Exploring the Weak Association between Flow Experience and Performance in Virtual Environments

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Is experience important in VE?

Is performance important in VE?

Flow experience

Optimal experience

Flow experience represents a highly enjoyable mental state where the individual is fully immersed and engaged in the process of the activity.

Higher level

Lower level

Flow experience

Performance

VEs and some other computer mediated environment（CME）

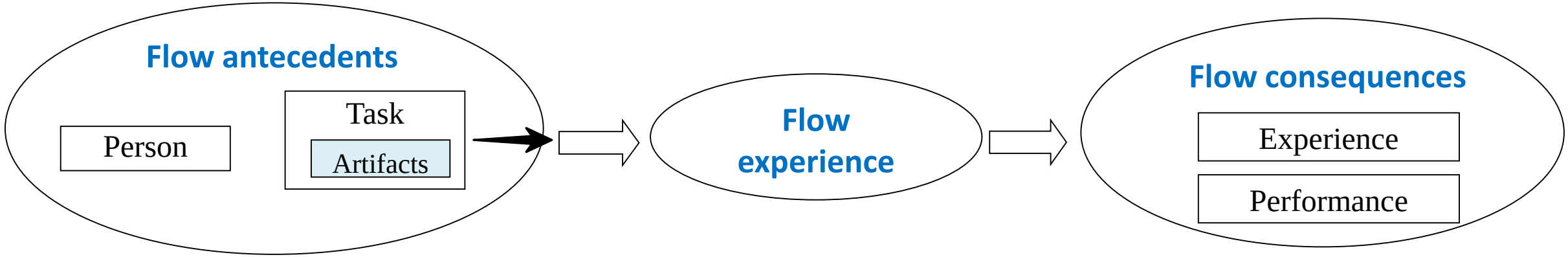
Flow experience

Performance

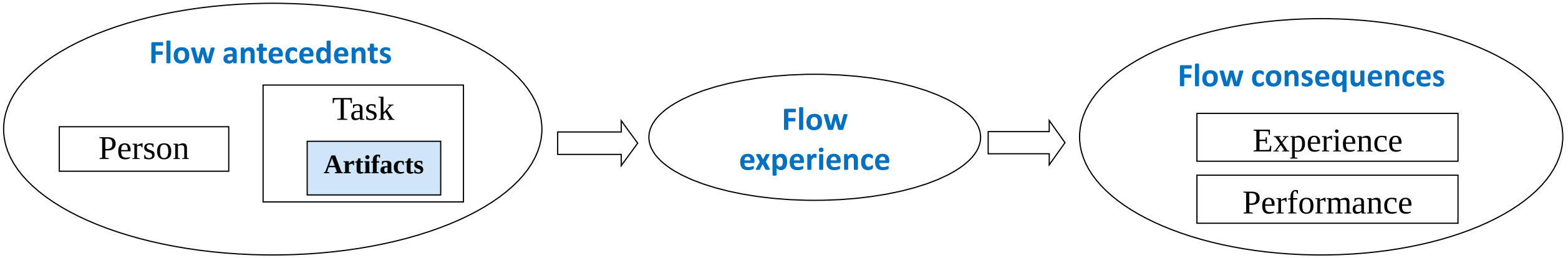
The main purpose of this study is to understand the reasons of the weak association, and to propose approaches that can alleviate the weak association problem in VE designs.

PART 01

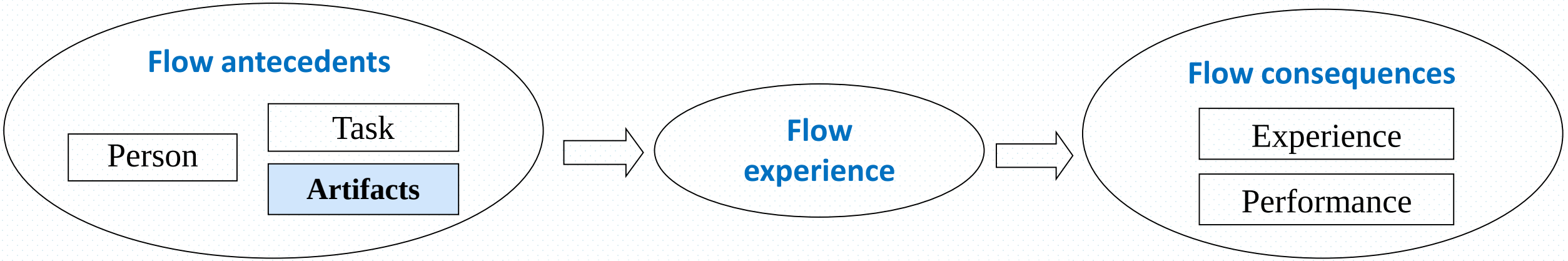
Building Theoretical Model



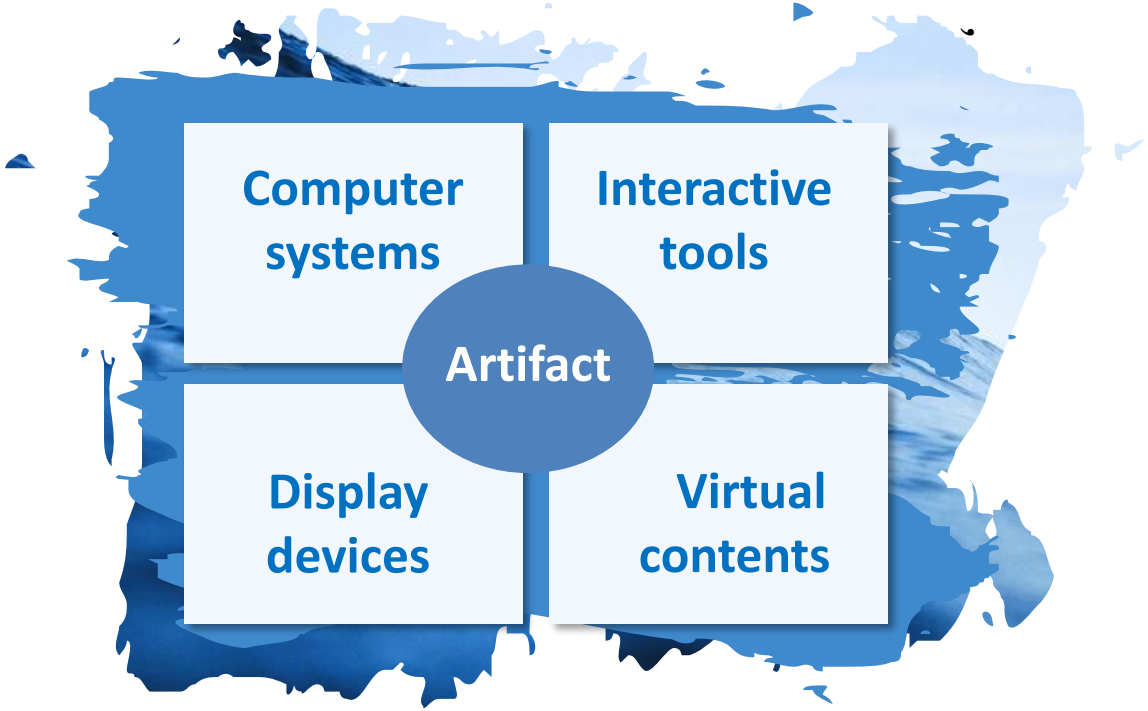
Traditional flow model for non-virtual activities

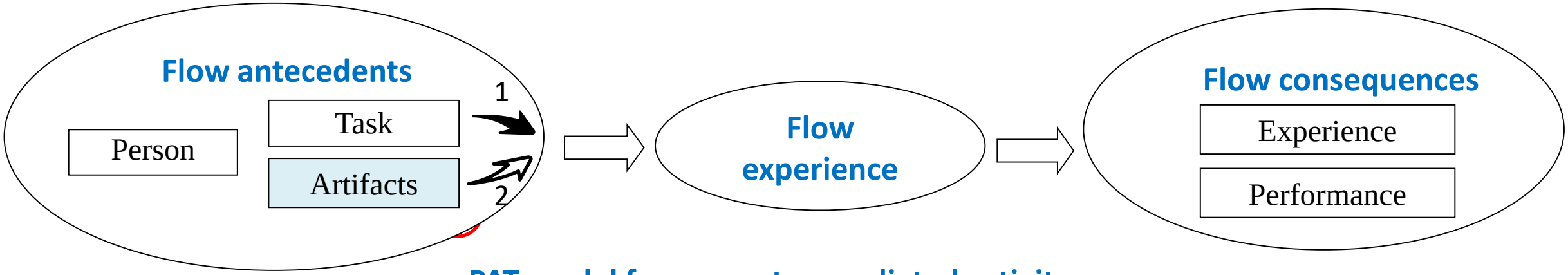


Traditional flow model for **non-virtual activity**

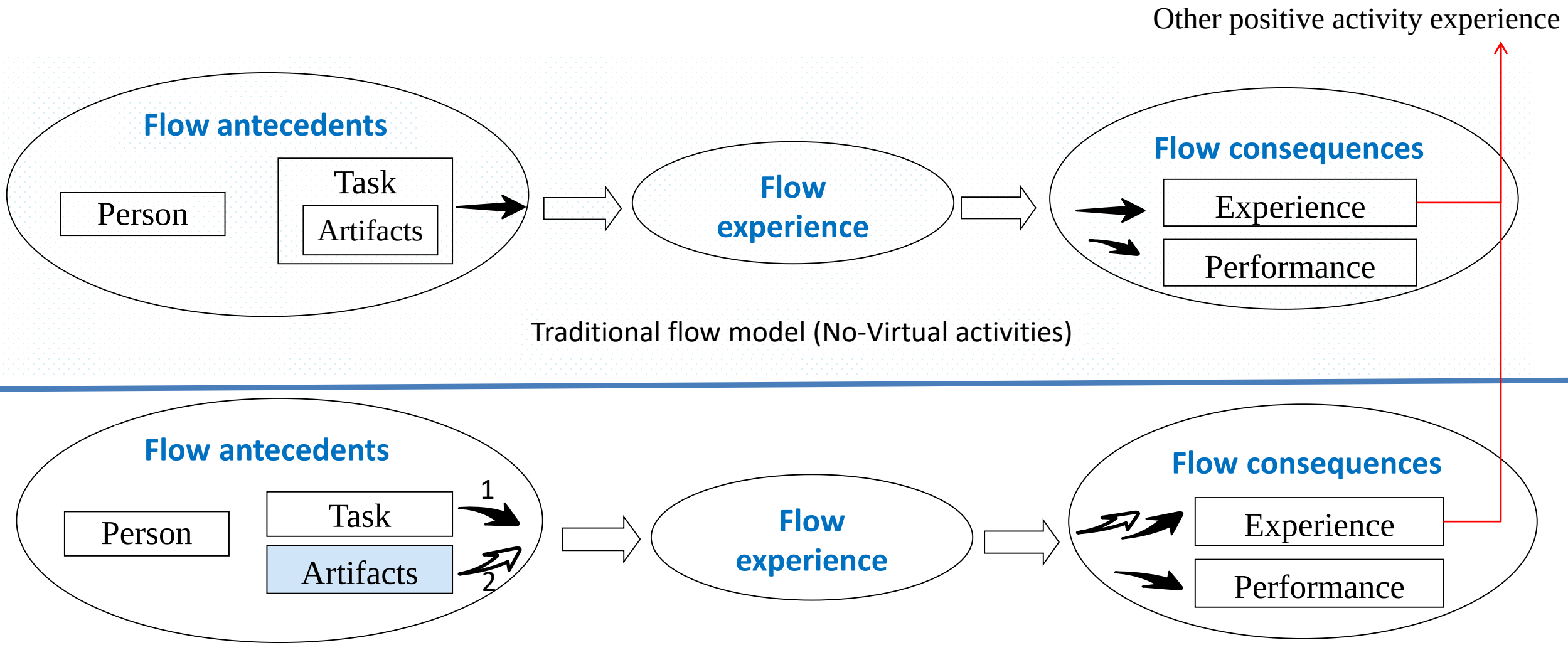


PAT model for **computer-mediated activity**





PAT model for computer-mediated activity


Other positive activity experience
Flow antecedents
Person
Task
Artifacts
Flow experience
Flow consequences
Experience
Performance
Traditional flow model (No-Virtual activities)
Flow antecedents
Person
Task
Artifacts
1
2
Flow experience
Flow consequences
Experience
Performance
PAT model for computer-mediated activity (Virtual activities)

PART 02

Empirical study 1

A STUDY EXPLORING WEAK ASSOCIATION BETWEEN FLOW AND PERFORMANCE IN VE ACTIVITIES

Hypothesis

In VEs where the artifacts are incongruent with the primary task, the relationship between flow and activity experience maybe strong, but relationship between flow and performance is weak.

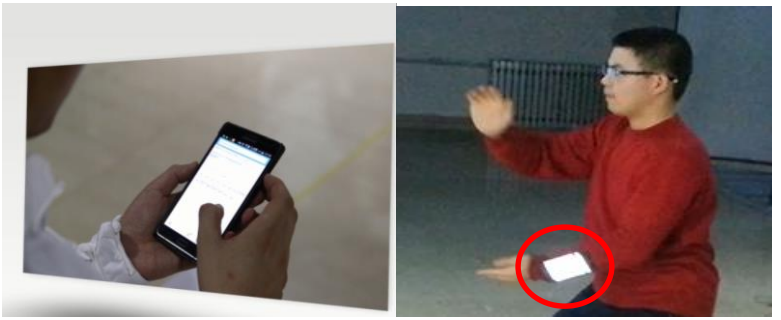
Virtual Tai Chi training (activity 1)

VR shooting game (activity 2)

Pedagogical agent

3D animation demonstration

Interactive device
(A Smartphone-based fixed on the forearm)



The Tai Chi training studio

Disjointing feature

The way of using interactive artifacts are disjointed from the primary task.

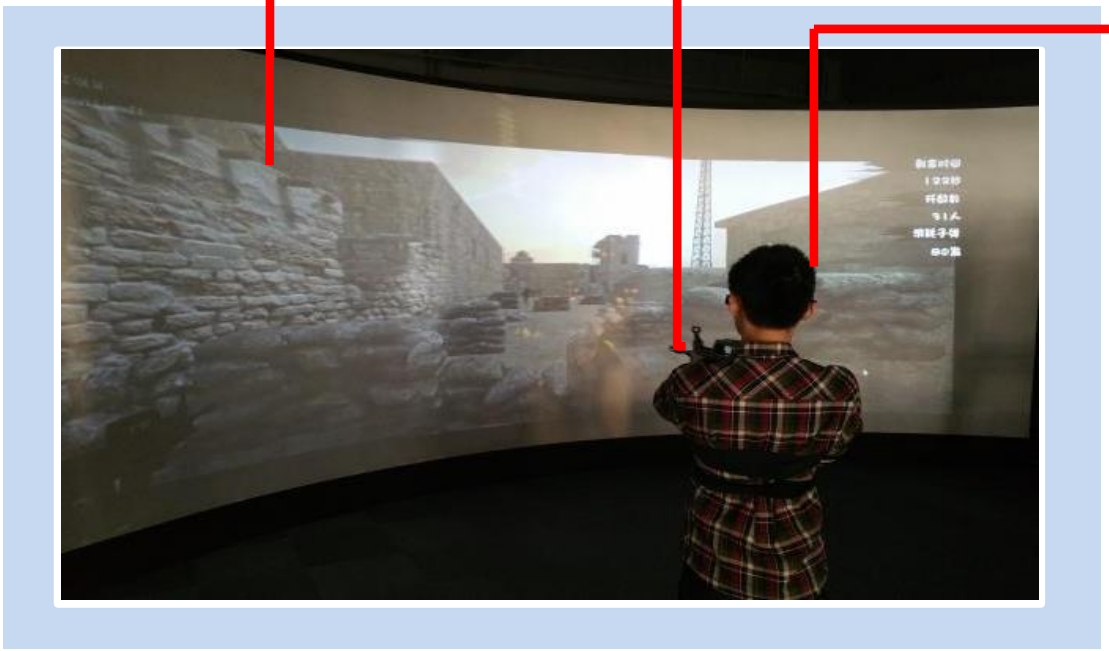
A *Artifacts are numerous and disjointed with primary task.*

B *The interactions are not intuitive*

3D scene

A simulation gun

Stereoscopic glasses



VR shooting game (activity 2)

Disjointing feature

The function of interactive artifacts disjointed with the context and requirements of the primary task

A *The number of bullets is unlimited*

B *The player is invincible*

Measures

The activity 1

- **Flow experience**
- **Learning experience**
  - Positive affects
  - Learning satisfaction
  - Self-efficacy
  - Intrinsic interest
- **Performance**

Valid questionnaires

Expert evaluation

Measures

The activity 2

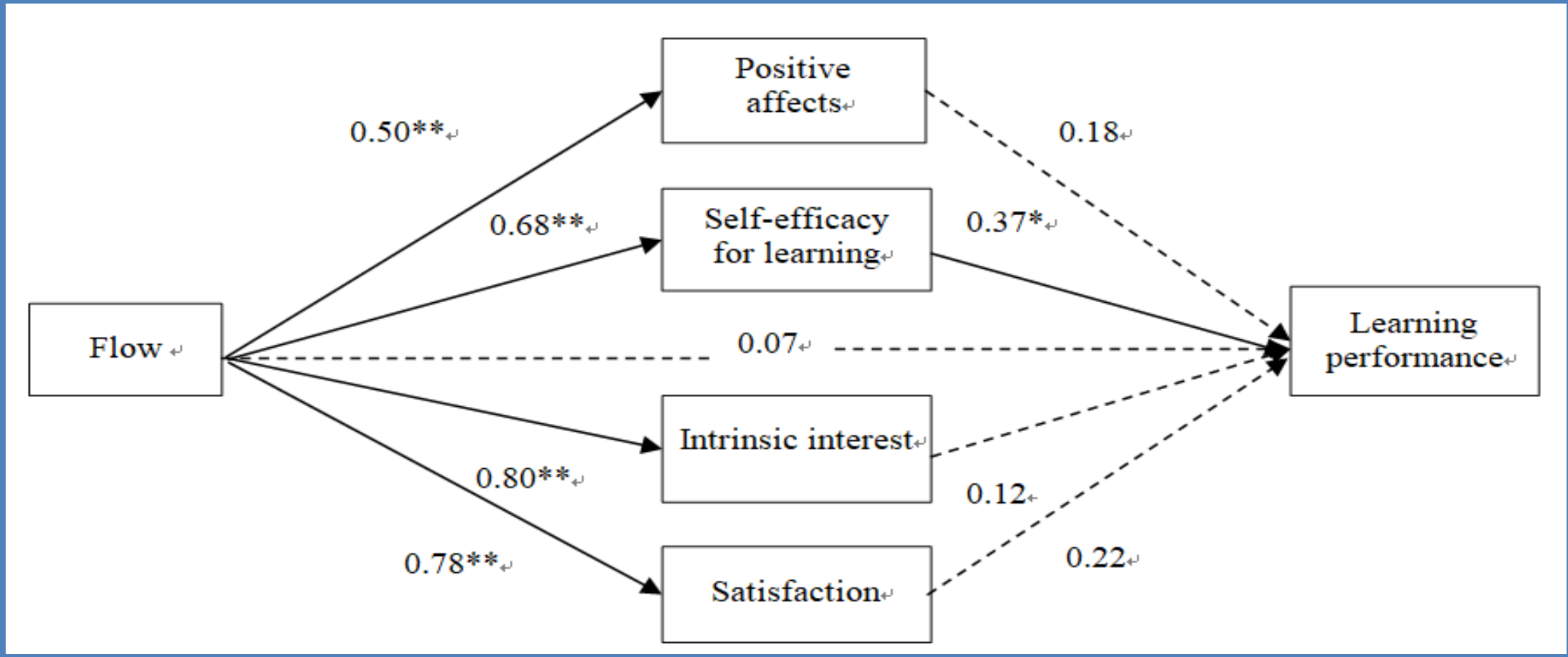
- **Flow experience**
- **Game experience**
  - Satisfaction
  - Playfulness
  - Game motivation
  - Presence
- **Performance**

valid questionnaires

Game scores were recorded by the system

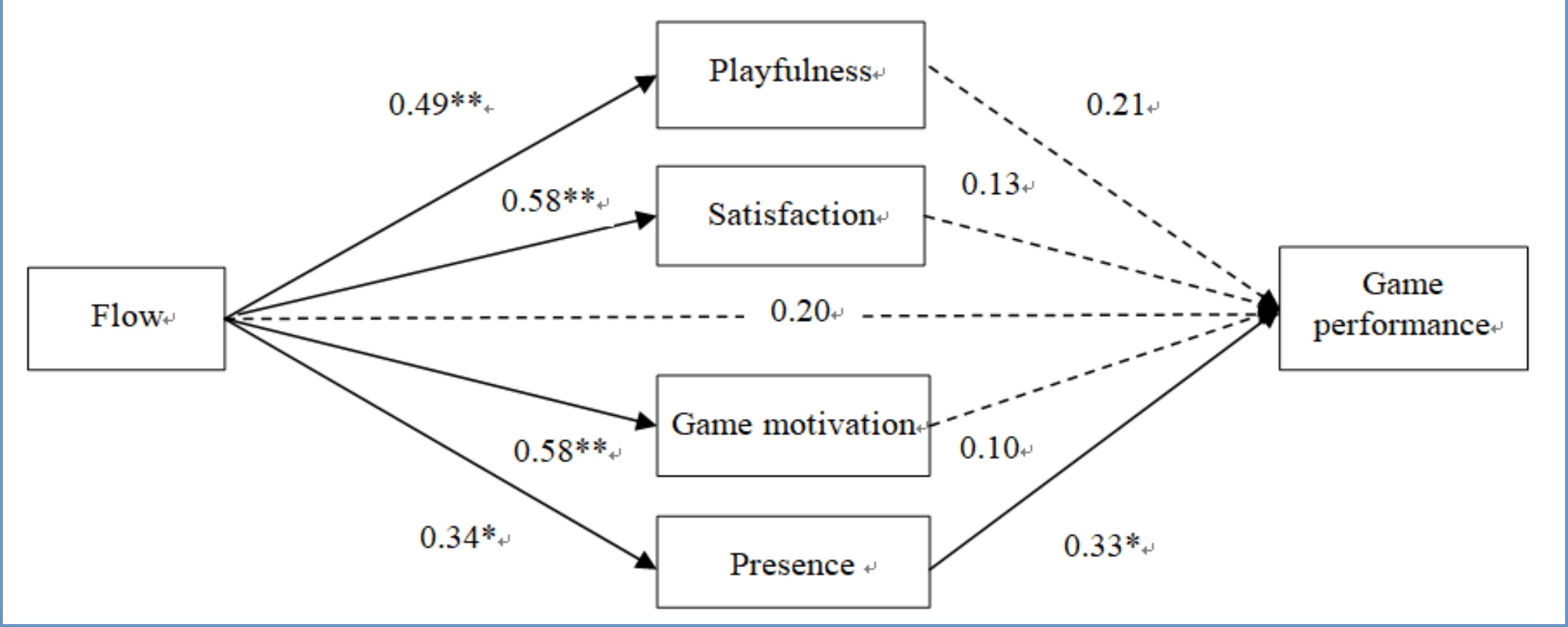
Results

Structural equation modeling (SEM) analysis



Structural equation model 1 (activity 1)

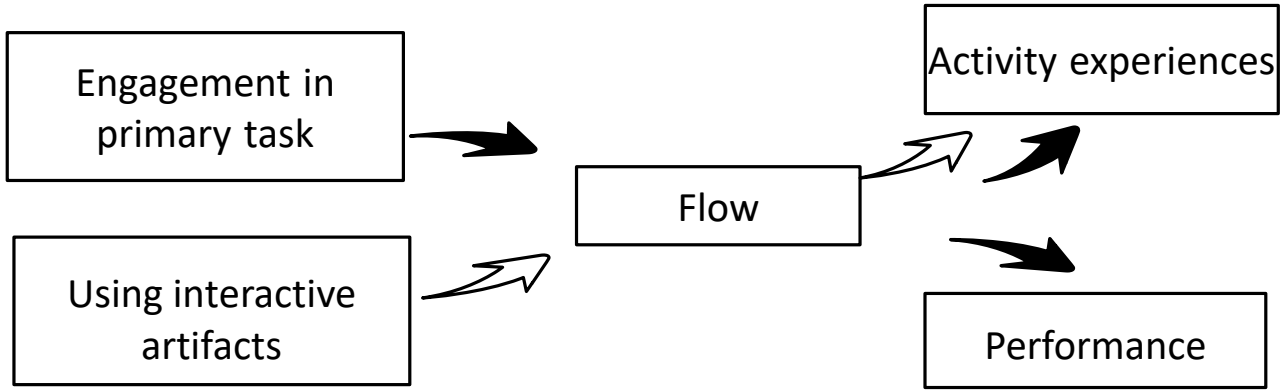
Structural equation modeling (SEM) analysis



Structural equation model 2 (activity 2)

Discussion

1



Disjointing features

2

A *Operating the interactive artifacts themselves is overtly fascinating, complicated or non-intuitive.*

B *The function/ content of interactive artifacts is disjoint with the context and requirements of the task.*

PART 03

Empirical study 2

A STUDY OF A POTENTIAL APPROACH TO STRENGTHEN THE WEAK ASSOCIATION

Hypothesis

Flow can significantly and positively influence game performance in a VE where the interaction design and the primary task are appropriately congruent.

A VR simulated driving game

A vehicle motion simulator

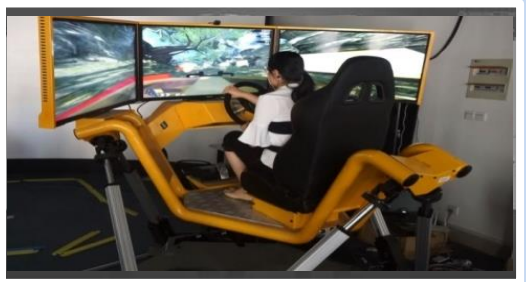
Steering wheel

Pedals

Congruence feature

A *The using of interactive artifacts is easy and intuitive, thus it does not distract users' attention from performing the primary task*

B *The interactive content is congruent with the context and requirements of the primary task*



Flow experience

Performance

Flow experience was measured with valid questionnaires.

β=0.524, p<0.001

β=0.457, ΔR^2=27.1, p<0.01 (Control the preexisting experience)

Game scores were recorded by the system.

PART 04

Empirical study 3

A CASE STUDY OF IMPROVING THE ASSOCIATION BETWEEN FLOW AND PERFORMANCE

Hypothesis

Our proposed interaction design guideline are effective in optimizing VR game.

VR tennis game

3D glasses

Kinect

A simulated racket

Old version (Disjointed)

- **The interaction is not sufficiently natural and intuitive.**

When hitting the ball by waving the racket, the return of the ball is set on a simplistic trajectory that does not reflect the player’s intention.

- **The interactive content is disjoint with the context and requirements of the primary task.**

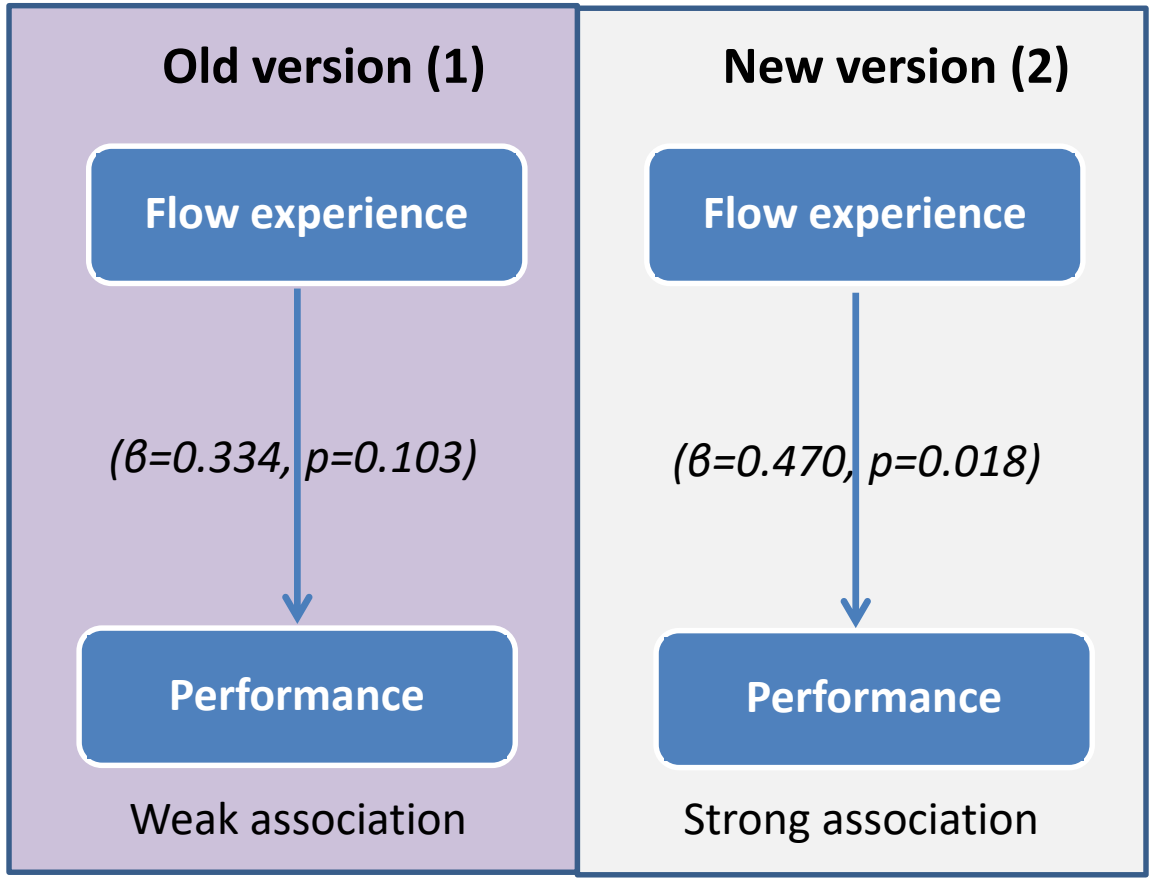
The viewpoint of the player is fixed and does not change with the real-time body movement of the player.

New version (Jointed)

- We optimized the return stroke trajectory to reflect the player's true intention.
- We modified the tennis racket design so that the ball hitting experience became more natural.

- We changed the fixed view point to a dynamic moving viewpoint, i.e. player’s view point changed according their body position in real time.

Results



Game experiences were measured with valid questionnaires.

Game scores were recorded by the system.

Conclusions

1

A theoretical model explaining the mechanism of weak association

2

We verify an approach for strengthening the relationship between flow and performance in VE

3

They have practical implications in optimizing VE design.

Limitations and future work

01

The sample sizes are small.

The small sample sizes may affect the reliability or stability of the outcomes. Therefore, our findings may need to be further tested with larger samples

02

We used games of different genres in the 3 studies.

The VE genres might lead to extra variables . The potential effect of VE genres needs to be tested in future work.

THANKS

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