

自我意識與身體經驗的 跨領域探索

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In this presentation

- **I.** 當代哲學對於自我意識的主流意見
- **II.** 關於自我意識的跨領域研究
- **III.** Philosophy and Virtual Body Lab

當代哲學關於自我意識的重要概念：

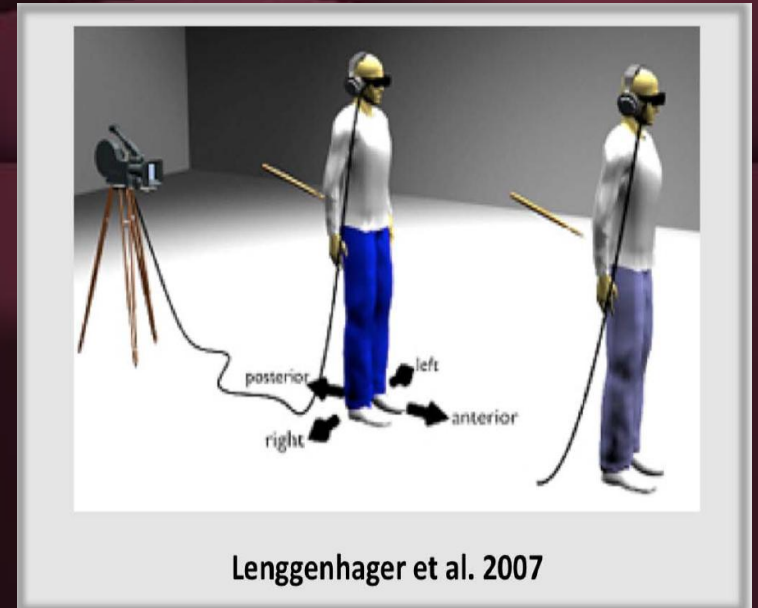
- What is self-consciousness?
- What is the difference between being conscious of, say, a flower and being conscious of myself?
- What is minimal self-consciousness?
- The sense of body ownership 「身體擁有感」：我是否將某一肢體或整個身體感受成自己的。
- The sense of experiential ownership 「經驗擁有感」：我是否將自己表徵為某個經驗的當事者。
- 「做為客體之自我」 **Self-as-object**: My arm is broken. I have grown six inches. I am bleeding. Consciousness of self-as-object can be mistaken. 與身體擁有感有關。
- 「做為主體之自我」 **Self-as-subject**: I am in pain. I have toothache. I see a canary. I am waving my arm. 專指經驗擁有感。

I. 當代哲學對於自我意識的主流意見

- 當代絕大多數的哲學家認為：關於意識經驗的內容（如：眼前鏡子裏的那個人是不是我？我現在是覺得痛，還是覺得癢？），我們可能會弄錯；但是對於自己是否為該經驗的當事者（**Self-as-subject**），則不可能弄錯。
- **Wittgenstein**: “there is no question of recognizing a person when I say I have toothache. To ask ‘are you sure it is *you* who have pains?’ would be nonsensical”.
- **Merleau-Ponty** : “body-as-subject” vs. “body-as-object”. An experience of body-as-subject is fundamentally different from experiencing the same body as-object.
- One can experience one’s own body or body-part either *as-object* or *as-subject* but cannot experience it as both at the same time.

II. 關於自我意識的跨領域研究

- **The rubber hand illusion (RHI):** (Botvinick & Cohen, 1998; Tsakiris & Haggard, 2005)
- **The full body illusion (OBE):** (Lenggenhager et al., 2007; Ehrsson, 2007)
- **The body swap illusion:** (Petkova and Ehrsson, 2008).

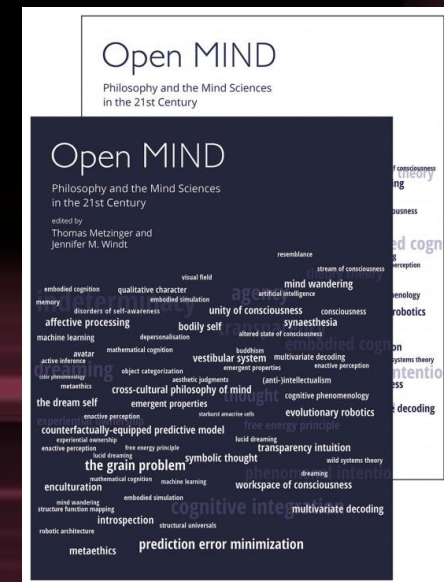


Experiential ownership vs. body ownership

- **Somatoparaphrenia:** patients deny ownership of parts of their body (Vallar & Ronchi 2009). Some patients have also hemispatial neglect and tactile extinction in the alienated body part.
- Moro et al. (2004): two patients reported that they felt tactile sensations after their left hand being moved to the right. However, they still denied that the hand was theirs.
- This suggests that subjects can have experiential ownership without body ownership (Liang, 2016).

Self-as-Subject and Experiential Ownership

Caleb Liang



Misrepresentation of experiential ownership

- **Somatoparaphrenia:** Bottini et al. (2002) describe a case of somatoparaphrenia. A woman (FB) reported that her left hand belonged to her niece and that she (FB) felt no tactile sensations there.
- FB, blindfolded, was told that *her* left hand will be touched; next the examiner touched the dorsal surface of her hand. Whenever this was done, FB said that she felt no tactile sensations.
- But when told that her niece's hand will be touched, upon actually being touched, **FB reported feeling tactile sensation.**
- **FB misrepresented her tactile sensation as belonging to someone else** (Liang, 2016).

III. Philosophy and Virtual Body Lab

- 1. 「自我觸碰錯覺」 **Self-touching illusion**: the subject wore a HMD connected with a stereo camera set on the experimenter's head. Through the HMD, the subject adopted the experimenter's first person perspective (1PP) *as if* it was his/her own 1PP. Sitting face to face, they used right hand to brush each other's left hand for two minutes.

Subject



Experimenter

Questionnaires

- **Body-part ownership:**

Q1 It felt as if the hand seen in the screen was my hand.

- **Touch referral:**

Q2 It seemed as if the touch I felt was on the hand brushed by the paintbrush in the screen.

- **Q11** It seemed as if the touch I felt was on the body in front of me.

- **Agency:**

Q3 It felt as if I could control the hand that holds the paintbrush in the screen.

Q8 It felt as if I could control the body in front of me.

- **Full-body ownership:**

Q6 It felt as if the body in front of me was mine.

Q7 It felt as if I was sitting in front of me.

- **Self-touching illusion:**

Q4 It felt as if I was brushing my own hand.

Q5 The person whom I brushed was me, not someone else.

- **Experiential ownership:**

Q9 It was me who felt being brushed, not someone else.

Q10 The person who felt being brushed was not me.

- **Double body effect:**

- **Q12** It felt as if I had two bodies.

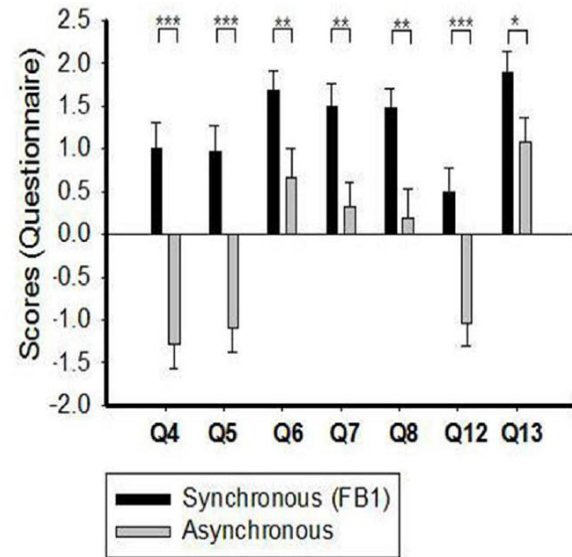
- **Q13** It felt as if I was looking at myself from the opposite side.

Experiment 1

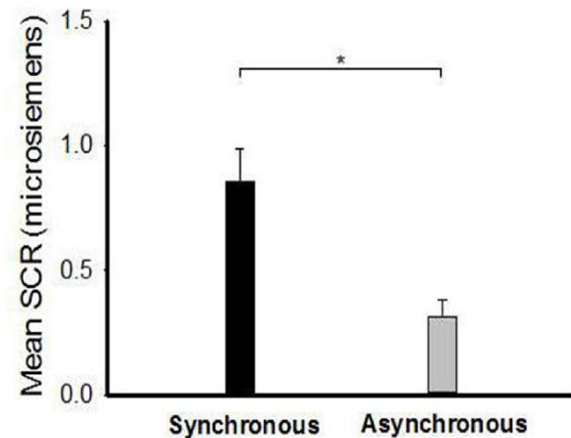
- **Full-body condition 1 (FB1)**



A Experiment 1 (Questionnaire)



B Experiment 1 (SCR)



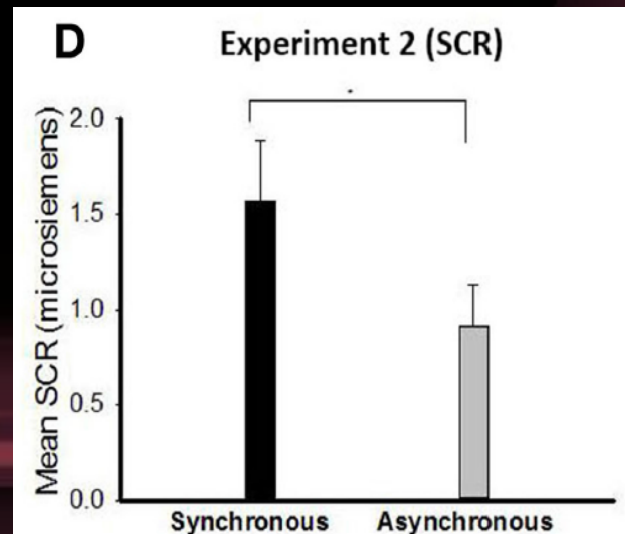
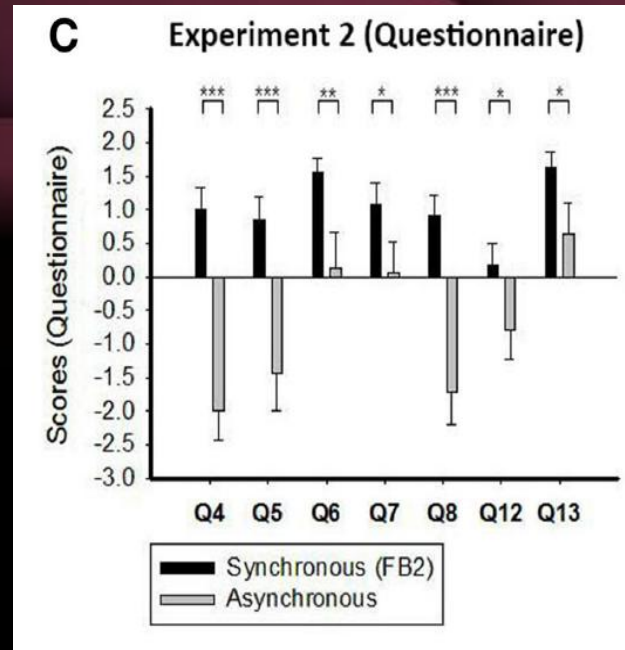
- Q4** It felt as if I was brushing my own hand.
- Q5** The person whom I brushed was me, not someone else.
- Q6** It felt as if the body in front of me was mine.
- Q7** It felt as if I was sitting in front of me.
- Q8** It felt as if I could control the body in front of me.

Experiment 2

- Full-body condition 2 (FB2)



- The synchronous full-body conditions (**FB1** & **FB2**) generate a **“self-touching illusion”**: subjects feel that **“I was brushing my own hand!”**
- Measured by SCR and questionnaire:
(Q4) “It felt as if I was brushing my own hand” **(Q5)** “The one whom I brushed was me, not someone else”.

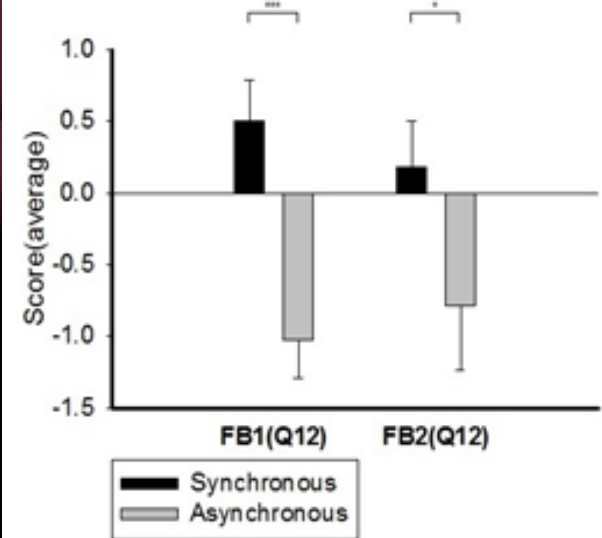


Double body effect?

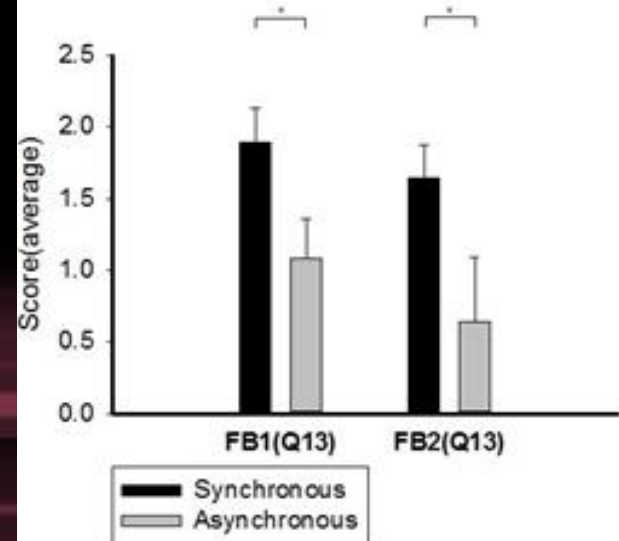
- Guterstam and Ehrsson (2012): “it might not be possible for a healthy brain to perceive the self to be located at two different places at the same time and owning two different bodies at these locations”.
- However, the synchronous full-body conditions **FB1** & **FB2** suggest a “**double body effect**”.
- Q12** It felt as if I had two bodies.
- Q13** It felt as if I was looking at myself from the opposite side.



(A) Double body effect (Questionnaire)

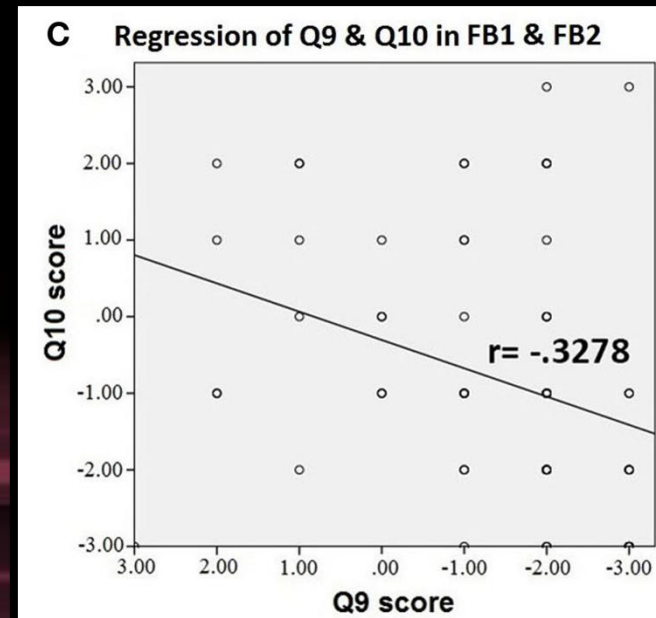
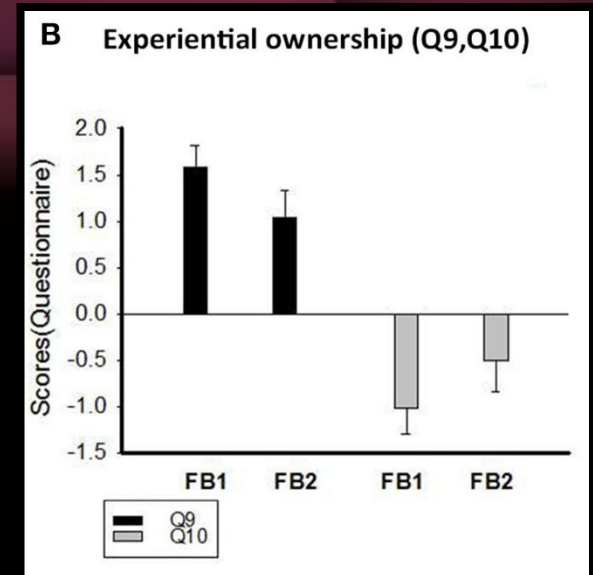


(B) Double body effect (Questionnaire)

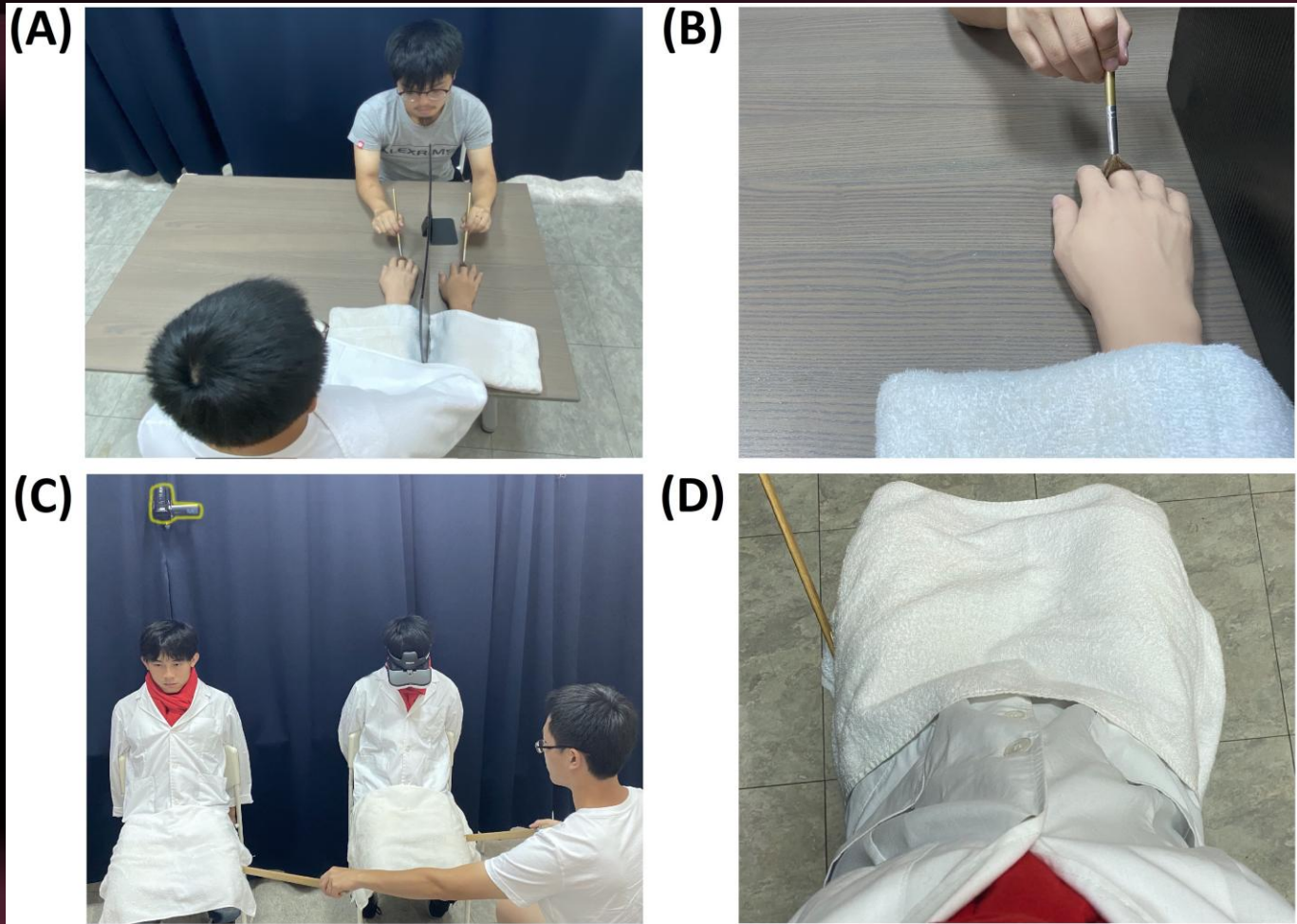


The Wittgenstein Question

- **Q9**: “It was me who felt being brushed, not someone else.”
- **Q10**: “The person who felt being brushed was not me.”
- **No interpretations of the data support IEM.** At least some participants were not completely certain about whether they were the subjects of the sensations that they actually felt.
- **推翻當代哲學的主流意見**



2. “Who” felt the touch on my hand?



- (A) & (B): Body-part Experiments 1 & 3
- (C) & (D): Full-body Experiments 2 & 4

Body ownership vs. Experiential ownership

Experiment 1 (body-part) / Experiment 2 (full-body)

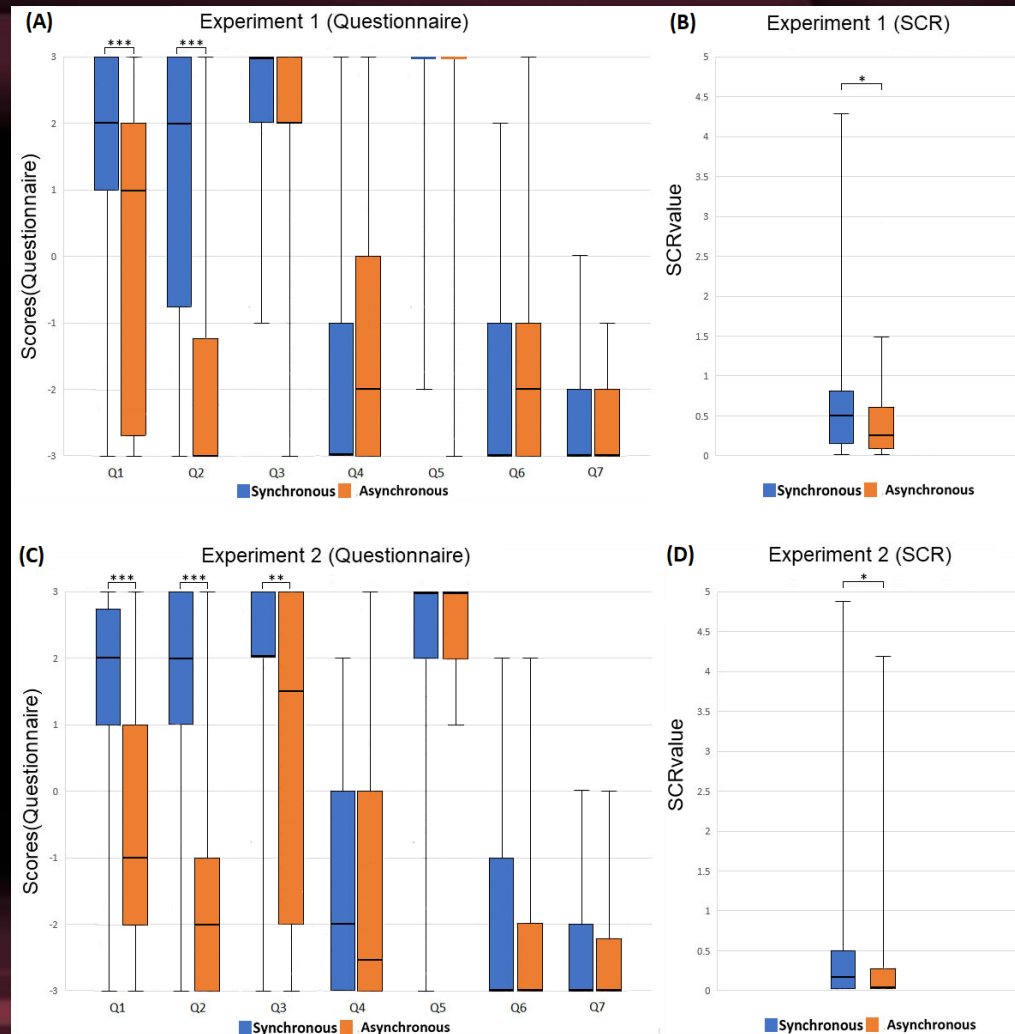
- Q1** It felt as if I was looking at my hand/body.
- Q2** The touch that I felt was caused by the paintbrush/wood stick in front of me.
- Q3** During the experiment it was me who felt touched.
- Q4** During the experiment it was me who felt pain/tickled.
- Q5** I felt that I was being touched during the experiment.
- Q6** I felt that I was being hit/tickled during the experiment.
- Q7** It felt as if the hand/body in front of me gradually became a flower.

Experiment 3 (body-part) / Experiment 4 (full-body)

- Q1** Right now, it feels as if I am looking at my hand/body.
- Q2** The touch that I felt was caused by the paintbrush/stick in front of me.
- Q3** Right now, it seems that it is me who is feeling touched.
- Q4** It seems that it was me who felt touched a moment ago.
- Q5** I am feeling touched right now.
- Q6** I felt that I was touched a moment ago.
- Q7** It felt as if the hand/body in front of me gradually became a flower.

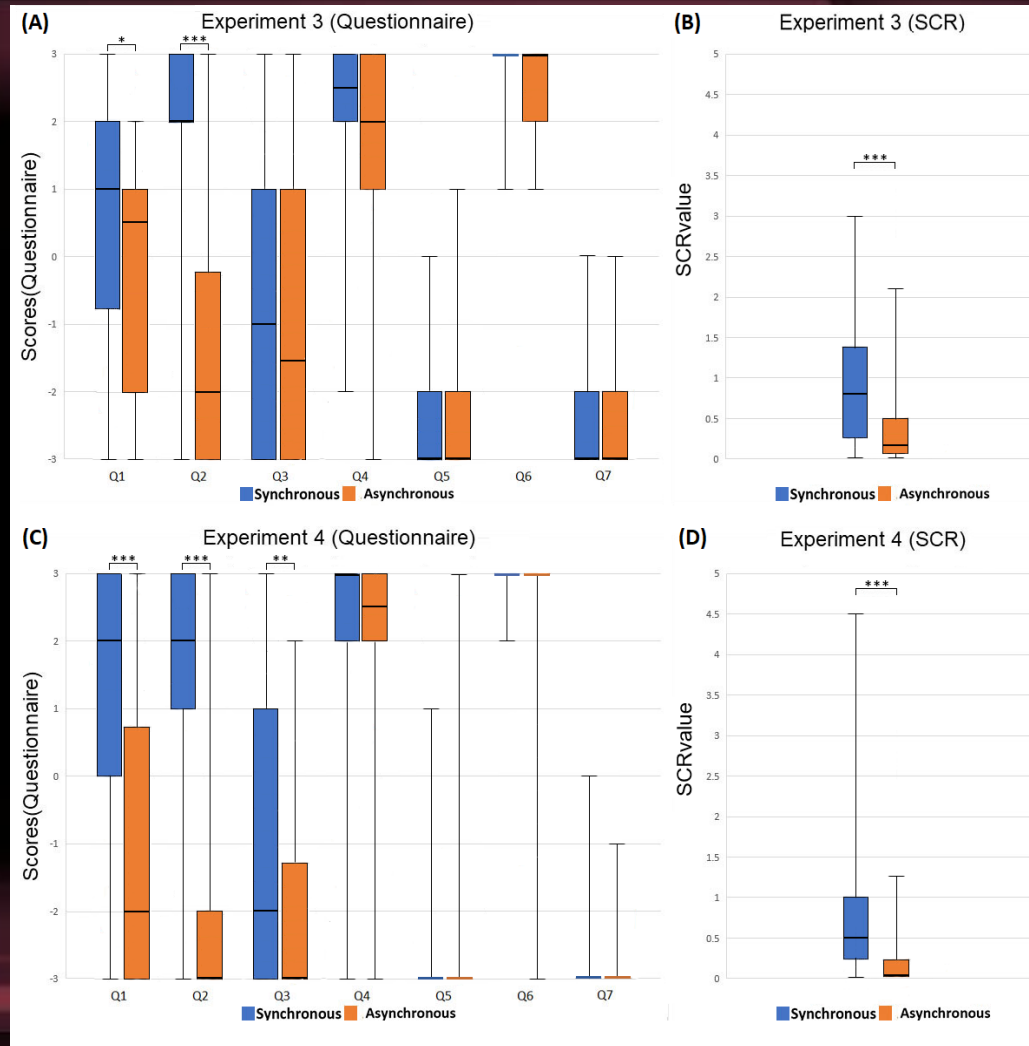
Experiments 1 & 2

- The sense of body ownership was hindered in the asynchronous conditions of both the body-part and the full-body experiments.
- However, a strong sense of experiential ownership was observed in those conditions.



Experiments 3 & 4

- We found the opposite when the participants' responses were measured *after* tactile stimulations had ceased for 5 seconds.
- In the synchronous conditions of Experiments 3 & 4, only experiential ownership was blocked but not body ownership.



Body ownership vs. Experiential ownership

- These results demonstrate for the first time the **double dissociation between body ownership and experiential ownership**.
- **Experiential ownership** is indeed a distinct type of bodily self-consciousness.

scientific reports

 Check for updates

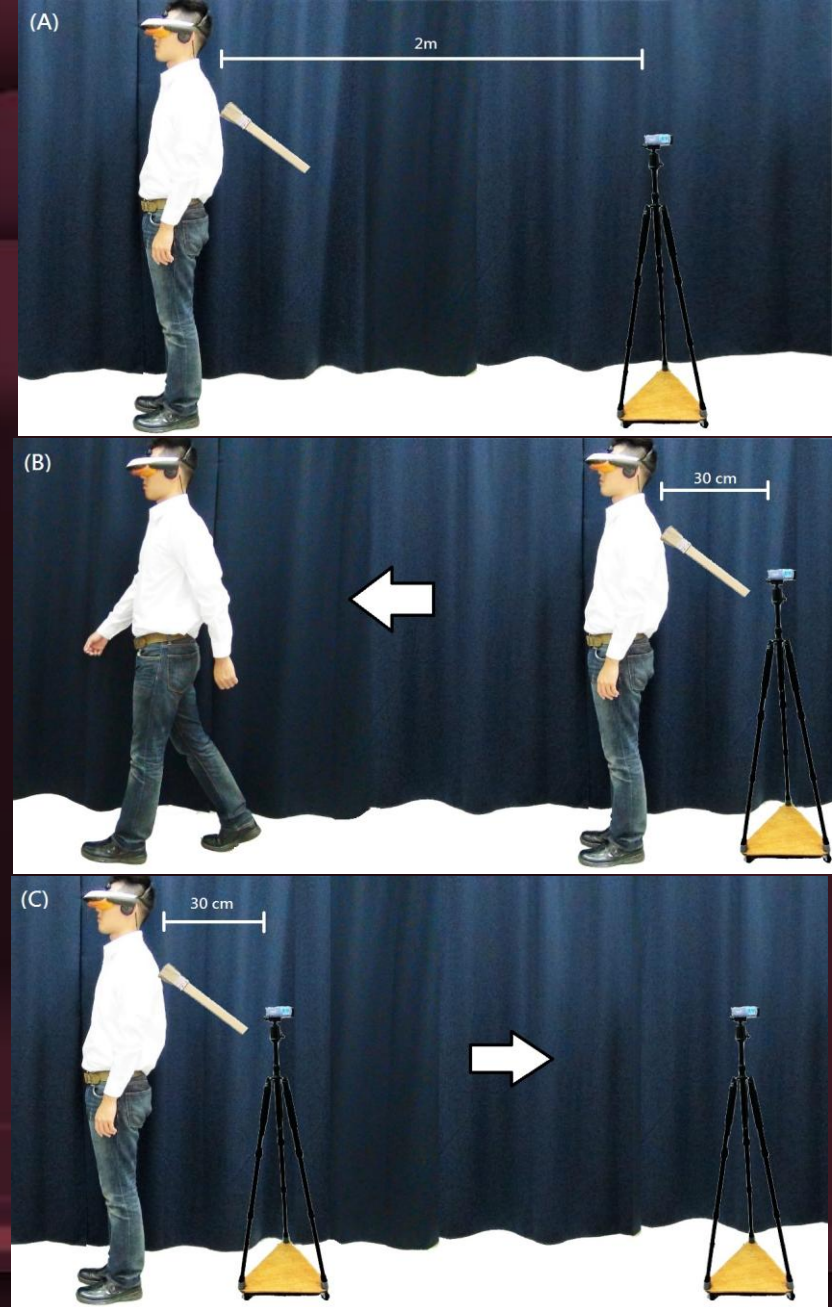
OPEN

Experiential ownership and body ownership are different phenomena

Caleb Liang^{1,2}, Wen-Hsiang Lin³, Tai-Yuan Chang^{1,4}, Chi-Hong Chen^{1,5}, Chen-Wei Wu¹, Wen-Yeo Chen², Hsu-Chia Huang² & Yen-Tung Lee^{5,7}✉

3. What is self-location? body-location vs. 1PP-location

- **Self-location:** the subjective feeling of where I am.
- **Body-location:** the sense of where my body is.
- **1PP-location:** the sense of where my first-person perspective is located relative to other things.
- **Issue: are they the same?**
- **Basic condition:** the participants stand still.
- **Walking condition:** the participants march forwards.
- **Visual condition:** swiftly moving the camera away from subject's body.

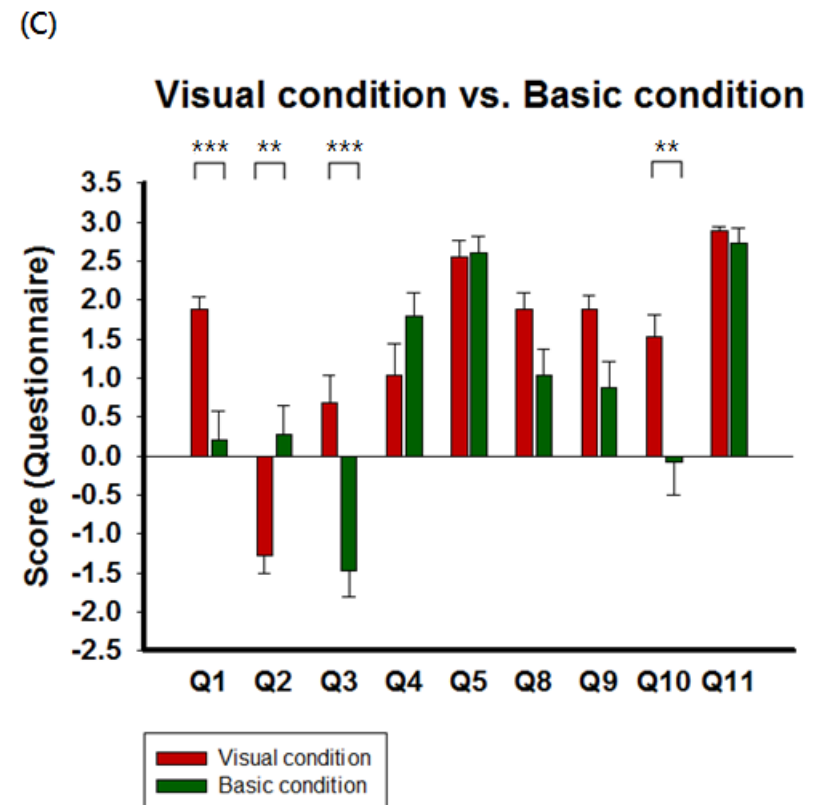
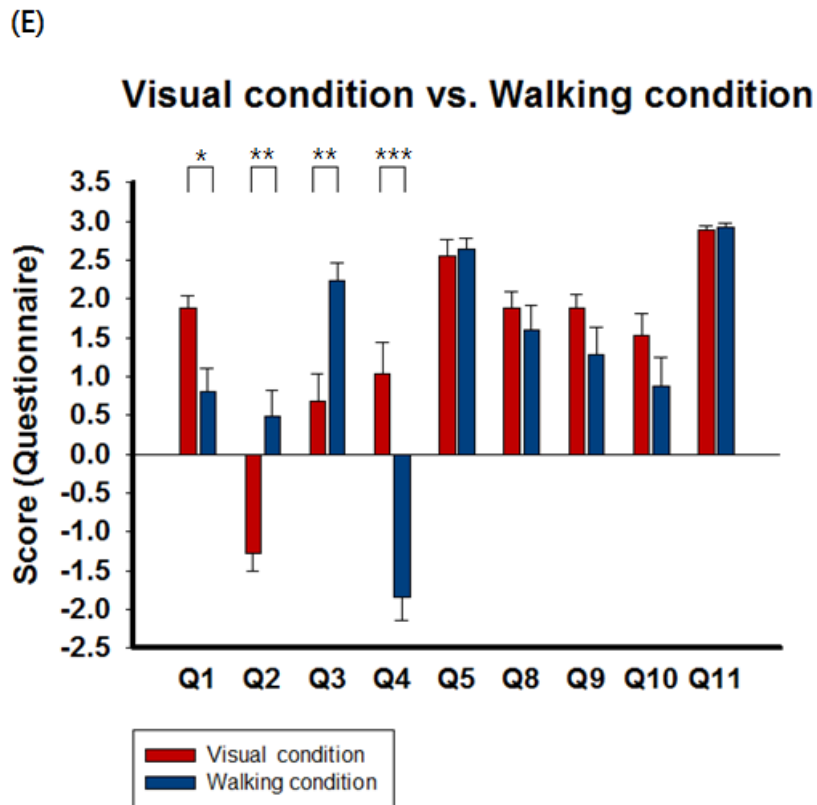


questionnaires

1PP-location	Q1. I felt that the position of my first-person perspective has changed.
	Q2. I felt that the position of my first-person perspective has not changed.
Body-location	Q3. I felt that the location of my body has changed.
	Q4. I felt that the location of my body has not changed.
Body-ownership	Q5. I felt that the body in the screen was mine.
1PP-location vs. Body-location	Q6. My body has left the position of my first-person perspective.
	Q7. I felt that my first-person perspective has left my body.
	Q8. My first-person perspective seems to be located behind my body.
	Q9. My first-person perspective and my body are not in the same location.
Double-body effect	Q10. It seemed that I have a body here and another body in front of me.
Positive control	Q11. I have been brushed during the experiment.

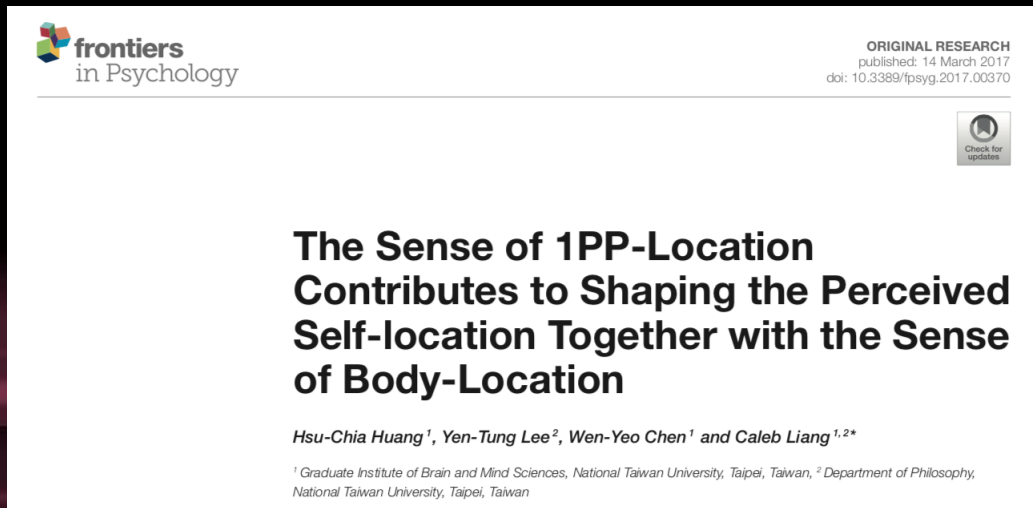
Results

- Results showed that 1PP-location and body-location are dissociable.
- We also observed the double-body effect.



Discussion

- **1. We demonstrate that the sense of 1PP-location and the sense of body-location are dissociable.** They are different subjective experiences.
- **2. The double-body effect is possible.** Hence, self-location is to be specified in terms of *embodied* 1PP-location. The self remains essentially embodied.



4. Body ownership and the four-hand illusion

- How flexible is our sense of body ownership?

Camera

Subject



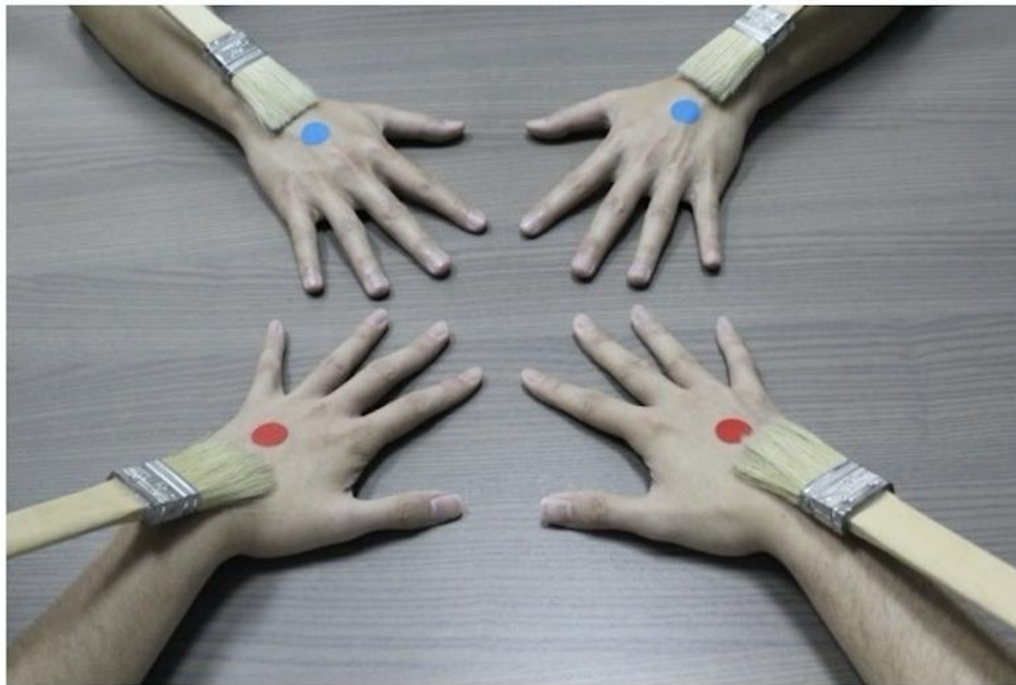
Experimenter

Questionnaires:

Category	Statements
Body ownership	1. I felt as if the hands with red tags were mine.
	2. I felt as if the hands with blue tags were mine.
Subjective tactile location	3. The touches that I felt were located on the hands with red tags .
	4. The touches that I felt were located on the hands with blue tags .
Agency	5. I felt as if I could control the hands with red tags .
	6. I felt as if I could control the hands with blue tags .
Key illusion	7. At a certain point, I felt as if I had two more hands.
Control question	8. I felt that my hands were brushed.

Experiment 1: Passive four-hand condition

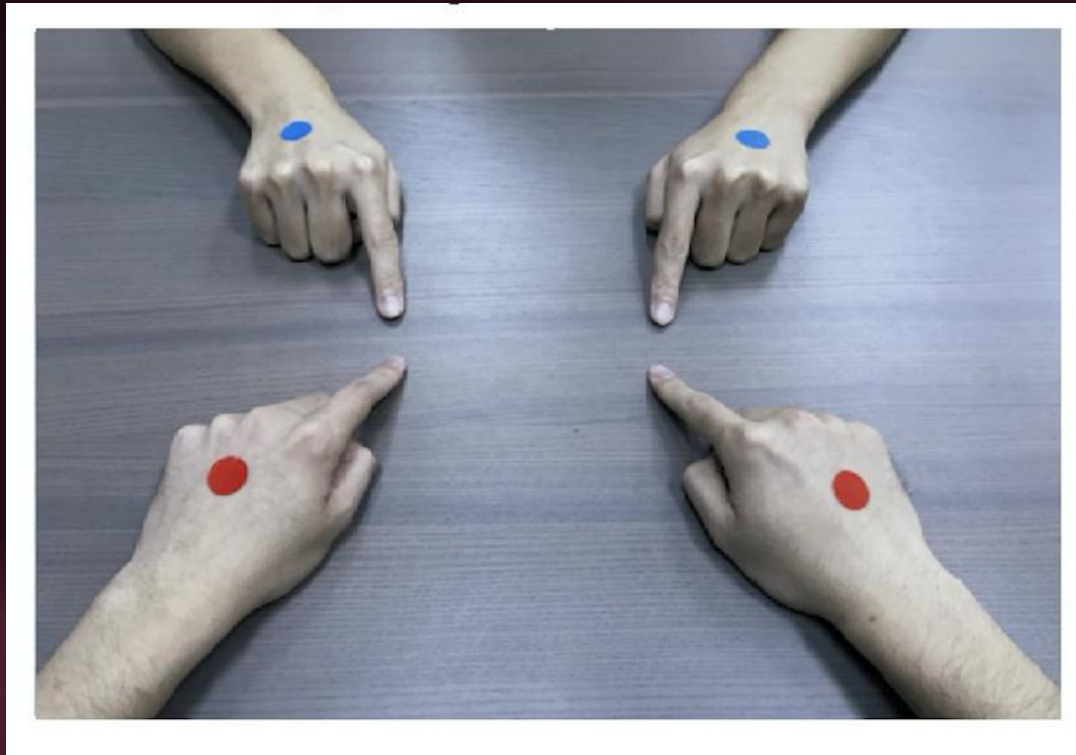
Sync. vs. Async. touch
1PP: other hands



Experiment 2: Active four-hand condition (without touch)

Sync. vs. Async. touch

1PP: other hands

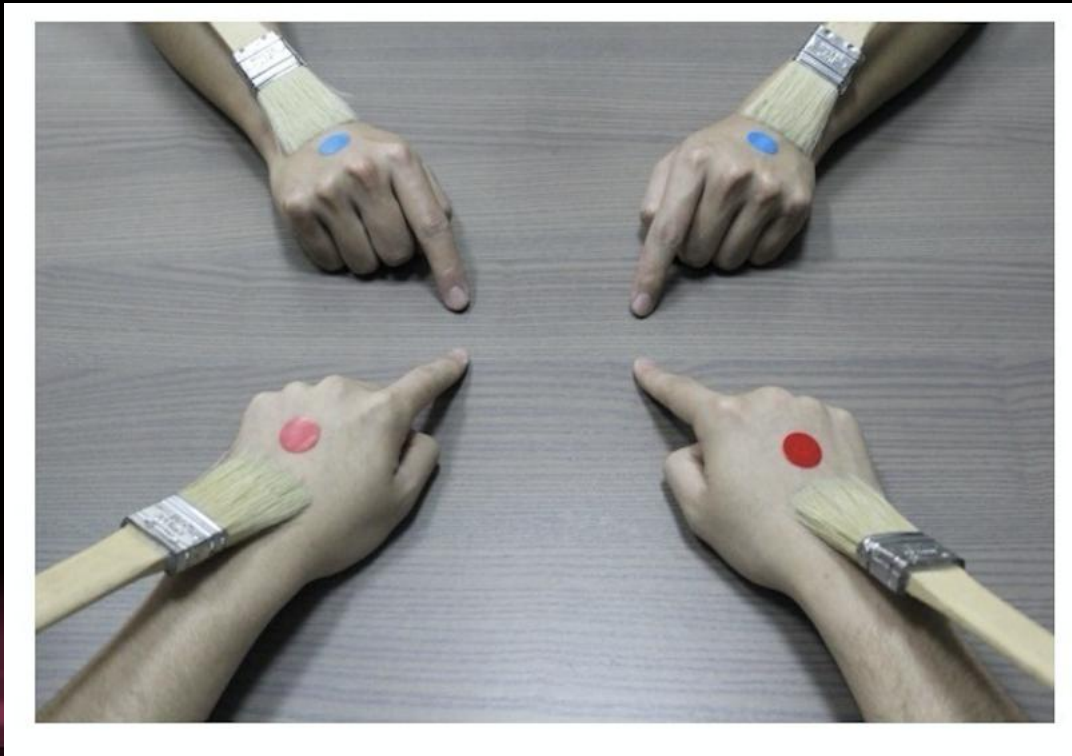


Experiment 3: Active four-hand condition (with touch)

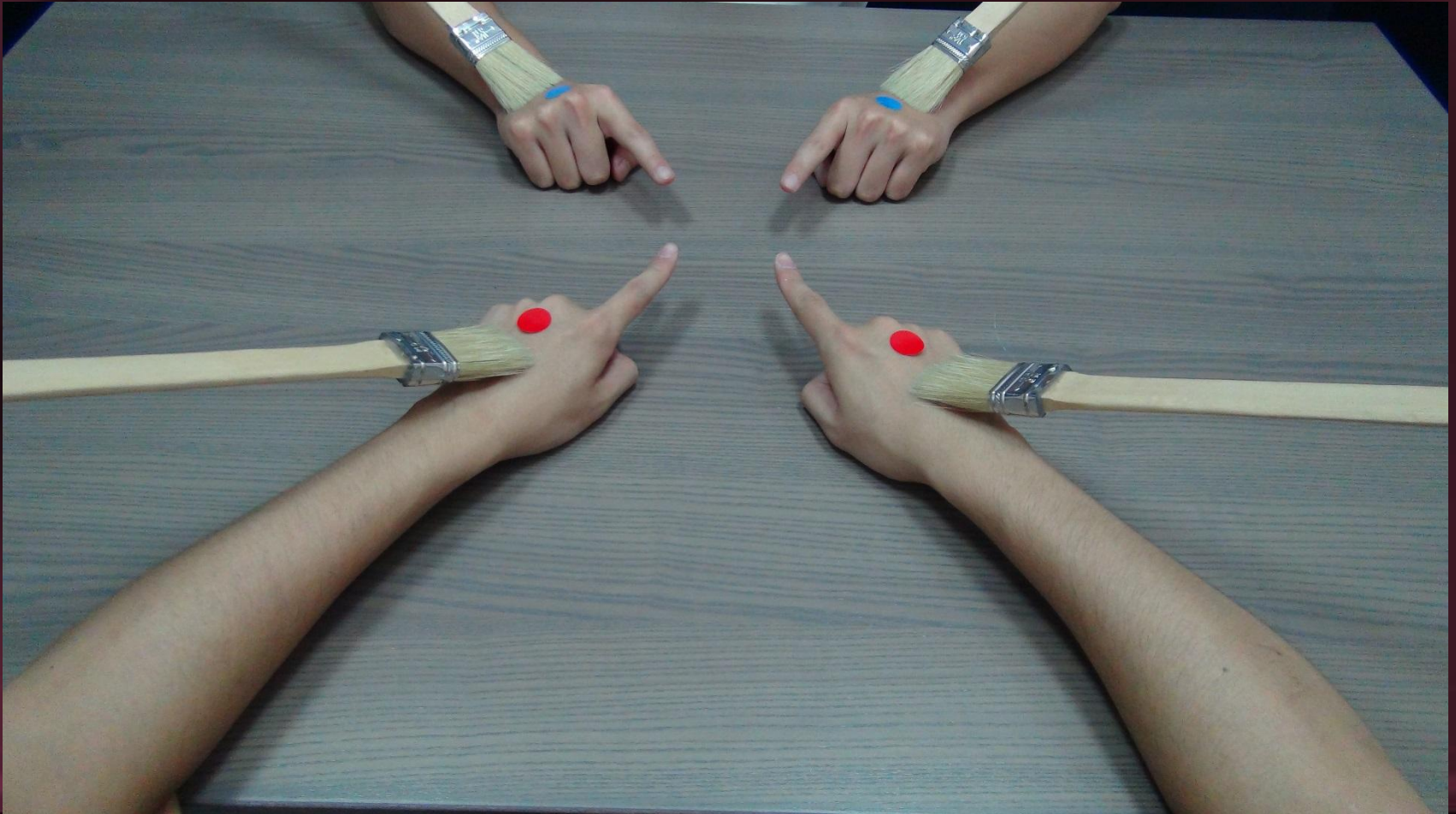
Sync. vs. Async. finger movement

Sync. touch

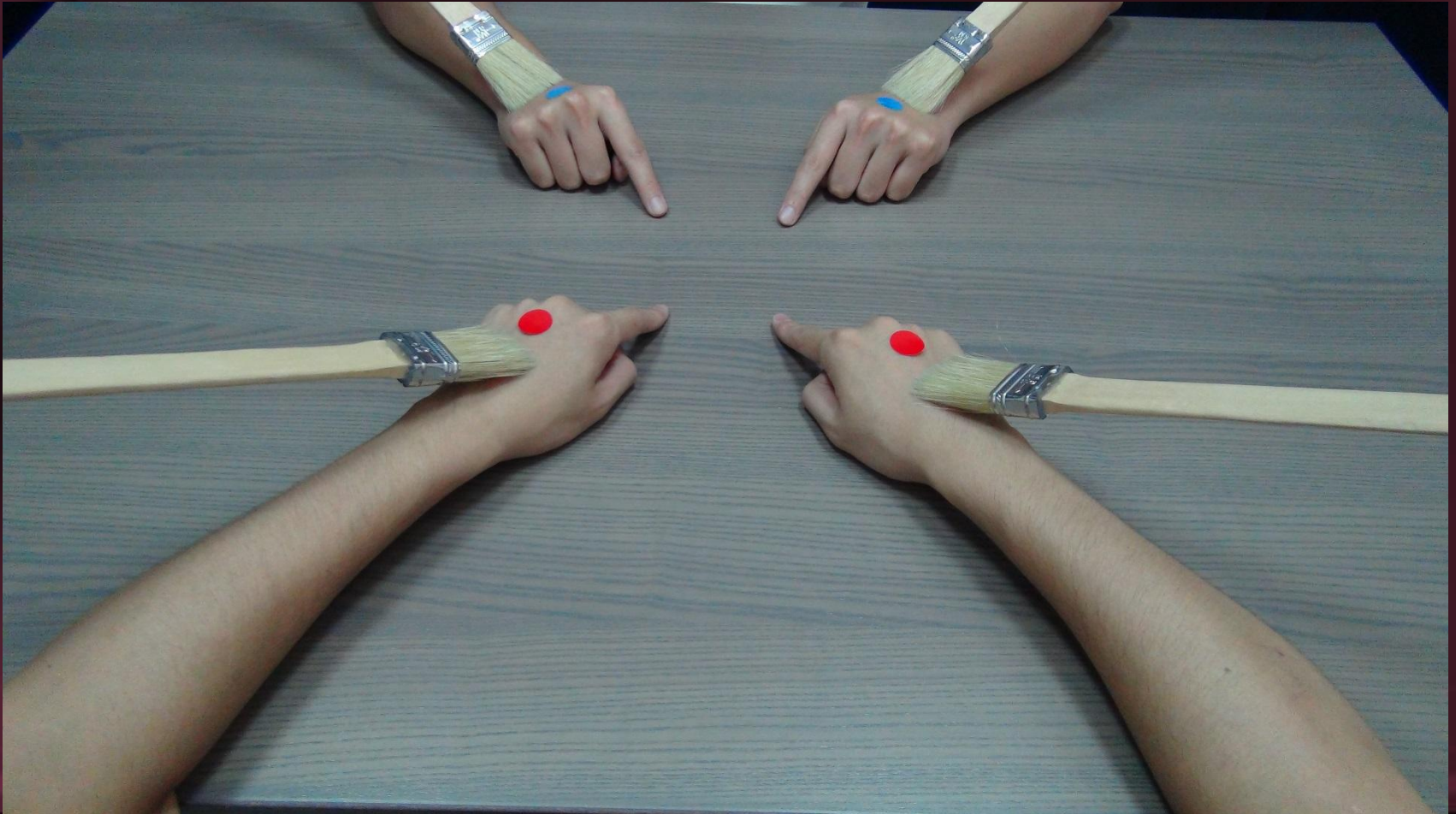
1PP: other hands



Experiment 3: Active four-hand condition (with touch) Synchronous movement

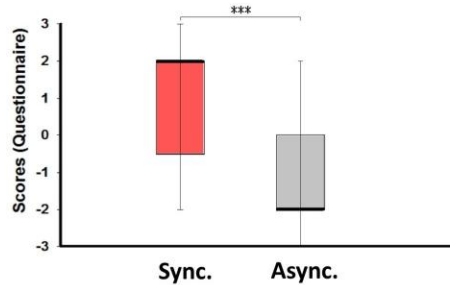


Experiment 3: Active four-hand condition (with touch) Synchronous movement

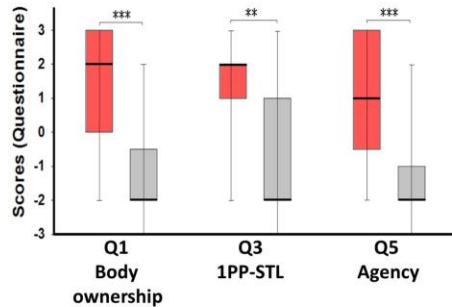


Experiment 3: Active four-hand condition (with touch)

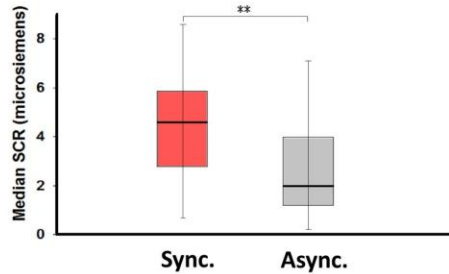
(a) Exp.3 Four-hand illusion (Q7)



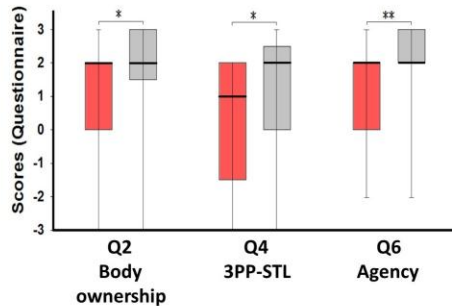
(b) Exp.3 1PP-hands (Questionnaire)



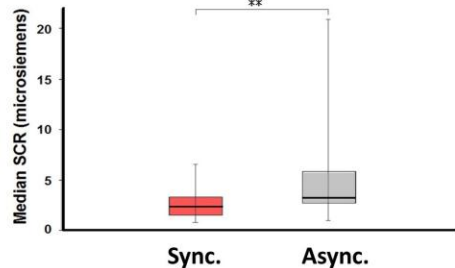
(c) Exp.3 1PP-hands (SCR)



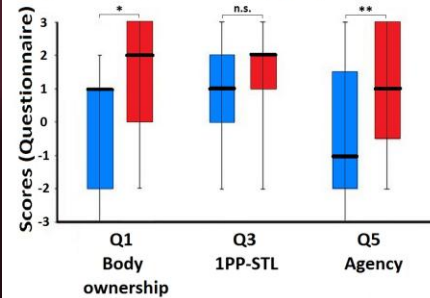
(d) Exp.3 3PP-hands (Questionnaire)



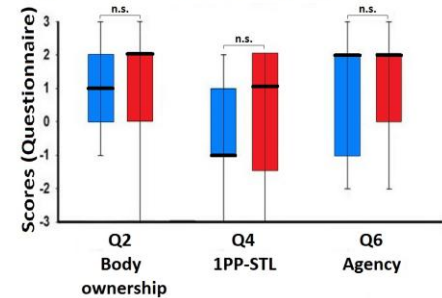
(e) Exp.3 3PP-hands (SCR)



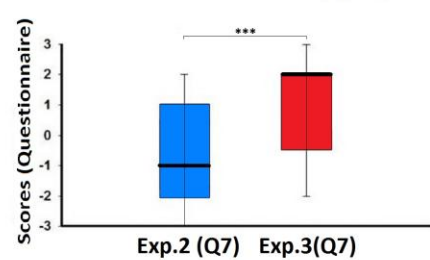
(a) 1PP-hands (sync.)



(b) 3PP-hands (sync.)



(c) Four-hand illusion (sync.)

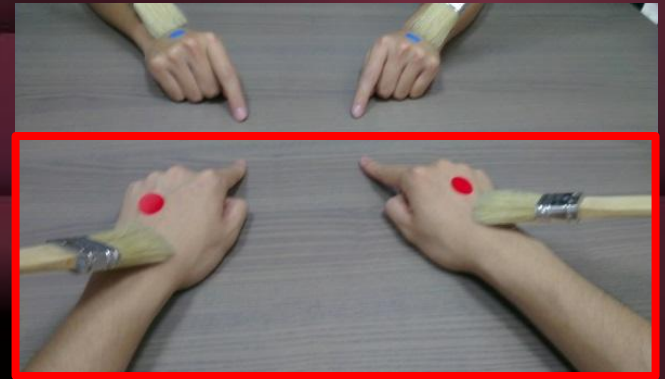


Experiment 2
Experiment 3

Once all four hands began to act synchronously, many participants felt as if they had two more hands.

OPEN Body ownership and the four-hand illusion

Wen-Yeo Chen¹, Hsu-Chia Huang¹, Yen-Tung Lee² & Caleb Liang^{1,2}



- It is possible to induce an illusion of owning another pair of hands. The sense of body ownership is more flexible than what most researchers have suggested.
- Legrand (2010): we can either experience “body-as-subject” or “body-as-object,” **but not both at the same time.**
- **In contrast, we created a novel experience that one could experience the same body-parts both “as-subject” and “as-object” simultaneously:** the hands seen from the adopted 1PP were experienced both as exercising agency and as the object of intentionality at the same time.

5. 1PP vs. 3PP in virtual reality

- Two philosophical observations: (i) Every conscious self is uniquely associated with a first-person perspective (1PP). (ii) All conscious experiences are anchored in a particular 1PP.
- Comparing **1PP** with **third-person perspective (3PP)**:
- **(1) Origin:** 1PP is the origin of the egocentric spatial framework that structures one's perceptual experiences and bodily movements. I perceive and interact with the world from my 1PP.
- **(2) Exclusiveness:** the 1PP that I have is no one else's but mine. Your 1PP is a 3PP to me. Other subjects can only observe me undergoing my experiences from the 3PP.
- **(3) Interiority:** 1PP can be experienced "from the inside" by the subject.
- The point is that our conscious experiences are permeated with these distinctive features of 1PP, and 3PP has none of them.

1PP vs. 3PP

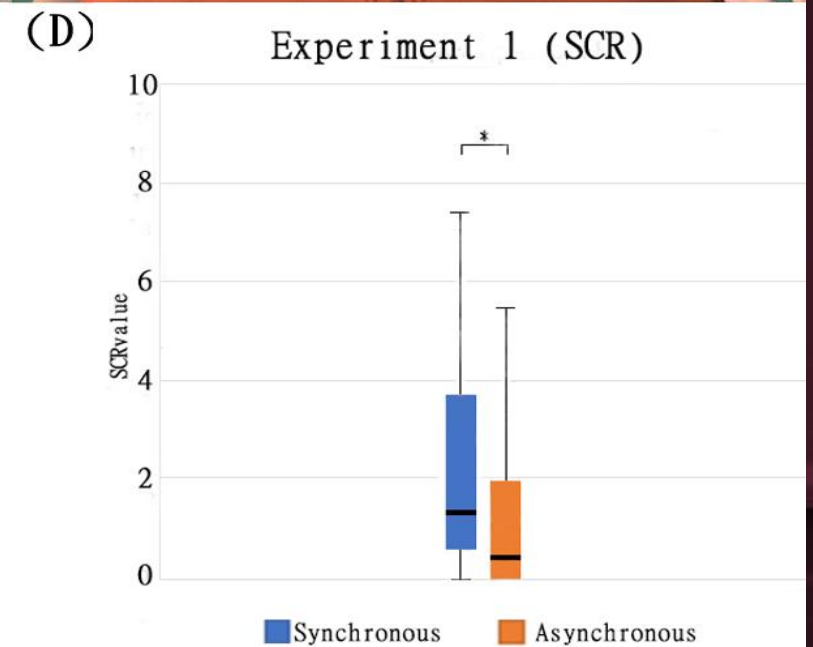
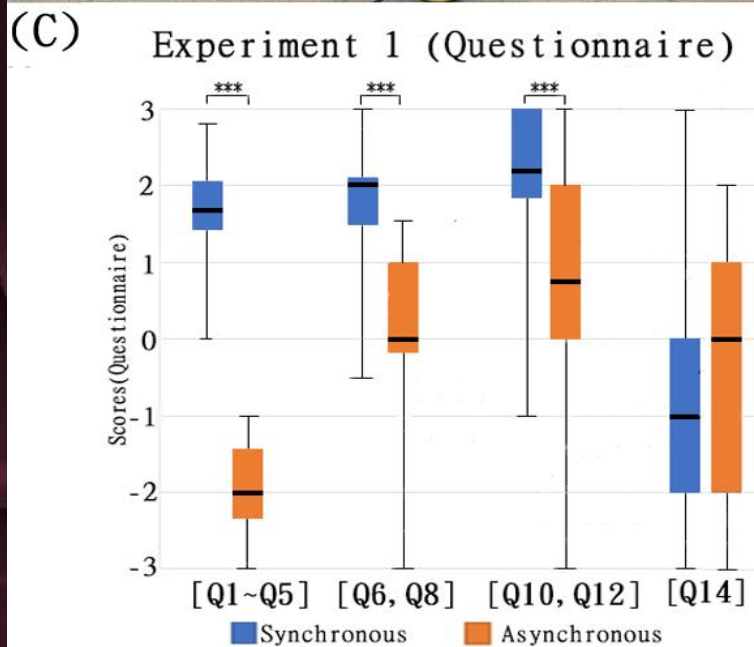
- Due to these observations, most researchers assume that the distinction between 1PP and 3PP is rigid such that experiences based on 1PP are *fundamentally different* from experiences based on 3PP.
- This assumption has become a mainstream view in the study of **bodily self-consciousness**.
- Petkova et al. (2011) argued that “the first person visual perspective would represent a fundamental constraint on the full-body illusion.” “the first person visual perspective is critical for triggering the illusion of full-body ownership.”
- **Key question: Is this mainstream view correct?**
- In this study, we suppose that the philosophical observations mentioned earlier are plausible. **Must they imply that there is a fundamental chasm between 1PP-experience and 3PP-experience?**

1PP vs. 3PP

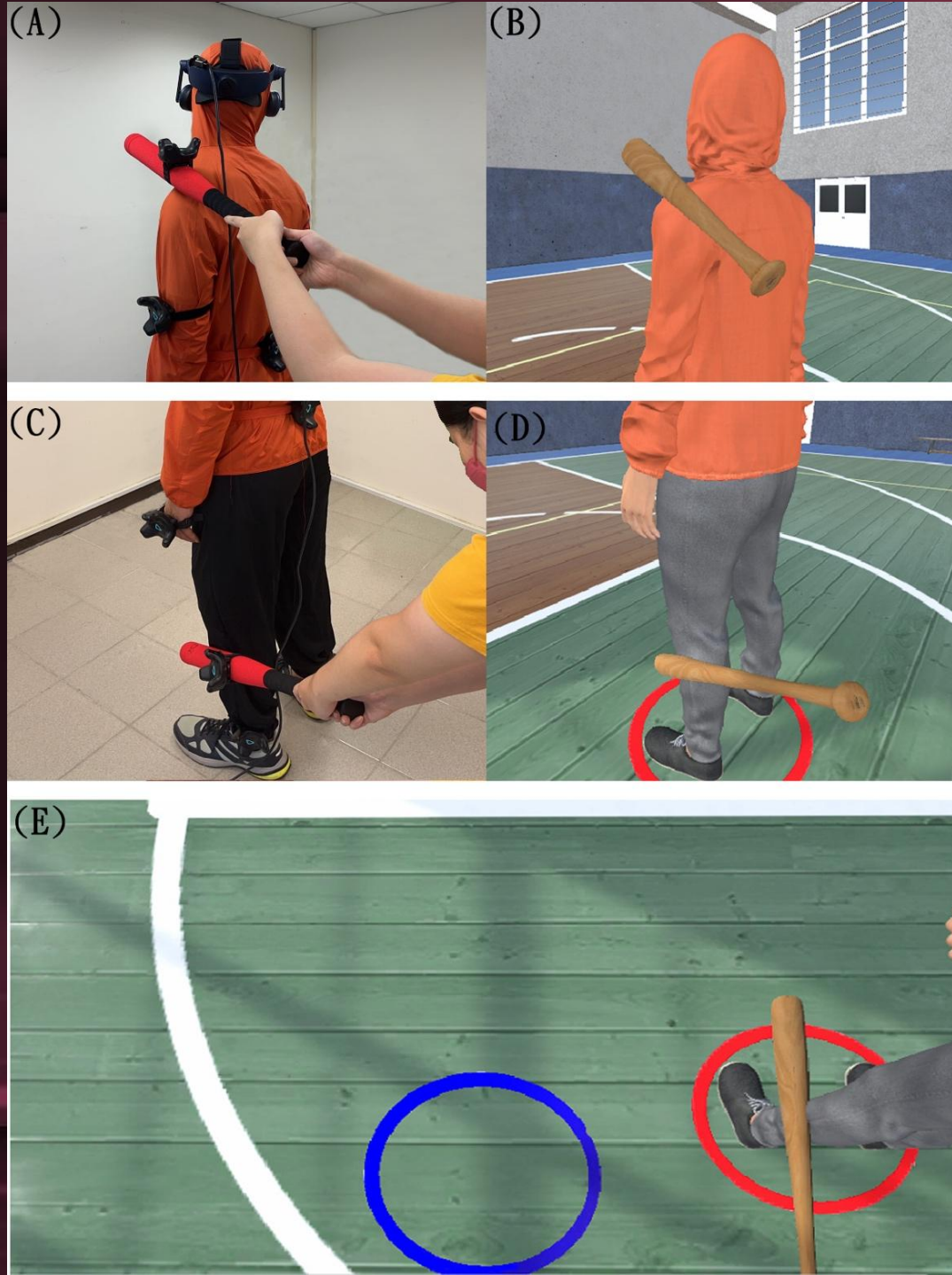
- **1PP-experience:** the experience of viewing an illusory body from the 1PP as if one directly looks down at one's own body.
- **3PP-experience:** the experience of viewing an illusory body from the 3PP as if one looks at someone else's body from a distance.
- The relationship between 1PP and 3PP may be more complicated than the mainstream view. Why? Because 1PP and 3PP share one feature that is equally essential:
- **(4) Embodiment:** my 1PP is not an abstract geometric point; rather, it is anchored on my body. Likewise, your 1PP, as a 3PP to me, is anchored on your body.
- The location and orientation of one's body have great influences on the spatial properties and one's experiences of 1PP and 3PP.
- Given the features of Origin, Exclusiveness, Interiority and Embodiment, **are experiences based on 1PP and experiences based on 3PP fundamentally different? Or is the difference between them a matter of degree?**

Body ownership	Body ownership	Q1	It felt as if the virtual body was my body.
		Q2	It felt as if I was looking at my body.
	Touch-referral	Q3	The touches that I felt seem to be located on the virtual body.
	Agency	Q4	It felt as if I could control the virtual body.
		Q5	It felt as if that the movements of the virtual body were my movements.
Body-location	Avatar Position	Q6	It felt as if my body was located at the place of the virtual body.
	Zero Point	Q7	It felt as if my body was located beside the virtual body.
	Avatar Position	Q8	It felt as if my body was located within the red circle.
	Zero Point	Q9	It felt as if my body was located within the blue circle.
1PP-location	Avatar Position	Q10	It felt as if my visual perspective was located at the place of the virtual body.
	Zero Point	Q11	It felt as if my visual perspective was located beside the virtual body.
	Avatar Position	Q12	It felt as if my visual perspective was located within the red circle.
	Zero Point	Q13	It felt as if my visual perspective was located within the blue circle.
Double body-location		Q14	It felt as if my body was located at two places at the same time.
Control question		Q15	It felt as if my body gradually became a flower.

Experiment 1: passive 1PP condition

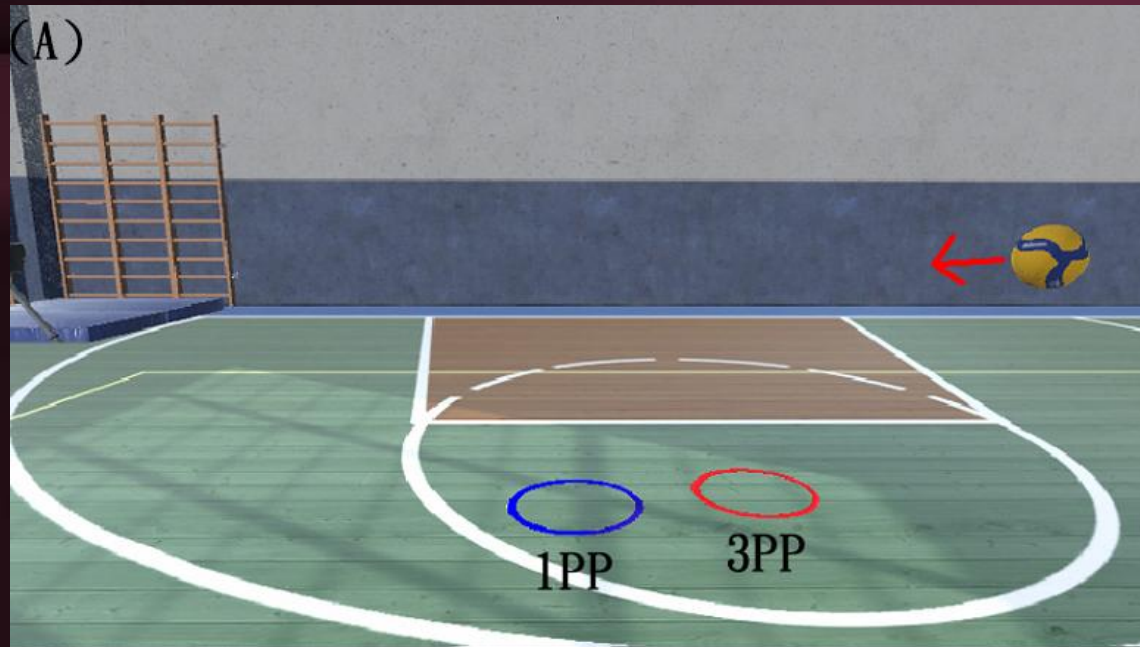


Experiment 2: passive 3PP condition

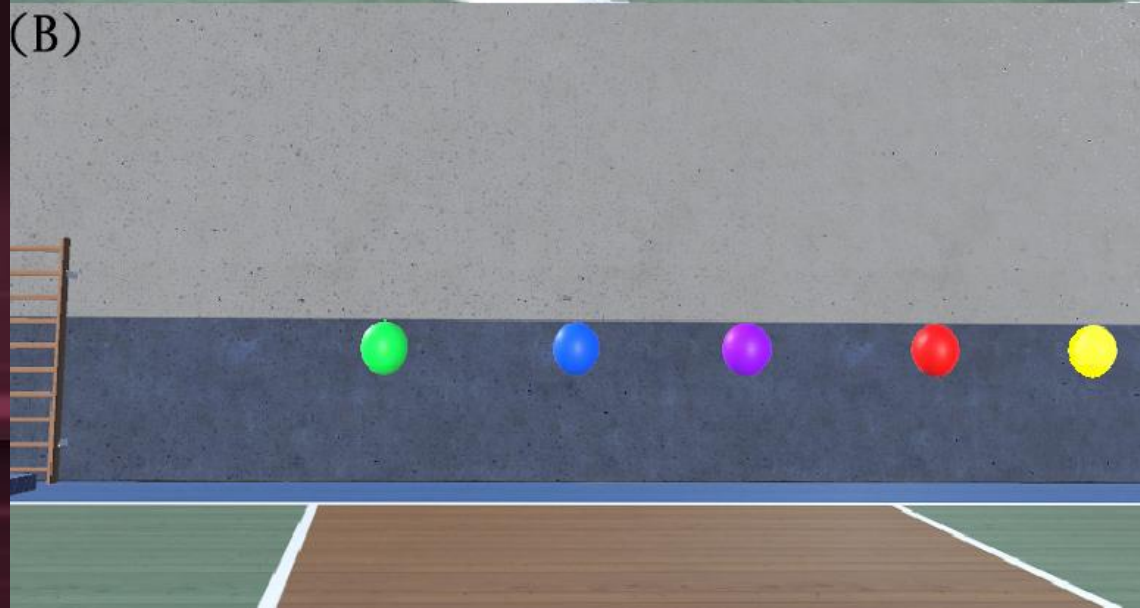


Experiment 2: MIT and CBT on self-location

**Mental Imagery
Task (MIT)**

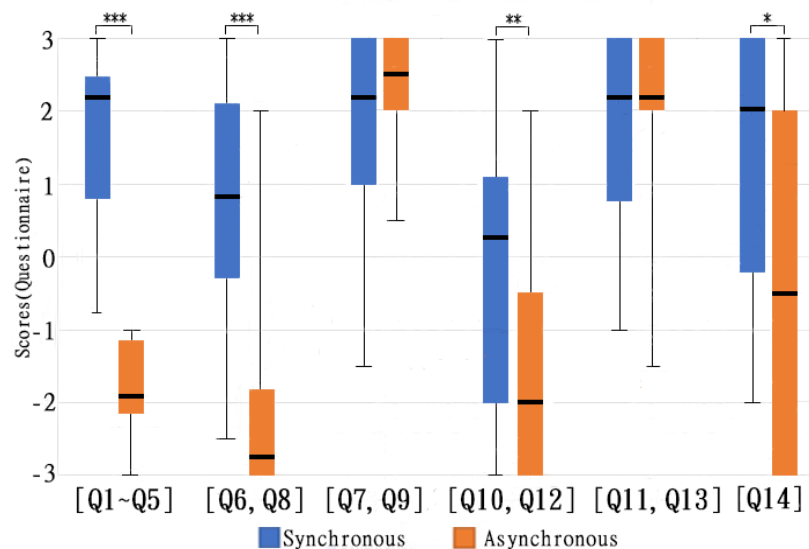


**Color Ball Task
(CBT)**

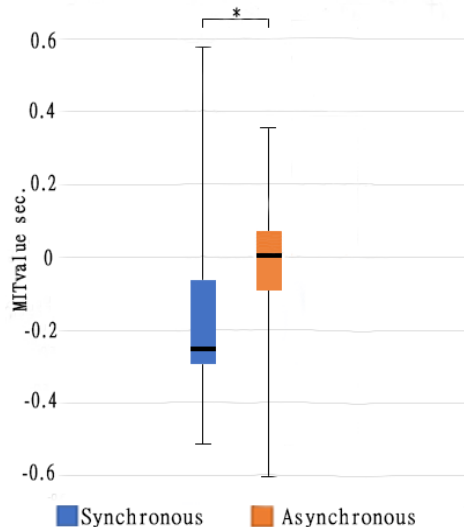


Experiment 2

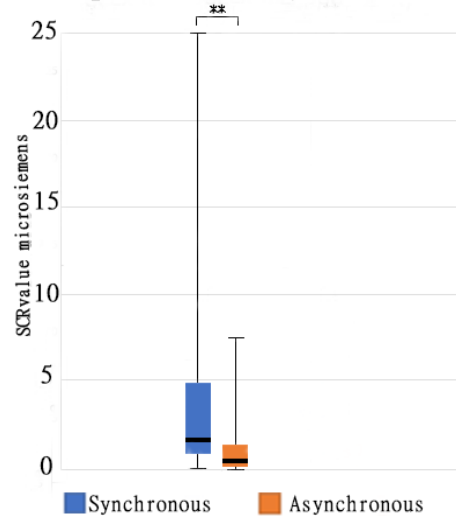
(A) Experiment 2 (Questionnaire)



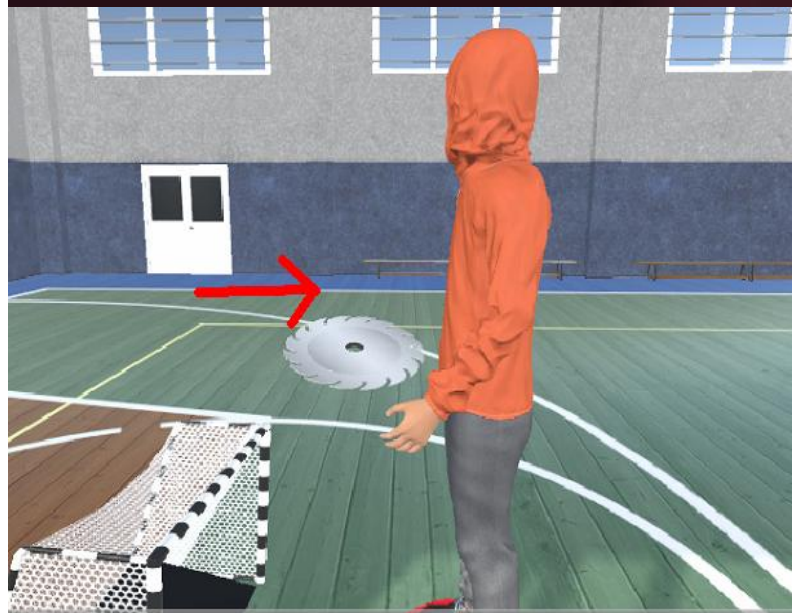
(B) Experiment 2 (MIT)



(C) Experiment 3 (SCR)



Experiment 3



Experiment 4: active 3PP condition

(A)



(B)



(C)

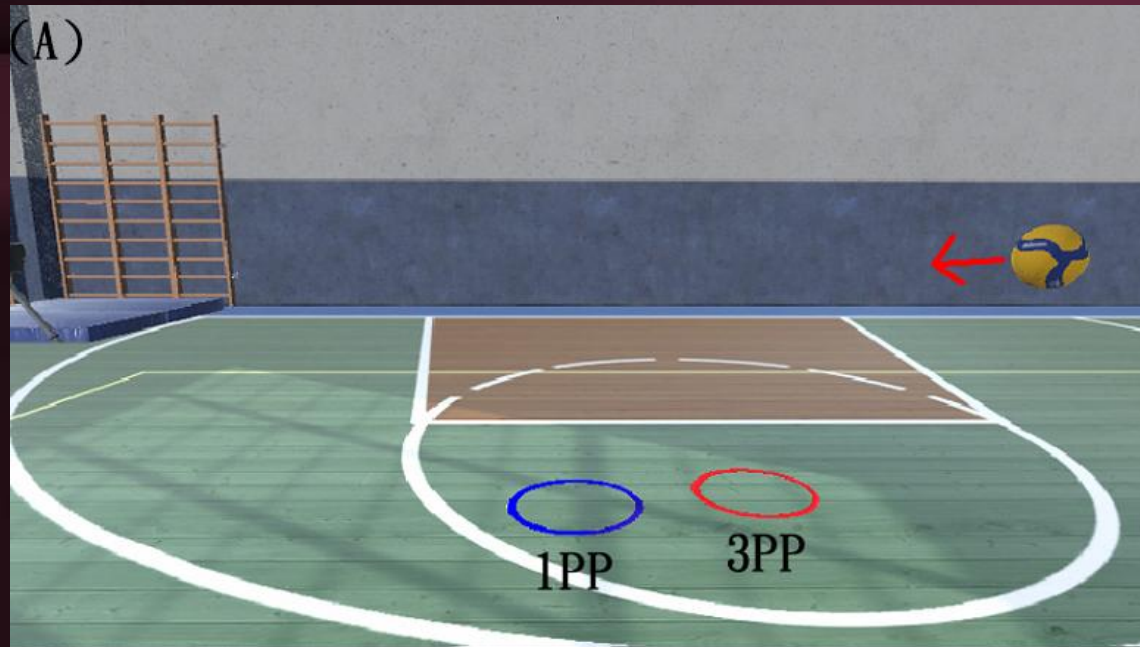


(D)

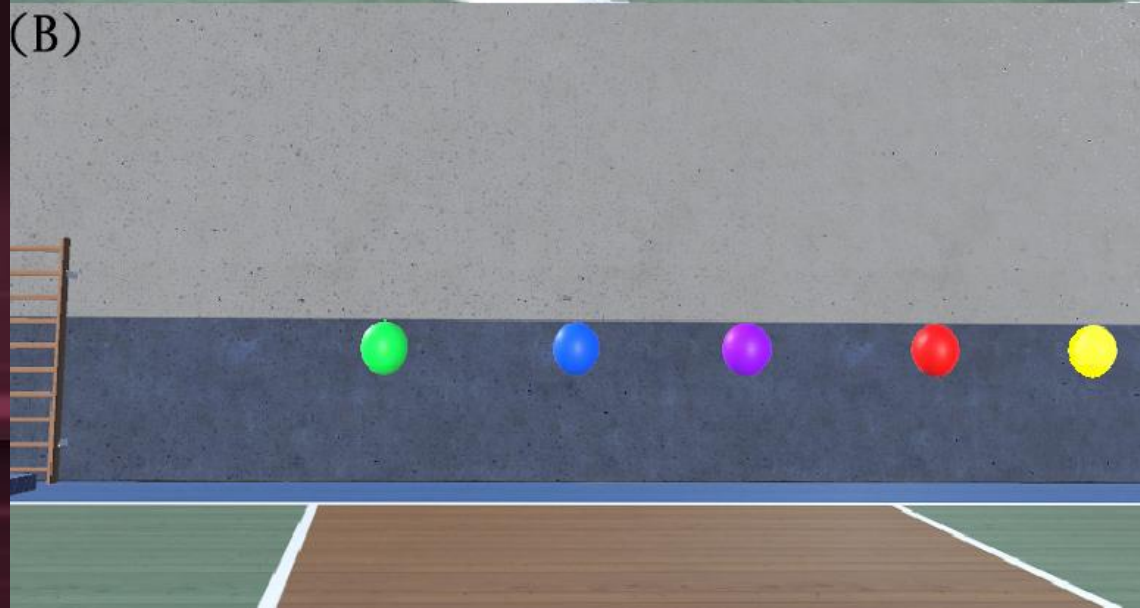


Experiment 4: MIT and CBT on self-location

**Mental Imagery
Task (MIT)**



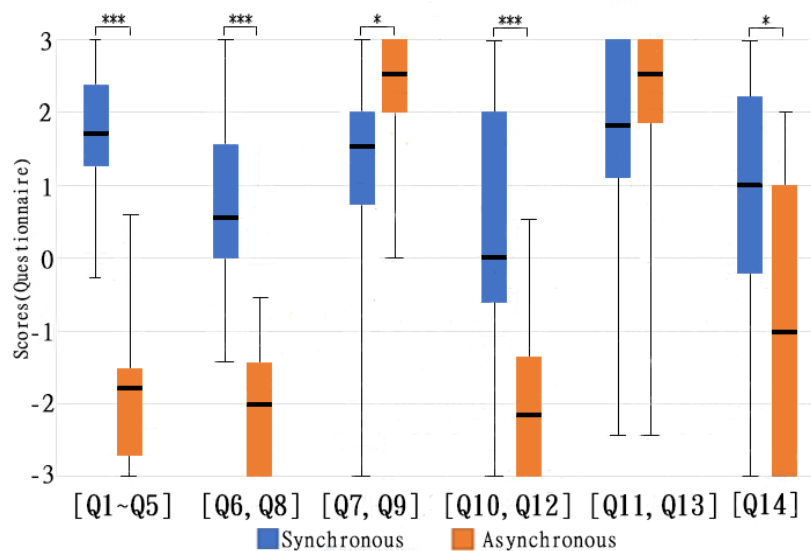
**Color Ball Task
(CBT)**



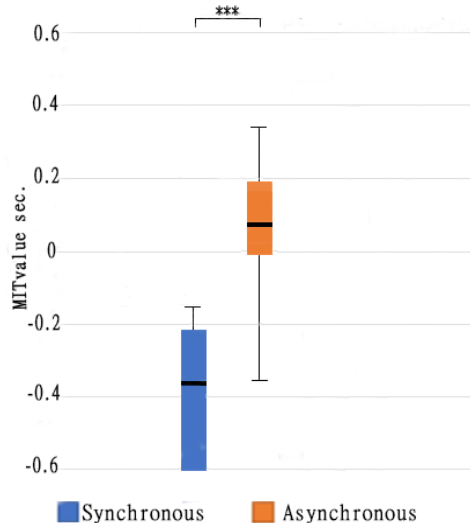
Experiment 4

Experiment 5

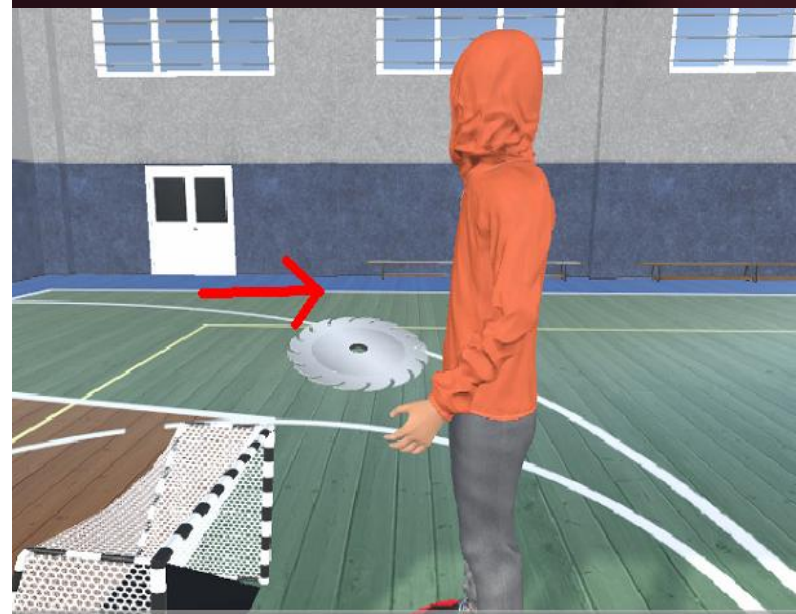
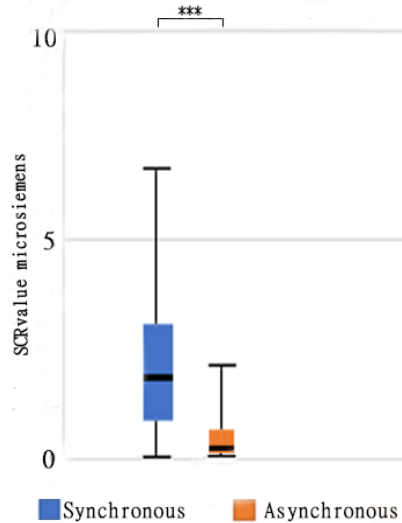
(A) Experiment 4 (Questionnaire)



(B) Experiment 4 (MIT)



(C) Experiment 5 (SCR)



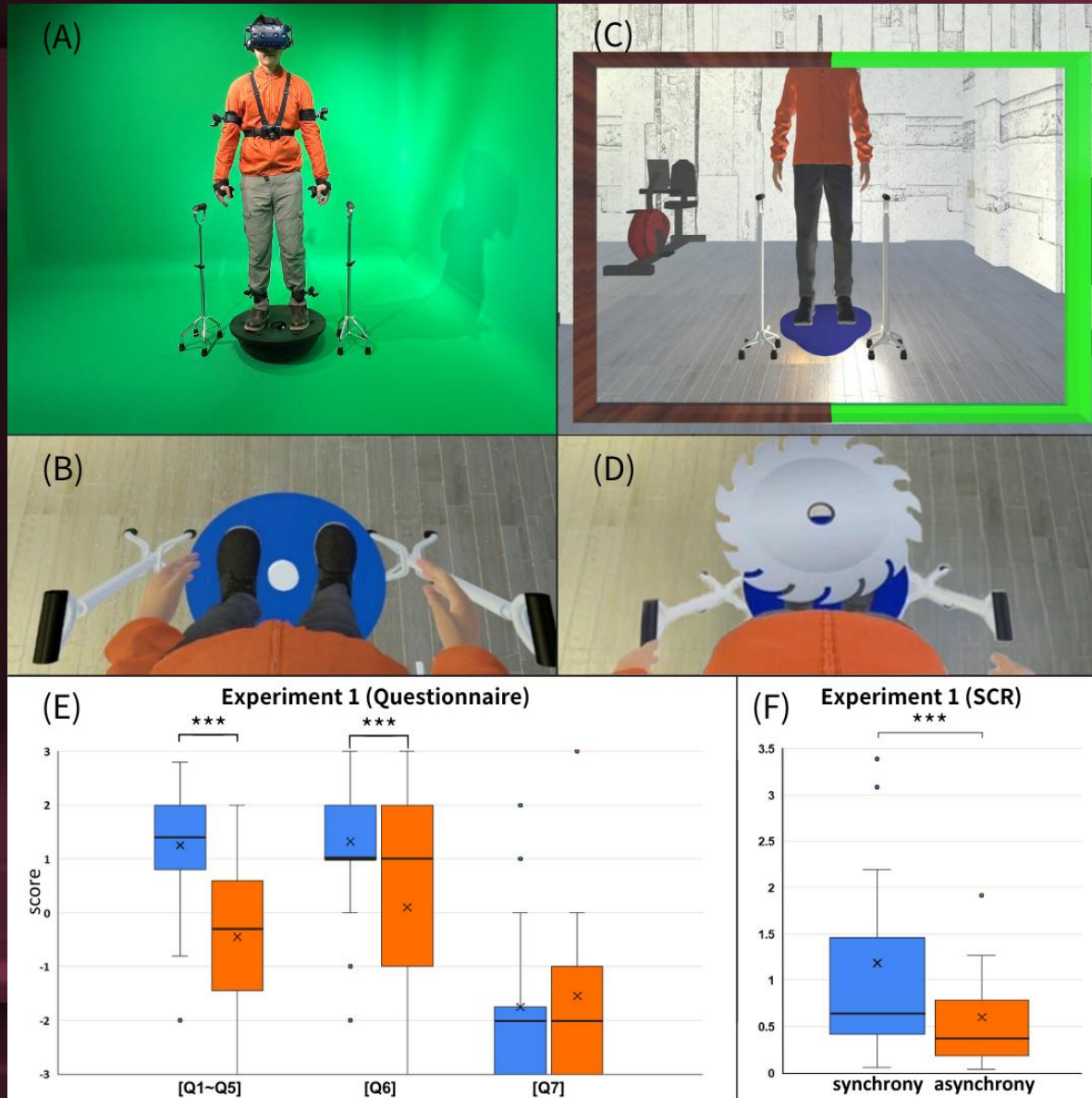
discussion

- **Body ownership:** the results of Experiments 2 ~ 5 together made a strong case for the view that it is possible for healthy subjects to experience ownership of a virtual body from the 3PP.
- **Since full body ownership can be experienced both from the 1PP and from the 3PP, this suggests that the distinction between embodied 1PP and embodied 3PP is actually not rigid but a matter of degree.**
- **Body-location:** the results of Experiments 2 and 4 showed that it is possible for healthy subjects to experience their body as being located simultaneously in two different places, that is, **the sense of double body-locations was induced in the synchronous conditions.**
- **Since it is possible to experience the location of one's body both from the 1PP and from the 3PP, this further supports the view that the difference between embodied 1PP and embodied 3PP is a matter of degree.**

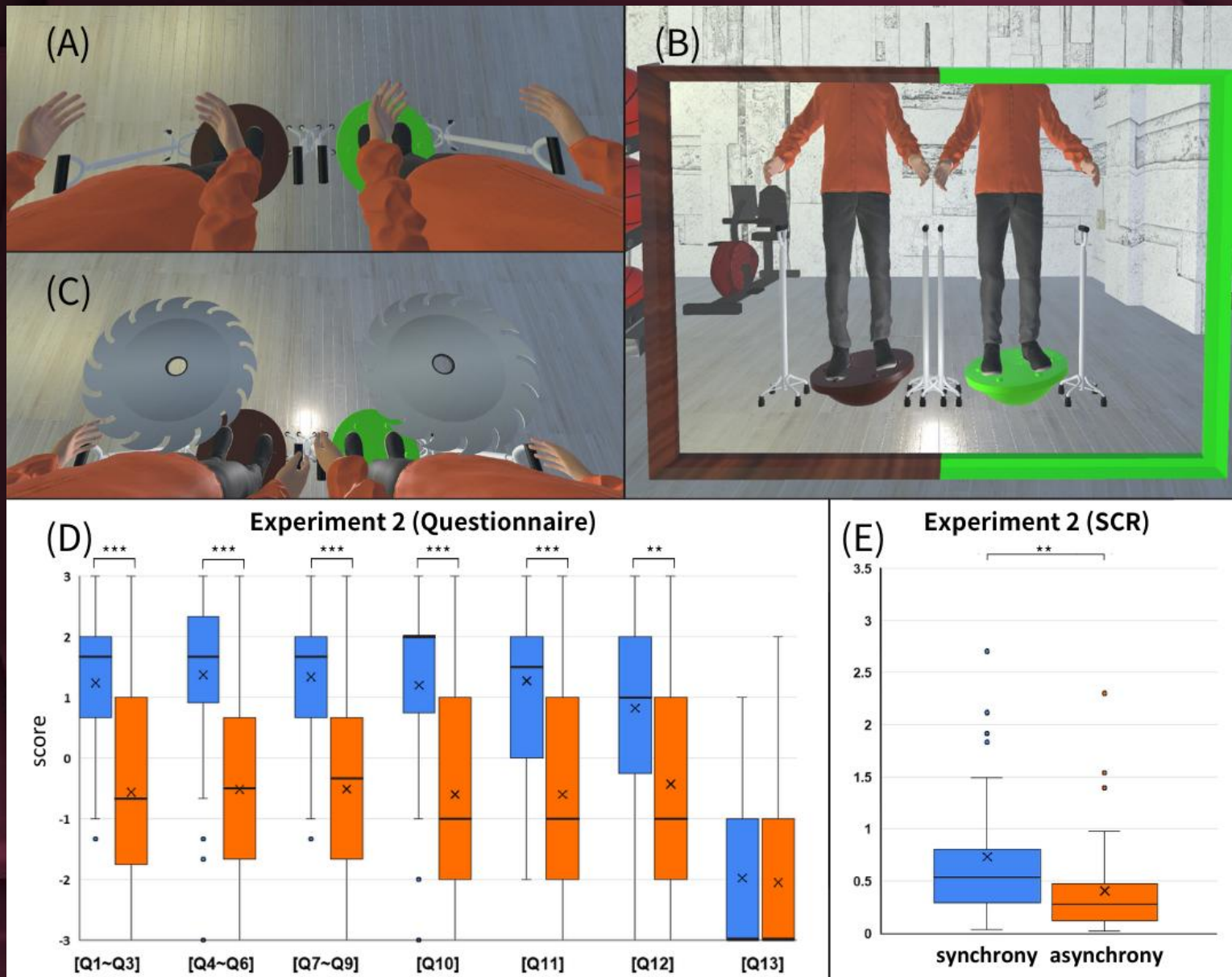
discussion

- **1PP-location:** the results of Experiments 2 and 4 suggest that the sense of 1PP-location could be felt not only at the Zero Point [Q11, Q13] but also at the Avatar Position [Q10, Q12].
- This provides additional support for the view that the difference between embodied 1PP and embodied 3PP is not rigid.
- **Self-location:** the results of MIT in both Experiments 2 and 4 showed that the participants in the synchronous conditions felt that they drifted toward the Avatar Position to a certain extent.
- Feeling one's self in between the Zero Point and the Avatar Position was still an experience of self-location not from the 1PP but from a 3PP. Hence, the results of MIT provided yet another way to diminish the distinction between embodied 1PP and embodied 3PP.

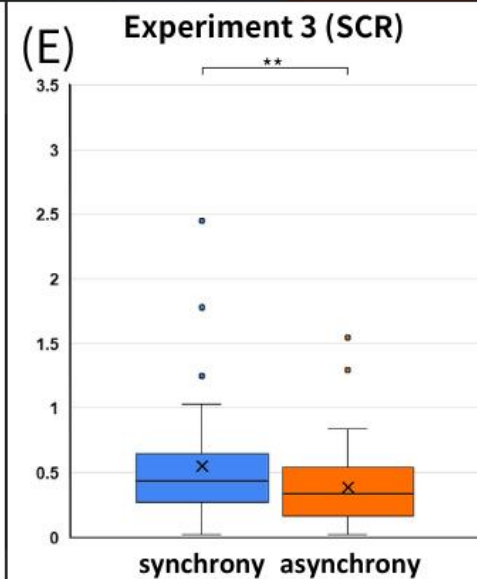
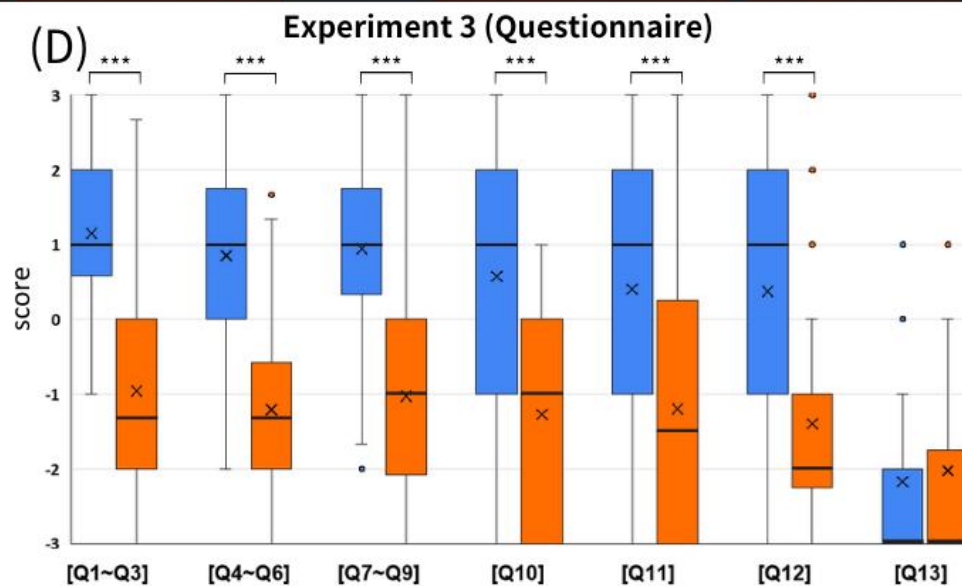
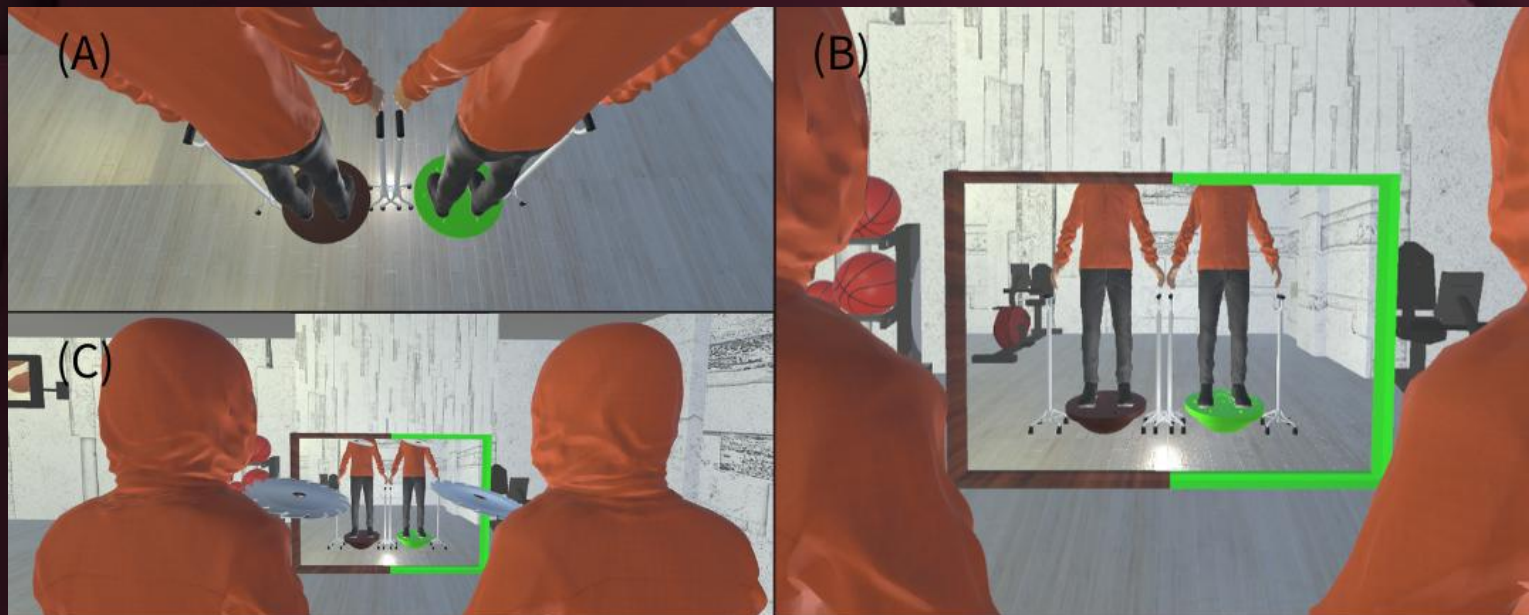
6. Double Body Effect : Experiment 1



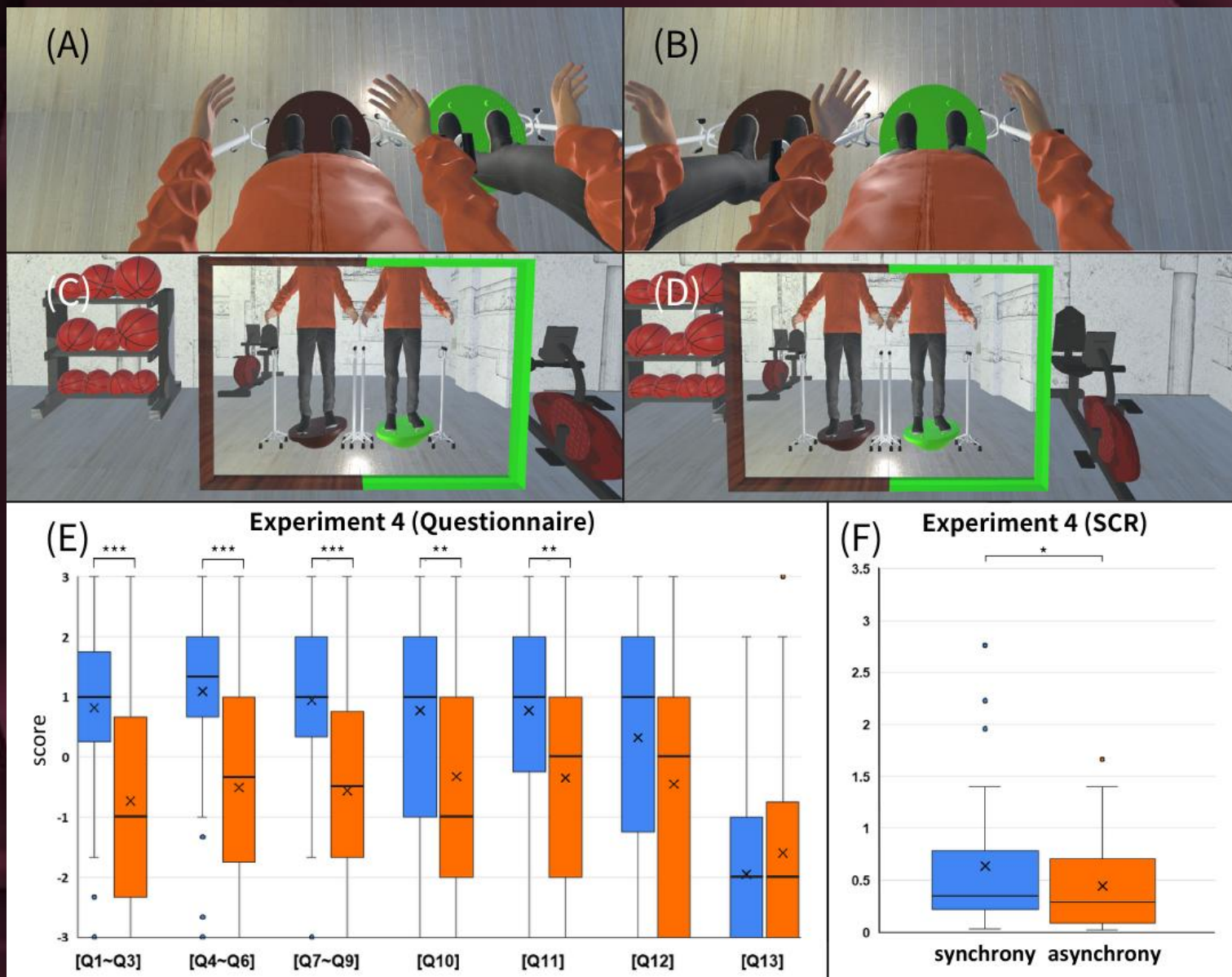
Double Body Effect : Experiment 2



Double Body Effect : Experiment 3



Double Body Effect : Experiment 4



Concluding remarks

- 1. The sense of body ownership:** (i) the self-touching illusion is a solid effect. (ii) It is possible for healthy participants to have illusory experiences of owning two bodies.
- 2. The sense of experiential ownership:** Wittgenstein is likely to be wrong: sometimes it makes sense to ask the Wittgenstein-style questions; it is probable that IEM as well as pre-reflective immunity fail to hold.
- 3. The sense of 1PP-location and the sense of body-location are not the same.**
- 4. It is possible to induce the four-hand illusion. The distinction between “body-as-subject” and “body-as-object” is not rigid.**
- 5. 開發新議題：關於「經驗擁有感」以及「做為主體之自我」（Self-as-subject），可以做跨領域的研究。**

Concluding remarks

- **6.** When it comes to bodily self-consciousness, there is indeed no fundamental chasm between embodied 1PP and embodied 3PP in the VR environment. **The distinction between embodied 1PP and embodied 3PP is at most a matter of degree.**
- **7. Double Body Effect is empirically possible.**

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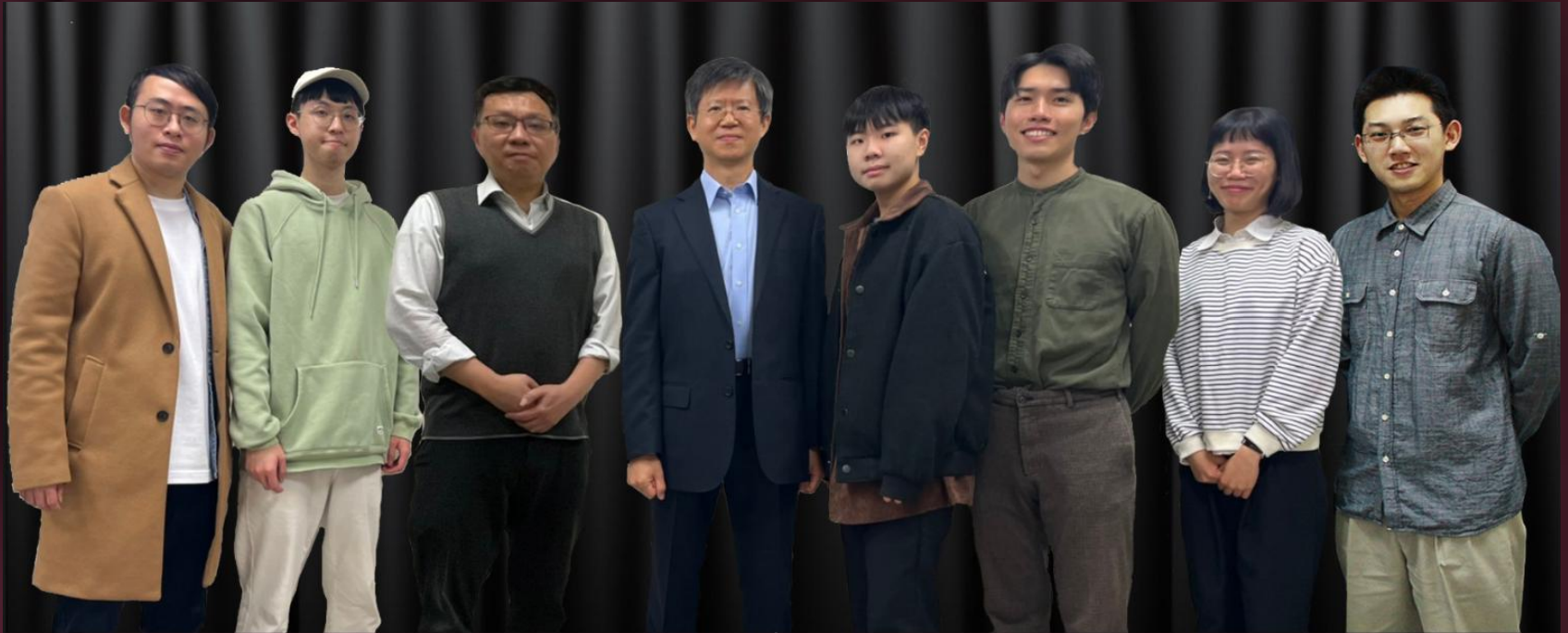
The distinction between first-person perspective and third-person perspective in virtual bodily self-consciousness

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Philosophy and Virtual Body Lab



Thank you!