Enhancing the Chinese identity of young people in Hong Kong and Macao based on the creation of cinematic virtual reality art, taking the cinematic virtual reality work *I love being me: in my place, my home* as an example

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Abstract   The subject of this paper is the use of cinematic virtual reality (CVR) to study the issue of Chinese identity. Guided by theories of immersion and presence, taking a cultural perspective (collective memory) on the context of the relationship between mainland China, Hong Kong, and Macao, we created a CVR work titled *I Love Being Me: in my Place, my Home*. We used CVR as a stimulus for an experiment with the aim of proving that CVR has a significant effect on enhancing the sense of Chinese identity in young people in Hong Kong and Macao. Based on the results of the experiment, we draw the following two conclusions: (1) CVR provides participants with a greater sense of immersion and presence compared to traditional 2D films; (2) CVR should be tailored to local culture—identity, history, language and politics—to maximize participants' sense of identity and immersion.

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Introduction

There are multiple research indicate that compared with those in mainland China, young people in Hong Kong and Macao have a relatively weak sense of Chinese identity; demonstrating the prominent phenomenon of the lack of a singular Chinese identity in areas such as these (Chen 2014; Liu 2014; Policy 2010; Tu et al. 2016; Tu et al. 2014; Xing and Xu 2014; Zhong et al. 2022). Young people in Hong Kong generally lack a nuanced understanding and basic knowledge of the history of China, they have a limited overall sympathy with the nation and only a vague sense of their role and positioning in the country's development (Qingxiang 2020). The reasons for this are complex and varied, and include, among others, differences in national and regional identities, cultural colonisation, ideology, economic disparities, blind Western democracy, and the irrationality of individual systems (Chen et al. 2017). Besides, many studies have indicated that virtual reality (VR) can create a strong sense of body ownership (Ehrsson 2007; Lenggenhager et al. 2007; Petkova and Ehrsson 2008), allowing participants to think from different perspectives. Thus, this study aims to enhance the sense of Chinese identity in young people in the Hong Kong and Macao regions through the use of CVR, awakening and constructing their collective memories, encouraging their trust in mainland China, strengthening their sense of cohesion within their respective regions, and reconstructing the values and identity of Hong Kong and Macao.

The Chinese identity of young people in Hong Kong and Macao

National identity is an important form of identity and is significant for the sustainability of a nation. Scholars have given different definitions of national identity from the point of view of their respective fields: national identity is the attitude orientation of people who are in the decision-making sphere of the country (Levenson 2018); national identity refers to a subjective consciousness and attitude, which is the result of the historical development of the country and the socialisation process of the individual (Jiang et al. 2003); the perception and acceptance of a country's citizens of their national identity, a system of entangled and coiled psychological structures (Zuo 2000); or the individual's identification with the country to which he or she belongs, the political system, cultural traditions, and values and ethical orientations of his or her homeland. (Chen et al. 2017).

Hong Kong and Macao returned to the embrace of the motherland in 1997 and 1999, respectively, marking the beginning of a new era of "One Country, Two Systems" in China after reunification. However, surveys from the Chinese mainland, Hong Kong and Macao have demonstrated consistently that there is a slightly weaker sense of Chinese identity among residents of Hong Kong and Macao compared with that among residents of mainland China. Research conducted by Tu et al. (2016) revealed that the level of adoption of a singular Chinese identity among young people in Hong Kong and Macao is generally low. Only 4.9% of young people in Hong Kong identified as Chinese, while the proportion

was 12.5% among those in Macao. Furthermore, both groups of young people presented a certain degree of de-Sinicization in the formation of their identity: those in Hong Kong showed this in a more pronounced way. Approximately 24.9% of young people in Hong Kong considered themselves as "Hong Kongers but not Chinese," while the proportion was 16.1% among those in Macao, who identified themselves as "Macao residents but not Chinese." Similarly, earlier studies conducted by Hong Kong scholars before 2014 suggested that "Chinese" and "Hong Kong" identity should be understood and assessed as two related but distinct attitudes, since local identity and national identity represent two sides of the same coin (Steinhardt et al. 2018).

Moreover, according to a survey conducted by the Public Opinion Programme of the Chinese University of Hong Kong, the main participants in the 2019 "legislative amendment controversy" are mainly young people aged between 20 and 30 with a high level of education, including secondary school students, with the youngest one being only 12 years old (Francis 2019). Therefore, the national identity and national sovereignty of young people in Hong Kong and Macao are closely related to national security, and have a bearing on the long-term stability of Hong Kong and Macao. These two studies and surveys also corroborate Jürgen Habermas's viewpoint: social instability may occur when people have different core goals and values, as well as when there is a wide variation in the social identity of members of a society (Habermas 1976). Apart from that, there are many other reasons for the lack of national identity among the youth in Hong Kong and Macau, including the transformation of Hong Kong and Macau in 1997 and 1999, the economic gap between Hong Kong, Macau and the Mainland, the subsequent impact of cultural colonisation, and the Central Government's approach to human rights issues.

As a matter of fact, since the handover of Hong Kong and Macao, in order to enhance the sense of national identity of Hong Kong and Macao, the Chinese Government has taken a number of initiatives. An essential part of which is the promotion of national symbols, such as the publicity of the Basic Law, the organisation of activities for the hoisting of the national flag and the singing of the national anthem, and the promotion of the legislation of Article 23 of the Basic Law on national security (Chen et al. 2017). Secondly, linguistic ecological reconstruction (Xu 2022), promotion of cultural and educational exchange mechanisms (Tu et al. 2021), and study tours to the Mainland for Hong Kong and Macao students (Wu et al. 2022), are the current directions of scholars' endeavours. In terms of culture and arts, Chinese elements are often seen in art exhibitions and fairs in Hong Kong and Macao, such as performances of traditional Chinese operas, sales of Chinese traditional style clothing, exhibitions of contemporary artists from the Mainland, concerts by Mainland singers, and shows by famous Mainland art groups.

Our study therefore aims to respond to this social phenomenon from the perspective of cinematic virtual reality, attempting to immerse the participants in CVR to form a sense of "being there." So that they can detach themselves from real life and think about their belonging of identity from a more diversified perspective.

Immersion and presence theory

Immersion is a technical description of multimodality, and presence is a state of consciousness that accompanies immersion. Mel Slater (2009, 2018) defines immersion based on Alva Noë's theory of sensorimotor contingencies as: "an objective property of a system, and higher or lower immersion as the extent to which a VR system can support natural sensorimotor contingencies for perception (O'Regan and noë 2001) including the response to a perceptual action (hence aspects such as display resolution and stereo are intrinsically connected to perception)." For example: when people are in a virtual environment (VE) of VR, Augmented Reality (AR) or Mixed Reality (MR), they must get more immersion than watching a desktop computer screen. "For as soon as you turn your head away from the screen you are no longer perceiving the virtual world;"(Slater 2018) in other words, immersion will thus be lost. Whereas in the VE of VR, AR, and MR, the participants is able to sustain the immersive experience. "Being there," often called "presence," Slater (2009) definite it into two main illusions: place illusion (PI) and plausibility illusion (Psi). PI is the qualia of having a sensation of being in a real place (even if you know you are not there). Psi refers to the illusion that the scenario being depicted is actually occurring (even if you know it is not real).

Existing research

Many researchers have utilized VR in their studies on social issues. Tabitha C. Peck is a paradigmatic case of a scholar whose *oeuvre* contains the use of VR to investigate various social issues. For instance, she immersed light-skinned participants in a virtual environment (VE) where they embodied an avatar of a dark-skinned person: the results showed a significant decrease in racial bias among the light-skinned participants (Peck et al. 2013). She's experiments have also demonstrated the significant impact of VR technology in mitigating stereotypical beliefs about women's competence in science, technology, engineering, and mathematics (STEM) (Peck et al. 2020).

Karim Ben Khelifa as a war correspondent, in the past decades of his work, he has argued that photojournalist struggles to have a tangible impact on its audience (Khelifa 2019). The reason for this is that, for example, when readers watch news stories about climate change, they can choose to commute by bicycle or reduce purchases of products containing plastics; however, when it comes to war, they cannot make much of a difference, and therefore struggle to develop a sense of agency, but it is possible with VR. In 2017, Khelifa and Professor D. Fox Harrell's team at the Massachusetts Institute of Technology (MIT) spent four years co-launching *The Enemy*, a 300 square meter VR art installation. Audiences are placed in a neutral space (a non-war zone) and comes face-to-face with fighters from Israel, Palestine, El Salvador and the Congo via VE. It is interesting to note that when Khelifa brought the work to Israel, and give it to a pilot from Gaza to experience. The pilot said, "when you look straight in the eyes of Abu Khaled, you cannot really say he is

your enemy. After all, what does he do? He fights for his freedom, same as we do, he fights for his life and for his family. It made me understand that the other side see things the same as we do." In this case, by using VR technology, *The Enemy* allows soldiers on both sides of the conflict to quieten down and listen to each other's voices. This allows them to reflect on their own prejudices and stereotypes of the "enemy." In a way, he builds a bridge of peace between the two opposing sides and comes to the conclusion: "The Enemy is always invisible. When he becomes visible, he ceases to be the enemy."

This research shows that Immersive Virtual Reality (IVR) can be used to generate an illusion of body ownership from a first-person perspective of a virtual body that substitutes for their own body. In other words, different races of people can experience one another's existence through IVR, and they can approach issues from a range of perspectives.

Peck's research (VR game) informed our thinking; however, it was not directly applicable to our project because people from Hong Kong, Macao and mainland China are all racially Chinese, and it is difficult to distinguish between them from their appearance. Therefore, this project chooses to continue Khalifa's work, i.e. with the creation of CVR to overcome the greatest challenges—how to create the illusion of recognising the identity of young people in Hong Kong and Macau via the establishment of an IVR, allowing them to stand in the perspective of different groups to rethink the issue of identity belonging?

Methodology

CVR—*I love being me: in my place, my home*

The methodology of this research is interdisciplinary, combining both practice-based research, virtual reality theory, identity theory, and experimental methods of quantitative research. Firstly, we produced a first-person perspective CVR titled *I Love Being Me: in my Place, my Home*, and then did an experiment with it as an experimental stimulus to prove that whether this CVR could enhance participants' sense of national identity to some extent. Based on identity theory, the background of the CVR screenplay was designed to be the Sino-Japanese War, a collective memory shared by mainland China, Hong Kong and Macao, which allows participants to immerse themselves in the IVR and experience the narrative. The aim was to blur participants' sense of identity ownership (PI and Psi) and provide them with an opportunity to contemplate issues from different perspectives.

The plot of *I Love Being Me: in my Place, my Home* revolves around a dialogue between a veteran of the Second Sino-Japanese War who lives in Guangzhou and his granddaughter (the CVR participant). The granddaughter's identity is established as a Hong Kong resident who is attending Sun Yat-sen University. The purpose of the narrative of *I Love Being Me: in my Place, my Home* was to stimulate Chinese collective memory in the CVR's viewers through the background of the war. The narrative includes and compares descriptions of the protagonist's life before, during, and after the war, as well as his life during peacetime, including

Fig. 1 Scene from the CVR work *I Love Being Me: in my Place, my Home*

aspects of lifestyle and society. Real-life scenes closely related to the viewer's experiences are incorporated to enhance their sense of identification with China (Fig. 1). In addition, taking into account the context of young people's upbringing in Hong Kong and Macao, the script of the CVR is in Cantonese, with the aim of further ensuring the immersion and presence of these young people in the work.

The production lasts 14 min, and it was filmed using the Insta 360 PRO 2 panoramic camera. The editing process was carried out using Adobe Premiere Pro 2023. The final film will be available in two versions: VR and 2D, to accommodate the preferences of the participants for viewing.

For this experiment, a pre-test and post-test approach was used to compare the participants' different experiences of national identity before and after viewing the VR and 2D versions of the film. This was in order to demonstrate the degree to which the CVR work enhanced the sense of Chinese national identity among young people in the Hong Kong and Macao regions. Based on the research question, experimental content, and CVR storyline, we propose the following six experimental hypotheses:

H1 We hypothesize that participants who view the VR version of the film will demonstrate a significant increase in their sense of Chinese national identity, immersion and presence compared to those who view the 2D version.

H2 We hypothesize that the different levels of immersion created by the different types of film (VR/2D) will mediate the differences in the enhancement of participants' sense of Chinese national identity.

H3 Due to the script sets the perspective of the participants as Hong Kong identity, we hypothesize that participants from Hong Kong and Macao will exhibit varying

degrees of immersion, presence as well as Chinese national identity after watching the CVR film.

Participants

The experiment recruited a total of 71 participants, ranging in age from 18 to 23 years (M = 20.13, SD = 1.055). Of these, 35 were male and 36 female. All participants had normal or corrected-to-normal vision and had no history of neurological disorders or visual impairment, epilepsy, or simulation sickness. They were in good physical health, and their first language was Cantonese. The participants were recruited from the University of Macao and surrounding areas, and they learned about the experiment and signed up to participate through social media platforms such as Instagram, Facebook, and WeChat. The experiment lasted approximately 20 min, and all participants received a compensation of 50 Chinese yuan for their participation. Their registered residences were either in Macao or Hong Kong, with 24 participants from Hong Kong and 47 participants from Macao. They were randomly assigned to the experimental group (EG) and the control group (CG) using systematic random sampling to ensure that each group had a stable number of 30 participants. The EG eventually consisted of 37 participants, while the CG consisted of 34 participants.

Experimental group (EG)

Participants wore a head-mounted display (HMD) to watch the VR version of *I Love Being Me: in my Place, my Home*.

Control group (CG)

Participants used a computer monitor to watch the 2D version of *I Love Being Me: in my Place, my Home*.

In addition to this, in order to identify whether there is any statistically significant difference between the results from the pre-test and the post-test questionnaires on participants' sense of Chinese identity, we invited 97 people who live in mainland China to complete the pre-test and post-test questionnaire. 51 of them completed the pre-test questionnaire; 46 completed the post-test questionnaire.

Questionnaire

Identity

The pre-test questionnaire used in this study was based on the psychometric structure of the *Chinese Multiethnic Adolescent Cultural Identity Questionnaire* (Hu et al. 2014). This questionnaire consists of six preference elements: Ethnic material culture, Religious belief, Ethnic acceptance, Ethnic convention, Dominant culture, and Social norms. Based on the research needs, we selected 17 items highly relevant

to the study to assess participants' sense of Chinese cultural identity, including their level of identification with Chinese culture, traditions, and values. Examples of these include "Prefer to use Mandarin or Chinese" and "Willing to take time to learn about Chinese traditional culture." The Likert scale used ranged from 1 (strongly agree) to 5 (strongly disagree).

The post-test questionnaire was based on Wei (2021)'s questionnaire surveying *Chinese Cultural Identity and Embodiment Experience* to assess participants' sense of Chinese cultural identity, including their level of identification with Chinese culture, traditions, and values. This questionnaire also utilized a Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree).

Immersion, presence

The immersion and presence questionnaire used in this study was adapted from the paper *A Virtual Presence Counter* by Slater and Steed (2000). This questionnaire employs a 7-point Likert scale, with aspects such as "I had a sense of 'being there' in the field: 1. Not at all … 7. Very much." The questionnaire is designed to assess participants' levels of analyse immersion and presence. It has been widely used by numerous researchers and is considered a mature and reliable measure of immersion and presence. Following open science practices, this CVR, pre-test and post-test questionnaire were pre-registered, available at https://osf.io/s54k2/?view_only=e589f8abd2e24e9cb270531349aa10ad.

Experimental process

Step 1 (Training)

Both EG and CG had a research assistant who provided a brief introduction to the VR equipment and guided participants on how to use the devices. EG used an Oculus Quest 2 and CG used a MacBook pro. Participants learned how to operate the equipment for the experiment from a demonstration.

Step 2 (Pre-test)

After completing Step 1, a baseline assessment questionnaire was administered to evaluate the participant' initial levels of Chinese identity. Participants were asked to complete *Chinese Multiethnic Adolescent Cultural Identity Questionnaire* that assessed this. To prevent participants from anticipating the research purpose, three distractor items were included in the pre-test questionnaire, and it was renamed as "*Survey on Preferences in Daily Life among Young People in Hong Kong and Macao.*"

Step 3 (Experiment)

Participants in the EG were brought to the laboratory to watch the VR version of *I Love Being Me: in my Place, my Home*, while participants in the CG watched the 2D version in the laboratory. All participants viewed the film (2D or CVR) only once. After the experiment, both EG and CG participants were immediately asked to complete an identical survey questionnaire. The questionnaire consisted of two parts, assessing first *Chinese Cultural Identity and Embodiment Experience* and second the level of immersion and presence (*A Virtual Presence Counter*).

Equipment

EG

Participants wore Oculus Quest 2 VR devices and Marshall Major II on-ear headsets. The Head-Mounted Display (HMD) devices were equipped with two LCD screens, with a single-eye resolution of 1832×1920 and a binocular resolution of 3664×1920. They supported refresh rates of 72 Hz and 90 Hz. The CVR content was played using a Skybox VR Player. The HMD featured an adjustable elastic head strap to accommodate participant' different head sizes. After putting on the devices, participants briefly used Six Degrees of Freedom (6DoF) controllers to select the film, with guidance provided by research team members during the selection process. Once the film started playing, the research team members no longer participated. Participants were instructed to wait until the research team members had left before starting the CVR experience.

CG

Participants used a 2019 16-inch MacBook Pro laptop to watch the film, along with the Marshall Major II on-ear headset. The laptop's display featured a 16-inch (diagonal) LED-backlit display with IPS technology and an initial resolution of 3072×1920 (226 ppi). The GoPro VR Player 3.0 was used as the media player, allowing participants to observe the scenes and characters in the film in a 360-degree view by dragging and moving the mouse. Prior to playing the film, research team members provided a brief introduction to this functionality. Once the film started playing, the research team members no longer participated. Participants were instructed to wait until the research team members had left before starting the film.

To minimize external influences, all of participants were placed in a relatively enclosed indoor environment during the experiment. Throughout the experiment, participants remained seated in pre-positioned chairs inside the room, and were not allowed to move freely within the virtual scene, see Fig. 2.

Fig. 2 The top picture shows
EG participants dared to watch
the VR version of *I Love Being
Me: in my Place, my Home*
during the experiment, and
the lower picture shows CG
participants watching the 2D
version of *I Love Being Me: in
my Place, my Home*

Ethics

Participants were asked to sign an informed consent form prior to their participation.
They were assured of anonymity and confidentiality, and that their data would be
securely stored.

Results

To detect whether there is a statistically significant difference between the pre-test
and post-test sense of identity as assessed by the Chinese Identity Scale, the data of
97 mainland Chinese participants who completed the pre-test and post-test Chinese
Identity Scale was imported into SPSS software. After exploring the data, two outli-
ers were removed that were far below the mean in the pre-test data and one outlier
that was far below the mean in the post-test questionnaire.

An independent samples *t*-test was run to determine whether there were differ-
ences in the results of the pre-test questionnaire and the post-test questionnaire in
terms of the sense of Chinese identity. The results showed that there was no sta-
tistically significant difference between the sense of identity demonstrated in the
responses to the pre-test questionnaire ($M=4.45$, $SD=0.38$) and the post-test ques-
tionnaire in the CG ($M=4.46$, $SD=0.08$), $p=.935$. Therefore, the results from the
pre-test and post-test questionnaires in relation to the Chinese Identity Scale were
homogeneous.

A set of 17 questions asked the respondents whether, for example, they preferred to use Mandarin or Simplified Chinese. These 17 items constituted one factor for an exploratory factor analysis. An average was therefore taken to form an index for discussion frequency ($\alpha = .819$, $M = 65.35$, $SD = 6.84$). A set of 9 questions asked the respondents whether they agreed or disagreed with statements such as "I am full of pride in Chinese culture". These 9 items constituted another factor for an exploratory factor analysis. An average was identified, to form an index for discussion frequency ($\alpha = .896$, $M = 35.86$, $SD = 5.17$). A set of 5 questions asked the respondents whether they agreed or disagreed with statements such as "I am full of pride in Chinese culture." These 5 items constituted a further factor for an exploratory factor analysis. An average was again taken to form an index for discussion frequency ($\alpha = .951$, $M = 80.31$, $SD = 8.96$). All the questionnaire data demonstrated good reliability and validity for further analysis.

Independent variable: different media—VR and 2D viewing of *I love being me: in my place, my home*

All participants (EG and CG) successfully completed the experiment and filled out the pre-test and post-test questionnaires. The pre-test and post-test questionnaire results were imported into SPSS software, and three distractor items were removed from the pre-test questionnaire, and one reverse item from the post-test questionnaires was recoded into different variables.

An independent samples t-test was run to determine whether there were differences in the sense of Chinese identity between those in the EG and those in the CG before they watched the film (VR/2D). The results showed that there was no statistically significant difference between the EG ($M = 3.87$, $SD = .39$) and the CG ($M = 3.82$, $SD = .42$), $p = .63$. Therefore, the EG and CG participants had a similar sense of Chinese identity. This analysis ensured the homogeneity of participant' identification as Chinese before they participated in the experiment.

A paired samples t-test was used to determine whether there was a statistically significant mean difference in the sense of Chinese identity in the CG participants before and after watching the 2D film. There were no significant outliers. The assumption of normality was met, as assessed by the Shapiro–Wilk test ($p = .27$). The results indicated that there was no significant change in the sense of Chinese identity in the CG participants before and after watching the 2D film ($p = .39$).

A paired samples t-test was used to determine whether there was a statistically significant mean difference in the sense of Chinese identity in participants in the EG group before and after watching the CVR version of the film. There were no significant outliers. As assessed by the Shapiro–Wilk test ($p < .05$), the assumption of normality was violated. However, the paired samples t-test is robust to violations of normality with respect to Type I error (Posten 1979; Rasch and Guiard 2004; Sunderland et al. 2003; Wiedermann and von Eye 2013). Because of this, we could continue to run the paired samples *t*-test even if this assumption had been violated. Participants presented a significantly higher sense of Chinese identity after watching the CVR version ($M = 4.23$, $SD = 0.55$) than before they watched it ($M = 3.87$,

$SD = 0.39$) (Fig. 3), a statistically significant mean increase of 0.36, 95% CI [0.18, 0.54], $t(36) = 4.11$, $p < .001$, $d = 0.68$. Therefore, the effect size of the sense of Chinese identity in the participants between before and after watching the CVR work is medium.

An independent samples t-test was run to determine the difference in the sense of Chinese identity between the EG and CG participants after watching the film (VR/2D). The EG participants had an enhanced sense of Chinese identity ($M = 4.23$, $SD = 0.55$) compared to the CG group ($M = 3.75$, $SD = 0.52$) that was statistically significant, $M = 0.47$, 95% CI [0.22, 0.73], $t(69) = 3.72$, $p < .001$.

To further understand the differences in the sense of Chinese identity and immersion in the participants between before and after watching the films (VR/2D) a one-way Multivariate Analysis of Variance (MANOVA) was run to determine the effect of the type of film (VR/2D) on the change in participants' sense of Chinese identity and their level of immersion. The participants in the EG had higher scores in terms of their sense of Chinese identity ($M = 0.36$, $SD = 0.53$) and level of immersion ($M = 5.13$, $SD = 1.06$) than those in the CG ($M = -0.07$, $SD = 0.46$; $M = 3.08$, $SD = 1.83$, respectively), as shown in Fig. 3. There was a statistically significant difference in the combined dependent variables between the experimental groups, $F(2, 68) = 23.58$, $p < .001$; Wilk' $\Lambda = 0.59$; partial $\eta^2 = 0.41$. Follow-up univariate ANOVAs (Analyses of Covariance) showed that both the sense of Chinese identity ($F(1, 69) = 13.1$, $p < .01$; partial effect size $\eta^2 = 0.16$) and immersion ($F(1, 69) = 34.32$,
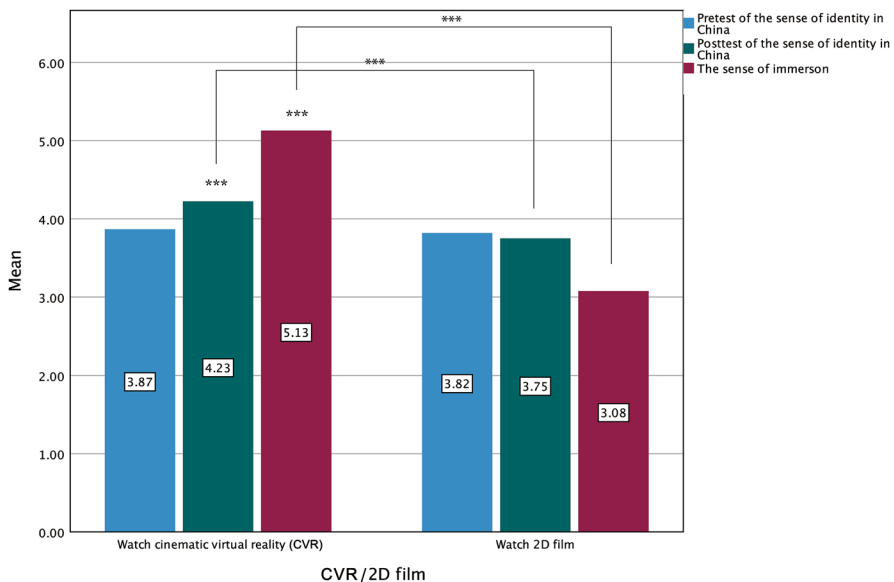

Fig. 3 The blue bars represent the results of the Chinese identity questionnaire administered to participants before watching *I Love Being Me: in my Place, my Home* (VR/2D), the green bars represent the results of the Chinese identity questionnaire administered to participants after watching *I Love Being Me: in my Place, my Home* (VR/2D), and the red bars represent the results of the immersion questionnaire administered to participants after watching *I Love Being Me: in my Place, my Home* (VR/2D). *Represent $p < .05$, **represent $p < .01$, and ***represent $p < .001$

$p < .001$; partial $\eta^2 = 0.33$) were statistically significantly different between the participants in the EG and the CG, using a Bonferroni adjusted α level of 0.025. Therefore, the results from the independent samples t-test and MANOVA support Hypothesis one: participants who watched CVR have a statistically significant increase in national identity and immersion compared to those who watched 2D films.

For hypothesis two, using Andrew F. Hayes' PROCESS v4.2 (Model 4, with 10,000 iterations), the media types (VR/2D) were set as the independent variable, the difference between the pre-test and post-test scores for the sense of Chinese identity as the dependent variable, and immersion as the mediating variable. The results showed a statistically significant effect of media type on the sense of immersion ($t(-2.75, -1.35) = -5.86$, $SE = 0.35$, $p < .001$), with an effect coefficient of -2.05. The sense of immersion had a statistically significant positive effect on the sense of identity ($t(0.13, 0.75) = 2.84$, $SE = 0.16$, $p < .01$), with an effect coefficient of 0.44. However, the total effect of media type on the sense of Chinese identity was not statistically significant ($p = .083$). The confidence interval for the final indirect effect $[-0.01, 0.36]$ is close to the value 0, indicating that immersion does not mediate the relationship between media types and the enhancement of a sense of Chinese identity within a 95% confidence interval. Therefore, Hypothesis 2 is not supported.

Independent variable: residence—Hong Kong and Macao

Independent samples t-tests were run to determine the differences in the sense of immersion among the Macao participants when watching different types of media (VR/2D). The Macao participants experienced higher levels of immersion when watching the VR version of the film ($M = 4.82$, $SD = 0.93$) compared to the 2D version ($M = 2.69$, $SD = 1.52$), with statistical significance, $M = 2.13$, 95% CI [1.35, 2.91], $t(32.13) = 5.57$, $p < .001$. Independent samples t-tests were run to determine the differences in the sense of immersion among Hong Kong participants when watching different types of films (VR/2D). Hong Kong participants experienced higher levels of immersion when watching the VR version of the film ($M = 5.7$, $SD = 1.07$) compared to the 2D version ($M = 3.11$, $SD = 1.72$), with statistical significance, $M = 2.6$, 95% CI [1.33, 3.86], $t(16.21) = 4.34$, $p < .001$.

To explore the effects of residency (Hong Kong/Macao) and the covariate media type (VR/2D) on participant' sense of Chinese identity and their immersive engagement, a total of 71 participants from Hong Kong and Macao were divided into two groups: an EG (watched the VR movie, $n = 37$), and a CG (watched the 2D movie, $n = 34$). A Multivariate Analysis of Covariance (MANCOVA) was run to show the effects of place of residence and media type on the sense of Chinese identity and immersion, while controlling for media type (VR/2D) as a covariate. The MANCOVA revealed significant multivariate effects of place of residence (Wilk' Lambda = 0.87, $F(2, 66) = 4.87$, $p < .05$, partial $\eta^2 = 0.13$) and media type (Wilk' Lambda = 0.58, $F(2, 66) = 23.57$, $p < .001$, partial $\eta^2 = 0.42$) on the composite dependent variables. Subsequent univariate ANCOVA analyses were conducted to examine the effects of place of residence and media type on the sense of Chinese identity and immersion separately. For the enhancement of the sense of Chinese

identity, both place of residence ($F(1, 67) = 7.77$, $p < .01$, partial $\eta^2 = 0.1$) and media type ($F(1, 67) = 12.03$, $p > .01$, partial $\eta^2 = 0.15$) showed statistically significant effects (see Fig. 4). For the sense of immersion, the analysis revealed the statistically significant effect of media type, $F(1, 67) = 72.8$, $p < .001$, partial $\eta^2 = 0.33$. However, the place of residence did not have a statistically significant effect on the sense of Chinese identity, $F(1, 67) = 3.66$, $p = .2$, partial $\eta^2 = 0.02$, with a Bonferroni-adjusted α level of 0.025. Therefore, these results support Hypothesis 6: in terms of the enhancement of a sense of Chinese identity, participants from Hong Kong ($M = 0.41$, $SD = 0.36$, $n = 23$) showed greater evidence of this than participants from Macao ($M = 0.05$, $SD = 0.57$, $n = 47$). However, there was no difference in overall immersion between the two groups (VR and 2D).

In order to gain a clearer understanding of the enhancement of a sense of Chinese identity among participants from different regions, we used paired sample t-tests to identify whether there were statistically significant mean differences in Hong Kong participants' sense of Chinese identity before and after watching the CVR version of the film. The data did not contain significant outliers. The assumption of normality was met, as assessed by the Shapiro–Wilk test ($p = .228$). Hong Kong participants demonstrated a significantly higher sense of Chinese identity after watching the CVR version ($M = 4.58$, $SD = 0.28$) than before they watched it ($M = 4$, $SD = 0.42$), a statistically significant mean increase of 0.57, a 95% CI [0.43, 0.71], $t(12) = 9.01$, $p < .001$, $d = 2.5$. Similarly, a paired sample t-test was run to determine whether there were statistically significant mean differences in Macao participants' sense of
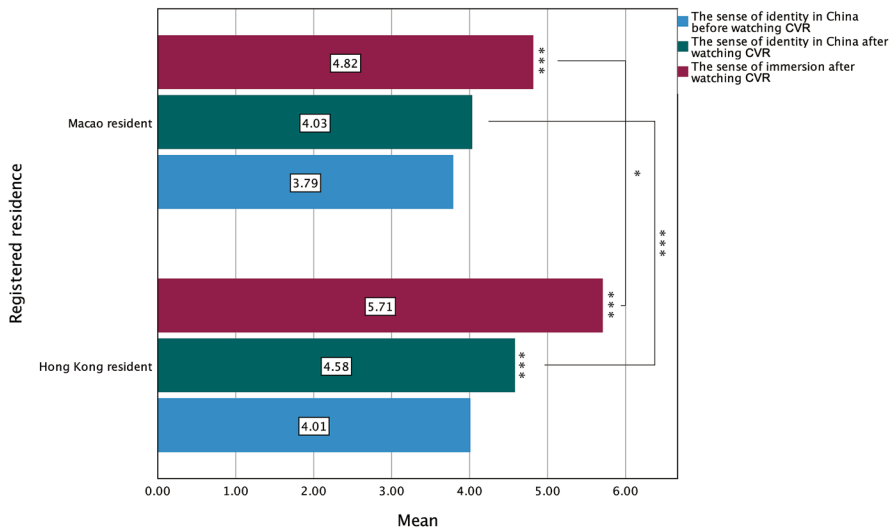

Fig. 4 The blue bars represent the results of the Chinese identity questionnaire administered to participants before watching the VR version of *I Love Being Me: in my Place, my Home*. The green bars represent the results of the Chinese identity questionnaire administered to participants after watching the VR version of *I Love Being Me: in my Place, my Home*. The red bars represent the results of the immersion questionnaire administered to participants after watching the VR version of *I Love Being Me: in my Place, my Home*. *Represent $p < .05$. **represent $p < .01$. ***represent $p < .001$

Chinese identity before and after watching the CVR version. The results showed that there was no statistically significant difference in these participants' sense of Chinese identity after watching the CVR version ($M=4.03$, $SD=0.57$) from their sense of Chinese identity before they watched it ($M=3.78$, $SD=0.36$), within a 95% confidence interval, $p=.06$.

Further, an independent samples t-test was run to determine whether there were differences in the sense of immersion between Hong Kong- and Macao-based participants after watching the CVR version of the work. The Hong Kong participants presented a higher sense of immersion ($M=5.7$, $SD=1.07$) compared to the Macao participants ($M=4.82$, $SD=0.93$), a statistically significant difference, $M=0.89$, 95% CI [0.21, 1.58], $t(35)=2.64$, $p<.05$ (see Fig. 4). Additionally, an independent samples t-test was conducted to examine whether there were differences in the sense of Chinese identity between Hong Kong and Macao participants after watching the CVR version. Hong Kong participants showed a stronger sense of Chinese identity ($M=4.5$, $SD=0.28$) than the Macao participants ($M=4.03$, $SD=0.57$), with a statistically significant difference, $M=0.55$, 95% CI [0.27, 0.83], $t(34.83)=3.93$, $p<.001$. Therefore, Hypotheses 3 are supported: the Hong Kong participants showed a stronger sense of Chinese identity as well as immersion and presence compared to the Macao participants after watching the CVR version of the work.

Discussion

This study has two objectives: (1) to blur the sense of identity ownership among Hong Kong and Macao youth by creating a new media artwork using theories of immersion and presence (PI and Psi), with the aim of encouraging participants to think about their identity from different perspectives, and (2) to empirically examine whether CVR can enhance a sense of Chinese national identity in young people in Hong Kong and Macao through experimental methods. Therefore, this study contributes to academic research both practically and theoretically.

In terms of our first objective, after conducting extensive artistic practice and theoretical research, we determined that virtualized cinematic reality would serve as the medium for our artwork. Drawing upon significant events from Chine's collective memory, specifically the historical backdrop of the Anti-Japanese War, and referring to related articles on immersion, presence and CVR creation, we created the CVR artwork *I Love Being Me: in my Place, my Home* for the purposes of the research.

Regarding the second objective of the study, the experiment was designed to divide participants into two groups (EG and CG): these groups watched the 2D version and VR version, respectively, of *I Love Being Me: in my Place, my Home*. The changes in participant' sense of identity were recorded through pre- and post-tests using questionnaires. The results of the experiment showed that participants who watched the CVR version exhibited a stronger sense of immersion than those who watched the 2D version. Furthermore, participants who watched the CVR version demonstrated a significant increase in their identification as Chinese after viewing, whereas participants who watched the 2D version did not show a statistically significant increase in this identification after viewing. Therefore, we hypothesized that

the different levels of immersion experienced by audiences through different media serve as a mediating variable in the enhancement of Chinese national identity in young people in Hong Kong and Macao. However, our attempt to conduct a mediation analysis was not successful ($p = .083$). Nevertheless, the results of the mediation analysis were close to the 95% confidence interval, suggesting that the insufficient sample size may have contributed to this outcome.

The artistic creation of *I Love Me: Home* offers an example of how virtual reality technology can intervene in social issues by attempting to blur the sense of identity ownership between individuals of the same ethnicity. It aims to achieve an interchange of identity and perspective and reflection on problems, and to establish a certain degree of ideological consensus. This study also offers an innovative approach to identity enhancement, utilizing the cultural dimension of collective memory, by exploring how an artistic creation can enhance young people's sense of identity as Chinese in Hong Kong and Macao.

Differences in the sense of identity between Hong Kong and Macao

Based on the statistical analysis conducted earlier, we have found that participants from Hong Kong showed a more significant increase in their sense of Chinese identity compared to participants from Macao. We speculate that there are several reasons for this disparity: first, it could be attributed to the script of *I Love Being Me: in my Place, my Home*, which is set against the backdrop of Hong Kong. Participants from Hong Kong may have experienced a greater level of immersion due to the familiar context, leading to a further blurring of their identity, better enabling them to address their identity issues from different perspectives. Second, as indicated in the previous analysis, Hong Kong residents generally exhibit a weaker sense of Chinese identity than residents of Macao. Unlike Hong Kong residents, those in Macao do not perceive the same level of distance between themselves and China. Hence, there may be greater potential for Hong Kong participants to enhance their sense of Chinese identity. Third, this observation may highlight the existence of inherent differences in the sense of identity between people in Hong Kong and those in Macao.

Identity in Hong Kong

Hong Kongers are torn between multiple identities, both "local" and "Chinese". The concepts of "nativism" and "Hong Kong identity" mean that people in Hong Kong have a weaker sense of "Chinese" identity. "Identity" is one of the least-established concepts in the social sciences, but it has important implications for understanding political paradigm shifts and the institutions that bring about social change (Hall and du Gay 1996). There are two main aspects of localism and Hong Kong identity, the "cultural domain" and the "civic domain" (Flowerdew and Leong 2010). The civic field pays more attention to rebuilding local ethnic communities, such as striving for more social democratic institutions and empowering vulnerable groups (Chen

and Szeto 2015). However, the policy of "one country, two system" is exactly the bridge that spans the gap between Hong Kong's "nativism" and a socialist future. This research, as a way of reconciling the relationship between Hong Kong and mainland China that is outside the realm of politics, replace the rational practice of politics with artistic exchanges, interactions, and collective memory. But other factors should also be explored in researching the reconciliation of different ideologies.

Identity in Macao

Since its return, the implementation of nationalist education in Macao has been relatively smooth, with schools and students in Macao showing a high degree of acceptance of nationalist education. The identity of Macao residents was first mentioned in a special edition of the magazine *Cultural Review* in 1994. The longstanding discourse of anti-colonialism and colonial politics between China and Portugal has dominated historical narratives within their respective communities. Furthermore, Macao's unique social structure makes it difficult to articulate the cultural identity of Macao residents (Li 2005). The government's attempts to construct national and cultural identity after the handover have become a lively research topic. Zonghai Shao (2016), in their comparative analysis of communities in Macao and Taiwan, pointed out that Portuguese efforts towards assimilation through intermarriage and naturalization have for a long time actually resulted in the isolation of Macao residents (Zonghai Shao 2016). During the late Qing dynasty, many Chinese were taken by force by the Portuguese to work overseas, and women were forced into prostitution, leading to resentment and protective measures among the local Chinese population, exacerbating the divide between Chinese and foreigners. These historical, cultural, and political factors have reduced the likelihood of Macao residents experiencing a significant sense of Chinese national identity.

However, Li Zhanpeng presents a different viewpoint, suggesting that Macao resident' identity has emerged during the social and cultural changes of the past 20 years. The concept of "Macao people governing Maca" in the Macao Basic Law has become the legal basis for Macao people's thematic identity. In 2005, the historic center of Macao was selected as a UNESCO World Heritage Site, highlighting Maca's cultural history. The impact of tourists on daily economic life has gradually strengthened the differentiation between Macao residents and the "other" Since Maca's return to the motherland in 1999, Macao residents have experienced a complex mix of feelings and an intertwining of local and national identities in relation to the unfamiliar "motherland."

There has been a longstanding issue of identity among mainland Chinese residents and residents of Hong Kong and Macao. Based on the above analysis, we can also observe a degree of heterogeneity in identity affiliation as experienced by Macao and Hong Kong residents. Factors contributing to this heterogeneity include cultural differences and civic values. Overall, a higher proportion of Macao residents identify themselves as Chinese, having a dual identity with a primary identification as Chinese, than Hong Kong residents. Therefore, even those tending to identify as Macao residents show less resistance towards, and rejection of, Chinese elements. Therefore, we need to treat the national identity issues of Hong Kong and

Macao differently, and create different CVR works for different regions in order to maximise the sense of national identity of local residents.

Research limitations and future research directions

The limitations of this experiment are as follows: first, the number of participants from Hong Kong ($n=24$) in this experiment was too small, and significantly smaller than the number of participants from Macao ($n=47$). Second, all the participants in this experiment were recruited solely from Macao, and the inclusion of more participants recruited locally in Hong Kong may yield different experimental results. Third, this project did not refine the identities of Hong Kong and Macau people, for example, Hong Kong/Macau people born and raised in Hong Kong/Macau, and Hong Kong/Macau people born and raised in Mainland China; some studies have shown that the national identities of these two people are different (Tu et al. 2014). Fourth, this project was a short-term experiment, and the long-term effects of participant identity enhancement after prolonged exposure are unknown.

In terms of future research directions, due to the first-person identity setting of the script in this experiment that features the character of a Hong Kong resident, participants from Hong Kong experienced a higher level of immersion compared to participants from Macao. Furthermore, the degree of Chinese identity enhancement among Hong Kong participants was greater than that among Macao participants. Therefore, we believe that future scholars researching the enhancement of identity through CVR should consider incorporating the local culture in which the participants were raised into the creative process of CVR to design more effective interventive measures that will enhance participant' sense of immersion and identity.

Finally, regarding the issue of identity differences between Hong Kong and Macao residents, we believe that it is difficult to make a more detailed distinction through the quantitative research model employed in this experiment. Factors influencing the sense of identity may be related to other variables such as environmental factors, educational attainment, age, etc. Future quantitative and qualitative research should be conducted based on these potential reasons and factors, exploring how local consciousness, social class, regional and nationalist sentiment and national identity interrelate.

Conclusion

This study makes both a theoretical and a practical contribution to scholarship through an interdisciplinary research method. In terms of practice, we created the CVR *I Love Being Me: in my Place, my Home* with reference to theories of identity, immersion, presence and related articles on CVR creation. In a theoretical context we demonstrated that using CVR as an experimental stimulus proves that targeted creation of CVR works can enhance the Chinese identity of young people in Hong Kong and Macao. At the social level, this research provides a feasible way in which young people in Hong Kong and Macao (or other area) can enhance their sense of identifying with the motherland and offers new ideas and new avenues of

research for scholars in this field—replace the practical rationality of politics with an approach involving interaction, communication and participation. This democratic mode of communication endows each "object" with subjectivity in the dialogue. This is precisely what Jürgen Habermas (1976) pursues in his theory of "communicative rationality", using the speech act theory to analyse the conditions that allow our discourse to be mutually intelligible.

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