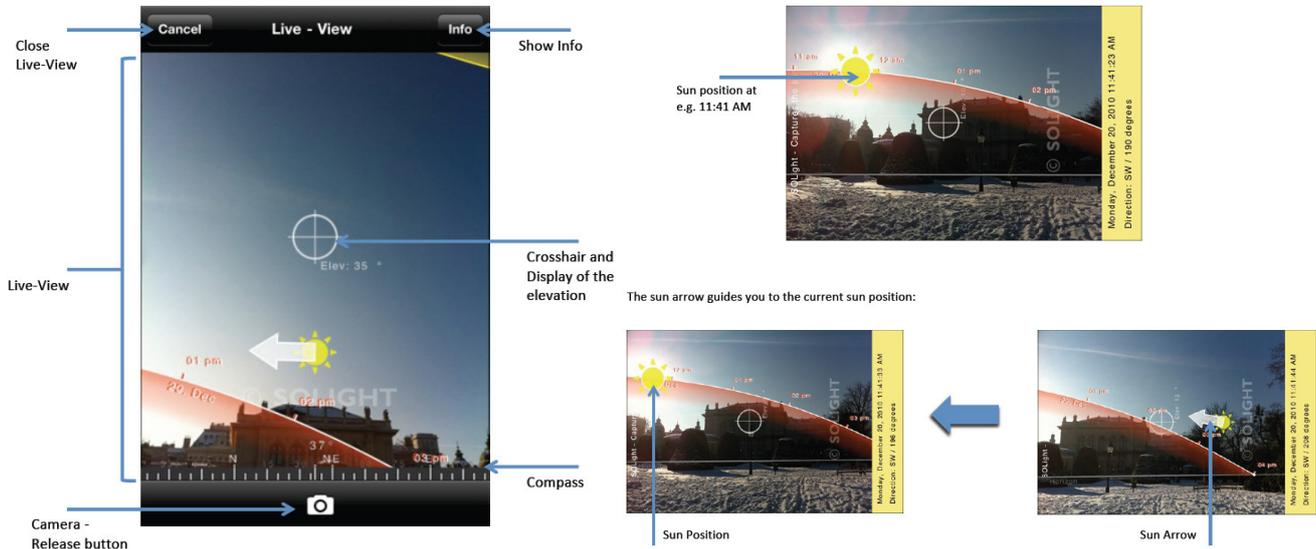
[Anvartec 2011]

Lexicon/Languages

The application Word Lens[9] was developed for tourism. Particularly the tourism benefits of AR applications. Word Lens is a entirely new tool for live translations on the smartphone. The camera image immediately translates the appropriate language and the result is simultaneously displayed. What currently works only with English and Spanish will soon cover more and other languages. With this application every language challenge or sign reading on a construction site will be no problem any more. [Lang Sittler 2011d]

AR application Word Lens for translating

[www.wordlens.com, visited 20 September 2011]

So the following table summarizes all AR applications in the field of real estate.

Summary of AR real estate applications

	AR real estate application
Real estate search/ Information on surrounding area	**AR real estate search** (Immobilien.net, Immonet.de, LiveSpot Property[10], Commonwealth Bank[11], MeilleurAgents[12], Zoopla[13], ZipReality[14]) **AR Browser** (Layar, Wikitude, Junaio, Ubique[15])
Information on real estate/Infotainment	**Infotainment AR app** (Commonwealth Bank AR Infotainment app[16]) **Indoor mapping service with AR functionality** (Point Inside[17], Fastmall[18], Micello[19])
Architecture/Interior design	**Ikea Living architecture** (Work in progress) **Augmented building model** (Work in progress) **AR app for large development area** (Vienna Seestadt Aspern[20])
Dimensions/Plannings	**Planning** (SOLight[21])
Lexicon/Languages	**Languages** (Word Lens[22])

(This table does not claim any completeness of the listed AR applications and websites.)

The focus of AR is located on presentation and visualization. The increasing availability of mobile AR in the field of Living Environment will become more relevant. The presented applications have different relevance in terms of their capabilities in use and their benefits for the user. The size of the circles indicates the estimated market share.

Classification of AR real estate applications
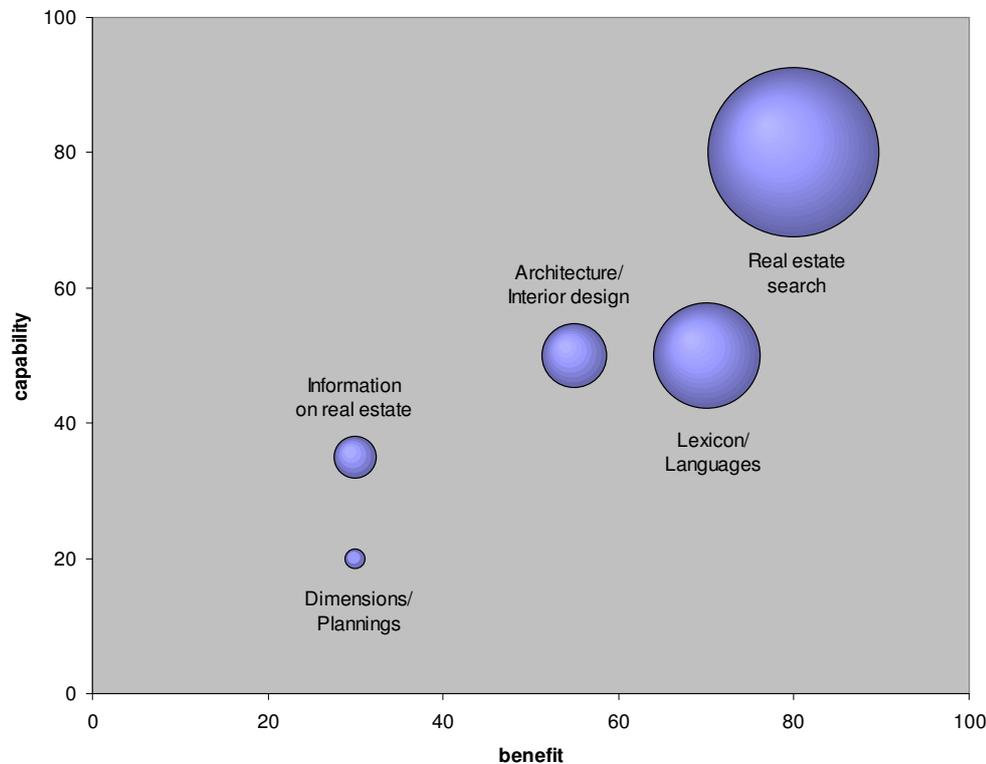
CONCLUSION

AR is predicted to be used by an even higher number of users in an increasing number of areas. [Bieszke 2011] There are two directions for the future development of AR. For one, the already foreseeable further technological development is very exciting. And secondly, there are the implications on our already predictable business models in the future. [Jánszky Schildhauer 2010] AR technologies can help us to handle the vast information flow generated by the ever increasing worldwide knowledgebase. [Bieszke 2011] Applications enhance customer perspective with a considerable simplification of the object search by showing free objects in the vicinity which are posted on various real estate websites. And if the customer wants to know how his future home looks like, the broker may have the desired property before construction begins on the spot including animation and virtual tours. [Gawlitta 2011] Also the location based services with GPS information will influence the customer use. [Tönnis 2010] AR will change the media world forever by offering a number of paid content business models, that no one thought of a few years ago. Just by connecting to the mobile phone this opens up many opportunities for creating new business models and revenue generation. [Caspari 2009] Especially the field of real estate should benefit from the increasing AR market.

Nevertheless, there is also the question of the added value for the consumers. Ganser (2010) comes to the conclusion that at the moment, the additional benefit of AR is only its fascination and not its utility. The usefulness of augmented reality can only be expanded with the number of applications in use.

Based on selected literature [Kleef van et.al. 2010] [Mehler-Bicher et.al. 2011] [Bieszke 2011] [Lang Sittler 2011] we collected a SWOT analysis for the use of AR.

SWOT-analysis of AR applications

Strengths	Weaknesses
Innovative and dynamic AR is aimed at young for technically interested consumers **AR is trendy** First-Mover-Advantage e.g. the application of immobilien.net supported first AR within the German speaking region **Redesign of mobile applications** Mobile real estate search and many other applications has been redesigned and given a new focus for the customer **New methods of application of real estate** AR offers a new approach to the customer	**Lack of suitable hardware** Even significant improvements have not established everyday use of hardware in terms of ergonomics **Limitations on the use of marker** Straight texture markers can not be used in any combination, as their use implies a very high computing power **Acceptance by users** AR often requires a differently use and handling **Difficult to quantify benefits and costs** AR has often not independently measurable benefits, but offers additional benefits due to synergy effects, which can hardly be quantified in monetary terms
Opportunities	**Threats**
Rapid transmission of content (time-to-content) AR enables a fast switching content, which consequently leads to a reduction in search times **Simultaneous addressing of different senses** The increase in emotionality, e.g. by moving images and the resulting response of different sensors supports the communication process **Increased activation of the participants** AR arouses curiosity in people that are less involved the communication **Increase the experience and credence qualities** Products and services are tangible and understandable by AR, particularly for complex applications in the technical area	**Transparent citizen** AR in combination with social networks poses significant risks with regard to data protection **Fusion of reality and virtuality** The increasingly perfect simulation of reality with virtual objects makes it difficult to distinguish between reality and virtuality **Dependence on technology** If you use AR in technical applications for visualization highly complex relationships creates a strong dependence on the technology **Augmented Reality spam** Another risk is AR spam, which means that advertising messages that will be augmented and sent to the user **Use of mobile devices** They are available to many people, but most people do not want to be walking around while holding a mobile phone in front of them for even a short period of time

ENDNOTES

1 http://www.layar.com

2 http://www.wikitude.org

3 http://www.junaio.com

4 http://www.immonet.de

5 http://www.immobilien.net

6 http://www.tupalo.com

7 http://www.metaio.com/iLiving

8 http://www.anvartec.com

9 http://www.wordlens.com

10 First AR real estate search app in Australia,
    http://www.livespot.com.au/LinkClick.aspx?fileticket=wJ1JoVARErM%3D, viewed 22 September 2011

11 http://www.commbank.com.au/mobile/commbank-app

12 http://www.meilleursagents.com/iphone

13 http://www.zoopla.co.uk

14 http://www.ziprealty.com

15 http://www.ubiqueapp.com

16 http://www.commbank.com.au/mobile/property-guide-app

17 http://www.pointinside.com

18 http://www.fastmall.com

19 http://www.micello.com

20 http://www.ovos.at/portfolio/87,augmented-reality-app-aspern-die-seestadt-wiens.html

21 http://www.anvartec.com

22 http://www.wordlens.com

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