

PET Users' Information Privacy Concerns

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GEFÖRDERT VOM

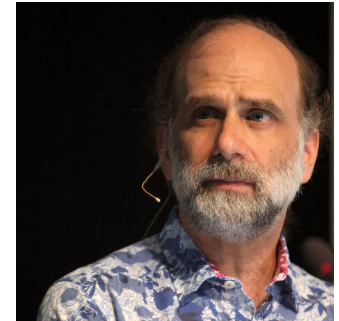


Bundesministerium
für Bildung
und Forschung

1. Introduction and Motivation
2. Methodology
3. Results
4. Discussion and Conclusion

Introduction and Motivation

- Bruce Schneier: “Surveillance is the business model of the internet. Everyone is under constant surveillance by many companies, ranging from social networks like Facebook to cellphone providers.” (August 2017)
- “The mean value for the statement *‘I feel very strongly about protecting my privacy’* was 3.64 on a five-point scale [...]“
[Singh, T., Hill, M.E.: Consumer privacy and the Internet in Europe: a view from Germany. Journal of consumer marketing 20(7) (2003) 634-651]



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Motivation and Definition

- Standalone PET: privacy protection as the primary goal of the users with respect to the PET
- PETs have specific characteristics:
 1. immediate results of use not visible (a “good” PET should not change user experience) → in contrast to other systems
 2. technical functioning quite complex (layman users will / cannot evaluate the services and their reliability)
- Goals:
 1. quantitative analysis of the relevance of privacy concerns, trust and risk relationships for PET users based on IUIPC
 2. integration of a new trust dimension (trust in Tor)

Research Question 1:

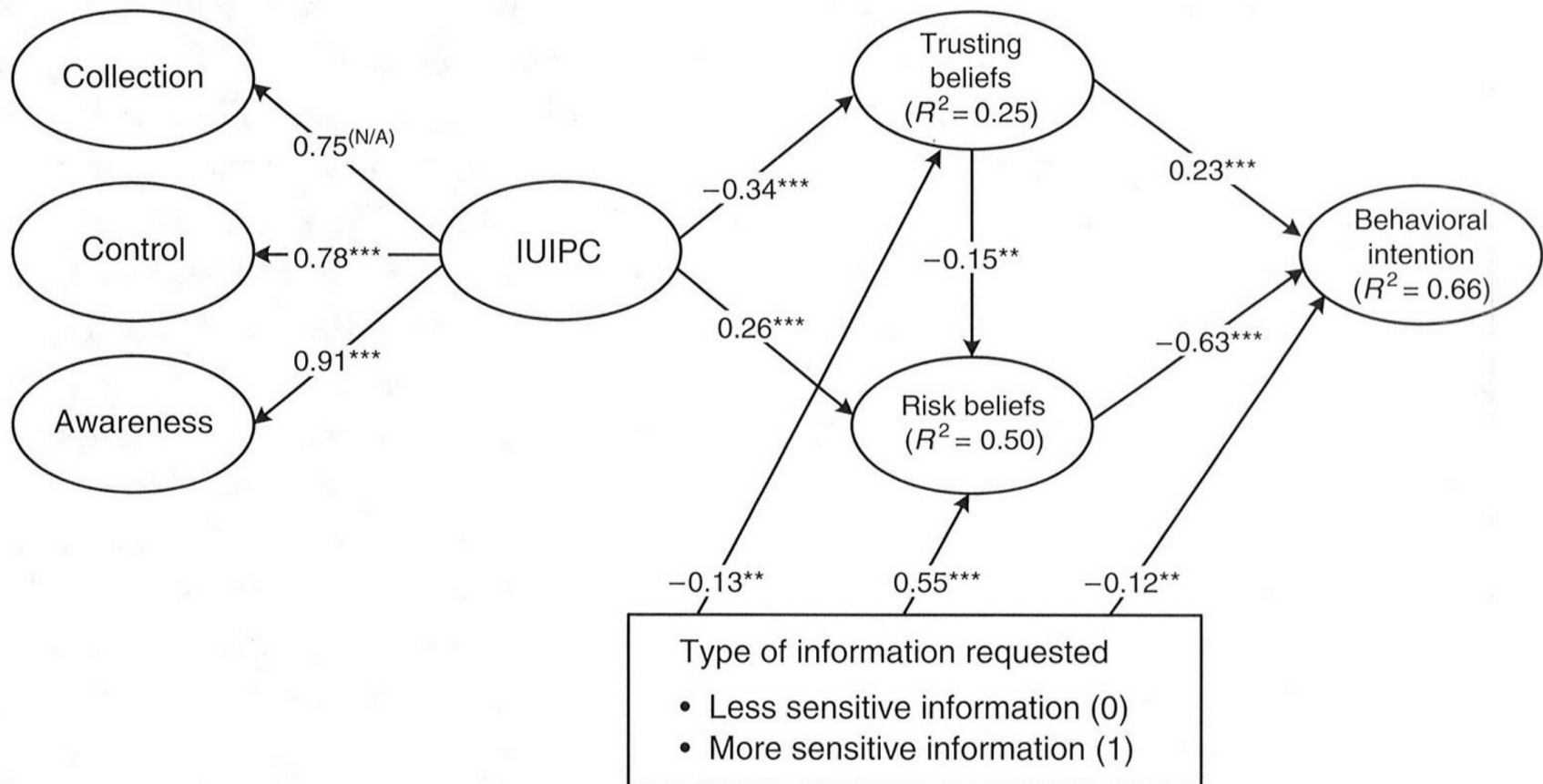
What influence have privacy concerns and associated trust and risk beliefs on the behavioral intention and actual use of Tor?



Research Question 2:

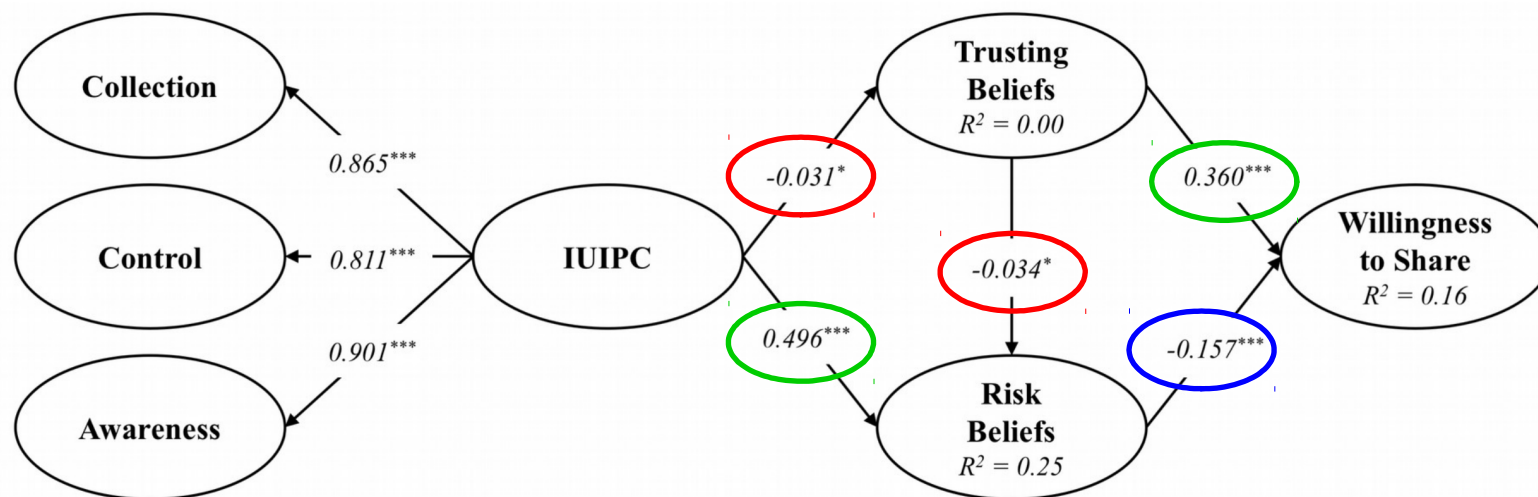
What influence does trust in Tor itself have on the behavioral intention and the actual use?

Internet Users' Information Privacy Concerns (IUIPC)



Malhotra, Kim & Agarwal: Internet users' information privacy concerns (IUIPC): The construct, the scale, and a causal model, *Information Systems Research* 15(4), 2004

Internet Users' Information Privacy Concerns (IUIPC)



* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Hypothesis	Result
1: IUIPC –negative→ Trusting Beliefs	Rejected (negligible effect)
2: IUIPC –positive→ Risk Beliefs	Confirmed
3: Trusting Beliefs –negative→ Risk Beliefs	Rejected (negligible effect)
4: Trusting Beliefs –positive→ Willingness to Share	Confirmed
5: Risk Beliefs –negative→ Willingness to Share	Confirmed

Sebastian Pape, Ana Ivan, David Harborth, Toru Nakamura, Shinsaku Kiyomoto, Haruo Takasaki, Kai Rannenber: *Re-evaluating Inter Users' Information Privacy Concerns: The Case in Japan* (Minor Revision requested, AIS Transactions on Replication Research)

Application of IUIPC to Privacy Enhancing Technologies

- IUIPC applied to a service (primary use)
- Primary purpose of PETs: Protect Users' Privacy

=> Distinguish between
trust beliefs with respect to PETs and
trust beliefs with respect to regular internet services

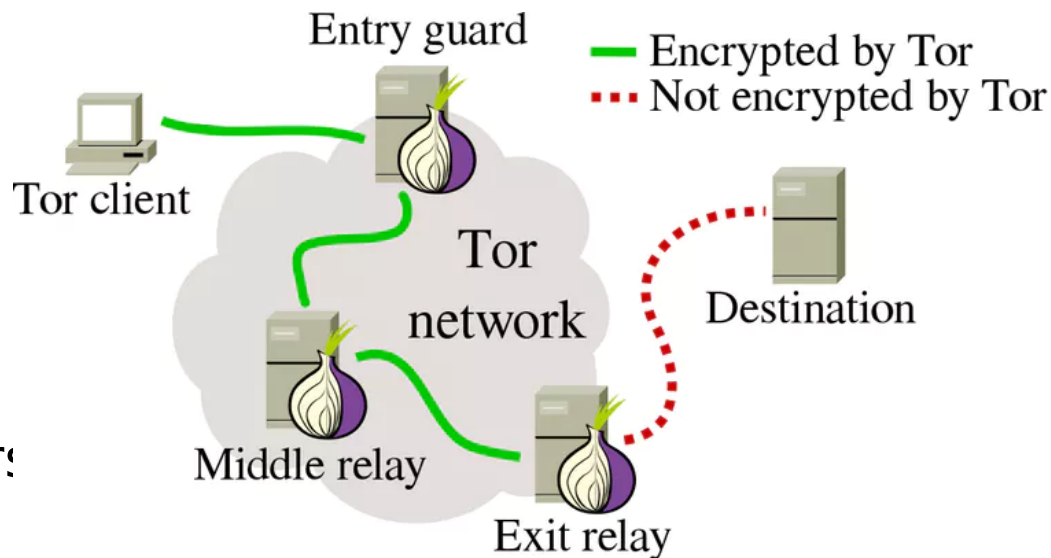


Harborth, D. and Pape, S.: JonDonym Users' Information Privacy Concerns. In ICT Systems Security and Privacy Protection - 33rd IFIP TC 11 International Conference, SEC 2018, Held at the 24th IFIP World Computer Congress, WCC 2018, Poznan, Poland, September 18-20, 2018, Proceedings, pages 170-184, 2018

Harborth, D. and Pape, S.: How Privacy Concerns and Trust and Risk Beliefs Influence Users' Intentions to Use Privacy-Enhancing Technologies -- The Case of Tor. In 52st Hawaii International Conference on System Sciences (HICSS) 2019, pages 4851-4860, 2019.

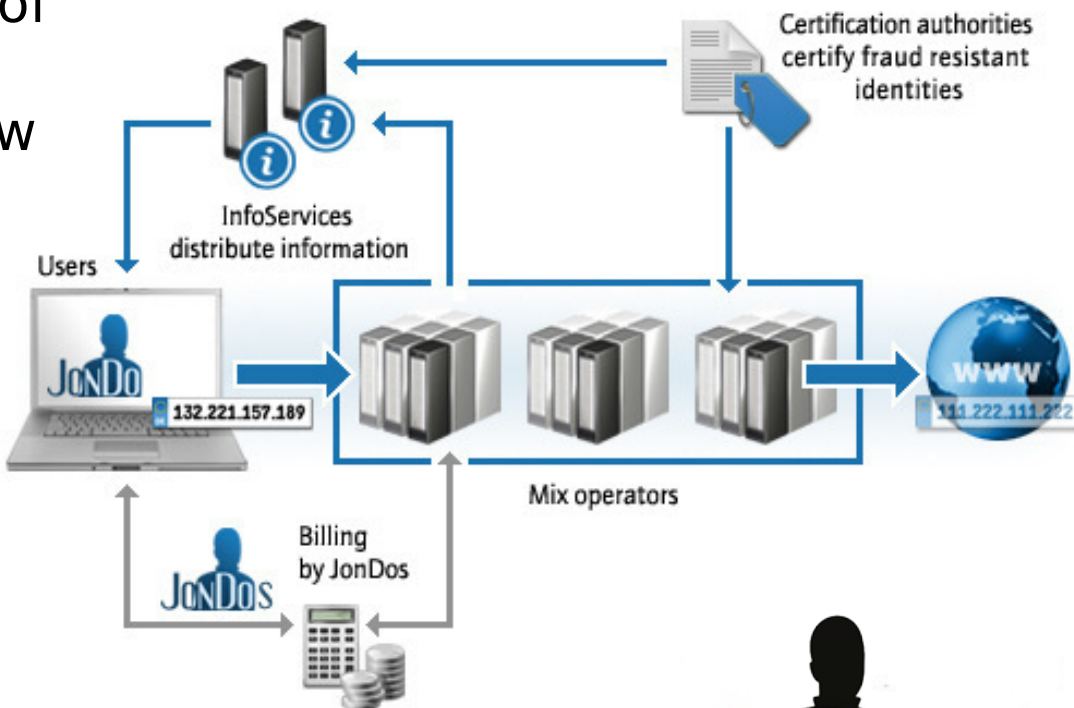
Introduction to Tor

- Group of volunteer operated servers
- Relays can be run by anyone
- Free to use
- Donations possible
- Roughly 2 million users



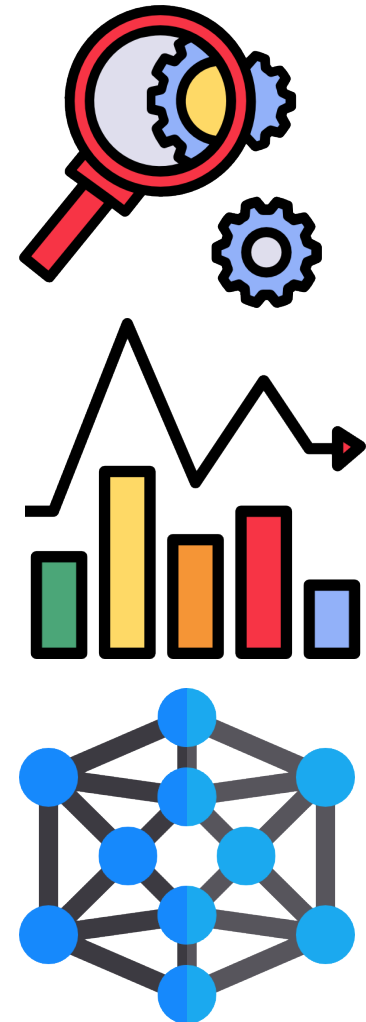
Introduction to JonDonym

- Service developed out of a research project
- Commercial service now
- Different pricing schemes
- Proxy system based on mix cascades
- Main differences to Tor:
 1. commercial
 2. fixed cascades vs. random onion routers



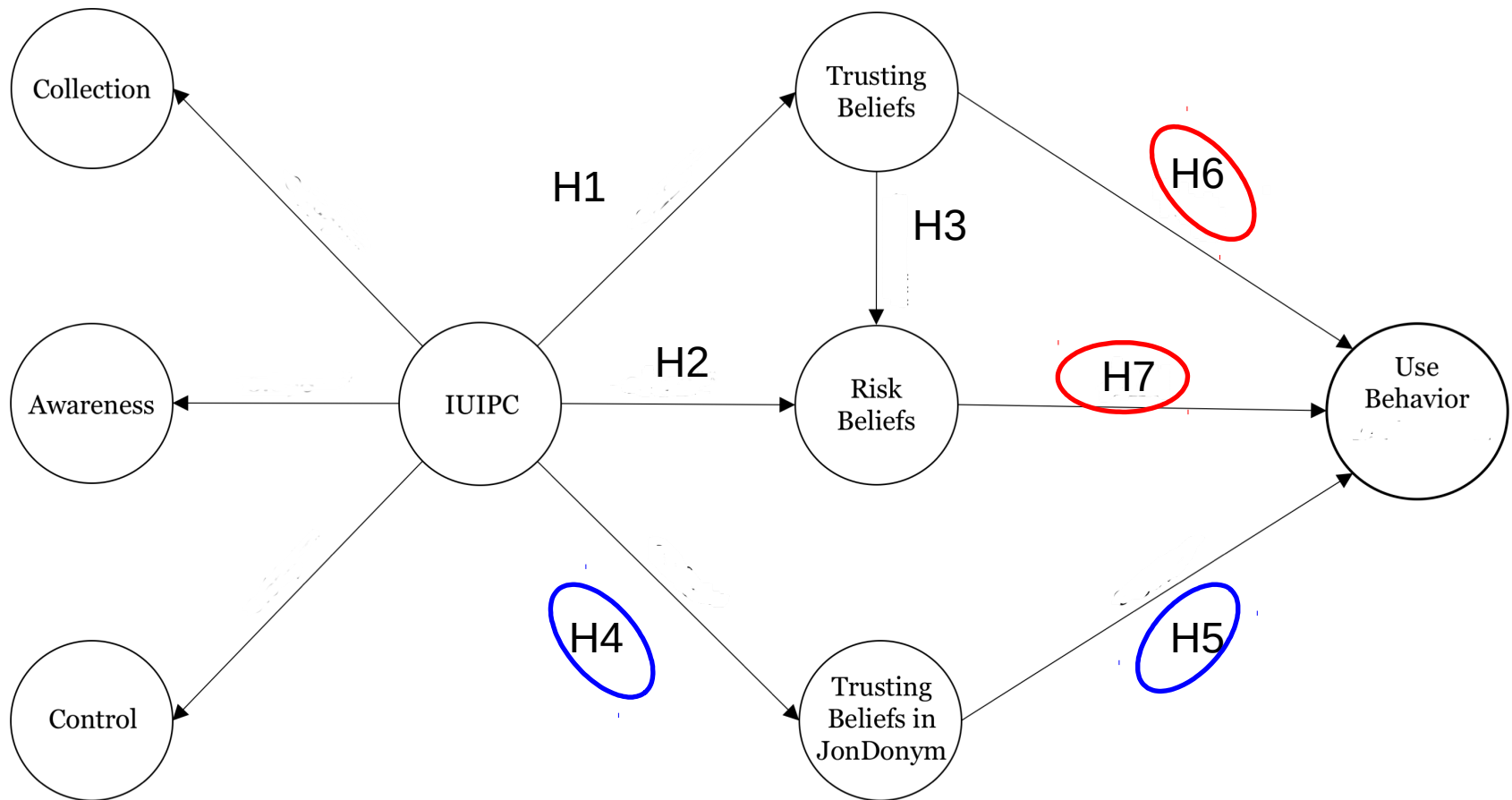
JonDonym

- Adapted Causal Model based on IUIPC
 - Research Hypothesis H1 to H7
- Online Survey
- Partial least squares structural equation modelling (PLS-SEM) with SmartPLS 3.2.7 (Ringle et al. 2015)



	Hypothesis
H1	Internet Users Information Privacy Concerns (IUIPC) have a negative effect on Trusting Beliefs (TB).
H2	Internet Users Information Privacy Concerns (IUIPC) have a positive effect on Risk Beliefs (RB).
H3	Trusting Beliefs (TB) have a negative effect on Risk Beliefs (RB).
H4	Internet Users Information Privacy Concerns (IUIPC) have a positive effect on the trusting beliefs in JonDonym (TB _{JD}).
H5	Trusting beliefs in JonDonym (TB _{JD}) have a positive effect on the actual use behavior of JonDonym (USE).
H6	Trusting beliefs (TB) have a negative effect on actual use behavior of JonDonym (USE).
H7	Risk beliefs (RB) have a positive effect on actual use behavior of JonDonym (USE).

Methodology: Research Model



Methodology: Questionnaire

- Constructs adapted from IUIPC (Malhotra et al. 2004)
- German and English-speaking users of JonDonym acquired via
 - survey ad during the rollout of a new browser and
 - on the official homepage
- Tor users respectively via mailinglists, forums, dark net, etc.
- Online survey with LimeSurvey
- Constructs translated into German with two certified translators
- Active users Jondonym (N=141, 53 English and 88 German)
- Active users Tor (N=124, 107 English and 17 German)

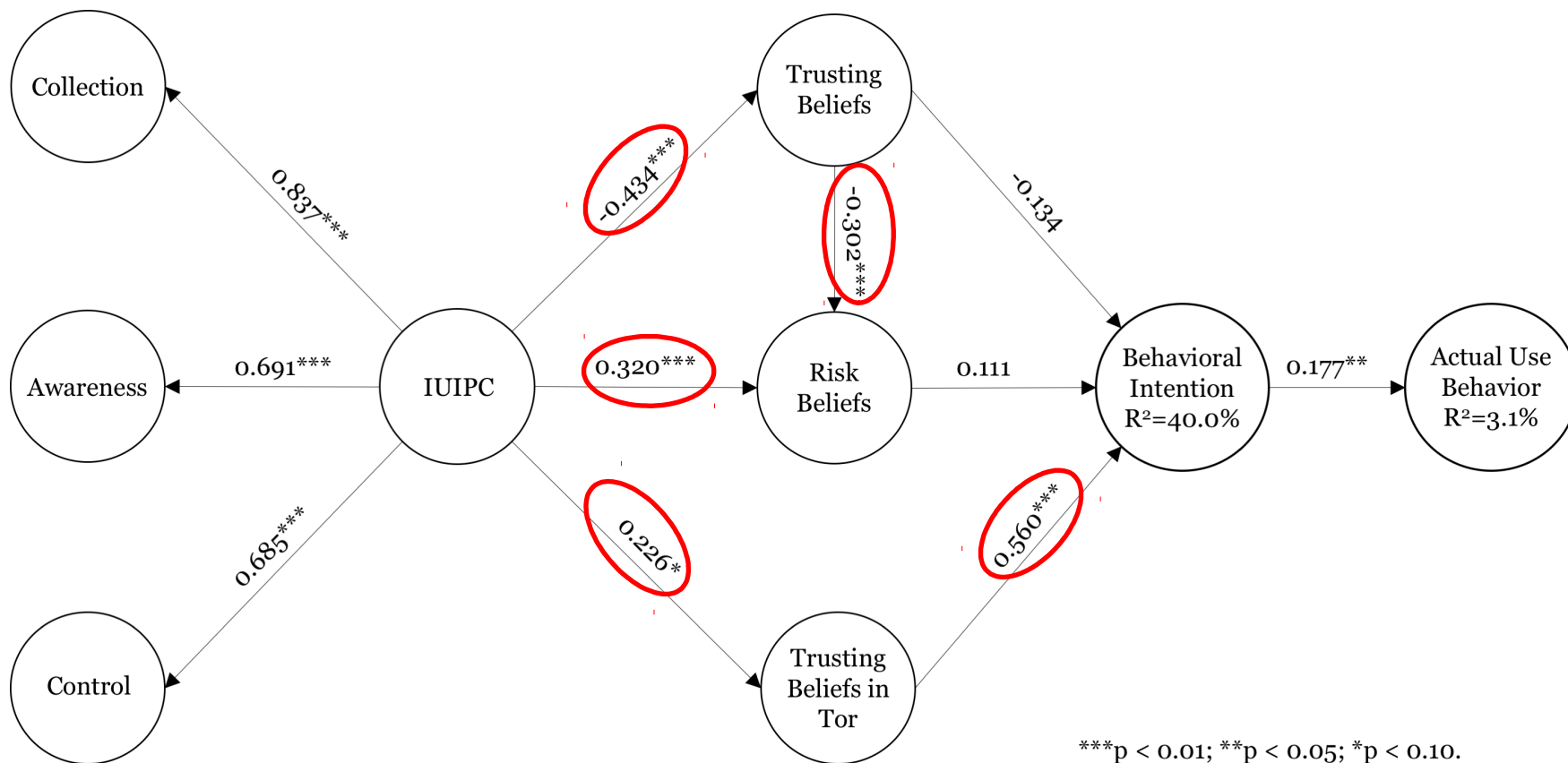


Results: Measurement and Structural Model

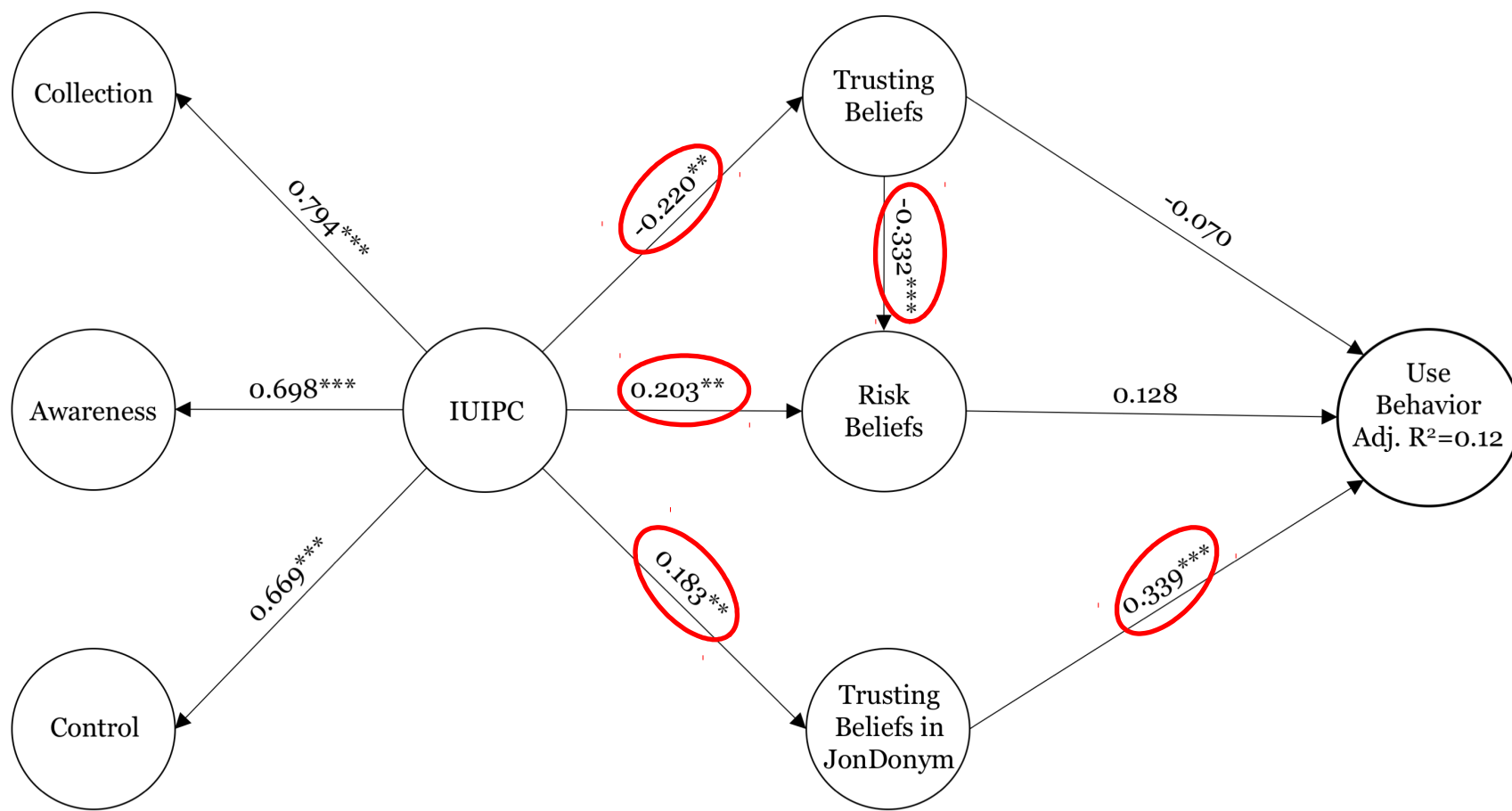
Measurement Model Assessment	Structural Model Assessment
Internal consistency reliability ✓	Collinearity ✓
Convergent validity ✓	Significance and Relevance of Model Relationships (see next slide) ✓
Discriminant validity ✓	Predictive Relevance ✓
Common Method Bias ✓	

- Assessments indicate valid and reliable results

Results Tor: Path Estimates and R²-values



Results Jondonym: Path Estimates and R²-values



***p < 0.01; **p < 0.05; *p < 0.10.

Summary of the Results

Hypotheses	Confirm / Reject
H1 (IUIPC → Trust Beliefs)	Confirmed ✓
H2 (IUIPC → Risk Beliefs)	Confirmed ✓
H3 (Trust Beliefs→ Risk Beliefs)	Confirmed ✓
H4 (IUIPC → Trust Beliefs (Jondonym/Tor)	Confirmed ✓
H5 (Trust Beliefs (Jondonym/Tor) → PEOU)	Confirmed ✓
H6 (Trust Beliefs → USE)	Not confirmed
H7 (Risk Beliefs → USE)	Not confirmed

- Sample size (124/141 participants)
- Self-reported biases
- Translation of existing constructs to other languages & combination of answers from English and German questionnaire
- Sample is biased “by default” since it only includes user

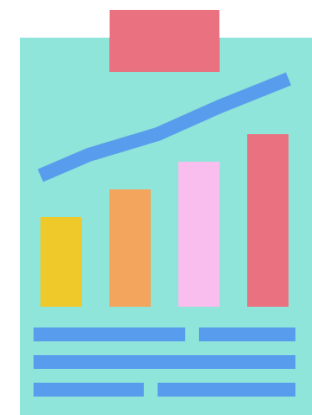


- Certain PET-specific constructs might be missing
 - i.e. distinguish between trust in company and trust in PET itself
- Analyze perceptions of non-users about PETs to provide deeper practical insights to enhance mass market adoption
- Research part of a larger research agenda:
Comparison of results from different models over different PETs (JonDonym, Tor, VPN)



Summary and Key Findings

- Past research on PETs mainly technical
→ successful implementation and adoption requires a profound understanding of the perceptions and behaviors of actual and non-users



- Extended IUIPC [Malhotra et al.] for use with PETs
1. Trust/risk relationships theoretically inverse for PETs
 2. IUIPC has an indirect effect on BI mediated by trust in the PET
 3. Trust in the PET is the most relevant antecedent of BI



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