Building and Measuring Trust in Human-Machine Systems

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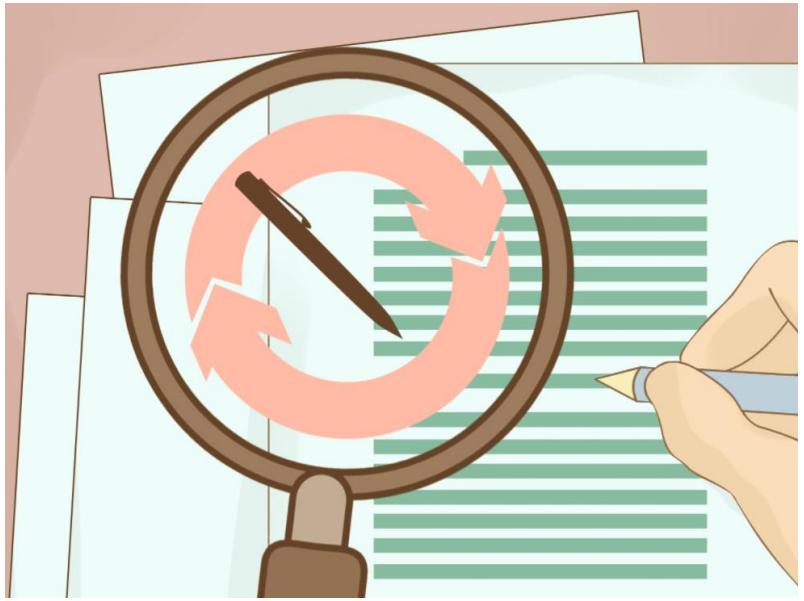
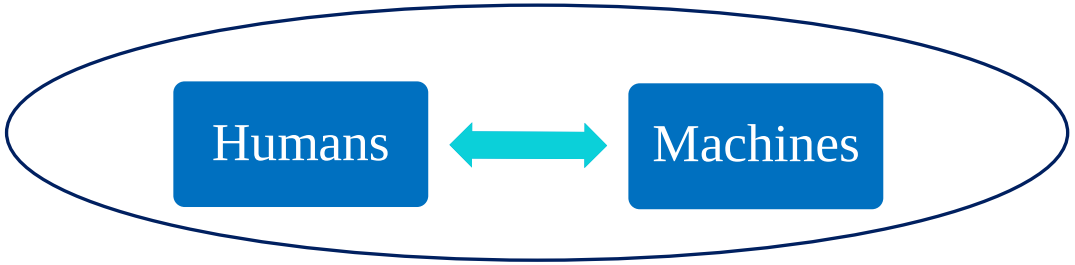
Outline

- Introduction
- Background
- Method
- Results and discussion
- Conclusion



Introduction



Human-machine systems (HMS)

- Trust on HMS ?
- Trust ↑
  - Human engagement ↑
  - Uncertainty ↓
- IMPACTS model:
  - Comprehensive
  - Specific

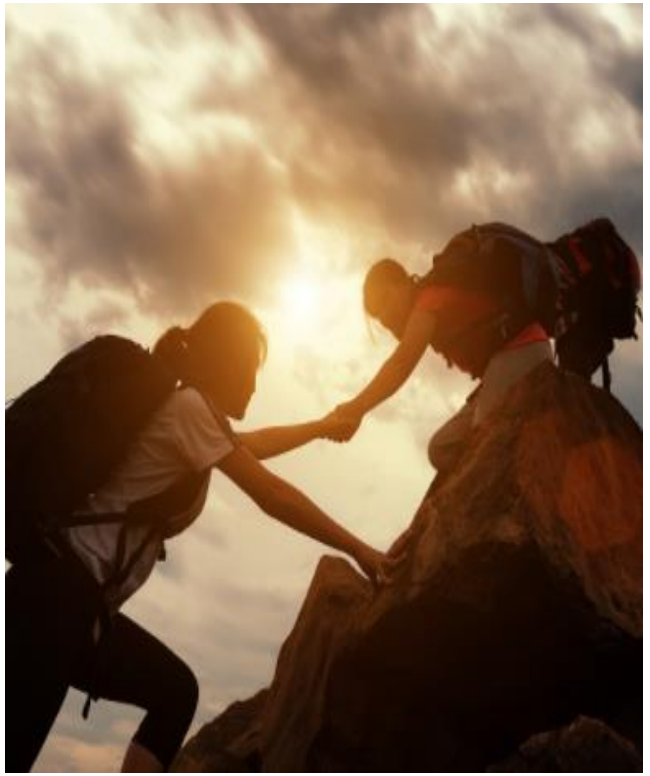
Definitions of Trust

- Assured reliance on someone or something

- User's confidence on something

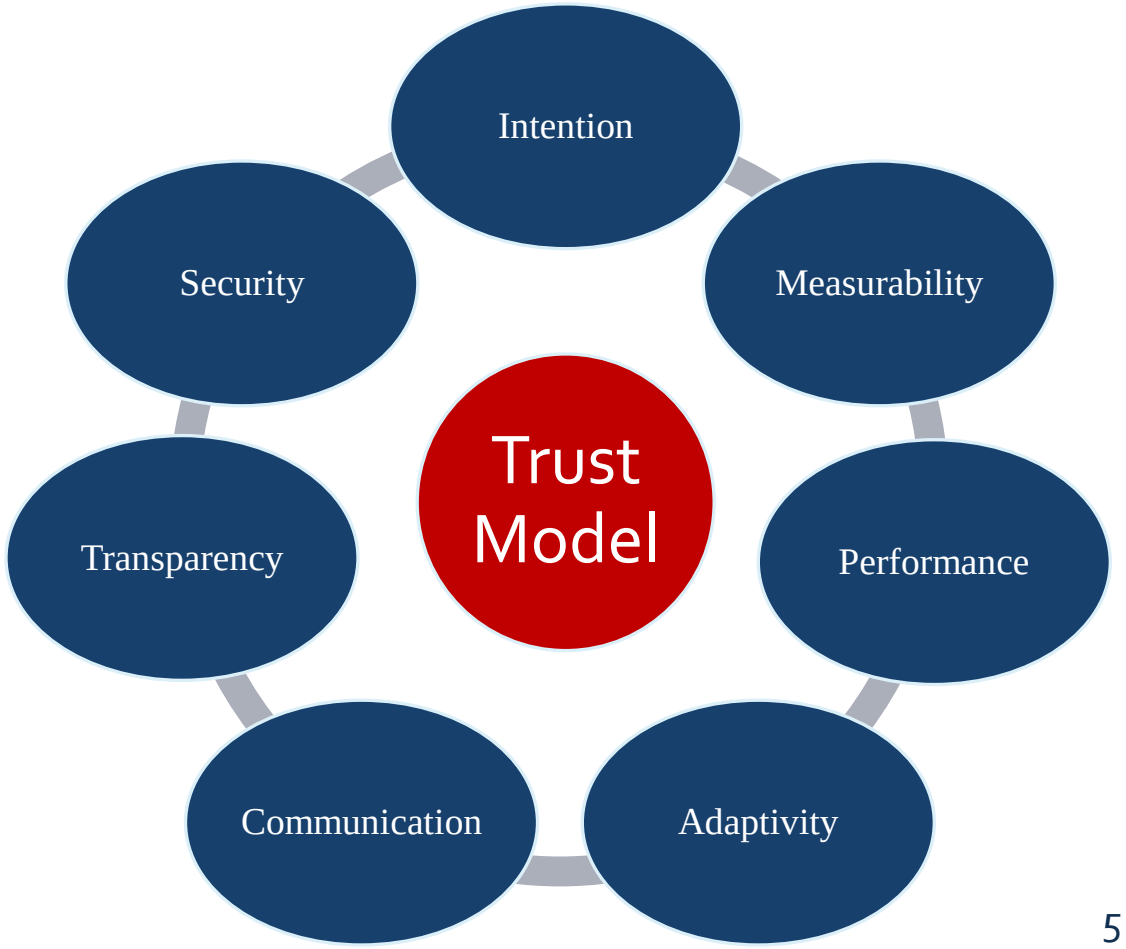
- In literature:

  - Human willingness ➔ behavioral dependence [2]
  - Machine actions and behaviours ➔➔ human interest [3]
  - …



Modelling of Trust

- IMPACTS **features**:
  - I ➔ Intention
  - M ➔ Measurability
  - P ➔ Performance
  - A ➔ Adaptivity
  - C ➔ Communication
  - T ➔ Transparency
  - S ➔ Security



Trust Measurement

- Measuring Trust
  - Quantitative
    - Subjective
    - Objective
  - Qualitative
    - Predictability
    - Reliability
    - Dependability

Method

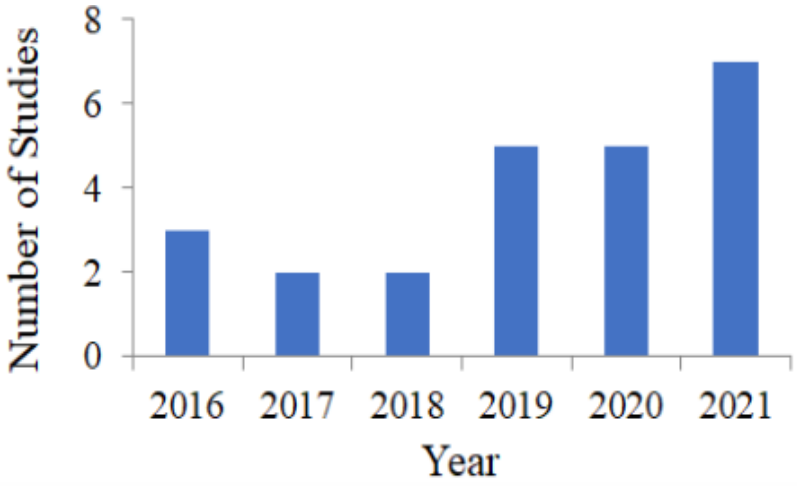
PRISMA [4]

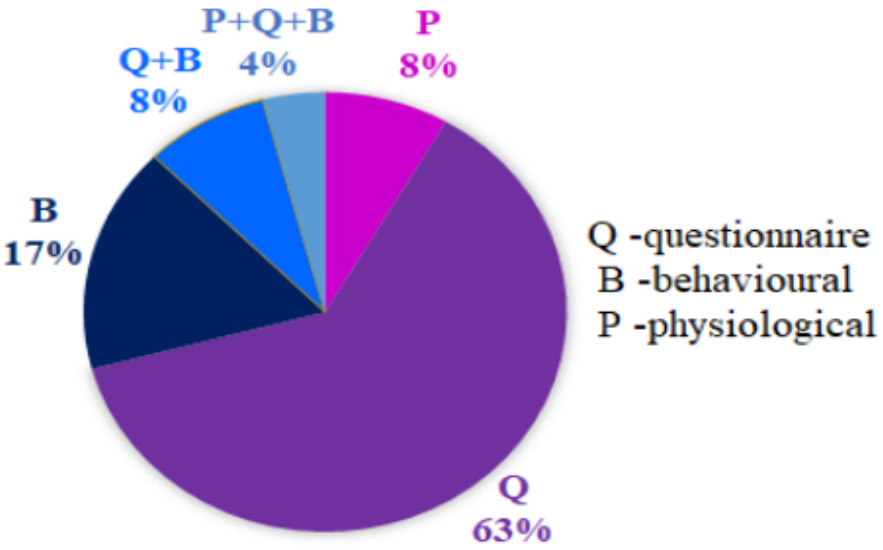
Databases	Keywords	Years	Inclusion criteria	Exclusion criteria
➢ ScienceDirect ➢ ACM Digital Library ➢ IEEE Xplore ➢ Google Scholar	➢ “Trust” ➢ “… ➢	➢ 2016 – 2021	➢ Title, abstract, …had … s … d …nt of … S …er-	➢ Reviews ➢ Books ➢ Thesis ➢ Reports ➢ Conference ➢ Other languages

Results: 494 records

Selected studies: 24 records

Results: Quantitative Analysis





Results: Qualitative Analysis

Study	Task	VR Simulation	I	M	P	A	C	T	S	Measurement
[26]	Operating machines - car	**Yes**	✓	✓	✓	✗	✓	✓	-	Q
[24]	Operating machines - car	No	✓	✓	✓	✗	✓	✓	-	Q
[20]	Operating machines - car	No	✓	✓	✓	✓	✓	✓	-	P
[21]	Operating machines - car	**Yes**	✓	✓	✓	✓	✓	✓	-	B
[15]	Operating machines - car	**Yes**	✓	✓	*	✗	✓	✓	-	Q
[16]	Operating machines - aircraft	No	✓	✓	✓	✗	✓	✓	-	Q
[17]	Operating machines - aircraft	No	✓	✓	*	✗	✓	✓	-	Q
[27]	Operating machines - aircraft	No	✓	✓	✓	✗	✓	✓	-	Q
[18]	Operating machines - aircraft	No	✓	✓	✓	✗	✓	✓	-	Q
[28]	Operating machines - aircraft	No	✓	✓	✓	✗	✓	✓	-	Q
[29]	Operating machines - spacecraft	No	✓	✓	✓	✗	✓	✓	-	Q
[22]	Operating machines - unmanned vehicles	No	✓	✓	✓	✓	✓	✓	-	Q+B
[30]	Classifying objects - product	No	✓	✓	*	✗	✓	✓	-	B
[5]	Classifying objects - shapes/words	**Yes**	✓	✓	✓	✗	✓	✓	-	P+Q+B
[31]	Classifying objects - emails	No	✓	✓	✓	✓	✓	✓	-	Q
[32]	Classifying objects - buildings	No	✓	✓	✓	✓	✓	✓	-	B
[33]	Classifying objects - buildings	No	✓	✓	✓	✓	✓	✓	-	B
[34]	Classifying objects - baggage	No	✓	✓	✓	✗	✓	✓	-	Q
[35]	Classifying objects - baggage	No	✓	✓	✓	✗	✓	✓	-	Q
[23]	Classifying objects - cyber-attacks	No	✓	✓	✓	✗	✓	✓	✓	Q+B
[36]	Managing things - chat-bots	No	✓	✓	✓	✗	✓	✓	-	Q
[37]	Managing things - resources	No	✓	✓	✓	✓	✓	✓	-	B
[38]	Managing things - inventory	No	✓	✓	✓	✓	✓	✓	-	Q
[39]	Managing things - spacecraft air quality	No	✓	✓	✓	✗	✓	✓	-	Q

VR - virtual reality

IMPACTS

I – intention
M- measurability
P – performance
A – adaptivity
C – communication
T – transparency
S – security

Measurement

P - physiological
B - behavioural
Q - questionnaire

Discussion

- Research progress of trust in HMS, but:
  - Inconsistent approach in measuring trust
  - Needed objective measurements

PULSE

- Comprehensive IMPACTS model ➔ Building and investigating trust in HMS

Conclusion

Unique definition of human trust in HMS

Trend in studying trust in HMS

Bibliography

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Thank you for your attention!

ANY QUESTIONS?