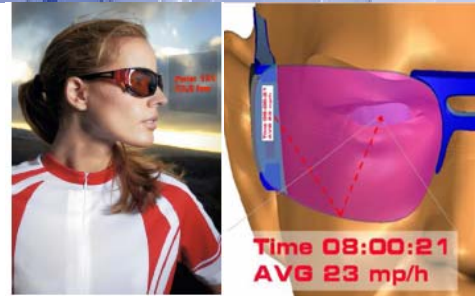


Business Innovation in Optics and Photonics

Course Objective and Idea

Prof. Dr. Michael Kaschke
Carl Zeiss AG



Course Objective A joint course of KSOP and Carl Zeiss AG

Course objective

The student is expected to gain an understanding how innovative concepts for optical and photonics products are transferred into a successful business development. The student will learn about and make first hands on experiences on business development aspects in a technology start up environment.

Real life example

The process is explained on a current example Head Mounted Display (**cinemizer®**) out of the New Venture Business of Carl Zeiss. The students are given an introduction into areas like intellectual property, data base research, business plan development project design a.o.

Group work

Equal emphasis is placed on relevant technology aspects. Students will work in small groups to develop innovative **business cases** for a potential future Carl Zeiss product called **“data glasses”** the best of which will receive an award.

Time: Every Monday according to the time schedule

Contact Information

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Timeline

Day 1 (2 h) Oct 15, 2012	Introduction - Introduction - Background of Cinemizer Department at CZ? - Status today - Brainstorming for ideas	M. Kaschke/ M. Weber	Day 7 (2 h) Nov 26, 2012	Project Design and Design for Manufacturing - How to run a R&D Project? - Targeting costing - Networked product development	M. Weber
Day 2 (2 h) Oct 22, 2012	Technology Introduction - Display technology (LCD, OLED) - Colour Management - HMD - Optical Designs - Diffractive optics	M. Weber	Day 8 (4 h) Dec 03, 2012	Project start – Group Work - Simulation game for running - Project development - Project selection and introduction into group work for groups 1 – 3	M. Kaschke/ J. Peter
Day 3 (2 h) Oct 29, 2012	Group Work Technology	M. Weber	Day 9 (4 h) Dec 10, 2012	as day 8 for groups 4 – 6	M. Kaschke/ M. Weber
Day 4 (2 h) Nov 05, 2012	Group Presentations Technology	M. Weber/ J. Peter	Day 10 (2h) Dec 17, 2012	Group Work	J. Peter/ M. Weber
Day 5 (2 h) Nov 12, 2012	Business Case Development/ Bus. Plan J. Peter - Market segmentation - Market research - Essentials of finance - How to write a business plan?	M. Weber/ J. Peter	Day 11 (2h) Jan 07, 2013	Group Work	M. Weber
Day 6 (2 h) Nov 19, 2012	IP-Management - The role of IP management - Patent research - Patent claims - Licencing - Patent infringement - Patent litigation	K. Gnatzig	Day 12 (2h) Jan 21, 2013	Group Work	J. Peter
			Day 13 Feb 4, 2013	Presentation of group work Excursion to Carl Zeiss AG in Oberkochen (full day)	M. Kaschke, M. Weber, J. Peter

Group work is a key part of this course - Let's define 6 groups of 3 persons each

Business Innovation in Optics and Photonics

Course Section 1

Introduction

Prof. Dr. Michael Kaschke
President & CEO
Carl Zeiss AG



Business Innovation in Optics & Photonics

Head-Mounted-Devices (HMD): Introduction

Carl Zeiss' cinemizer

Carl Zeiss' data glasses concepts

Brainstorming

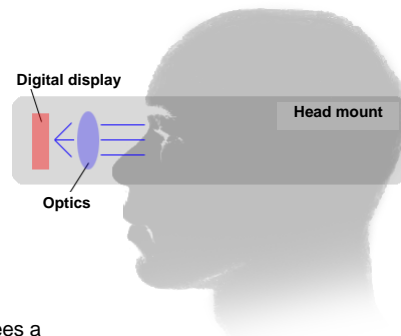
HMD offers big picture despite small device

Definition and basic principle

HMD = Head-Mounted Display or Head-Mounted Device

Other terms used:

- NTE = Near-To-Eye Display
- Video Eyewear
- Video Goggles
- ...



Basic principle: Virtual image is projected to the eye

- Small digital micro display images projected to the eye, so the user sees a magnified image apparently hovering in front of him

The HMD promise: Big screen experience with a small device

- Trend for mobility and miniaturization
- Dilemma: Compromise between display size and portability is difficult to break



Main advantages of video eyewear

- Breaking the compromise between actual and virtual display size allows cinema experience on the road
- Hands-free usage allows relaxed viewing position for long movies
- Potentially lower power consumption than bigger device screens extends battery life
- Positioning ensures privacy of viewed content in crowded areas

Four main variants of HMDs for different use cases

- **„immersive“**: no environmental vision, only the display can be seen, with large field of view and high resolution displays
- **„see only“**: environmental vision is somewhat blocked by the head-unit, but not fully, field of view likely smaller than in "immersive" units
- **„see through“**: environment is fully visible and the display imaged is seen as floating within the environment ("augmented reality")
- **„look around“**: environment mostly visible, only a small fraction is covered by the display optics. Is mainly used to show limited additional information

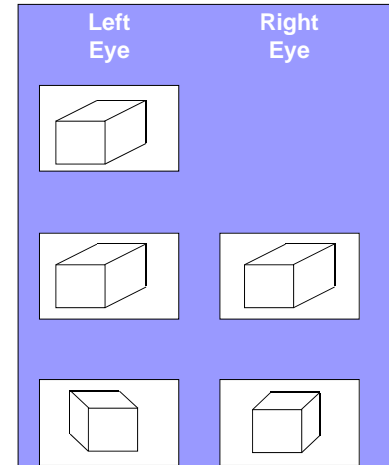


Each of the four variants with 3-subtypes

Mon-ocular: The information is only shown to one eye. The second eye still sees only the surrounding environment

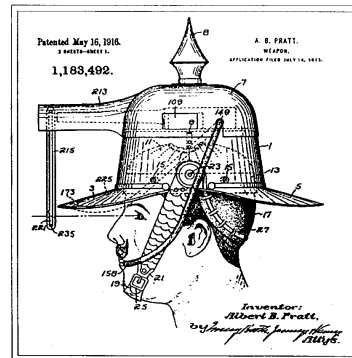
Bi-ocular - Monoscopic: The user sees the exact same display information with both eyes. Each eye has its own optics system and often also its own display, but the impressions is like watching a single display with both eyes. There is no 3D impression.

Bi-ocular - Stereoscopic: Each eye sees a different image showing the eye's individual perspective. The impression is like looking at a real 3D scene.



Idea for an HMD predecessor exist from almost 100-years ago

Albert Bacon Pratt: Patent 1916
„helmet mounted gun and sight“



- Helmet mounted aiming device
- „aim and fire“ (trigger with balloon in mouth)
- Idea likely never been realized

First working HMDs with electronic displays for military applications in 1960

- 1960** Beginning of first military developments to be used in helicopters and fighter jets (Ivan Sutherland; CRT + Optics)
- 1969** Testing of first in-flight prototype
- Mid 80s** Main key technologies developed




- VCASS:**
„Visually Coupled Airborne Systems Simulator“
- Flight simulator of US Air Force
 - Large Field of View
 - First studies about the physiological implications of wearing an HMD

- IHADSS:**
„Integrated Helmet and Display Sighting System“
- Used in Apache helicopters of the US Army
 - Coupled with IR camera
 - Monocular and monochrome system


What are major applications for an HMD in professional markets today?

Some examples

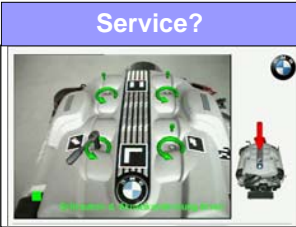
Military?



Fire Fighting?



Service?

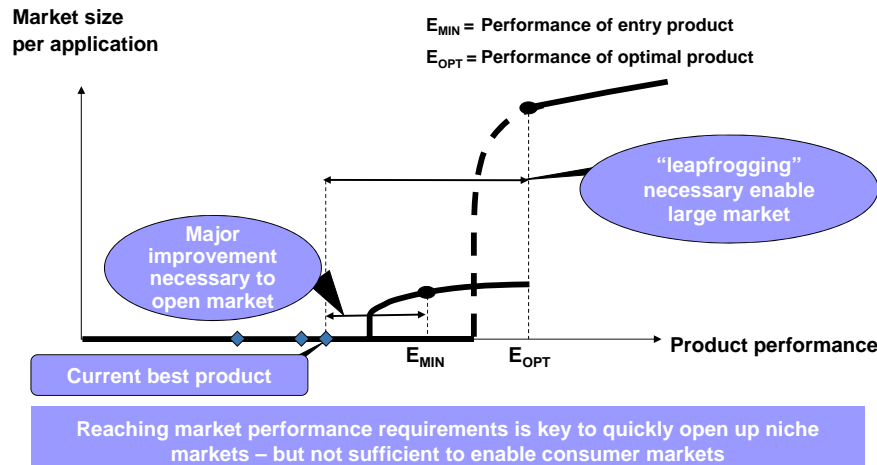


Carl Zeiss started to look into Video Eyewear already in 1999

↑

2012	Launch of cinemizer OLED at IFA 2012 with global sales approach
2011	Development of cinemizer OLED with HDMI interface and new design
2010	Sell through of 15k units of cinemizer PLUS in test market Germany
2009	Launch of cinemizer PLUS (V2) in Germany.
2008	First product "cinemizer V1" launched. Market research Germany and US.
2007	Functions and people from consumer industry joined the cinemizer team
2006	Start-up to launch video eyewear in the <u>consumer</u> mobile video space.
2005	Start-up to launch video eyewear business for industrial applications.
2004	Market study. 2nd Augmented Reality project with BMW and Siemens.
2003	First functional eyewear for service and military applications.
2002	Carl Zeiss starts research project for elimination of technological barriers.
2001	Augmented Reality project of Carl Zeiss together with Siemens and BMW.
2000	Business screening outside medical markets reveals attractive potential.
1999	Carl Zeiss Medical starts activities in "digital visualization".

In 2001 Zeiss started major R&D efforts, because existing product's performance not sufficient to open up niche market



Why did Carl Zeiss try to enter the professional market first?

Summary of Hypothesis for discussion

	Professional HMD Market	Consumer HMD Market
Pros	<ul style="list-style-type: none"> • Many applications with good fit to existing Zeiss business? • Zeiss with key competences to significantly increase product performance? • Markets less price sensitive? • ... 	<ul style="list-style-type: none"> • Consumer market is largest HMD market? • Only limited number of main applications? • Standardized display interfaces allow selling as stand-alone accessory? • ...
Cons	<ul style="list-style-type: none"> • Fragmented market with many applications? • HMD only small part of systems solution? • ... 	<ul style="list-style-type: none"> • No fit to existing Zeiss businesses? • Market very price sensitive? • Is there sufficient content available and how does it get to the user? • ...

Would you have made the same decision?

First Zeiss HMD Prototype in 2003

Milestones in Carl Zeiss HMD history (excluding the cinemizer)



Business Innovation in Optics & Photonics

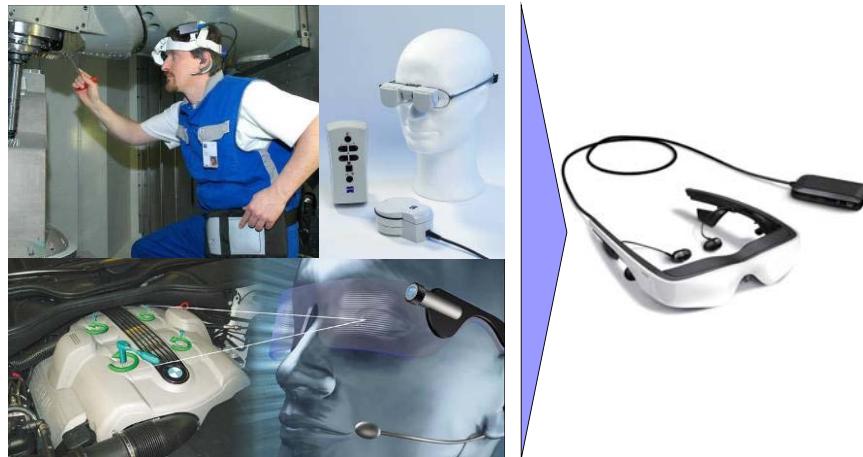
Head-Mounted-Devices (HMD): Introduction

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Brainstorming

The cinemizer: Technology from professional applications transferred into a cost-competitive consumer product



How to price an innovation like the cinemizer?

Overview of different approaches

Comparable Products	Consumer Research	Channel Surveys	Analogies
<ul style="list-style-type: none"> Analyze price brackets of existing products Position your new product relative to existing products based on relative attributes (performance, brand, ...) 	<ul style="list-style-type: none"> Focus Groups Surveys Lead User Trials ... Confront users with pictures, mock-ups, prototypes or first product? 	<ul style="list-style-type: none"> Ask distributors and retailers about their willingness to carry the product and the achievable RRP 	<ul style="list-style-type: none"> Compare prices of similar products in similar markets How much do other iPod accessories cost? How much should the cinemizer cost relative to an iPod?

What would you consider as the best method for an innovation like the cinemizer and why?

Initial value proposition of cinemizer V1: Movies in a cinema to take anywhere



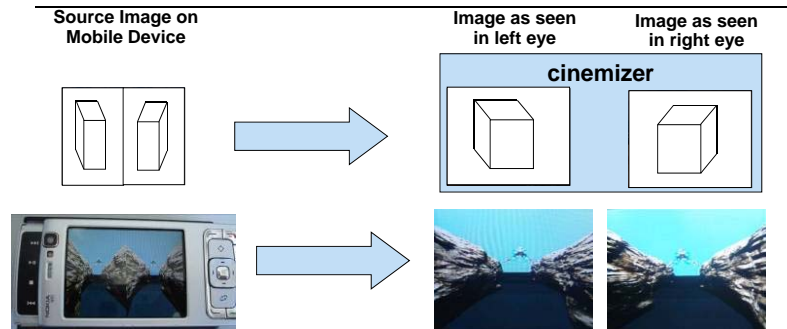
ZEISS' cinemizer is optimized for iPods and iPhones to be able to use the existing Apple iTunes infrastructure for content

Key question: Does the iPod video platform need an HMD?
USPs of HMDs versus Alternatives

	HMD	Internal screen	Pocket Imager	Flexible displays
USPs	<ul style="list-style-type: none"> • New experience • Immersion + privacy • Lean-back experience • Least reflexes 	<ul style="list-style-type: none"> • No additional device • Can be interactive 	<ul style="list-style-type: none"> • Shared experience 	<ul style="list-style-type: none"> • High portability • Most intuitive usage
Barriers	<ul style="list-style-type: none"> • User could look alien • Vulnerability of user • Weight on nose 	<ul style="list-style-type: none"> • Reflexes • Limited size 	<ul style="list-style-type: none"> • Plain surface needed • Darker environment 	<ul style="list-style-type: none"> • Earlier technology stage

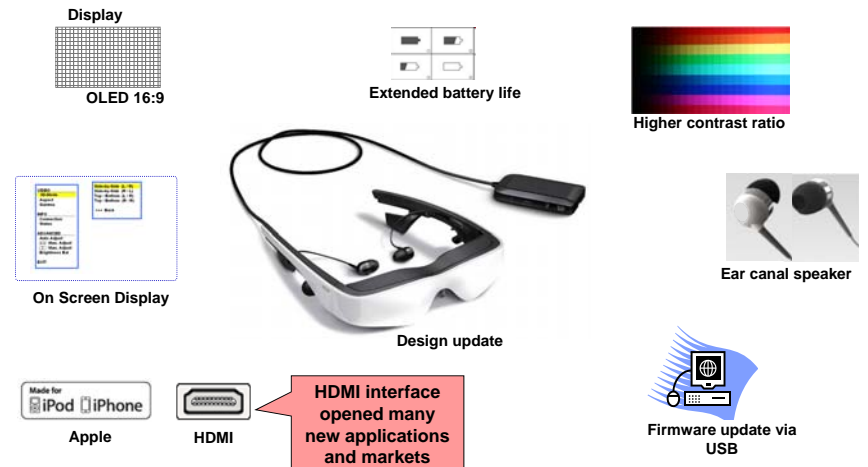
Discussion point: Change in perspective: USP vs. pain points:
Can any USP be successfully pushed via marketing, PR, channel and lead-users?
(Examples: surround sound, HDTV, induction stove, pyrolytic oven, APS photo system)

Additional USP relative to alternatives: Real 3D capability for games and videos



Key question: Where does the user get the content from?

Based on test market results, many technical changes were realized for cinemizer OLED



Ergonomic details have been “fine tuned” to fit human anatomy variety

Silicon nose pad with adapters for 3 different positions



Focus adjustment within a range of 7 diopter (-5 / +2 dpt)
Range of interocular distance covered by large Eye-box



In-ear speaker for superior sound
Adjustable ear slider for best fit



What could users see as the main benefit of using a cinemizer?

In General

- 40" screen size to **carry around** (“breaking compromise between screen size and portability”)
- Watch content **immersively** and **privately** (“truly cinema-like”, “fully concentrated”)
- Allows **hands-free relaxing viewing position** (“lean back experience”)
- Enables **mobile 3D watching and 3D gaming**
- Enables **interaction in virtual environments** (due to “head tracking” accessory)

Future benefit (planned for early 2013)

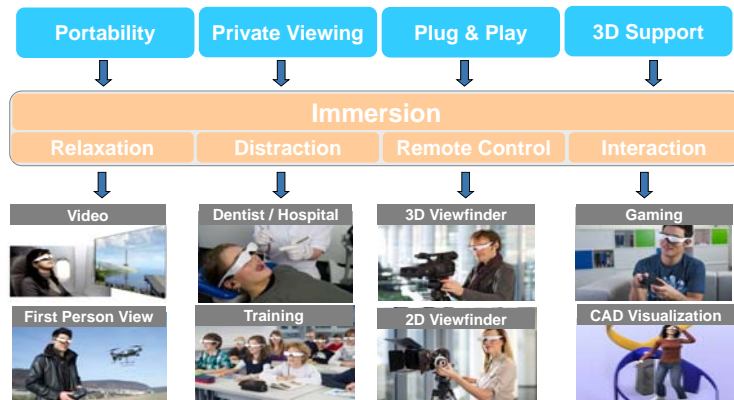
At home

- Use **anywhere in and around the house** (in bed, in the garden, in the bath-tub, ...)
- **Immersive tool** for existing Bluray Player and Gaming Console to watch videos and play games (2D & 3D)

On the road

- Seamless **integration** to existing Note PC & iPod/iPhone hardware and content infrastructure
- Prolongs **battery life** of mobile video player

What could be the main cinemizer application drivers?



Immersion, Distraction, and Interaction are the main drivers for typical cinemizer applications.

Cinemizer has always received positive feedback from press and tech enthusiast



Youtube version: “These are the coolest 3D glasses on planet earth”

Pro7 Galileo: “Thumbs up for cinemizer use in fitness studio / gym”

CeBIT 2012: “3D Gaming application with racing seat in focus”

But has the cinemizer really taken off ?

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Carl Zeiss' cinemizer

Carl Zeiss' data glasses concepts

So how do we move on ? (Brainstorming)

A vision of the use of augmented reality in everyday life

Video by the Google glass project



Visualize Smartphone content in Smartphone (SP) Glasses

Benefits are:

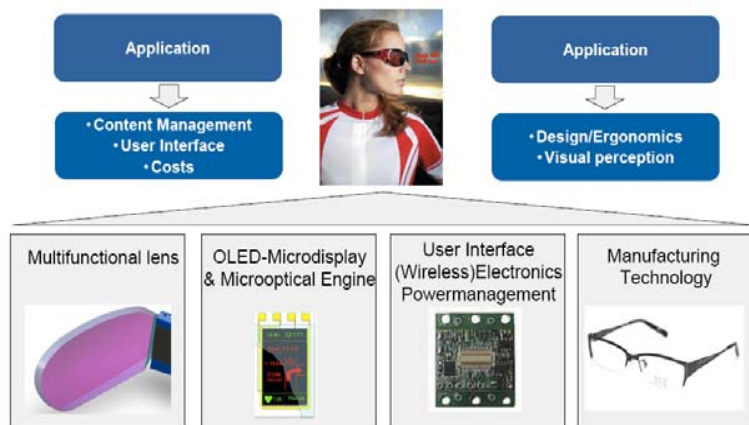
- Hands free
- Overlaid information
- Augmented Reality
- Integration in correction glasses
- Privacy
- Personal large display everywhere

World of Data Glass Lens Concepts

Success factor:

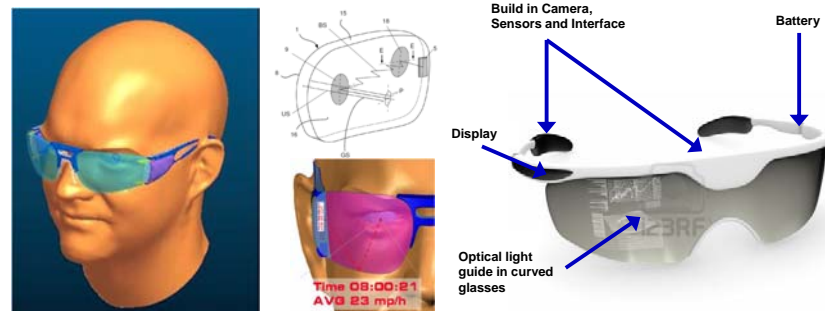
1. Ergonomical design
2. Performance
3. Costs
4. Intuitive usage

Data glasses System components of data glasses



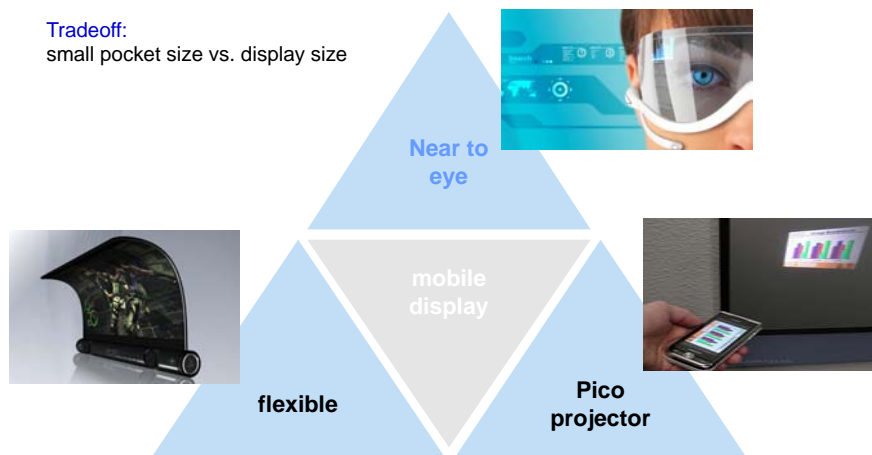
Data glasses are just at the hand-over point from research to product development

- Activities regarding data glasses since 3.5 years at Carl Zeiss.
- Focus was on optical concepts. Activities were driven from central R&D and have been part of German funded projects.
- Now we are at the point of redirecting the activities from basic research for concepts to product development.



Alternatives for Smartphone displays

Tradeoff:
small pocket size vs. display size



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Brainstorming

Split-Up in Work Groups (until next week)

Please collect ideas along the following list of questions:

1. Which are potential drivers and barriers for a market success of cinemizer and data glasses?
2. What could be levers to address and remove the barriers?
3. What could be done to use the drivers?
4. What could be good applications and business cases ? Which tech features would be needed ?

Ideas will be discussed and further developed in the following sessions.
Based on these ideas the business case for the work groups will be selected
finally on Day 8

Data glasses System components of data glasses

Group work:

How can a data glasses and cinemizer business be further developed?

What do you think are the major reasons that data glasses have not taken off yet?

What could be attractive business cases ?

What would be good add-on tech features ?

