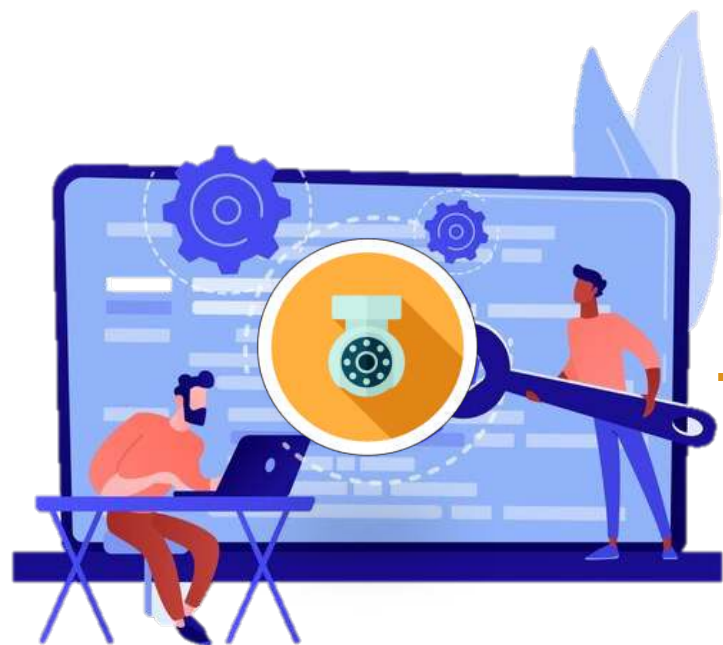


Application of behaviour change theory to the design, development and implementation of camera systems for active and assisted living

Natalie Tham
Trinity College Dublin
1st December 2023

Supervisors
Dr John Dinsmore (TCD)
Prof Anne-Marie Brady (TCD)
Prof Martina Ziefle (RWTH Aachen)

- Camera-based AAL is theoretically interesting but practically complex



Camera-based AAL technologies
in-development

Non-acceptance

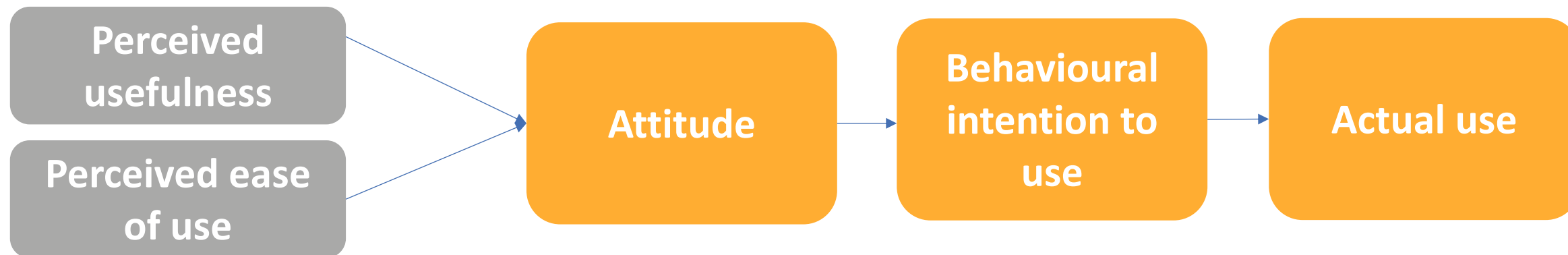
ESR 8



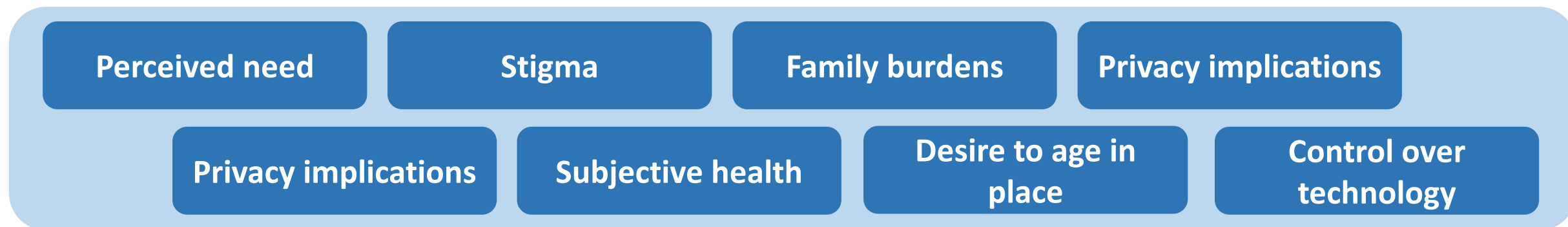
Camera-based AAL technologies
in-use

How does my research contribute?

- Current understanding of acceptance focused on **pragmatic factors** à la the Technology Acceptance Model¹



- Neglects other potentially (more) important environmental, social, psychological determinants²



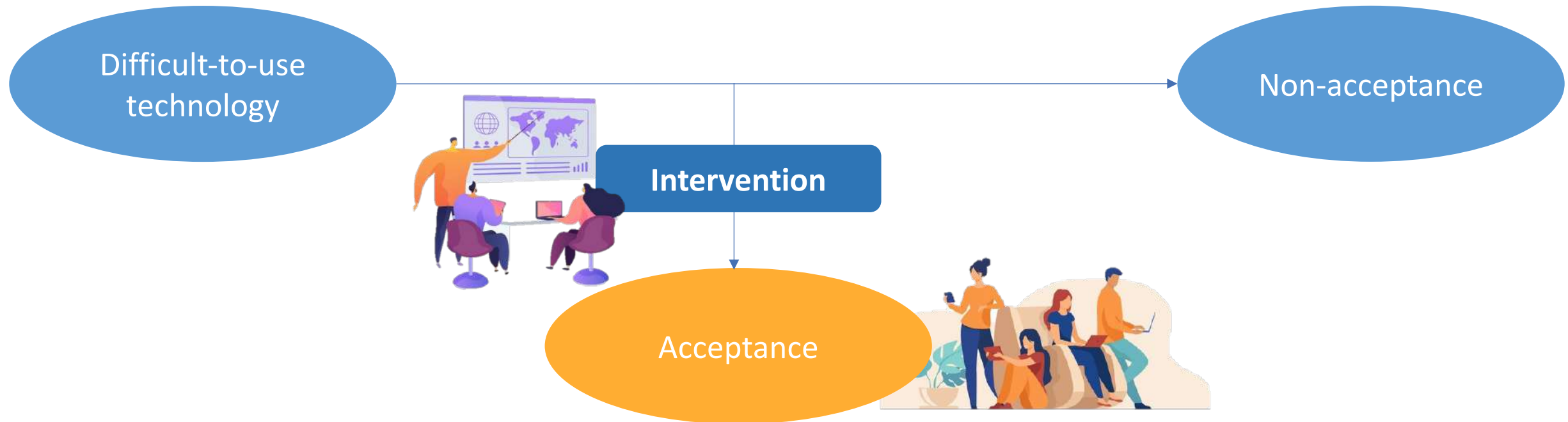
- Leveraging both pragmatic and psychological determinants may be important to promote acceptance

To use **behaviour change theory** to understand how best to facilitate older adults' **acceptance** of camera-based AAL technologies, and to locate, understand, and empirically validate **mechanisms of action** through which **interventions** can enhance said acceptance

The Experimental Medicine Approach to Behaviour Change

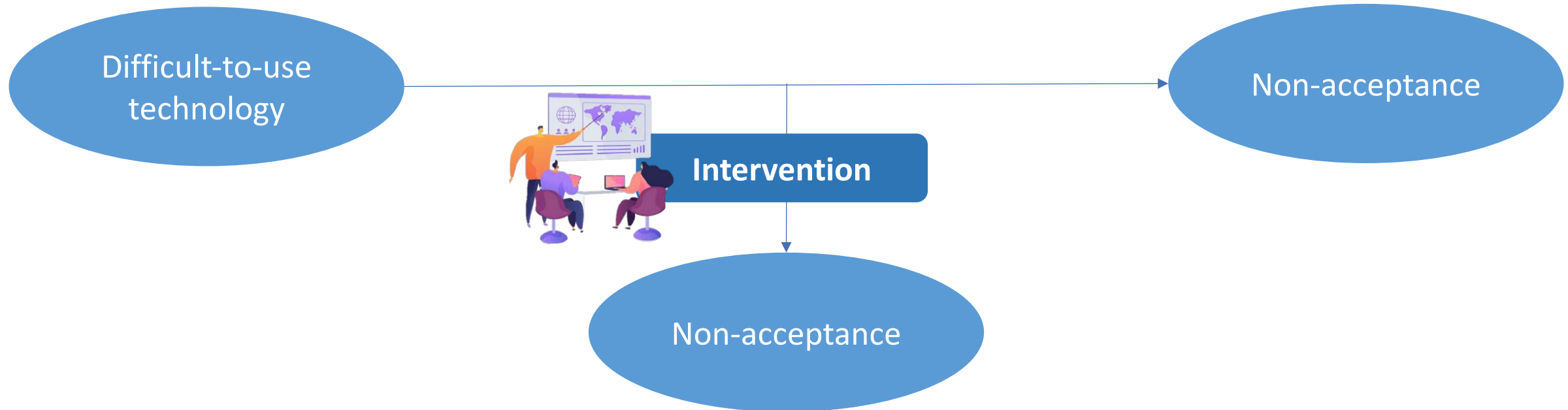
- Knowledge on **theoretical change mechanisms** is essential to intervening on behaviour effectively and efficiently³⁻⁴

An **atheoretical, non-experimental** approach to behaviour change



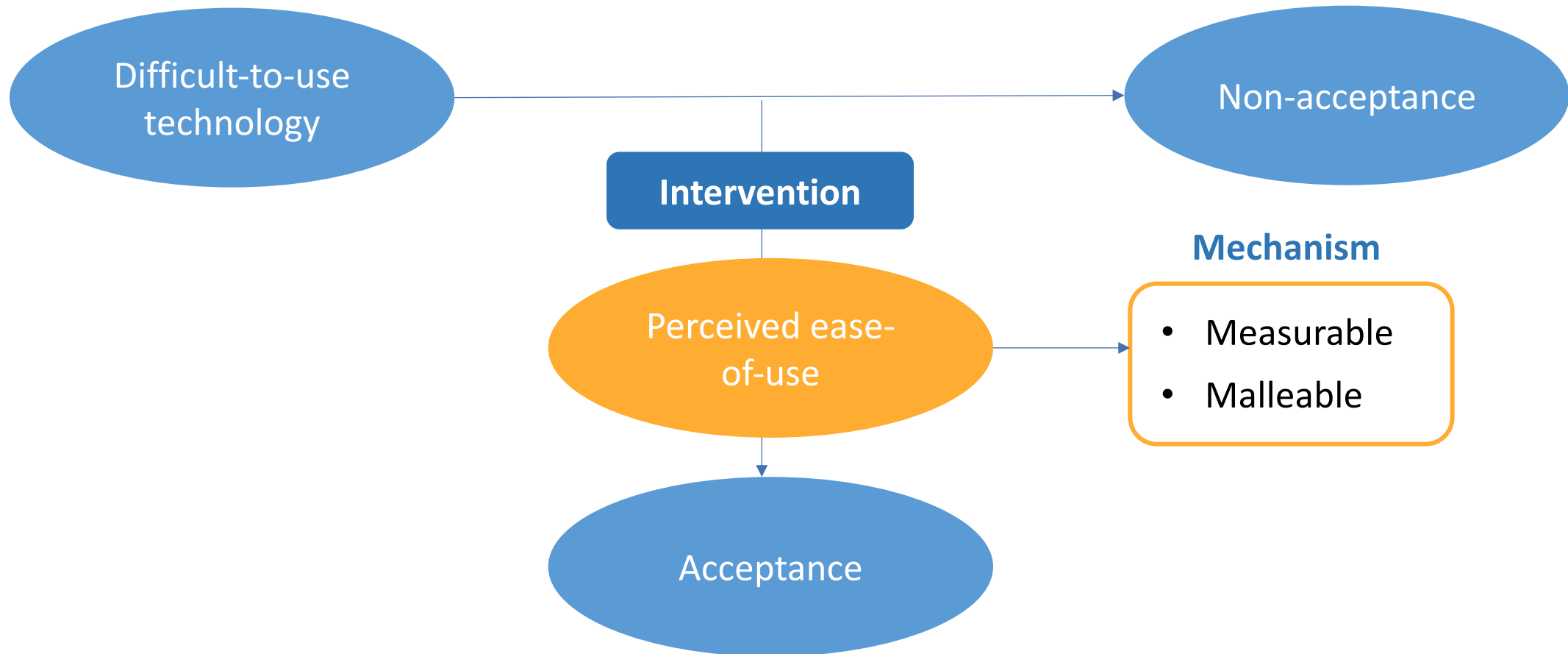
- The effectiveness question:** Does an upskilling intervention increase technology acceptance?

An **atheoretical, non-experimental** approach to behaviour change

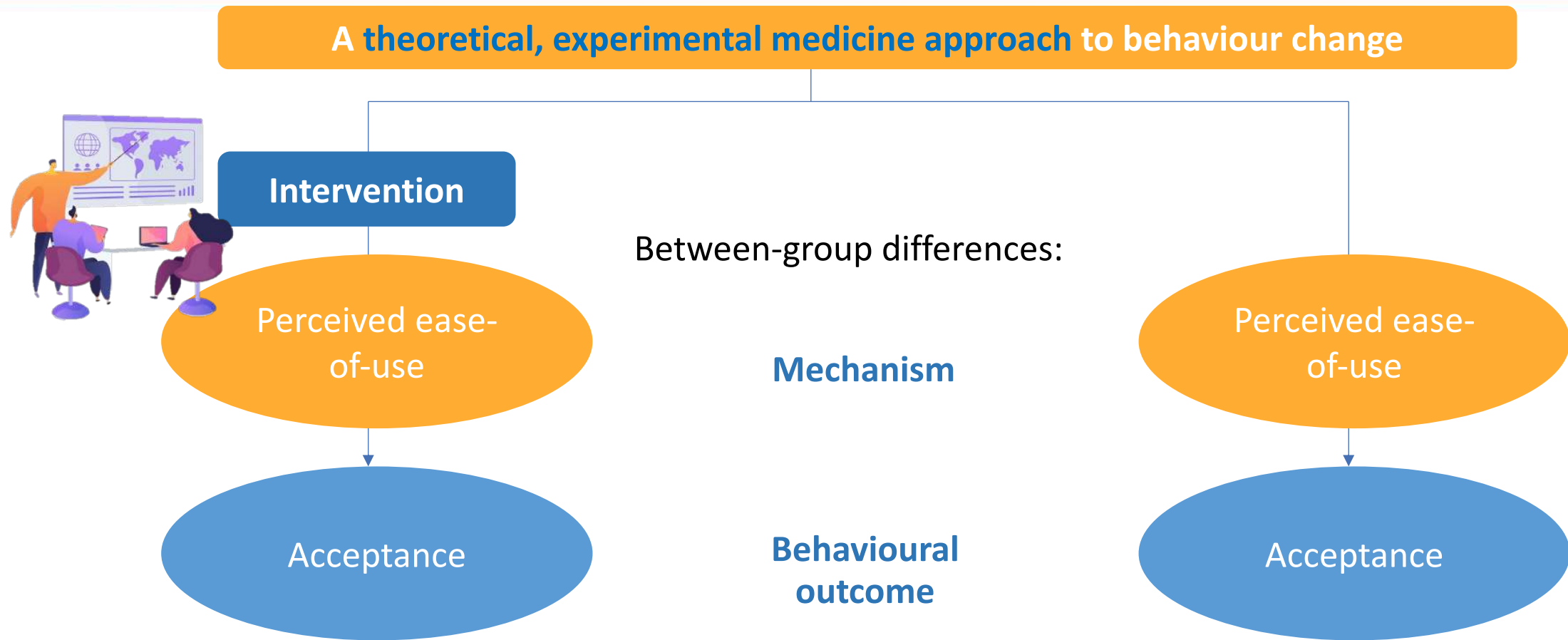


- Many plausible explanations for intervention's ineffectiveness:
 - Wrong mechanism targeted
 - └─> Other potential targets e.g. cost, perceived usefulness, privacy concerns, etc.
 - Intervention did not successfully manipulate mechanism (i.e., ease-of-use)
- The **effectiveness** question is insufficient

A **theoretical, experimental medicine approach** to behaviour change

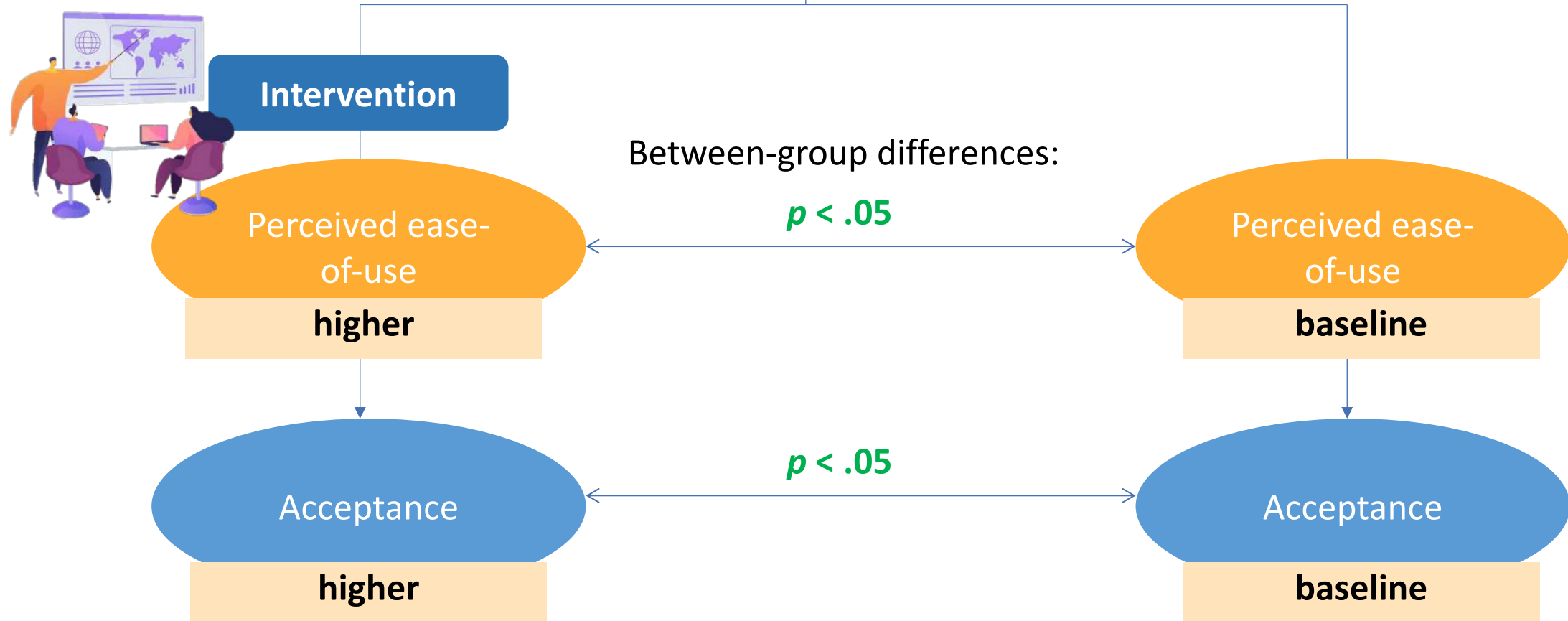


- The **mechanism** question: How does an upskilling intervention increase technology acceptance?



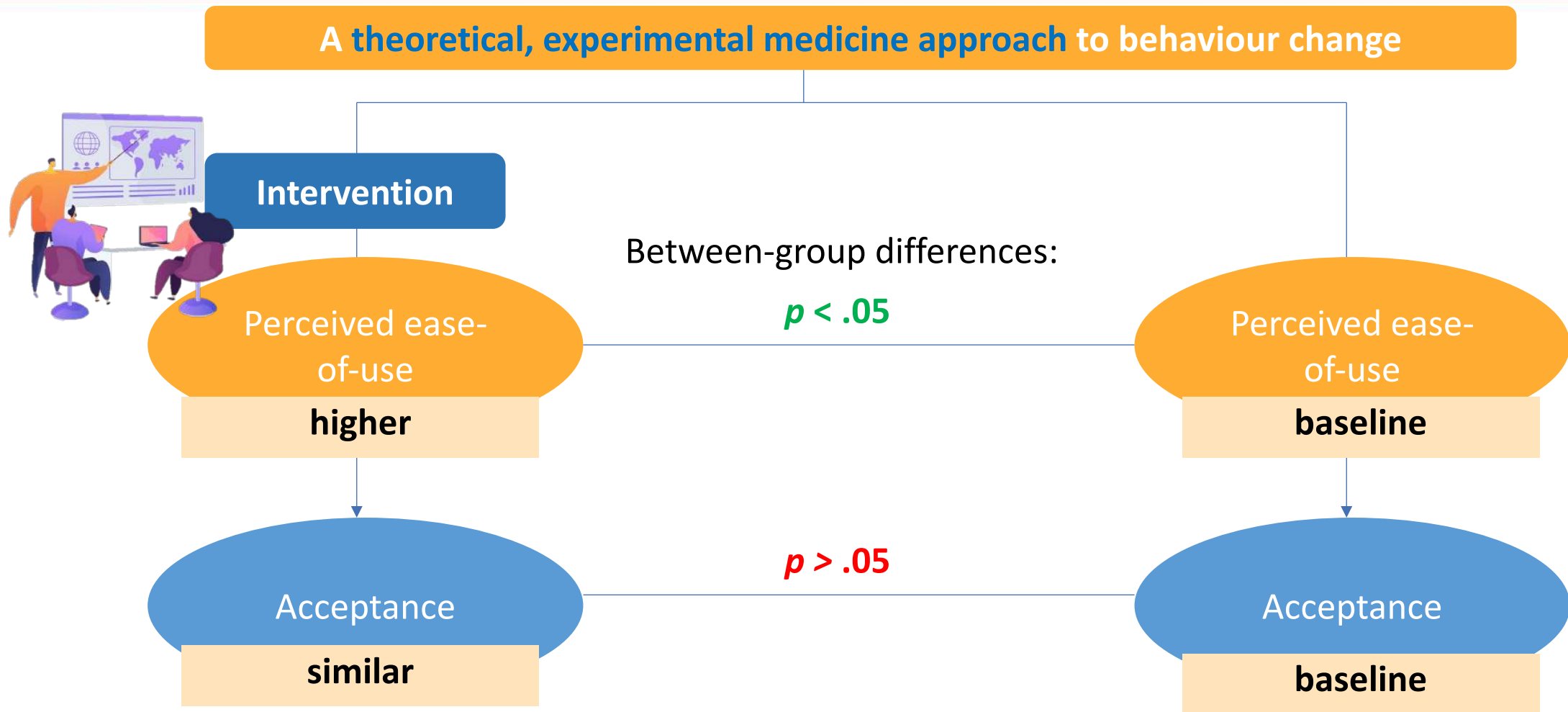
- Tests of behavioural outcomes *and* change mechanisms enables conclusions about **why** an intervention did/did not work

A **theoretical, experimental medicine approach** to behaviour change



- The **mechanism question**: How does an upskilling intervention increase technology acceptance?

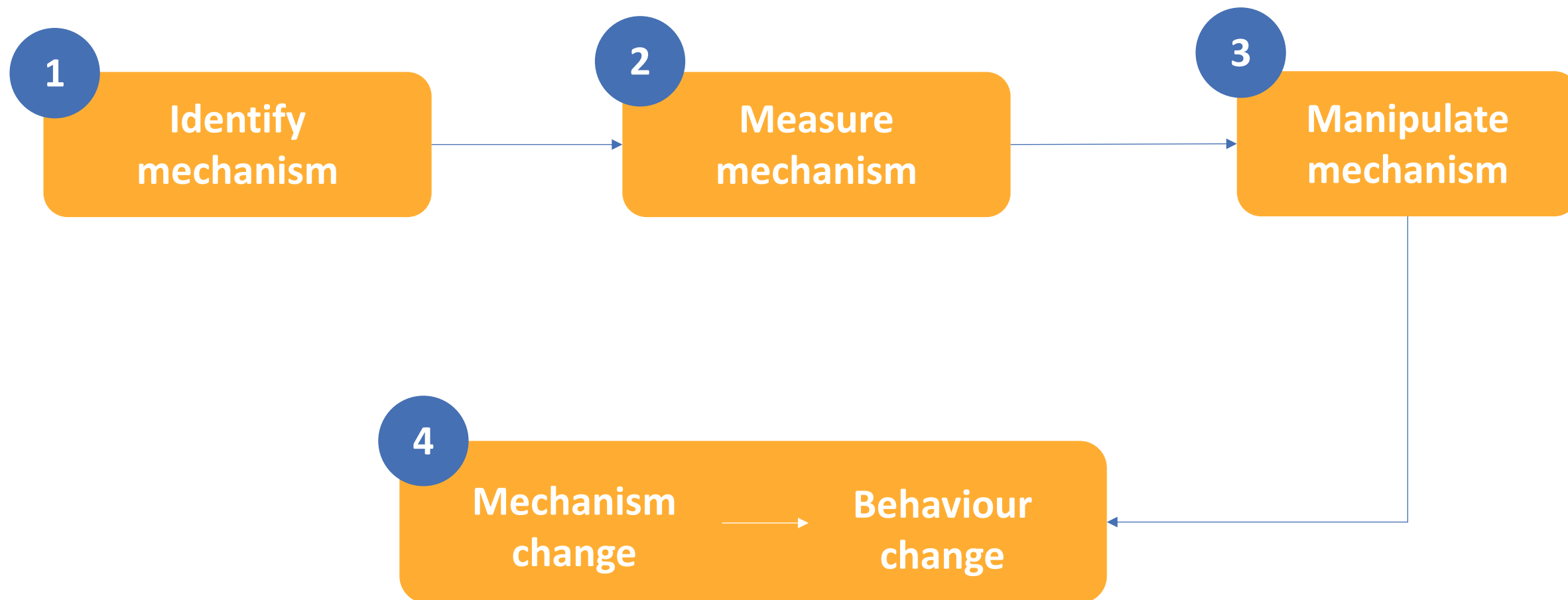
By increasing ease-of-use perceptions

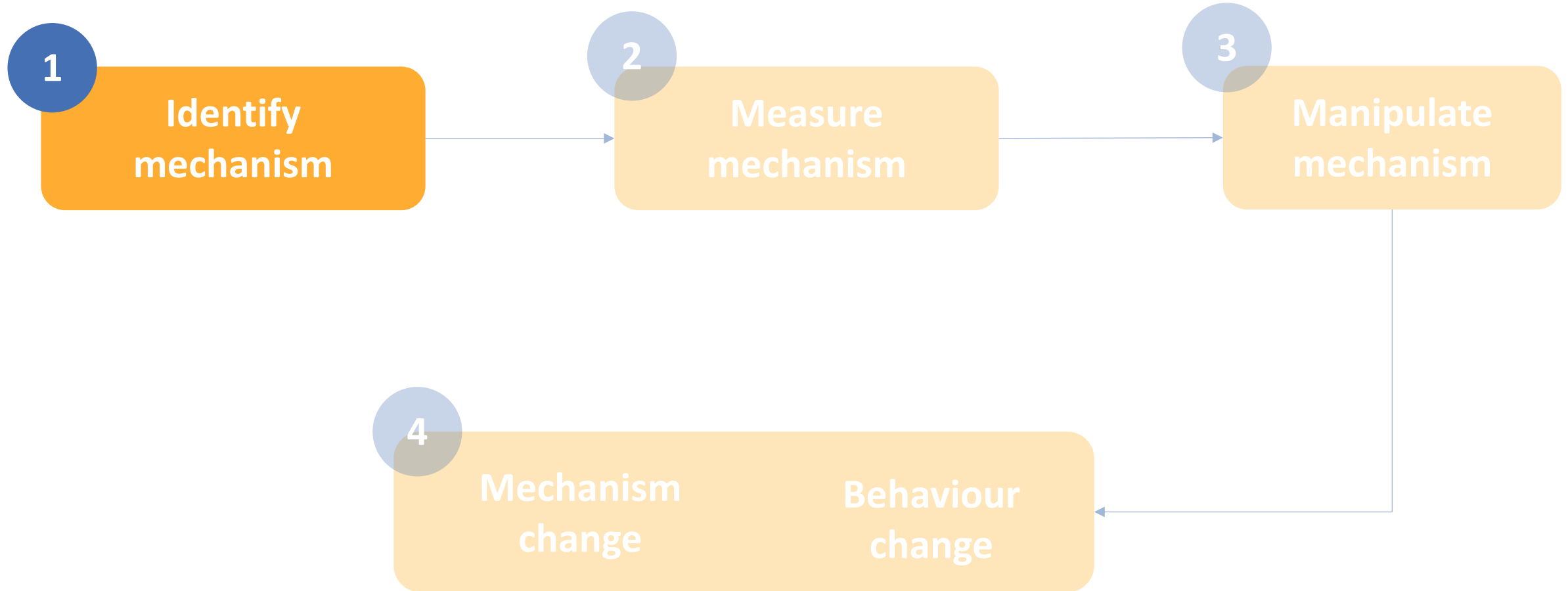


- The **mechanism question**: How does an upskilling intervention increase technology acceptance?

→ **Not by** increasing ease-of-use perceptions

An
**experimental medicine
approach**
to increasing older adults'
acceptance of camera-
based AAL technologies





Study 1: Identifying candidate mechanism

13

Natalie Tham

1

Identify
mechanism

A **scoping review** of the **barriers and facilitators** to older adults' **acceptance** of camera-based AAL technologies

RQ1

What are the **barriers and facilitators** to older adults' acceptance of camera-based AAL technologies?

Perceived lack of
current need

"I don't need this now, but
perhaps at a later point."

"I can't really see at this
point [but] possibly in the
future"

**Future self-
continuity**

similarity, vividness, positivity

**Candidate mechanism
underpinning acceptance**

Self-other
distinction in
perceived need

"I don't need this [but] I have
friends who'd benefit from
this a great deal."

"Thinking of other people, I think it is
marvellous."

If individuals consider their future selves as different people, they may have no more reason to reward the future self than to give resources to strangers⁵



Present self

Privacy violations

Stigma

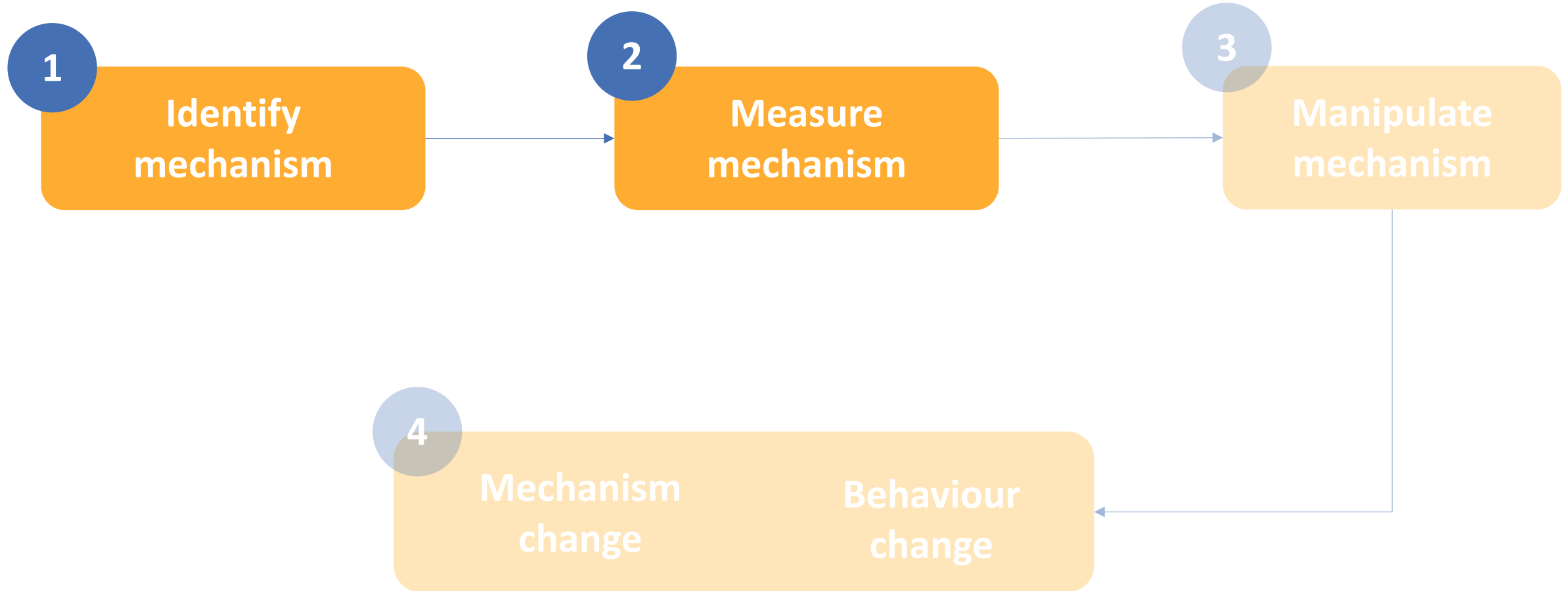
Monetary cost

“

Increased wellbeing
& longevity



Future self



2

Measure
mechanism

A **cross-sectional study** of the association between future self-continuity and acceptance

RQ2

What is the association between **future self-continuity** and older adults' **acceptance** of camera-based AAL technologies?

- n = 183 participants with valid responses ($M_{\text{age}} = 64.2$; range 60 – 87, 51.9% male)

Future self

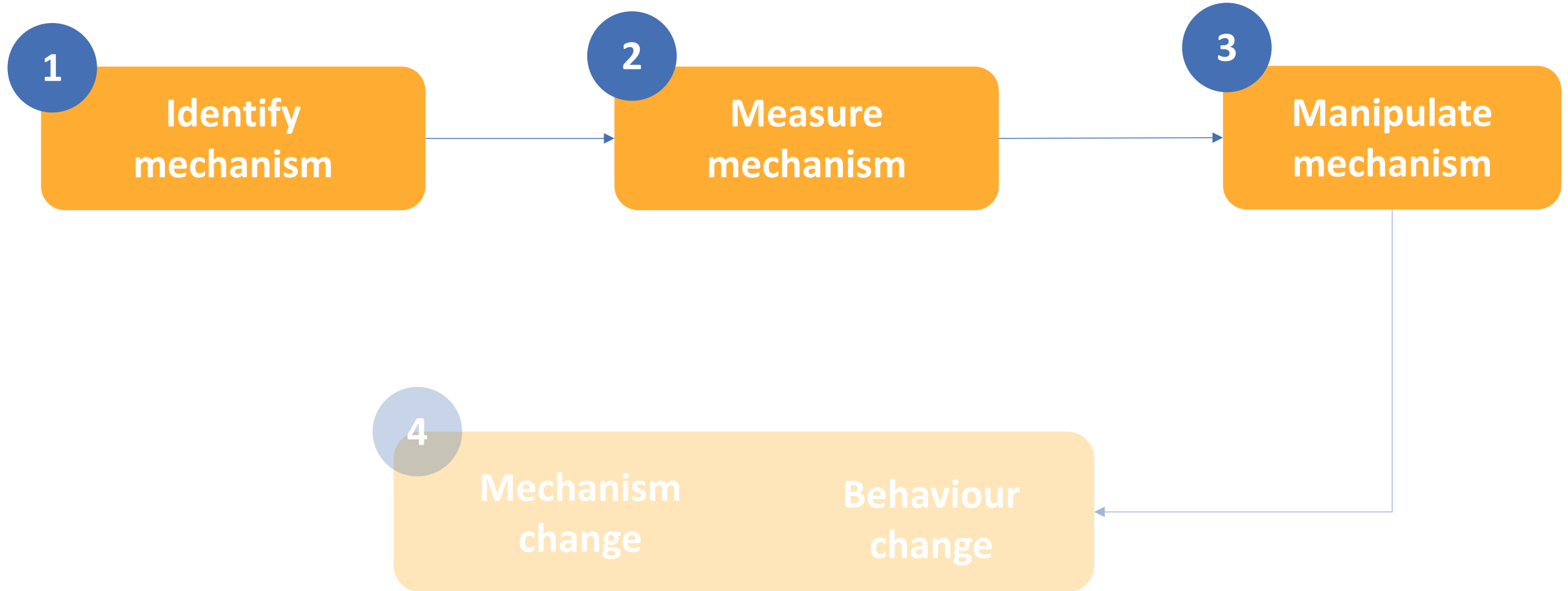
Lower acceptance

Greater acceptance

Lower acceptance

Greater acceptance

- More **vivid** or **positive** future-self impressions increased odds of acceptance by 3-fold
- Increasing future-self vividness and/or positivity may increase acceptance



Study 3: Developing a future-self intervention

3

Manipulate
mechanism

Developing and optimising “**future-self intervention**” designed to increase older adults’ continuity to their future selves

Original Shah et al. (2022) future-self intervention

Future-self questions

Where would you like to live in the future?

Why there?

Who would you like to spend more time with in the future?

Future-self story

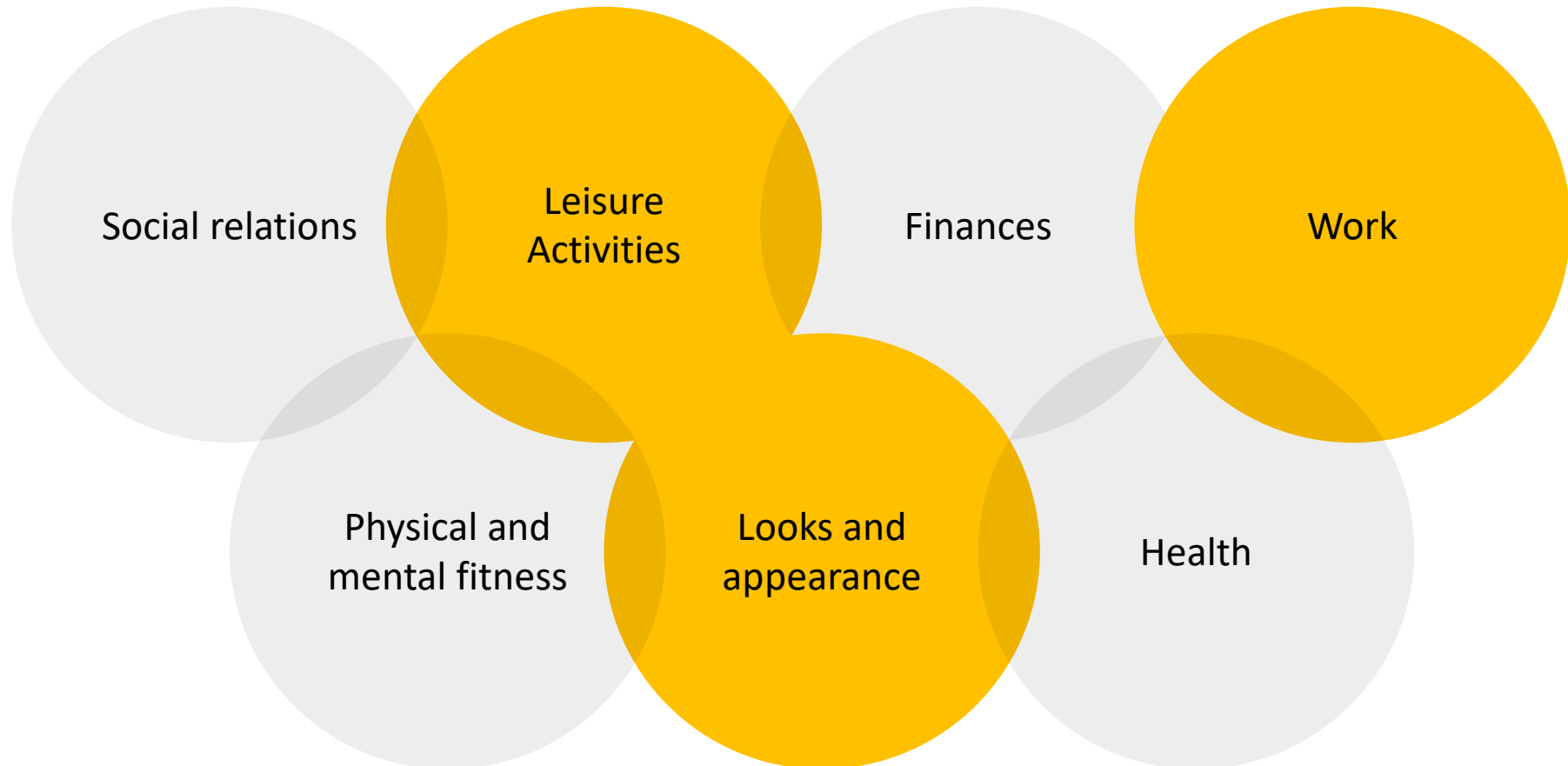
When I get older, I would like to live **in the mountains** because **I like to ski**.

I also would like to spend more time with my **friend, Jessica**.

- Increased retirement savings behaviour among working age adults⁶
- Requires adaptation to the **older adult** and **AAL** context

Adapting a future-self intervention for older adults

- Question-and-story adapted with reference to literature on **future-self-views** among **older adults**⁵⁻⁶
- **7 life domains** deemed important by older adults



Adapted future-self intervention

What is your first name?



Optimising the future-self intervention



- Semi-structured interviews at DkIT with $n = 7$ older adults ($M_{\text{age}} = 71.7$ years, 57.1% male)
- Experience, likes/dislikes, **acceptability, relevance, usability**, recommendations for improvement
- Iterative modifications (e.g., wording, response options) until no further changes required

“It was good, because **it was simple**. People who wouldn't be as [good] as me with tablet usage- they'd still be able to do it fine.”

– P1

“**Very easy to understand**. Some of them not so easy to answer. You just have to, as I say, **the challenge; Think**. that's why I don't like box ticking exercises.”

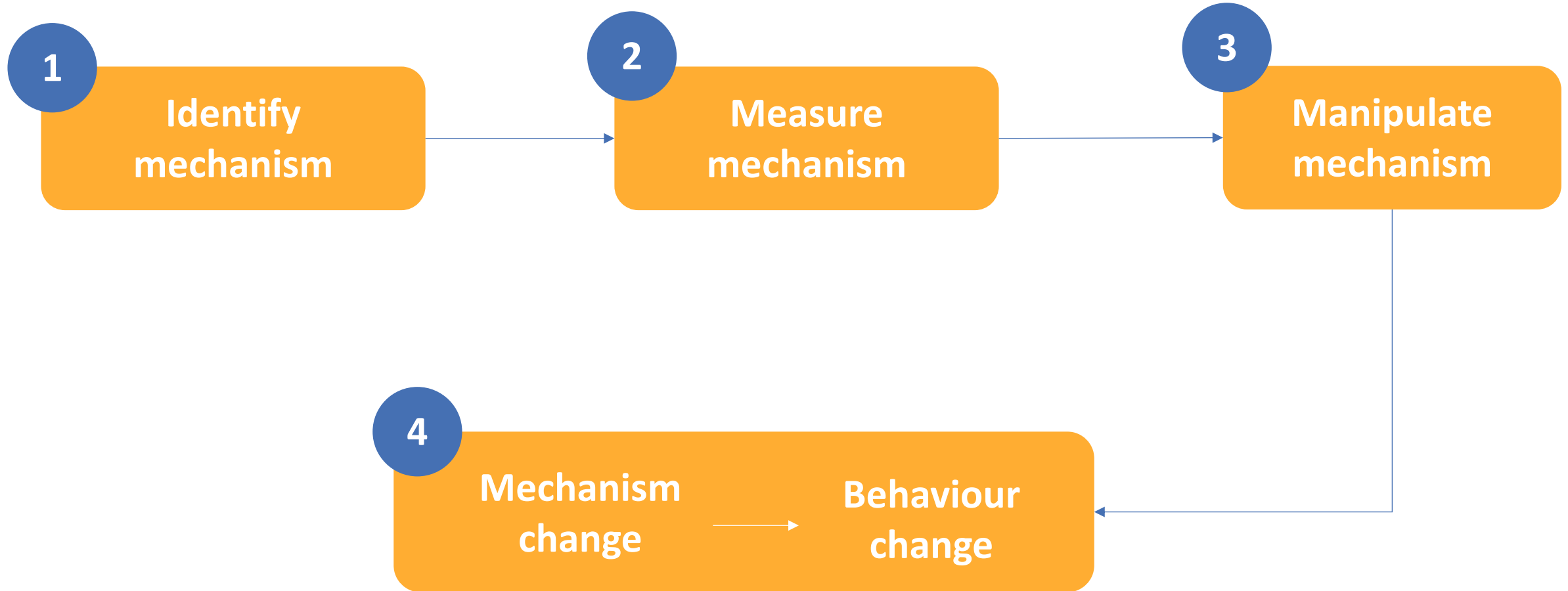
– P2

“I was **allowed to tell my own story**, and I like that.”

– P2

“It was concise, and **it hit on [...] the things that would be in your head at times about growing older.**”

– P4



Study 4: Testing effectiveness of a future-self intervention

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Natalie Tham

4

Mechanism
change



Behaviour
change

A **randomised controlled** investigation of the effect of a “**future-self intervention**” on acceptance

RQ3

Does a “future-self intervention” increase older adults’ acceptance of camera-based AAL technologies, and if so, how?

Participants

- Older adults aged 60-80, living at home
- Amazon MTurk / Prolific Academic

Informed consent

Demographics

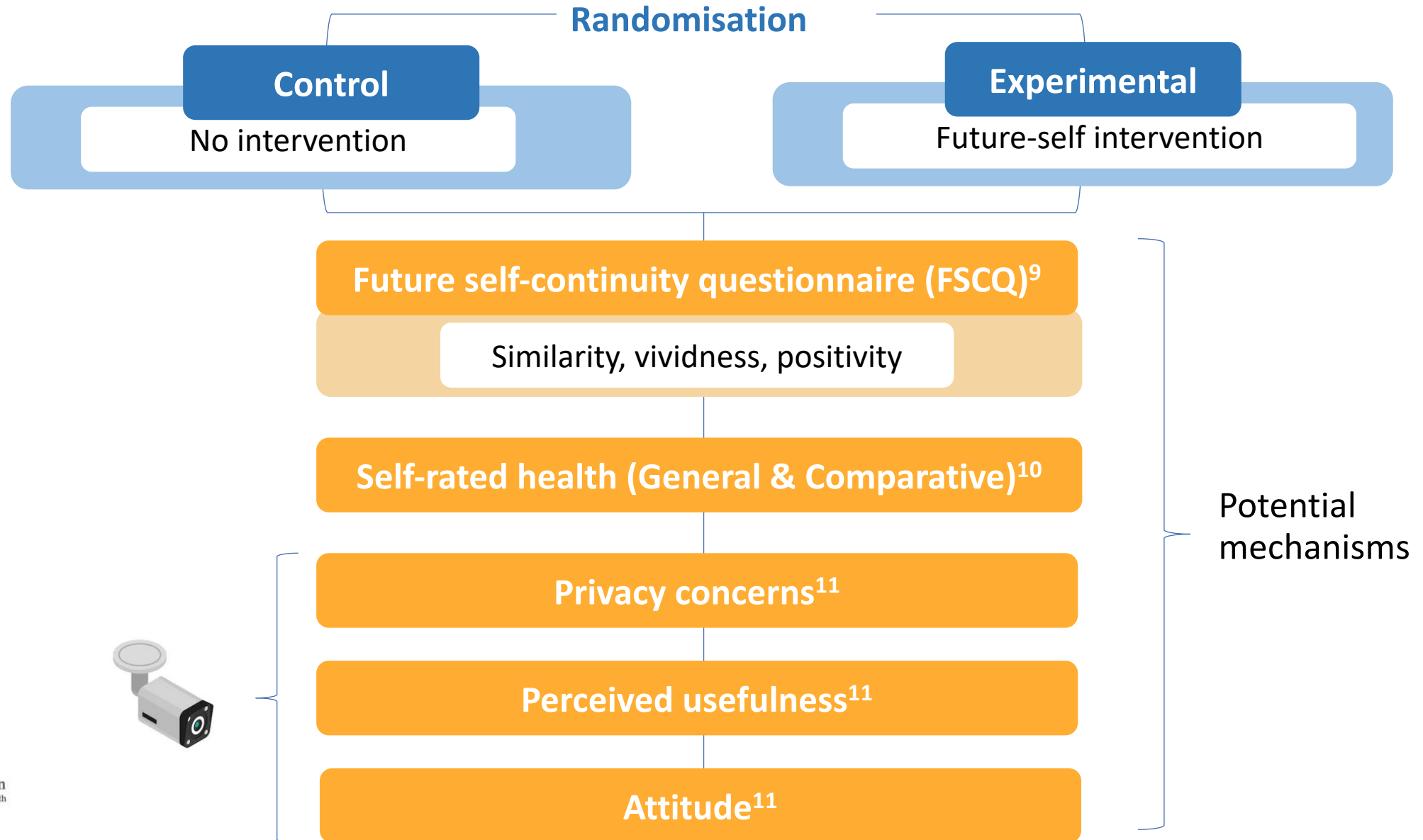
Randomisation

Control

No intervention

Experimental

Future-self intervention



Acceptance

Now, please think about your own willingness to use camera-based home monitoring technologies **in the near future (e.g., within the next 6 months)**.

4 items e.g., “Assuming I had access to camera-based AAL technologies, I intend to use it.”¹²
(1 = strongly disagree; 7 = strongly agree)

Reasons for (non-)acceptance

Can you explain, in your own words, why you are [not accepting / moderately accepting / strongly accepting] of camera-based home monitoring technologies?

to parse (unmeasured) barriers to acceptance

Study 4: Preliminary results

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Natalie Tham

Descriptive statistics

n = 181 participants with valid responses ($M_{\text{age}} = 65.4$, range 60 – 80, 54.7% female)

Bivariate correlations

FSCQ-Vividness	Perceived usefulness	Privacy concerns	Attitude	Acceptance
FSCQ-Vividness	.027	.045	.141	.154*
Perceived usefulness		-.404**	.712**	.593**
Privacy concerns			-.508**	-.489**
Attitude				.811**

Note: * $p < .05$ and ** $p < .001$ indicate statistical significance

Consistent with
cross-sectional study

Consistent with literature

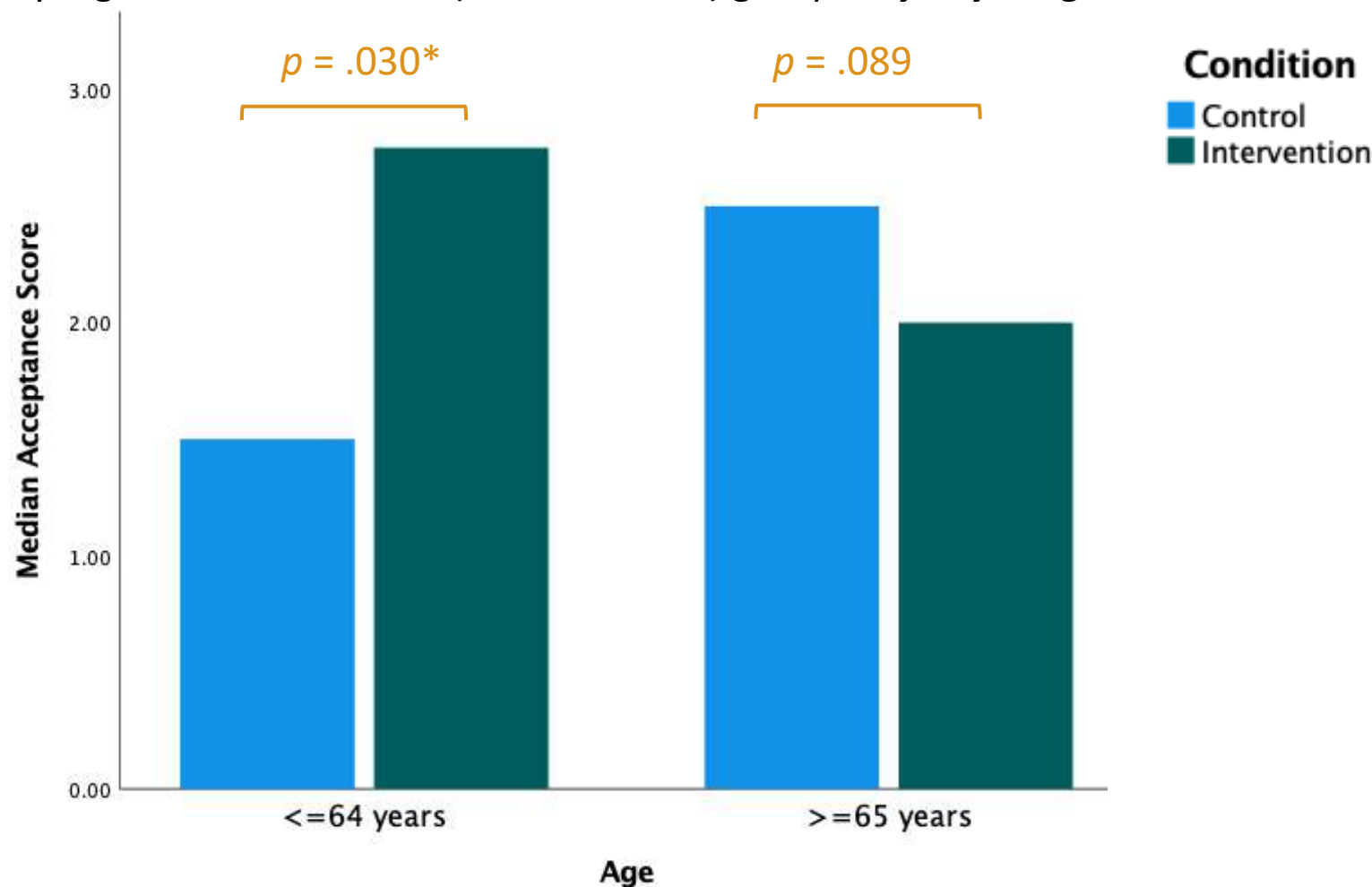
Study 4: Preliminary results

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Moderation analyses: Acceptance of camera-based AAL technologies

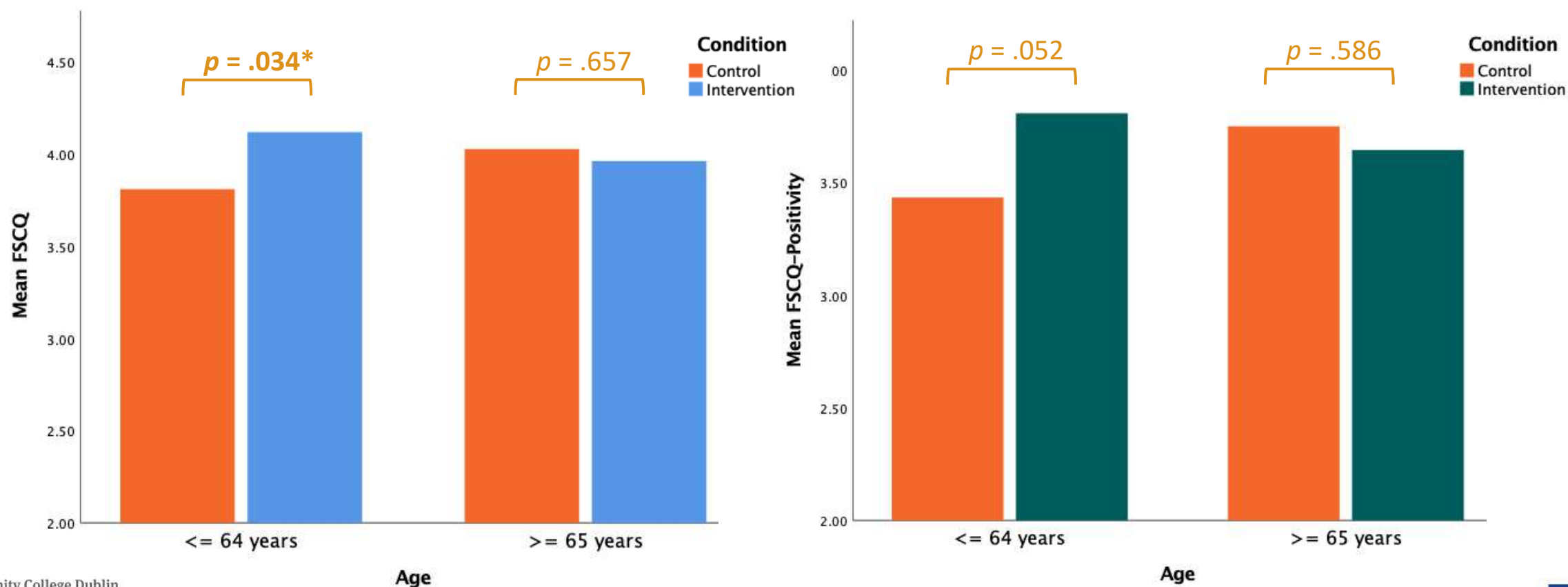
- Acceptance significantly higher in intervention (versus control) group **only in younger old**



Covariates were race (White/other), and chronic disease status (present/absent)

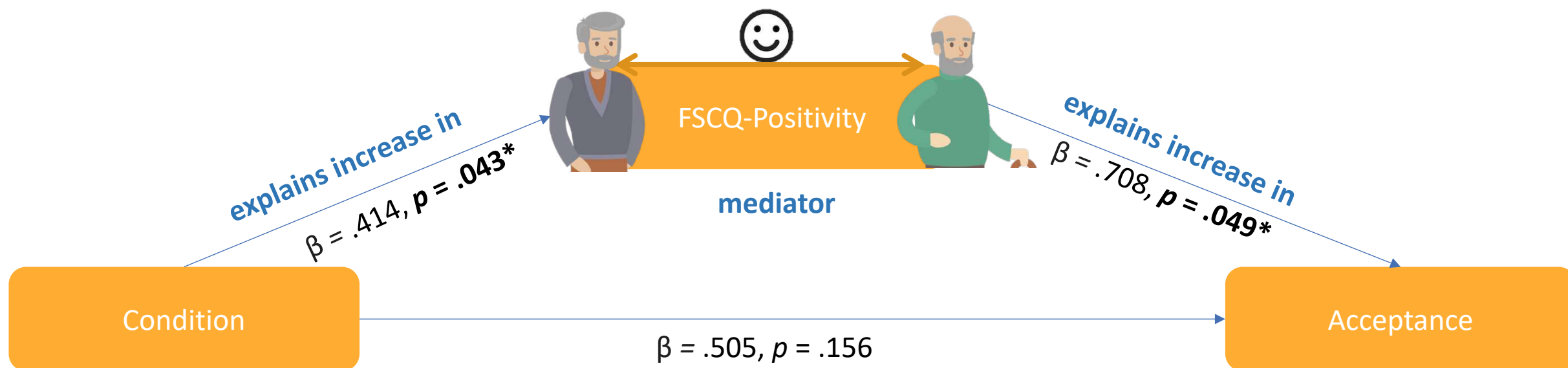
Moderation analyses: Future self-continuity

- Future self-continuity significantly higher in intervention (versus control) group **only in younger old** (≤ 64 years)



Covariates were income ($< \$35,000 / \geq \$35,000$), and chronic disease status (present/absent)

Mediation analyses



Covariates were income (<\$35,000/>=\$35,000), race (White/other), and chronic disease status (present/absent); n = 91 (aged ≤ 64 years)

- Intervention increased acceptance by increasing future-self positivity in the younger old

Study 4: Summary of preliminary results

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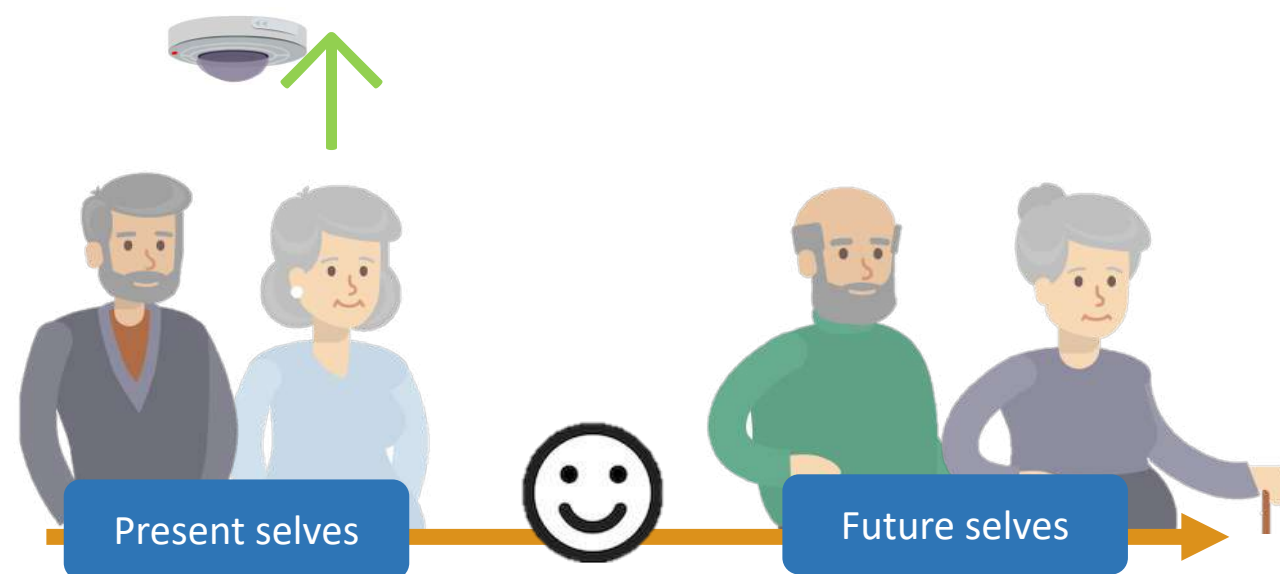
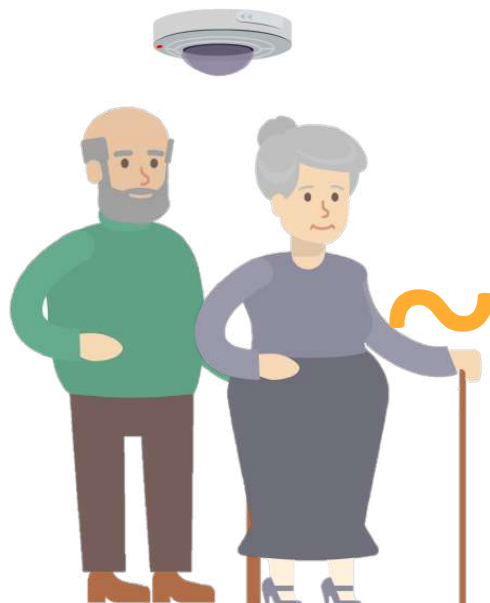
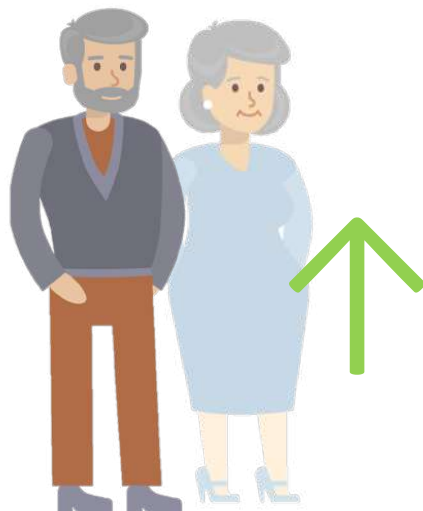
Effects of future-self intervention

Acceptance of camera-based AAL technologies

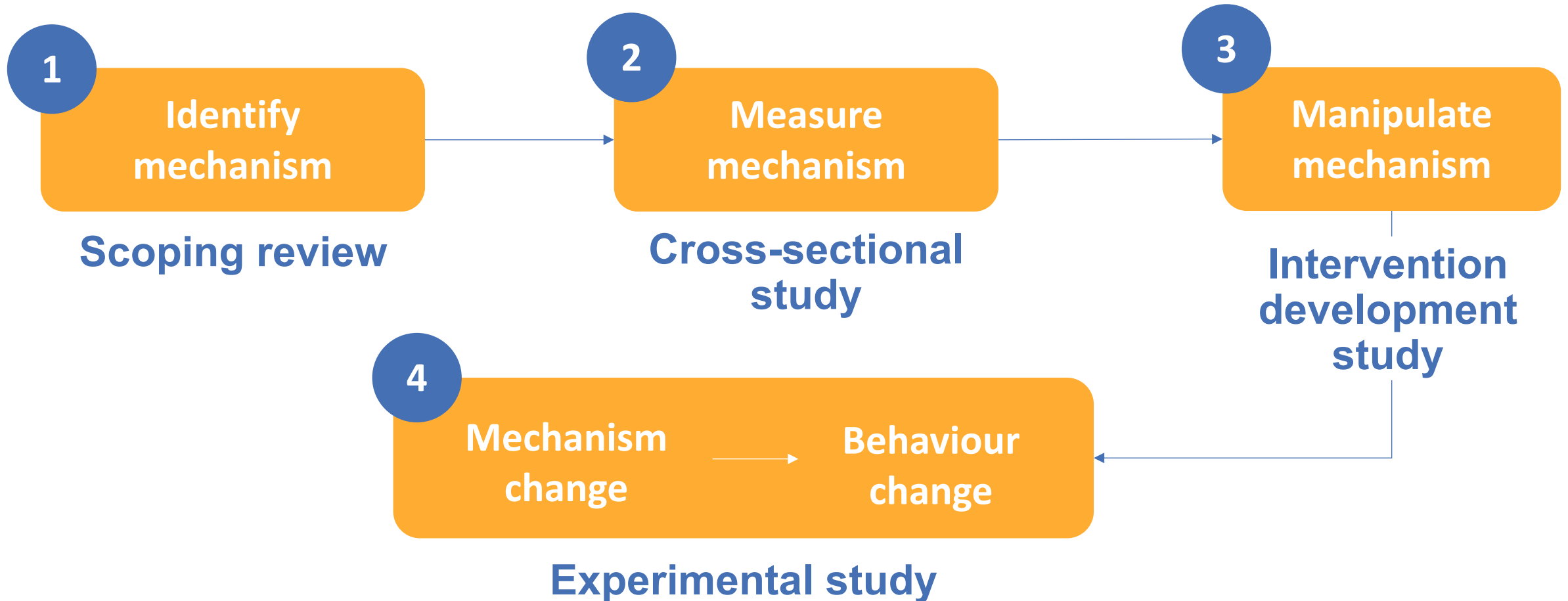
- Increased in younger old; No effect on older old
- Exploratory analyses (e.g., of qualitative data) required

Future self-continuity

- Increased in younger old; No effect on older old
- Mediation pathway (**Intervention** → **Future self-positivity** → **Acceptance**) established



An **experimental medicine approach** to increasing older adults' **acceptance** of camera-based AAL technologies



Exploring other potential future-self interventions

Why?

What is
out
there?

What
then?



Lower acceptance



Greater acceptance

- Vividness interventions may benefit acceptance at the whole group level



- Existing vividness interventions¹³ are sparse, resource intensive and impractical

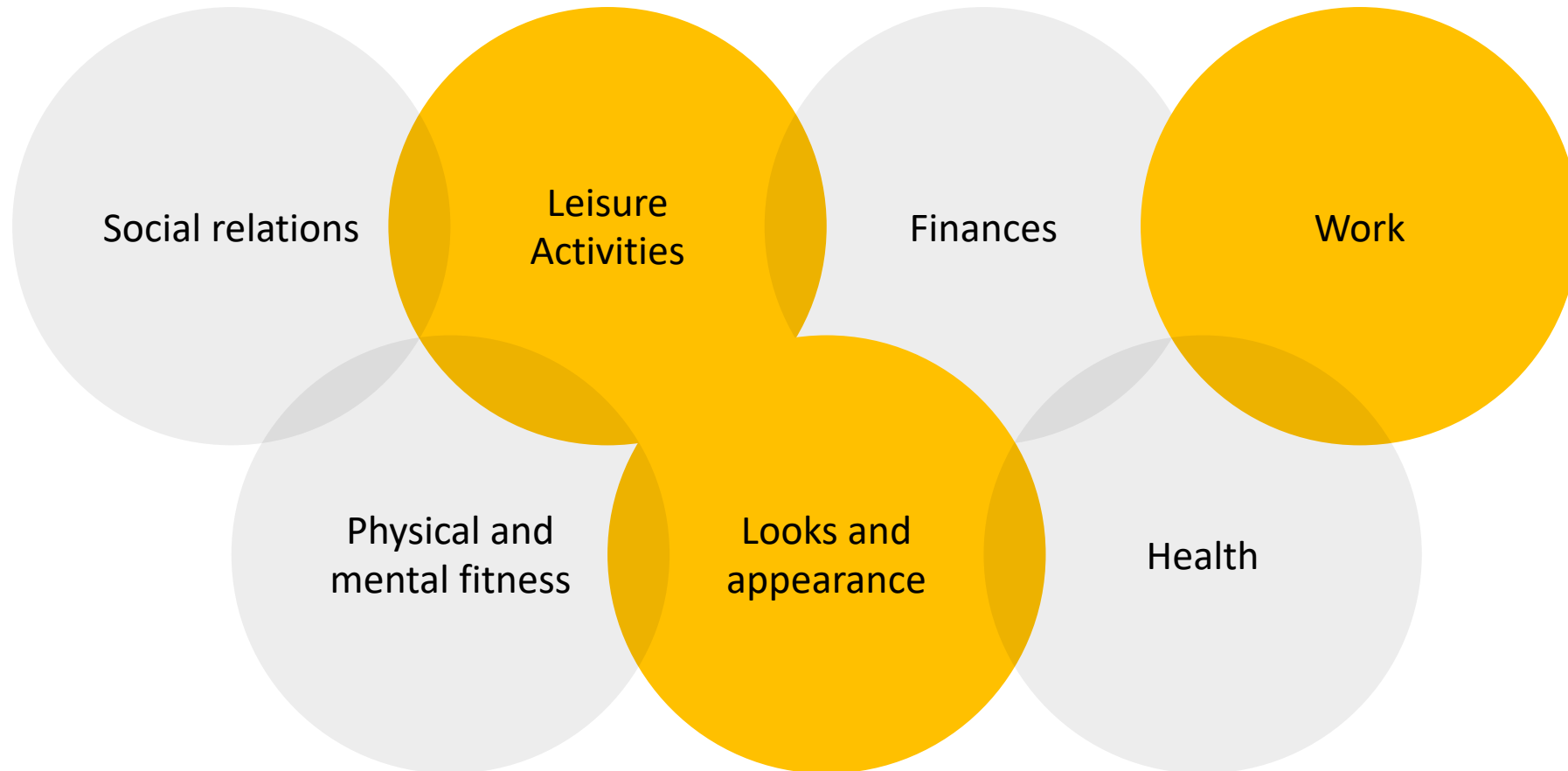
When I get older, I would like to live in the mountains because I like to ski.

I also would like to spend more time with my friend, Jessica.

- Need for light-touch, practical, scalable interventions

Exploring potential future-self intervention

- **7 life domains** feature in older adults' future-self thinking⁷
- Brief scale developed to measure future self-views among older adults

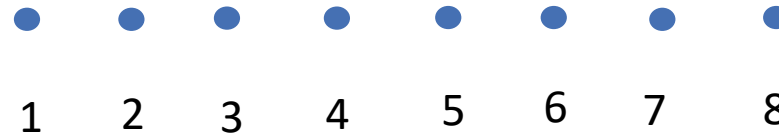


Exploring potential future-self intervention

Kornadt et al.¹⁴ Brief Domain-Specific Future Selves Scale

Social relations

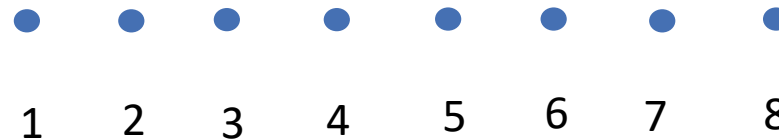
“When I am older, I
will be **lonely and
alone**”



“When I am older, I will be
**secure and interpersonally
connected**”

Leisure
Activities

“When I am older, I will
have **little drive and
opportunities** to
participate in leisure and
volunteer activities”

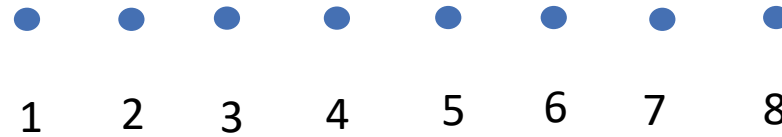


“When I am older, I will have
**a lot of drive and many
opportunities** to participate
in leisure and volunteer
activities”

Exploring potential future-self intervention

Looks and
appearance

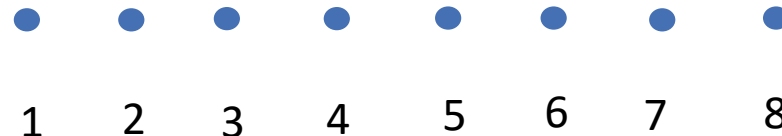
“When I am older, I will
have an **unattractive
appearance**”



“When I am older, I will
have an **attractive
appearance**”

Health

“When I am older, I will
be **severely limited** in my
daily routine by health
problems”



“When I am older, I will **not
be limited** in my daily
routine by health problems”

- Completing scale may prompt future-self contemplation and increase future self-continuity

Study 4: Testing effectiveness of future-self intervention

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Natalie Tham

4

Mechanism
change



Behaviour
change

A **randomised controlled** investigation of the effect of answering a brief future self-views scale on acceptance

RQ4

Can answering a brief future self-views scale increase acceptance of camera-based AAL technologies, and if so, how?

Participants

- Older adults aged 60-80, living at home
- Amazon MTurk / Prolific Academic

Informed consent

Demographics

Randomisation

Control

No intervention

Experimental

Future-self views scale

Scoping review

Document	Targeted publication avenue	(Planned) publication date	Conference presentations
Protocol	Open Research Europe	24 th Nov 2023	
Manuscript	Computers in Human Behaviour	Spring 2024	CBC, University College London (Online; Nov 2022)

Cross-sectional study

Manuscript	Journals of Gerontology: Series B	Spring 2024	<ul style="list-style-type: none">theconf2023, TCD (Mar 2023)Society for Social Medicine and Population Health – Newcastle, UK (Sep 2023)European Public Health Conference (Nov 2023)
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Experimental study

Manuscript – Intervention development	Internet Interventions	N/A	
Manuscript - intervention	Journals of Gerontology: Series B / BMC Geriatrics	Spring 2024	

Research timeline

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Natalie Tham

		2021		2022				2023				2024	
		Jun-Aug	Sep-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun
Research focused													
Step 1	Scoping review												
Step 2	Correlational study												
Steps 3 & 4	Experimental study												
	Ethics application												
	Intervention validation												
	Data collection + analysis												
Thesis focused													
	Introduction, Literature review, Methods												
	Body												
	Conclusion												



Completed

In progress

May 2022: Submitted ethics application for correlational study

Feb 2023: Submitted ethics application for experimental study

DkIT secondment

July 2024: Submit thesis

- Post-doctoral research in (digital) behaviour change
 - Technology- and data-suffused world opens up huge recourses to change behaviour for good and at scale
- Behavioural science research institutes



Allowed to pave my own research path



Valuable opportunities for networking and research dissemination



Facilitated interdisciplinary learning



Developed research-specific and transferrable skills

e.g., TCD Postgraduate Certificate in Statistics, delivering presentations

Thank you!



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[@natalietaq](https://twitter.com/natalietaq)

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13. Shen YI, Nelson AJ, Oberlin BG. Virtual reality intervention effects on future self-continuity and delayed reward preference in substance use disorder recovery: pilot study results. *Discov Ment Heal*. 2022;2(1):1-16. doi:10.1007/S44192-022-00022-1
14. Kornadt AE, Hess TM, Rothermund K. Domain-Specific Views on Aging and Preparation for Age-Related Changes—Development and Validation of Three Brief Scales. *Journals Gerontol Ser B*. 2020;75(2):303-307. doi:10.1093/GERONB/GBY055

1. What is your first name?
2. What is one value that is important to you today? (for example, being honest, reliable, organised, etc.)
3. When you are older, will being **[value]** still be important to you? [yes/no]
4. What do you like doing in the daytime?
5. What do you like doing over the weekends?
6. Is it important to you that you can continue doing these things in the future, when you are older?
7. How would you feel if you were not able to keep doing the things that you enjoy when you are older?
8. What is the first name of one person you like spending time with?
9. What is this person's relationship to you?
10. Would you like to continue spending time with this person in the future, when you are older? [yes/no]
11. About how many hours do you work per week, if any?
12. When you are older, how many hours per week would you like to work, if any?
13. What would you like to do more of in the future when you are older?
14. Currently, you would say your health is... [poor/fair/good/very good/excellent]
15. In the future, you would want your health to be...[poor/fair/good/very good/excellent]
16. Do you have any chronic conditions now? [yes/no]
17. How would you feel if your health declined in the future?
18. In the future, do you wish to be able to help yourself and manage life well on your own? [yes/no]
19. How would you feel if you had to depend on others for help in the future?
20. Do you think that there is a risk that you could experience a fall in the future, when you are older? [yes/no]

21. In the future, where would you want to live?

- In my own home
- With my adult child/children
- In an assisted living facility or continuing care residence
- In a nursing home

22. Why there?

23. How would you feel if you lived in a nursing home in the future?

24. How would you feel if you remained living at home in the future?

25. Is it important to you that you can continue living at home in the future? [yes/no]

26. Do you think there is a risk that you might not be able to live the life that you want in the future? [yes/no]

27. Do you think you can lower this risk by taking the necessary steps today? [yes/no]

28. Currently, do you feel confident that you are on the path to achieving the future that you want? [yes/no]