APPLYING THE SOLOMON FOUR-GROUP DESIGN TO SHORT FILM PSAS: A METHODOLOGICAL REFLECTION ON EXPERIMENTAL MANIPULATION

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Abstract

This paper provides a methodological reckoning of how experimentation can be practiced in the context of creative audiovisual research practices, through phonemic treatment of short films PSAs). Based on the Solomon Four-Group Experimental Design as a theoretical base, the chapter outlines how traditional experimental principles might be combined with narrative and artistic invention. The alteration, which was to add subtitles and narrator narration to an already existing short film PSAs, was to demonstrate a sense of how theoretical concepts drawn from narrative transportation – in particular the cognitive, emotional and imaginative aspects - might be made operative in audiovisual design. The study was not intended to generate empirical findings but to expose the process of translating theoretical ideas into a form of communication and to consider whether leading-edge methodological rigor and creative pliability might be harmonized in the medium of examining is. The team learned that slight interventions — subtitles and narration — can shape the interpretive process along with the narrative flow and emotional pitch of brief stories. In employing the Solomon design as a guide for structure and evaluation, this work provides a methodological approach for integrating empirical thought and artistic production in the field of communication studies. It makes a contribution to the ongoing debate and dialogue concerning how experimental forms can be means for reflection and renewal within current audiovisual communication.

Keywords: narrative transportation; experiment manipulation; Solomon four-group design; short film PSAs; methodological reflection

1. INTRODUCTION

It is a common practice in communication research to pretest participants, which may result in an experimental sensitization and a consequent distortion of results (Eveland, 2003; Lee & Kim, 2021). The Solomon four-group design and its variations were proposed as solutions to this limitation. The Solomon four-group designs separates the intervention effect from the testing effect by randomly assigning the participants into four groups (two that receive pre-tests and two that do not), providing an improvement in the two types of validity, internal and external (Solomon, 1949; Shadish, Cook, & Campbell, 2002). Therefore, this makes it an ideal fit for the communication studies persuasion research area as this line of research frequently involves comparing attitude differences between a pre-test and a post-test (Şahin, 2024; Golboni, Yazdani, & Ghanbari, 2024).

In contrast, this study is from a narrative transportation theory perspective to manipulate short film public service announcement (PSA) using the Solomon four-group experiment design. This study presents the manipulation of Solomon four-group design on the cognition, emotion and imagination in the story (Green & Appel, 2024). Concretely, the manipulation of such elements is realized by modifying the original short film PSAs' audio-visual language, with the addition of subtitles and narrator. Through the integration of experimental method practice and narrative transportation the principle,this study is considered as the best approach to explore persuasion mechanism of short film PSAs.

Based on the media context of China, this study takes the short film PSAs from popular Chinese social media platforms (e.g. Douyin and Bilibili) as the samples to discuss the communication features of short film PSAs in China. Chinese short film PSAs often take 'family issues' as their theme and use dramatic narratives to evoke empathy (Lu, 2023; Li, 2022). The experimental materials selected for this study involve four typical family issues. Therefore, this research also focuses on the localization practice of short film PSAs in China and provides methodological suggestions for conducting experimental research on Chinese short film PSAs.

In conclusion, this study aims to integrate theoretical insights, methodological rigor and practical design. His contributions include: (1) Extending the narrative immersion theory to the field of short film PSA communication; (2) A method for manipulating short film PSA under the Solomon Four Group experimental framework is provided; (3) It provides a systematic experimental research method for the practical research of short film PSAs based on the Chinese mainland. Through this integration, this study provides a methodological innovation for the experimental practice in the field of contemporary social communication studies.

2. LITERATURE REVIEW

2.1 Narrative Transportation Theory

Narrative transportation theory explains how individuals enter the narrative world and the impact on their beliefs, attitudes, and behaviors after being transported to it. The origin of this theory can be traced back to the cognitive psychology perspective that readers or viewers sometimes feel 'immersed in the book' or 'carried away' by the narrative world (Gerrig, 1993). Green and Brock (2000) formally proposed the narrative transportation theory, defining it as 'the state in which all psychological systems and abilities are focused on narrative events.' They believed that the story recipient, under the guidance of the storyteller, would be transported to the story world and temporarily detached from reality. This state of deep transportation reduces resistance to persuasive information, subtly influencing readers' attitudes and beliefs, and ultimately changing their perspectives and behaviors. Their research empirically shows that the higher the degree of transportation, the more significant the persuasive effect - even when the information itself has a clear persuasive intention.

Green&Brock and Kaufman (2004) revealed that narrative transportation is achieved through the synergistic effect of cognitive attention, mental imagery and emotional investment. Thomas and Grigsby (2024) systematically reviewed 95 documents, revealing the application of narrative transport in interdisciplinary fields, highlighting its new preliminary circumstances (such as media forms, individual differences) and new outcomes (such as trust, identity transformation). They elaborated the theoretical constructs by including digital and interactive narrative contexts. Moreover, the chapter in 'Advances in Experimental Social Psychology' by Green & Appel (2024) purports to synthesise across disciplines to address the use of narrative immersion in other domains (misinformation education, climate comm, VR).

The areas of application for narrative transportation effect are diverse and its impact is far-reaching. Narratives in Health Communication: A Systematic Review of the Evidence Murphy, Frank, Baezconde-Garbanati Are narratives more engaging than non-narrative or expository formats in health communication? In consumer research, van Laer et al. (2014) reviewed 40 studies and found that narrative transportation positively predicts attitudes and behaviours. Kubrak and Starostina (2023) adopted the narrative transportation theory to film communication and revealed that narrative transportation significantly transformed students' beliefs. The marketing application, 'Narrative, Action and Resonance' a study on visual narrative 2024(Smith et al., 2024) demonstrates how to shape narrative immersion deliberately by images, plots and audience appeal to produce measurable persuasive effects. This theory also applies to the digital realm. Studies have demonstrated that interactive media, virtual reality, and algorithm-mediated narratives further increase immersion by engaging imagination and affect (Shin, 2018; Thomas & Grigsby, 2024).

The narrative transportation theory is valuable in that it has strong explanatory and practical power. Metaphorically, it conceptualizes experiencing transported by a story as "thinking with feeling" (Green & Appel, 2024). It brings us beyond these essential information-processing models (e.g., the elaboration likelihood model [ELM]; Petty & Cacioppo, 1986) and sheds light on the reasons to the powerful influence of storytelling. On the practical side, this theory offers guidance for crafting persuasive narratives in the domains of public health, social advocacy, marketing, and entertainment education. For example, by knowing how the narrative transportation process works, communicators may concentrate on immersive stories, character empathy, and concrete imagery to create stronger narrative messages (Escalas, 2007; van Laer et al., 2014). With the modern media environment allowing audiences to consume streaming media, interactive narratives and algorithmic recommendations, the significance of this theory is becoming more notable (Thomas & Grigsby, 2024).

The process of narrative transportation has been elucidated and is usually described via three dimensions that are cognitively, emotionally and imaginatively related (Polk, 2012) as follows: Attention or Cognition: Focusing one's attention on the narrative content, understanding the story, and decreasing the motivation to counter argues (Green & Brock, 2000); Emotional Involvement is defined as empathy for the characters, emotional involvement and emotional connection to the protagonist (de Graaf, Hoeken, Sanders, & Beentjes, 2012); Imagination involves mental imagery and the simulation and construction of the storyworld and the 'virtual' experience (Busselle & Bilandzic, 2009). These three components provide a combined explanation for the process through which immersion arises and the sources of its persuasive impact.

To sum up, narrative transportation theory has been applied beyond the field of psychology to other disciplines to explain how stories inform beliefs, modify attitudes and behaviors across a variety of media formats. Narrative transportation theory is an essential tool for communication scholars and practitioners. With the continuous

development of media technology and audience behavior, narrative transportation theory not only offers an explanation of how stories can generate persuasiveness, it also helps us understand the way stories reshape the individual and society.

2.2 Short Film PSAs

PSA is a type of non-commercial advertisement. PSAs serve to inform the public, educate the public, and guide the public to the attitudes and behaviors that society expects. It goes back to World War II when the War Advertising Committee of the U.S. government made the 'Loose Lips Sink Ships' campaign to alert the public and raise morale (Advertising Committee, 2018; Wikipedia, 2023). Following the war, PSA changed from an instrument of war propaganda to an effective and widely used medium for advocating policies in areas such as public health, safety, and environmental protection (Durkin & Smith, 2013).

In the beginning, PSAs were disseminated through print media, radio and television. Condram, (2020) has noted, however, that since the development of communication technologies and media, PSAs have gradually extended to other media digital platforms. The main purposes of PSAs lie in raising public awareness on societal issues, creating positive social intention and motivating behavioural changes (Hassan, Ab Ghahi & Faezah, 2022). The communicative importance of a PSA can be found in these three levels (educational, persuasive and motivational levels: [1] informing/broadening knowledge, [2] influencing beliefs about the utility of drinking tap water and risks related to using bottled water, and [3] encouraging civic or individual behaviour which relates to its title) (Nabi & Oliver, 2009). Public service announcements articulate shared values and obligations and thus help articulate solidarity and collective identity within the public discourse (Cho & Brower, 2018).

The importance and dignity of public service announcements went way beyond simply informing the public. Public service announcements What is more, scholars underline that PSAs constitute a channel between citizens, government, and social organizations that apply ethical limitations to the development of society and a system to enhance the public trust (Slater, 2016). Globally, public service announcements are often used to raise awareness in response to emergencies such as public health issues, environmental dangers, or humanitarian solicitations. PSAs serve the double purpose of providing information and moderating emotions (Elareshi et al., 2024).

Recent studies underline an emerging trend in the distribution of public service advertising. The blossoming of digital platforms and social media has multiplied the audience reach potential of PSAs, evolving these from a unidirectional to a multidirectional communication (Hassan et al., 2022). Audiovisual PSAs disseminated on the web during the COVID-19 outbreak were instrumental in raising awareness, sustaining behavior for prevention, and dispelling false information (Elareshi et al., 2024). But as Sivakumaran (2023) cautions, although they are able to have a significant short-term impact on attitudes, bringing about long-term behavioural change is a very difficult task. This disadvantage has led to the development of more effective PSAs, by enhancing their communicative efficacy through the content of the PSAs themselves and the means by which they are distributed. In sum, the history of PSAs demonstrates the diversification of their functions and content, and the diversification of their channels of dissemination, as well as the evolving nature of the topics. What makes them important is not the fact that they inform, but that they actively engage citizens to themselves persuade citizens in an ever changing media environment thus contributing to the shaping of social consciousness within the public sphere (Durkin & Smith, 2013; Cho & Brower, 2018).

As the choice of PSA types widens, the short film PSA is now considered a unique and compelling medium in its own right. Their communicative functions are the convergence of traditional PSA messages with the narrative and cinematic aesthetic appeal of film. Dramatic storytelling such as seen in short film PSAs are characterized as telling a complete, dramatic story that has a beginning, middle and end plot (Lee & Kim, 2021).

The percent of dramatics is an important feature for short film public service announcements. Emotional arousal has been argued to be elevated by a story's dramatization and to contribute to memory enhancement (Slater, 2016). Narrative persuasion studies document that using dramatic elements such as climaxes, conflicts, increases immersive experiences of a story for audience (Nabi & Oliver, 2009). In reality many short film PSAs use cinematic narratives to create empathy and urgency (Fabros, Pasia, & Caldito, 2023).

Short film PSAs are trying to narrate a story in a compelling and believable way. Unlike entirely iconic or abstract public service announcements, short film PSAs are more focused on creating life-like situations, which makes them feel more real and relevant (Ma, 2021). Realism mediates the distance between media presentation and experience and is particularly important when behaviour change or intervention is implicated. Studies on Chinese digital PSAs also indicate that these realistic stories, based on daily-life situations, make the audience more emotionally involved and willing to share (Li, 2022).

Short film PSAs use the audiovisual power to tell stories related to the issues of specific charities. These texts synthesize public service advertising's educational goals with cinematic narrative techniques to produce a hybrid form (Perdana et al., 2023; Lu, 2023). In the era of audiences binge-consuming narratives on digital, story-driven PSAs outperform in engagement and lasting persuasive impact over static or purely informative pieces (Lee & Kim, 2021). This is consistent with the theoretical assumptions of narrative transport theory.

2.3 Solomon Four-Group Experimental Designs

The Solomon four-group design provides rigorous experimental control. Developed by Solomon (1949), this design extends the traditional pretest-posttest control group design by adding two more groups that are not pretested. Random assignment places participants into one of four groups: pretest-intervention, pretest-control, no-pretest-intervention, or no-pretest-control. This arrangement allows for testing the intervention effect, the main effect of the pretest, and the pretest by intervention interaction. This design takes into account the effect of pretest sensitisation, which is a danger to experimental validity (Campbell & Stanley, 1963; Shadish, Cook, & Campbell, 2002; Dimitrov & Rumrill, 2003).

In communication and media studies, the pre-test sensitisation effect can be problematic since pre-testing may cause changes in participants that influence how they process information in an experiment (Eveland, 2003; Nabi & Oliver, 2009). For example, questions about political trust or environmental risk perceptions before media exposure modify participants' interpretive frames, creating artificial effects not caused by the communication stimulus (Kim & Kim, 2022; Lee & Kim, 2021). The Solomon four-group design offers a straightforward way to examine this form of measurement-induced bias. By observing the differences in the pretested and non-pretested groups, the study determines if the effects are due to the specific communication treatment, or are the result of cognitive activation brought on by the pretest itself (Solomon, 1949; Shadish et al., 2002).

This design uses a 2×2 factorial structure at the level of analysis, as a crossed design of the pre-test factor and intervention factor. Typically, a two-way analysis of variance (ANOVA) or analysis of covariance (ANCOVA) is run to test the interactions and the main effects (Dimitrov & Rumrill, 2003; Mai, Pham, & Nguyen, 2020). If no this interaction pre-test × treatment interaction is significant, this would suggest that the pre-test had no effect on treatment effects, thereby increasing external validity of this study. By contrast, a significant interaction would indicate that the pre-test sensitised participants (Eveland, 2003; Slater, 2016).

What makes the Solomon four-group design so valuable is that it captures both internal and external validity together. As to internal validity, randomization assures equivalence between groups and thus controls for confounding factors (Campbell & Stanley, 1963; Shadish et al., 2002). Concerning external validity, lack of pre-testing allows for a broader generalizability of results (Lee & Kim, 2021; Krcmar, 2022). This dual validity ascribes to the design its special value in measurements of persuasion, public advocacy efforts, as well as investigations into the effects of digital media (Nabi & Oliver, 2009; Kim & Kim, 2022).

Of course, this design has its own operational and analytic challenges. The implementation of the Solomon four-group protocol is also more demanding in terms of the need for much larger sample sizes, the mobilisation of more resources, and more complex coordination (Shadish et al., 2002; Mai et al., 2020). In addition, because the data analysis is complicated, misinterpretations of interaction terms can also obscure substantive results. However, the obvious increase in 'costs' associated with this design are argued to be offset by the greater rigour to which it inherently aspires (Eveland, 2003; Slater, 2016). For communicology studies examining reflexivity, media effects, and audience involvement, the Solomon four-group experiment provides a boundedly rational yet highly scientific methodological approach for communication research.

In conclusion, the Solomon four group design remains a strong methodological tool for the communication researcher that controls for the effect of the experiment itself while examining experimental results. This design improves methodological transparency and validity of experimental design by explicitly testing for pre-test sensitisation effects. The Solomon four-group design successfully eliminates reactivity bias, so any observed effects can be trusted to genuinely reflect communicative influence. Its continued use in present day research highlights its sustained value as a foundation for complex, reflective and context-dependent experimental investigations in communication studies and the social sciences more broadly.

3. METHOD

3.1 Participants

Subjects in the present study were recruited on the basis of experimental demands. Selection was based on Solomon's four-group experimental design and included the introduction of specific principles relevant to the aims of the study. According to Rossco's (1975) empirical rule, 120 participants were recruited. The 120 participants were randomly and evenly distributed among four experimental conditions so as to avoid unbalanced groups and maximize statistical power. This sample size is large enough to detect substantial effect sizes even if there would be attrition. All 120 participants in the study were recruited from a public university in Jinan City, Shandong Province in China, and they hold the same educational background and academic qualifications. To further ensure the consistency of the subjects, they were also selected according to other criteria, some of which were based on the questionnaires the students filled out when they enrolled.

It should be noted that this study examines the influence of the independent variables—short film PSA characteristics (complete storyline, dramatic, verisimilitude, identifiable characters), audience characteristics (familiarity, attention, transportability), and social media characteristics (likes, bullet screen)—on the dependent variable of narrative transportation. Therefore, when selecting participants, this study made every effort to control

other factors that could influence the experimental results, such as participants' age, educational attainment, family structure, and household income, all of which were effectively controlled during participant screening.

The participants were aged 20 years old, all being second-year undergraduate students. The reason for standardising participants' ages is to avoid discrepancies in developmental or cognitive levels arising from excessive age differences, which could compromise the validity of experimental results. In addition, students in this age group are adults who have undergone more than one year of campus life and study, and their thinking and behavior are relatively mature, which is in line with the requirements of this experiment. The selection of participants was limited to undergraduate students, excluding graduate students, and ensure they are in the same year group to avoid cognitive differences among participants due to educational disparities that could affect the experimental results. Additionally, all students were enrolled in the Digital Media Arts program, eliminating any potential influence of professional teaching differences on their ability to receive and process information. Furthermore, students in this program have extensive exposure to video imagery and are likely to have a higher interpretive ability for short film PSAs, or, as viewers, are more easily engaged in the narrative of short film PSAs. The selection of participants also took into account family income and family structure, as the experimental materials used in this study were short film public service announcements related to family issues. It is believed that differences in family income and family structure may influence participants' perceptions of family issues, and these differences may affect their intuitive feelings and further understanding of the stories in the short film PSAs. Family income and family structure (such as whether the family is single-parent) are relatively private matters. Therefore, the researchers took this into consideration when selecting participants, using the questionnaires filled out by students upon enrollment as a basis rather than directly asking about these issues. This approach avoided the ethical issue of potential harm caused by the experiment and further mitigated the impact of 'prior disclosure' on the experimental results. According to the Jinan Municipal People's Government (2025), the per capital disposable income of residents in Jinan City was 54,390 yuan, an increase of 5.1% over the previous year. By urban and rural areas, the per capital disposable income of urban residents was 65,364 yuan, an increase of 4.6%. We took the average income of urban residents, which is 65,364 yuan, as the reference standard and chose the participants whose household income ranged up to 2,000 yuan higher or lower than this amount. The family configuration is an important determinant of family relations and is influential to family education and family values formation. Since the study is based on family issues in Chinese society, the researchers hope that the family structures of the subjects do not change. The family structure criteria defined in the present study are "the two-parent family with only one child". This norm is based on the historical context of China. Family planning policy was introduced in China as according to Hou (2024) in December 1982 to restrict the population growth, which mandated each household to have only one child. This policy will remain in effect until the gradual phasing out of the one-child policy on 1 January 2016. The participants were all born in 2004 to 2005 and during this period "one-child family" was the prevailing family type. In addition, all of the 120 students are Han (the dominant ethnic group in China), which guarantees the homogeneity of living habits and religious beliefs. This unity is vital to comprehending how the participants conceive of the family-active problems.

Participating in the experiment can be considered part of their professional education, ensuring the rationality of the experiment's initiation and the subjects' enthusiasm for participating in it. All participants signed a consent form prior to the experiment, but were unaware of the experimental process and purpose. All participants were randomly assigned to one of four groups, and did not know whether they had been assigned to the experimental group or the control group.

3.2 Stimulus: Four Short Film PSAs and Manipulated video

Four short film PSAs were assigned to two control groups (see Table 3.1). All were produced by Chinese government departments, with three producing from China Central Television (CCTV) and one from the Beijing Fire and Rescue. These four short film PSAs were either made directly by government departments, created by subordinate agencies, or commissioned to film and television production companies. The four short film PSAs all address family issues, including 'Spending Time with Children,' 'Fatherly Love,' 'Returning Home for the New Year,' and 'Home Fire Safety.' These family issues are all hot topics of significant concern in Chinese society. The four short film PSAs all had high view counts on Chinese social media. They come from the Dou Yin, Bilibili and New Film Studio platforms, both of which have extensive user bases in China.

Table 3.1   Overview of Short Film PSAs

NO.	1	2	3	4
Title of PSA	My dad is an ATM	Father's Journey	Aunt Ning and Uncle De's New Year	Extinguish the real fire, truly extinguish the fire
Theme	Parents' companionship with their children is more important than making money.	A father's love is like a mountain, silent and steadfast.	Don't have to go back to hometown during the Spring Festival. Travelling is also an ideal way to spend it.	Fire safety is very important in the home, so it is essential to learn how to use a fire extinguisher properly.
Production	CCTV	CCTV	CCTV	Beijing Fire and Rescue
Maker	CCTV	CCTV	Shangtuan Culture Company	Beijing Fire Department Media Center
Provider	4A Advertising Proposal Network	4A Advertising Proposal Network	Shangtuan Culture Company	Beijing Fire and Rescue
Platform	Bilibili	Bilibili	New Film Studio	Dou Yin
Length	3 mins	5 mins 33s	5 mins 20 s	2 mins 25s

Four manipulated videos were distributed to two experimental groups for viewing. This manipulation was based on four original short film PSAs. The manipulations in this study were designed according to the three dimensions of narrative transportation (cognitive, emotional, and imaginative). Without altering the original four short film PSAs (such as their plot, duration, or visuals), additional audiovisual information was incorporated to further enhance audience' comprehension of the short film PSAs. This study employed two methods to manipulate four short film PSAs. The first method involved adding text to the video, either within the narrative of the short film PSA or after the story concluded. The second method involved adding narration to the short film PSA, which was applied to the third short film PSA, as it was longer in duration and originally lacked any narrator or narration. Both methods of manipulation can exaggerate the story, elicit feelings, state opinions more bluntly and make it easier for the spectators to understand.

The software for video processing is Final Cut Pro. This is a boutique video editing company brought to you by Apple Inc. The application is stable enough to ensure that the quality of the 4 source videos will remain untouched throughout your editing/adding effects and exporting process, and that no unexpected problems such as frame drops will occur. In addition, for the third short film PSA where we need to insert narration, FCP will seamlessly add an audio track without changing the source video sound quality and making sure the audio doesn't got distorted when outputting.

The first PSA is a sad and gut-wrenching tale, with its distortions mainly designed to heighten emotions. We added subtitles during some of the story's most charged moments and after the story concluded. The most emotionally charged section of the story lies between 35 seconds and 1:15 into the PSA. It's about a lonely little girl who thinks an ATM is her father, who visits her as she swings on a swing, rides a bicycle, plays with toys and sleeps. This deeply powerful scene gives audiences an emotional understanding of the monumental loneliness suffered by left behind children. There is no dialogue in this scene, only background music playing the role of emotion so it is suitable for subtitles to express the emotion better.

This scene has three subtitles: 'In the eyes of a child, a father is a machine,' 'This sort of companionship has a mechanical quality,' and 'It is cold'. These subtitles present themselves as the ATM engages with the child, laying bare the pain and helplessness underlying the ecstatic couple of minutes. This can evoke more feeling which enhances the feeling. After the film ended, three other subtitles were shown: 'Love Is Companionship,' 'Not just cold hard cash,' and 'You Only Get One Childhood.' These three related lines appeared in turn on screen to create a sense of climax. Apart from expressing emotion, these subtitles were also instrumental in reinforcing the core message of the PSA.

The second short film PSA is infused with manipulation, but this time through the use of subtitles. The beginning subtitle, 'A father's love is like a silent mountain' is shown It lays the foundation for the story, and fits in with

the plot of the story. As a result, it gives the spectator a cue to expect, and assists the spectator's entry into what has been described as 'a telling.'

Then, the subtitles were added successively to the father section in the first 30 seconds of the video. The subtitles are (respectively) "He is serious and taciturn", "My old father lives there," "Farthest mountains of my native town." These subtitles add more information concerning the living conditions of the father and his character, thus the image of the father becomes more solid and realistic. A well drawn protagonist is essential to a story, because it makes the forward motion of the story more understandable, and the themes of the story can be explored more deeply.

In 40s~2m 40s, depicting the father as he sets out to search for his son, we have added four subtitles. 'My father decided to come and reunite with me' is what expresses the father's deep desire to be with his son. The sub title 'set off on his adventurous journey' shows how determined the father is to leave, and 'adventurous' predicts the sufferings and troubles he will face. This prepares the ground for later part of the plot where troubles arise on the journey, as well as increasing the emotional tension and mood. 'The mountain road is rough and treacherous' is an extra subtitle for the present images, showing the father making his way through the hills to the town. This addition not only reiterates the hard road of leaving the mountains a farmer father undertakes but also also captures the unyielding spirit of China's mountain bound people in a higher measure.

Between 2:50 and 4:30 the father is lost in the city before being reunited with his son, two subtitles are added. "The bustling city overwhelmed him" was added to the picture showing the situation of the father who has just arrived in the city, but he cannot get in touch with his son. This highlights both the him panic and far more importantly, dramatizes the seemingly impossible city to mountain divide. 'This is a moment of reunion that just can't be paid for!' was added to the shot of the father and son crying tears of happiness after they are reunited. The addition of this subtitle visually strengthened the emotional atmosphere of their happy reunion and the feelings told in this part.

The manipulation used in the third mini film PSA is the addition of narration, which has 15 sentences (Refer to Table 3.2). At the same time, the content of the narration is displayed on the screen as subtitles. These subtitles are centrally aligned in the screen. Considering the cheerful mood, the energetic rhythm, the theme of "Go home for the New Year" of this PSA, the colour of the text was made in red and a traditional Chinese calligraphic font was used to fit in with overall design of the PSA.

These narration and subtitles are to a large part condensed versions of the ongoing narrative, with the storyline of the scenes they are located in. Narration as manipulation has two functions: on the one hand it is the only plot that is narrated in this short film PSA with very limited plot development and a lot of background music, adding narration expands the expression of the PSA; on the other hand, by connecting the scenes, the narration makes the plot easier to follow for the audience and understand the message behind the PSA. The narration was spoken by broadcasting professionals, which provided high-quality narration work that can connect with its audiences. Furthermore, the female narrator's light, energetic voice perfectly captures the emotional heart of the PSA and the celebratory spirit of the story.

Table 3.2 Subtitle compilation for the third short film PSA

No.	Timing	Subtitles and Narration	Plot
1	Beginning	Do you think going home for Chinese New Year is the only option?	Before the story begins
2	00:00:26	Perhaps there are other options	The son called to say he won't be coming home
3	00:00:51	Go on a trip	The elderly couple are riding a cow
4	00:00:54	Go and experience the rural scenery	The elderly couple are riding a cow
5	00:00:58	Go explore the ocean	The elderly couple were enjoying themselves by the seaside
6	00:01:13	Go experience the hustle and bustle of everyday life	The elderly couple are enjoying local cuisine
7	00:01:27	Try the local cuisine	The elderly couple are enjoying local cuisine
8	00:01:30	Experience folk culture	The elderly couple were conversing with the locals

9	00:02:26	Share your experiences and joys on the road with your family	The elderly couple were sharing photos with their son
10	00:02:47	Sometimes minor conflicts	The elderly couple had a minor disagreement
11	00:02:50	But it became the spice of the journey	Resolution of the conflict
12	00:04:14	No matter where you celebrate the New Year	The elderly couple were releasing sky lanterns
13	00:04:16	Everyone can pray for blessing and welcome spring	Countless sky lanterns drifted through the heavens
14	00:04:19	Wishing each other well	The elderly couple and their son exchanged New Year greetings via video call
15	00:05:10	No matter where you are, as long as your heats are together, it's New Year's	Fireworks burst into bloom

The fourth short film PSA is an educational video. It uses a relatable household scenario to demonstrate the proper use of fire extinguishers. Subtitles were added to this PSA as well. Before the story begins, the subtitle 'Do you really know how to use a fire extinguisher?' appears, clearly stating the video's purpose and significance. The original short film PSA tells a lively, humorous story featuring actors from the renowned Chinese media company Happy Mahua, known for their comedic roles. Vivid fonts and colors were used. The tag line 'A day in everyday life' was added at the start of the story to hook the audience to the narrative milieu. 'Serious study makes all the difference!' is displayed in the finale, when the mother, trained in the use of the fire extinguisher, gets home just in time to put out the blaze and rescue her family. The caption both praises her doing so and reiterates how crucial it is to have they really "know" how to use a fire extinguisher.

Now, near the end of the story, a trio — mom, dad, and kid —is frozen in place right before our eyes: A classic coda. We included the subtitle: 'You don't have to memorize mnemonics, you can also use them.' This line stems directly from the PSA's plot — the father repeats the multiplication tables to his son. Timely, it's just the right touch of humor while immediately driving home the main message. When the video has finished we added two further captions: 'Learn to use fire extinguishers accurately to protect your family in critical moments' and 'Real firefighting, real fires, putting out your fire.' These are encapsulations of the PSA, that further engrain it in the viewer.

3.5 Procedure (Solomon Four-Group Design)

This study employed a Solomon four-group design, which is a powerful variation of the classic pre-test-post-test control group design. The design enables the experimenter to test three null hypotheses simultaneously: the null hypothesis of no main effect of the experimental treatment, the null hypothesis of no effect of the pre-test, and the null hypothesis of no interaction between the pre-test and the experimental treatment (Campbell & Stanley, 1963; Shadish, Cook, & Campbell, 2002). The presence of both pre-tested and non-pre-tested groups allows an analyst to gauge whether taking a pre-test sensitizes subjects to the treatment in a way that affects their post-test responses. This type of configuration offers an additional safeguard against internal validity threats in experimental research and increases the confidence to make causal inferences in the experiment (Dimitrov & Rumrill, 2003).

As shown in Table 3.3, four independent groups were randomly created. Groups 1 and 2 had a pre-test, but Groups 3 and 4 did not. Groups 1 and 3 watched the experimental (altered) PSA videos while Groups 2 and 4 served as the control (original, unaltered PSA videos). Post-tests were given to all participants. This configuration allows us to separate out the effect of the treatment (the effect of the manipulated variables), the effect of testing (the effect of pre-testing on responses), and the interaction between the two effects. The Solomon 4-group design is thus a strong strategy for balancing true experimental effects with good internal and external validity.

Table 3.3　　The Solomon Four-Group Experimental Design Used in This Study

Group	Randomization	Pre-test	Treatment (X)	Post-test
1	R	O_1	X	O_2
2	R	O_3	—	O_4

3	R	—	X	O_5
4	R	—	—	O_6

Note. R = Random assignment; O = Observation (pre-test or post-test); X = Exposure to manipulated PSA treatment. Groups 1 and 3 received the experimental stimuli, while Groups 2 and 4 viewed the control stimuli. This structure allows for comparison of treatment, testing, and interaction effects simultaneously (Campbell & Stanley, 1963; Shadish, Cook, & Campbell, 2002).

As shown in Figure 3.1, the study procedure followed a Solomon 4-group design with participants randomly assigned (Random) to the experiment or control groups, two groups took part in a pre-test and two did not. In particular, an experimental and a control group took the pre-test before video exposure, the other experimental group and the control group did not. In both the pre-test and non-pretest groups, members of the experimental group watched the edited PSA videos, while the control group watched the version of the short film that was unaltered as a PSA. All participants then filled out the post-test, allowing for a comparison between the experimental and control conditions, and also testing for pre-test sensitization.

Figure 3.1   Experimental procedure
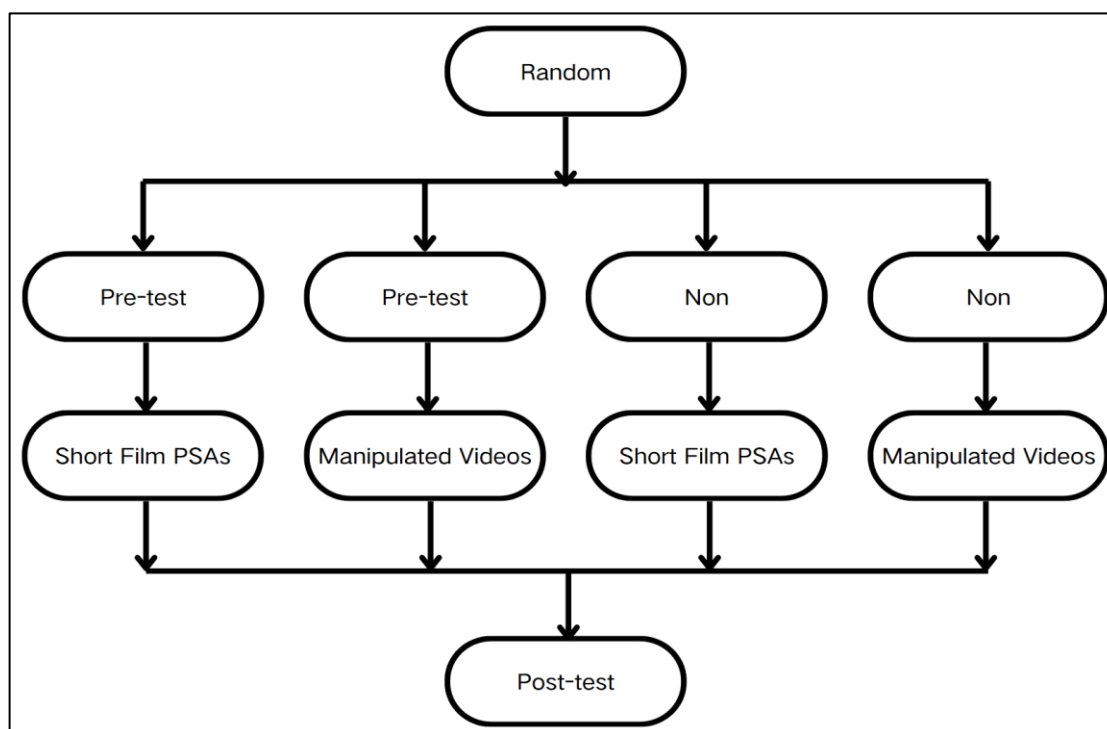
The sessions took place in four multimedia classrooms, with each room having the same professional-grade projector and a calibrated audio system so that video and sound quality would be uniform across condition. Brightness, color temperature, and volume were standardized before each session to rule out any influence of equipment variation on participants' perceptions. The original (control) PSAs totaled 16 minutes 18 seconds of run time, and the modified versions were 16 minutes 30 seconds ensuring that duration of exposure was similar between groups.

An initial screening using questionnaires filled out by students at the time of enrolment (which included questions about family structure and household income) was used, and 120 participants were chosen via simple random sampling. A total of 120 participants were randomized to the four groups with a computer-generated randomization sequence (Suresh, 2011). Randomization guaranteed that each subject had the same chance of being placed in any of the three experimental groups and in the control group or both in the pre-test and in the no-pre-test groups. Crucially, participants were blind to their allocation; they did not know if they had been allocated to an experimental or control condition, or if they would complete the pre-test. All study participants were greeted by research assistants and asked to sign a written informed consent form, which detailed their voluntary participation as well as their right to withdraw the study at any point, once they arrived in the assigned rooms. Consistent with ordinary classroom rules, participants had to hand in their phones to prevent distraction. Then, they were sat down with enough distance between them so that they wouldn't be able to talk to each other during the experiment (Babbie, 2016).

For the pre-test conditions, participants filled out a 15-minute survey on paper prior to viewing the video. The pre-test contained demographic validation questions as well as the 13-question Transportability Scale (Jensen et al., 2016) that measures trait-level differences in narrative susceptibility. Then — or immediately for the non-pre-test groups — the predetermined videos were played. Research staff initiated and supervised the playback, ensuring consistency of delivery across classrooms, and were instructed to have no interaction with participants so as not to illicit demand characteristics (Orne, 1962).

Following the video, all subjects responded to the post-test. This tool assessed the main variables of interest such as attention, familiarity, perceived likes, bullet screen, and narrative transportation, along with other constructs such as dramatic, complete storyline, verisimilitude, and identifiable characters. Questionnaires were gathered immediately after they were filled to preserve the validity of responses and avoid communication among subjects. At the conclusion of the session, participants were thanked and given a brief debriefing about the goal of the study. All responses were de-identified using numeric codes. Questionnaires were double entered by two research assistants to ensure the precision of data and electronic files were stored securely on password-protected computers with access limited to the research team. This tightly controlled process guaranteed uniformity between the experimental and control groups, reduced the potential impact of confounding variables, and increased the reliability and validity of the results.

3.7 Pilot Experiment Reflection

The pilot was a dress rehearsal for the formal Solomon four-group study designed to establish the practical application, dependability, and procedural integrity of the experimental design and to discover any unforeseen problems that might arise prior to a full-scale execution. The pilot, which was conducted at the same university as the main study, used the same procedures and environmental conditions as the main study. All participants were undergraduate students in the Digital Media Arts program and were 21 years old, and they were recruited on a voluntary basis. Their similar academic background thus reduced the potential confounding effects of such extraneous variables as media literacy or interpretive variation. After the initial screening, twenty incomplete or invalid questionnaires were discarded, and sixty valid samples were obtained for the statistical analyses, a size of sample which is deemed to be adequate for pilot reliability testing by Hertzog (2008).

The pilot study was conducted in four multimedia classrooms which had identical setup including projection and sound system. The researchers adjusted all the projectors to the same brightness, color tone, and audio output. The seat allocation, distance to the screen and the viewing angle were the same in all the sessions. This resulted in environmental consistency and minimized error due to situational variation. The short film PSAs serving as stimuli were twofold: an original and a modified. The edited version contains narration and explanatory subtitles, and a few pacing modifications aimed at making the film clearer, more emotionally compelling, and thematically salient. The duration of the manipulated version was sixteen minutes and thirty seconds, with the original being sixteen minutes and eighteen seconds keeping the exposure duration almost equal.

The general process was the same as for the official experiment. Two of the four groups of participants took a pre-test assessing demographic information and transportability, before and after watching the films, with the pre-test serving as the administration of a pre-test sensibilization measure, while the other two groups simply watched the films without taking a pre-test on testing for possible pre-test sensitization effects. After the viewing, all participants were asked to fill out a post-test questionnaire assessing variables including attention, familiarity, likes, bullet screen and narrative transportation. It also contained questions about story elements, such as completeness, dramatic engagement, verisimilitude, and recognizable persons. All responses were given on a seven-point Likert scale (1 = strongly disagree; 7 = strongly agree).

One glitch resulted in one of the four classrooms freezing during the pilot sessions when the video playback software froze due to a missing codec. The video temporarily froze, and the audience became befuddled. The problem was swiftly fixed by re-encoding the file and the session was re-started for the sake of fairness and completeness of exposure. This episode revealed an essential flaw in the operational scheme — lack of sufficient technical inspection before the experiment. Consequently, the study staff revised the protocol to require that "all computers and playback software must undergo full system check prior to each session in the definitive study," and added a suggestion to allow participants to take breaks while watching the films in the definite study. This fix was successful as there were no further technical glitches during subsequent trials.

There was also a related problem of environment control that emerged during the pilot. Though the noise level in the classrooms was low, the hall noise and the echoes reached the class during some sessions in the afternoon. These disruptions were not of a magnitude to compromise data quality, but they do speak to importance of timing control. As a result, all official experimental sessions were moved to the morning when external disturbances were at a minimum. In addition, the distance between the two sides was enlarged in the official version to minimize potential peer influences while filling out the questionnaire.

The pilot also revealed several human-factor difficulties. A few participants took an unusually short time to answer the questionnaires, raising concerns about their engagement or social desirability bias. To remedy this, additional, clearer instructions were included in the formal experiment, stressing on answering accurately and thoughtfully. Proctors were instructed to notify participants to make sure everything was complete before sending.

These small procedural amendments later resulted in better quality of responses and lower rates of missed data. Another result from the pilot was related to the different manipulative forms: If emotional intertitles in one PSA successfully affected empathy, the cognitive narration in the other film did increase understanding but it negatively impacted emotional immersion. This difference led to modified editing in the final stimulus, so that emotional and cognitive cues encompassed narrative clarity and affective power.

Data from the pilot were analyzed using SPSS 28.0. The results of the reliability analysis were on the whole satisfactory, with Cronbach's alpha of most constructs higher than 0.70. Yet, the Familiarity construct initially demonstrated less reliability ($\alpha = .628$). Analyses at the item level showed that the third item contributed little to the internal consistency. With that item removed, the alpha coefficient increased to .781, reflecting a more-defined construct. This led to the decision that the deviant item would be eliminated from the official questionnaire. Other factors (Attention, Likes, Bullet Screen and Narrative Transportation) showed excellent internal consistency reliability ($\alpha > 0.80$) and all factor loadings were above 0.60, indicating all those factors are appropriate to be examined in the main study.

In general, the pilot study served its diagnostic function well. It demonstrated that a Solomon four-group design could be used with audiovisual material and it also identified major operational issues such as technical preparation, environmental control, and participant attentiveness. These experiences contributed directly to the formal experiment's modifications. During the pilot study, the researcher gained a better sense of how to conduct media-based manipulations in a tightly controlled classroom-based setting that would still be ecologically valid. The reflection on these pilot studies ensured that the subsequent formal study was conducted with greater reliability, procedural accuracy and methodological rigour.

4. DISCUSSION

This chapter discusses the theoretical entanglement and methodological articulation of the study, focusing its analysis on short film PSAs crafted employing subtitles and narrator narration based on the Solomon four-group experimental design. Instead of expecting statistical finding or persuasive effects, this study functions methodological showcase on how such manipulations can be systematically constructed, administered, and ascertained within an experimental communication frame. The discussion is therefore threefold and focuses on the methodological justification for employing the Solomon design, the reflective experience of manipulating audiovisual texts, and the general implications for narrative and experimental research in communication studies.

4.1 Methodological Rationale for Using the Solomon Four-Group Design

The selection of Solomon Four-Group Experimental Design for the current study was due to mainly methodological considerations. Typically, this design is intended to control for testing effects and identify pure treatment effects (Solomon, 1949; Shadish, Cook, & Campbell, 2002 Standard 4-1). That is, in this study, it was not the purpose to observe or compare statistical differences but instead to use the Solomon framework as a methodological frame a lens through which to conceptualize and visualize the logic of manipulation in the context of a communication experiment.

The four-group arrangement made a neat template to help think about how manipulative variables (in our case subtitles and narrator can be considered manipulative variables) might be methodically introduced. Two had pretests and two did not; two watched the PSA with additional subtitles and narration, two the original. This organizational strategy illustrated how experimental reasoning could be transported to audio-visual material, and still be internally cohesive. It was used as a framework to think about the relation between theory, manipulation and observation more than as a statistical model.

Building on this paradigm, the study was also an investigation into the manner in which humanistic modes of inquiry (i.e., filmic interpretation) could be compatible with experimental forms of thought. In communication, the integration of methodology is at times at odds with creativity and empirical control (Krcmar, 2022). In this, the Solomon design was a compromise between these two paradigms: it was logically rigorous but not so rigid as to prohibit the expressive and narrative qualities of short film PSAs. Therefore, the conception of the methodological working approach unfolds at the design level: contemplating how to organize operational techniques to achieve its artistic and analytical objectives.

4.2 Manipulating Short Film PSAs through Subtitles and Narrator

Manipulation in the present study was limited to superimposing English subtitles and narrator narration on the original short film PSA. These "technical" additions (to be contrasted with the text-based DVD extras) were not considered post-processing manipulations but rather as narrative/communicative interjections – intentional strategies to influence how viewers might think and feel about the messages.

rom a methodological perspective, this manipulation had two main purposes. It was first a means of rendering the content of the PSA more accessible and explicit and thus more consistent with the agency of the cognitive component of narrative transportation (Green & Brock, 2000; see also Appel, Gnambs, & Richter, 2019). With the addition of subtitles, the viewer's attention was focused on the verbal message and the message was more accurately understood, also in sequences with auditory-visual complexity that could have distracted the plot.

Second, the presence of the narrator narration creates the effect of an interpretative framing. The narrator's voice served as a sort of viscoelastic anchor for the images and emotions, providing continuity and emotional concentration. This treatment was representative of the affective and imaginative facets of transportation theory, with auditory cues leading to immersion and coherence in narrative processing.

In terms of methodology, the provision of subtitles and a narrator was a controlled manipulation of communicative components a minor, yet significant, modification of the media text that was still able to preserve its aesthetic integrity. The treatment showed how small-scale but purposeful design manipulations can be made operable in a tightly controlled experimental design that situates media production and the experiment tradition.

It was none the less the end result of two practical labors of considerable length. The process necessitated a degree of technical and conceptual synchronization: subtitles must adhere to the speech rhythm and narrative sequence, and the narrator is required not to overshadow but to augment the visual storytelling. This required on the one hand repeated testing and, on the other, awareness to how each change would influence the speed, mood and perception of the audience. In so doing, the research substantiated that the standards of methodological rigor for communication experiments are applied also to the textual and sensorial aspects of media design.

4.3 Reflecting on Methodology as Practice

One of several important knowledge claims from this study is that the designing/making of a brief film PSA is a practice-based investigation in its own right. Doing this research made it clear that methodology in communication is not simply knowing how to do some statistical analyses but rather that it is knowing how to go about designing, considering, and thinking.

The process of adding subtitles and narrations became a means of making methodological knowledge. It was a constant balancing act between theoretical thought, aesthetic considerations and pragmatic realisation. Each decision—like when to show subtitles or what the voice of the narration should be—was a moment of negotiation between theory and practice. As such, the researcher-while also as the experimenter (think: character in a novel) and as the media designer (think: novelist): analysis and creation.

It also aids in helping researchers to think systematically about manipulations in terms of how they are thought about, justified, and constructed, even when the research is exploratory as opposed to confirmatory. The process of carrying out the design emphasizes that communication research may create knowledge not only by measurement but through the enacted design, in principle and through and through..

4.4 Insights and Methodological Implications

The methodological implications of this study contribute to an understanding of the ways in which design and creative media practice can be enacted in communication research. The intervening method-agent added subtitles and a narrator to the short film PSAs, and we learn here that even small interventions can have large methodological and theoretical ramifications. The process of adding these pieces suggested how abstract narrative transportation theory constructs—cognitive guidance, emotional resonance, and imaginative engagement—can be translated into an audiovisual format without fundamentally changing the original narrative. This is to show that experimental logic in communication research need not be grounded in the large scale manipulation or quantification of variables, but could be conceptualized as a structural logic that organizes reflection, design, and interpretation. In this role, the Solomon Four-Group design model was more than a tool for experimentation; it became an organizer of concepts that enabled systematic thinking about the process of manipulation. It enabled the researcher to think critically about the ways in which design choices are informed by theoretical presuppositions and how methodological control converse with narrative meaning.

At the same time, the communication process was revealing not only the procedures of experimentation but also its own creativity and reflexivity. The dual role of the researcher as designer and analyst illustrated that design work can contribute theoretical insights through the process of design itself. In this sense, this study locates methodology as a place for inquiry and making – where static empirical forms and fluid creative thinking can intersect. The Solomon design, employed in this way, provides researchers a means to experiment not only to test but to think, build, and invent in the domain of media and narrative communication.

4.5 Limitations and Future Directions

From a methodology standpoint, this thesis revealed both the affordances and the limitations of applying experimental logic to innovative AV research. The treatment of the short film PSAs with the inclusion of subtitles and narrator was a fruitful, though limited, strategy. It did translate some promising theoretical conceptions of narrative transportation into controlled and testable design decisions. Conversely, the outcome demonstrated that prioritizing linguistic and aural molding over other aspects of shaping narratives may limit methodologically how narrative form may be conceptualized across various sensory and symbolic modalities. This limitation, however, is to be regarded as the starting point for amending the way in which experimental designs such as the Solomon Four-Group Design may be considered as reflective tools of methodological investigation rather than as tools of evaluation.

Still another methodological problem encountered throughout this study related to the "tightrope walking" between scientific rigor and artistic freedom. Imposing a strict structural pattern on a filmic text necessitated endless compromises among narrative logic, technical consistency, and aesthetic desires. Balancing four

experimental conditions while preserving the integrity of the story was a good indication that the Solomon design needs to be flexibly interpreted when applied to research in the mass media and communications field. It showed that in humanistic experimentation one attains precision not simply by means of control, but also by visibility of process and consistency of reasoning and reflexive insight into decisions of design.

Building on this methodological basis, forthcoming investigations might consider more-varied narrative manipulations consistent with this reflective ethos. Directions could include investigating the effects of modified subtitle rhythm, voice perspective, or alignment with image sequences on interpretive engagement. Other research could take the Solomon framework into practice-based research, making creative work itself a site for methodological analysis. This would both maintain the focus on reflective experimentation developed here, while broadening the intent to explore how narrative form, technological mediation and methodological design coalesce to produce meaning in the contemporary art of the moving image. In so doing, the Solomon Four-Group design can continue to be viewed as an adaptable and productive model for methodological enhancement in the examination of the short film public service announcement (PSA) and more.

5. CONCLUSION

The main purpose of this study was to investigate what potential relevance experimental logic can find in media and communication research via a methodological reflection on the contextualisation of short film PSAs. Drawing on the Solomon Four-Group Experimental Design as a conceptual framework, the study here is designed around a single yet theoretically illustrative manipulation—the addition of subtitles and a narrator—to show how theoretical concepts from narrative transportation can be operationalized experimentally. Instead of generating empirical findings, the study sought to articulate the process-based thinking of the manner in which creative media work and experimental rigor can be synthesized.

The adoption of the Solomon structure provided a methodological outline or framework, which was manageable with sufficient rigor, but at the same time flexible. It demonstrated that the conventional experimental paradigm, translated into imaginative experiential scenarios, can be established as a mirror rather than as a window for research. The PSA on manipulation was an example of how small tweaks to design can bring into focus the relationship between form, message and engagement, while at the same time steering the researcher between methodological rigour and creative intuition.

All, this report adds to the methodological development of communication studies by reconstructed experimentation as a kind of reflective and creative investigation. This indicates that outcome verification is not essential, yet such medium-based experiments can yield profound methodological insights. In this way, the Solomon Four-Group Design becomes a heuristic device which can flexibly support structure and interpretation. Drawing from narrative theory, screen design, and experimental logic, this article outlines a methodological approach that may inform attempts by future researchers to unite systematic investigation and creative practice in the emergent discipline of short film PSA's and more.

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