

**TITLE:** Understanding Augmented Reality for Blending Online and In-Store Experiences

**PROTOCOL VERSION DATE:** 1/2/2017

**VERSION*:*** 0

# **PRINCIPAL INVESTIGATOR (PI)**:

Name: Enter the PI's name -- this must match the eRA eForm

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Telephone: XXX-XXX-XXXX

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# KEY PERSONNEL

**Name**: Enter name of key personnel -- must match name in eRA eForm

**Role in project**: Enter the role (e.g.co-investigators, faculty advisor, research coordinator)

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*To add additional key personnel, highlight the above text, then copy (CTRL+C or ⌘ +C) and paste (CTRL+V or ⌘+V). If not, delete this text.*

# OBJECTIVES

This study will identify properties of in-store and online shopping experiences that might be combined to design an effective mixed reality application for retail shopping. We will identify attributes of online and in-store experiences that consumers feel are important and collect subjective feedback on prototype augmented reality applications for in-store shopping.

This work was initially completed as a Classroom Research Project for CSCI 5839, and we would like to disseminate the results through publication.

# BACKGROUND AND SIGNIFICANCE

* *Provide the scientific or scholarly background and rationale for the research based on the existing literature.*
* *Describe the relevant prior experience and gaps in current knowledge.*
* *Explain the significance of the human research in terms of why it is important and how it will add to existing knowledge.*

There has been previous work on successful use of augmented reality in several domains. Augmented reality has been used as a shopping assistant in works such as [1, 2, 3, 4]. With these papers in addition to more broad-reaching papers such as [5, 6], a theoretical grounding of augmented reality applications has been laid out. From this prior work, we hypothesize that users have different expectations of augmented reality, pervasive information systems than they would for existing mobile or desktop technologies. Augmented reality should provide context-awareness, increased efficiency, user empowerment and efficiency among users, and an enjoyable experience.

[1] *Personalized In-store E-Commerce with the PromoPad: an Augmented Reality Shopping Assistant*

[2] *Comparison of consumer purchase intention between interactive and augmented reality shopping platforms through statistical analyses*

[3] *Supporting Healthy Grocery Shopping via Mobile Augmented Reality*

[4] *Improving the In-Store Customer Information Process using Mobile Augmented Reality*

[5] *Expected user experience of mobile augmented reality services: A user study in the context of shopping centeres*

[6] *Enhancing user experience through pervasive information systems: The case of pervasive retailing*

# PRELIMINARY STUDIES

The PI and Key Personnel have no preliminary studies immediately relevant to this work.

# RESEARCH STUDY DESIGN

**Design:** This work will occur in a set of three specific studies: one online elicitation study to understand perceived trade-offs in online and in-store shopping, four preliminary think-alouds using A/B paper prototypes to identify critical design components of a mixed reality shopping experience, and an evaluative study to understand trade-offs in a virtual reality prototype implemented using a stereoscopic head-mounted display (HMD). We expect to complete all three studies over the course of one semester (approximately 15 weeks).

*Online Elicitation Study:* We composed a series of multiple choice and free response questions regarding participants’ shopping habits and what they saw as trade-offs between online and in-store shopping. We will distribute the survey via key personnel’s social media accounts and intend to enroll about 80 people. Participants will not be asked to provide any personal information. The responses to the survey will be used to judge what features from online shopping our mixed reality application should include, and what problems with in-store shopping we may be able to mitigate using this approach.

*Preliminary Think-Aloud:* We will create two low-fidelity prototypes of the in-store mixed reality application and conduct an A/B test with 4 - 5 users from the campus community. The users will be presented with a task that they must perform in each of the prototypes. During the task, users will be asked to “think-aloud” about their experience, and will receive some prompting and guidance from one of the researchers. A second researcher will be present to take notes during the test. After the user has completed the task in both prototypes, they will be asked a few questions about what aspects of each they liked and disliked. Findings from these preliminary think-aloud tests will guide design decisions for a mid-fidelity prototype.

*HMD Evaluation:* Using feedback from the low-fidelity prototype, we will create a virtual reality prototype using Unity 3D game engine. A virtual store environment will be created for the user to navigate, and elements from the mixed reality application will be laid on top of this environment. A demo of this prototype will be presented at the ATLAS Expo and users will be asked to fill out a voluntary survey to provide feedback on the prototype’s usability and feasibility as well as the potential for use of augmented reality for an in-store shopping experience. We anticipate enrolling 25 users in this survey.

# ABOUT THE SUBJECTS

Subjects will be recruited in from three separate pools: an online pool, an in-person pool, and ATLAS Expo attendees. Approximately 80 online participants will be recruited through the key personnel’s Facebook page. This number is inline with participation numbers from previous social media studies run by the PI and Key Personnel. 4 participants will be recruited from the local campus community for the second study. Finally, approximately 25 people will be recruited from the ATLAS Expo, inline estimates provided by researchers involved with the event. In all cases, we anticipate the demographics of the subject population to reflect those of the national population.

All participants will be at least 18 years of age. No additional exclusion criteria will be used.

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| --- | --- |
| *Subject Population(s)* | *Number to be enrolled in each group* |
| *Online Surveys* | *80* |
| *In-person Surveys* | *4* |
| *Expo Survey* | *25* |

# VULNERABLE POPULATIONS

No vulnerable populations will be used in this study.

# RECRUITMENT METHODS

**Online Participants:** Participants for the online survey will be recruited through the Key Personnel's Facebook accounts. The survey will be shared as a public-facing link with an informal request for participation. The survey will be administered through Google Forms.

**In-Person Participants:** Participants for the think-aloud A/B testing will be recruited from the local campus community. For the second survey, the Key Personnel have a booth at the ATLAS Expo and will ask those who interact with the technology to voluntarily complete a brief survey.

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| --- |
| *List recruitment methods/materials and attach a copy of each in eRA* |
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# COMPENSATION

Participants completed these studies voluntarily and were not directly compensated for their time.

# CONSENT PROCESS

Participants were informed that the studies would be used for research prior to completion and no identifying information was collected. Participants were also asked to complete these studies voluntarily. Consent was provided as part of participation.

# PROCESS TO DOCUMENT CONSENT IN WRITING

* *Describe whether and how consent/assent of the participant will be documented in writing.*
  + *In accordance with 45 CFR 46.117, a copy of the form used to document consent must be given to the person signing the form.*
* *If you are requesting IRB approval for waiver of documentation of consent, see the* [*Verbal Consent*](http://humanresearch.colorado.edu/sites/default/files/docs/Verbal%20Consent%2008.31.11.pdf) *guidance document. This section should include rationale for the request.*
* *Depending on the populations being studied, multiple versions of the informed consent / assent / permission forms may be needed, e.g., screening, study participation, future use specimens, and assent form for minors of different age groups. If different forms will be used, they should be identified here.*

For the third phase of the study conducted during the ATLAS Expo, attendees who try out the demo will be given the option to participate in an in-person written survey. Participants will be asked to provide verbal consent for their survey to be used in research, as no personally identifying information will be collected and requiring a written document of consent would be the only way they could be linked to the study. The verbal script asking attendees to participate in the survey will be: “We are conducting research into augmented reality applications and would love for you to fill out a survey about this demo and using AR in a store setting. Your participation is voluntary and no personal information will be collected from you.”

# PROCEDURES

* *As a whole, this section should describe what the participant will encounter throughout the study so it is clear to an independent reader.*
* *Describe all study procedures, assessments, and subject activities.*
* *What data will be collected, including pre-screening and long-term follow up.*
* *List instruments/tools used for data collection and the purpose for each.*
  + *Note: Data collection instruments, surveys, questionnaires, etc. should be attached to your submission in eRA. The IRB will need to review the full text of each tool.*

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| --- | --- | --- |
| *Name of instrument/tool/procedure* | *Purpose (i.e. what data is being collected?* | *Time to Complete* |
|  |  |  |
| *Online Elicitation Survey* | *shopping habits, trade-offs for online and in-store shopping* | *10 minutes* |
| *In-person A/B paper prototype test* | *feedback on the design of the prototype and features that should be removed/added* | *30 minutes* |
| *In-person survey at ATLAS Expo* | *feedback on the VR prototype, potential uses of an AR in-store shopping application* | *10 minutes* |

Questions asked during all three phases of the study are attached.

# SPECIMEN MANAGEMENT

Specimens will not be collected, sent, received, or transported as part of this research.

# DATA MANAGEMENT

**Security Requirements: Level 1**

Data will be stored in the CU Google Drive with access permissions restricted to key personnel. Low-level permissions restrictions will be placed on any data stored on the machines to provide password-protection. De-identified responses will be retained indefinitely for archival purposes. Data will be stored as a Google Forms response table, with password protection applied to all archival data. All physical response forms from the in-person studies will be transcribed and shredded.

# WITHDRAWAL OF PARTICIPANTS

Participants will not be withdrawn from the research without their consent. Should participants voluntarily withdraw, their responses will be discarded.

# RISKS TO PARTICIPANTS

This work will involve no risks beyond those associated with everyday activity.

# MANAGEMENT OF RISKS

This work will involve no risks beyond those associated with everyday activity.

# POTENTIAL BENEFITS

There is no direct benefit to the participants. However, the findings from these studies will provide better insight into how to design more effective mixed reality applications by drawing on the benefits of existing real world and virtual experiences.

# PROVISIONS TO MONITOR THE DATA FOR THE SAFETY OF PARTICIPANTS

We anticipate no significant safety concerns as these studies will only require participants to answer quantitative and qualitative questions about existing real world and online shopping experiences generally and a prototyped immersive reality platform. The surveys should be limited to a short duration (less than 30 minutes). All statistical analyses will occur after the study has been completed.

# PROVISIONS TO PROTECT THE PRIVACY INTERESTS OF PARTICIPANTS

We anticipate minimal privacy risks for participants. No personally identifying information will be collected and all data collected will be kept private. Data will be stored either on the password protected University Google Drive system or in ENVD 201, which is a locked office space for the Department of Information Science.

# MEDICAL CARE AND COMPENSATION FOR INJURY

This research does not involve more than minimal risks to participant health and safety. No provisions will be made for medical care and injury compensation.

# COST TO PARTICIPANTS

Because recruitment of participants will be limited to online and on-campus, participants should not incur any costs as a direct result of this work.

# DRUG ADMINISTRATION

No drugs will be administered in this work.

# INVESTIGATIONAL DEVICES

No investigational devices will be used.

# MULTI-SITE STUDIES

This work will only take place at the University of Colorado Boulder and online through Google Forms.

# SHARING OF RESULTS WITH PARTICIPANTS

The results will not be shared with participants.