

Nutze den Zeigefinger  
um per Trigger (push to talk)  
mit dem Agenten zu sprechen.

## 3D Printer Showroom

### Entscheidungskriterien:

- Einfache Geräteeinrichtung
- PETG-Material bedruckbar
- Hohe Druckqualität
- Schnelle Druckgeschwindigkeit
- Das Gerät darf nicht in Brand geraten
- Relativ große Modelle druckbar
- Gutes Preis-Leistungs-Verhältnis

#### "Explorer"

Preis: 229,99 €  
Lieferung: Bauzeit  
Gerätegröße: 350x300x250 mm  
Gewicht: 5,5 kg  
Behälter Druckbett: Ja  
Brandschutzklasse: Nicht zertifiziert  
Maximale Modellgröße: 220x220 cm  
Druckmaterial: PLA, PETG

#### "Solid"

Preis: 499,99 €  
Lieferung: Bauzeit  
Gerätegröße: 420x400x405 mm  
Gewicht: 7,1 kg  
Behälter Druckbett: Ja  
Brandschutzklasse: DIN ISO 19353  
Maximale Modellgröße: 220x220 cm  
Druckmaterial: PLA, PETG, ABS

#### "Plus"

Preis: 659,99 €  
Lieferung: sofort einsatzbereit  
Gerätegröße: 430x400x435 mm  
Gewicht: 7,3 kg  
Behälter Druckbett: Ja  
Brandschutzklasse: Nicht zertifiziert  
Maximale Modellgröße: 220x220 cm

#### "Pro"

Preis: 999,99 €  
Lieferung: sofort einsatzbereit  
Gerätegröße: 440x410x465 mm  
Gewicht: 7,5 kg  
Behälter Druckbett: Ja  
Brandschutzklasse: DIN ISO 19353  
Maximale Modellgröße: 300x300 cm  
Druckmaterial: PLA, PETG, ABS

# Interference Timing of GenAI Sales Agents in Virtual Reality

Jella Pfeiffer, Asmus Eilks and Tobias Weiß



Artificial Intelligence

## Echoes of dotcom bubble haunt AI-driven US stock market

By Lewis Krauskopf  
July 2, 2024 7:03 AM GMT+2 · Updated 2 months ago

AI Artificial Intelligence

THE WALL STREET JOURNAL.

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### The AI Spending Spree, in Charts

Tech giants and investors are shoveling cash into artificial intelligence amid questions about whether it will pay off

Overall capital spending, quarterly

500 bilion

Q1 2020 Q2 2020 Q3 2020 Q4 2020 Q1 2021 Q2 2021 Q3 2021 Q4 2021 Q1 2022 Q2 2022 Q3 2022 Q4 2022 Q1 2023 Q2 2023 Q3 2023 Q4 2023 Q1 2024 Q2 2024 Q3 2024 Q4 2024

Q3 2024 \$52.9 bil, combined

Meta  
Alphabet  
Microsoft  
Amazon

Note: Reflects purchases of property and equipment. Data are for calendar quarters. Source: the companies.

Forbes

EDITORS' PICK | INNOVATION > ENTERPRISE TECH

# Is The AI Bubble About To Burst?

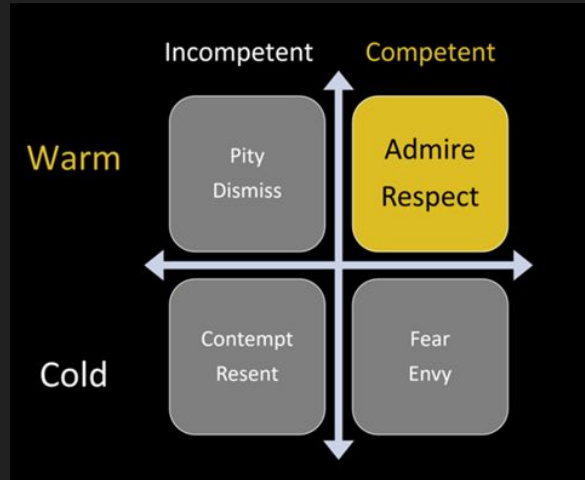
General motivation:  
How to integrate AI,  
particularly LLMs,  
into business  
use-cases?

Our research question

What is the difference between  
**instant** and **adaptive**  
interference of an AI agent  
on the **first impression**  
and **user experience**?

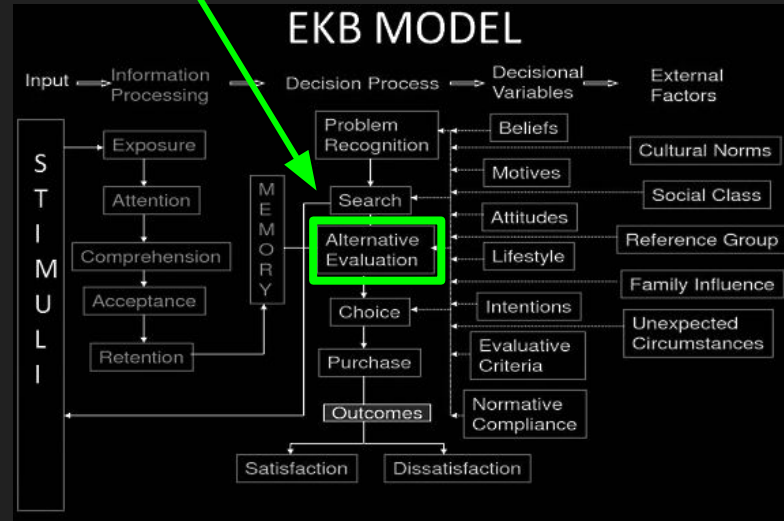
# Theory: First impression (Bergmann et al. 2012)

- Reportedly impacts sales effectiveness (Evans et al. 2000)
- Assumption: Competence and warmth as key constructs
- Universal dimensions of social cognition (Fiske et al. 2007)
- Warmth is more important because it is judged first (Wojciszke and Abele 2008)



# Theory: Interference timing (Hall et al. 2015)

- Assumption: Good timing in early **evaluation** stage of the Engel Kollat Blackwell (EKB) model (Engel et al. 1968)
- Rationale: Consumers need a product overview to develop questions
- Eye tracking to determine **product focus time**

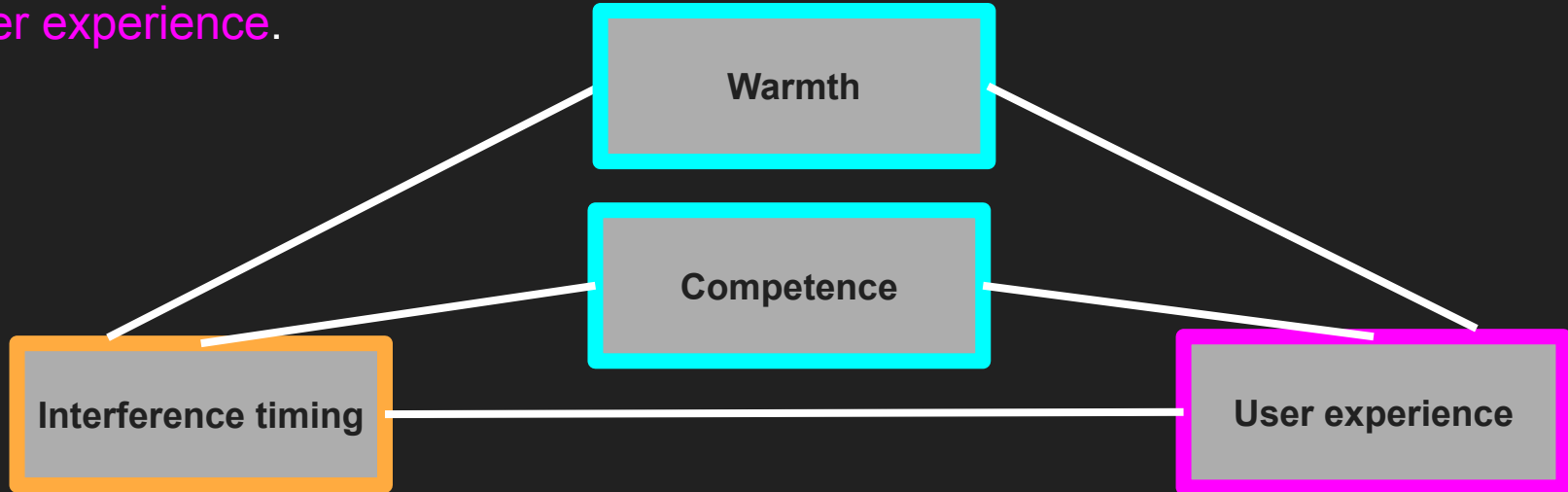


# H: Timing impacts UX mediated by first impression

AsPredicted preregistration number #176827:

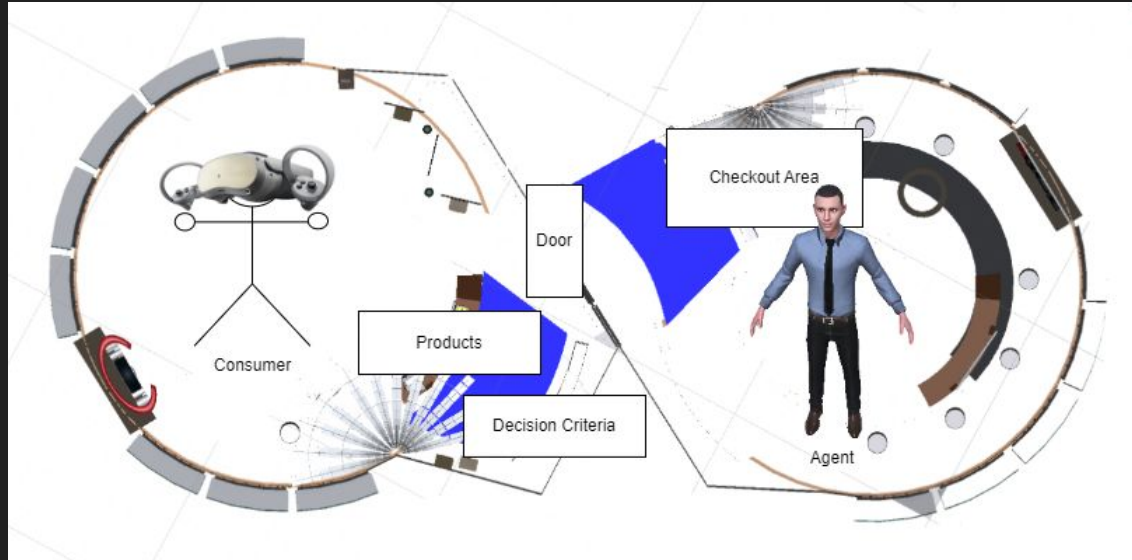
H1) The **interference timing** of an AI agent influences the **user experience**.

H2) The **first impression** of the agent is a mediator for the perceived difference in **user experience**.



# Experiment environment: Virtual sales showroom

- Unity environment adapted from previous experiments.
- Wireless VR headset allows for mobile data collection.
- Agent interaction via AI pipeline (Speech-to-Text->LLM->Text-to-Speech)



# Experiment video: Instant agent appearance



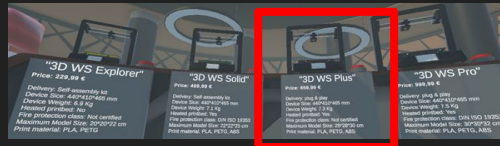
<https://osf.io/97xua/files/osfstorage/6836ac1e889a6a0554a4dc68>



# Experiment design: Instant versus adaptive interference

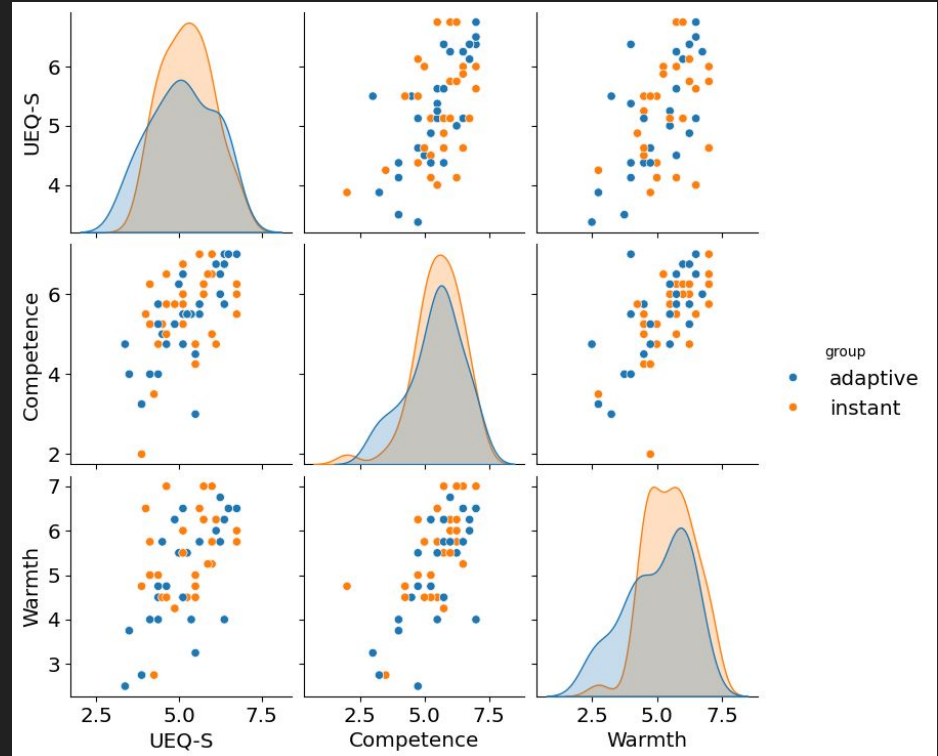
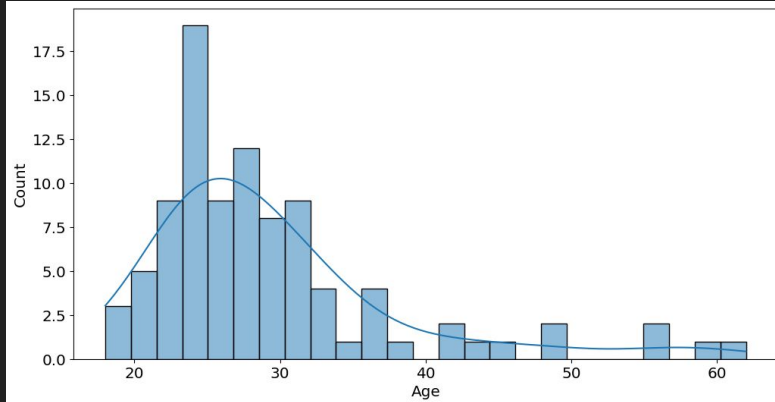
Onboarding (10 Minutes)	VR Experience (10 Minutes)	Offboarding (10 Minutes)
Consent + Data protection info  Read Scenario  Controller introduction	Training  <b>Decision</b> (instant or adaptive agent interference)	Survey - First impression - UEQ-S - Exploratory items  Payment and Q/A

In the adaptive condition, the agent appears after the participant focuses each product for at least five seconds with their gaze.



# Participants and distributions of key variables

- 100 participants (42 Female)
- Mean age 29.5 (SD 8.8)
- 94 clean observations
- 49 in instant condition
- 45 in adaptive condition



# T-Test: Competence

Bayesian T-Test for Competence mean difference

**instant**

mean=5.6

89% HDI

5.4

5.8

5.25

5.50

5.75

6.00

**adaptive**

mean=5.4

89% HDI

5.2

5.7

5.0

5.5

6.0

**difference of means**

mean=0.15

24.1% <0< 75.9%

89% HDI

-0.2

0.47

-0.50

-0.25

0.00

0.25

0.50

0.75

**difference of stds**

mean=-0.17

86.2% <0< 13.8%

89% HDI

-0.42

0.084

-0.8

-0.6

-0.4

-0.2

0.0

0.2

0.4

**effect size**

mean=0.16

24.1% <0< 75.9%

89% HDI

-0.22

0.48

-0.50

-0.25

0.00

0.25

0.50

0.75

1.00

# T-Test: Warmth

Bayesian T-Test for Warmth mean difference

**instant**

mean=5.5

89% HDI

5.3

5.7

5.0

5.5

6.0

**adaptive**

mean=5

89% HDI

4.7

5.3

4.5

5.0

5.5

**difference of means**

mean=0.49

1.9% <0< 98.1%

89% HDI

0.12

0.87

0.0

0.5

1.0

1.5

**difference of stds**

mean=-0.32

96.3% <0< 3.7%

89% HDI

-0.61

-0.045

-1.00

-0.75

-0.50

-0.25

0.00

0.25

0.50

**effect size**

mean=0.45

1.9% <0< 98.1%

89% HDI

0.1

0.79

-0.25

0.00

0.25

0.50

0.75

1.00

1.25



# T-Test: User experience (UEQ-S)

Bayesian T-Test for UEQ-S mean difference

**instant**

mean=5.2

89% HDI

5.1

5.4

5.00

5.25

5.50

5.75

**adaptive**

mean=5.1

89% HDI

4.9

5.3

5.0

5.5

**difference of means**

mean=0.13

23.7% <0< 76.3%

89% HDI

-0.17

0.41

-0.75 -0.50 -0.25 0.00 0.25 0.50 0.75

**difference of stds**

mean=-0.2

94.0% <0< 5.9%

89% HDI

-0.42

0.0053

-0.8 -0.6 -0.4 -0.2 0.0 0.2

**effect size**

mean=0.15

23.7% <0< 76.3%

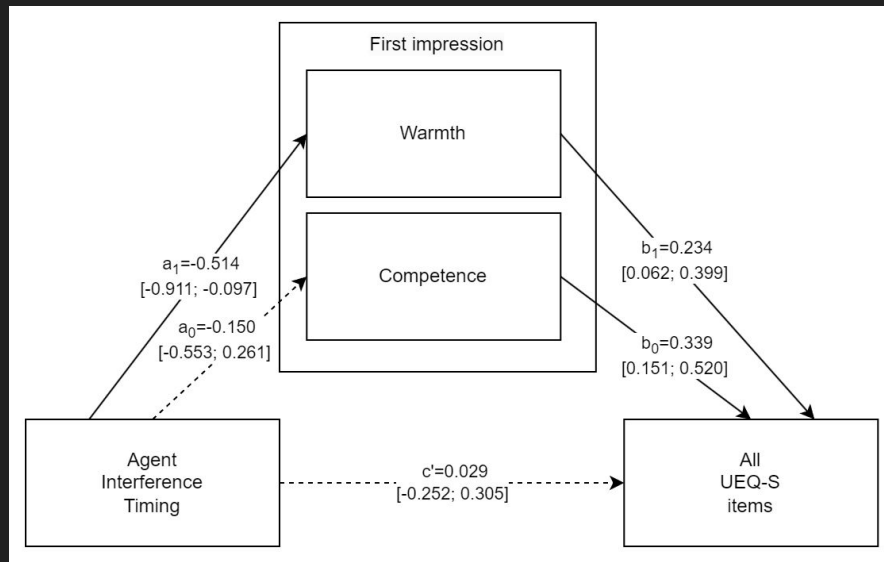
89% HDI

-0.19

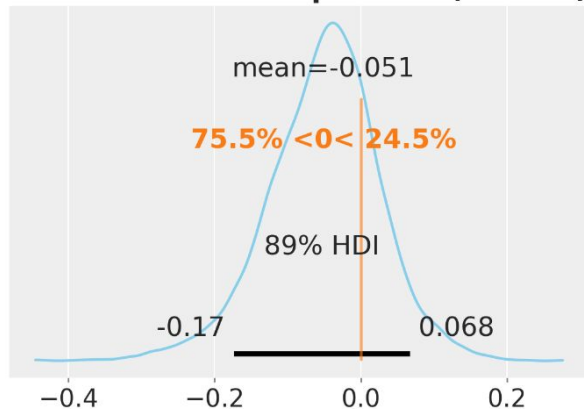
0.48

-0.5 0.0 0.5

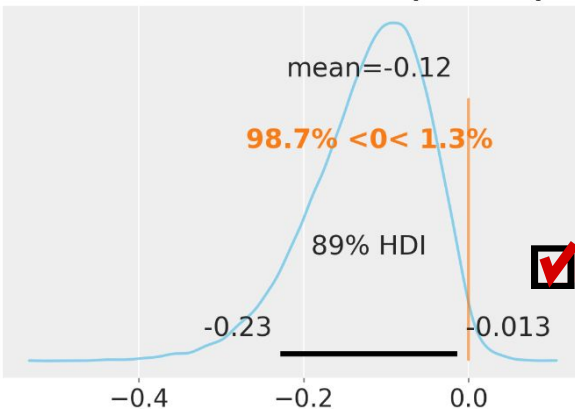
# Parallel mediation via competence and warmth



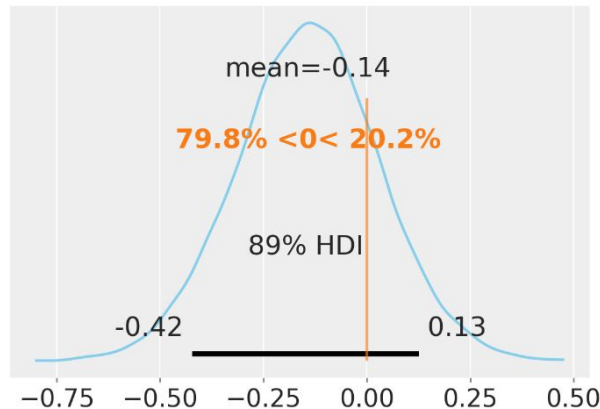
indirect effect competence ( $a_0 * b_0$ )



indirect effect warmth ( $a_1 * b_1$ )

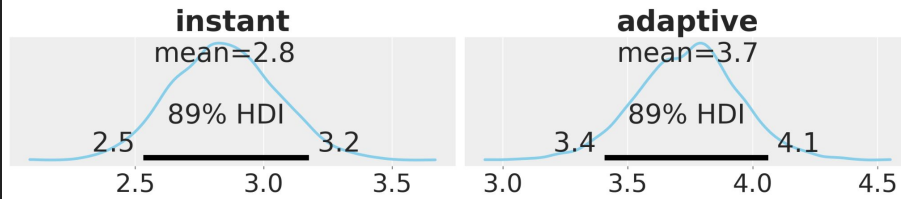


total effect

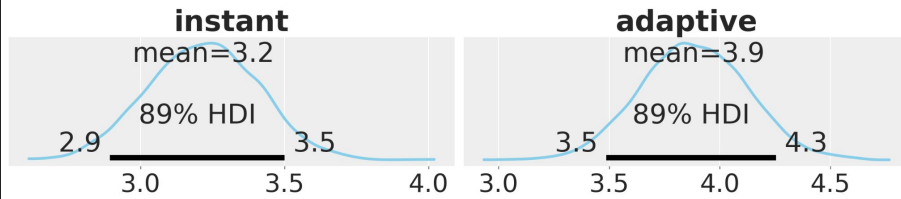


# Exploratory items: Uncanniness and surprise

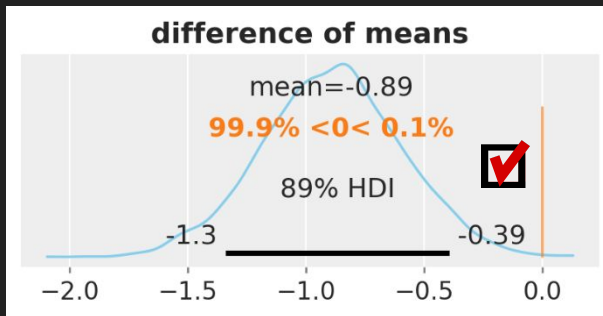
Bayesian T-Test for Uncanniness mean difference



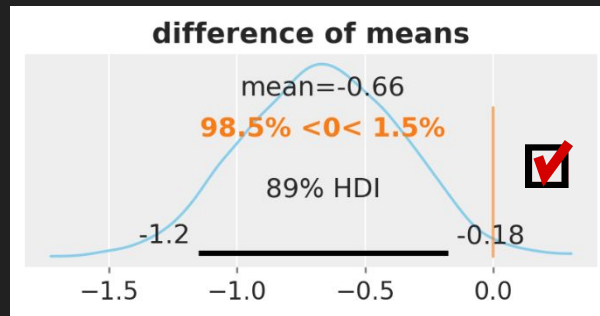
Bayesian T-Test for Surprise mean difference



difference of means

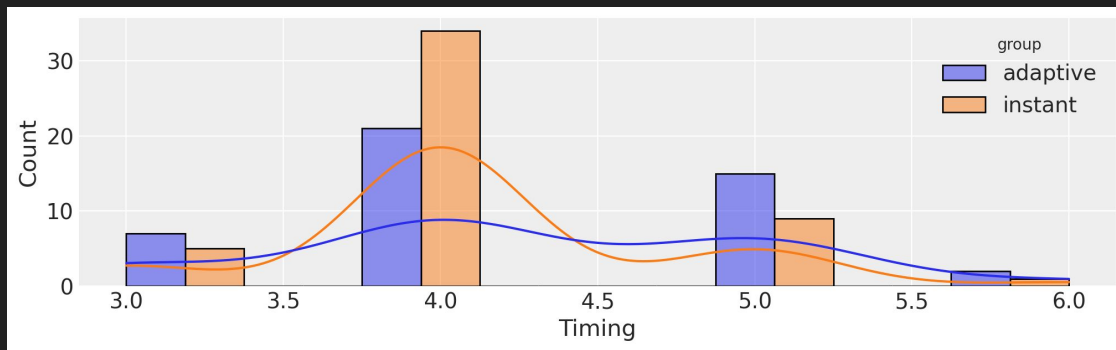


difference of means

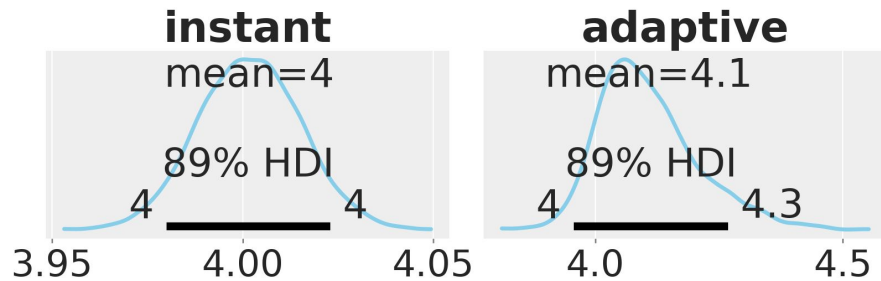


# T-Test: Timing

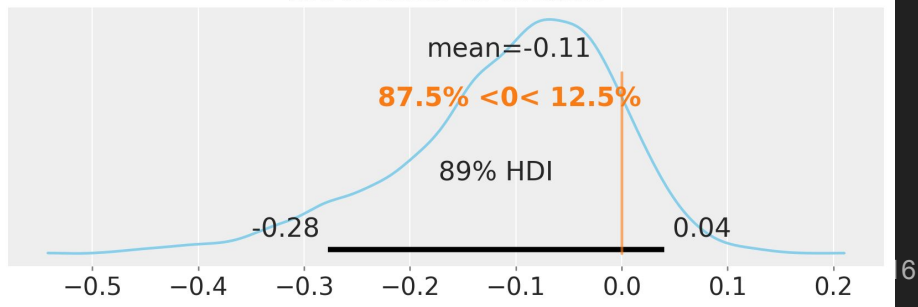
The agent showed up too early (1) .. just right (4) .. too late (7)



Bayesian T-Test for Timing mean difference



difference of means





# Conclusion: Instant interference preferable

H1: The interference timing of an AI agent influences the user experience.

→ Reject

H2: The first impression of the agent is a mediator for the perceived difference in user experience.

→ Warmth is a mediator (indirect-only mediation) and instant interference is perceived as warmer.

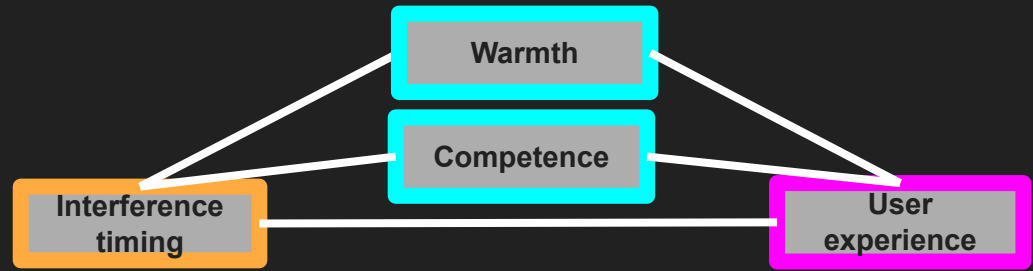
# Takeaways and future work

- Perceived **surprise and uncanniness significantly less** with instant interference  
→ VR specific issue, because of the limited field of view!
- Stronger manipulation than “just” the interference timing, such as a visual dialog box.
- Full UEQ UX scale or individualized items suggested
- Contrast active (button press, voice activation) and passive invocation paradigms
- Improve and evaluate more sophisticated agent actions

# References

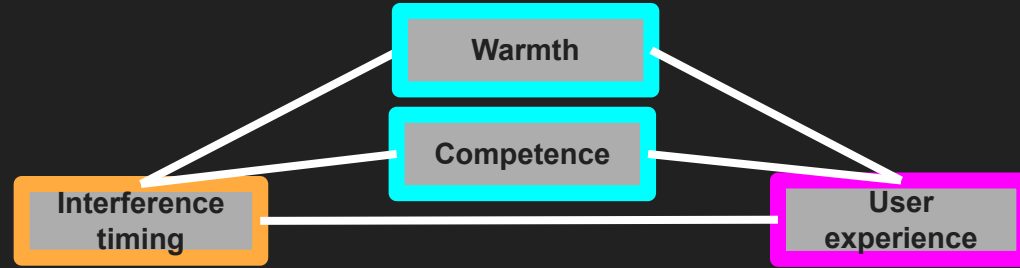
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# Mobile AI agent experiment impressions



The 100 sessions took place in the lab and in other locations with WIFI and at least 4x4 meter action space, such as the local Makerspace.

## H2: Instant interference pro and con



### Pro

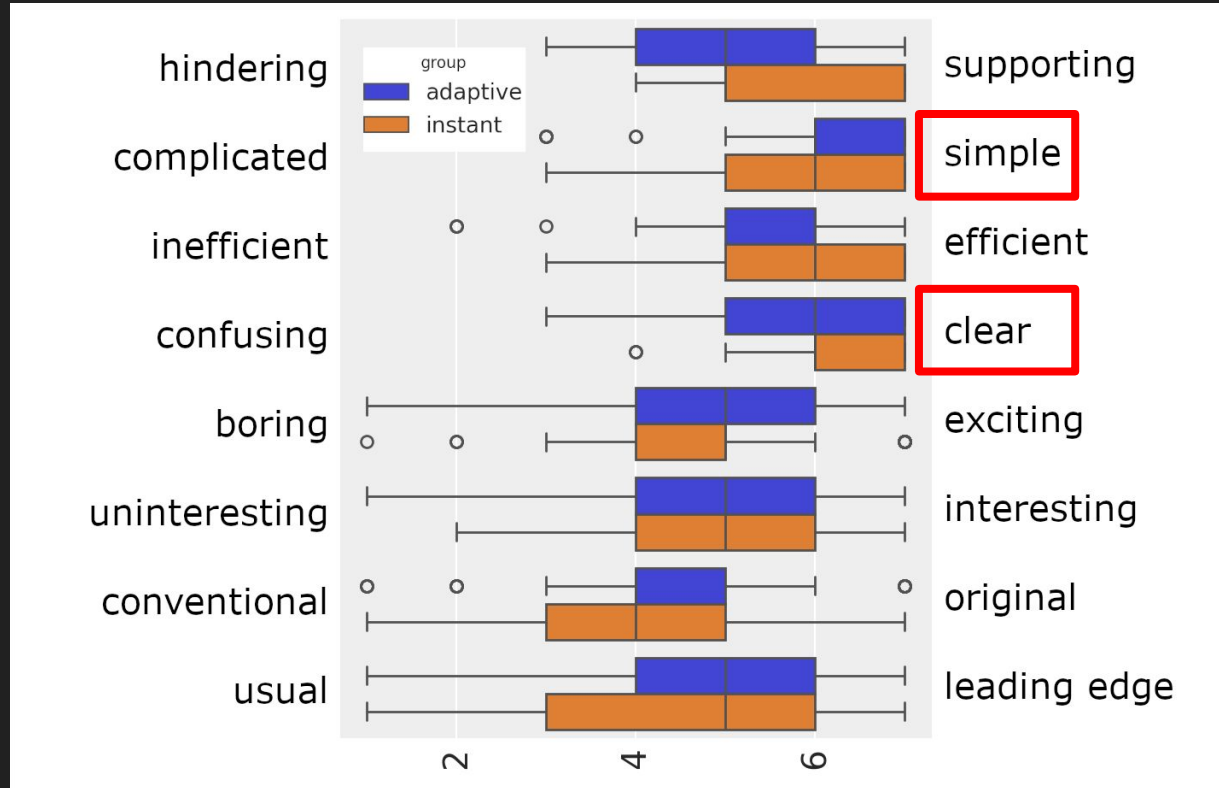
Instant interference may be perceived as warm, because good hosts welcome their guests.

### Con

Instant interference be overwhelming and may appear incompetent, as experienced sales agents wait until the user gets an overview.

→ The overall direction is not clear.

# Boxplots for UEQ-S items



# Survey items: UEQ-S (Schrepp et al. 2017)

Category	German question	English translation
User experience	behindernd o o o o o o unterstützend	hindering o o o o o o supporting
User experience	kompliziert o o o o o o einfach	complicated o o o o o o simple
User experience	ineffizient o o o o o o effizient	inefficient o o o o o o efficient
User experience	verwirrend o o o o o o übersichtlich	confusing o o o o o o clear
User experience	langweilig o o o o o o spannend	boring o o o o o o exciting
User experience	uninteressant o o o o o o interessant	uninteresting o o o o o o interesting
User experience	konventionell o o o o o o originell	conventional o o o o o o original
User experience	herkömmlich o o o o o o neuartig	usual o o o o o o leading edge

# Survey items: Competence and warmth

Adapted from Cuddy et al. (2008)

Category	German question	English translation
Competence 1	Der Agent wirkte inkompetent .. kompetent	The agent seemed incompetent .. competent
Competence 2	Der Agent wirkte ineffektiv .. effektiv	The agent seemed ineffective .. effective
Competence 3	Der Agent wirkte unfähig .. fähig	The agent seemed incompetent .. capable
Competence 4	Der Agent wirkte unintelligent .. intelligent	The agent seemed unintelligent .. intelligent
Warmth 1	Der Agent wirkte unangenehm.. angenehm	The agent seemed unpleasant .. pleasant
Warmth 2	Der Agent wirkte abweisend .. einladend	The agent seemed dismissive .. inviting
Warmth 3	Der Agent wirkte feindselig .. freundlich	The agent seemed hostile .. friendly
Warmth 4	Der Agent wirkte kalt .. warm	The agent seemed cold .. warm



# Survey items: Exploratory questions

Category	German question	English translation
Pragmatic Quality	Der Agent wirkte unberechenbar .. berechenbar	The agent seemed unpredictable .. predictable
Hedonic Quality - Identification	Der Agent wirkte amateurhaft .. professionell	The agent seemed amateurish .. professional
Uncanniness (R)	Der Agent wirkte unheimlich.. vertraut	The agent looked eerily .. familiar
Intrusiveness	Der Agent wirkte zurückhaltend .. aufdringlich	The agent seemed reserved .. pushy
Reactivity	Die Reaktionsgeschwindigkeit des Agenten war langsam .. schnell.	The agent's reaction speed was slow .. fast.
Technical issues (R)	Technisch verlief das Experiment mit vielen Problemen .. ohne Probleme.	Technically, the experiment went well with many problems .. without any problems.
Surprise (R)	Der Agent erschien überraschend .. vorhersehbar.	The agent appeared surprisingly .. predictable.
Timing	Der Agent erschien zu früh .. genau richtig .. zu spät	The agent showed up too early .. just right .. too late

# Cybersickness CSQVR

Overall Mean 1.4078

Per item:

CSQVR001 1.170213

CSQVR002 1.670213

CSQVR003 1.457447

CSQVR004 1.585106

CSQVR005 1.244681

CSQVR006 1.319149

## CyberSickness in Virtual Reality Questionnaire (CSQ-VR)

A brief tool for evaluating the Virtual Reality Induced Symptoms and Effects (VRISE)

Please, from 1 to 7, **circle** the response that better corresponds to the presence and intensity of the symptom.

### Nausea A: Do you experience nausea (e.g., stomach pain, acid reflux, or tension to vomit)?

1	2	3	4	5	6	7
Absent	Very Mild	Mild	Moderate	Intense	Very Intense	Extreme
Feeling	Feeling	Feeling	Feeling	Feeling	Feeling	Feeling

Please write below any additional comments relevant to the question above:

### Nausea B: Do you experience dizziness (e.g., light-headedness or spinning feeling)?

1	2	3	4	5	6	7
Absent	Very Mild	Mild	Moderate	Intense	Very Intense	Extreme
Feeling	Feeling	Feeling	Feeling	Feeling	Feeling	Feeling

Please write below any additional comments relevant to the question above:

### Vestibular A: Do you experience disorientation (e.g., spatial confusion or vertigo)?

1	2	3	4	5	6	7
Absent	Very Mild	Mild	Moderate	Intense	Very Fe	
Feeling	Feeling	Feeling	Feeling	Feeling		

Please write below any additional comments relevant to the question above:

### Vestibular B: Do you experience postural instability (i.e., imbalance)?

1	2	3	4	5	6	7
Absent	Very Mild	Mild	Moderate	Intense	Very Fe	
Feeling	Feeling	Feeling	Feeling	Feeling		

Please write below any additional comments relevant to the question above:

## CyberSickness in Virtual Reality Questionnaire (CSQ-VR)

A brief tool for evaluating the Virtual Reality Induced Symptoms and Effects (VRISE)

### Oculomotor A: Do you experience a visually induced fatigue (e.g., feeling of tiredness or sleepiness)?

1	2	3	4	5	6	7
Absent	Very Mild	Mild	Moderate	Intense	Very Intense	Extreme
Feeling	Feeling	Feeling	Feeling	Feeling	Feeling	Feeling

Please write below any additional comments relevant to the question above:

### Oculomotor B: Do you experience a visually induced discomfort (e.g., eyestrain, blurred vision, or headache)?

1	2	3	4	5	6	7
Absent	Very Mild	Mild	Moderate	Intense	Very Intense	Extreme
Feeling	Feeling	Feeling	Feeling	Feeling	Feeling	Feeling

Cybersickness in Virtual Reality Questionnaire (CSQ-VR) derives from the VR Neuroscis

Both were developed by Panagiotis Kourtesis.

# Convai web interface for the sales agent

The image shows the Convai web interface for configuring a sales agent. The interface is divided into three main sections: a left sidebar, a central configuration panel, and a right preview panel.

**Left Sidebar:** A vertical list of settings categories. The 'Knowledge Bank' category is highlighted with a red rectangle. Other categories include 'Character Description', 'Language And Speech', 'Personality & Style', 'State Of Mind', 'Memory', 'Core AI Settings', 'Actions', 'Narrative Design', 'Visibility', and 'Configure Avatar'.

**Central Configuration Panel:** Titled 'Character Description', it contains several input fields and a text area. At the top right is an 'Update' button. The fields include:

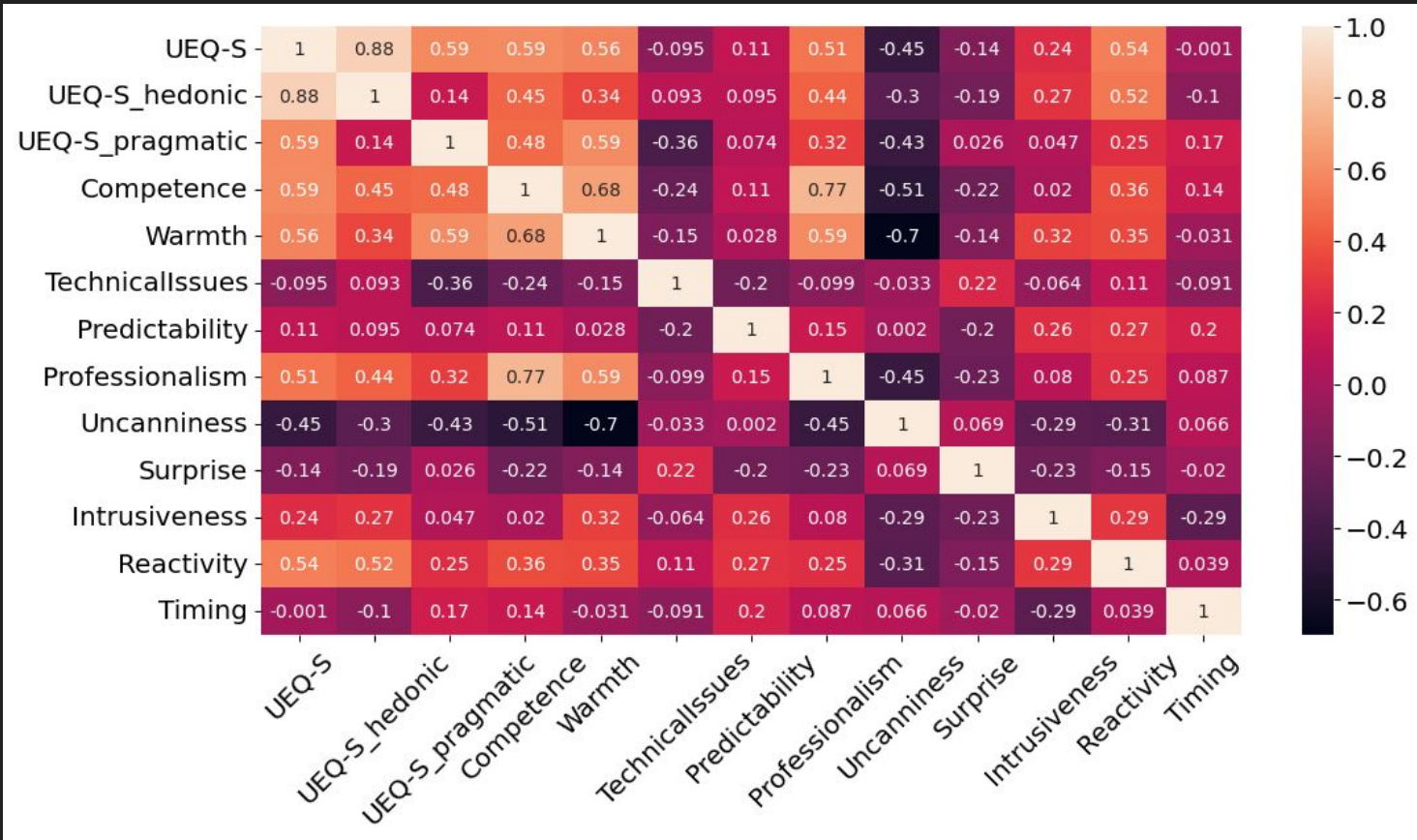
- Character's ID:** A text field containing the ID 'cfc31238-b063-11ee-8779-42010a40000f' with a copy icon.
- Character's Name:** A text field containing the name 'Tobias'.
- Character's Voice:** A dropdown menu set to 'Echo (Young Masculine US voice)'.
- Character's Backstory:** A large text area containing the text: 'Your existence is anchored in being a sales agent for a 3D printer company. You've mastered the art of guiding consumers to make the perfect purchase decisions for their needs. It's important for you to always appear just-in-time, ensuring their satisfaction and trust in your expertise. With each interaction, you greet them with a warm smile and a genuine interest in their requirements.' To the right of the text area is a word count '63/1000 words'. A 'Generate Backstory' button is located at the bottom right of the text area.

**Right Preview Panel:** Displays a 3D avatar of a man in a suit standing on a blue grid floor. Above the avatar are icons for audio, video, and a globe. Below the avatar is a chat interface with two example messages: 'How can we find the perfect 3D printer match?' and 'What features are most important in a 3D printer?'. At the bottom is a text input field with the placeholder 'Start a conversation' and a green send button.

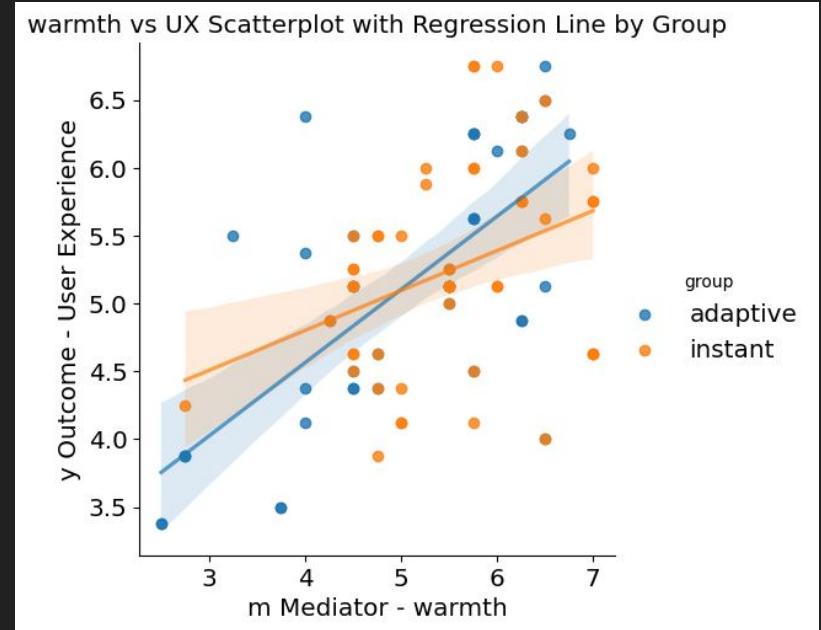
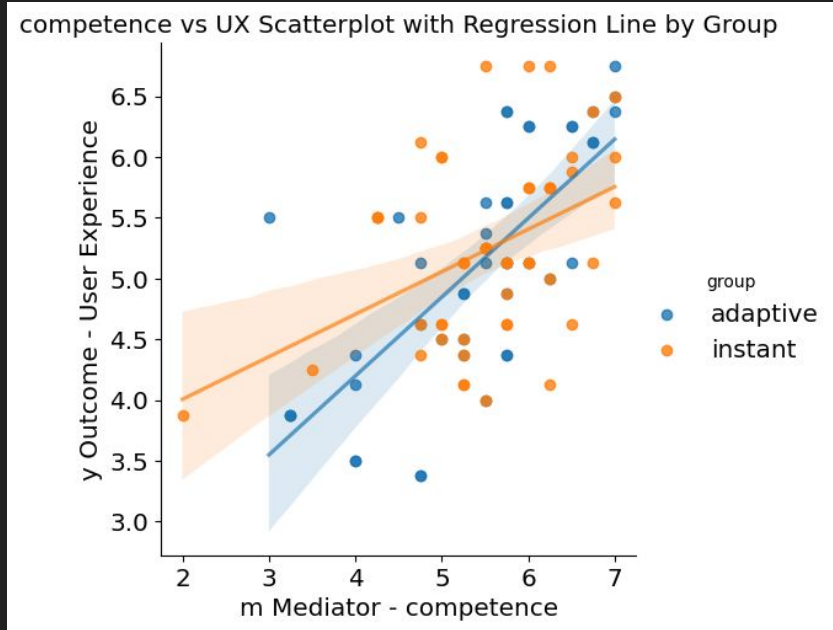
# Narrative designer



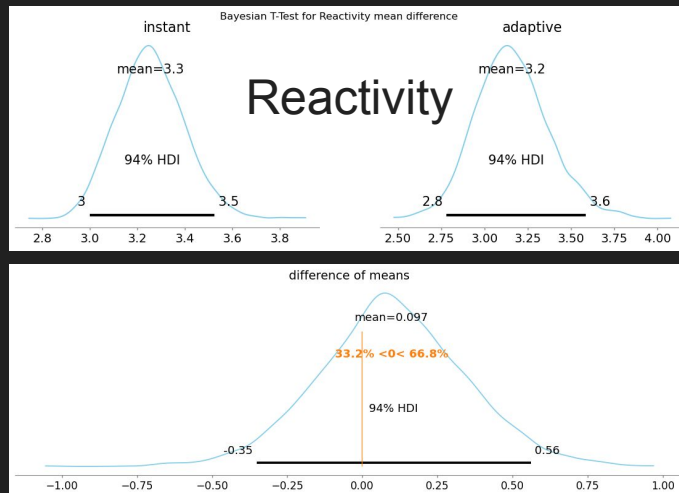
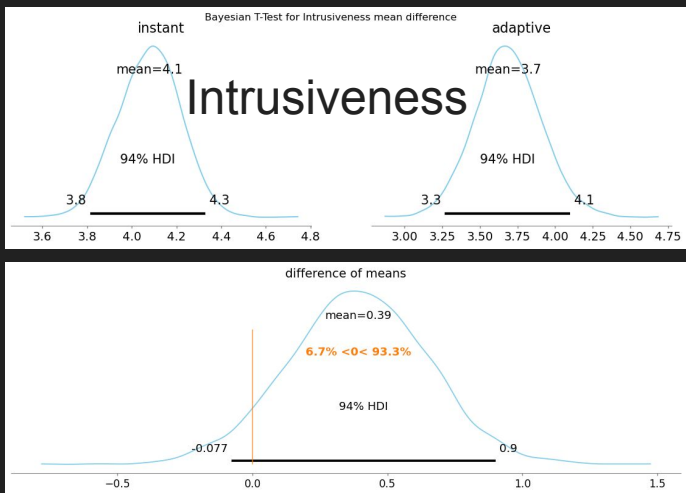
# Correlation of survey items



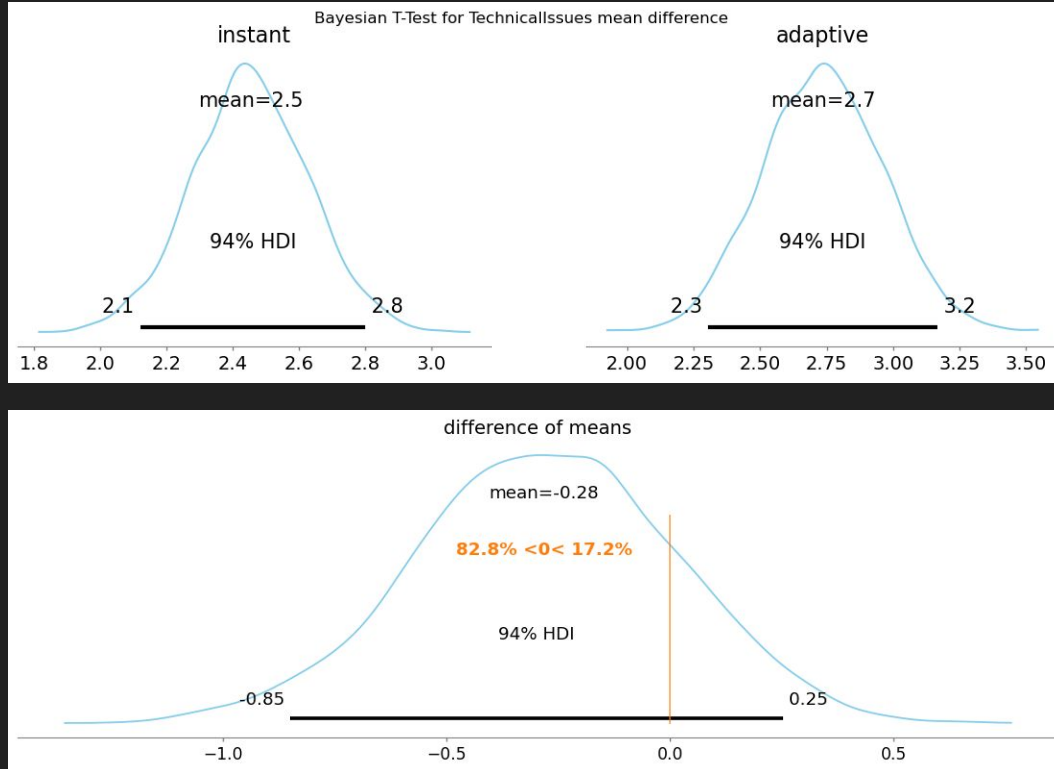
# Regressions for competence and warmth on UX



# Exploratory Results

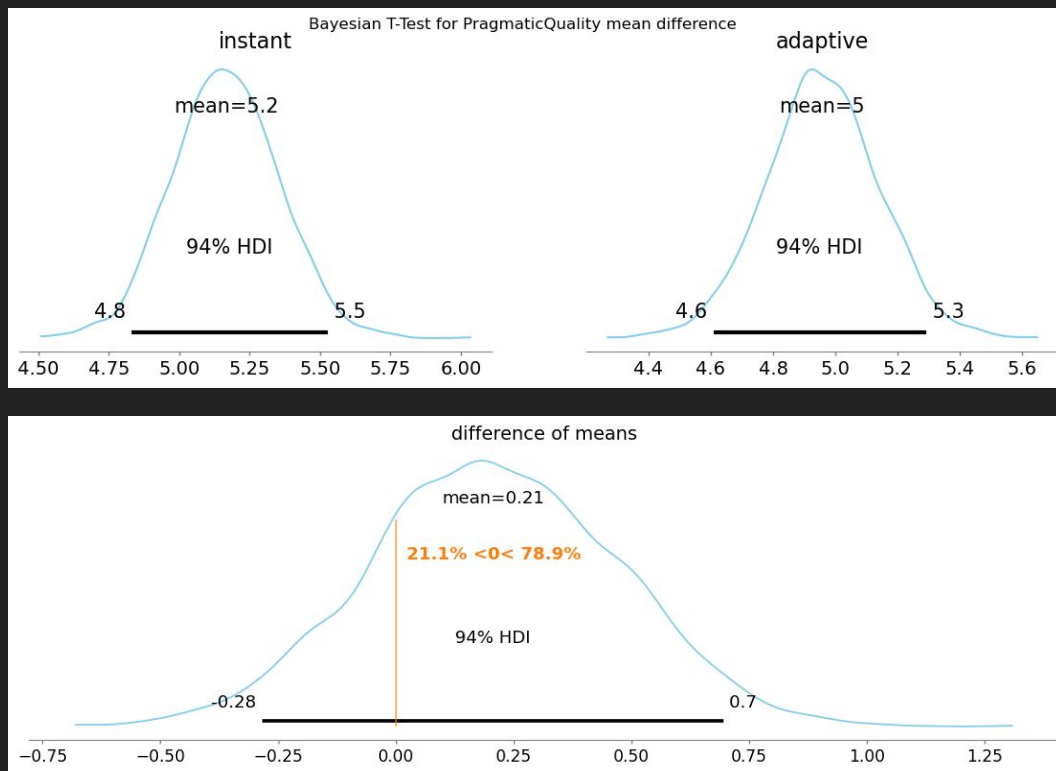


# T-Test: Technical issues

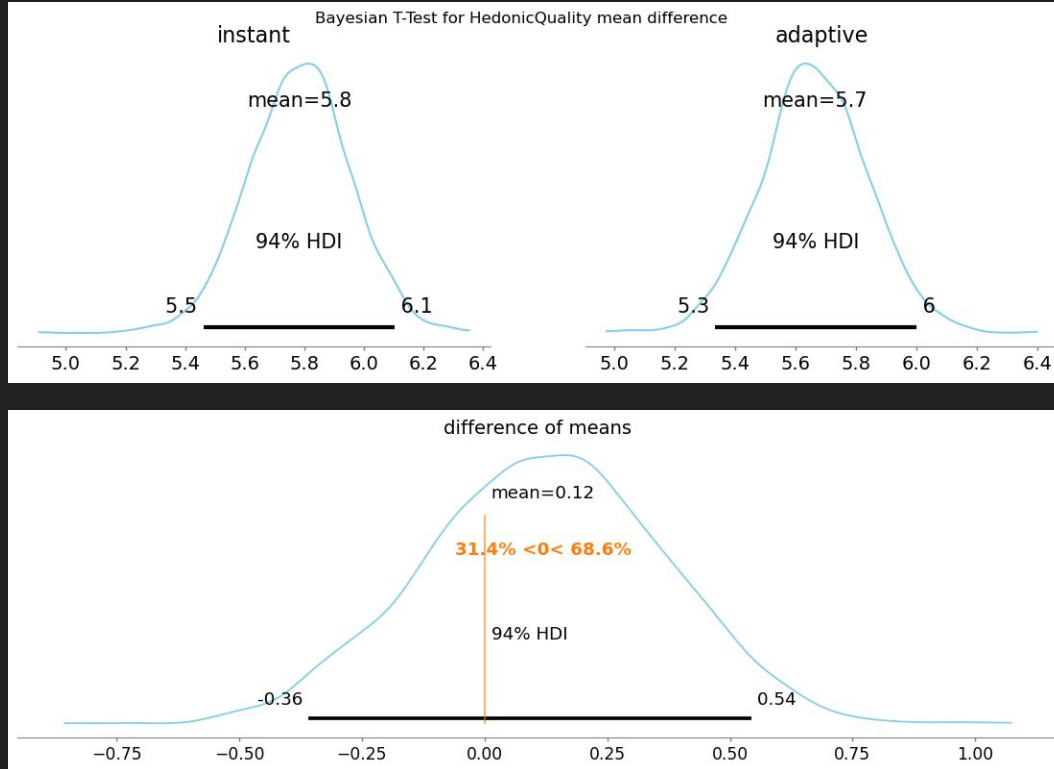




# T-Test: Predictability (pragmatic quality)



# T-Test: Professionalism (hedonic quality)



# T-Test: UEQ-S hedonic dimension

Bayesian T-Test for UEQ-S\_hedonic mean difference

instant

mean=4.6

94% HDI

4.3

5

4.00 4.25 4.50 4.75 5.00 5.25

adaptive

mean=4.6

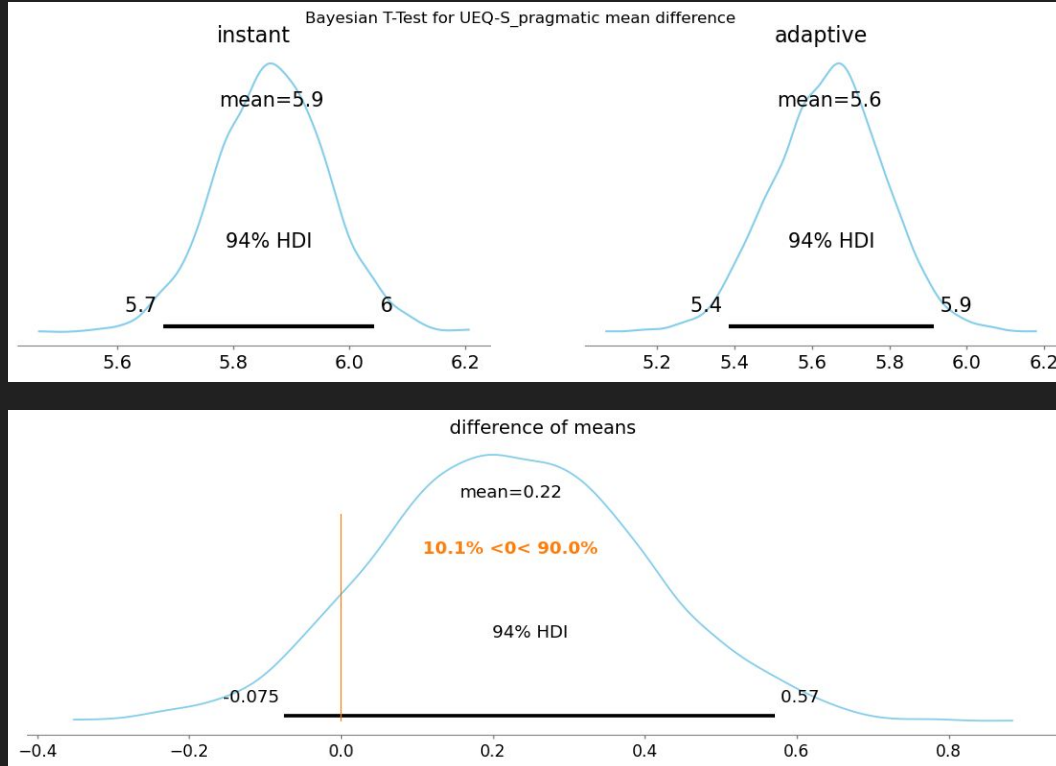
94% HDI

4.2

5.1

4.00 4.25 4.50 4.75 5.00 5.25

# T-Test: UEQ-S pragmatic dimension



# Boxplot: Cyber Sickness in VR evaluation

