

# ACT-R in the military: a systematic review

Veerle Loykens ([v.n.loykens@tudelft.nl](mailto:v.n.loykens@tudelft.nl)) Supervisor: Chenxu Hao. Responsible professor: Bernd Dudzik

## 1. Background and Motivation

- Cognitive architectures – infrastructures to model human thought and behaviour
- Adaptive Control of Thought – Rational (ACT-R) a cognitive architecture
- Create trust and insight by delivering an overview to the people of the nations, who might be sceptical towards technology in the military, and who want to know how their taxpayer's money is spent.
- In case ACT-R becomes outdated, an overview might come in handy to see where the military might need to make adjustments.

## 2. Research Question

- In which applications does the military make use of ACT-R?
- And why is ACT-R used in these applications?

## 3. Methodology

- **Systematic literature review**, has been used to answer these questions and create an overview.
- **Inclusion and exclusion criteria**
  - Include papers with ACT-R as a subject and a military focus
  - Exclude all papers that are not English, not about the U.S. military or do not have the inclusion criteria.
- **Databases**: Scopus, IEEE Xplore, ACM Digital Library and Web of Science. These databases were consulted. For each database a query was made.
- **Literature selection**, through an abstract screening all papers were included or excluded for further review based on the inclusion and exclusion criteria.
- **Availability**, papers were checked on availability.
- **Full text screening**, Every available and suitable paper was screened on its full text.
- **Data Extraction**, the parts were the papers reflected on the ACT-R model and their function to the military, were extracted.

## 4. PRISMA diagram

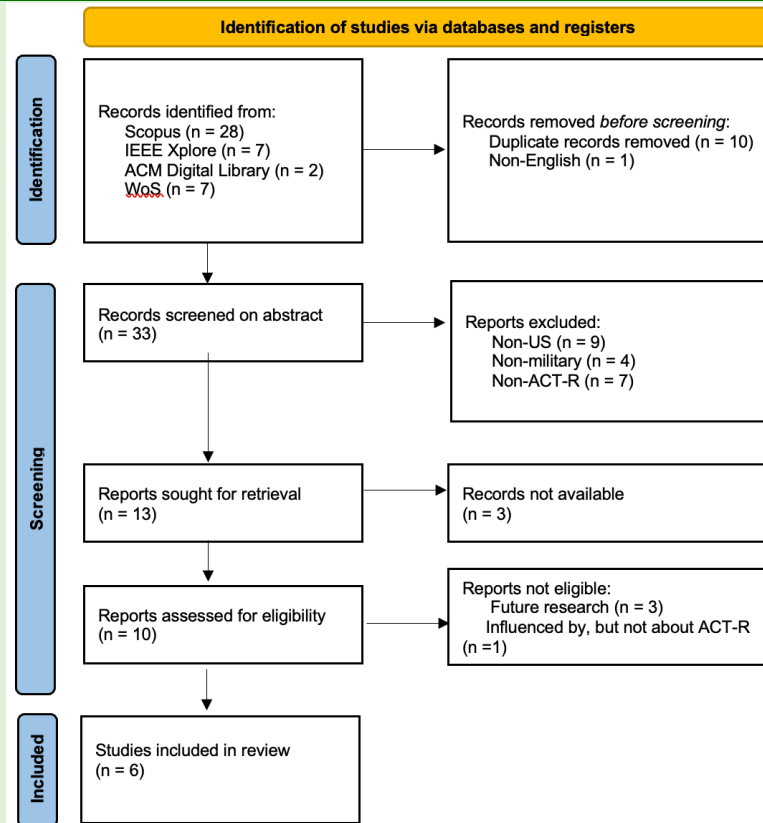


Figure 1. A PRISMA diagram of included and excluded papers

## 5. Responsible research

- **Biases**, The paper had a bias towards ACT-R and the US military. It means that not every possibility of cognitive architectures has been taken into account.
- **Ethical considerations**, insight to opponents can pose a threat to the US, however, every used document is publicly available and only 6 papers were reviewed in this study.
- **Reproducibility**, the whole project is reproducible.

## 6. Results

- **Analyst supporting tool**, a tool that can help military analysts determine the value of information.
- **Tutoring systems**, ACT-R has been utilized to improve tutoring systems for ship navigation manoeuvres and visual aircraft recognition.
- **Robotics operator Manager**, ACT-R has been utilized as a model to test whether a ROM could be a beneficial new function in the military.
- All applications choose ACT-R for its speciality in **simulating human behaviour and thought process**.

## 7. Discussion

- **Only ACT-R**, this impacted the study due to excluding papers that might have been interesting but were not considering ACT-R
- **Only U.S. military**, due to this measurement papers with a different view from outside the U.S. military were not addressed in this study.
- **Confidentiality**, the military is an institute where confidentiality is very important. This may result in research not being disclosed to the public. Especially the foreign public.

## 8. Conclusion and Future work

- To conclude this research, the military uses ACT-R as a supporting tool for analysts, to improve their tutoring systems, and to test if a ROM could be beneficial. All these applications choose ACT-R because of its ability to simulate human thoughts and behaviour.
- For future works; include multiple nations and cognitive architecture. This allows for an interesting comparison and more complete overview of the possible applications of ACT-R in the military