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Systematic Review

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We use this protocol and it's working

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Abstract

This protocol details the systematic review methodology used by the authors of "Virtual versus Reality: A Systematic Review of Real-World Built Environment Tasks Performed in CAVEs and a Framework for Performance and Experience Evaluation."

The purpose of this review protocol is to systematically identify, filter, and synthesise literature regarding the use of Cave Automatic Virtual Environments for Built Environment Tasks. This is achieved by following the procedure of the PRISMA 2020 guidance for systematic reviews.

PRISMA Systematic Review Protocol

- 1 First, the motivation for the systematic review was developed. No previous reviews sought to evaluate the previous applications of Cave Automatic Virtual Environments (CAVEs) to Built Environment Tasks (BETs). The motivation to conduct a systematic review of CAVEs for BETs can be summarised as:

(1) CAVEs have specific advantages over other types of Extended Reality (XR) devices.
 (2) These advantages would specifically help Operations and Maintenance BETs, whereby expert users can collaboratively gain situation awareness and execute decisions from a remote environment.

- 2 The problem statement of the systematic review was developed as "What are the previous applications of CAVEs for undertaking tasks in the built environment?"

- 3 The key concepts of the problem statement were extracted, and synonyms generated, and terms labelled.

TERM A: "CAVE" → "Computer Aided Virtual Environment"; "Computer Assisted Virtual Environment"

TERM B: "Task" → "Scenario"

TERM C: "Built environment" → "Facility management"; "Asset management"; "Maint*"; "Emergenc*"

TERMS D: "Geology"; "Art"

(Where * indicates truncation).

(Where TERMS D are exclusion criteria, due to the high number of results relating to Cave drawings and the geographical formations).

- 4 A boolean search procedure was developed:

Search 1 (High Specificity Search): "TERM A" AND "TERM B" AND "TERM C" NOT "TERMS D"

Search 2 (Low Specificity Search): "TERM A" AND "TERM B" NOT "TERMS D"

Searches 1 and 2 were applied for each synonym pair from Step 3. For example:

A	B	C	D
	AND	AND	NOT



A	B	C	D
"CAVE"	"Task"	"Built environment"	-geology -art
"CAVE"	"Task"	"Facility management"	-geology -art
"CAVE"	"Task"	"Asset management"	-geology -art
"CAVE"	"Task"	"Maint*"	-geology -art
"CAVE"	"Task"	"Emergenc*"	-geology -art
"CAVE"	"Scenario"	"Built environment"	-geology -art
"CAVE"	"Scenario"	"Facility management"	-geology -art
"CAVE"	"Scenario"	"Asset management"	-geology -art
"CAVE"	"Scenario"	"Maint*"	-geology -art
"CAVE"	"Scenario"	"Emergenc*"	-geology -art
"Computer Aided Virtual Environment"	"Task"	"Built environment"	-geology -art
"Computer Aided Virtual Environment"	"Task"	"Facility management"	-geology -art
"Computer Aided Virtual Environment"	"Task"	"Asset management"	-geology -art



A	B	C	D
"Computer Aided Virtual Environment"	"Task"	"Maint*"	-geology -art
"Computer Aided Virtual Environment"	"Task"	"Emergenc*"	-geology -art
"Computer Aided Virtual Environment"	"Scenario"	"Built environment"	-geology -art
"Computer Aided Virtual Environment"	"Scenario"	"Facility management"	-geology -art
"Computer Aided Virtual Environment"	"Scenario"	"Asset management"	-geology -art
"Computer Aided Virtual Environment"	"Scenario"	"Maint*"	-geology -art
"Computer Aided Virtual Environment"	"Scenario"	"Emergenc*"	-geology -art
"Computer Assisted Virtual Environment"	"Task"	"Built environment"	-geology -art
"Computer Assisted Virtual Environment"	"Task"	"Facility management"	-geology -art
"Computer Assisted Virtual Environment"	"Task"	"Asset management"	-geology -art
"Computer Assisted Virtual Environment"	"Task"	"Maint*"	-geology -art
"Computer Assisted Virtual Environment"	"Task"	"Emergenc*"	-geology -art

	A	B	C	D
	"Computer Assisted Virtual Environment"	"Scenario"	"Built environment"	-geology -art
	"Computer Assisted Virtual Environment"	"Scenario"	"Facility management"	-geology -art
	"Computer Assisted Virtual Environment"	"Scenario"	"Asset management"	-geology -art
	"Computer Assisted Virtual Environment"	"Scenario"	"Maint*"	-geology -art
	"Computer Assisted Virtual Environment"	"Scenario"	"Emergenc*"	-geology -art

5 The exclusion and inclusion criteria were developed. To be included in the systematic review, papers must:

1. Be about an application of CAVEs to a built environment task;
2. Be presented in English;
3. Be from between 1992 (inception of the CAVE) and present.

Citations inside papers were also considered for their eligibility ("snowballing").

Furthermore, automotive or automotive-pedestrian interactions papers were excluded as they do not specifically focus on the built environment, but rather the vehicles themselves.

6 The databases to be searched were identified as:

1. SCOPUS;
2. Web of Science;
3. IEEEExplore.

Databases 1 and 2 were selected for their established position as comprehensive databases for scientific literature, and Database 3 was selected due to its relevance to

the systematic review topic area. Three databases were used to ensure comprehensiveness and sensitivity of the systematic review.

- 7 Each search string was used for each database. This resulted in 89 individual searches. High Specificity Search was as default, however, where results were fewer than 10, Low Specificity Search was used instead. This returned 2241 papers (IEEE Xplore: 218, SCOPUS: 1788, Web of Science: 235).
- 8 Duplicate papers were removed manually and automatically (using Endnote 20). The total number removed was 599 papers (Manually: 16, Automatically: 541).
- 9 Each paper was screened manually by the Principal Investigator, by comparing the title to the inclusion criteria and purpose of the systematic review. This first screen removed 667 papers (IEEE Xplore: 20, SCOPUS: 575, Web of Science: 72). Therefore, 1017 papers passed the first screen (IEEE Xplore: 172, SCOPUS: 703, Web of Science 142).
- 10 Each paper was screened manually by the Principal Investigator, by comparing the abstract to the inclusion criteria and purpose of the systematic review. This second screen removed 877 papers (IEEE Xplore: 139, SCOPUS: 619, Web of Science: 119). Of these papers, 160 were not able to be retrieved, and 4 were not presented in English language. Therefore, 140 papers passed the second screen (IEEE Xplore: 33, SCOPUS: 84, Web of Science: 23).
- 11 Each paper was screened manually by the Principal Investigator, by comparing the full text to the inclusion criteria and the purpose of the systematic review. This final screen removed 53 papers (IEEE Xplore: 1, SCOPUS: 52, Web of Science: 0). Therefore, 119 papers were included in the final review (IEEE Xplore: 32, SCOPUS: 32, Web of Science: 23, Additional papers identified: 32).
- 12 From the 119 final papers, 120 studies were identified (1 paper presented 2 studies). Information from each of the 120 studies was extracted. This was:
 1. Study year.
 2. Authors.
 3. The country of publication.
 4. Whether or not psychological or physiological measures were taken.
 - 4.a. If so, the variable of interest measured.
 - 4.b. The experimental measurement technique.
- 13 From the 120 studies, the following information was calculated and or synthesised:
 1. Study type (whether the study was concerned only with a CAVE system, or compared it to another technology, or to a real-world equivalent).
 2. Study purpose (a brief overview).
 3. Study category (what area the study broadly belonged to).



4. Author co-occurrence network (calculated using VOSviewer and EndNote bibliographic data).

14 Limitations of the studies and of the systematic review methodology were formulated. These limitations are:

1. Inclusion criteria - the systematic review required studies to be in the context of "built environment tasks", however, this is a difficult context to specify. The systematic review attempted to address this by specifically excluding certain applications.

2. Applications of CAVEs outside literature - the systematic review investigated the use of virtual environments (such as CAVEs) for replicating real-world tasks. However, it is possible that research and applications of CAVE technology in this area has not been published or has been undertaken by private companies.

3. Highly sensitive - the systematic review was highly sensitive (low specificity). This implies that, while the confidence that most papers relevant to the review were identified is high, the review took a long time to conduct.

15 The results of the systematic review of 120 papers was then thoroughly discussed, research gaps identified, future work directions proposed based on these research gaps, and the motivation and implications of the systematic review and future work directions stated.