DIGITAL HERITAGE (2025)
S. Campana, D. Ferdani, H. Graf, G. Guidi, Z. Hegarty, S. Pescarin, and F. Remondino (Editors)

Promoting Positive Attitudes Through Narrative-Driven Digital Heritage Games

L. Kolek [1,2], D. Šosvald[1,2], F. Flores[3] and J. Halilovic [3]

[1] Charles Games, 110 00 Prague, Czech Republic
[2] Faculty of Mathematics and Physics, Charles University, 121 16 Prague, Czech Republic
[3] War Childhood Museum, 71000 Sarajevo, Bosnia and Herzegovina

Abstract

Video games offer new ways to engage audiences with cultural heritage beyond traditional museum settings. However, can video games authentically replicate the narrative depth of museum experiences while promoting the positive attitudinal impacts museums seek to achieve? This study investigates whether a narrative-driven video game, We Grew Up in War, inspired by historical research and curatorial practice can positively influence players' attitudes towards the depicted topics. The game employs complementary multiperspectivity, a storytelling strategy that presents different but thematically aligned perspectives focused on the topics of refugees and migration. Using a pretest–posttest design with experimental and control groups (n = 116), we measured both explicit and implicit attitude changes. Results show that players who played the game exhibited significantly more positive explicit attitudes than those in the control group (d = 0.33, p = .037). Implicit attitudes did not significantly differ between groups. A more detailed analysis showed that there was a statistically significant change in players' affective responses between the pretest and posttest, whereas no such significant change was observed in the cognitive or behavioral components of explicit attitudes. Despite using a short prototype of the game (approx. 23 minutes), these findings suggest that video games can be effectively employed in promoting cultural heritage and attitude change to wide audiences across geographical boundaries.

CCS Concepts

• ***Human-centered computing*** → *Empirical studies in interaction design; User studies;* ***Empirical studies in HCI;*** • ***Applied computing*** → ***Interactive learning environments;*** *Psychology;* ***Computer games;*** • ***Social and professional topics*** → ***Informal education;*** *Adult education;*

1. Introduction

Museum collections and exhibitions possess immense potential to promote and preserve cultural heritage by offering visitors meaningful, carefully crafted narrative experiences. However, their impact is often constrained by physical limitations: exhibitions are designed for specific locations and typically require in-person attendance. As a result, museums face significant challenges in extending their reach to a global audience.

Recent advances in digital technologies have opened new possibilities for overcoming these barriers. Among these, video games offer a particularly promising avenue. In 2024 alone, more than 3 billion people worldwide played video games [BBG*24], and the global industry produced tens of thousands of new titles [Sta24a] [Sta24b], spanning a wide range of topics, including history, identity, and cultural heritage [KRŠ*23]. By leveraging the immersive and interactive nature of video games, museums have an opportunity to extend their missions beyond physical walls and engage audiences in new, emotionally resonant ways.

Yet museums are not only repositories of objects; they are curators of stories that shape public understanding, foster empathy, and influence attitudes about the topics they depict. It is therefore essential to ask: Can video games authentically replicate the narrative depth of in-person museum experiences while promoting the positive attitudinal impacts museums seek to achieve?

To explore this question, we examine the case study of *We Grew Up in War* (Charles Games, 2025), a narrative-driven video game currently being developed by Charles Games in collaboration with the War Childhood Museum. The game is inspired by real personal stories from the museum's archive and seeks to replicate the principles of its curatorial practices. The prototype used in this case study focuses on the Yugoslav wars and their impact on children. It adopts a complementary multiperspective approach, presenting different but thematically aligned perspectives on the lived experiences of children during wartime. Through this study, we aim to assess whether such a digital intervention can foster positive explicit attitude changes, i.e. changes in propositional reasoning about the topic, and implicit attitude changes, i.e. changes in associative evaluations of the topic.

DOI: 10.2312/dh.20253327

To this end, we conducted an empirical study with 116 participants divided into an experimental group and a control group. We collected data on their explicit and implicit attitudes towards refugees and migration in a pretest before the intervention and in a posttest afterwards. As an intervention, participants in the experimental group played a prototype version of *We Grew Up in War*, while participants in the control group played an environmental card game, *Beecarbonize* (Charles Games, 2023), which was unrelated to the attitude topic under investigation. The data from this study contribute valuable empirical insights to the ongoing transformation of cultural heritage engagement in the digital age.

2. Theoretical background

In relation to the objectives of this study, we elaborate on the conceptualization of explicit and implicit attitude change, the role of multiperspectivity in video games, and the mechanisms through which these areas may interact and influence each other.

2.1. Implicit and explicit attitudes

An attitude is defined as a summary evaluation of an object of thought. These evaluative responses provide an assessment of the object of thought, usually resulting in either a positive or negative evaluation. Our attitudes help us navigate the world by simplifying decision-making and complex information processing [VW16].

There are numerous theories about the processes underlying attitudes and their change. In this study, we use the Associative-Propositional Evaluation model (APE model) because it allows us to differentiate between explicit and implicit attitudes. This model assumes that while there is a single associative network in our memory, there are two distinct processes — associative and propositional — by which mental representations are formed and expressed in our behavior [GB18].

The associative process leads to the formation and expression of implicit attitudes. Our implicit attitudes rely solely on the structure of associations in our memory. Such associations are formed by observed co-occurrences of objects of thought. When a stimulus is encountered, our resulting implicit attitude is based on the valence of stimuli that we have associated with it. This process does not take the perceived validity of those co-occurrences into account.

The propositional process, which governs the formation of explicit attitudes, differs in two main aspects. First, it takes the perceived validity of co-occurrences into account, and second, it captures the relationships between stimuli, rather than just their co-occurrence.

2.2. Attitude change

As the processes governing implicit and explicit attitude formation differ, the processes governing attitude change are also distinct.

Changes in implicit attitudes are driven by changes in the underlying associative network, or by temporary changes in the associations considered (based on context cues). The most prominent mechanism of implicit attitude change is evaluative conditioning, which is based on pairing a conditioned stimulus with an unconditioned stimulus of positive or negative valence. If enough observations of the co-occurrence take place, the valence of the unconditioned stimulus is transferred to the conditioned stimulus [GB06].

There are three main causes of explicit attitude change. The first one stems from changes in the associative evaluation of an object, therefore it is mediated by changes in implicit attitudes. As the associative evaluation changes, the propositions considered when making an evaluative judgment also change, potentially leading to a different resulting evaluation.

The second cause is based on considering new propositional beliefs, either because they have been newly acquired, or because individuals are motivated to do so (e.g. instructions to re-evaluate; introspection). The acquisition of new beliefs is usually linked to being exposed to new persuasive arguments. It is important to note that an attitude change only happens if the newly acquired beliefs imply a different evaluation of the attitude object.

The third cause involves a change in the strategy used to achieve consistency among propositions considered. As our propositional thinking considers the result of our associative judgment, we might reject the result, or we might come up with a new proposition that solves the inconsistency. In the latter case, no change in evaluation occurs.

2.3. Multiperspectivity in video games and attitude change

Building on the findings of the most recent meta-analysis [KRŠ*23] on video games and attitude change, multiperspectivity, often referred to as *perspective-taking*, is understood as a persuasive game mechanic that presents multiple points of view on a particular topic. These viewpoints can be either complementary or contradictory. Complementary perspectives are thematically aligned, offering deeper context and reinforcing the persuasive message. Contradictory perspectives, on the other hand, promote critical reflection by presenting opposing or conflicting viewpoints within a single narrative experience.

In research on attitude change and multiperspectivity, both types are often examined under the same umbrella. However, from the perspective of attitude formation and change, they represent distinct cognitive processes. According to the APE model, each type activates different pathways to attitude change: complementary perspectives typically strengthen or elaborate existing attitudes, while contradictory perspectives challenge prior beliefs and may induce cognitive conflict as a precursor to change.

In the studies included in the referenced meta-analysis, which covered the field up to August 2020, all identified research utilized contradictory multiperspectivity. These studies consistently demonstrated the impact of video games employing contradictory perspectives on explicit attitudes across most measured questionnaires and research designs [KS15, Kam16a, Kam16b, PHP20, KŠMB21, KMV*24, Kam16a]. An exception is [PHPKCG18], where, as analyzed in [KRŠ*23], the use of multiperspectivity was limited in relation to the specific construct being measured. However, implicit attitudes were not assessed in any of the included studies except for [KŠMB21], where no significant change was observed.

We extended the references identified by the meta-analysis by reviewing all the databases used (Scopus, ACM, Eric, Science Direct, WoS, ProQuest) with the same search string, adding a focus on perspective-taking (perspectiv*) or multiperspectivity (multiperspectiv*). We reviewed all the articles matching our search strings from 2020 until March 2025, identifying 223 articles (for more details, see Data supporting the article in Data Availability section).

Three additional studies using contradictory multiperspectivity were identified; in each study, at least one questionnaire showed explicit positive attitude changes, either supported by the use of a control group [KMV*24], or as part of experiments focused on several multiperspective games [KN24, WLL*24]. Beyond that, we also identified two studies using complementary multiperspectivity, [CR24], that employed a between-group design, and [DKS*25], which conducted two parallel within-subjects experiments using two climate-themed games. The former [CR24] confirmed explicit attitude changes in the short term compared to the control group. The latter [DKS*25] confirmed explicit attitude changes for both games in the short term and for one even in the long term. Furthermore, game interventions also explored implicit attitude changes, but did not confirm any changes. However, the study [DKS*25] did not use control groups. In summary, to our knowledge, there is only one study using a control group focused on explicit attitudes changes [CR24] and no studies using control groups to explore the effect on implicit attitudes. Therefore, although the results of complementary multiperspectivity are promising, empirical evidence is rather scarce, and more data are needed to draw stronger conclusions.

2.4. Multiperspectivity mechanisms and attitude changes

An attitude is a summary evaluation and may encompass affective, behavioral, and cognitive responses, among others [BW02]. Because attitudes are influenced by affective and cognitive processes, strategies that engage these mechanisms, such as perspective-taking, can play a crucial role in shaping and changing them. Todd and Galinsky [TG14] describes several mechanisms through which perspective-taking operates. Specifically, this article focuses on affective and cognitive processes that may underlie the perspective-taking's positive impact on attitude change.

The affective mechanisms through which perspective-taking operates include *parallel and reactive empathy*. Parallel empathy operates under the *feeling as another* paradigm, where the viewer feels the same emotions as the subject observed (e.g. a video of a child being bullied). Reactive empathy entails *feeling for another*, for example when taking the perspective of a homeless person. Both mechanisms have been shown to increase empathic concern and positively affect explicit attitudes.

The cognitive mechanisms of multiperspectivity include *shifts in attributional thinking* and *self-outgroup merging*. Research on the shifts in attributional thinking reported that respondents assigned greater importance to non-dispositional rather than dispositional factors following intergroup perspective-taking, which indicated a positive effect on explicit attitudes about affirmative actions. The self-outgroup merging mechanism refers to the creation of a stronger associative link between the self and the outgroup following perspective-taking. Since most people have a positive evaluation of themselves [YGB*07], this results in a positive effect on implicit intergroup evaluation.

The components of attitude change within a serious game dealing with the topic of refugees were explored in a study by Szatkowska et al. [SĆW25]. A game presenting perspectives of people on the Poland–Belarus border challenged players' assumptions, increased sympathy, and made them more willing to take action. However, empathy did not increase, possibly because players did not take the role of refugees themselves.

2.5. Credibility bias

Attitude change through games can be influenced by various psychological mechanisms, including credibility bias and motivated reasoning. Credibility bias refers to the tendency to perceive information from sources we distrust or view unfavorably as less credible [vSKBGB16, BTE07], whereas motivated reasoning leads individuals to favor information that aligns with their pre-existing beliefs and to dismiss conflicting perspectives [EG16]. In the case of complementary perspective-taking, where all information is presented from the viewpoint of a single party, the risk of inducing credibility bias may increase. Players with polarized attitudes may perceive the game's narrative as one-sided or biased, leading them to reject its message rather than reconsider their stance.

3. This Study

At the general level, our objective was to investigate whether a video game inspired by a museum's exhibition and narrative format can promote positive attitudinal impact on players towards the topics depicted in the game. Specifically, we aimed to evaluate the effect of complementary multiperspectivity on attitude change resulting from playing video games. We define complementary multiperspectivity as the representation of different yet aligned perspectives within a game narrative on a specific topic.

To achieve this, we conducted a pretest-posttest empirical study with one experimental and one control condition. We measured players' explicit and implicit attitudes and analyzed changes between the groups. The chosen topic of focus was refugees. For the experimental intervention, we used a modified version of the game *We Grew Up in War*, while for the control group, we used a video game *Beecarbonize*.

We Grew Up in War is inspired by the personal stories of children affected by the war in Sarajevo. It presents the perspectives of multiple children who experienced the conflict's hardships, recounting their stories and the impact the war had on their lives. By incorporating these complementary perspectives into its narrative design, the game aligns well with our experimental framework.

Given the region's history of conflict and its experience with migration crises in recent years, the topic of refugees and migration remains highly relevant and emotionally salient. This context provides a meaningful opportunity to capture a wide range of attitudinal responses among participants and to effectively measure attitude change.

3.1. Hypotheses

Based on the objectives of this study and the theoretical framework outlined above, we formulated the following four hypotheses:

H1: As a result of the intervention, participants in the experimental group will have more positive explicit attitudes towards refugees compared to those in the control group.

Using complementary multiperspectivity, the game provides players with a rich, aligned, and consistent narrative on the topic, eliciting compassion towards the main characters. As players are exposed to multiple perspectives highlighting the struggles of children during wartime, including their motivations and reasoning for migration, we expect that the intervention will significantly improve explicit attitudes compared to the control condition.

H2: As a result of the intervention, participants in the experimental group will have more positive implicit attitudes towards refugees compared to those in the control group.

In contrast to contradictory multiperspectivity, the game offers repeated exposure to consistent perspectives portraying children as victims who were either forced to leave their homes or witnessed their friends and family leaving, providing full emotional background and context. The main characters are rounded individuals associated with multiple positive qualities. Therefore, we expect that repeated positive associations will result in more positive implicit attitudes towards refugees compared to the control group.

H3: The affective response items of the explicit attitudes measurement will be more affected by the intervention in the experimental group than cognitive and behavior items, compared to the control group.

Existing research suggests that multiperspectivity influences affective responses more than cognitive or behavioral ones. [TG14]. Since multiperspectivity is central to our intervention, we expect greater changes in the affective component.

H4: Participants with less polarized attitudes will experience greater explicit attitude changes than those with more polarized attitudes.

We expected that complementary multiperspectivity alone would be insufficient to overcome credibility bias, particularly among participants with highly polarized initial attitudes. Because the game does not incorporate contradictory perspectives, an element that may enhance perceived credibility among skeptical individuals, we predicted that participants with less polarized baseline attitudes would exhibit greater attitude change toward the neutral point. For the purpose of this hypothesis, we classified the 50% of participants whose initial responses were closest to the neutral point on the explicit attitude scale as *less polarized*, and the remaining 50% as *more polarized*, based on their relative distance from the scale's midpoint.

4. Methodology

4.1. Participants

Since the intervention games were only available in English, we sought participants with a reasonable level of English proficiency.

Figure 1: *Dialogue interaction within a vignette*

We selected students from international English high schools in Sarajevo. The cultural heritage of this region is deeply intertwined with several recent conflicts and migration crises, which makes this topic highly relevant. Moreover, the game itself is directly inspired by real stories from this region, which enhances its relatability to the participants.

In total, we collected data from 126 participants. They were divided into two groups — experimental and control — by allowing them to select a room at random, with no prior information about the activity they would participate in. The study was introduced as research examining the effects of multimedia in education, and participants were informed that they would be exposed to video games.

Due to missing information on some consent forms, we excluded 6 individuals from the experimental group and 4 from the control group, resulting in a final sample of 116 participants (Experimental: n = 53; Control: n = 63). Due to technical issues related to internet connectivity, 7 implicit attitude measurements from the experimental group and 6 from the control group could not be collected properly. For participant characteristics, see Table 1. There were no statistically significant differences in gender, age, frequency of computer or smartphone use. All participants resided in Bosnia and Herzegovina at the time of the experiment.

4.2. Experimental intervention

Participants in the experimental group played a modified version of the narrative adventure game *We Grew Up in War*. The game is directly inspired by the War Childhood Museum's exhibition and replicates its curatorial principles, particularly the use of micro-stories. In the game, these micro-stories are presented as small narrative segments, or vignettes (see Figure 1), each representing a specific memory of a child in an armed conflict. Players encounter several children's stories, with multiple vignettes related to each character. These vignettes are not arranged chronologically but are thematically connected to form a cohesive narrative. Players' objective is to explore all the vignettes and, based on the clues within them, arrange them in the correct chronological order to uncover the ending.

Each vignette follows a similar structure. First, players metaphorically "unbox" the vignette by constructing its main ele-

Table 1: *Descriptive statistics for experimental and control group in pretest*

	Experimental group			Control group			Experimental vs. Control Comparison		
	n	Male	Female	*n*	Male	Female	*w*	Chi2 stat	*p*
Gender	53	27	26	63	29	34	0.05	0.28	0.60

	Experimental group			Control group			Experimental vs. Control Comparison				
	n	*M*	*SD*	*n*	*M*	*SD*	M_{diff}	*SD*	*d*	*t stat*	*p*
Age	53	16.89	1.03	63	17	0.96	-0.11	0.99	-0.11	-0.61	0.54
Computer use	53	4.28	0.97	63	4.25	0.98	0.03	0.98	0.03	0.16	0.87
Smartphone use	53	4.96	0.27	63	5.00	0.00	-0.04	0.19	-0.20	-1.00	0.28

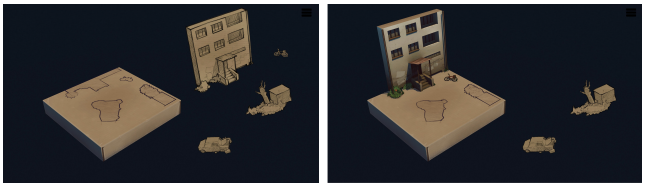

Figure 2: *Initial vignette construction process*

ments based on the context provided by an adult's retrospective narration (see Figure 2). This small puzzle — requiring the placement of crucial aspects of the scene — allows more time and space for narrative development and context-building. Once the scene is assembled, players take on the role of a particular child character, such as Mak (see Figure 1). They either engage in interactive dialogues where they choose emotional responses rather than specific dialogue lines, or they experience short minigames that represent activities from the child's memory (e.g., tuning a radio or throwing chestnuts at a car wreckage). In some cases, players enter one of the child's fantasies, illustrating how imagination occasionally helps children understand or cope with difficult situations (see Figure 3).

We Grew Up in War is inspired by real stories of people affected by conflicts in Bosnia, Ukraine, and Syria. However, for the purpose of this study, the game content was deliberately restricted to five vignettes inspired by the experiences of children during the Yugoslav wars of the 1990s, with a specific focus on topics related to migration, refugees, and displacement, aligning with the study's focus on refugee attitudes. Three of the five vignettes follow the story of Melisa (14 years old) and her refugee journey with her mother: her escape from Sarajevo, her experiences in a refugee camp (see Figure 4), and the challenges she faced after resettling in Germany with her mother. The remaining two vignettes follow the story of Mak (11 years old), Melisa's friend who stayed in Sarajevo with his family. In the first vignette, Mak and his friend reconnect after a long separation during the siege, spending time together playing and discussing recent news, illustrating how children attempted to maintain normalcy and friendship despite the war's constraints. The second vignette focuses on a much darker experience: hiding in the cellar of their home with his brother, coping with fear, isolation, and the recent death of his best friend.

The game employs complementary multiperspectivity by presenting different yet thematically aligned perspectives of various children. Each child is portrayed as a complex character with a unique background and war experience: some were forced to flee their homes, while others remained and witnessed the departure of friends and family. Despite these differences, all narratives emphasize the negative impact of war on children's lives, highlighting the overarching theme of shared suffering and loss.

To evaluate the specific effects of this intervention, we selected a control condition featuring a thematically unrelated video game, which allowed us to isolate the impact of the refugee-focused narrative experience.

4.3. Control intervention

For the control group, we selected the game *Beecarbonize*, an environmental digital card strategy game in which climate change serves as the primary opponent. Due to its rogue-like and emergent gameplay elements, players often repeat sessions after early failures, which is a typical part of the experience. The game addresses a broad range of environmental and societal issues, such as pollution, deforestation, and energy crises, with only peripheral references to migration. These references are not central to the gameplay, making *Beecarbonize* a suitable control condition, clearly distinct from the refugee-focused narrative of the experimental intervention.

Importantly, *Beecarbonize* is freely available, well-reviewed, and features variable session durations, allowing for comparable exposure times between the experimental and control groups. By selecting a game that is similarly engaging and educational, yet unrelated to the refugee or forced migration themes, we were able to control for the general effects of gameplay experience and focus specifically on the narrative and emotional content of the experimental game.

4.4. Measures

We collected questionnaire data on basic demographics and explicit attitudes digitally using the EUSurvey platform. Subsequently, we gathered implicit attitude measurements using a custom SC-IAT software [KS06] adapted for Android and touch controls.

Background Demographics Questionnaire – This 10-item questionnaire asked about participants' characteristics (age, class, country of residence, gender, frequency of computer/smartphone or

Figure 3: *Integration of children's fantasy in the vignette*

Figure 4: *Scene depiction from a refugee camp vignette*

tablet use, gaming habits, VR use, preferred game genres, and devices). Although part of a larger research project, for this study we focused only on age, gender, country of residence, and frequency of computer and smartphone or tablet use.

Single-Category Implicit Association Test (SC-IAT; [KS06]) – As an implicit attitude measurement towards refugees, we used the tablet-based version of the SC-IAT in which participants categorize words as fast as possible into relevant categories while the test measures their response times. We measured implicit attitudes towards only one concept, so we employed the SC-IAT, which is specifically designed for single-category evaluation. SC-IAT is the most reliable measurement tool for implicit attitudes towards one concept. We developed a custom SC-IAT software for Android tablets with touch controls following the original specification [KS06], thus we had three categories - Positive Adjectives, Negative Adjectives and the topic-related category Refugees. There were 7 words belonging to each category (for the full list, see Table 2).

Explicit Attitude Questionnaire – To measure explicit attitudes towards refugees, we used a modified version of the scale developed by [KFS*22]. The scale consists of three components, each assessed by two items evaluated on a five-point Likert scale:

1. Cognitive component

- When refugees arrive and decide to stay and live in a country, do they threaten or enrich the values of that country and its society?
- Do refugees rather threaten or enrich the prosperity in your country?

Table 2: *List of words used in SC-IAT*

Positive adjectives	Negative adjectives	Refugees
Just	Criminal	Relocation
Good	Wrong	Movement
Right	Bad	Diaspora
Fair	Evil	Deportation
Well-managed	Humiliating	Displacement
Merciful	Unfair	Refugee
Moral	Disgusting	Fleeing

Both items were rated on a five-point scale from *Threaten* to *Enrich*.

2. Affective component

- How strongly do you sympathize with refugees?
- How likeable are refugees to you?

Both items were rated on a five-point scale from *Not at all* to *Very strongly*.

3. Behavioral intentional component.

- I can imagine being friends or attending school with refugees.
- I would not mind refugees living in my neighborhood.

Both items were rated on a five-point scale from *Strongly Disagree* to *Strongly agree*.

The Cronbach's alpha values indicated acceptable internal consistency for the explicit attitude scale, with $\alpha = .724$ at pretest and $\alpha = .729$ at posttest. We made minor modifications to specific items to make the questionnaire more accessible to younger participants in our experiment (e.g. the term "Residential area" was replaced by the term "Neighborhood"). We piloted this updated version of the questionnaire as part of our small-scale pilot study [NNF*24].

4.5. Procedures

Data were collected in Sarajevo during five sessions across five international high schools in October and November 2024. In each session, participants were divided into two equally sized rooms: one for the experimental group and one for the control group. Data were collected using Android tablets with pre-installed software to minimize technical issues. As participants were underage,

parental consent was obtained in advance. The study was introduced to school administrators as research on multimedia in education, and participants were informed they would be exposed to video games. The intervention lasted approximately 50 minutes, with data collected at pretest and posttest (see Figure 5 for details). After data collection, participants were fully debriefed. Our procedures and questionnaires were successfully evaluated within the pilot study [NNF*24]. All data collection sessions were supervised by a trained experimenter.

4.6. Data analysis

We used independent samples *t*-tests to compare the experimental and control groups for differences in age, frequency of computer and smartphone use, and pretest scores. A chi-squared test was used to compare gender ratios.

To evaluate the intervention's effects, we conducted between-group comparisons of change scores (posttest minus pretest) in explicit and implicit attitudes toward refugees. Each participant's change score was calculated by subtracting their pretest from their posttest score, allowing us to directly assess attitude change.

Independent samples *t*-tests were used to compare mean change scores between the experimental group (who played *We Grew Up in War*) and the control group (who played *Beecarbonize*). One-tailed *t*-tests were used for all hypotheses, based on directional predictions. Prior to analysis, we verified that assumptions of normality and homogeneity of variances were reasonably met. Effect sizes were calculated using Cohen's *d* (0.2, 0.5, and 0.8 interpreted as small, medium, and large effects, respectively).

To evaluate the intervention's effects on the affective, cognitive, and behavioral components, we calculated pre–post change scores for each component and compared experimental and control groups individually using significance tests and effect sizes.

To evaluate the hypothesis concerning more and less polarized participants, we categorized them based on their initial explicit attitude scores. The scale ranged from 6 to 30, with 18 representing a neutral response. Participants furthest from 18 (top 50%) were classified as polarized; the remainder as unpolarized.

5. Results

Full descriptive and inferential statistics are presented in Table 3. The table includes both within-group pre–post changes and between-group differences in change scores; the latter are the basis for hypothesis testing. There was no significant difference in explicit attitudes at baseline between the experimental and control groups (d = –0.07, p = .722). The difference in implicit attitudes was moderate in magnitude (d = –0.38) but did not reach statistical significance (p = .055).

5.1. Hypothesis 1

H1: As a result of the intervention, participants in the experimental group will have more positive explicit attitudes towards refugees compared to those in the control group.

As expected, we found a significant difference in the pretest-posttest change scores in explicit attitudes between the experimental and control group (d = 0.33; p = .037) with a small-to-medium effect size. In other words, players who played a prototype of *We Grew Up in War* for approximately 23 minutes showed significantly more positive attitudes towards refugees as a result of the intervention. Therefore, Hypothesis 1 was supported.

5.2. Hypothesis 2

H2: As a result of the intervention, participants in the experimental group will have more positive implicit attitudes towards refugees compared to those in the control group.

Although there was a statistically significant pretest–posttest change in implicit attitudes within the experimental group (d = 0.61, $p < .001$), the between-group difference in change scores was not significant. Therefore, Hypothesis 2 was not supported.

5.3. Hypothesis 3

H3: The affective response items of the explicit attitudes measurement will be more affected by the intervention in the experimental group than cognitive and behavior items, compared to the control group.

As expected, the affective component showed a significantly greater change in the experimental group compared to the control group (d = 0.39, p = .021). In contrast, the cognitive (d = 0.23, p = .103) and behavioral components (d = –0.04, p = .595) did not show significant changes. While these results suggest the affective component was influenced by the intervention, no formal statistical test was conducted to compare the effect across components. Therefore, Hypothesis 3 was only partially supported.

5.4. Hypothesis 4

H4: Participants with less polarized attitudes will experience greater explicit attitude changes than those with more polarized attitudes.

To evaluate H4, we compared pre–post change scores between more and less polarized participants in the experimental and control groups. Contrary to our prediction, participants with more polarized attitudes showed greater attitude change. As the effect was in the opposite direction of our hypothesis, H4 was not supported. Nonetheless, this trend may warrant further investigation.

6. Discussion and Conclusion

Our aim was to evaluate whether a video game directly inspired by a museum exhibition could positively influence players' attitudes. Using complementary multiperspectivity in the video game, mirroring the curatorial approach of the museum exhibition, we conducted an empirical study measuring players' explicit and implicit attitudes before and after playing the game, and compared their results with those of a control group. In our case, the thematic focus was on refugees and migration.

Our research sample consisted of 116 high school students from

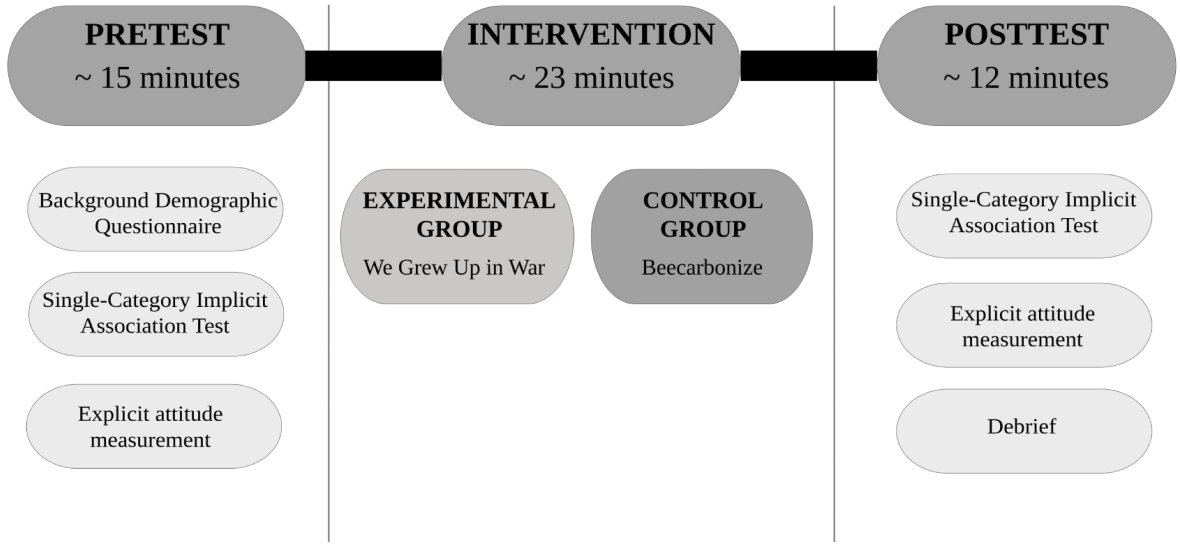

Figure 5: *Experiment procedure*

Table 3: *Pretest–Posttest Changes Within Each Group and Between-Group Differences*

Experimental Group

	n	PRE *M*	PRE *SD*	POST *M*	POST *SD*	DIFF *M*	DIFF *SD*	*d*	*p*
Explicit	53	17.45	5.35	18.51	5.34	1.06	2.80	0.38	.004
Explicit cognitive	53	3.85	2.73	4.21	2.91	0.36	1.70	0.21	.653
Explicit affective	53	5.91	2.31	6.55	2.06	0.64	1.55	0.42	.002
Explicit behavior	53	7.70	2.20	7.55	2.18	0.06	1.05	0.05	.348
Explicit polarized	26	16.92	7.39	18.62	6.85	1.69	2.22	0.76	$< .001$
Explicit less polarized	27	17.96	2.03	18.41	3.44	0.44	3.18	0.14	0.237
Implicit	46	-0.21	0.30	-0.01	0.24	0.20	0.32	0.61	$< .001$

Control Group

	n	PRE *M*	PRE *SD*	POST *M*	POST *SD*	DIFF *M*	DIFF *SD*	*d*	*p*
Explicit	63	17.79	4.92	17.89	4.93	0.10	2.93	0.03	.399
Explicit cognitive	63	3.63	2.44	3.56	2.35	-0.08	2.00	-0.04	.377
Explicit affective	63	5.98	2.13	6.05	2.22	0.06	1.46	0.04	.365
Explicit behavior	63	8.17	1.83	8.29	1.82	0.11	1.38	0.08	.263
Explicit polarized	31	18.26	6.83	18.58	6.02	0.32	2.87	0.11	.268
Explicit less polarized	32	17.34	1.70	17.22	3.54	-0.13	3.02	-0.04	.408
Implicit	57	-0.09	0.31	0.04	0.25	0.13	0.39	0.32	.009

Experimental vs. Control Comparison

	M_{diff}	*SD*	*t stat*	*d*	*p*
Explicit	0.96	2.90	1.80	0.33	.037
Explicit cognitive	0.44	1.88	1.27	0.23	.103
Explicit affective	0.58	1.52	2.06	0.39	.021
Explicit behavior	-0.05	1.23	-0.24	-0.04	.595
Explicit polarized	1.37	2.66	2.03	0.53	.024
Explicit less polarized	0.57	3.08	0.70	0.18	.243
Implicit	0.07	0.36	1.00	0.19	.159

Bosnia, divided into an experimental and a control group. The experimental group played a prototype version of the game *We Grew Up in War*, focused on war childhood and directly inspired by the stories and curatorial work of the War Childhood Museum. The control group played a thematically unrelated, yet still awareness-raising game, *Beecarbonize*, which addresses climate change. The data collected in this study offer new insights into the field of digital cultural heritage, its potential impact on general audiences, and the role that video games can play in disseminating and amplifying museum content and its broader mission.

6.1. General Findings

In line with our predictions, the explicit attitudes of players in the experimental group were positively affected compared to those in the control group. By confirming Hypothesis 1, we also support the broader assumption that representing a museum collection in a video game format can promote positive attitudes aligned with the museum's mission. Since the game employed complementary multiperspectivity, these results provide valuable insight into an underexplored area of research: how different video game narrative structures and mechanics can influence players' attitudes.

Our findings on the impact of video games on explicit attitudes are consistent with existing literature on the potential of video games to drive attitudinal change [KRŠ*23]. Furthermore, they contribute to the emerging understanding of how complementary multiperspectivity promotes attitude change. This mechanism is shared by both *We Grew Up in War* and the museum exhibition that inspired it. These results strengthen the argument that complementary multiperspectivity can effectively promote changes in explicit attitudes. Our findings also suggest that multiperspectivity had a measurable effect on the affective component of explicit attitudes, while cognitive and behavioral components showed no significant change.

However, contrary to our expectations, the experimental intervention did not lead to a significant change in players' implicit attitudes compared to the control group. Therefore, Hypothesis 2 was not confirmed. These findings diverge from some meta-analytical evidence suggesting that video games can influence implicit attitudes [KRŠ*23], but the results are consistent with recent studies employing contradictory multiperspectivity that did not confirm such an effect (e.g. [KMV*24, KŠMB21]). To our knowledge, no prior studies have specifically examined the impact of complementary multiperspectivity on implicit attitudes, limiting direct comparisons.

Implicit attitudes are thought to shift through repeated co-occurrences of a target concept with positively or negatively valued stimuli. We propose two main reasons why this shift may not have occurred in our study. First, the video game format used is relatively complex, presenting a broad range of interconnected topics and narrative elements. As a result, the associative links needed to influence implicit attitudes may have been diluted among competing themes. Second, the duration of the intervention may have been too short to allow for the repeated associative exposure typically required to produce measurable changes in implicit attitudes. While our game incorporated associative mechanisms, the limited exposure time may have reduced their effectiveness. Although these changes did not reach statistical significance, the observed trend offers tentative support for this interpretation, which should nevertheless be treated with caution. To clarify the relative impact of narrative complexity and intervention length, future research should replicate the study using the full version of the game and a longer play session.

Contrary to our expectations, more polarized participants showed a greater trend toward attitude change. As the effect was in the opposite direction of our hypothesis, it cannot be considered statistically significant. This unexpected pattern may reflect stronger emotional engagement with the game's narratives, potentially overriding credibility bias. In contrast, less polarized participants may have been less invested. Further research is needed to explore this possibility.

6.2. Limitations

This study has several limitations. First, our participant sample consisted exclusively of high school students from Sarajevo. A replication study using a different research sample, especially from areas not recently affected by war, might yield different results and help strengthen the generalizability of the findings. Second, we tested only a short version of the game (approximately 15% of the final content) due to the time constraints. Future studies could assess the effects of the full game. Third, we did not test whether the affective change was significantly greater than the others, limiting direct comparison across components. Fourth, the polarized group included both strongly positive and negative baseline attitudes, which may have obscured distinct response patterns. Fifth, our sample size was relatively small for evaluating Hypothesis 4.

6.3. Conclusion and Implications

Building on the results of this empirical study, video games represent a promising format for shaping players' attitudes on difficult topics. Their narrative and mechanical languages enable the integration of multifaceted topics and even the replication of museum curatorial practices. In this case study, we focused on the so far under-researched area of complementary multiperspectivity in video games, which was shown to be capable of influencing players' explicit attitudes, although not their implicit ones.

These findings suggest that video games can replicate the positive messaging embedded in museum exhibitions. As such, they offer a way to extend a museum's mission beyond its physical limits. Conversely, video games can also be enriched by the careful, well-researched narratives developed in museum work, creating an ideal synergy between museums and video game studios while raising awareness about important social and cultural issues. By bridging the worlds of digital storytelling and cultural heritage, video games offer a transformative opportunity to reach and inspire new generations across geographical boundaries.

7. Acknowledgment and Data Availability

This work has received funding from the European Union (GA no. 101061496). Views and opinions expressed are however those of

the authors only and do not necessarily reflect those of the European Union or the Research Executive Agency. Neither the European Union nor the granting authority can be held responsible for them. Human data were collected in accordance with APA ethical principles, and all authors had full access to all data supporting the article. All supporting data will be shared upon request..

References

[BBG*24] BUIJSMAN M., BRENNAN D., GU T., SIMON L. I., KUZUHARA T., GEORGIOU S., WAGNER M., NGUYEN N. L., HUNT B., VIDAL A. M., REIS T.: Global Games Market Report. https://newzoo.com/resources/trend-reports/newzoos-global-games-market-report-2024-free-version/, August 2024. Accessed: 2025-04-20. 1

[BTE07] BRANNON L., TAGLER M., EAGLY A.: The Moderating Role of Attitude Strength in Selective Exposure to Information. *Journal of Experimental Social Psychology 43* (07 2007), 611–617. doi:10.1016/j.jesp.2006.05.001. 3

[BW02] BOHNER G., WÄNKE M.: *Attitudes and attitude change*, vol. 6. 02 2002. doi:10.4324/9781315784786. 3

[CR24] CHATRUC M. R., ROZO S. V.: In someone else's shoes: Reducing prejudice through perspective taking. *Journal of Development Economics 170* (2024), 103309. 3

[DKS*25] DAIIANI M., KYBURZ P. S., STANLEY S., VAN ROOY D., CALDWELL S.: Gameful interventions for pro-environmental attitude change. *International Journal of Human-Computer Studies 196* (2025), 103439. 3

[EG16] EPLEY N., GILOVICH T.: The Mechanics of Motivated Reasoning. *Journal of Economic Perspectives 30* (08 2016), 133–140. doi:10.1257/jep.30.3.133. 3

[GB06] GAWRONSKI B., BODENHAUSEN G.: Associative and Propositional Processes in Evaluation: An Integrative Review of Implicit and Explicit Attitude Change. *Psychological bulletin 132* (09 2006), 692–731. doi:10.1037/0033-2909.132.5.692. 2

[GB18] GAWRONSKI B., BODENHAUSEN G.: Evaluative Conditioning From the Perspective of the Associative-Propositional Evaluation Model. *Psychologia Społeczna 13* (07 2018), e28024. doi:10.5964/spb.v13i3.28024. 2

[Kam16a] KAMPF R.: Long-term effects of computerized simulations in protracted conflicts: The case of global conflicts. In *Persuasive Technology: 11th International Conference, PERSUASIVE 2016, Salzburg, Austria, April 5-7, 2016, Proceedings 11* (2016), Springer, pp. 242–247. 2

[Kam16b] KAMPF R.: The Context Is the Message?! Learning about the Israeli-Palestinian Conflict through Computerized Simulations in Different National Contexts. *Universal Journal of Educational Research 4*, 8 (2016), 1787–1796. 2

[KFS*22] KOTZUR P. F., FRIEHS M.-T., SCHMIDT P., WAGNER U., PÖTZSCHKE S., WEISS B.: Attitudes towards refugees: Introducing a short three-dimensional scale. *British Journal of Social Psychology 61*, 4 (2022), 1305–1331. doi:https://doi.org/10.1111/bjso.12538. 6

[KMV*24] KOLEK L., MARTINKOVÁ P., VAŘEJKOVÁ M., ŠISLER V., BROM C.: Is video games' effect on attitudes universal? Results from an empirical study comparing video games' impact on the attitude change of players with different backgrounds. *Journal of Computer Assisted Learning 40*, 2 (2024), 667–684. doi:https://doi.org/10.1111/jcal.12911. 2, 3, 9

[KN24] KAMPF R., NICOLAIDOU I.: Using social impact games to overcome intractable conflicts: the case of Fact Finders and PeaceMaker. *Information, Communication & Society* (2024), 1–16. 3

[KRŠ*23] KOLEK L., ROPOVIK I., ŠISLER V., VAN OOSTENDORP H., BROM C.: Video games and attitude change: A meta-analysis. *Contemporary Educational Psychology 75* (2023), 102225. doi:https://doi.org/10.1016/j.cedpsych.2023.102225. 1, 2, 9

[KS06] KARPINSKI A., STEINMAN R.: The single category implicit association test as a measure of implicit social cognition. *Journal of personality and social psychology 91 1* (2006), 16–32. 5, 6

[KS15] KAMPF R., STOLERO N.: Computerized simulation of the Israeli-Palestinian conflict, knowledge gap, and news media use. *Information, Communication & Society 18*, 6 (2015), 644–658. doi:10.1080/1369118X.2014.982142. 2

[KŠMB21] KOLEK L., ŠISLER V., MARTINKOVÁ P., BROM C.: Can video games change attitudes towards history? Results from a laboratory experiment measuring short- and long-term effects. *Journal of Computer Assisted Learning 37*, 5 (2021), 1348–1369. doi:https://doi.org/10.1111/jcal.12575. 2, 9

[NNF*24] NTOA S., NTAGIANTA A., FLORES F., KOLEK L., PETROVA A., APOSTOLAKIS K. C., STAMOU S., MARGETIS G., STEPHANIDIS C.: Serious games beyond entertainment and learning: An evaluation methodology for assessing awareness raising, empathy, and social change. In *International Conference on Human-Computer Interaction* (2024), Springer, pp. 141–164. 6, 7

[PHP20] PEÑA J., HERNÁNDEZ PÉREZ J. F.: Game Perspective-Taking Effects on Willingness to Help Immigrants: A Replication Study with a Spanish Sample. *New Media & Society 22*, 6 (2020), 944–958. doi:10.1177/1461444819874472. 2

[PHPKCG18] PEÑA J., HERNÁNDEZ PÉREZ J. F., KHAN S., CANO GÓMEZ Á. P.: Game Perspective-Taking Effects on Players' Behavioral Intention, Attitudes, Subjective Norms, and Self-Efficacy to Help Immigrants: The Case of "Papers, Please". *Cyberpsychology, Behavior, and Social Networking 21*, 11 (2018), 687–693. 2

[SĆW25] SZATKOWSKA W., ĆWIL M., WARDASZKO M.: Awareness Over Knowledge: An Exploratory Study on a Refugee Crisis Game. *Simulation & Gaming 56*, 2 (2025), 210–236. doi:10.1177/10468781241311627. 3

[Sta24a] STATISTA RESEARCH DEPARTMENT: Games - Worldwide, 2024. Accessed: 2025-04-30. URL: https://www.statista.com/outlook/amo/media/games/worldwide?currency=USD#key-market-indicators. 1

[Sta24b] STATISTA RESEARCH DEPARTMENT: Number of games released on Steam worldwide from 2004 to 2024, 2024. Accessed: 2025-04-30. URL: https://www.statista.com/statistics/552623/number-games-released-steam/. 1

[TG14] TODD A. R., GALINSKY A. D.: Perspective-Taking as a Strategy for Improving Intergroup Relations: Evidence, Mechanisms, and Qualifications. *Social and Personality Psychology Compass 8*, 7 (2014), 374–387. doi:https://doi.org/10.1111/spc3.12116. 3, 4

[vSKBGB16] VAN STRIEN J., KAMMERER Y., BRAND-GRUWEL S., BOSHUIZEN H.: How attitude strength biases information processing and evaluation on the web. *Computers in Human Behavior 60* (07 2016), 245–252. doi:10.1016/j.chb.2016.02.057. 3

[VW16] VOGEL T., WÄNKE M.: *Attitudes and attitude change: Second edition*. Psychology Press, 04 2016. doi:10.4324/9781315754185. 2

[WLL*24] WU Y., LI Z., LIU Z., CUI B., YIN A.: Third party interventions promote cooperation on the interdependent networks: A perspective based on prospect theory. *Chaos: An Interdisciplinary Journal of Nonlinear Science 34*, 10 (2024). 3

[YGB*07] YAMAGUCHI S., GREENWALD A., BANAJI M., MURAKAMI F., CHEN D., SHIOMURA K., KOBAYASHI C., CAI H., KRENDL A.: Apparent universality of positive implicit self-esteem: Short report. *Psychological science 18* (07 2007), 498–500. doi:10.1111/j.1467-9280.2007.01928.x. 3