Buying the Pig in a Poke? Barriers to Consumer Acceptance of Non-Transparent Technologies

Andreas Strebinger
Professor of Marketing & Business Analytics
School of Business, Economics, and Social Sciences,
University of Graz

BioNanoNet Gold Member Webinar, June 27, 2023

Bild: Uni Graz/Marija Kanizaj

Non-Transparent ("Black-Box) Technologies

- users perceive a „non-transparent relation between input and output" (Cliff et al. 2011)

- Examples:
  - Artificial Intelligence (e.g., Adadi & Berrada 2018; Holzinger et al. 2019; Rudin & Radin 2019; Arrieta et al. 2020; Venkatesh et al. 2021)
  - Distributed Ledger and Blockchain Technology (Dodd 2018; Hirtan & Dobre 2018; Mason 2018)
  - Genetically modified organisms (Taylor et al. 2013; Van Motagu 2018)
  - Nanotechnology (Peterson et al. 2009)

- mechanisms hard for users to understand (Boukis 2020; Ming-Hui & Rust 2021)
- create fear of losing control (Venkatesh et al. 2021; Puntoni et al. 2021)

Model

Confirmed by:
Alsajjan & Dennis 2010; Lopez-Vazquez et al. 2012; Mäntymäki et al. 2014; Sawang et al. 2014; Amaro & Duarte 2015; van Velsen et al. 2015; Buckley et al. 2018; Hegner et al. 2019; Feindt & Poortvliert 2020; Kaye et al. 2020; Yu-Ting, McInnis & Eisingerich 2020

AI love you: Japanese man not alone in 'marriage' to virtual character

April 18, 2020 (Mainichi Japan) Japanese version

Akihiko Kondo talks to Hatsune Miku, who has been summoned to his Gatebox at his home in Tokyo on March 17, 2020. Kondo says, "I've vowed my everlasting love to Miku herself, not as a replacement for a live human being." (Mainichi/Toshiki Miyazaki)

Nov 02, 2018 08:00 PM BUSINESS & TECH

Alibaba Switches On First Smart Hotel

By Coco Feng and Tanner Brown

A robot serves a guest on Monday at Alibaba's futuristic FlyZoo Hotel in the eastern city of Hangzhou. Photo: IC

#WSJ #ArtificialIntelligence #China

How China Is Using Artificial Intelligence in Classrooms | WSJ

Forbes

ALPHA ALARM

Metaverse In Numbers: How Vietnam Is Fueling The Crypto Game Boom

Joseph Young Contributor

Alpha Alarm Premium Editorial Newsletter

Crypto & Blockchain

Analyst and investor. Forbes and Hashed. @iamjosephyoung on Twitter.

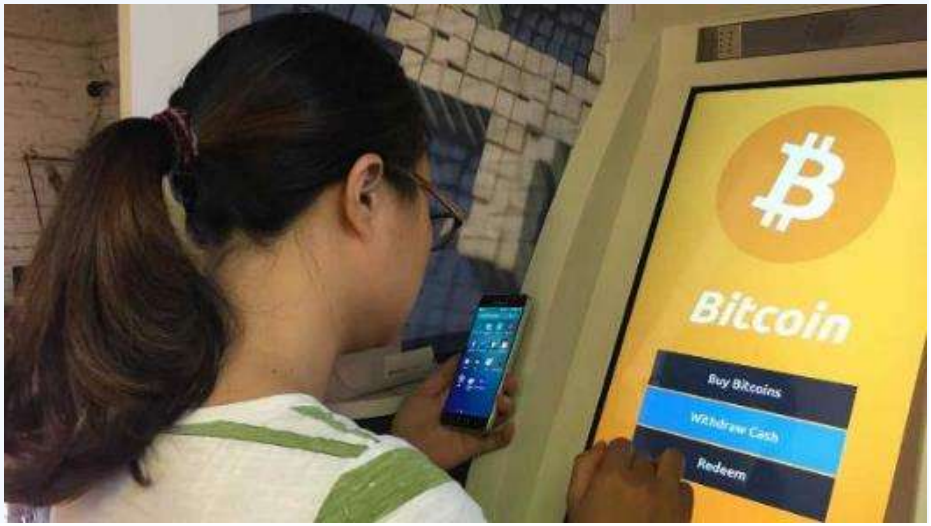
Listen to article 4 minutes

Oct 21, 2021, 11:25pm EDT

Vietnam is the home to Axie Infinity, the biggest crypto game that has gained massive popularity across Southeast Asia. As a result of its explosive growth, the demand for blockchain games in Vietnam, the Philippines, and Thailand is rapidly increasing.

Cityscape of Ho Chin Minh Skyline, Ho Chi Minh City (Saigon), Vietnam. (Photo by: Godong/Universal ... [+] UNIVERSAL IMAGES GROUP VIA GETTY IMAGES

Bitcoin ATMs Taking off in Vietnam With New Arrivals



KOREA.net

LIVE! NEWS FOCUS ABOUT KOREA EVENTS RESOURCES GOVERNMENT ABO

HOME > News Focus > Culture

Culture

Lifelike virtual humans dominate Korean marketing industry

Sep 03, 2021

A+ A A-

Rozy is Korea's first virtual influencer. (Screen capture from Rozy's Instagram page)

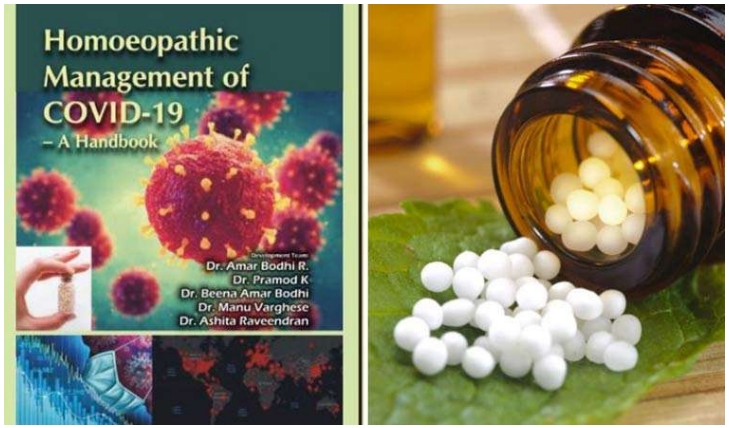
By Yoon Hee Young
Video = Shinhan Life's official YouTube channel

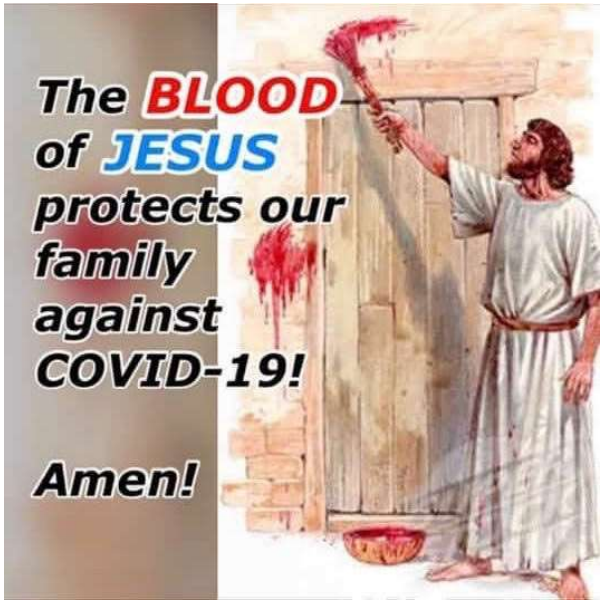
A woman in a YouTube commercial for an insurance company shows off her attractive appearance and dancing skills. This ad exceeded 10 million views in under a month.


WER IN DER DEMOKRATIE SCHLÄFT, WACHT IN DER DIKTATUR AUF!
Nie mehr Faschismus
PROTEST AGAINST VACCINE MANDATE
WION


FREEDOM CONVOY 2022


WE CALL THE SHO
MY CHILDREN ARE NOT YOUR SCIENCE EXPERIMENT
FREEDOM NOT FORCE


Homoeopathic Management of COVID-19
– A Handbook
Dr. Amar Bodhi R.
Dr. Pramod K
Dr. Beena Amar Bodhi
Dr. Manu Varghese
Dr. Ashita Raveendran


The BLOOD of JESUS protects our family against COVID-19!
Amen!

Model

Confirmed by:
Alsajjan & Dennis 2010; Lopez-Vazquez et al. 2012; Mäntymäki et al. 2014; Sawang et al. 2014; Amaro & Duarte 2015; van Velsen et al. 2015; Buckley et al. 2018; Hegner et al. 2019; Feindt & Poortvliert 2020; Kaye et al. 2020; Yu-Ting, McInnis & Eisingerich 2020

Rationalism and Individualism as two of the pillars of Western thinking

Individualism and Black-Box Technologies

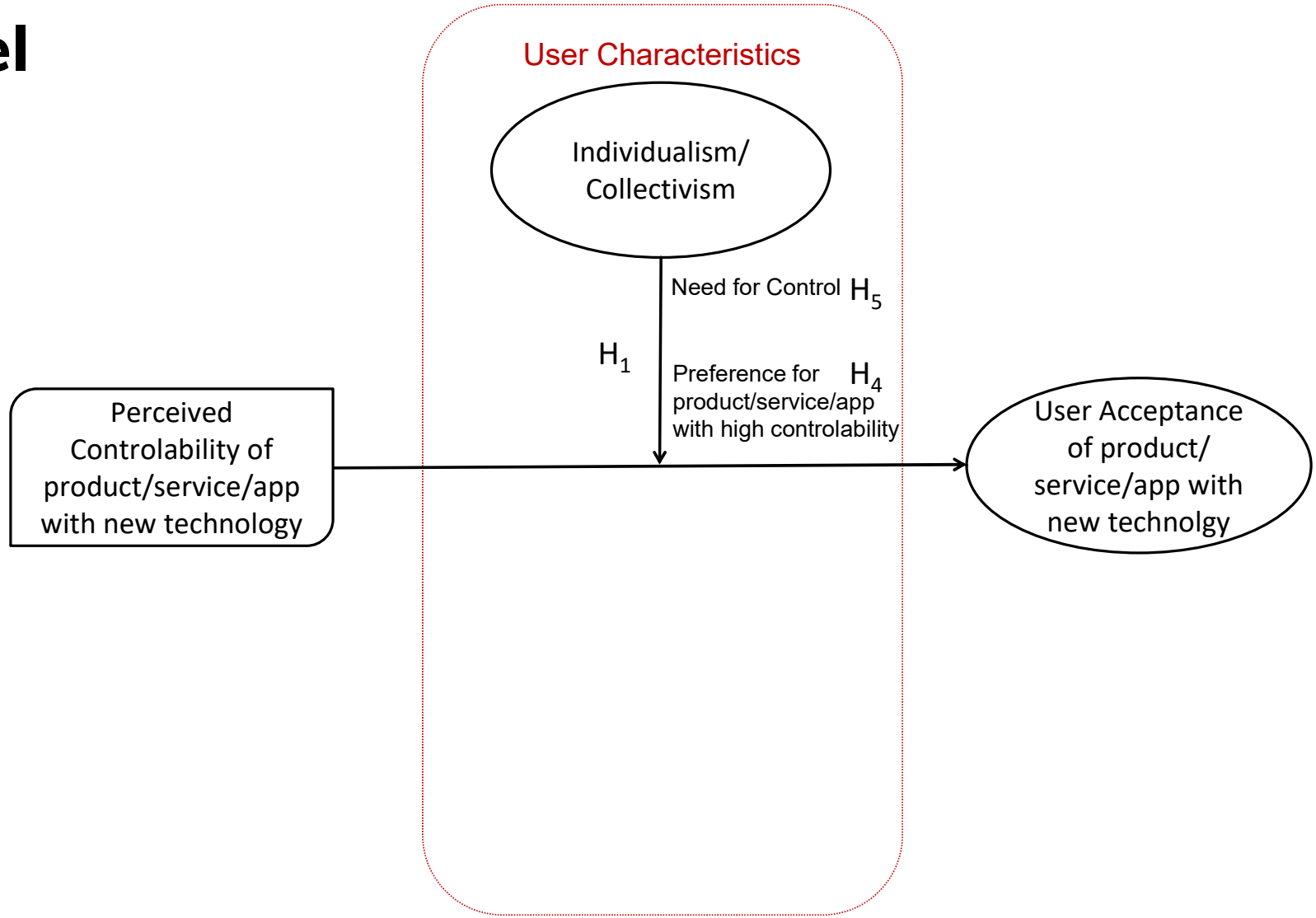
- Need for Control varies between cultures (Venkatesh 2021).
- higher in individualistic countries (Weisz et al 1984, Morling et al. 2002, Markus et al 2006, Cheng et al., 2013, Eisen et al. 2016).

+

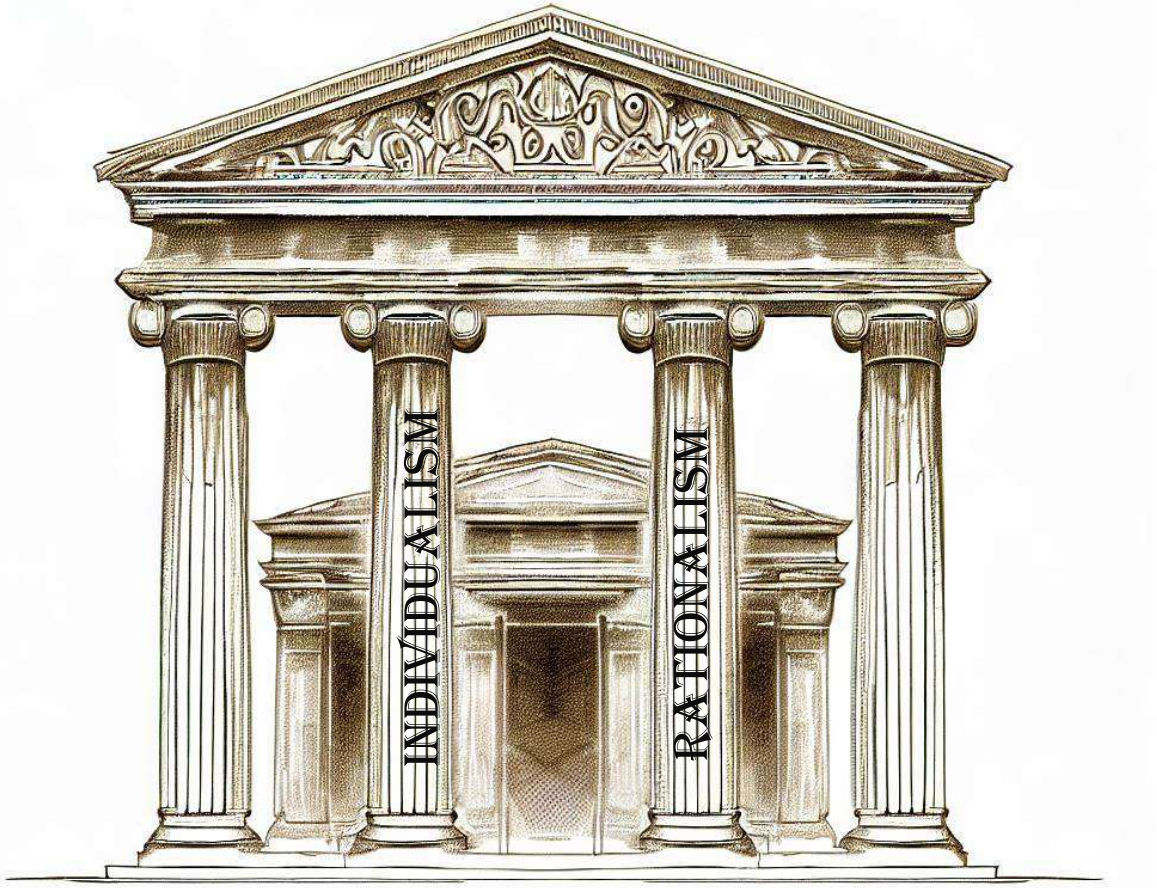
- Black-Box Technologies → Fear of losing control (Puntoni et al. 2021; Venkatesh et al. 2021)

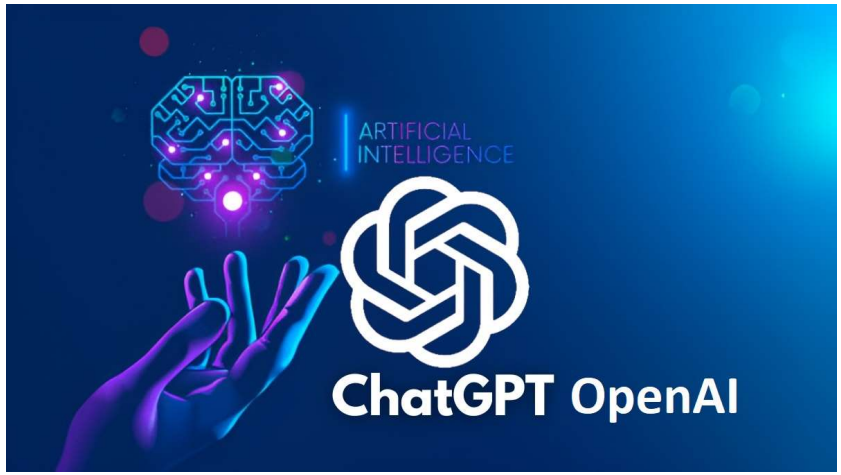
→

Model


User Characteristics
Individualism/
Collectivism
Need for Control H_5
H_1
Preference for H_4
product/service/app
with high controlability
Perceived
Controlability of
product/service/app
with new technology
User Acceptance
of product/
service/app with
new technolgy

Rationalism and Individualism as two pillars of Western thinking





tutorialspot.com

INDUSTRIAL AUTOMATION

Machine Learning: The Magic is How it Works

July 3, 2019

No overarching artificial intelligence looms on the horizon, but machine-learning tools can make applications do some magical things.

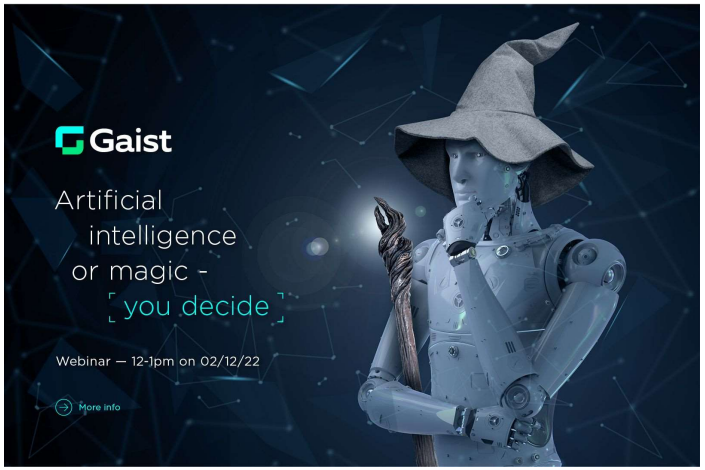
William G. Wong

Telefonica.com

Artificial Intelligence: the day magic came into our lives

The applications of Artificial Intelligence are increasingly numerous and surprising. No economic sector or social sphere escapes its influence.

#innovation #technology #artificial intelligence

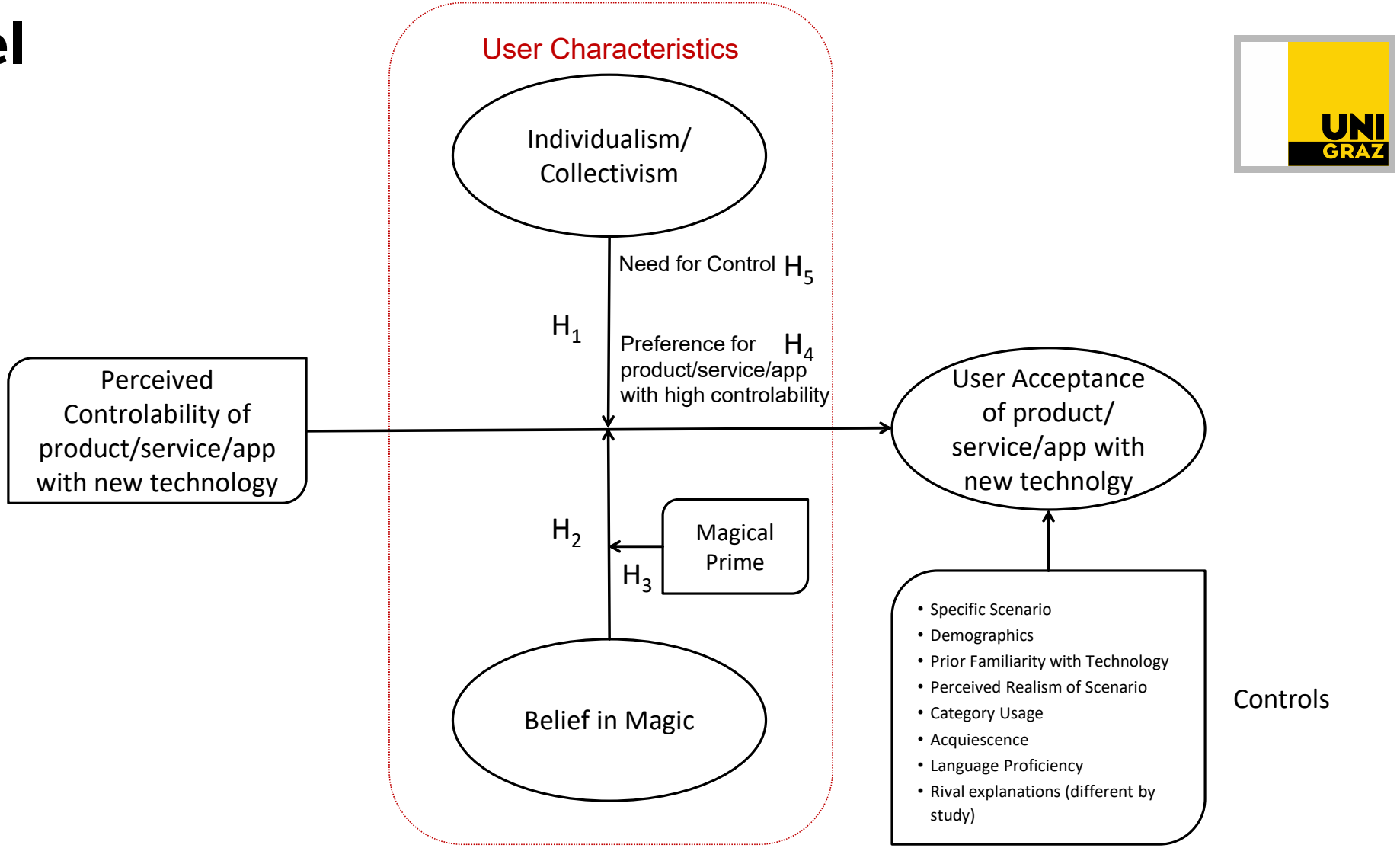


Icrig.com

Belief in Magic and Taking Risks

- Belief in Magic (BiM): assumption of a causal relationship between action and outcome without a rationale explanation (Thalbourne 1997; Carlson et al. 2009; Matute et al. 2011; Fluke et al. 2014)
- Higher in Asian cultures (Darke and Freedman 1997; Valenzuela et al. 2010, 2015; Chen & Young 2018; Bhattacharya et al. 2018; Hirshleifer et al. 2018)
  - But: 63% of US-Americans and 45% of Austrians believe in at least one paranormal phenomenon (OnePoll, 2021; Spectra 2019).
- Increases the expectation of stable personal luck (Matute, 1994; Darke and Freedman 1997; Rudski, Lischner, & Albert 1999; Keinan 2002 Valenzuela et al. 2010, 2015; Chen & Young 2018)
- Creates an illusion of control and raises the willingness to take risks (Kramer & Block 2008; Hernandez et al. 2008; Subbotski 2014; Chinchanachokchai et al. 2017; Valenzuela et al. 2015).

Model


User Characteristics
Individualism/ Collectivism
Need for Control
H5
H1
Preference for product/service/app with high controlability
H4
Perceived Controlability of product/service/app with new technology
User Acceptance of product/ service/app with new technolgy
H2
Magical Prime
H3
Belief in Magic
• Specific Scenario
• Demographics
• Prior Familiarity with Technology
• Perceived Realism of Scenario
• Category Usage
• Acquiescence
• Language Proficiency
• Rival explanations (different by study)
Controls

Method

Empirical Studies

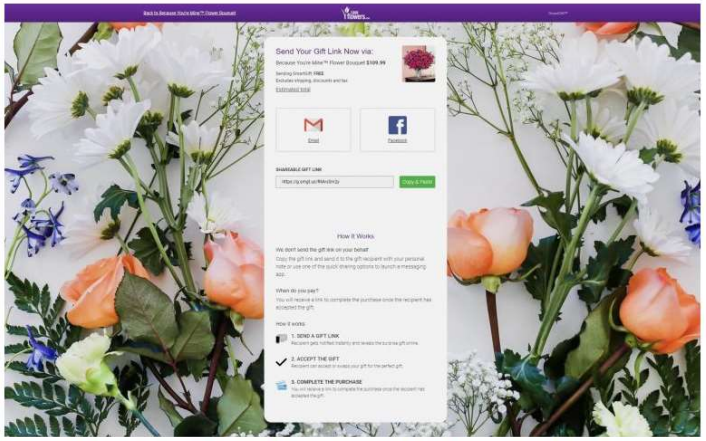
- 5 quantitative experimental studies in US, Canada, and India
- additional smaller pilot and qualitative studies (including Austria)
- multicultural samples within countries or cross-cultural sampling
- >2,500 respondents and >15,000 observations
- Respondents evaluating scenarios with innovative services using AI or Blockchain (as black-box technologies)
- Fully-autonomous vs. semi-autonomous versions
- also comparing to AR or 3D (as open-box technologies)
- Standard scales, extensive quality measures and checks
- Various control measures and test of rival explanations
- Multilevel Modelling with Random Intercepts

AI Scenarios

Customize Your Vitamins with an
AI Vitamins Personalizer

Investing $20,000 with AI Investment Management

Renting a fully-autonomous self-driving car



Letting an AI Flower Advisor put together
a bouquet for your Mom's birthday

Using an AI Social Media Agent to post on your behalf while you are on vacation

Taking a course with an AI Professor

Letting an AI Calendar Assistant make an appointment with your hairdresser

Paying in Fast-Food Restaurants with Facial Recognition

Results

Test of Model, Study 1

n=451 students, 7,216 observations

	Model 1				Model 2			
FIXED EFFECTS	*b*	*S.E.*	*t*	*p*	*b*	*S.E.*	*t*	
Intercept	4.919	.045	109.612	.000 [a]	4.919	.045	109.602	.000 [a]
Product Scenarios [1]								
AI professor	-.513	.071	-7.238	.000 [a]	-.513	.071	-7.246	.000 [a]
AI calendar assistant	-.281	.069	-4.056	.000 [a]	-.281	.069	-4.053	.000 [a]
AI investment	-.322	.069	-4.658	.000 [a]	-.322	.069	-4.653	.000 [a]
AI payment	-.239	.069	-3.442	.001 [a]	-.239	.069	-3.446	.001 [a]
AI car	-.340	.069	-4.922	.000 [a]	-.340	.069	-4.924	.000 [a]
AI social media assistant	-1.553	.069	-22.522	.000 [a]	-1.553	.069	-22.522	.000 [a]
AI flower selector	.209	.070	2.992	.003 [a]	.210	.070	2.998	.003 [a]
AI and Culture								
Lack of Controllability (LoC): AI Autonomy	-.597	.034	-17.368	.000 [a]	-.597	.034	-17.344	.000 [a]
Individualism (IDV) [2]	-.004	.038	-.114	.909	-.004	.038	-.095	.925
Belief in Magic (BiM)	.047	.030	1.553	.121	.062	.035	1.784	.075 [c]
LoC * Individualism	-.069	.027	-2.522	.012 [b]	-.070	.027	-2.535	.011 [b]
LoC * Belief in Magic	.071	.023	3.167	.002 [a]	.063	.026	2.418	.016 [b]
Thought-Action Fusion (TAF)					-.010	.037	-.278	.781
LoC * Thought-Action Fusion					.037	.028	1.360	.174
Spirituality					-.026	.029	-.890	.374
LoC * Spirituality					-.024	.021	-1.169	.242
Controls								
Gender [3]	.038	.043	.890	.374	.037	.043	.860	.390
Age (ln)	-.011	.287	-.037	.970	-.008	.288	-.029	.976
International Student Status	.263	.045	5.869	.000 [a]	.249	.046	5.380	.000 [a]
Category Usage	.051	.011	4.850	.000 [a]	.052	.011	4.880	.000 [a]
Stated Familiarity with AI	.067	.031	2.150	.032 [b]	.066	.031	2.092	.037 [b]
Language Proficiency	.099	.036	2.773	.006 [a]	.106	.036	2.920	.004 [a]
Marker for Common Method Variance	.040	.039	1.018	.309	.048	.040	1.203	.230
Perceived Realism of Scenario	.275	.013	21.972	.000 [a]	.275	.013	21.980	.000 [a]
RANDOM EFFECTS	σ^2	*S.E.*	*Wald*		σ^2	*S.E.*	*Wald*	
Random Intercept	.605	.050	12.005	.000 [a]	.605	.051	11.978	.000 [a]
Residual	1.911	.033	58.119	.000 [a]	1.911	.033	58.110	.000 [a]

[1] Reference Category: AI Vitamine Selector, effect coded; [2] Higher values indicate stronger individualism; [3] 1 = male, -1 = female
[a] $p \leq .01$; [b] $p \leq .05$; [c] $p \leq .10$

Test of Model, Study 1

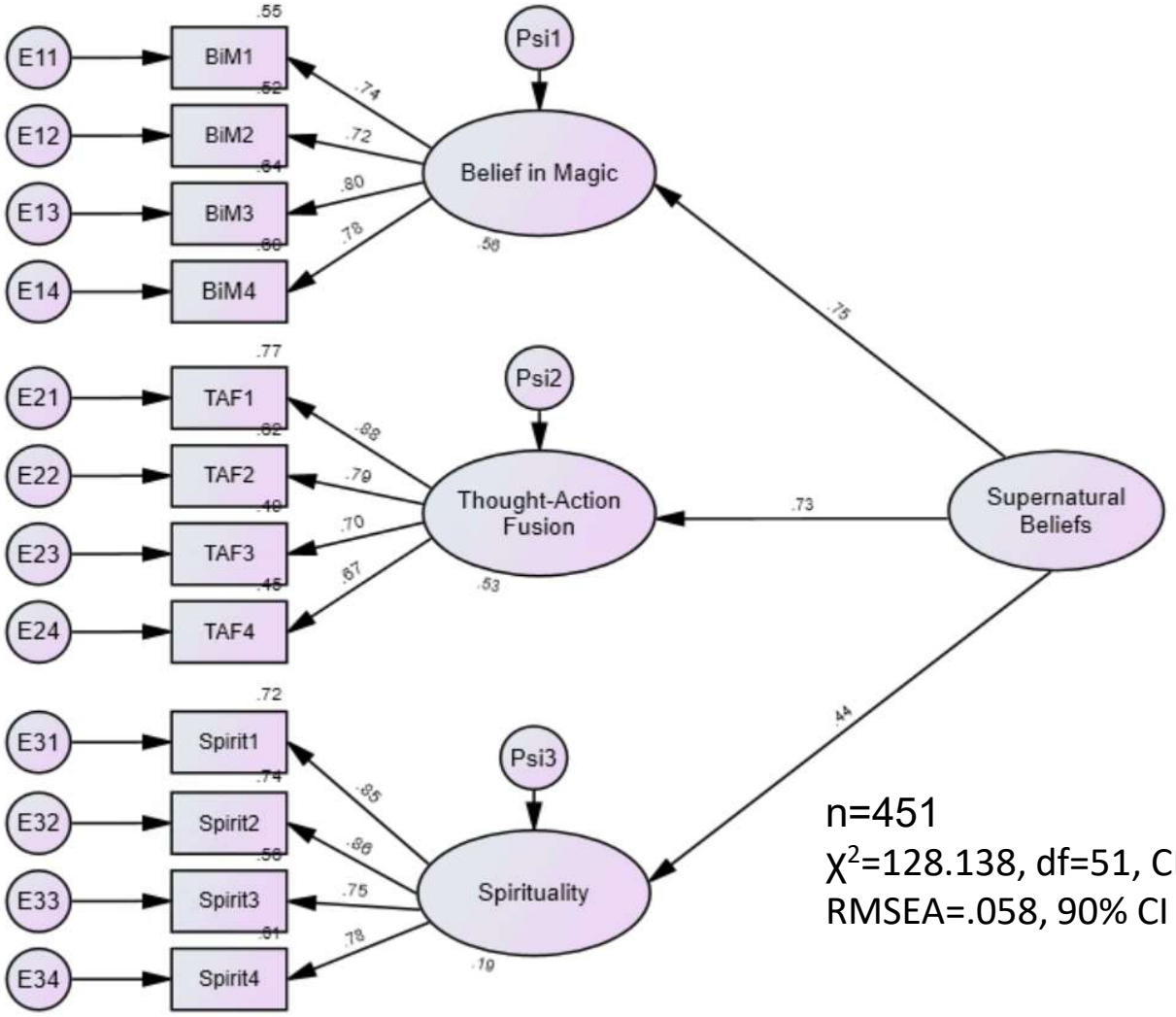
	Model 1				Model 2			
FIXED EFFECTS	*b*	*S.E.*	*t*	*p*	*b*	*S.E.*	*t*	
Intercept	4.919	.045	109.612	.000 [a]	4.919	.045	109.602	.000 [a]
Product Scenarios [1]								
AI professor	-.513	.071	-7.238	.000 [a]	-.513	.071	-7.246	.000 [a]
AI calendar assistant	-.281	.069	-4.056	.000 [a]	-.281	.069	-4.053	.000 [a]
AI investment	-.322	.069	-4.658	.000 [a]	-.322	.069	-4.653	.000 [a]
AI payment	-.239	.069	-3.442	.001 [a]	-.239	.069	-3.446	.001 [a]
AI car	-.340	.069	-4.922	.000 [a]	-.340	.069	-4.924	.000 [a]
AI social media assistant	-1.553	.069	-22.522	.000 [a]	-1.553	.069	-22.522	.000 [a]
AI flower selector	.209	.070	2.992	.003 [a]	.210	.070	2.998	.003 [a]
AI and Culture								
Lack of Controllability (LoC): AI Autonomy	-.597	.034	-17.368	.000 [a]	-.597	.034	-17.344	.000 [a]
Individualism (IDV) [2]	-.004	.038	-.114	.909	-.004	.038	-.095	.925
Belief in Magic (BiM)	.047	.030	1.553	.121	.062	.035	1.784	.075 [c]
LoC * Individualism	-.069	.027	-2.522	.012 [b]	-.070	.027	-2.535	.011 [b]
LoC * Belief in Magic	.071	.023	3.167	.002 [a]	.063	.026	2.418	.016 [b]
Thought-Action Fusion (TAF)					-.010	.037	-.278	.781
LoC * Thought-Action Fusion					.037	.028	1.360	.174
Spirituality					-.026	.029	-.890	.374
LoC * Spirituality					-.024	.021	-1.169	.242
Controls								
Gender [3]	.038	.043	.890	.374	.037	.043	.860	.390
Age (ln)	-.011	.287	-.037	.970	-.008	.288	-.029	.976
International Student Status	.263	.045	5.869	.000 [a]	.249	.046	5.380	.000 [a]
Category Usage	.051	.011	4.850	.000 [a]	.052	.011	4.880	.000 [a]
Stated Familiarity with AI	.067	.031	2.150	.032 [b]	.066	.031	2.092	.037 [b]
Language Proficiency	.099	.036	2.773	.006 [a]	.106	.036	2.920	.004 [a]
Marker for Common Method Variance	.040	.039	1.018	.309	.048	.040	1.203	.230
Perceived Realism of Scenario	.275	.013	21.972	.000 [a]	.275	.013	21.980	.000 [a]
RANDOM EFFECTS	σ^2	*S.E.*	*Wald*		σ^2	*S.E.*	*Wald*	
Random Intercept	.605	.050	12.005	.000 [a]	.605	.051	11.978	.000 [a]
Residual	1.911	.033	58.119	.000 [a]	1.911	.033	58.110	.000 [a]

[1] Reference Category: AI Vitamine Selector, effect coded; [2] Higher values indicate stronger individualism; [3] 1 = male, -1 = female

[a] p≤.01; [b] p ≤ .05, [c] p≤.10

n=451 Studierende,
7.216 Beobachtungen

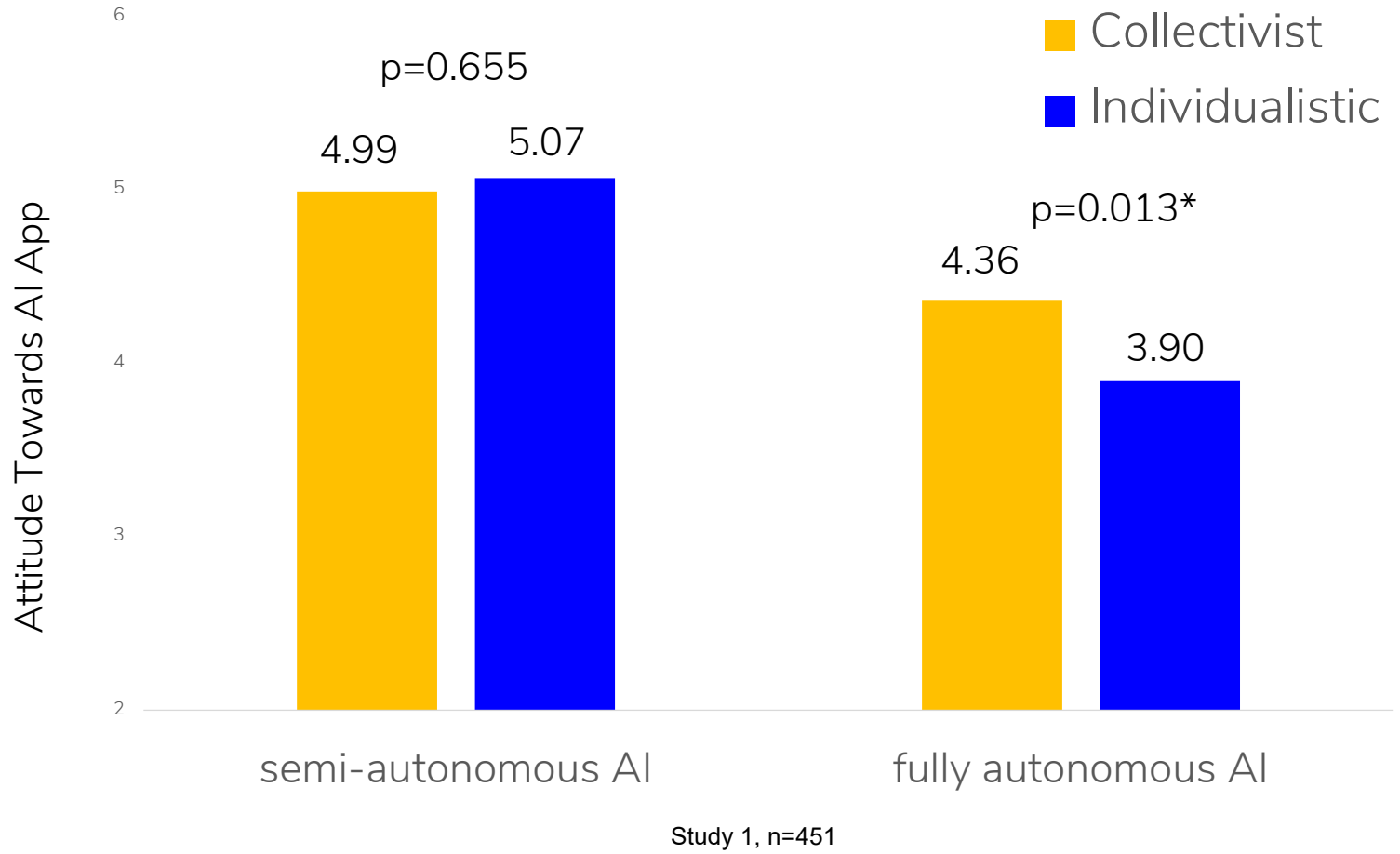
Dimensions of Belief in Supernatural Forces



n=451

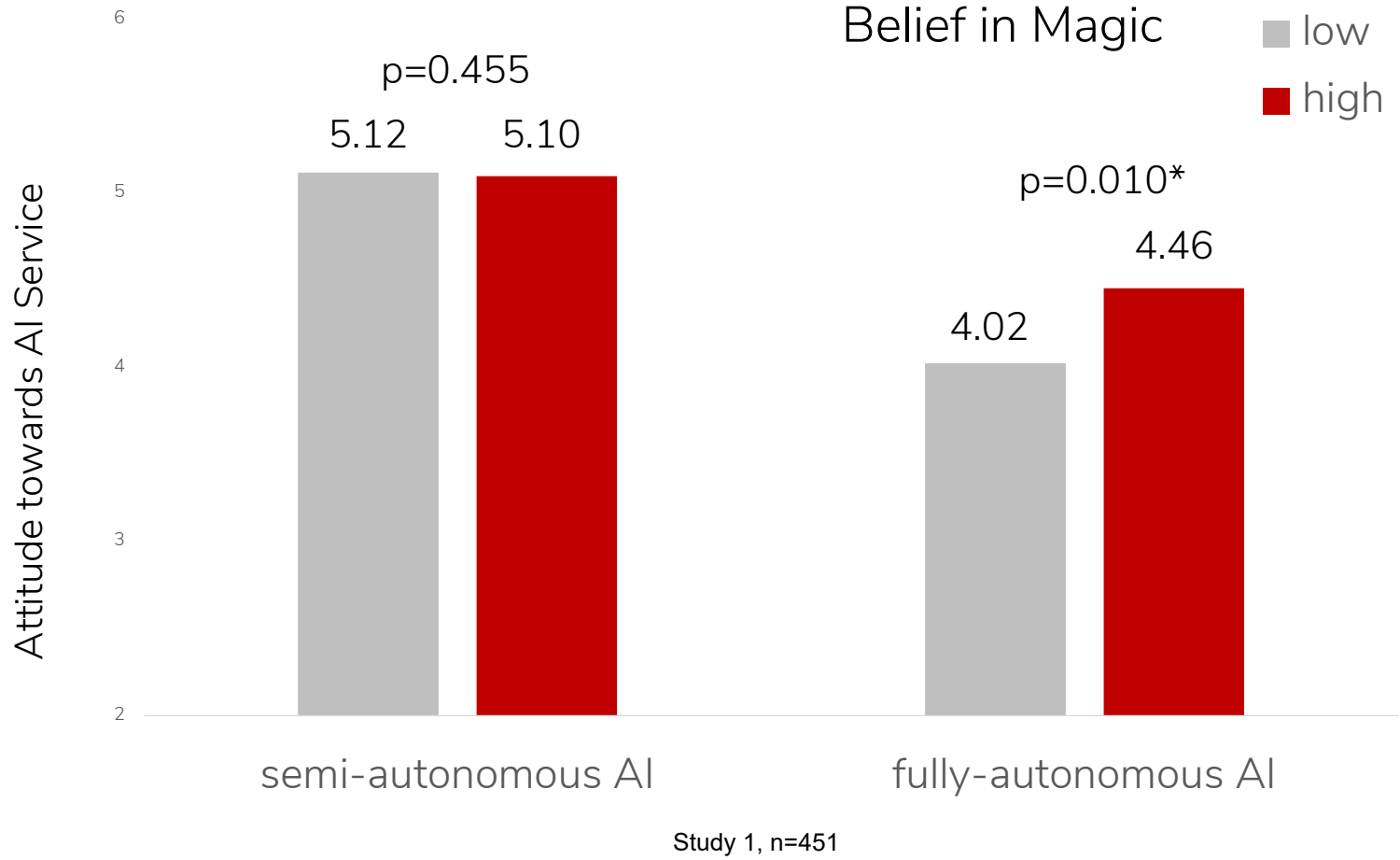
χ^2=128.138, df=51, CFI=.971, TLI=.963,
RMSEA=.058, 90% CI .046<RMSEA<.071

Study 1: High Individualism reduces Acceptance of Fully-Autonomous AI (but not of semi-autonomous AI)



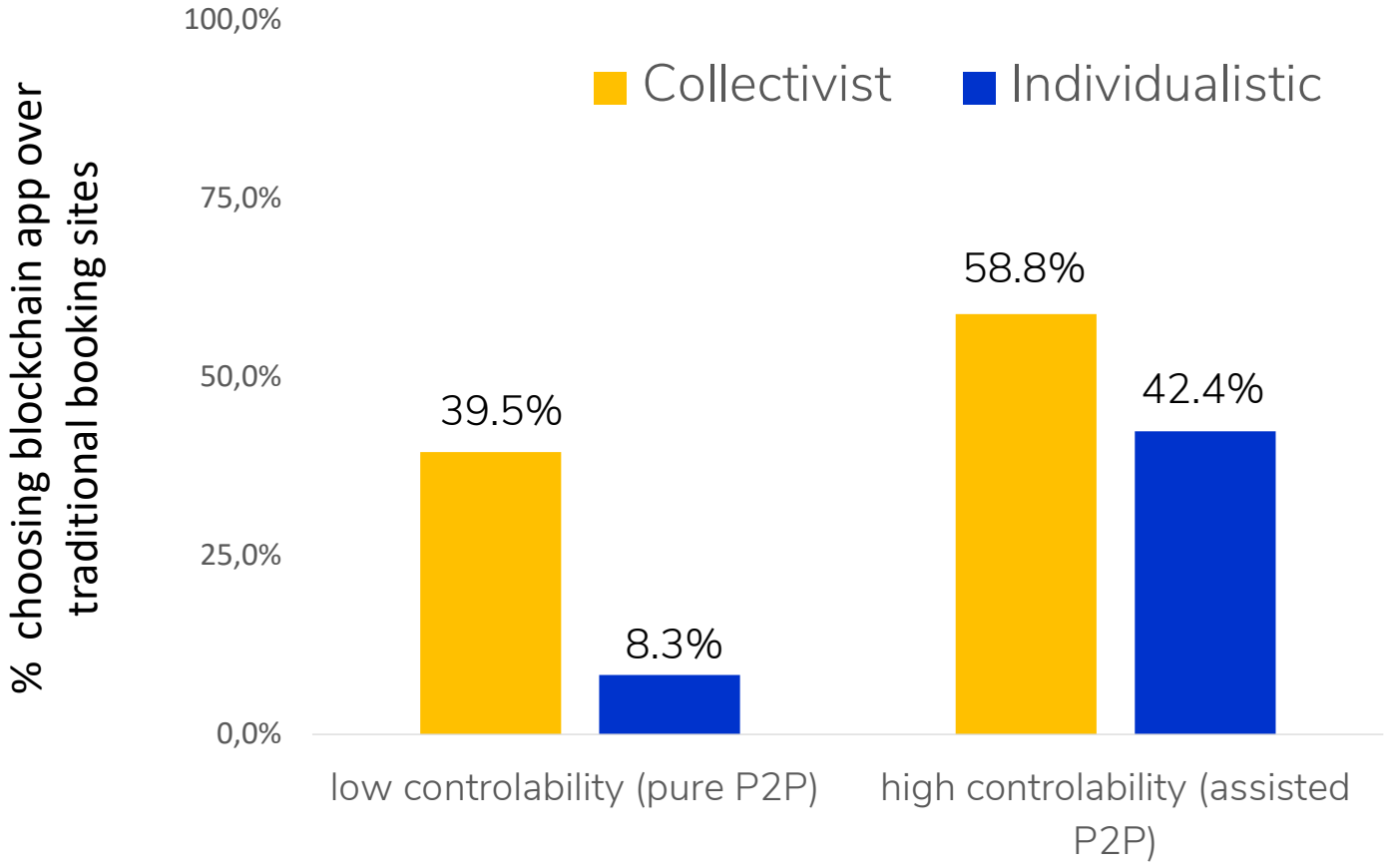
Study 1, n=451

Study 1: Belief in Magic increases Acceptance of Fully Autonomous AI (but not of Semi-Autonomous AI)



Study 1, n=451

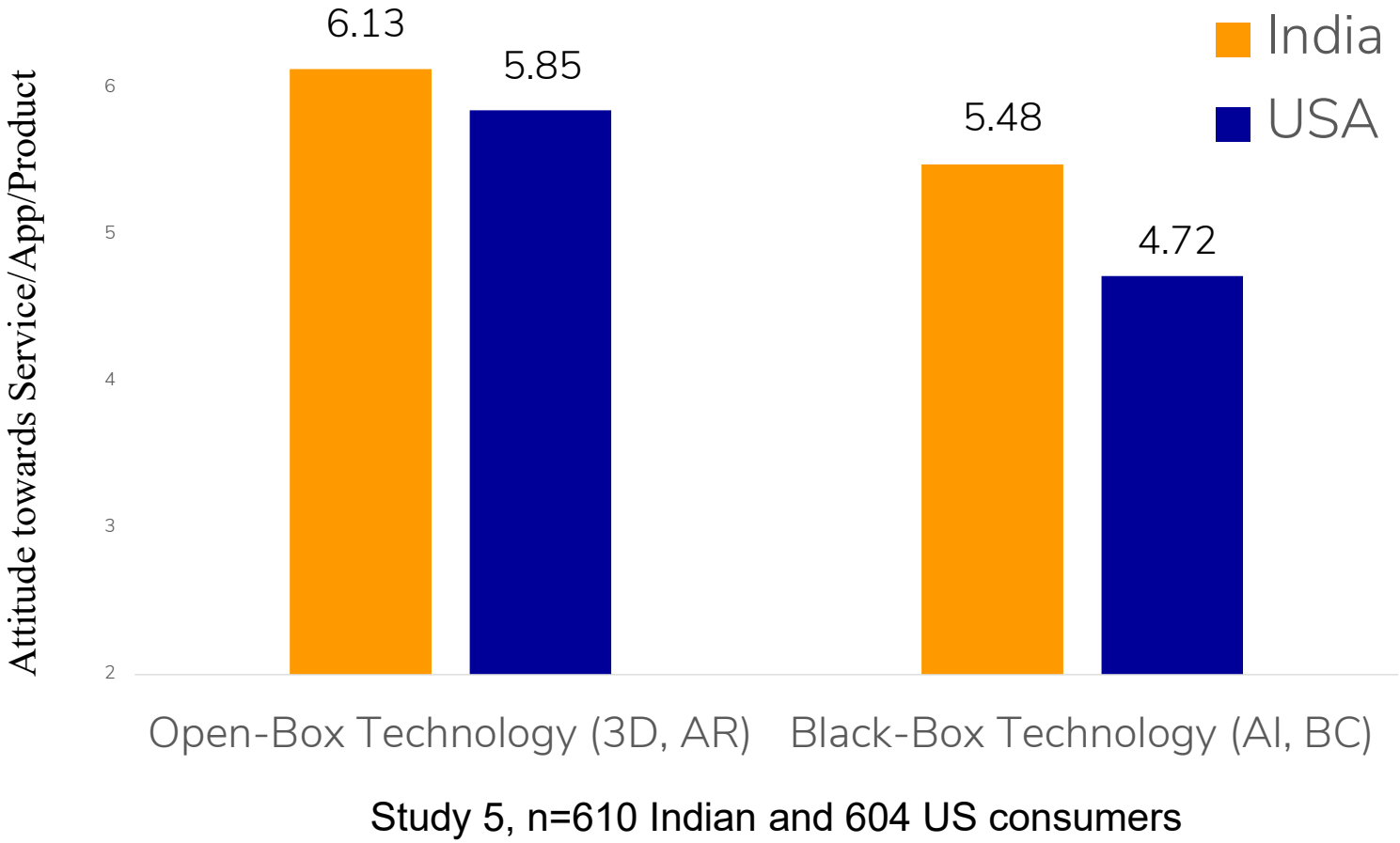
Study 3: Only 8% of individualistic consumers would use pure P2P Blockchain App to book hotel



Study 3, n=492

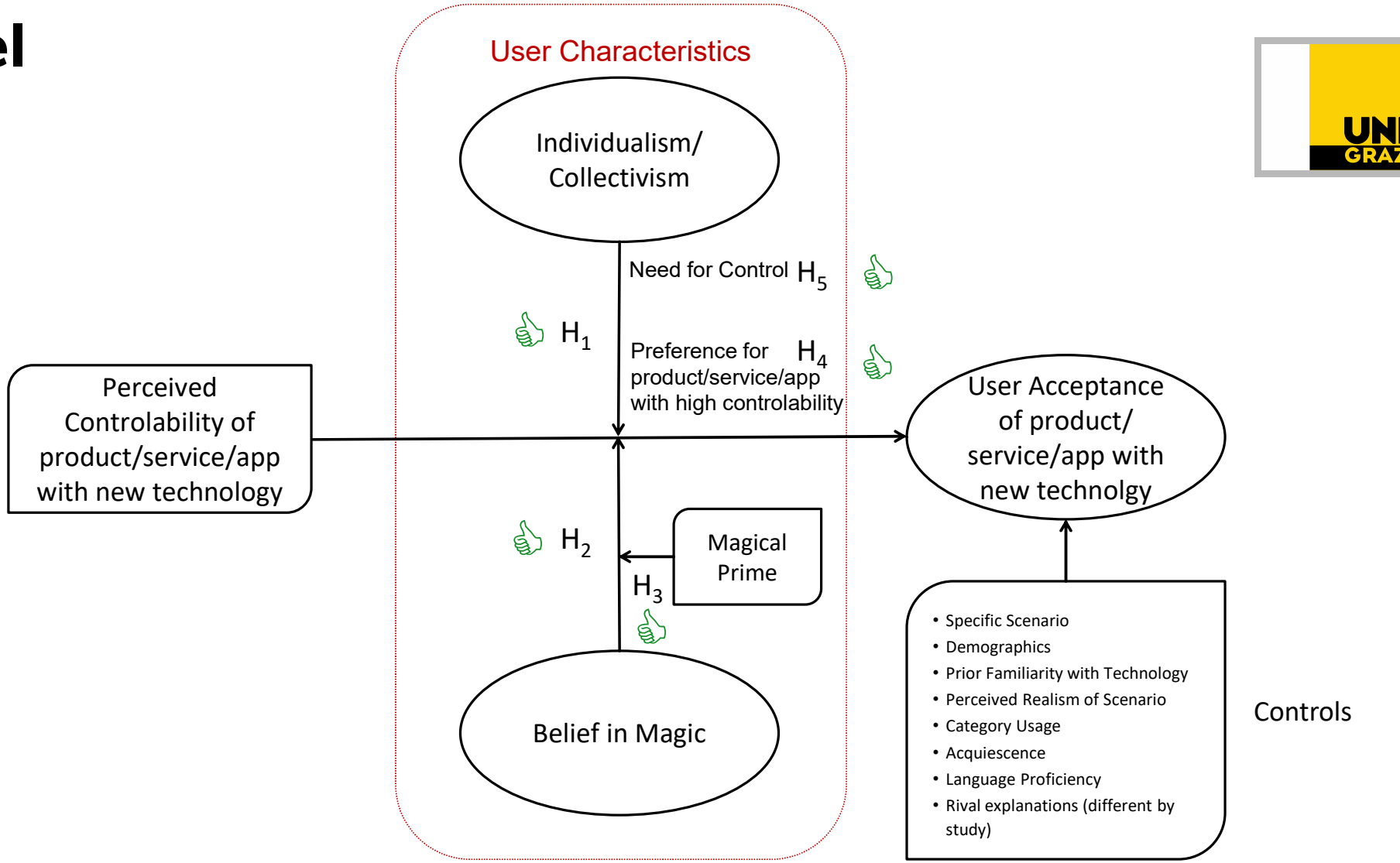
Blockchain App offers:

Study 5: US consumers more skeptical towards Black-Box Technologies than Indian Consumers



Study 5, n=610 Indian and 604 US consumers

Model


User Characteristics
Individualism/ Collectivism
Need for Control
H5
H1
Preference for product/service/app with high controlability
H4
Perceived Controlability of product/service/app with new technology
User Acceptance of product/ service/app with new technolgy
H2
Magical Prime
H3
Belief in Magic
• Specific Scenario
• Demographics
• Prior Familiarity with Technology
• Perceived Realism of Scenario
• Category Usage
• Acquiescence
• Language Proficiency
• Rival explanations (different by study)
Controls

Discussion & Outlook

Conclusions

- Users with more individualistic and rational world views are less likely to buy „the pig in a poke“, i.e. to try out black-box technologies.

- This creates stronger barriers to the adoption of black-box technologies in Western countries (e.g., USA, Canada, Western Europe) than in Non-Western countries (e.g., India, China, Korea).

- Within Western countries:
  - Highly individualistic consumers are particularly hard to win over for black-box technologies.
  - Users holding supernatural beliefs can be interested in black-box technologies with corresponding narratives and analogies.

Practical Implications

- Design products, services, applications using black-box technoolgies with
  - a maximum of transparency and explainability
  - mechanical controls, buttons to abort/stop, codes to approve/override etc.
  - user support and customer/patient/citizen services for information and assistance with user mistakes and technology failures

- Communicate the benefits of new technology with pluralistic narratives, including non-scientific ones which fit the mode of reasoning of your audiences.

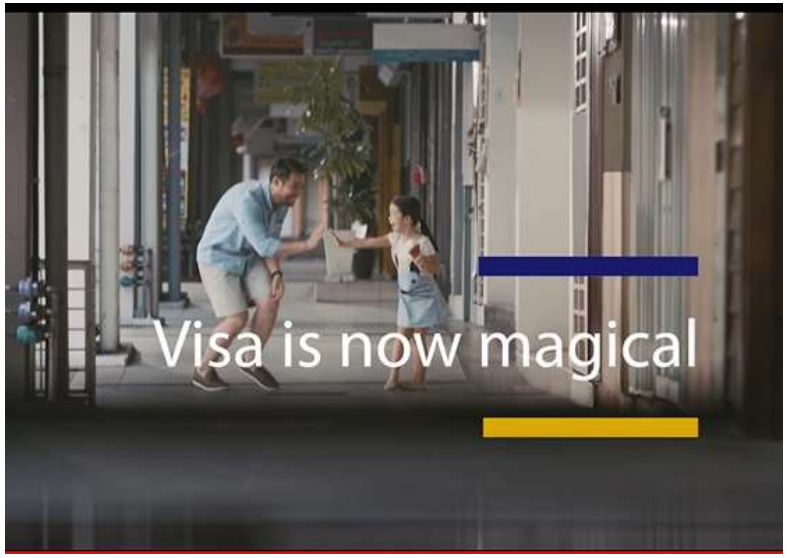
Tentative Dos and Don´ts in Maximizing Societal (and Commercial) Impact of Black-Box Innovations

Dont´s	Dos
Focus on one or two major target audiences	Identify a multitude of potential target audiences, including different user segments, societal stakeholders and niches
Start communicating after technical development is completed	Investigate needs and barriers of target users from get-go to continuously identify and adapt applications
Focus exclusively on a scientific narrative	Use story-telling with a plurality of narratives tailored to the world views of different target users and stakeholders
Top-Down Monologue on your own channels as the technical authority	Dialogue among equals to engage multiple audiences on multiple social platforms and forums
Communicate with your target audiences on your own	Identify trusted partners per community which can help you get the word out to multiple communities
Rely on informal feedback	Continuously measure audience response and social metrics

HONOR

荣耀Magic V

折叠旗舰 展跃万千



Future Research

- Expand research to other technologies (e.g., nano-, biotech)
- Work with prototypes with varying degrees of control for the user
- Test different narratives in various sub-segments of society
- Multilingual cross-cultural Social Media Analytics / Mining.
- Field Experiments with Content Marketing and Social-Media Marketing

Thank you for your attention and comments

Andreas.Strebinger@uni-graz.at


We work for
tomorrow