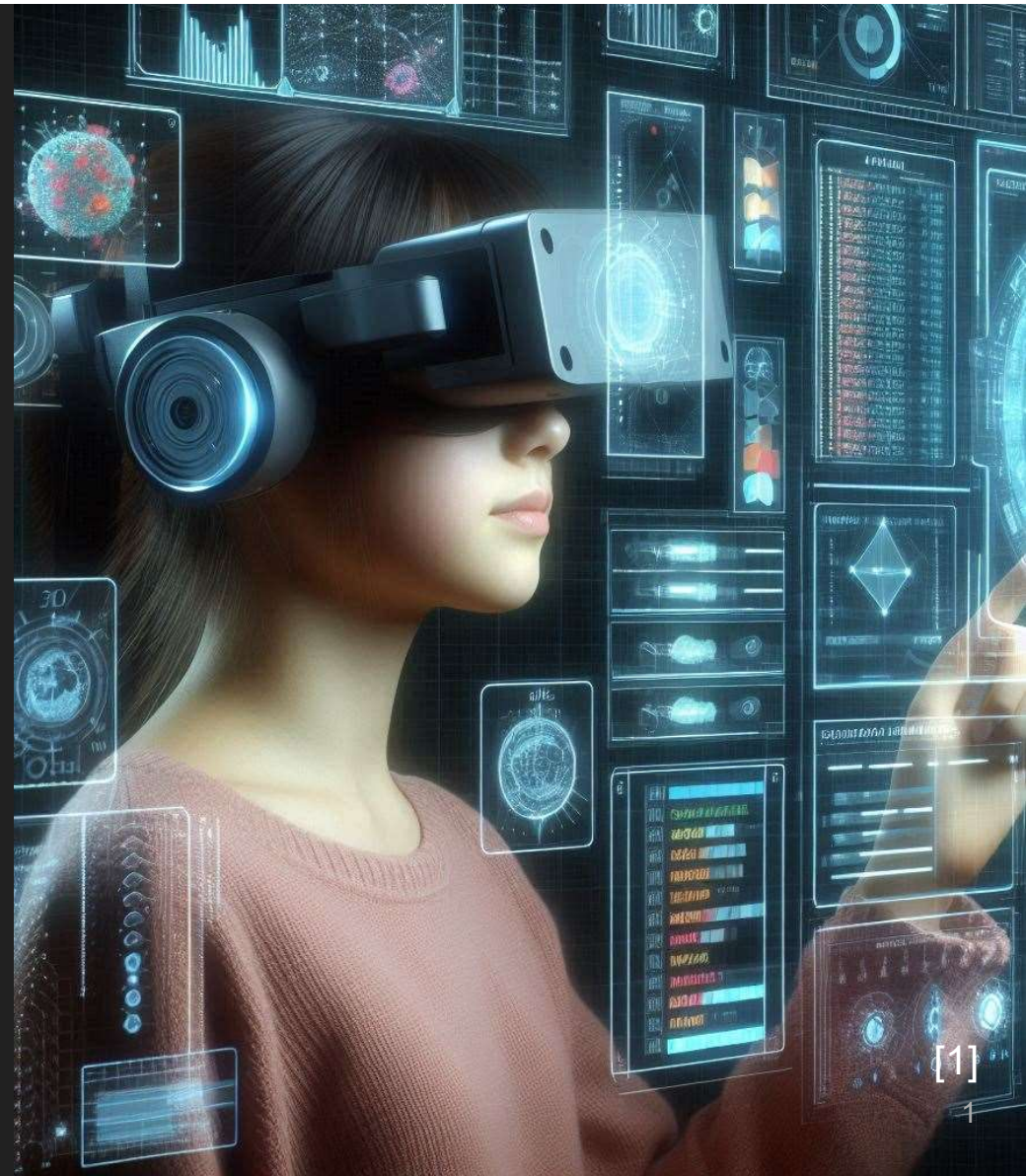


Recent Topics in XR and XAI '24/25:

Kick-Off

Margarita Chikobava
Gian-Luca Kiefer
Dr. André Zenner
Prof. Dr. Antonio Krüger



Warum?



Wissenschaftliche Vorträge

Anhang B. Beispielstudienpläne Bachelor-Medieninformatik

§ 1 Allgemeiner Aufbau

6	Stammvorlesung (9 CP)	Bachelor-Seminar (9 CP)		Bachelor-Arbeit (12 CP)	30	
	Seminar (7 CP)	Wahlpflicht (7 CP)	Medienprojekt (9 CP)	Medien- psychologie Seminar (4 CP)	27	
4	Informations- systeme (6 CP)	Nebenläufige Programmierung (6 CP)	Interaktive Systeme (alt: Ubiquitous Media) (6 CP)	MAD-Projekt (8 CP)	Allg. Psychologie 2 (4 CP)	30
3	Stammvorlesung (9 CP)	Human Computer Interaction (alt: User Interface Design) (9 CP)	Algorithmen & Datenstrukturen (6 CP)	Proseminar (5 CP)	Allg. Psychologie 1 Teil 1 (4 CP)	33
2	Programmierung 2 (9 CP)	Mathematik für Informatiker 2 (9 CP)	Softwaredesignpraktikum (9 CP)	Grundlagen Media, Art & Design (4 CP)	31	
1	Programmierung 1 (9 CP)	Mathematik für Informatiker 1 (9 CP)	Grundlagen der Medieninformatik (9 CP)	Ring (2 CP)	29	

Ziel:

Grundlagen

Praxiserfahrung

Tipps & Tricks



Ablauf

Recherchieren

- Benotete tabellarische Literaturrecherche über 5-6 Paper

Üben

- Ein unbenoteter Kurzvortrag über 3 Paper (15+5 min)
- Benotete Zusammenfassung des Vortrages des zugewiesenen Peers (2 Seiten)
- Eine wissenschaftliche Frage zum Vortrag des Peers stellen
- **Folien** am Vorabend per E-Mail an Gian-Luca schicken

Anwenden

- Ein benoteter Vortrag über 1 Paper (20 min) + Diskussion (10 min)
- optional Probevortrag spätestens 1 Woche vor echtem Vortrag
- **Folien** am Vorabend per E-Mail an Gian-Luca schicken

Literaturrecherche

- 5-6 zum Thema passende Paper recherchieren
- Sie in einer Tabelle zusammenfassen
- Metadaten richtig ausfüllen
- Zusammenfassende Spalten bestimmen und ausfüllen
- Interpretierende Spalten bestimmen und ausfüllen
- Anhand der erstellten Tabelle 3 Papers für den Kurzvortrag aussuchen
- Die Tabelle per E-Mail an den Betreuer (XR - Margarita, XAI – Gian-Luca) spätestens **am 21. November** schicken

Kurzvortrag

- Motivation für das Thema vorstellen
- Jedes Paper kurz beschreiben (Studie, Resultate, Diskussion)
- Qualität der Paper einschätzen
- Ein Paper für den Langvortrag auswählen
- Relevanz des Papers für den Langvortrag begründen
- Die Folien **am Vorabend** per E-Mail an Gian-Luca schicken

Zusammenfassung und wissenschaftliche Frage

- Zusammenfassung des Kurzvortrags des zugewiesenen Peers:
 - Erwähnung und Zusammenfassung aller drei Paper
 - Struktur der Arbeit, roter Faden (Story der Recherche)
 - Konsistente und verständliche (wissenschaftliche) Sprache
 - Fragen und Antworten der Präsentationsdiskussion
- Selbst dem zugewiesenen Peer eine gute wissenschaftlich Frage stellen
- Die Zusammenfassung **2 Wochen nach dem Vortrag** an den Betreuer schicken

Organisatorisches

Datum/Uhrzeit	Thema	Raum
24.10.2024, 12-14 Uhr	Kickoff	Turing 1, DFKI
31.10.2024, 12-14 Uhr	Präsentationstechniken	Turing 2, DFKI
05.12.2024, 12-14 Uhr	Kurzvorträge I	Turing 2, DFKI
12.12.2024, 12-14 Uhr	Kurzvorträge II	Turing 2, DFKI
19.12.2024, 12-14 Uhr	Kurzvorträge III	Turing 2, DFKI
16.01.2025, 12-14 Uhr	Langvorträge I	Turing 1, DFKI
23.01.2025, 12-14 Uhr	Langvorträge II	Turing 1, DFKI
30.01.2025, 12-14 Uhr	Langvorträge III	Turing 1, DFKI
06.02.2025, 12-14 Uhr	Langvorträge IV	Turing 1, DFKI

Anwesenheit ist Pflicht

Themenblöcke

- Explainable Artificial Intelligence (XAI)
- Extended Reality (XR)
- Gesundheitswesen
- Finanzwesen
- Autonomes Fahren
- Energie
- Bildung
- Industrie

Aufteilung

- XR

- Dajnec, Jan
- Buhl, Niklas
- Schaefer, Moritz
- Wunn, Felix
- Mayer, Elvira
- Rief, Vera

- XAI

- Busch, Marius
- Halili, Laurant
- Müller, Lukas
- Toukea Koagne, Amour Parfait
- Leongard, Vanessa
- Johr, Thorben

<https://umtl.cs.uni-saarland.de/teaching/winter-2024/2025/recent-topics-in-xr-and-xai.html>

Alle Infos



<https://forms.gle/2bAERBtqSEXwTxLAA>

Bidding auf Paper



bis heute 24:00
24.10.2024 bidden



am Montag 28.10.2024
Bekanntgabe der
Zuweisungen von
Themen, Terminen und
Peers per E-Mail

Bis 12.11.24


Anmeldung im LSF

Bis 05.12.24

Teams installieren und
eingeloggt sein

Literaturrecherche

ChatGPT Auto MA



Four suggested prompts are displayed in rounded rectangular boxes:

- Create an illustration for a bakery
- Count the number of items in an image
- Activities to make friends in new city
- Message to comfort a friend

Mache mir Literaturrecherche zum Thema Finanzen und Erweiterte Realität ✓ ↑

ChatGPT can make mistakes. Check important info.

Überblick

- **Visualisierung komplexer Finanzdaten:** Finanzinstitute nutzen AR, um komplexe Datenmengen in interaktiven 3D-Modellen darzustellen. Dies hilft Investoren und Analysten, besser informierte Entscheidungen zu treffen.
- **Benutzererfahrung im Finanzbereich:** Durch die Integration von AR in mobile Banking-Apps und Beratungsdienste könnte die Benutzerfreundlichkeit und der Zugang zu Informationen erheblich verbessert werden.
- **Bildung und Training:** AR kann zur Schulung von Finanzfachleuten verwendet werden, indem sie realistische Szenarien und Simulationen bietet, die auf virtuellen Finanzmärkten basieren.

Literaturquellen:

- Müller, M. & Schmidt, K. (2022). "Augmented Reality in Finance: Potentials and Challenges". *Journal of Financial Technology*, 12(4), 47-58.
- Johnson, T. (2021). "The Role of Augmented Reality in Investment Decision Making". *Journal of Digital Banking*, 5(2), 65-82.
- Li, X., Wang, J. & Zhao, Y. (2020). "Enhancing Financial Visualization with Augmented Reality". *International Journal of Augmented and Virtual Reality*, 9(3), 120-138.
- Smith, A. & Brown, R. (2019). "Emerging Technologies in Finance: The Case for Augmented Reality". *Fintech Insights*, 3(1), 34-51.

Gibt es sie wirklich?

The screenshot shows a Google Scholar search results page. The search query is "Augmented Reality in Finance: Potentials and Challenges". The results are sorted by "Beliebige Zeit" (Arbitrary Time) and show three articles. The first article is "Augmented and virtual reality in financial services: A review of emerging applications" by AT Oyewole, OB Adeoye, WA Addy, and CC Okoye, published in 2024. The second article is "Augmented reality in support of Industry 4.0—Implementation challenges and success factors" by T Masood and J Egger, published in 2019. The third article is "Evaluating augmented reality applications in construction—a cost-benefit assessment framework based on VoFI" by T Oesterreich and F Teuteberg, published in 2017. The fourth article is "Augmented reality (AR)-based sharia financial literacy system (AR-SFLS): a new approach to virtual sharia financial socialization for young learners" by R Candra Sari, PL Rika Fatimah, and S Ilyana, published in 2022. The page includes a left sidebar with filters for time, relevance, language, and type, and a search bar at the top.

Google Scholar

Augmented Reality in Finance: Potentials and Challenges

Artikel

Ungefähr 31.100 Ergebnisse (0,04 Sek.)

Beliebige Zeit

Seit 2024

Seit 2023

Seit 2020

Zeitraum wählen...

Nach Relevanz sortieren

Nach Datum sortieren

Beliebige Sprache

Seiten auf Deutsch

Alle Typen

Übersichtsarbeiten

Patente einschließen

Zitate einschließen

Alert erstellen

Augmented and virtual reality in financial services: A review of emerging applications [PDF] wjarr.com

AT Oyewole, OB Adeoye, WA Addy, CC Okoye... - World Journal of ..., 2024 - wjarr.com

... **Augmented Reality (AR)** and **Virtual Reality (VR)** technologies in the **financial** services sector, assessing their **potential** ... significance of addressing **potential challenges** early on. For the ...

☆ Speichern Zitieren Zitiert von: 16 Ähnliche Artikel Alle 2 Versionen

[HTML] **Augmented reality** in support of Industry 4.0—Implementation **challenges** and success factors [HTML] sciencedirect.com

T Masood, J Egger - Robotics and Computer-Integrated Manufacturing, 2019 - Elsevier

... Its goal is to assess how **potential issues** concerning the user acceptance can affect the implementation, like ergonomic **problems** or the perceived trust of users in the technology. The ...

☆ Speichern Zitieren Zitiert von: 504 Ähnliche Artikel Alle 7 Versionen

[PDF] Evaluating **augmented reality** applications in construction—a cost-benefit assessment framework based on VoFI [PDF] core.ac.uk

T Oesterreich, F Teuteberg - 2017 - core.ac.uk

... benefits can help companies to evaluate the **potential** effectiveness of the investments. In ... participants have **difficulties** in dealing with the complexity of the VoFI method and the **financial** ...

☆ Speichern Zitieren Zitiert von: 19 Ähnliche Artikel Alle 5 Versionen

[HTML] **Augmented reality (AR)**-based sharia **financial** literacy system (AR-SFLS): a new approach to virtual sharia **financial** socialization for young learners [HTML] emerald.com

R Candra Sari, PL Rika Fatimah, S Ilyana... - Eastern Finance and ..., 2022 - emerald.com

... This study provides encouraging evidence about the **potential** of sharia **financial** education for ... In addition, the complex topics of sharia **financial** literacy can pose quite a **challenge** for ...

☆ Speichern Zitieren Zitiert von: 39 Ähnliche Artikel Alle 5 Versionen

Geht es ohne Halluzinationen?

Mache mir Literaturrecherche zum Thema Finanzen und Erweiterte Realität

Synthesize Copilot

Copilot Beta
2 papers analyzed

Literaturrecherche zum Thema Finanzen und Erweiterte Realität

1. Augmented Reality in Finance Learning Games

- Zusammenfassung:** Dieser Artikel untersucht die Innovation in Lernprozessen durch den Einsatz von Augmented Reality (AR) in Lernspielen, speziell im Bereich der Finanzbildung. Der Fokus liegt auf der Gestaltung von AR-Lernspielen, die Finanzindikatoren wie den Return on Investment (ROI) lehren. Das Spiel passt sich an den Standort des Spielers an und fordert ihn auf, 15 Entscheidungen zu den wichtigsten Aspekten eines Unternehmens zu treffen. Dies soll die Effizienz der Kapitalallokation und die Generierung von Betriebsgewinnen verdeutlichen.
- Zitation:** 1

2. Virtual and augmented reality in finance: State visibility of events and risk

- Zusammenfassung:** Dieser Artikel analysiert die Rolle von Informations- und Kommunikationstechnologien (IKT) im globalen Finanzwesen, insbesondere im Kontext der Finanzkrise. Die Autoren argumentieren, dass die mangelnde Sichtbarkeit von Risiken und die unzureichende Reaktion auf Ereignisse zur Krise beigetragen haben. Der Artikel untersucht das Potenzial von Virtual Reality (VR) und Augmented Reality (AR) Technologien, um die Dynamik globaler Finanzsysteme zu unterstützen und die Wahrnehmung des finanziellen Zustands und Risikos zu verbessern. Es werden traditionelle und frühe Anwendungen von VR/AR in der Finanzwelt sowie Fallstudien zur Sichtbarkeit des finanziellen Zustands diskutiert. Abschließend wird eine Forschungsagenda vorgeschlagen, um Technologien zu entwickeln, die die Wahrnehmung des finanziellen Zustands und Risikos erhöhen und katastrophale Ereignisse abmildern können.
- Zitation:** 2

Zusammenfassung

Die beiden untersuchten Artikel zeigen, dass Augmented Reality (AR) und Virtual Reality (VR) ein großes Potenzial im Bereich der Finanzbildung und des Finanzmanagements haben. Während der erste Artikel 1 sich auf die Anwendung von AR in Lernspielen zur Vermittlung von Finanzindikatoren konzentriert, untersucht der zweite Artikel 2 die breitere Anwendung von VR/AR-Technologien zur Verbesserung der Sichtbarkeit und des Managements von finanziellen Risiken und Zuständen. Beide Studien unterstreichen die Notwendigkeit, innovative Technologien zu entwickeln, um die Effizienz und Nachhaltigkeit im Finanzwesen zu steigern.

Consensus:

1 Augmented Reality in Finance Learning Games

Augmented reality learning games can effectively teach financial indicators, such as return on investment, by allowing players to analyze real-life business scenarios and make 15 decisions about key aspects.

Translational Systems Sciences | Błażej Podgórski et al. | 0 citations | 2019


 [Study snapshot](#) 

 [Save](#)  [Cite](#)  [Share](#)


2 Virtual and augmented reality in finance: State visibility of events and risk

Virtual and augmented reality technologies show potential in supporting global financial systems and addressing challenges posed by unexpected events and crises.

S. Maad et al. | 5 citations | 2010

 [Ask this paper](#)


 [Study snapshot](#) 

 [Save](#)  [Cite](#)  [Share](#)

4 THE ROLE OF VIRTUAL AND AUGMENTED REALITY IN MODERN MARKETING: A CRITICAL REVIEW

VR and AR technologies in the financial services sector enhance customer engagement and experience, with HR playing a crucial role in facilitating adoption and training employees.


Computer Science & IT Research Journal | Zainab Efe Egieya et al. | 0 citations | 2023

 Literature Review

 Ask this paper

 [Study snapshot](#) 

 [Save](#)

 [Cite](#)



 [Share](#)

5 Augmented reality in smart retailing: A (n) (A) Symmetric Approach to continuous intention to use retail brands' mobile AR apps


Augmented reality in smart retailing positively impacts customer benefits perception, engagement, and willingness to pay price premiums, with customisation playing a moderating role.

Journal of Retailing and Consumer Services | S. R. Nikhashemi et al. | 94 citations | 2021

 Highly Cited

 [Study snapshot](#) 

 [Save](#)

 [Cite](#)

 [Share](#)

Augmented reality in smart retailing: A (n) (A) Symmetric Approach to continuous intention to use retail brands' mobile AR apps

S. R. Nikhashemi, Helena H. Knight, K. Nusair+1 more · 1. Mai 2021

[Save](#) [Cite](#) [Share](#)

94 Citations 2 Influential Citations

Journal of Retailing and Consumer Services

Q1 SJR score

Quality indicators

Highly Cited

Study snapshot

Methods	Survey and data analysis
Outcomes	Customer benefit perception, engagement, willingness to pay a price premium.
Results	AR customisation enhances engagement and willingness to pay a price premium.

Extracted 3/7 study attributes

[Semantic Scholar](#)

Key takeaway

Augmented reality in smart retailing positively impacts customer benefits perception, engagement, and willingness to pay price premiums, with customisation playing a moderating role.

Abstract

Abstract Smart retailing has recently emerged as a new form of retail brand management enabled by novel technologies such as mobile augmented reality applications, to create better experience and value for customers. Augmented reality has also received significant attention as a growing field in marketing theory and practice. However, there is a limited understanding on how and why customer interactions with an augmented reality app can result in positive customer benefit perception, engagement and behavioural consequences. This study examines the chain of effects from AR attributes on the building blocks of continuous intention to use a shopping AR app and to pay a price premium, by incorporating the roles of a customer's benefits perception, psychological inspiration and engagement via a(n) (A)Symmetric Approach. The results support all direct hypothesised relationships among the variables, except the relationship between interactivity and utilitarian benefits, which was found to be insignificant. The study further demonstrates the moderating role of AR customisation in the proposed model, and reveals that the impact of utilitarian and hedonic benefits on shopping AR application engagement is non-linear. Non-linearity also transpires in the impact of psychological inspiration on willingness to pay price premium. Interestingly, the findings indicate that augmented reality customisation to some extent enhances the relationships in the hypothesised model.

Papers Lesen: Level 1

- Abstrakt
- Untertitel
- Figuren und Beschriftungen
- Introduction und Conclusion

Paywall: Richtige Lösung

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Search

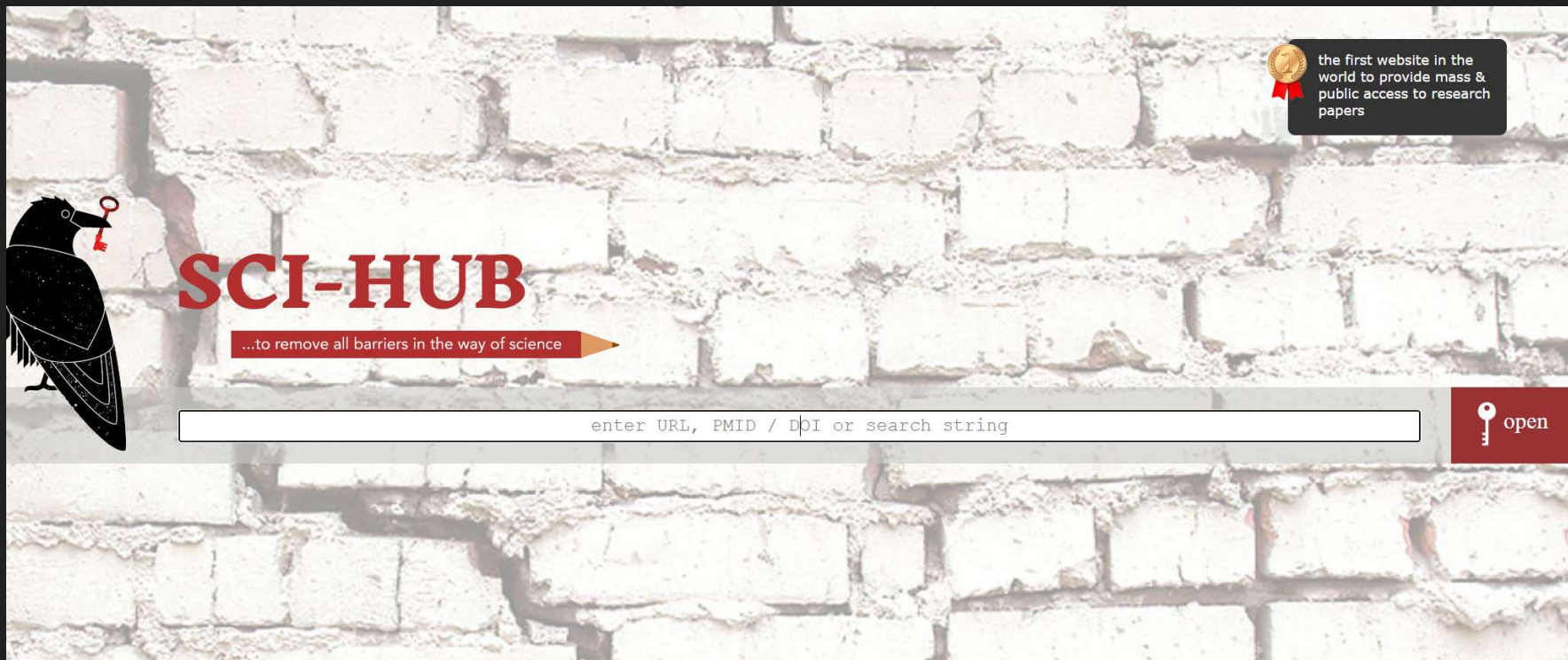
Advanced Search

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Please explore and use the [Feedback] button on any page to help us shape the new site.

Journals Magazines Proceedings ACM Books SIGs Conferences People

Feedback

Paywall: Falsche Lösung



The image shows the Sci-Hub website interface. On the left, there is a black crow holding a red key. The text "SCI-HUB" is written in large, bold, red letters. Below it, a red banner contains the text "...to remove all barriers in the way of science" with a pencil icon. A search bar is located in the center, with the placeholder text "enter URL, PMID / DOI or search string". On the right, there is a red button with a white key icon and the text "open". In the top right corner, there is a gold medal icon with a red ribbon and the text "the first website in the world to provide mass & public access to research papers". The background is a light-colored, textured wall.

Mit den Papers Arbeiten

	A	B	C	D	E	F
1	Titel	Jahr	Autoren	Venue	Citations	
2	Augmented reality in smart retailing: A (n) (A) Symmetric Approach to continuous intention to use retail brands' mobile AR apps	2021	S. R. Nikhashemi, Helena H. Knight, K. Nusair, Cheng Boon Liat	Journal of Retailing and Consumer Services	94	
3						
4						
5						
6						
7						
8						
9						
10						
11						

Andere Optionen:



- <https://youtu.be/am2eDyGba34>

Selbst Suchen

The screenshot shows a Google Scholar search interface. At the top, the search bar contains the text "Augmented Reality in Finance: Potentials and Challenges". Below the search bar, the results are categorized under "Artikel" with approximately 31,100 results found in 0.04 seconds. The left sidebar offers various filters: "Beliebige Zeit" (with options for 2024, 2023, 2020, and a custom range), "Nach Relevanz sortieren", "Nach Datum sortieren", "Beliebige Sprache" (with "Seiten auf Deutsch"), "Alle Typen" (with "Übersichtsarbeiten"), and checkboxes for "Patente einschließen", "Zitate einschließen", and "Alert erstellen".

The main results area displays three entries:

- Entry 1:** "Augmented and virtual reality in financial services: A review of emerging applications" (NA). Authors: AT Oyewole, OB Adeoye, WA Addy, CC Okoye. Source: World Journal of ..., 2024 - wjarr.com. [PDF] wjarr.com. Abstract: "... Augmented Reality (AR) and Virtual Reality (VR) technologies in the financial services sector, assessing their potential ... significance of addressing potential challenges early on. For the ...". Cited by: 16. Similar articles and 2 versions available.
- Entry 2:** "[HTML] Augmented reality in support of Industry 4.0—Implementation challenges and success factors" (Q1, A). Author: T Masood. Source: Robotics and Computer-Integrated Manufacturing, 2019 - Elsevier. [HTML] sciencedirect.com. Abstract: "... Its goal is to assess how potential issues concerning the user acceptance can affect the implementation, like ergonomic problems or the perceived trust of users in the technology. The ...". Cited by: 504. Similar articles and 7 versions available.
- Entry 3:** "[PDF] Evaluating augmented reality applications in construction—a cost-benefit assessment framework based on VoFI" (Q2, A, C). Author: T Oesterreich. Source: F Teuteberg - 2017 - core.ac.uk. [PDF] core.ac.uk. Abstract: "... benefits can help companies to evaluate the potential effectiveness of the investments. In ... participants have difficulties in dealing with the complexity of the VoFI method and the financial ...". Cited by: 19. Similar articles and 5 versions available.

The bottom entry is partially visible:

- Entry 4:** "[HTML] Augmented reality (AR)-based sharia financial literacy system (AR-SFLS): a new approach to virtual sharia financial socialization for young learners" (Q2, B). Authors: R Candra Sari, PL Rika Fatimah, S Ilyana. Source: Eastern Finance and ..., 2022 - emerald.com. [HTML] emerald.com. Abstract: "... This study provides encouraging evidence about the potential of sharia financial education for ... In addition, the complex topics of sharia financial literacy can pose quite a challenge for ...". Cited by: 39. Similar articles and 5 versions available.

Selbst Suchen

The screenshot shows the Semantic Scholar search interface. At the top left is the Semantic Scholar logo. The search bar contains the text "Augmented Reality and Finance". To the right of the search bar are buttons for "Search" (with a magnifying glass icon), "Sign In", and "Create Free Account". Below the search bar, the results are displayed for the query "Augmented Reality and Finance". There are 255 results. A filter bar includes options for "Fields of Study", "Date Range", "Has PDF", "Author", and "Journals & Conferences". A "Sort by Relevance" dropdown is also present. The first result is titled "Prospects of augmented reality and virtual reality for online education: a scientometric view" by Chandan Kumar Tiwari, P. Bhaskar, and Abhinav Pal, published in the International Journal of Educational Management on 9 August 2023. The TLDR for this article states: "This research indicates that AR and VR can be utilized to teach various areas and specialties in online education, and lays the framework for educational institutions, legislators and researchers to investigate additional applications of VR and AR." Below the article title are icons for citation (6), publisher, save, and cite. The second result is titled "Augmented Reality in Finance Learning Games" by Błażej Podgórski, published in Translational Systems Sciences in 2019. The TLDR for this article states: "The presented project focuses on augmented reality learning game design as a new way of teaching financial indicators, such as return on investment (ROI), which shows the efficiency at capital".

SEMANTIC SCHOLAR Augmented Reality and Finance Search Sign In Create Free Account

255 results for "Augmented Reality and Finance"

Fields of Study Date Range Has PDF Author Journals & Conferences Sort by Relevance

Prospects of augmented reality and virtual reality for online education: a scientometric view
Chandan Kumar Tiwari P. Bhaskar Abhinav Pal Education, Computer Science ·
International Journal of Educational Management · 9 August 2023
TLDR This research indicates that AR and VR can be utilized to teach various areas and specialties in online education, and lays the framework for educational institutions, legislators and researchers to investigate additional applications of VR and AR. Expand
6 Publisher Save Cite

Augmented Reality in Finance Learning Games
Błażej Podgórski Computer Science, Education · Translational Systems Sciences · 2019
TLDR The presented project focuses on augmented reality learning game design as a new way of teaching financial indicators, such as return on investment (ROI), which shows the efficiency at capital

Selbst Suchen

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Augmented Reality in Finance Learning Games

Origin paper

Augmented Reality in Finance Learning Games	Blazej Podgórski	2019
Mobile game for the elderly: Bundled bingo game	Yi Jia Chin, Woan Ning Lim, Chien-Sing Lee	2017
Mobile game design for the elderly: A study with focus on the motivation to play	T. T. Cota, Lucila Ishitani, Nilton Vieira	2015
HCI: Design Guidelines of Mobile Device Games for the Elderly	Emma Mainza Chilufya	2014
Motivation and benefits of digital games for the elderly: a systematic literature review	T. T. Cota, Lucila Ishitani	2014
Investigating Motivational Aspects of Brazilian Elderly to Interact with Digital Games	Gleice Souza, Luciana Salgado, E. Clua, D. Trevisan	2016
Digital Game Design for Elderly Users : A Multi-Disciplinary Review	Jiahui Wang	2016
Universal Access in Human-Computer Interaction. Methods, Techniques, and Best Practices	M. Antona, C. Stephanidis	2016
Motivational Factors for Mobile Serious Games for Elderly Users	R. Nogueira, S. D. Carvalho, Lucila Ishitani	2012
Estudo investigativo sobre idosos, jogos e sua motivações	G. Souza, Daniela Trevisan	2014

Augmented Reality in Finance Learning Games

Blazej Podgórski

2019, Translational Systems Sciences

0 Citations

Open in:

S2 TL;DR: The presented project focuses on augmented reality game design as a new way of teaching financial literacy. It uses a return on investment (ROI) model, which shows the effective allocation in the process of operating profit generation.

Papers Lesen: Level 2

- Schema überlegen
- Aufmerksam durchlesen
- Wichtigste laut dem Schema markieren
- Schema erweitern

History by arguments

paper memo
http://dx.doi.org/10.2332/ISSN.2470-1123.2017.3.1006934
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CAVE versus Head-Mounted Displays: Ongoing thoughts

Daniel R. Madsen, Aix Marseille Univ., CNRS, ISM-CRPM, Marseille, France

Abstract

In a short period of time, virtual reality has taken over the media, leading to promote that idea that it is a new technology. In fact, all started as early as the twenties and applies, for portable devices (e.g. Head-Mounted Displays) as well as for complex and large devices (CAVE). In this paper, we try to put these different systems in perspective, and to show the interest of comparing them in an experimental approach.

Introduction

If you look at the news and/or social network sites, you might think that the age of the HMD (for Head-Mounted Display) has come and that it is going to be the ultimate display. In fact, I had the idea of writing this in 1985 [1]. Well, for one thing, HMD are no new story. Back to 1945, lucky ones could test the "Street of Danzonia" (figure 1). Since then, it is certainly true that technological power has taken over the wireframe cube rotating in the viewer's field of view. However, for this device and the idea of immersing the viewer in a surrounding virtual environment, **Subtland is often cited as the "inventor" of Virtual Reality**. For him, the purpose of virtual reality was to look at the (virtual) display as a "window" to a realistic virtual environment.



Figure 1: The Street of Danzonia [1]. Two cathode tubes cover the subject's eyes, but no means are required to a motor arm to assure real-time acquisition of 30 images. This is considered as the first virtual reality system.

ISA International Symposium on Electronic Imaging 2017
The Engineering Society of Virtual Reality 2017

Since then, many advances have been made, including developments by NASA Ames Research Center in the Eighties [2, 3], or by people around Fred Brooks [4], at Chapel Hill (such as Henry Fuchs), and the recent initiative for telepresence, through the BeingThere International Centre). The "Virtual Environment

display screen. This is the default option, because we do not know when and where the eye will fall. However, we also know that the resolution of our visual system is not the same across the visual field, being highest at the fovea and decreasing dramatically in peripheral vision (for instance, refer to the cortical magnification factor [15]). Confronted with this fact, vision scientists have long been trying to develop gaze contingent displays [16]. This manipulation of the rendered image requires real-time acquisition of the position of gaze in the virtual environment, which, by itself, poses a number of technological problems. However, advances have been made, including gaze capture inside a HMD. The real problem with gaze contingency is in the temporal domain. Saccades are (more or less) unpredictable and incredibly fast (over 600 degrees/sec peak velocity). In the current state of the technology, this would require tracking latencies well below what is achievable.

Now, concerning temporal resolution: Most CAVE systems run at 60 frames per second, while "modern" HMDs run at 90 Hz. Referring to early standards of VR, saying that 20 Hz was enough, we are now in a more comfortable zone of smooth motion perception. However, it is illusory to say that 90 Hz is always enough to enable the perception of continuous motion. In fact, systematic studies revealed that there is an upper displacement limit of a given pixel from one frame to the next, for a given frame rate, above which the continuity of motion is lost [17]. In our own experiments [18], using SGI hardware at 75 Hz, we found that it was not possible to investigate retinal speed above around 30 degrees/second. In other words, as compared to the analogical nature of our visual system, the digital nature of computer graphics poses serious challenges and more power/resolution remains to be developed.

Finally, we will evoke quickly the accommodation-vergence issue in virtual environments. The fact that we use flat displays (being computer screens, CAVE walls or HMDs/OLED screens) results in the fact that accommodation is fixed on the screen. We will not discuss here the fact that this might cause serious ophthalmological problems, such as myopia for future generations using tablets from birth. More specifically, in the case of stereoscopic displays, this creates a decoupling between vergence and accommodation mechanisms of human vision. Recent studies have shown that such decoupling of a natural behavior impairs visual performance and causes visual fatigue [19, 20]. This problem exists in the CAVE as well as in the HMD.

Up to now, we saw that many problems, of technological as well as sensorimotor nature, exist whatever the system used, and that progress has to be made at a number of levels: oculomotor coupling, temporal and spatial resolution, system latency, extent of the field of view. We would like to turn now to short (narrative) reports of recent experiments using one system or both, to give some feedback at a more experimental level.

Experimental observations

Interacting with objects

First of all, we encountered a classical problem, when studying simple reaching and tracking arm and finger movements inside a CAVE system [21]. We were trying to study the effect of

vibrotactile feedback for collision avoidance, since haptics feedback remains a hard problem in virtual reality.

In fact, in a CAVE, having a force-feedback poses a perceptual problem, since the apparatus itself has (often) nothing to do inside the virtual environment. On the other hand, not having haptics feedback, does not prevent subjects to "pass through" virtual objects. Once that happens, the objects instantaneously become transparent and their "presence" is lost. Such a problem does not exist using an HMD. However, as we will see, other problems arise.

Acted affordances

In this line of research, we evaluated embodied presence in virtual environments, which is the way presence in VR can be directly observed at a behavioral level. To do so, we designed a simple experiment, in which subjects were asked to pass through an aperture of variable width. In normal (real) circumstances subjects systematically rotate their shoulders, in order to avoid "colliding" the environment [22]. We essentially observed the same behavior in a virtual environment [23], thus qualifying our approach to presence.



Figure 4: Representation of the virtual environment, with the variable width aperture and the subject rotating his/her shoulder to pass through.

We decided to replicate this experiment using a HMD (Oculus DK2), in a similar virtual environment (figure 4). In this case, one observation can be immediately made: when you put the helmet on, you no longer see your own body. We then decided to use the vision of an avatar of the subject's own body as an experimental factor. To do that, the subject was equipped by whole body markers (ART system) and a co-localized avatar of him/herself could be inserted in the visual display.

Results are straightforward. Without the self-avatar, subjects collide with the aperture borders more than half of the time (for a small aperture of 40 cm). Collisions are significantly reduced with the self-avatar [22]. Such results clearly demonstrate that the presence of a visual representation of your own body, co-localized in real-time with your own movements is decisive in enabling one to calibrate body-environment relationships.

At first view, this is a clear advantage for the CAVE, in which the vision of your own body is always present.

Clinical feedback

Another supporting argument for the crucial role of the vision of your own body comes from recent evaluations we conducted during a clinical protocol involving Virtual Reality Exposure

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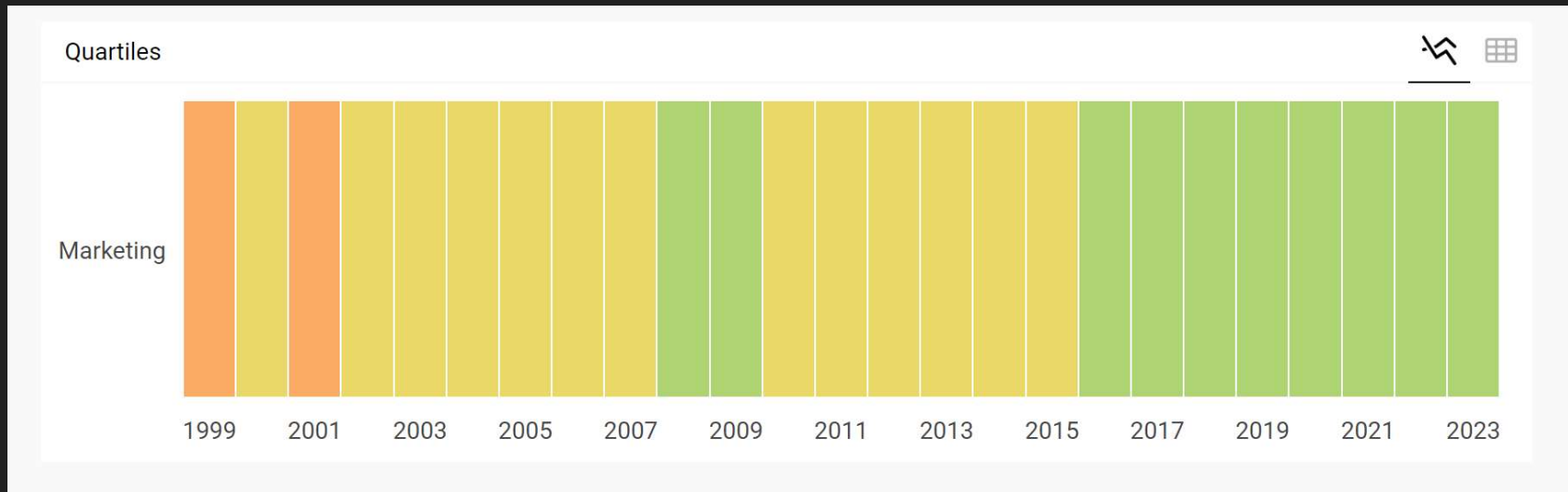
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CAVE versus Head-Mounted Displays: Ongoing thoughts

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Abstract

In a short period of time, virtual reality has taken over the media, tending to promote that idea that it is a new technology. In fact, all started as early as the seventies and eighties, for portable devices (e.g. Head-Mounted Displays) as well as for complex and large devices (CAVEs). In this paper, we try to put these different systems in perspective, and to show the interest of comparing them in an experimental approach.

Introduction

If you look at the news and/or social network sites, you might think that the age of the HMD (for Head-Mounted Display) has come, and that it is going to be the ultimate display Ivan Sutherland was dreaming of in 1965 [1]. Well, for one thing, HMD are no new story. Back to 1965, lucky ones could test the "Sword of Damocles" (figure 1). Since then, it is certainly true that technological power has taken over the wireframe cube rotating in the viewer's field of view. However, for this device and the idea of immersing the viewer in a surrounding virtual environment, Sutherland is often coined as the "inventor" of Virtual Reality. For him, the purpose of virtual reality was to look at the (visual) display as a "window" to a realistic virtual

Since then, many advances have been made, including developments by NASA Ames Research Center in the Eighties [2, 3], or by people around Fred Brooks [4], at Chapel Hill (such as Henry Fuchs, and the recent initiative for telepresence, through the BeingThere International Center). The "Virtual Environment Workstation" included a LCD display and a Polhemus head tracker and represented, on that respect, a significant technological progress, as compared to the "Ultimate Display" (figure 2). We are today getting closer to that "embodied" vision, which is not far from the vision of a totally immersive cinema, stimulating all the senses, by Morton Heilig [5] or the proposition of Virtual Reality as a "mind-expanding" feature, by Myron Krueger [6].



Theory | Study Design | Findings | Implementation

Tools

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