

# **Theoretical considerations and development of a questionnaire to measure trust in automation**

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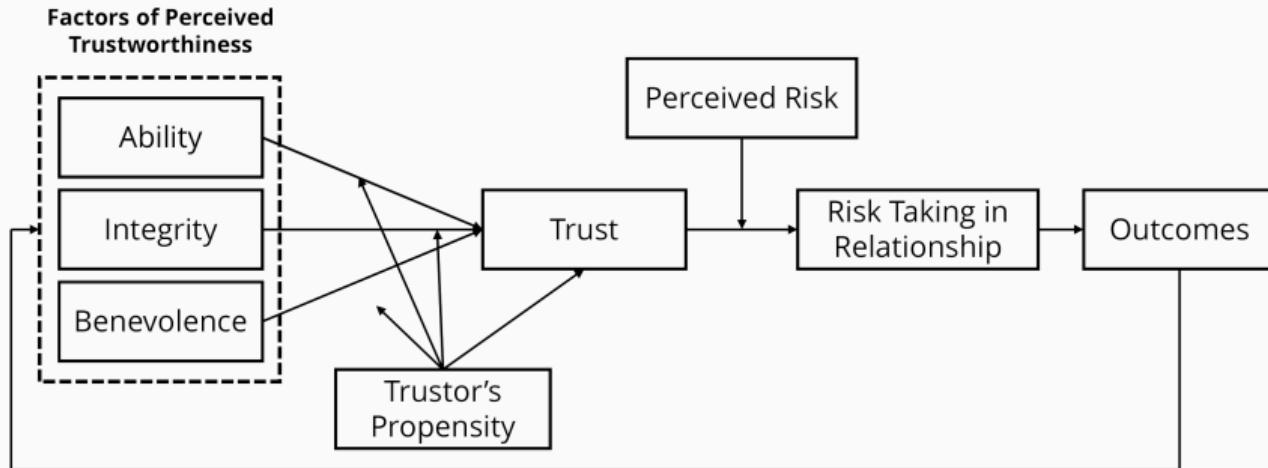
Moritz Körber

August 29<sup>th</sup>, 2018

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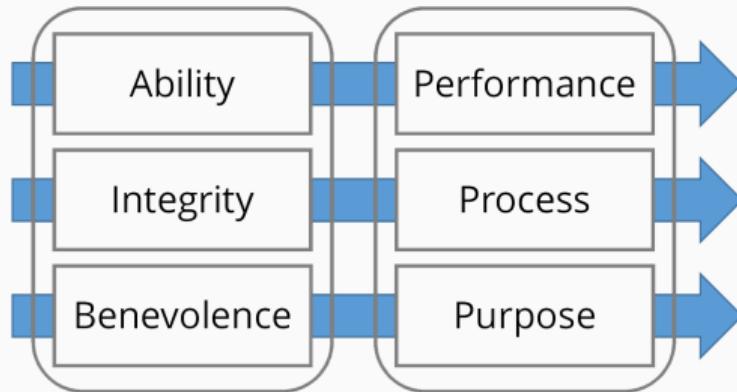
- Automated systems are taking over more and more functions in work and leisure environments
- Trust in automation determines if and how we use automated systems
- An empirical investigation of trust in automation necessitates a measurement of trust in automation

# The dyadic model of organizational trust

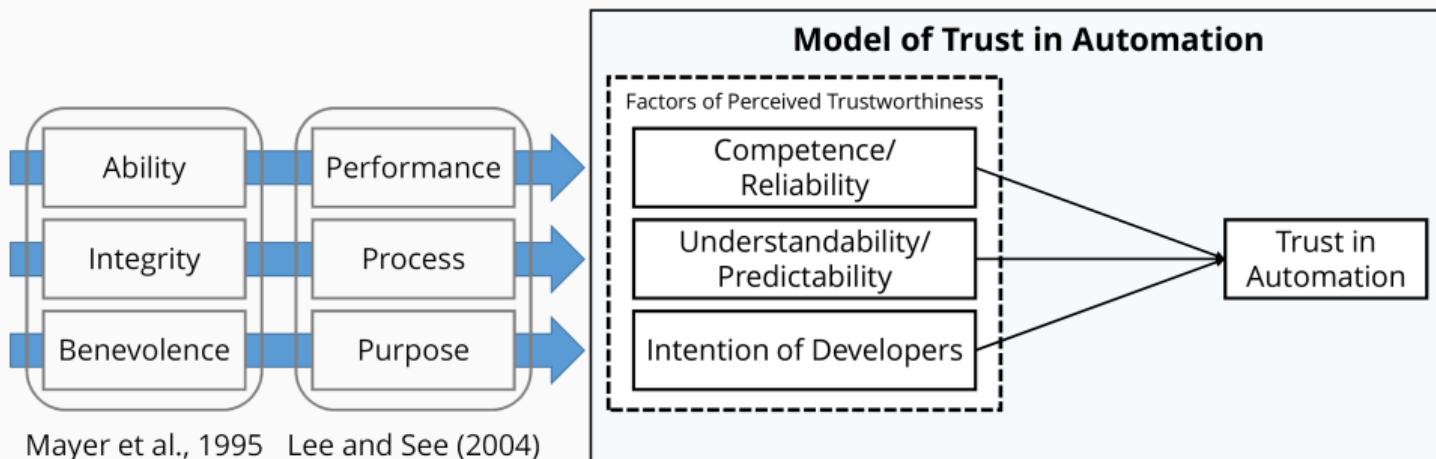


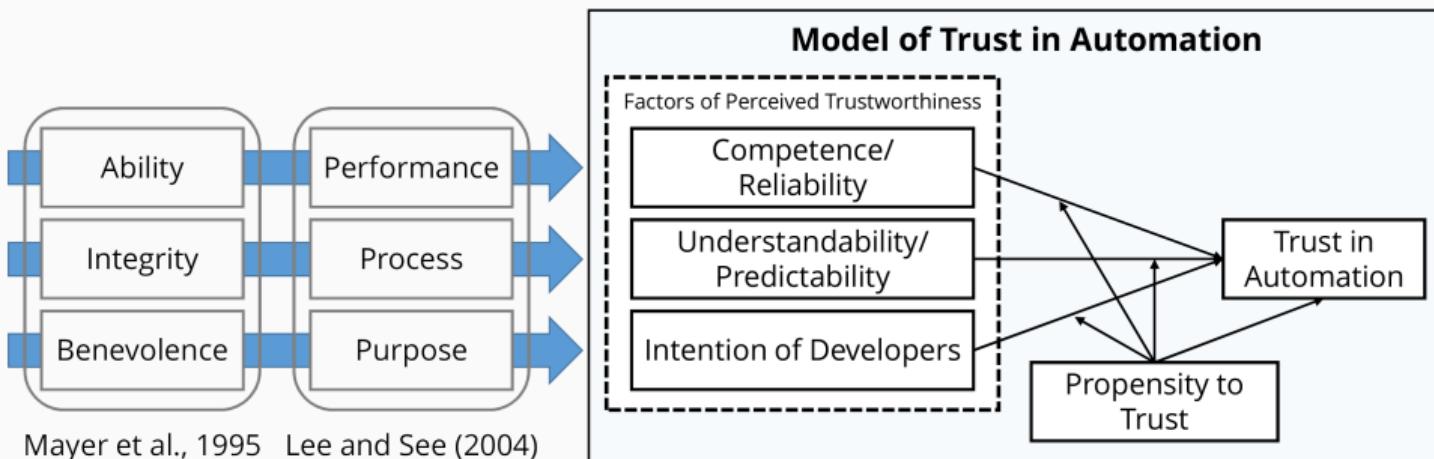
Model from Mayer, Davis, and Schoorman (1995)

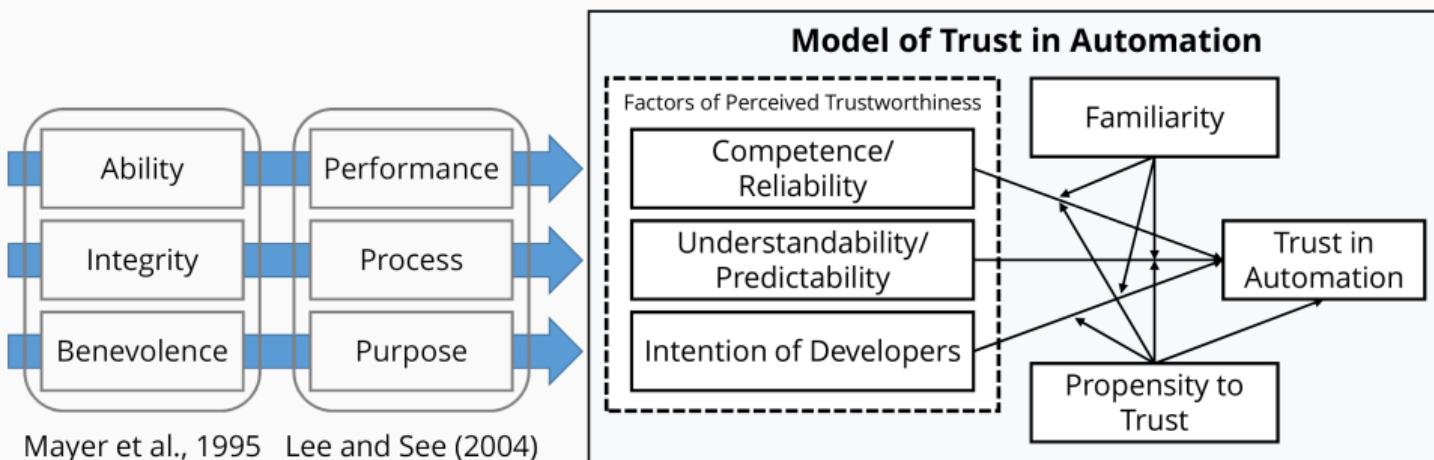
# Bases for interpersonal trust matched to trust in automation



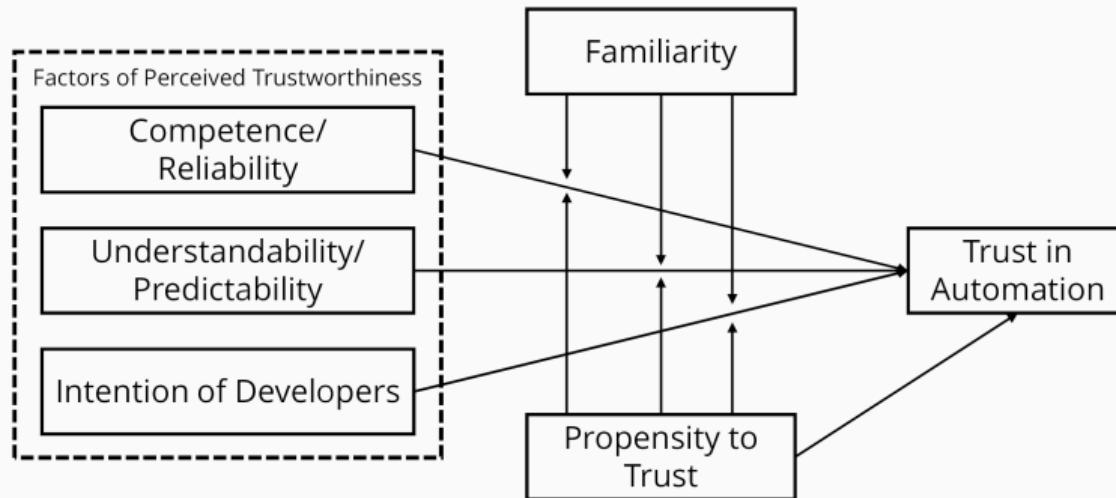
Mayer et al., 1995 Lee and See (2004)







## Model of Trust in Automation



1. Item generation
2. Study 1: Item analysis and elimination
3. Study 2: Construct validation
4. Study 3: Predictive validity

- Initial set: 57 items
- Format: 5-point rating scale ranging between 1 (= strongly disagree) to 5 (= strongly agree)
- Online study:  $n = 94$  participants watched 2 videos on automated driving (explanation + performance demonstration)
- Elimination of 40 items based on the criteria item difficulty, standard deviation, item-total correlation, internal consistency, content overlap with other items, response quote

**Result:** 17 items

Detailed data in the paper!

Does the observed data reflect the structure of the theoretical model?

- Online study:  $n = 58$  participants
- Video of conditionally automated drive; 2 conditions:
  1. Reliable automation with a perfectly functioning automation
  2. Non-reliable condition including a take-over request

## Study 2: Initial construct validation

	Factor 1	Factor 2	Factor 3	Factor 4
Familiarity 1	.	.	.	.82
Familiarity 2	.	.	.	.80
Intention of Developers 1	.	.75	.	.
Intention of Developers 2	.	.51	.	.
Propensity to Trust 1	.	.	.69	.
Propensity to Trust 2	.	.	.50	.
Propensity to Trust 3	.	.	.74	.
Reliability/Competence 1	.87	.	.	.
Reliability/Competence 2	.66	.	.	.
Reliability/Competence 3	.79	.	.	.
Reliability/Competence 4	.84	.	.	.
Reliability/Competence 5	.88	.	.	.
Reliability/Competence 6	.71	.	.	.
Understanding 1	.	.69	.	.
Understanding 2	.	.51	.	.
Understanding 3	.67	.	.	.
Understanding 4	.	.60	.	.

Principal axis factoring with oblique rotation (oblimin) and parallel analysis; loadings < .35 have been omitted.

- Exploratory factor analysis: The proposed factor structure was found, but no factor for *Intention of the Developers* could be extracted
- Good to excellent reliability for all scales (.77 to .95)
- The unreliable automated driving system received a lower reliability rating and a lower trust rating

Detailed data in the paper!

## Study 3: Predictive validity

- Driving simulator study:  $n = 40$  participants
- Conditionally automated vehicle on a highway while being engaged in a non-driving-related task (SuRT)
- Trust in automation rated before experimental drive

(Körber, Baseler, & Bengler, 2018)

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- Participants who crashed reported higher trust than collision-free participants ( $d = 0.51$ ).

(Körber, Baseler, & Bengler, 2018)

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- Structural Equation Model
  - Is the measurement model valid?
  - Do observed data reflect the proposed theoretical model?
  - How are the relations to outcomes such as reliance behavior?

- More details in the paper!
- The questionnaire is available at  
[https://github.com/moritzkoerber/TiA\\_Trust\\_in\\_Automation\\_Questionnaire](https://github.com/moritzkoerber/TiA_Trust_in_Automation_Questionnaire)
- Feel free to use it and to gather more data!

- Körber, M., Baseler, E., & Bengler, K. (2018). Introduction matters: Manipulating trust in automation and reliance in automated driving. *Applied Ergonomics*, 66, 18-31.
- Lee, J. D., & See, K. A. (2004). Trust in automation: Designing for appropriate reliance. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, 46(1), 50-80.
- Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995). An integrative model of organizational trust. *Academy of Management Review*, 20(3), 709-734.

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