VIRTUALLY IMAGINED TOUCH

Augmented and virtual reality's impact on product expectations via touch simulation

Maaike Ven

with Lieve Doucé & Kim Willems

maaike.ven@uhasselt.be

Problem?

Inability to touch

Solution?

Immersive technology

Touch simulation

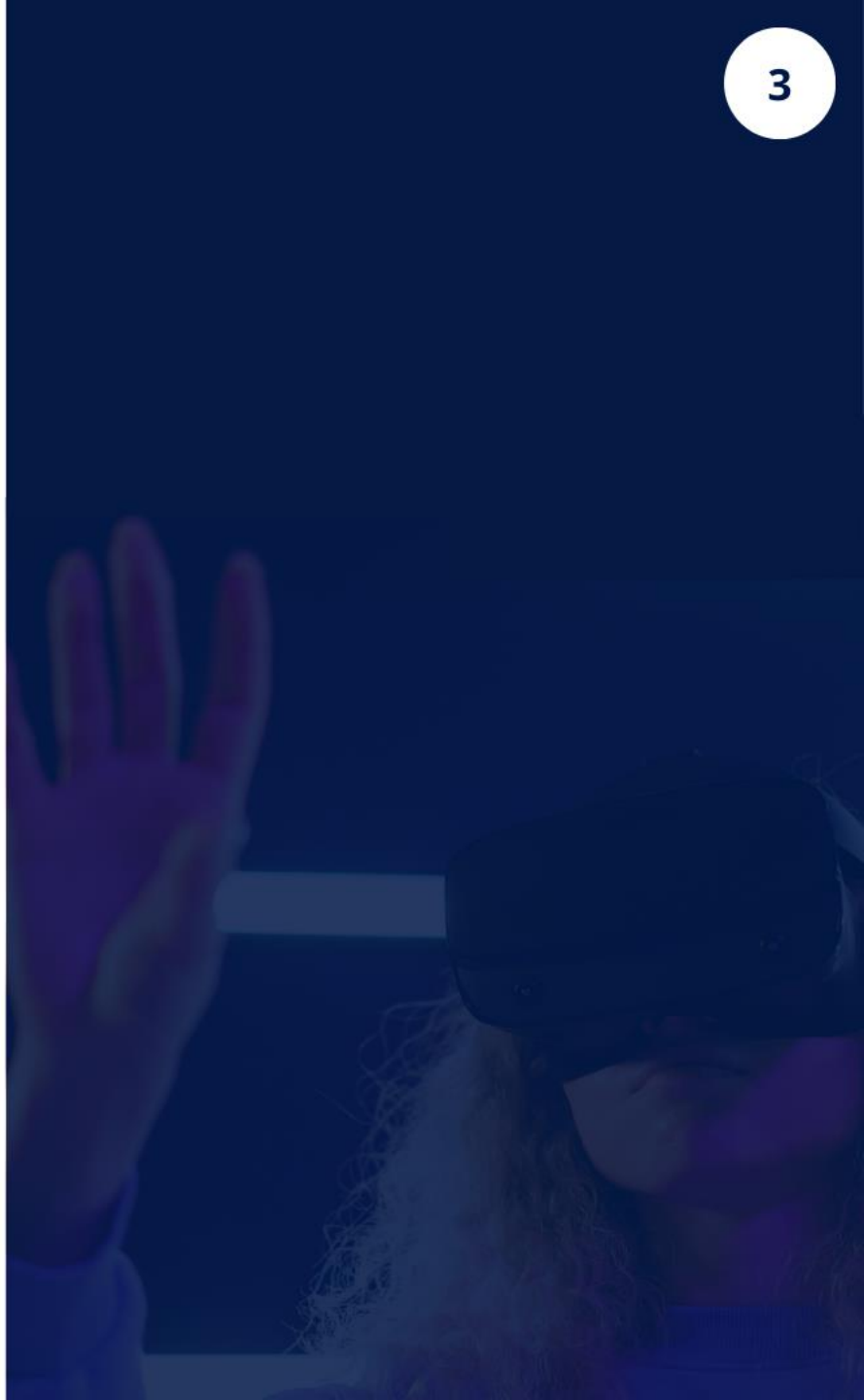
Gaps in literature

Direct comparison of AR and VR is lacking

1. Is there a difference in touch simulation evocation in order to **enhance comfort expectations**?

2. **Why** there is (or is not) a difference?

3. Effect on **product return** intentions?



Expectation formation & **Expectation (dis)confirmation**

Study 1 **Study 2**

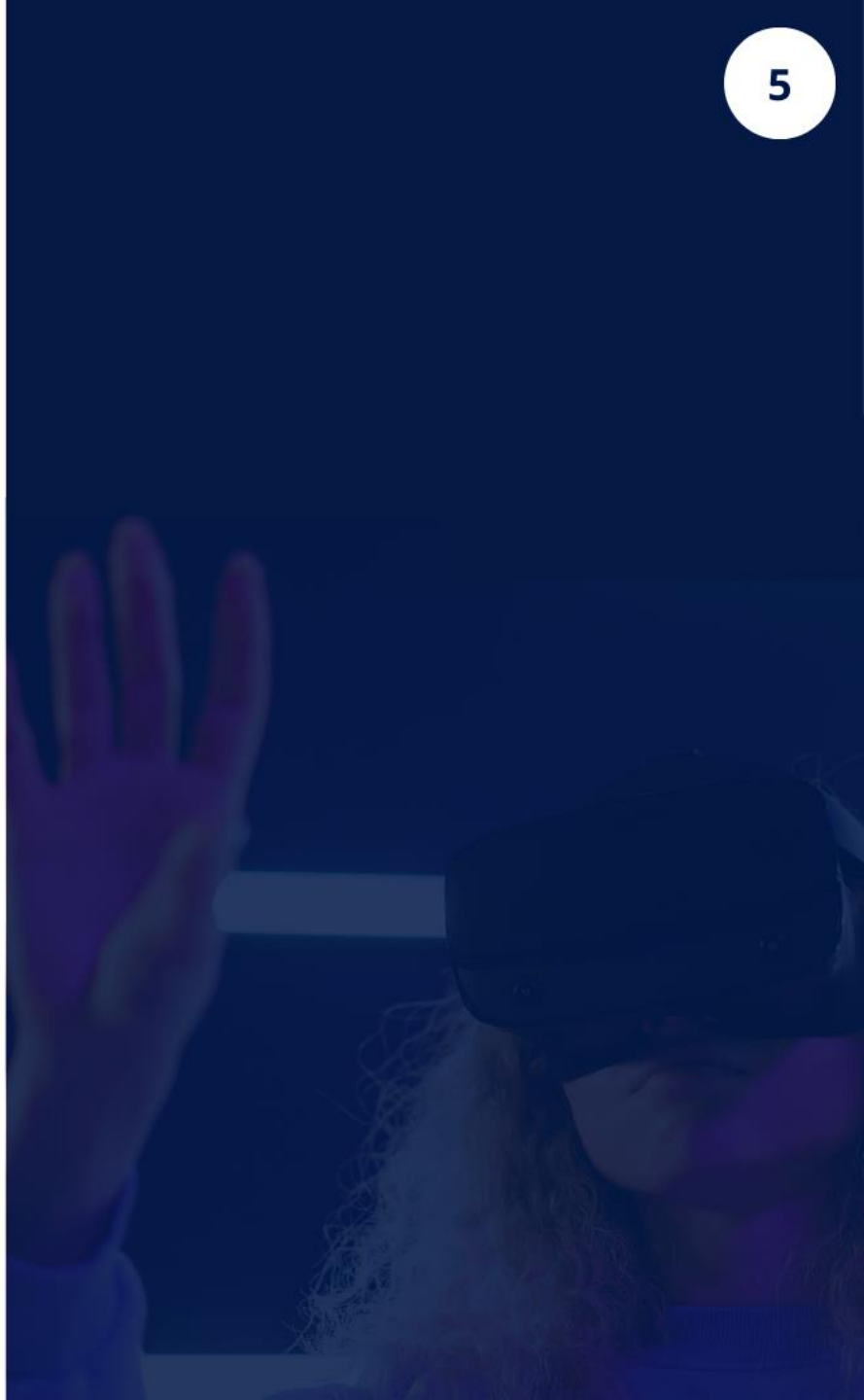
Theoretical background

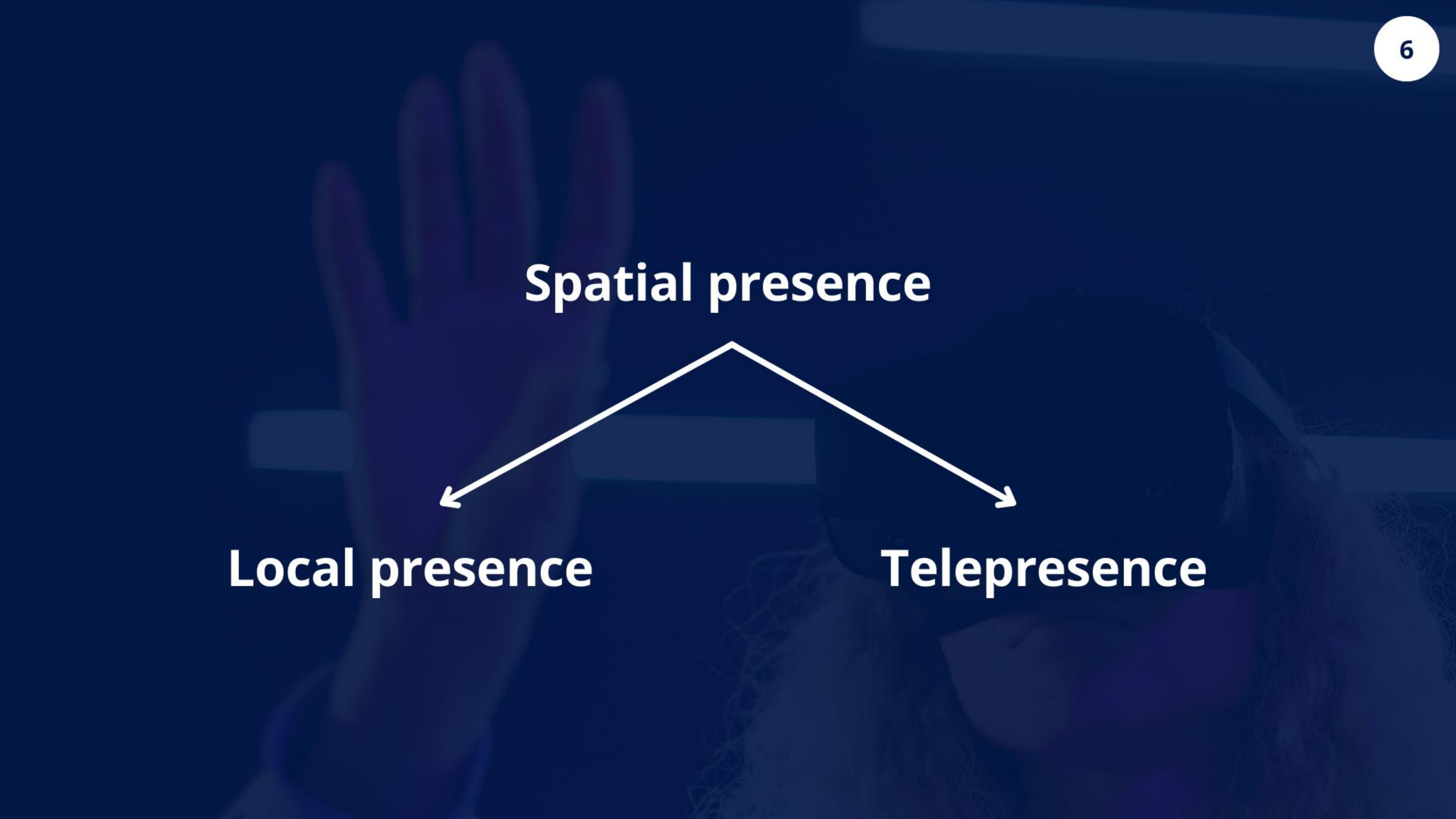
Expectation Confirmation Theory *(Oliver, 1980; Bhattacherjee, 2001)*
Theory of Grounded Cognition *(Barsalou, 2008)*

Expectations are formed by ...
... individual characteristics
... the situational context
... **the nature of the stimulus** → including prior experience

Expectation formation is a cognitive activity

- Cognition grounded in mental simulations
- Immersive tech evokes mental simulations
- **How?** → spatial presence




Spatial presence
Local presence
Telepresence

Theoretical background

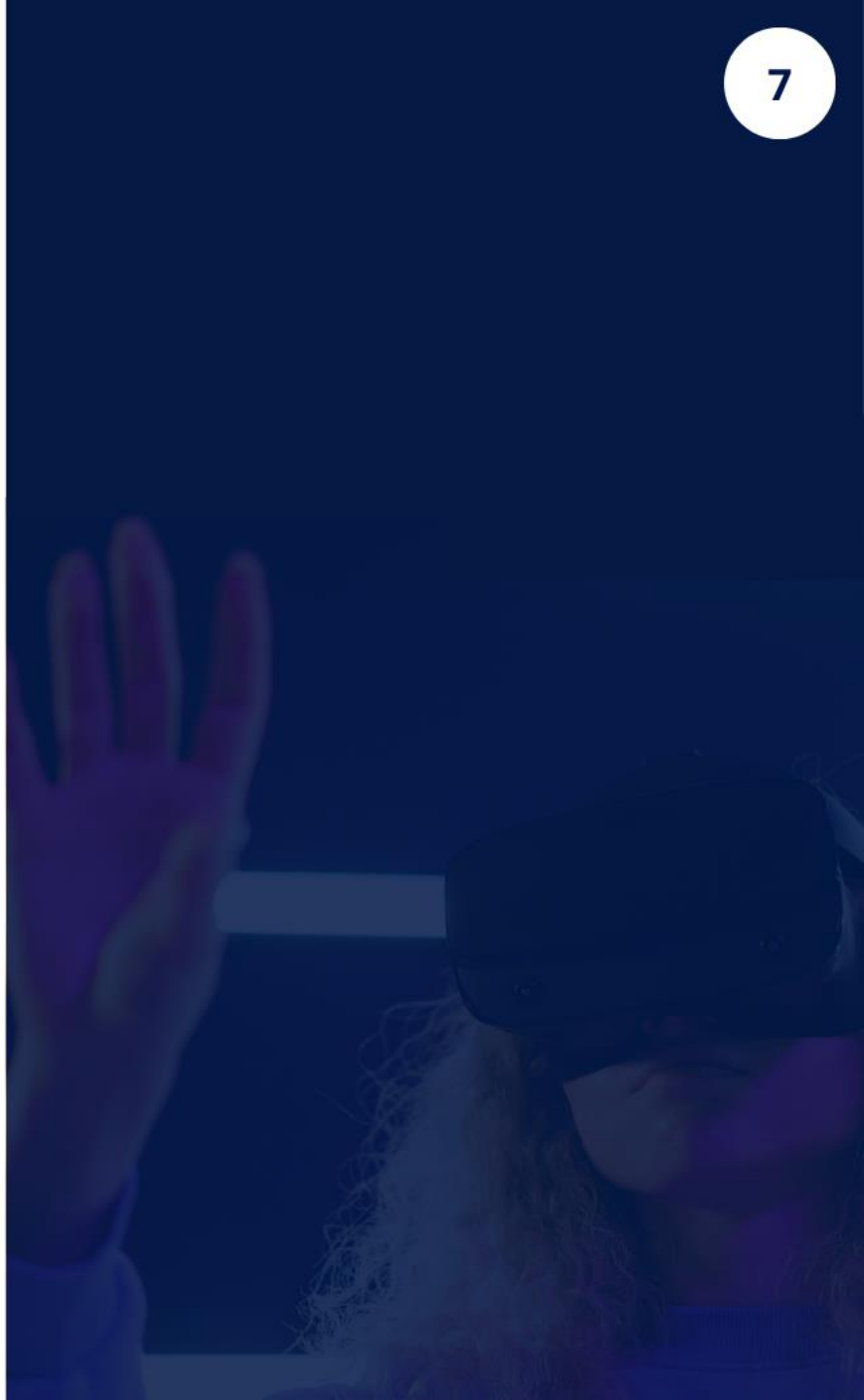
Expectation Confirmation Theory *(Oliver, 1980; Bhattacherjee, 2001)*

Expectations can ...

... be met → confirmation

... be exceeded → positive disconfirmation

... fall short → negative disconfirmation



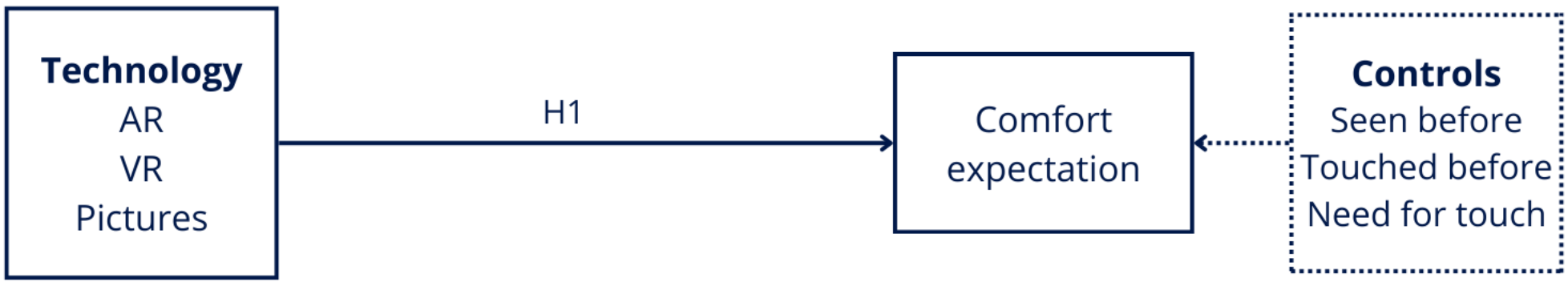
STUDY 1

Expectation formation

Conceptual model

Study 1 - expectation formation

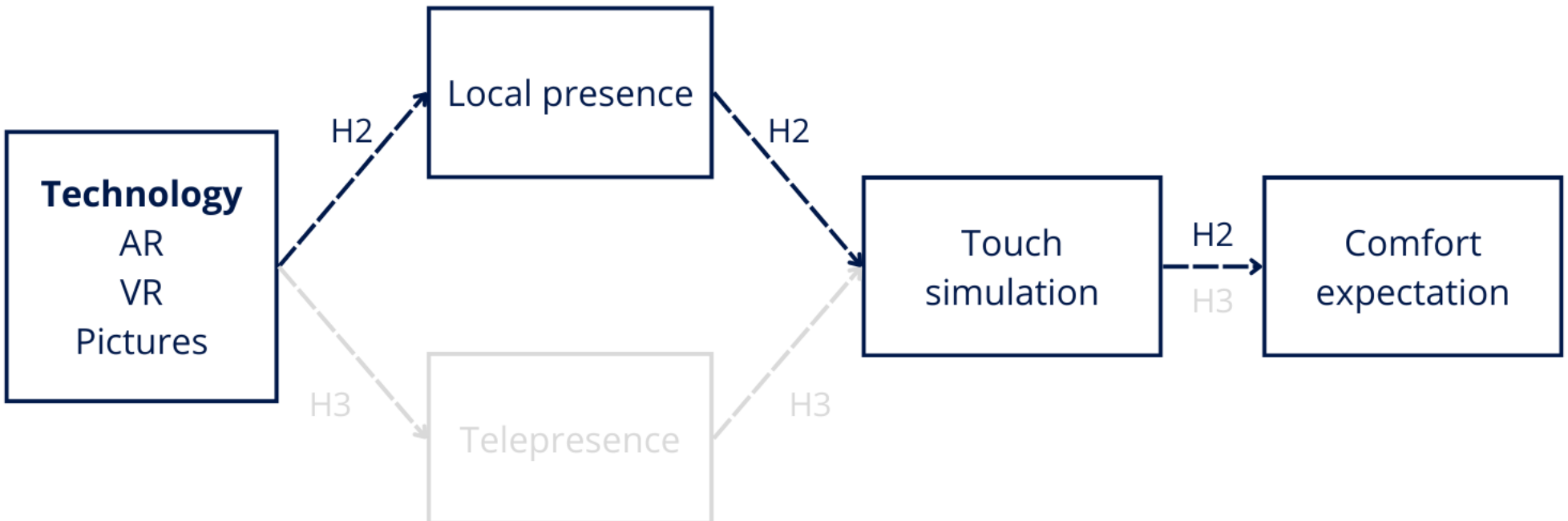
H1: Viewing a product in AR or VR has a greater positive impact on comfort expectation than viewing in 2D. However, there is no difference in comfort expectation between AR and VR.



Conceptual model

Study 1 - expectation formation

H2: The positive effect of viewing in AR and VR on comfort expectations is sequentially mediated by local presence and touch simulation.

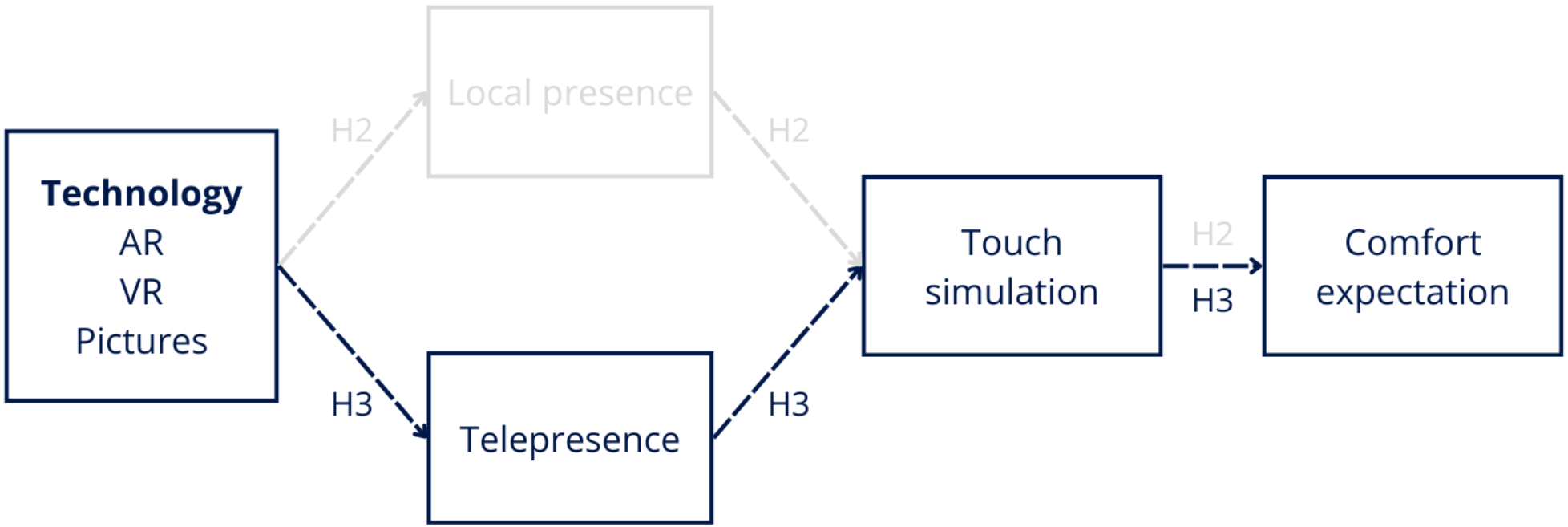


Note: Dashed arrows indicate mediation.

Conceptual model

Study 1 - expectation formation

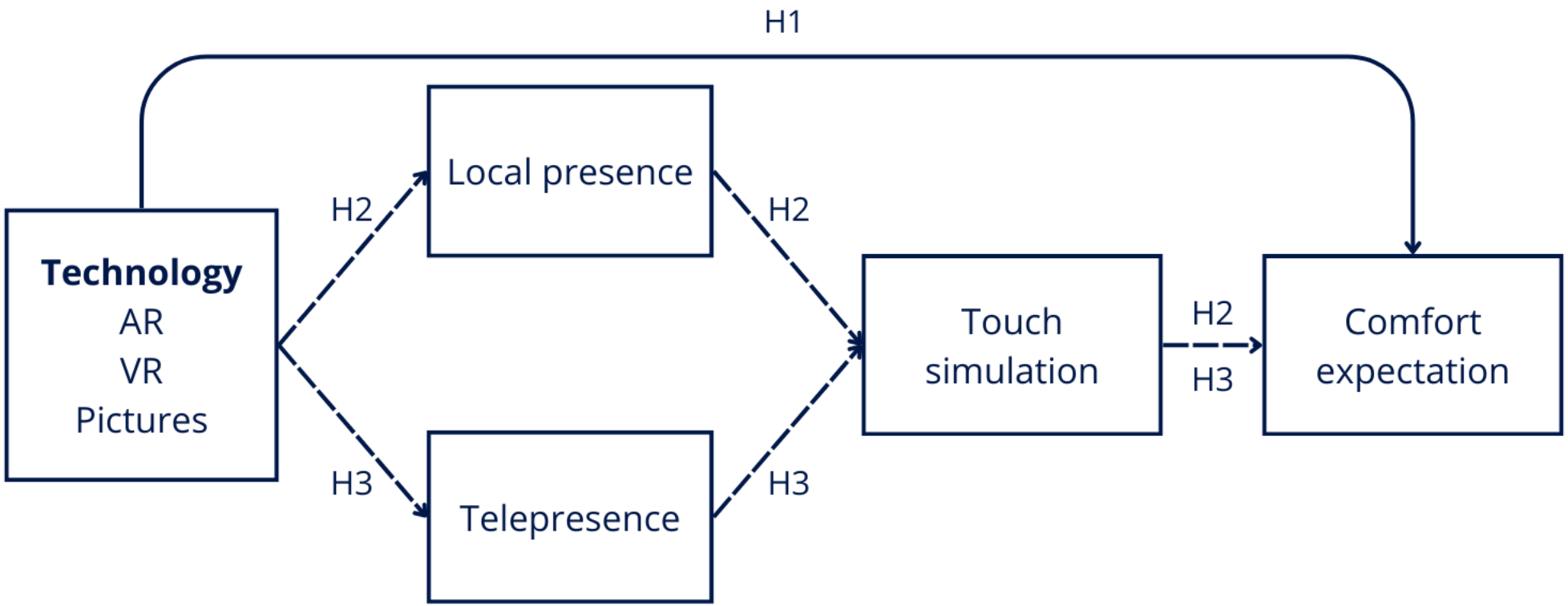
H3: The positive effect of viewing in AR and VR on comfort expectations is sequentially mediated by telepresence and touch simulation.



Note: Dashed arrows indicate mediation.

Conceptual model

Study 1 - expectation formation



Note: Dashed arrows indicate mediation.

Pre-test - choice of armchair

Online survey

Design	4 x 1 between-subjects design
Participants	N = 176 (M_{age} = 43,91; SD_{age} = 16,12; 73,9% women)
Measures	Product liking Importance of haptic information

Pre-test - choice of armchair

Online survey

Design
4 x 1 between-subjects design

Participants
N = 176
(M_{age} = 43,91; SD_{age} = 16,12; 73,9% women)

Measures
Product liking
Importance of haptic information

Results
Product liking
($F(3,172) = 3.837$; $p = .011$)
Importance of haptic info
($F(3,172) = 5.220$; $p = .002$)

M_{liking} = 5.40; SD = 1.62
$M_{importance}$ = 6.02; SD = .89

M_{liking} = 4.69; SD = 1.70
$M_{importance}$ = 5.19; SD = 1.35

M_{liking} = 4.50; SD = 1.60
$M_{importance}$ = 5.20; SD = 1.33

M_{liking} = 4.25; SD = 1.81
$M_{importance}$ = 5.75; SD = 1.22

Study 1 - methodology

Lab experiment

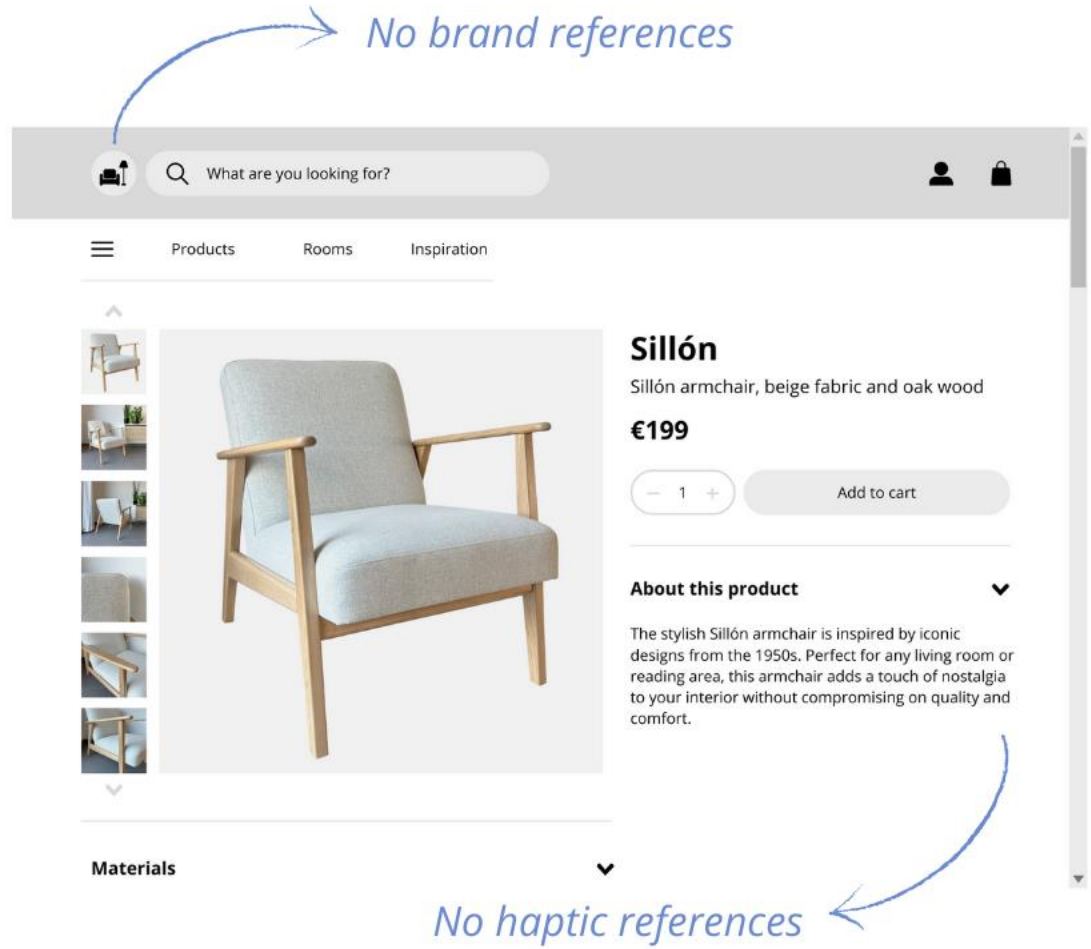
Design	3 x 1 between-subjects design
Participants	N = 276 (M_{age} = 28.88; SD_{age} = 11.90; 59.1% women; 50.7% students)
Task	furniture shopping for study or work space

Study 1 - methodology

Lab experiment

Design | 3 x 1 between-subjects design

Condition 1: 2D pictures
furniture website on laptop



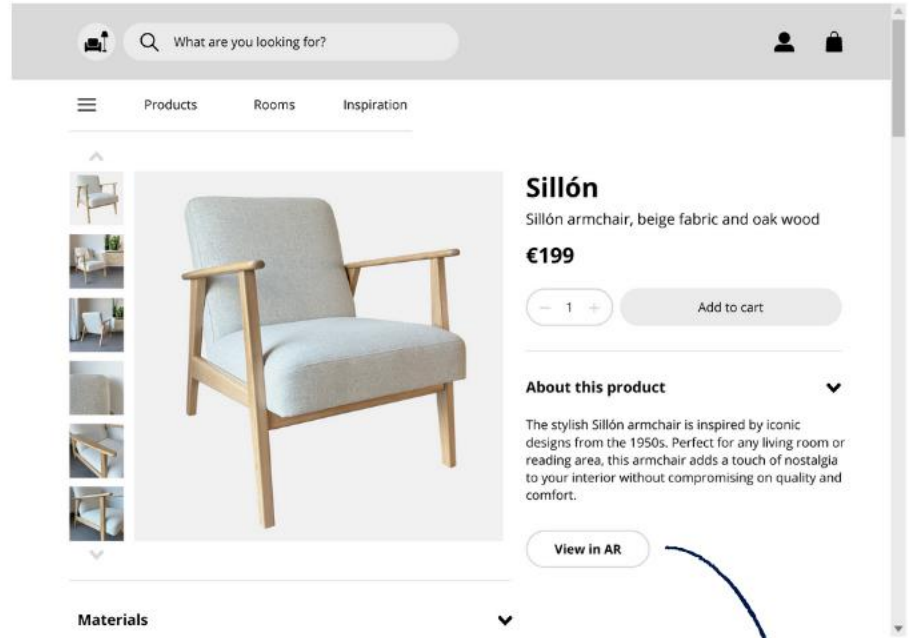
Study 1 - methodology

Lab experiment

Design | 3 x 1 between-subjects design

Condition 1: 2D pictures
furniture website on laptop

Condition 2: Augmented reality (AR)
furniture website on laptop
AR using Meta Quest 3



Study 1 - methodology

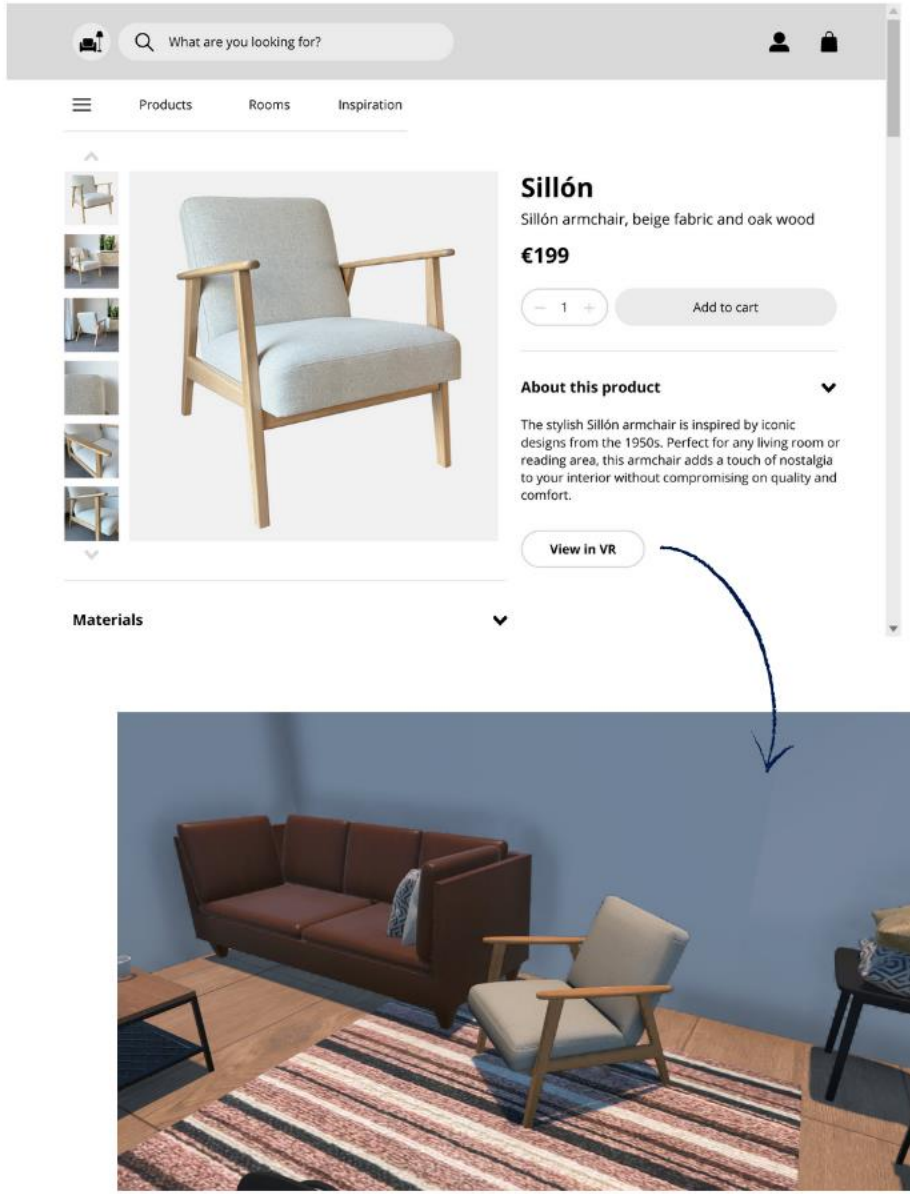
Lab experiment

Design | 3 x 1 between-subjects design

Condition 1: 2D pictures
furniture website on laptop

Condition 2: Augmented reality (AR)
furniture website on laptop
AR using Meta Quest 3

Condition 3: Virtual reality (VR)
furniture website on laptop
VR using Meta Quest 3



Study 1 - results

ANCOVA

H1 univariate analysis

sig. **main effect** of technology on comfort expectations F(2,270) = 8.708; p = .004

not sig. main effect of control variables:
seen before (F(1,270) = .008; p = .928)
touched before (F(1,270) = .113; p = .737)
need for touch (F(1,270) = .222; p = .638)

→ *omitted in later analyses*

Study 1 - results

ANCOVA

H1 univariate analysis

sig. **main effect** of technology on comfort expectations

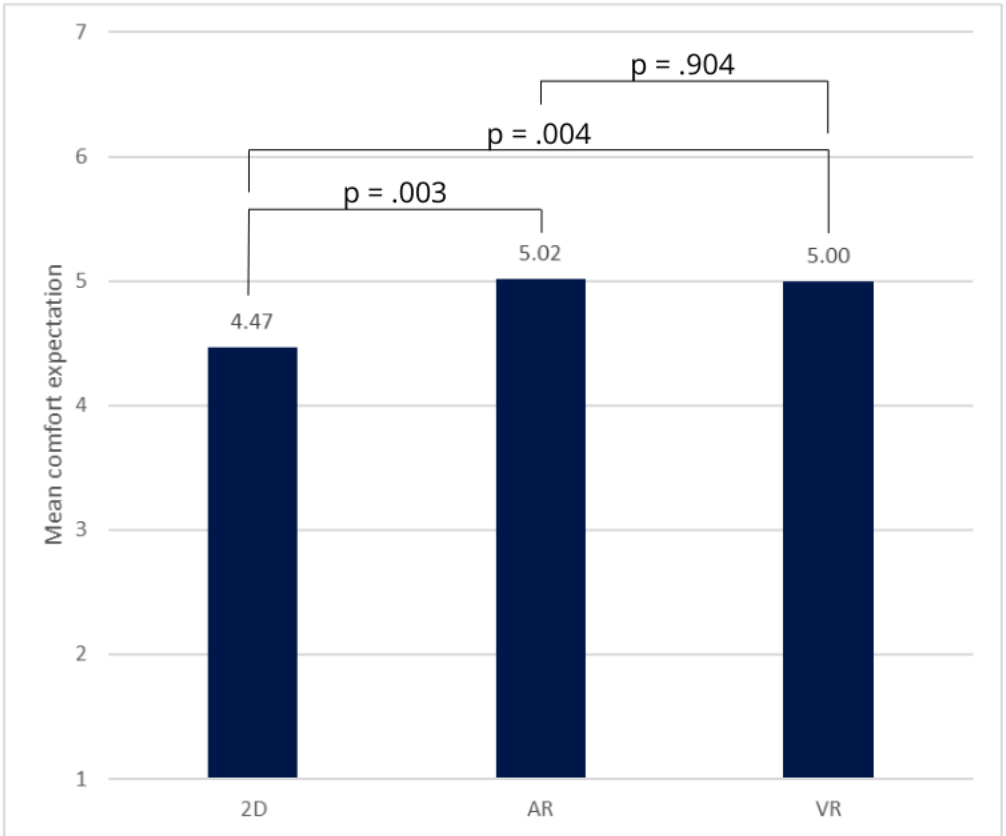
H1 post-hoc analyses

sig. AR vs. 2D

sig. VR vs. 2D

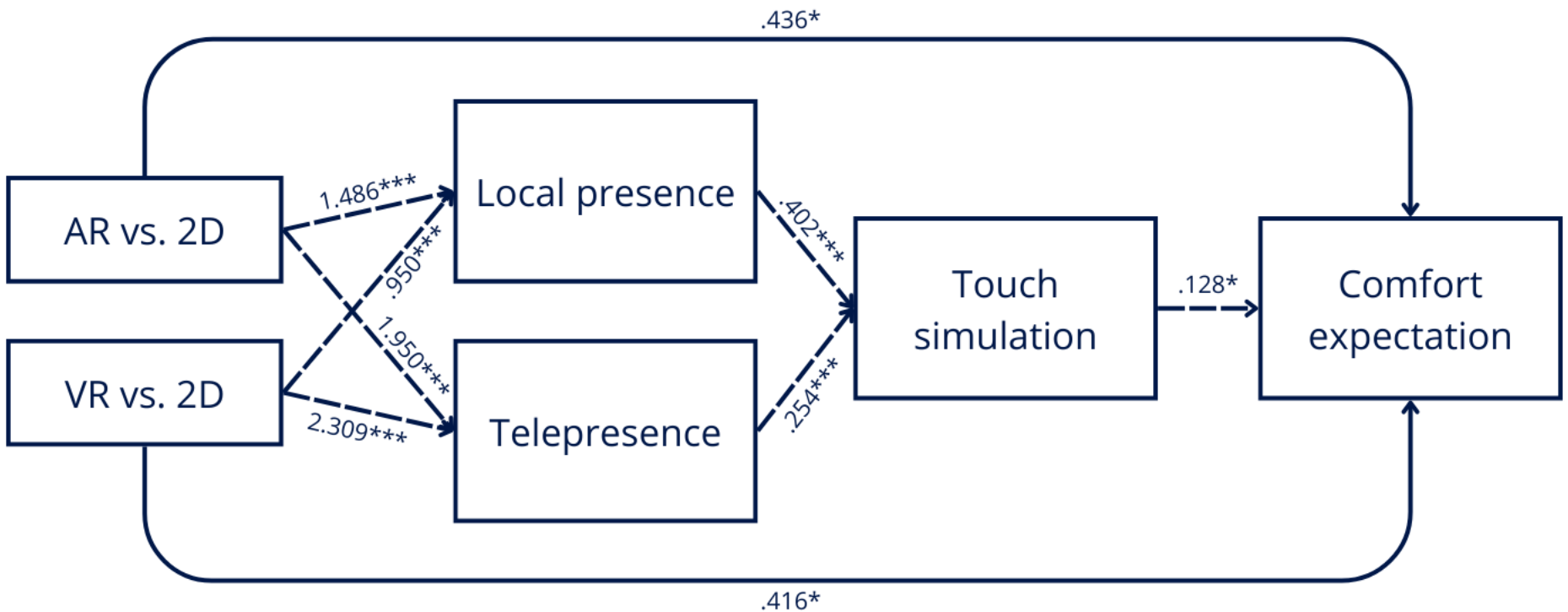
not sig. AR vs. VR

H1 accepted



Study 1 - results

PROCESS Macro custom model



Note: Figure represent unstandardized beta coefficients. ***p < .001, **p < .01, *p < .05
Dashed arrows indicate mediation.

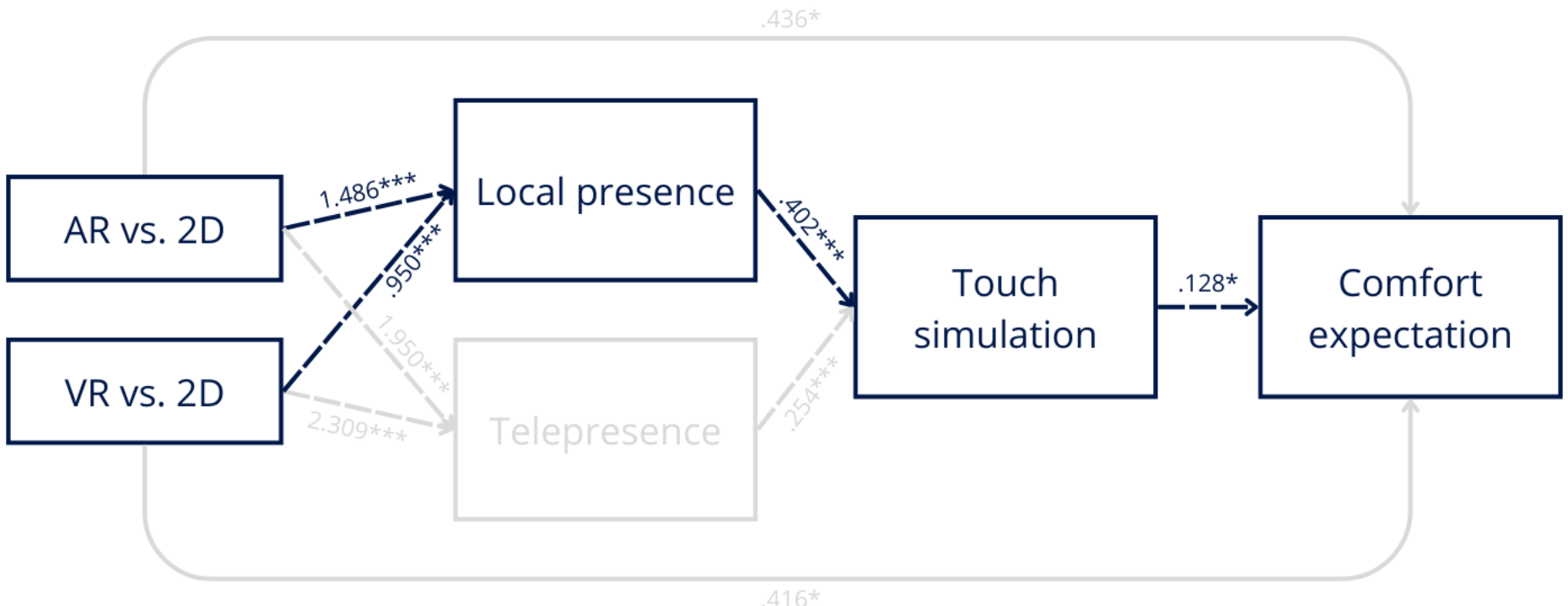
Study 1 - results

PROCESS Macro custom model

H2 accepted ✅

Sig. indirect effect AR vs. 2D
(β = .076; SE = .037; 95% CI = [.013, .154])

Sig. indirect effect VR vs. 2D
(β = .049; SE = .024; 95% CI = [.009, .100])



Note: Figure represent unstandardized beta coefficients. ***p < .001, **p < .01, *p < .05
Dashed arrows indicate mediation.

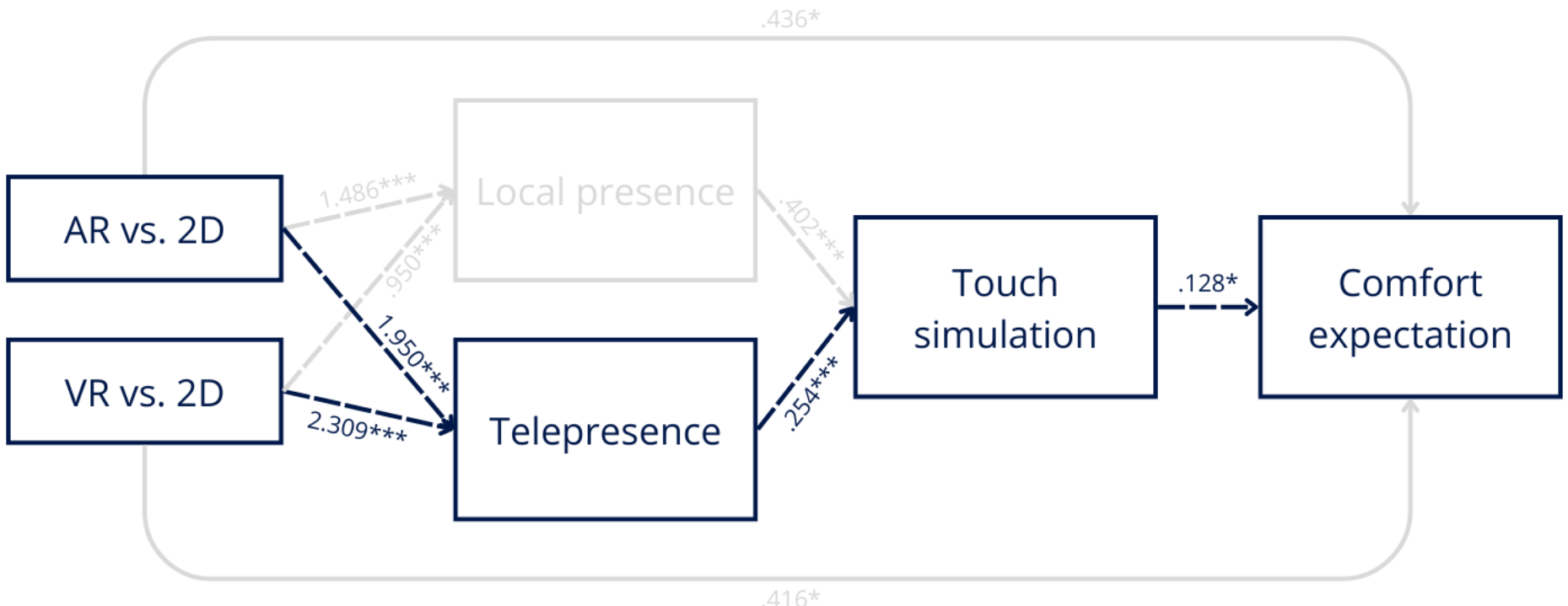
Study 1 - results

PROCESS Macro custom model

H3 accepted ✅

Sig. indirect effect AR vs. 2D
(β = .064; SE = .036; 95% CI = [.008, .148])

Sig. indirect effect VR vs. 2D
(β = .076; SE = .042; 95% CI = [.010, .171])



Note: Figure represent unstandardized beta coefficients. ***p < .001, **p < .01, *p < .05
Dashed arrows indicate mediation.

Study 1 - results

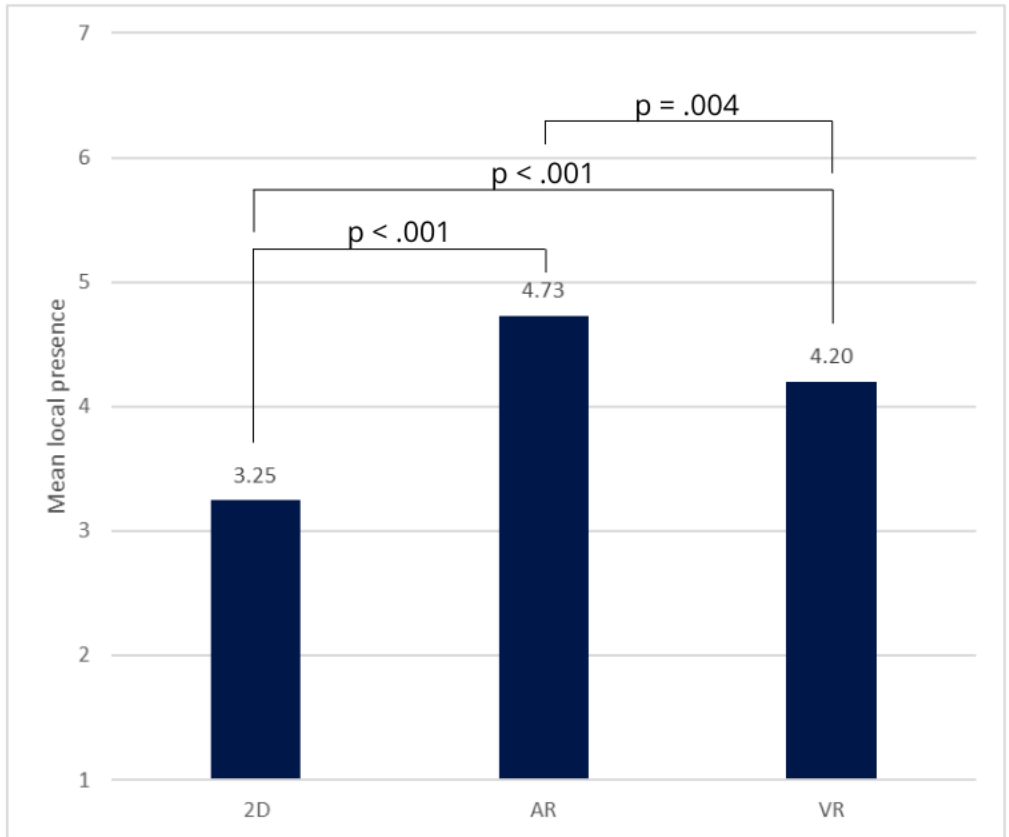
ANOVA

H2 univariate analysis

sig. **main effect** of technology on local presence
F(2,273) = 34.101; p < .001

H2 post-hoc analyses

sig. AR vs. 2D
sig. VR vs. 2D
sig. AR vs. VR



Study 1 - results

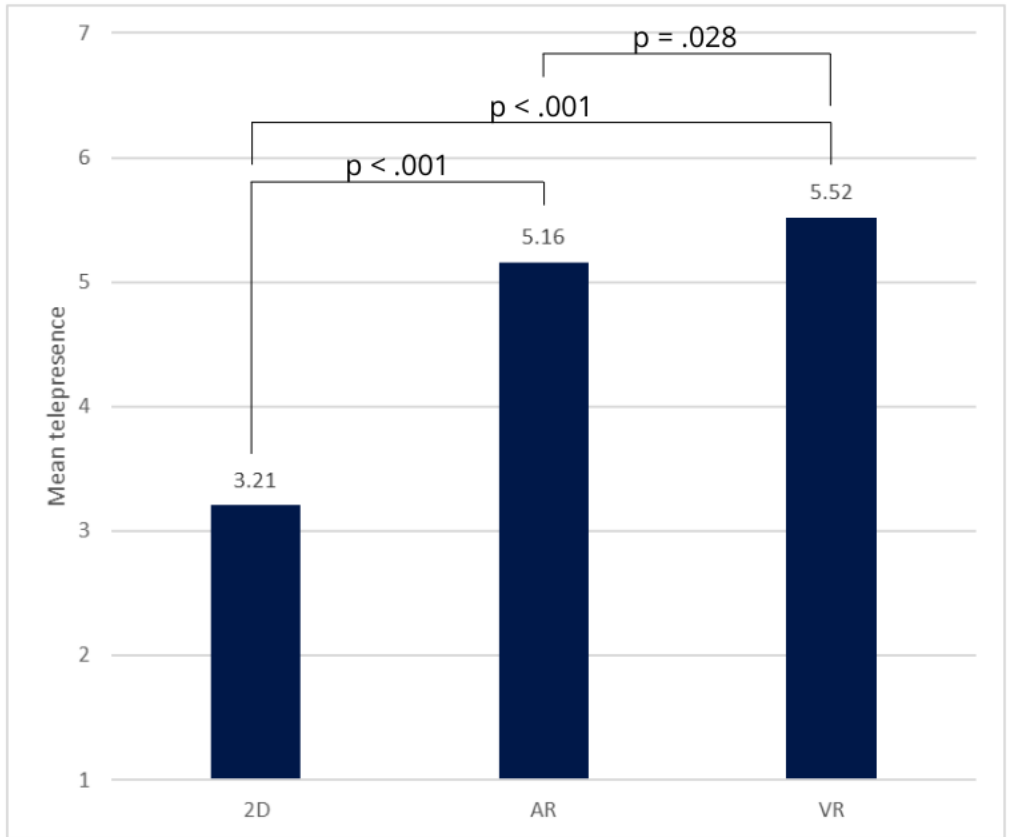
ANOVA

H3 univariate analysis

sig. **main effect** of technology on telepresence
F(2,273) = 117.461; p < .001

H3 post-hoc analyses

sig. AR vs. 2D
sig. VR vs. 2D
sig. AR vs. VR



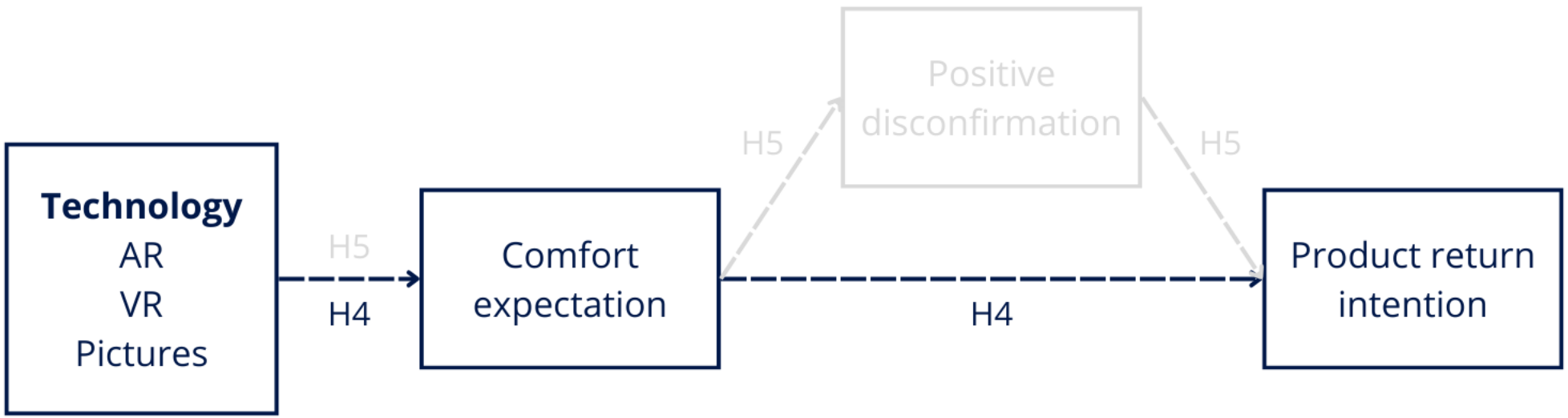
STUDY 2

Expectation (dis)confirmation

Conceptual model

Study 2 - expectation (dis)confirmation

H4: There is a mediation such that viewing a product in AR or VR (compared to 2D) has a positive impact on comfort expectation, which leads to lower product return intention.

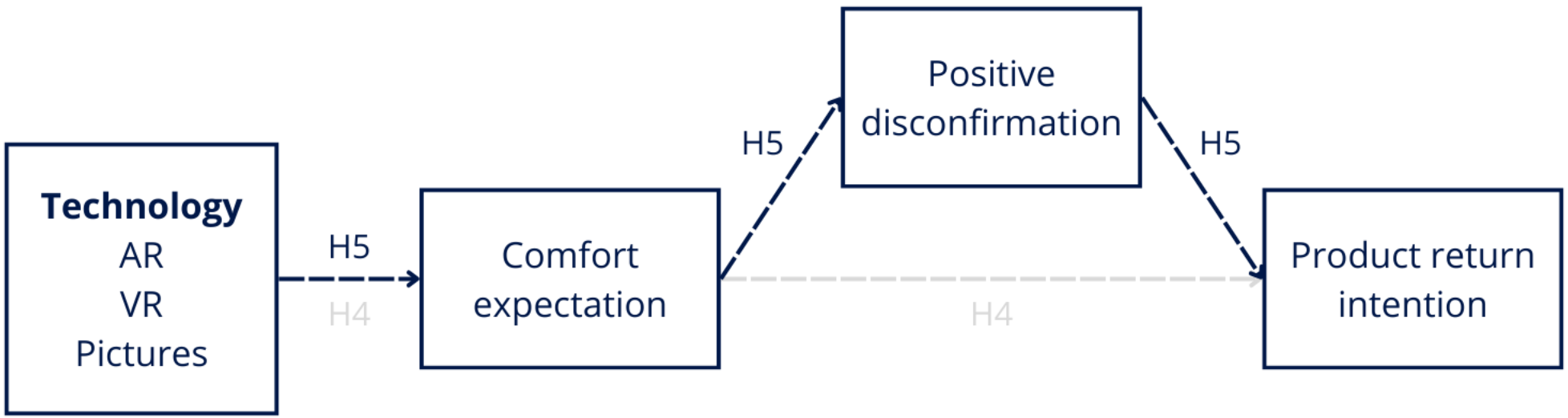


Note: Dashed arrows indicate mediation.

Conceptual model

Study 2 - expectation (dis)confirmation

H5: There is a serial mediation such that viewing a product in AR or VR (compared to 2D) has a positive impact on comfort expectation, which subsequently leads to lower positive disconfirmation and higher product return intention.

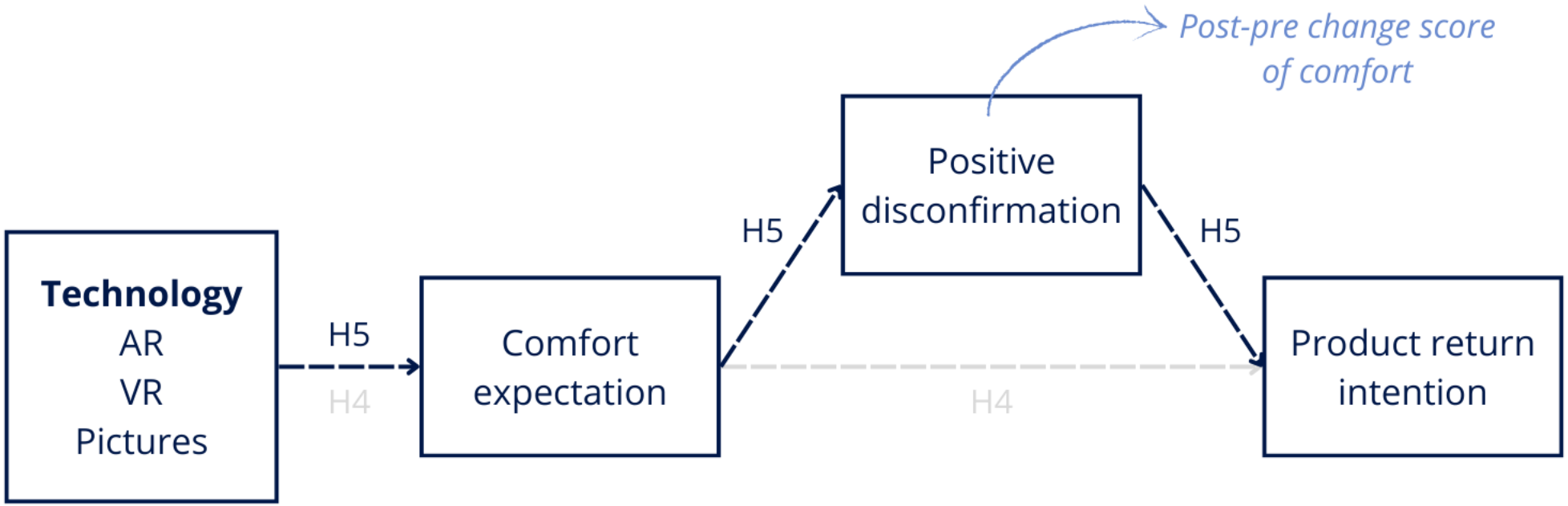


Note: Dashed arrows indicate mediation.

Conceptual model

Study 2 - expectation (dis)confirmation

H5: There is a serial mediation such that viewing a product in AR or VR (compared to 2D) has a positive impact on comfort expectation, which subsequently leads to lower positive disconfirmation and higher product return intention.



Note: Dashed arrows indicate mediation.

Pre-test - How comfortable is the real armchair?

Real touch + survey

Participants

N = 40

(M_{age} = 27.5; SD_{age} = 12.68; 52.5% women)

Measures

Perceived comfort

Results

$M_{comfort}$ = 5.975; $SD_{comfort}$ = .800

T-test with test-value 4:

(t(39) = 15.609; p < .001)

Study 2 - methodology

Lab experiment

Design

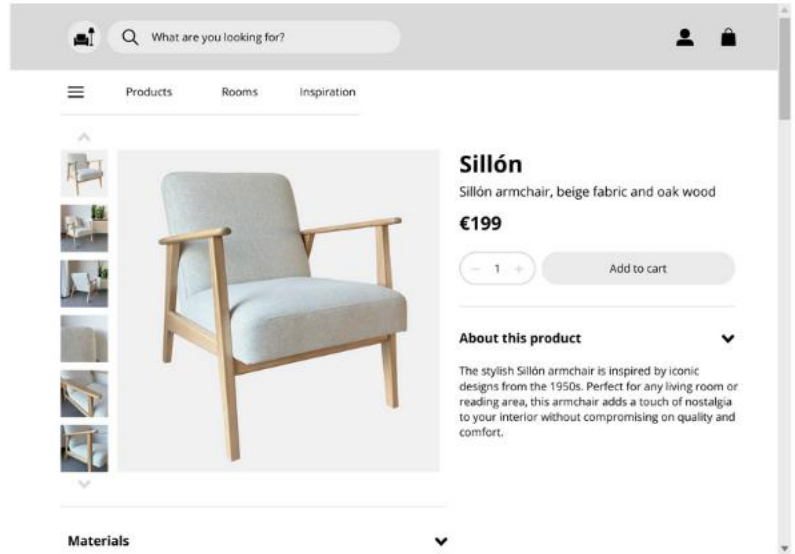
3 x 1 between-subjects design
Same conditions as study 1: 2D, AR & VR

Participants

N = 143
(M_{age} = 37.04; SD_{age} = 11.33; 65.7% women)

Task

furniture shopping for work space



Study 2 - methodology

Lab experiment

Design

3 x 1 between-subjects design
Same conditions as study 1: 2D, AR & VR

Participants

N = 143
(M_{age} = 37.04; SD_{age} = 11.33;
65.7% women)

Task

furniture shopping for
work space

+ actual touch of the armchair

Study 2 - results

ANOVA

Re-test H1

H1 univariate analyses

sig. **main effect** of technology on comfort expectations

F(2,140) = 5.353; p = .006

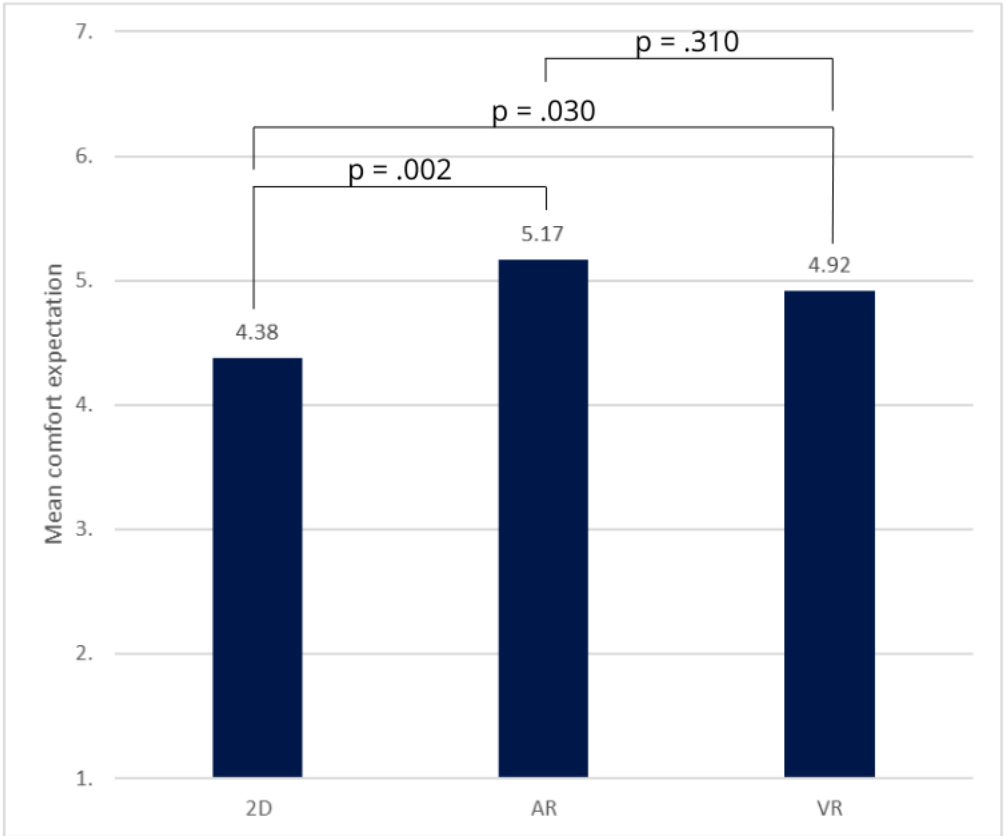
H1 post-hoc analyses

sig. AR vs. 2D

sig. VR vs. 2D

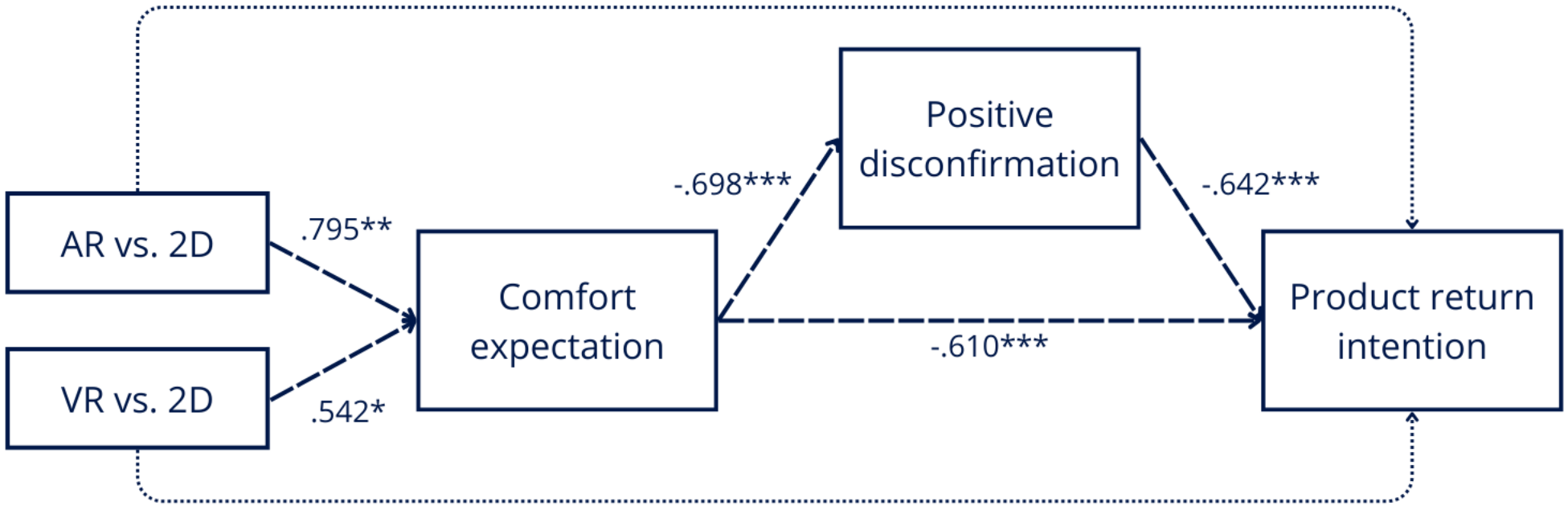
not sig. AR vs. VR

H1 accepted ✅



Study 2 - results

PROCESS Macro custom model



Note: Figure represent unstandardized beta coefficients. ***p < .001, **p < .01, *p < .05
Dashed arrows indicate mediation. Dotted arrows indicate a non-significant effect.

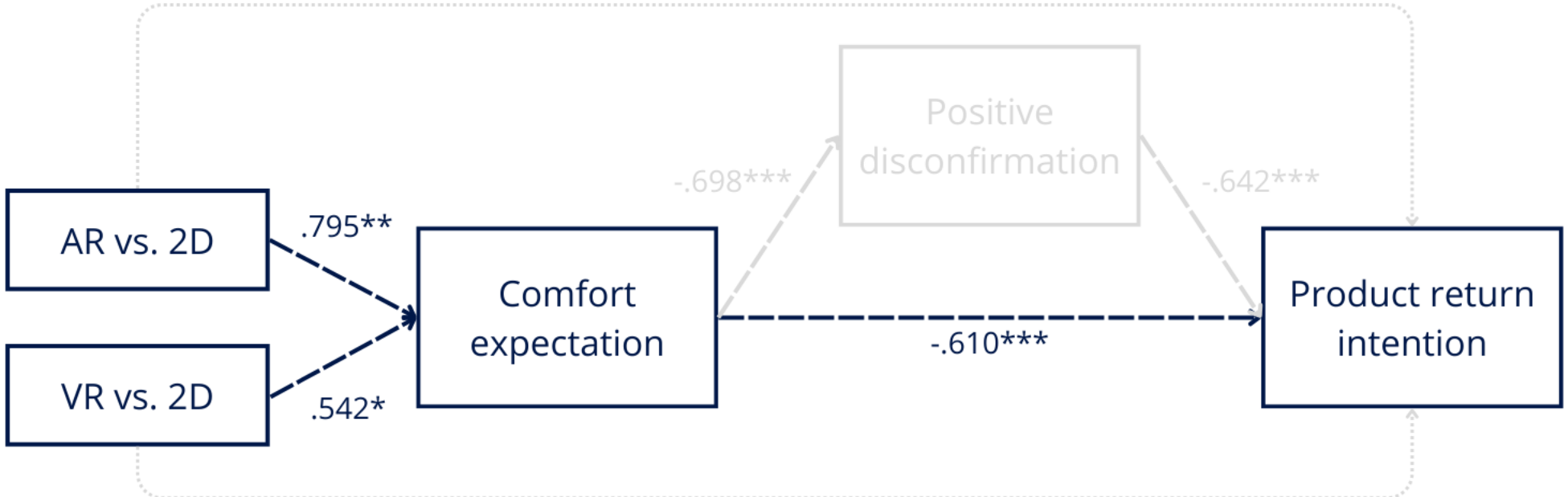
Study 2 - results

PROCESS Macro custom model

H4 accepted ✅

Sig. indirect effect AR vs. 2D
(β = -.485; SE = .197; 95% CI = [-.902, -.153])

Sig. indirect effect VR vs. 2D
(β = -.330; SE = .184; 95% CI = [-.731, -.019])



Note: Figure represent unstandardized beta coefficients. ***p < .001, **p < .01, *p < .05
Dashed arrows indicate mediation. Dotted arrows indicate a non-significant effect.

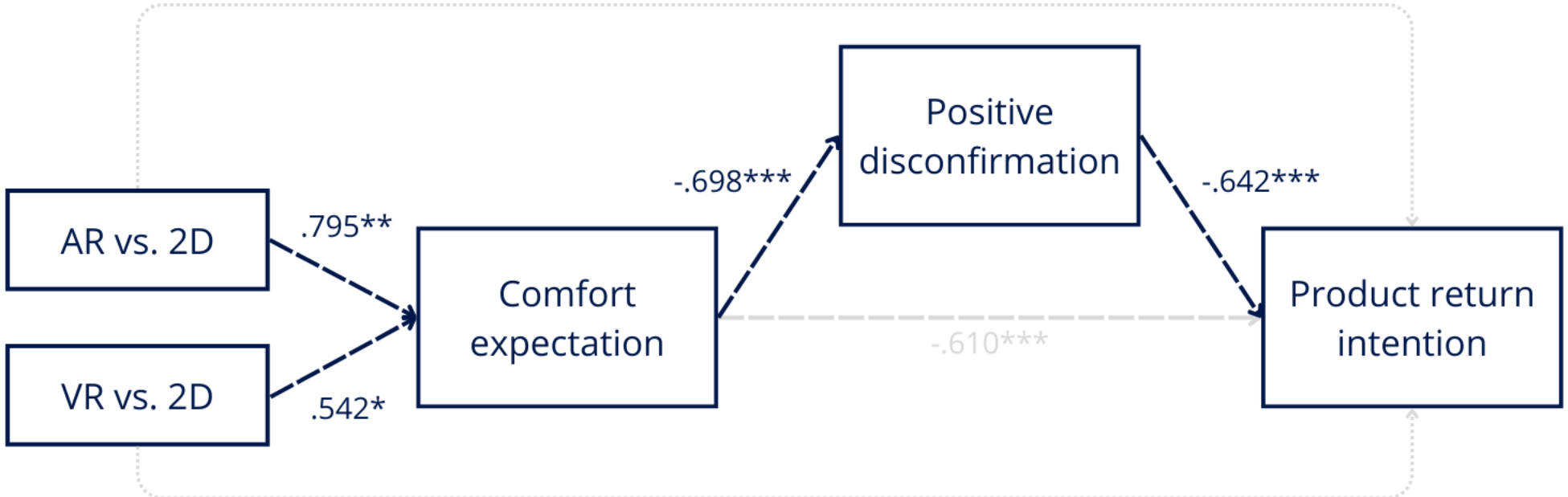
Study 2 - results

PROCESS Macro custom model

H5 accepted

Sig. indirect effect AR vs. 2D
(β = .356; SE = .139; 95% CI = [.111, .653])

Sig. indirect effect VR vs. 2D
(β = .243; SE = .130; 95% CI = [.017, .527])



Note: Figure represent unstandardized beta coefficients. ***p < .001, **p < .01, *p < .05
Dashed arrows indicate mediation. Dotted arrows indicate a non-significant effect.

Study 2 - results

PROCESS Macro custom model

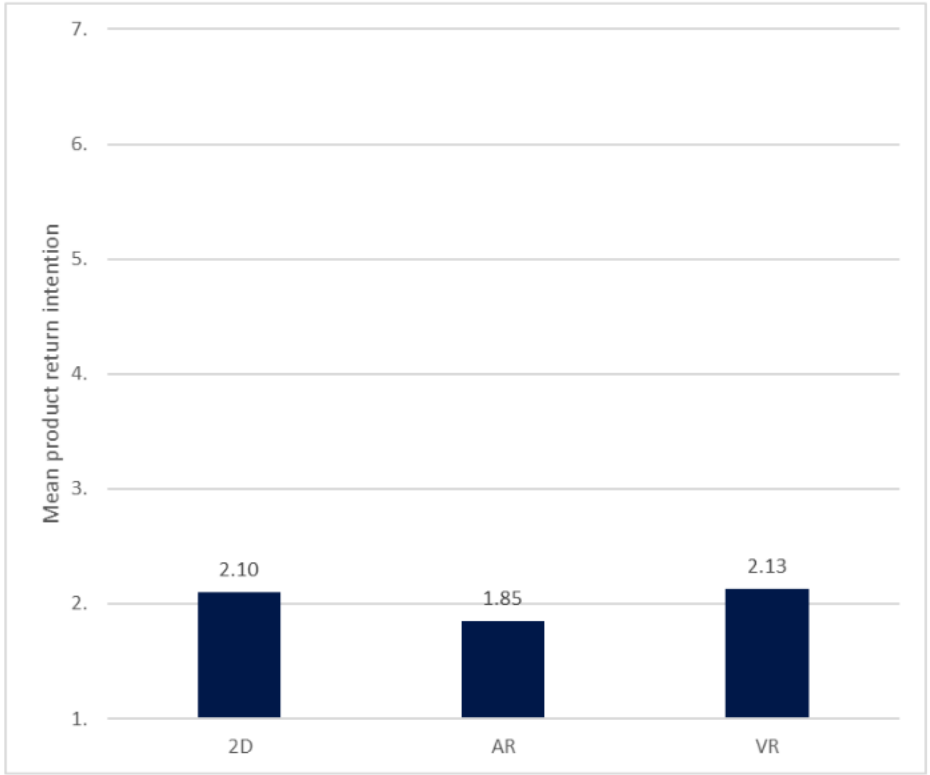
Univariate analyses

No significant main effect of technology on return intention

F(2,140) = .617; p = .541

Negative indirect effect AR/VR vs. 2D → Expectation → Product return intention

Positive indirect effect AR/VR vs. 2D → Expectation → Positive disconfirmation → return intention



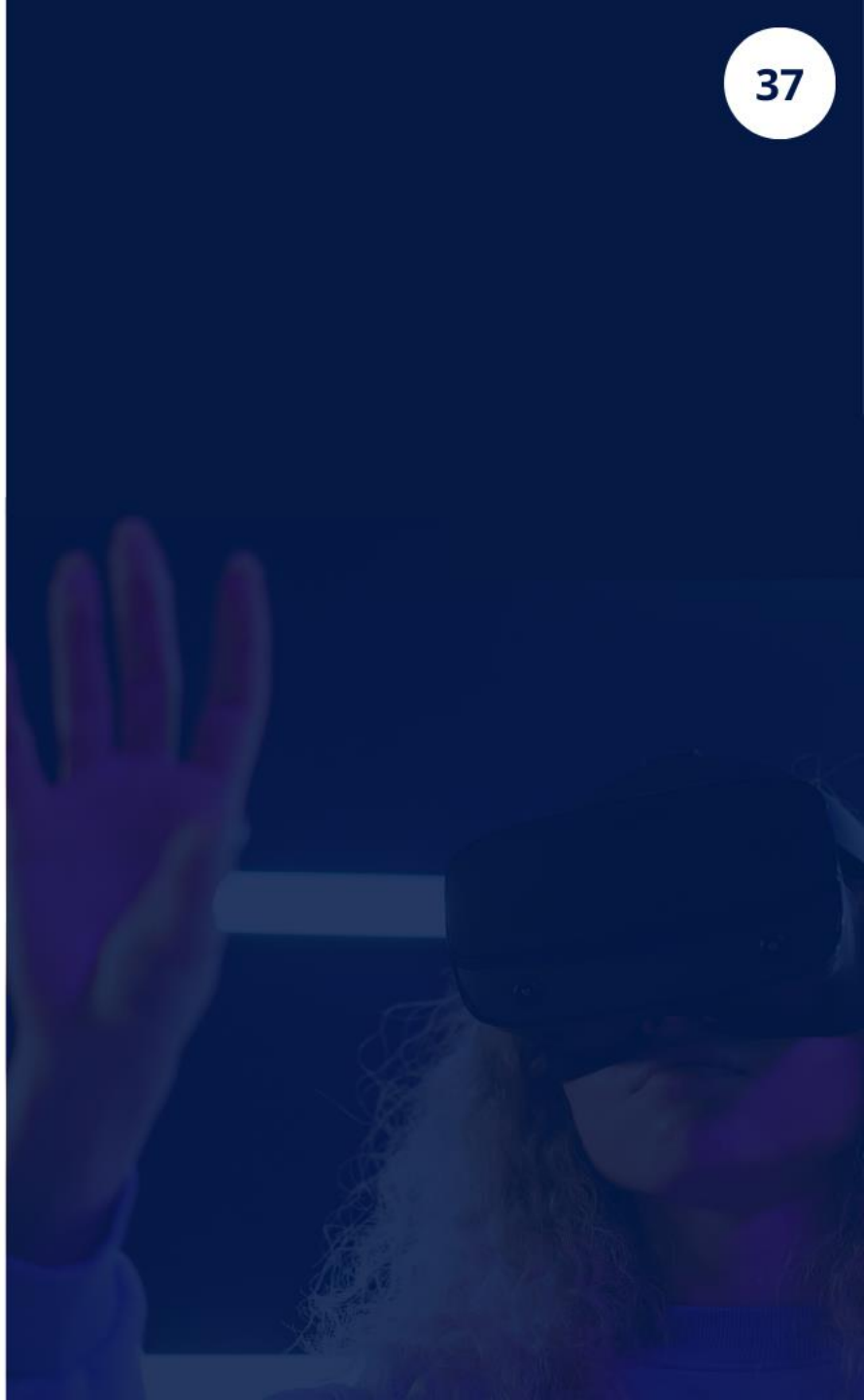
Contributions

Comparison of AR and VR

Independent ways to achieve the same results

Combination of expectation confirmation theory & grounded cognition

Post-purchase insights are lacking



Limitations and future research

Lab experiments

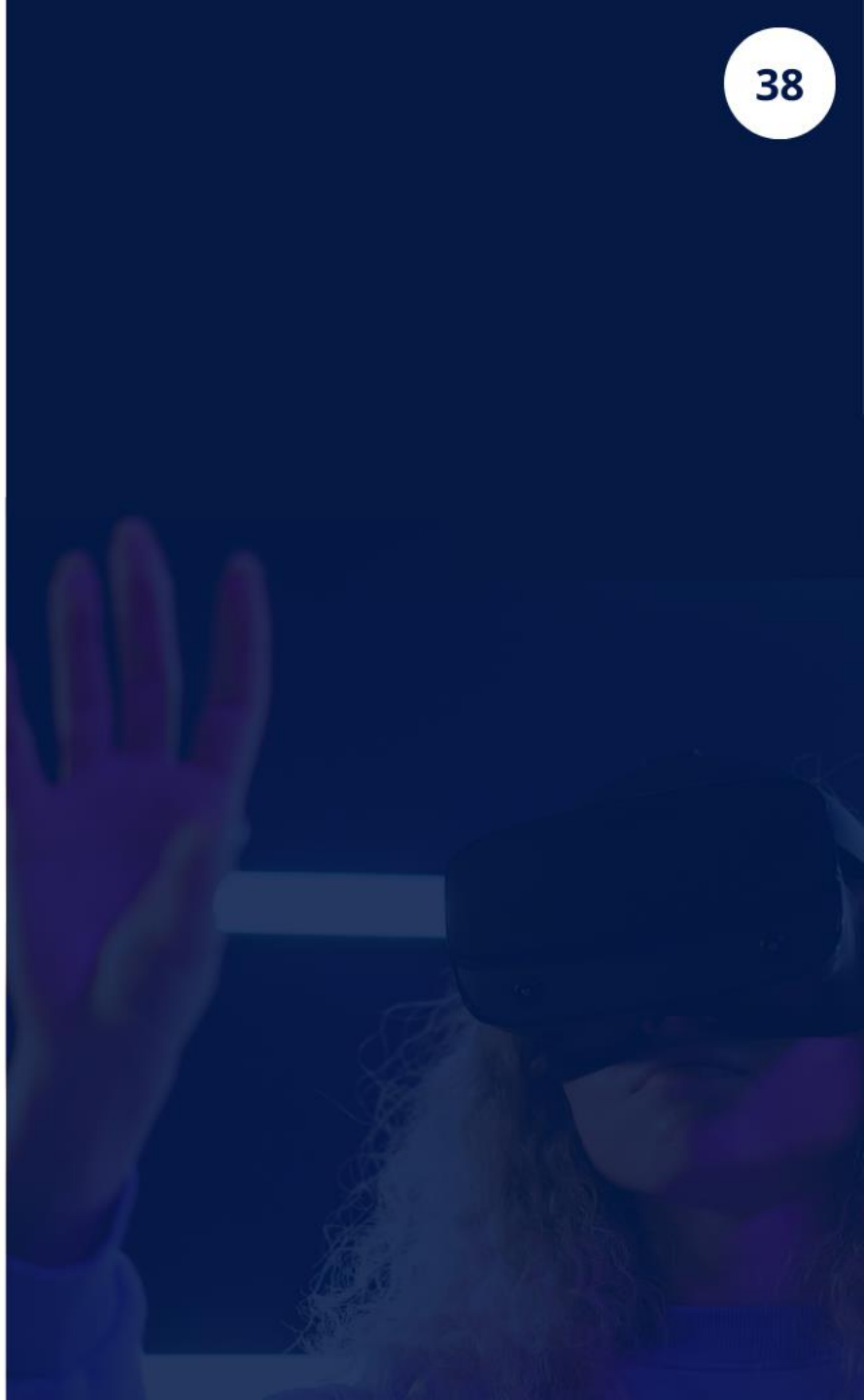
Replication in different contexts

No anticipation effects

Allowing time between pre-purchase & post-purchase

(In)congruence of delivered product

Allowing negative disconfirmation to happen



QUESTIONS?
FEEDBACK?

Maaike Ven
maaike.ven@uhasselt.be

UHASSELT

VUB VRIJE UNIVERSITEIT BRUSSEL

DIGITAL FUTURE LAB

UHASSELT

DEPARTEMENT ECONOMIE WETENSCHAP & INNOVATIE

European Commission

Infrastructure financed by the European Union NextGenerationEU program