Social Modeling in Computational Simulations: Racial and Ethnic Representation in Videogames and Virtual Reality Systems

by

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B.S., Massachusetts Institute of Technology (2014)
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Computational simulations such as videogames and virtual reality (VR) systems already pervasively attempt to represent aspects of human identity, including modeling race and ethnicity-related phenomena. However, existing strategies typically focus on representing racial and ethnic identity only as graphics-level customizations and often rely on racial stereotypes [222]. Race and ethnicity are tied to social systems, histories, embodied experiences, interpersonal interactions, and discourse [129, 72, 48] which cannot be reduced to solely graphical models. Furthermore, individuals within the same racial or ethnic groups may have a wide range of differences in their racial and ethnic socialization (RES) experiences [113], feelings of commitment and belonging to their group [171], racial ideologies [153], and how they perceive discriminatory racial encounters (DREs) [15]. It is critical to address the shortcomings of racial and ethnic identity representations in virtual systems because they have real-world consequences on human users (e.g., academic outcomes [120, 41], social behavior [188], racial attitudes [88, 25], healthcare outcomes [111]). There are a lack of formal design approaches for creating compelling racial identity representations and models for use in computational simulations that address these shortcomings.

An interactive narrative videogame system called *Passage Home* was developed through a design-based research collaboration with clinical and community psychology researchers who study racial discrimination and socialization in Black families to reduce racial stress and trauma [13, 14]. The system embeds a computational model informed by the *Racial Encounter Coping Appraisal and Socialization Theory* (RECAST; [197, 15]) to simulate a DRE between a Black student and her white teacher. Using *Passage Home*, two user studies were conducted with 110 PreK-12 educators and 60 youth across the U.S. to understand the relationships between participants' physical-world RES experiences, identity development, and attitudes and their experience and interpretations in the game. Quantitative analyses revealed statistically

significant relationships between participants' RES experiences [113, 12], colorblind racial attitudes [153], and ethnic identity development [185] with their game experiences [115] and narrative interpretations. Qualitative analyses revealed a range in appraisals of and emotional responses to the DRE in the game. Implications, limitations, and future work are discussed.

Computational simulations are powerful socializing agents that influence individuals' race-related beliefs, values, and attitudes [76]. This dissertation proposes a novel design framework for racial and ethnic identity representation in these systems, which maps four themes of RES practices—(1) *cultural endorsement of the mainstream*, (2) *promotion of mistrust*, (3) *alertness to discrimination and preparation for bias*, and (4) *cultural pride and legacy appreciation*—onto four simulation components—(1) environments, (2) player characters, (3) non-player characters, and (4) content structures. The upshot is a framework featuring 16 novel design strategies, each with prompts for *critical reflection* [191], examples from existing systems, and theorized consequences of these representations on users based on the RES literature [113]. The framework provides a new tool to aid practitioners in becoming more conscious of the RES practices they are using when developing racial and ethnic identity representations.

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Dedicated to my mother, Léontine, my father, Paul,
my grandparents, Jimmie and Alvhild, and my entire village.
Thank you for raising me.

In Loving Memory Of:

Ole and Eva Olson

Alf and Mari Melvor

Ndéké Rebecca

Jean Gogo

Amina Alissa

Namgbanga Rachel "Dassia"

Inna Pauline

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This doctoral thesis has been examined by the following committee:

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Contents

List of Figures

List of Tables

Chapter 1

Introduction and Motivation

Videogames are a powerful mainstream medium, as evidenced by games outstripping the film industry in terms of revenue and impact [152] and the increasing racial, ethnic, socioeconomic, and gender diversity of game players worldwide [47]. Videogames, in addition to other forms of computational media such as virtual reality (VR) and mixed reality (MR), are no longer used solely for entertainment or fun. The fast-growing genre of *serious games* describes interactive games designed for educational purposes [2, 183]. The use of serious games as an alternative to traditional workplace training and educational interventions have become increasingly commonplace in classroom and workplace settings [35, 36]. Other terms referring to games whose purposes are beyond or in addition to entertainment are *impact games* and *games for change*, which are games that focus on investigating, innovating, and cultivating solutions to social issues using gaming.

Nearly all computational simulations involving human characters portray race and ethnicity, at least incidentally, and an increasing number prominently represent, or even thematically focus on, race and ethnicity [88, 168, 20, 107, 45]. This dissertation provides a more accurate, expressive and nuanced approach to racial and ethnic identity representations that can be used in these systems. Toward considering the implications of these identity phenomena being so widely represented in these sys-

tems, let us first consider the definitions of race and ethnicity. Modern sociologists typically consider *race* to be a socially constructed category that is not rooted in biology, but based on "social ideas about what it means to belong to one race group versus another" [72]. These social ideas are often arbitrarily defined for the purpose of creating legislation to maintain social hierarchies, such as the "one-drop rule" in the United States which asserts that "one drop of Black blood makes a person Black" [110] and Brazil's return to a race-color system in their 1980 census, a system in which "the perception of phenotype overrides descent as a principle of identity" [105]. "*Ethnicity* refers to a social category of people who share a common culture" [72]. Ideas about race and ethnicity in computational simulations may be represented through characters, environments, narratives, and other content, spanning many game genres and subject matter. For example, such representations can be found in action-adventure videogames featuring protagonists whose racial or ethnic backgrounds are systematically underrepresented in videogames[1], or VR experiences which specifically aim to tackle issues related to discrimination and racial equity. Early character design was limited by technological and gaming style constraints [177] which are no longer barriers for today's system designers and developers. However, although cutting-edge innovations have since been made in gaming technologies, presumably paving the way for more inventive portrayals, racial and ethnic identity representations in computational simulations are still lacking.

1.1 Existing Racial and Ethnic Representations

This research is motivated by the need for better approaches to depicting racial or ethnic identity and modeling related social phenomena in virtual environments. Main-

[1]A Pew Research Center report found that game players quite diverse in terms of race, ethnicity, and gender: roughly 49% of all U.S. adults play videogames across racial and ethnic background, with 50% male and 48% female players [40]. In contrast, a 2005 report commissioned by the International Game Developers Association found the makeup of videogame developers to be much more homogenous: 88.5% of all game development workers are male and 83.3% are white citefron2007hegemony. An analysis of the representations of primary characters within videogames have found that they similarly lack diversity: 84.95% White, 9.6% Black, 3.69% Biracial, 1.69% Asian, 0% Latine or Native American, 73% men, and 12% women [222].

stream representations are typically constructed upon several fundamental assumptions that do not sufficiently reflect the complexity of race and ethnicity-related social dynamics. These representations are often limited and simplistic or even detrimental to society by perpetuating and exacerbating racist ideas and experiences. These ideas are embedded within computational structures, resulting in systems that promote harmful racial ideologies. This section discusses three specific representational strategies and their limitations.

The first assumption is that visual or graphics-level customizations are sufficient for representing racial and ethnic identity. For example, selecting a certain racial or ethnic group for one's character may only change to its graphical model (e.g., skin color, hair texture, or facial features). Given the phenotypic diversity that exists within individual racial and ethnic groups, conflating visual appearance with a person's race or ethnicity is an insufficient approach. It is important to represent a character's group independently of their visible appearance to account for this diversity, such as the wide range of skin complexions individuals within the same racial or ethnic group may have. Additionally, decoupling group and character appearance allows systems to model more complex racial and ethnic identity phenomena such as *colorism*, which is "the allocation of privilege and disadvantage according to the lightness or darkness of one's skin" [34] across racial and ethnic groups.

The second assumption is that uniform (and often stereotypical) character behavior customizations are sufficient for representing racial and ethnic identity. *Essentialism* is the erroneous "belief that racial group membership is fixed and reflects an underlying essence shared by like individuals" [75]. In many popular videogames such as the massively multiplayer online role-playing game *World of Warcraft* (WoW) [56], "race is a determinant of ones geographic starting point, physical appearance, skill set, talents, intellect, temperament, career (class), language, technology, and culture" [149], supporting an essentialist view in a fantasy context with fictional races. In games that feature humans, "racialized stereotypes of virtually every community of color" are often hard-coded into the game [132, 149]. For example, selecting a Black

character will automatically update its speech/dialogue to feature a specific dialect, accent, or vernacular. Systematic analyses of videogame representations of Black and Latine[2] characters have found that they are "often restricted to athletic, violent, and victim roles, or rendered entirely invisible" [79, 57] and that, for these portrayals, one of the primary strategies for representing race is through "its dialogue: street and ethnic slang, thug and gangster speak" [57]. Representational strategies which ignore the wide range in how individuals within racial or ethnic groups express their identities (including but not limited to how they speak in different contexts) often rely on social stereotypes that lead to racial discrimination. This approach reflects an ideology that privileges American Standard English and perceives the use of structural patterns, discourse, and rhetorical style that are different from this norm to be subordinate deviations, and corruptions, mostly associated with the socially disadvantaged [23]. Linguistics scholar John Baugh created the term *linguistic profiling* to describe "the racial identification and discrimination of an individual or group of people based on their speech" [23]. This is a form of racial discrimination which can influence a person's access to opportunities resources. For example, speech cues during phone calls can affect a person's chances for job interviews or housing rentals [23].

Finally, the third assumption is that most, if not all, individuals within the same racial or ethnic group will appraise or respond to race and ethnicity-related topics and issues depicted in computational simulations in a similar way. For example, there are a growing number of human-computer interaction (HCI) researchers who develop and study computational simulations about racial phenomena. Much of the HCI literature on these systems employ methodologies that examine differences in outcomes along racial category lines (for instance, comparing the results between Black and white participants) [59, 203, 20, 168, 225]. These methodologies reflect an assumption that racial or ethnic group is a sufficient category line along which to study these outcomes. Social science research that indicates that people in the

[2] *Latine* is a gender-inclusive term that uses the morpheme -e (already existent in the Spanish phonological and lexical systems) and is here used as an alternative to *Latinx* (which does not provide a uniform pronunciation) [195].

same groups do not necessarily have the same knowledge of their cultural group, feel the same kind of commitment or belonging toward their group, have similar political orientations towards racial issues, or cope with discriminatory experiences in the same way [113, 171, 153, 15] challenges this assumption. Sociology scholar Wayne Brekhus has discussed how "[searching] for commonalities *across* different social categories rather than necessarily assuming similarity *within* categories and difference between categories" can assist social scientists in "heuristically [grouping] people together along less politically salient 'identity dimensions'" [32]. Moving beyond the assumption that race alone is the most important identity dimension to use when evaluating serious games about these topics could reveal design insights that would otherwise remain latent when studying users only along racial lines.

Although there have been major strides in racial and ethnic identity representations in computational simulations resulting from advancements in computer graphics, artificial intelligence (AI)-generated dialogue, and greater awareness of the need to design for today's more ethnically and racially diverse gaming population [40], there are still considerable limitations to these approaches due to their underlying assumptions, which regard racial and ethnic groups in a monolithic way. Additionally, beyond being overly simplistic technical and creative approaches, numerous empirical studies have demonstrated that identity representations and modeling social phenomena in virtual environments affect important in-game and post-game outcomes such as:

- **Academic Outcomes:** A 2015 study with over 10,000 aggregate participants in a science, technology, engineering, math (STEM) learning game found that when participants had the opportunity to use role model avatars and avatars that looked like themselves while they were succeeding in the game, it resulted in higher affect, performance, and engagement [120]; a 2019 study found that sexist behavior in a virtual math classroom worsened the performance and learning outcomes of female students [41].

- **Social Behaviors:** A 2013 study with a VR game that gave participants super-

powers in the virtual environment led to increased altruistic behaviors (specifically, helping a research confederate pick up dropped items) in the physical world after the experience ended [188].

- **Racial Attitudes:** A 2009 study with a VR interview simulation found that participants who were assigned Black avatars demonstrated greater implicit racial bias towards Black people after the experience ended [88]; in contrast, a 2016 study with an avatar creation videogame found that participants who created and played the game using a Black avatar reported a higher level of favorable attitudes towards African American men (not women) and policies supporting racial and ethnic minorities compared to participants who played using a white avatar [25].

- **Healthcare Outcomes:** A 2019 study found that a virtual perspective-taking intervention for physician residents (which used vignettes generated using a life simulation videogame) resulted in evidence of improved patient care for participants who demonstrated bias, discomfort, and anxiety in prescribing pain medication to Black patients [111].

In summary, videogames, VR systems, and other kinds of computational simulations are increasingly pervasive in modern society. They are not only popular forms of entertainment, but also tools for teaching and learning used in academic and professional settings. The racial and ethnic identity representations within these systems have significant opportunities on real-world outcomes. Like other forms of media, computational simulations are powerful socializing agents that influence individuals' race-related beliefs, values, and attitudes [76]. Thus, it is important to improve the racial and ethnic representational strategies used by the creators of these systems. Motivated by these opportunities, the next section describes the overall goals of this research.

1.2 Research Goals

This dissertation presents a more accurate, expressive and nuanced approach to racial and ethnic identity representation that can be used in computational simulations for important application areas such as clinical research, learning, and social impact. This novel approach maps concepts from empirical social science research about individuals' physical-world *racial and ethnic socialization* (RES; which describes the process through which children learn about race and ethnicity, both directly and indirectly [113]) to computational simulation components such as the simulation environment, characters, and content structure (e.g., narrative, achievement and reward structures, rules). Given the wealth of empirical research that social scientists have done for decades on the nuanced and complex nature of racial and ethnic identity in the real world, I argue that computational simulation designers and developers can use their models to build better virtual representations of race and ethnicity.

Three endeavors were pursued to explore the efficacy of this approach. For the first endeavor, an interactive narrative videogame system called *Passage Home* was designed and developed using the *Racial Encounter Coping Appraisal and Socialization Theory* (RECAST) [197, 15], rather than using the assumptions previously described in Section 1.1. RECAST provides a model for understanding the effects of racial socialization on racial coping and self-efficacy for addressing racialized stress.

The system provides a flexible architecture in which many different narratives can be instantiated atop the same underlying RECAST-informed narrative model. For the purpose of this research, the system was designed to simulate a discriminatory racial encounters (DRE) between an adolescent from a marginalized group (the main character) who is discriminated against by an authority figure from the mainstream group (the main antagonist). The ground truth in the scenario is that the discrimination is racially motivated. This ground truth enabled assessment of whether users' socialization impacted their appraisal of the encounter as well as their racial and ethnic socialization (RES) and coping style. The version of *Passage Home* used in this

research featured a specific narrative constructed using these criteria. The system puts players in the first-person perspective of Tiffany, a Black high schooler who is a high-achieving English student at an all-white school. In the game, the player (as Tiffany) is falsely accused of plagiarism by her teacher, Mrs. Smith, who is white. The accusations of plagiarism are based on the teacher's belief that Black students are incapable of producing high-quality writing, as she observes that Tiffany's essay is very well-written and does not believe Tiffany was capable of writing it. The player must make a series of choices indicating what they think about the teacher's statements, how they feel internally, how they would like to respond verbally and through body language, what they were taught by their caregivers that could help them in situations like this, and how they would like to end the interaction. Because the narrative in *Passage Home* centers the experience of a Black adolescent, RECAST—a model informed by research with Black adolescents and their caregivers—was used to inform the racial and ethnic identity model embedded in the system.

It is important to note that while this approach helped take into account more of the nuance and complexity of race and ethnicity than many existing approaches, there are always limitations to describing sociocultural and subjective phenomena in purely formal terms. Computer scientist Joseph Goguen argued that the obstacles of "giving precise formulations of realistic problems" cannot be overcome and "are artifacts of a misguided reductionist program that attempts to apply successful methods from the hard sciences to domains having completely different characteristics" [80]. In short, complex racial and ethnic identity phenomena are not fully reducible to structures that are easily implementable in computing systems. He nonetheless states that "semi-formal approaches that take account of social processes can be valuable" [80], and this framework aims to support improving these representations rather than aiming for a fully reductionist approach.

For the second endeavor, two user studies were conducted using *Passage Home* to better understand how PreK-12 educators and youth blend their physical-world RES, racial attitudes, and ethnic identities with the virtual-world identity they enact in

computational simulations that model racial and ethnic identity phenomena. *Blended identity* describes how "aspects of a player's physical identity (such as preferences, control, appearance, and understanding social categories) are selectively projected with aspects of the virtual identity onto a blended identity, integrating and elaborating aspects of each" [96, 101]. While much of the existing literature has characterized how individuals in different racial or ethnic groups may differently experience virtual experiences that explore racial issues, there is a lack of understanding of how these other factors (related to but distinct from racial or ethnic group) affect in- and post-game outcomes.

Although RECAST specifically focuses on adolescents and their caregivers, a child's educators also play a significant role as socializing agents in a child's development. Given the amount of time children spend in school, educational practices in these settings significantly influence their racial and ethnic identity development and consciousness [10]. Furthermore, in addition to being socializing agents, educators can perpetuate racial discrimination towards the youth they serve. Thus, the study aimed to better understand how both youth, who are possible targets of these kinds of accusations, and PreK-12 educators, who are possible perpetrators of these discriminatory acts, perceived and responded to *Passage Home*.

Finally, the third endeavor resulted in the development of a novel design framework for representing race and ethnicity in computational simulations. The knowledge gained through the research and development of *Passage Home* informed the design framework. To achieve the goals summarized in this section, the next section presents the research questions investigated by this dissertation and the novel contributions it makes to the field of HCI.

1.3 Research Questions and Contributions

To provide a more principled approach to designing, developing, and deploying simulations that represent and portray social phenomena related to racial and ethnic

identity, this dissertation seeks to answer the following research questions (RQs):

RQ1. How can we characterize the interrelationships between individuals' physical-world racial and ethnic socialization, attitudes, and identity development and their choices, interpretations, and experiences within this virtual simulation of racial discrimination?

RQ2. How can racial and ethnic socialization strategies be *operationalized*[3] to represent racial and ethnic identity in simulations?

In answering these research questions, this dissertation makes the following contributions:

1. *Passage Home*, a videogame system which embeds a novel computational model and simulation informed by RECAST to simulate a discriminatory racial encounter

2. Findings from a user study evaluation of *Passage Home* with PreK-12 educators and youth

3. A novel design framework that applies RES practices to describing and creating racial and ethnic identity representations in computational simulations

1.3.1 User Study Findings Summary

To answer RQ1, user studies were conducted with 110 PreK-12 educators and 60 youth across the U.S. using two versions (a graphics and a hypertext version) of the *Passage Home* interactive narrative game. Data on participants' in-game choices, their game experience, post-game reflections, narrative interpretations (i.e., how they perceived the story and characters in the game), and their level of identification with the player character were collected. Validated social science instruments were used to assess participants' ethnic identity development, colorblind racial attitudes (educators only), and racial socialization competency (youth only). Descriptive and inferential

[3]In this context, *operationalization* refers to the use of operational logics (OLs) as a strategy for representing social science models of racially stressful encounters in computational simulations. OLs are further defined in Chapter 2.

statistical analyses were performed on the quantitative data and the qualitative data was systematically coded [42] to identify emergent patterns in participant responses.

The notable findings from the studies (further detailed in Chapter 5) were:

- Participants' primary self-reported RES experiences while growing up had significant relationships with their game experience (i.e., their level of immersion, emotions, and feelings of competence while playing the game) and how they interpreted the narrative
- Participants' ethnic identity development had significant relationships to their game experience and narrative interpretations
- PreK-12 educators' colorblind racial attitudes had significant relationships to their game experience and narrative interpretations (generalizing the findings from [162] to a larger study population)
- The youths' racial socialization competency had significant relationships to their game experience and narrative interpretations
- Participants' in-game choices and level of identification with the player character were not significantly related to these factors (i.e., primary self-reported RES experiences, ethnic identity development, colorblind racial attitudes, or racial socialization competency)

Chapter 7 discusses the implications of these findings, recommending that simulation designers and developers attend to differences in players' RES experiences, level of ethnic identity development, and colorblind racial attitudes to create more compelling experiences (and, in the case of educational applications, more effective interventions).

1.3.2 Design Framework

Like caregivers, educators, and peers, computational simulations are powerful agents of RES which influence how youth acquire values, beliefs, and behaviors related to

race and ethnicity. This dissertation presents a novel design framework in response to RQ2 as a tool for critical reflection on the specific RES practices that are embedded into simulation components. Specifically, the framework focuses on the following four simulation components: (1) environments, (2) player characters, (3) non-player characters, and (4) content structures. The framework maps the following four RES practices onto each of these simulation components: (1) *alertness to discrimination and preparation for bias*, (2) *cultural endorsement of the mainstream*, (3) *cultural pride and legacy appreciation*, and (4) *promotion of mistrust* (defined in Chapter 2 Section 2.3.2). The upshot is a novel design framework featuring 16 novel design strategies that can be used by simulation designers and developers to describe and generate new virtual representations of racial and ethnic identity.

Chapter 6 presents this framework (shown in Figure 6-2), which is divided into two categories of racial and ethnic identity representational strategies. The first category features strategies that reinforce dominant racist ideologies by using RES practices of *cultural endorsement of the mainstream* and *promotion of mistrust*. The second category features strategies that resist these ideologies by promoting racial and ethnic consciousness and communicating cultural knowledge by using RES practices of *alertness to discrimination and preparation for bias* and *cultural pride and legacy appreciation*. Each strategy is accompanied by prompts for reflection that can be used by practitioners to analyze and design new systems, examples of how these strategies have been used in existing systems, and theories of potential consequences these design strategies may have on users based on empirical research on the effects of RES on various real-world outcomes. The chapter concludes by translating these 16 strategies into a prescriptive format (shown in Figure 6-24) which can be used as design guidelines and best practices for representing race and ethnicity by development teams.

1.4 Dissertation Overview

The dissertation is organized into seven chapters presenting the research conducted to answer the primary research questions stated in Section 1.3. Chapter 2 establishes the theoretical framework, summarizing important concepts from subfields of computer science and social science that were used to guide this research. Then, the system design and development process for *Passage Home* is detailed in Chapter 3. Next, the methods used to answer the primary research questions are described in Chapter 4. After establishing this methodology, Chapter 5 reviews the results and findings from the user studies conducted using *Passage Home*. Finally, Chapter 6 proposes a novel design framework for racial and ethnic identity representation. Finally, the dissertation concludes in Chapter 7 with reflections on these outcomes and their implications for future work.

Chapter 2

Theoretical Framework

This dissertation research is built upon an interdisciplinary framework, spanning the fields of computer science, human-computer interaction, game studies, and social psychology. This chapter provides background on the key theories and approaches that guided this research.

2.1 Computer Science

This section summarizes concepts from subfields of computer science used to guide this research including human-computer interaction (HCI) and applied artificial intelligence (AI).

2.1.1 Human-Computer Interaction

Human-Computer Interaction (HCI) research can be described as "the study and practice of the design, implementation, use, and evaluation of interactive computing systems" [163]. However, as explained by internationally renowned computer scientist Yvonne Rogers, modern HCI research has expanded to include and overlap with many other academic disciplines, design practices, and interdisciplinary fields concerning "how people make use of computational systems and devices and how they could be

designed to be usable and useful" [187].

Her taxonomy of HCI theory frames the evolution of theoretical developments in HCI research in terms of three periods: *Classical*, *Modern*, and *Contemporary* theories, as described in Table 2.1.

Table 2.1: A taxonomy of HCI theory [187].

Period	**Era**	**Description**
Classical	1980s	When classical cognitive theories were first imported from cognitive psychology, primarily for modeling and analytic purposes.
Modern	1990s	When a wide body of theories and frameworks were brought to the field from quite diverse disciplines to address the burgeoning challenges
Contemporary	2000s and later	Includes postmodernist, philosophical and in-the-wild approaches. More socially conscious than the previous movements. Theories have been imported and developed with the goal of making an impact on life and a difference to society.

She proposes a classification of 9 kinds of theories (not mutually exclusive and some overlapping) which have been developed over the last four decades with different roles in the HCI community [187]:

- **Descriptive**: Providing concepts, clarifying terminology, and guiding further inquiry in a clear and consistent way to enable researcher cooperation
- **Explanatory**: Explicating relationships and processes to support researcher education and training
- **Predictive**: Enabling predictions about user performance to increase the likelihood of success
- **Prescriptive**: Providing design and evaluation guidelines and best practices to practitioners and cautioning them about dangers
- **Informative**: Importing relevant research findings from other fields to ground understandings and designs

- **Ethnographic**: Providing detailed descriptions of real-world phenomena that are interpreted and grounded in other disciplines which scientifically study human behavior

- **Conceptual**: Developing high-level frameworks and dimensions for informing the design and evaluation of prototypes, user interactions and user studies

- **Critical**: Critiquing and reasoning about HCI design and practice from various cultural and aesthetic stances

- **Wild**: Developing new theories of technology in their context of use

Computer scientists and HCI researchers Bederson and Shneiderman [24] propose five kinds of HCI theory (four of which overlap with Rogers' classification), with one kind which is not included in the above classification:

- **Generative**: Enabling practitioners to create, invent, or discover new ideas that improve research and practice

This dissertation proposed a novel approach to the design of interactive computing systems (i.e., videogames and VR systems) informed from critical cultural perspectives on how racial and ethnic identity shape social interactions. According to these taxonomies, this can be considered contemporary research contributing new *critical*, *prescriptive*, and *generative* theory.

The following subsections describe specific topics in the field of HCI which were applied to the research presented in this dissertation. These topics include embodied interaction, immersion, and critical approaches to HCI, specifically from the fields of critical technical practice (CTP) and computer-supported cooperative work (CSCW)[1].

[1]CSCW can also be considered its own independent subfield. For the purposes of this theoretical framework, it has been organized within the HCI section given that many of the issues addressed by CSCW research are of central importance to HCI.

Embodied Interaction and Immersion

The concept of *embodied interaction* [55]—a human-computer interaction design approach which emphasizes people's experiences and skills in the physical world over disembodied logic—is especially important for videogame developers who emphasize the importance of the *virtual body* to produce immersion. As detailed in research by Sidhu [194], immersion linked to bodily concerns in the transportation model "incorporates elements of a player's sensory perception, spatial awareness, and occupation with control-oriented input tasks, in addition to his or her intellectual engagement with a game's rule-based, goal-oriented demands" and in the *absorption model*, "a player's engagement with gameplay systems and goals is seen as important" in addition to "the continuous demands of exerting control over an in-game surrogate body, or avatar." Digital media scholars Harrell and Chow [44] have applied cross-disciplinary theoretical frameworks of embodied cognition to gesture-driven interactive narrative systems, producing a framework for embodied meaning expression "to result in narratively salient, evocative, and even intimate interaction mechanisms in interactive narrative environments." These concepts were used to guide the analysis of *Passage Home* and existing videogame and VR representations of race and ethnicity.

Critical Technical Practice

Originally formulated by computer scientist Phil Agre, critical technical practice (CTP) describes the incorporation of critical cultural perspectives into the development of technologies [7]. In his book *Computation and Human Experience*, Agre critiqued the ways in which the dominant design philosophies in the field of AI marginalized aspects of humans activity. CTP has been described as "identifying the core metaphors of the field, noticing what, when working within those metaphors, remains marginalized, inverting the dominant metaphors to bring that margin to the center, and embodying the alternative as a new technology" to uncover the values and assumptions embedded into technology design [29].

Computer scientist and cultural theorist Phoebe Sengers' work has integrated cultural

studies into CTP to understand technical systems as cultural artifacts. In her work on *reflective design*, she argues that "reflection on unconscious values embedded in computing and the practices that it supports can and should be a core principle of technology design" [191].

Design and HCI scholar Carl DiSalvo created the term *adversarial design* to describe the practice of using design to do the work of agonism (i.e., revealing and contesting hegemonies in society as a foundational democratic process) [54]. This is a participatory practice which collaboratively engages with communities to explore political conditions and structures of power to make them "available for debate and further investigation" [53].

Computer scientist Michael Mateas incorporated ideas from CTP, art practice, and AI research into the interdiscipline of *expressive AI* (E-AI) [139]. E-AI enables AI-based cultural production and art-based AI production [140]. It dialectically combines art and AI for knowledge production in a way that continually examines, informs, and alters the other field.

Computer-Supported Cooperative Work

Computer-supported cooperative work (CSCW) is an interdisciplinary field of research, development, and production officially coined in 1984. CSCW focuses on how collaboration between individuals can be supported by computing systems.

Computer science scholar Mark Ackerman termed the *social–technical gap* to describe "the great divide between what we know we must support socially and what we can support technically" [3]. He argues that addressing this gap is the fundamental intellectual challenge of CSCW. This gap results from systems not allowing enough nuance for users (e.g., lacking background knowledge or having too few states), not being socially flexible, and not allowing for enough ambiguity (e.g., not adapting to the implicit switches in states or roles made by users in everyday life). In his seminal 2000 article, Ackerman summarizes key principles and findings regarding the design

of systems in social settings based on decades of research by various CSCW scholars:

- Technical mechanisms should sometimes be augmented with social mechanisms for behavior control, regulation, or encouragement based on the fluid and nuanced nature of social activity.

- There should be ways to manage conflict and support coordination when different groups are negotiating their meanings and uses of *boundary objects*, or "objects that are plastic enough to be adaptable across multiple viewpoints, yet maintain continuity of identity" [196].

- Workflow and process engineering approaches must deal with exceptional situations and transitions between roles which are informal and fluid.

- Tradeoffs between privacy and awareness should be addressed given that people prefer knowing who else is present within a space and this knowledge influences their behavior.

- Tradeoffs between visibility and information sharing should be addressed given that people feel less inclined to share and behave more formally when they are more aware of their work's visibility.

- There should be some way of allowing users to negotiate the norms, exceptions, and breakdowns in the use of a system.

- People will not adopt or use a system if it has the "melt-down" problem (i.e., when the number of active users of a system is too low) or until a critical mass of users is reached.

- There is a "coevolution" between the user and the system; each adapts based on the others' needs.

- Incentives or reward structures must be in place to address the costs of using the system to collaborate.

Computer science scholar Ben Shneiderman distilled decades of research on CSCW

research related user interfaces into a set of eight key principles to guide students and designers [193]:

1. Strive for consistency
2. Seek universal usability
3. Offer informative feedback
4. Design dialogs to yield closure
5. Prevent errors
6. Permit easy reversal of actions
7. Keep users in control
8. Reduce short-term memory load

He explains that although these principles must be contextualized to the specific system setting, they provide a strong foundation for user interface designers. These general design principles were applied to the design and development of *Passage Home*. An evaluation of three aspects of system usability was conducted using an earlier version of *Passage Home* in 2019, providing a subjective evaluation of the system's effectiveness (how well users were able to successfully achieve their objectives), efficiency (how much effort and resources users felt they needed to invest to achieve those objectives), and satisfaction (how satisfied users felt with their overall experience) [160]. Participants' average usability scores of *Passage Home* indicated the system design met their usability needs during gameplay and they enjoyed their overall experience [160].

2.1.2 Interactive Narrative Technologies

An article published by the Association for the Advancement of Artificial Intelligence synthesizing 20 years of intelligent narrative systems research describes the goal of an *interactive narrative system* as "[immersing] the user in a virtual world such that

he or she believes that they are an integral part of an unfolding story and that their actions can significantly alter the direction and/or outcome of the story" [182]. The authors of this article organized the narrative intelligence research landscape into three dimensions that can be used to distinguish different approaches to applying artificial intelligence to interactive narrative technologies: *authorial intent*, *virtual character autonomy*, and *player modeling*, which are each described below.

- **Authorial intent**: the extent to which the system is constrained by the author's storytelling intent (ranging from manually authored to automatically generated)
- **Virtual character autonomy**: the extent to which non-player characters have autonomy or are controlled by the experience manager (ranging from strong autonomy to strong story systems)
- **Player modeling**: the extent to which the system adapts to what it learns about individual differences of the user (ranging from mapping behaviors into abstractions to eliciting structured feedback)

The descriptive framework presented in this dissertation articulates novel principles informed by empirical work in the social sciences which can be applied to all three of these dimensions of narrative intelligence research to improve the expressive potential of videogames and VR systems. The generative framework presented in this dissertation focuses primarily on player modeling.

2.1.3 Morphic Semiotics in User Interface Design

Goguen's concept of *algebraic semiotics* [81] provides a precise mathematical theory that can be used in a practical way to make these trade-offs and design decisions explicit. His theory demonstrates the close relationships between representation quality and structure preservation in mappings between sign systems. Building on this concept, Goguen and Harrell [83] further elaborated the application of *semiotic morphisms*, "a model for mapping a representation of one semiotic space into of the signs

of another semiotic space," to system design. There are a number of ways that a sign from one semiotic space (called the *source domain*) can be represented in a another semiotic space (called the *target domain*). Given that one cannot always preserve all of the structure of the original concept in the target space, designers are tasked with navigating the decisions of what to preserve versus leave out which results in different meanings and values. A central notion of their work is that the choices made throughout the design and development process reflect the social and psychological needs and values of stakeholders.

Harrell's application of morphic semiotics in his book *Phantasmal Media* [97] to the concept of *social-computational flow* which can be used to describe the "relationship between the social world of human understandings and computational algorithms and data structures" and reveal how "social issues of power are connected to technical aspects of [videogames] such as gameplay mechanics, graphics, and voice and text communication systems." These concepts provide tools for describing and analyzing how abstract ideas can be mapped to and represented in user interfaces and computing systems including, for example, "the design problem of taking a complex real-world phenomenon and deciding what from all of that complexity to represent" [97]. Algebraic semiotics has also been applied in combination with *conceptual blending* and *structural blending theory* [58] to the creation of interactive and generative narrative and poetry systems [84], contributing algorithmic implementations to generate mappings of elements from a semiotic input spaces into a blended space. In this dissertation, *algebraic semiotics* were used as a tool for explaining how theories and concepts from the social scientific study of race and ethnicity were mapped into elements of the *Passage Home* system and interface design, and the impact of these choices on the system quality as indicated by the user study evaluation.

2.2 Videogames and VR Systems

This section summarizes key concepts from the field of *ludology* (game studies) and prior work related to videogames and VR systems which were applied in this research.

2.2.1 Immersion

Although the term immersion is frequently used to describe digital games, its exact meaning when referenced is often vague and imprecise. Through extensive examination of game scholars' use of the term, game studies scholar Calleja [37] identified *immersion as absorption* ("the degree of emotional affect with a loss of awareness of self and surroundings") and immersion as transportation ("the idea of being present in another place") as the two key intended meanings.

Salen and Zimmerman [189] have argued that immersion is a byproduct of developing games which have engaging gameplay mechanics, rather than being tied to a specific audiovisual representation. They challenge game design principles which simply seek greater realism to achieve immersion, citing Elena Gorfinkel's quote that "representational strategies are conflated with the effect of immersion," explaining that individuals can become just as deeply engrossed and engaged in solving a crossword puzzle or playing *Tetris* as they do in a high-technology videogame.

2.2.2 Videogames as Systems

To take a structured approach to the analysis of existing videogame representations, games can be understood as systems made up of *objects, attributes, internal relationships,* and an *environment* which combine to form a complex whole [189, 136]. Game systems can be *open*—having some kind of exchange between the game and its environment—or *closed*—isolated from its environment. Game systems can be considered open or closed depending how they are framed, and a single game system can be framed as a *formal*, *experiential*, or *cultural* system, defined in Table 2.2.

Using Salen and Zimmerman's model, *Passage Home* can be considered a cultural system with open exchange between the game and the players' environment. The game is not structured to have any explicit "win state" and therefore there is no formal rule system which dictates the "correct" way to play the game. Rather, players are asked to share their own interpretations of the game attributes (including the

Table 2.2: Core concepts of framing games as systems [189].

System Framing	Description	Exchange
Formal	Framing a game as a "formal system of rules."	Closed
Experiential	Thinking of a game as "a system of interaction between the players and the game."	Open or closed
Cultural	"Considering the way that the game intersects with other contexts such as society, language, history, etc." Game "as a representation of ideological values associated with a particular time and place." "[Making] connections between the design of the game and larger structures of culture."	Open

narrative content, characters, mechanics, and environment) which shapes the way that the experience unfolds. Following the experience, players' interpretations of the game story and themes are directly connected to their ideological values.

2.2.3 Games Engineering

Defining Games

In their 2012 work on advanced game design, scholars Ernest Adams and Joris Dormans offer several definitions of what a *game* is to illustrate that, although there is not a single best definition of a game, rules are an essentially unifying feature of them:

- "A game is a type of play activity, conducted in the context of a pretended reality, in which the participants try to achieve at least one arbitrary, nontrivial goal by acting in accordance with the rules" [5].

- "A game is a system in which players engage in artificial conflict, defined by rules, that results in a quantifiable outcome" [189].

- "A game is a rule-based system with a variable and quantifiable outcome, where different outcomes are assigned different values, the player exerts effort in order to influence the outcome, the player feels emotionally attached to the outcome, and the consequences of the activity are negotiable" [118].

Videogames can be thought of as finite state machines with a potentially large number of states. They begin in an initial state, progress to new states (reflecting player actions, player location, location of other players and NPCs, the distribution of game resources, etc.), and culminate with some end state (e.g., player wins, loses, or quits) [6]. How the state of the videogame updates is dictated by *game mechanics* (defined in the next section), which are related to but distinct from game rules.

Videogame Mechanics

Game mechanics control what actions the player is allowed to take and how the system responds to them. They "need to be detailed enough for game programmers to turn them into code without confusion" [6]. Whereas game rules are made explicit to the player (e.g., in the form of instructions or system prompts), game mechanics may or may not be hidden. Videogame mechanics can be broken down across four elements: *quantity, spatial, state,* and *action*. Figure 2-1 defines these four elements and provides several examples of each [208].

4 Elements of Game Mechanics

Element	Definiton	Examples
Quantity	Mechanics that can be represented as a number.	• Resource: Health, mana, energy, rage • Currency: Gold, zeny, bells • Abstract: Time
Spatial	Mechanics that affect space.	• World: Position and rotation of objects • Tangible: Collision, characters, props • Intangible: Inventory, storage
State	Mechanics that apply additional rules.	• Player: Grounded, airborne, swimming, alive, dead • Game: Victory, lobby, loading • Object: On, off, open, closed
Action	Mechanics that drive change.	• Resource: Health regen, shooting ammo • World: Running, jumping, teleporting • Object: Unlock door, open chest

Fig. 2-1: Stephen Trinh's technical framework of four elements of game mechanics [208].

To demonstrate how this framework can be applied, Trinh (2020) [208] uses *Super Mario Maker 2* [154] to provide examples of how each mechanic is involved in a

specific interaction, as shown in Figure 2-2. The description "Mario turns big when he eats a mushroom; when Mario is big, if he takes damage, he turns small" can be broken down across these four mechanics in the following way:

> "Big or small are *state* mechanics that (1) apply to Mario, (2) visually represent Mario's health points (*quantity*), and (3) affect how tall Mario is when he is standing (*spatial*). When Mario collides with another entity (*spatial*), that entity may change Mario's health state to big, to small, or to dead (*action*)" [208]

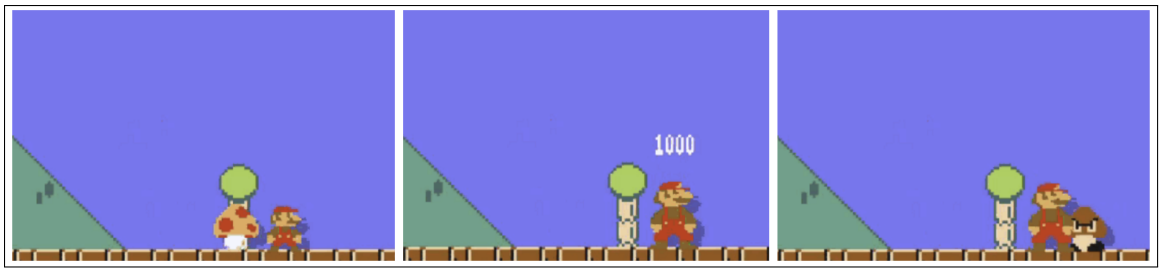


Fig. 2-2: A simple example of the game mechanics in *Super Mario 2* [154]. At first, Mario is small (shown in the first image, on the left). After he collides with a mushroom, the mushroom disappears and he gets bigger and earns health points (shown in the second image, in the middle). When he collides with an enemy, he takes damage (shown in the third image, on the right) [208].

While this framework is not comprehensive, it provides a tool to break down complex mechanics into extremely simplistic forms.

Videogame Genres

Videogames are an extremely diverse medium that employ a wide array of representational strategies and structures. Multimedia communications scholar Mark J. P. Wolf created a taxonomy for the structured classification of videogame genres which yielded 42 categories [223], demonstrating the breadth of the types of interactive characteristics videogames feature. Game culture studies scholar Thomas Apperley conducted a critical examination of game genres [16] and identified the four most popular ones through his synthesis of many different taxonomies: *simulation, strategy, action,* and *role-playing games*. Each of these genres are briefly described using definitions from his work in Table 2.3.

Table 2.3: Definitions of the four most popular videogame genres identified by Thomas Apperley [16].

Videogame Genre	**Definition**
Simulation	"The simulation genre includes video games that simulate sports, flying and driving, and games that simulate the dynamics of towns, cities, and small communities. [...] Their content and play is either repurposed from relatively common activities, and/or the depiction of those activities on media such as cinema and television" [16]
Strategy	"Games emphasizing the use of strategy as opposed to fast action or the use of quick reflexes, which are usually not necessary for success in these games" [223]
Action	"The action genre consists of two major subgenres: first-person shooters and third person games. Although the first-person games are played as if the screen were the players' own vision, third person are played with avatars that are fully visible to the player" [16]
Role-Playing	"Games in which players create or take on a character represented by various statistics, which may even include a developed persona. The character's description may include specifics such as species, race, gender, and occupation, and may also include various abilities, such as strength and dexterity, to limited degrees usually represented numerically" [223]

Videogames do not necessarily need to fit into an individual genre, as they may contain features which reflect aspects of multiple genres. For example, *Passage Home* can be considered a role-playing game, given that players take on the perspective of the player character (PC), Tiffany, whose backstory is established at the beginning of the experience. It could also be considered a simulation game, as the game simulates the dynamics of a discriminatory racial encounter (DRE) within an everyday setting (i.e., a classroom).

Fundamental Videogame Structures

Videogames can be developed for numerous platforms (e.g., PCs, consoles, mobile devices, web browsers) using applications called *game engines*. Although there are many different game engines available which may have unique system features, there are fundamental structures and concepts that are common to most of them. This section briefly describes some of the most basic structures and concepts underlying the implementation of the *Passage Home* system.

Developers typically create a *project* associated with the videogame system they are working on, which contains "all the elements that make up the game, including models, assets, scripts, scenes, and so on. Projects are organized hierarchically in the same manner as a file-system's folder structure" [150]. Figure 2-3 shows the project view for *Passage Home*, with red bounding boxes designating its four core elements.

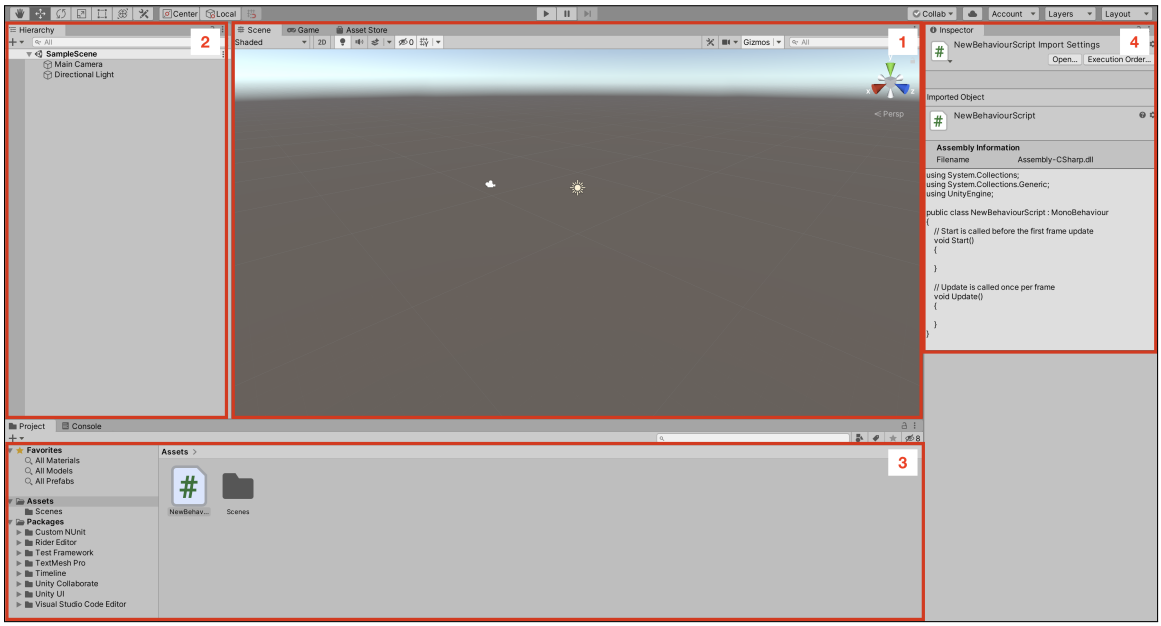


Fig. 2-3: An image of the project view associated with the development of a videogame or VR system in Unity [204]. The red bounding boxes designating its four core elements: (1) the current scene, (2) project hierarchy, (3) assets, and (4) script view.

The first bounding box in Figure 2-3 shows the current *scene* being worked on in the project. "A scene contains a collection of game objects that constitute the world that the player sees at any time. A game generally will contain many scenes. For example, different levels of a game would be stored as different scenes" [150]. As shown in Figure 2-4, *Passage Home* begins with the classroom scene (Scene 1, shown in the image on the left). At the end of the game, they are transitioned to a city scene (Scene 2, shown in the image on the right). Scenes constitute one of the many components associated with a given state of a videogame.

The second bounding box in Figure 2-3 shows the project *hierarchy*, organizing the project similarly to a folder structure in a file system. Within this hierarchical view

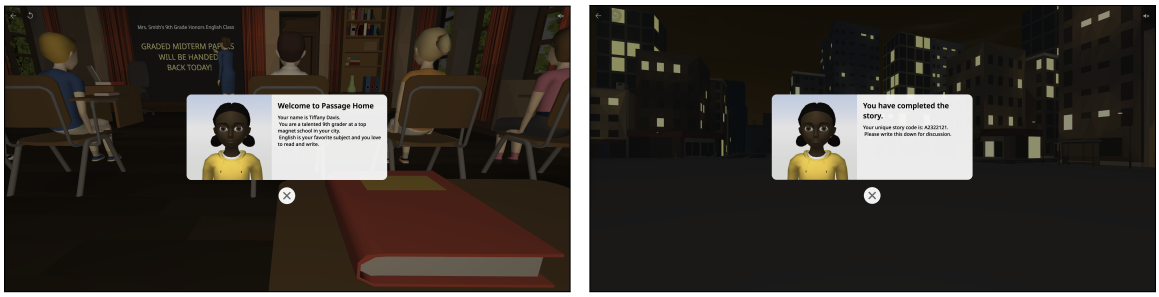


Fig. 2-4: The two scenes featured in *Passage Home*. The experience first begins by putting the player in the classroom scene (Scene 1, shown in the image on the left). At the end of the game, the player is automatically transitioned to a city scene (Scene 2, shown in the image on the right).

contains a list of the *game objects* (e.g., Mrs. Smith, text panels, desk, office chair, laptop). "The game objects are all the 'things' that constitute your scene. Game objects not only include concrete objects (e.g., a chair in a room), but also other elements that reside in space such as light sources, audio sources, and cameras" [150].

Attached to each one of these game objects could be a number of *assets*, which describe "any resource that will be used as part of an object's component. The third bounding box in Figure 2-3 shows the view of the project's assets. Examples include meshes (for defining the shapes of objects), materials [which describe the object's color, texture, and shading], physics materials (for defining physical properties like friction), and scripts (for defining behaviors)" [150]. For example, Figure 2-5 shows the *assets* associated with a cube game object (e.g., position, mesh, materials, lighting).

Cameras are some of the most important game objects in a project because they "are the devices that capture and display the world to the player" [204]. Figure 2-6 shows a camera object in a scene. To situate the player in the first-person perspective of the PC, the camera was placed above her desk and chair objects, rotated at an angle so they could see the classroom environment around them, and positioned at a height where it appeared that they were seated at her desk.

In *Passage Home*, the camera position controlled the origin position of the player's *ray* cast, shown as the white lines coming out of the camera in Figure 2-6. "Rays are often used in geometric programming to determine the object that lies in a given

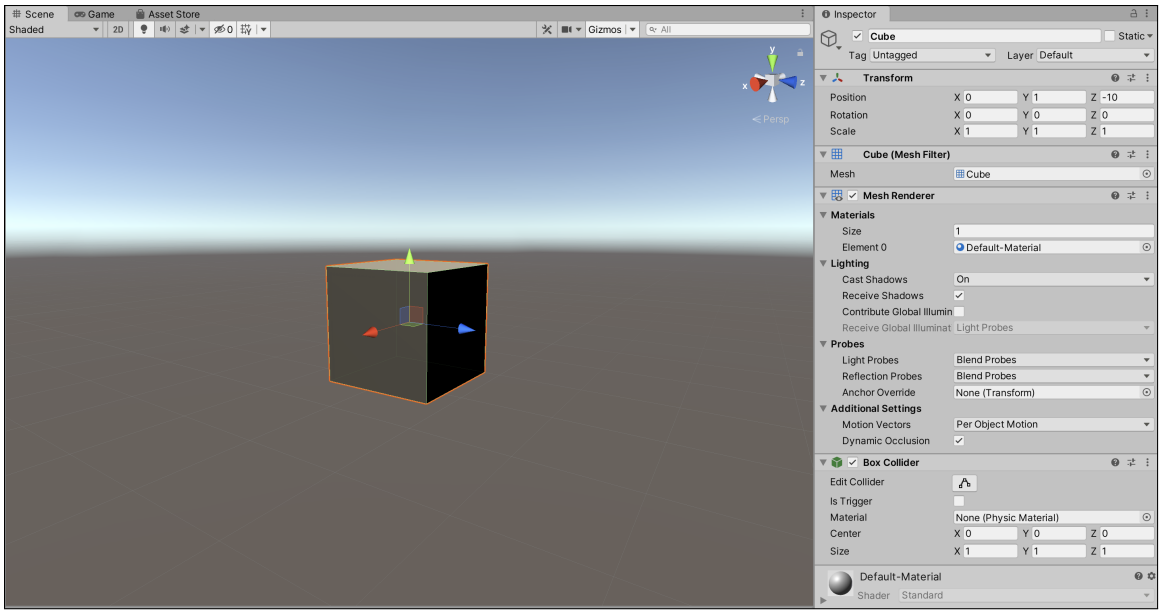


Fig. 2-5: A view of the assets associated with a cube game object (e.g., position, mesh, materials, lighting) in Unity [204].

direction from a given location. (Think of shooting a laser beam from a point in a direction and determining what it hits.) A ray is specified by giving its origin and direction" [150]. In *Passage Home*, players' field of view (FOV) is determined by the origin and direction of their ray. Throughout the experience, elements would appear in the user's FOV that they were able to click on to provide *input* to the system. "Input allows the user to control your application using a device, touch, or gestures. You can program in-app elements, such as the graphic user interface (GUI) or a user avatar, to respond to user input in different ways [...] from many types of input devices, including: keyboards and mice, joysticks, controllers, touch screens, movement-sensing capabilities of mobile devices, such as accelerometers or gyroscopes, VR and AR controllers" [204]. In the graphics version of *Passage Home*, the player could use their keyboard arrow keys and their mouse to change their FOV and they could use their mouse to click on objects to provide input to the system.

Finally, the fourth bounding box in Figure 2-3 shows the *script* view. "A script is a chunk of code that defines the behavior of game objects. Scripts are associated with game objects. There are various types of scripts classes, depending on the type of

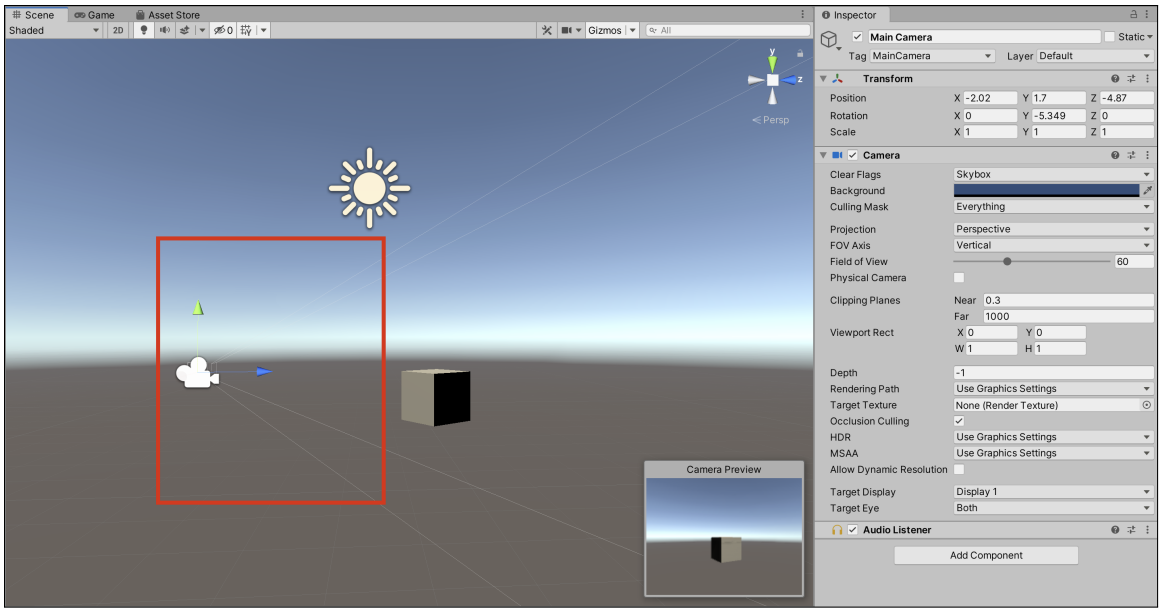


Fig. 2-6: The red bounding box shows a camera object in a scene in Unity [204]. The white lines coming out of the camera are associated with the rays the camera is casting, which is associated with the player's field of view (FOV) while playing the game.

behavior being controlled. Because interactive game programming is event-driven, a typical script is composed as a collection of functions, each of which is invoked in response to a particular event or user action (e.g., a function may be invoked when an object collides with another object, or when a user clicks on a certain object.) Typically, each of these functions performs some simple action (e.g., moving the game object, creating/destroying game objects, triggering events for other game objects), and then returns control to the system" [150].

The entire end-to-end narrative experience in *Passage Home* was implemented in a single script which contained a series of events. For example, at the beginning of the game, the script contained functions to begin playing background music (stored as an audio file in the project) and display the game instructions as a user interface (UI) element on the *canvas*, which "is an object that is used for rendering text and images directly on the screen" [150]. The script specified how the user's input would cause the videogame state to update throughout the experience. For example, Figure 2-7 shows a simple example of how user input was used to update the videogame state in *Passage Home*. The first image (on the left) shows a UI prompt in which the user

Fig. 2-7: These two images present a simple example of how user input was used to update the videogame state in *Passage Home*. The first image (on the left) shows the player character's (PC's) initial body language (outlined by the left red bounding box). When they make a choice (outlined by the right red bounding box), the state is updated. The second image (on the right) shows the change to the PC's body language and dialogue (outlined by the red bounding box), reflecting this change in state.

is asked how they want to respond to the non-player character (NPC), Mrs. Smith. At the time of the prompt, the body language of the PC, Tiffany, appears neutral (outlined by the left red bounding box in the first image) and she has no dialogue. After the user clicks on an option (e.g., "I'm confused," which is outlined by the right red bounding box in the first image), the second image (on the right) shows how that input is translated to an updated game state. The PC's body language changes to appear confused and features dialogue (i.e., "Mrs. Smith, I'm really confused. I have no idea what you're talking about."), both outlined by the red bounding box in the second image, corresponding to the user's input.

2.2.4 Operational Logics

Operational logics (OLs) provide strategies for computational representation which "connect fundamental abstract operations, which determine the state evolution of a system, with how they are understood at a human level" [142]. Each OL "has an implementable abstract process, a communicative goal, and a strategy for presenting game state to players" [142].

The concept was first proposed by computational media scholar Noah Wardrip-Fruin in 2005 [216], which he further developed in subsequent works [217, 218]. This the-

ory has also been advanced through discussions by and with collaborators including computational media scholar Michael Mateas [141], game design and media studies scholar Ian Bogost [30], computer science scholar Joseph C. Osborn [165], and others. This continual refinement has helped to operationalize this theory by providing a catalog of fundamental OLs and how they combine to support its uses in game studies, generation, modeling languages and more [166].

OLs serve as units with a process to "provide *effective authorial affordances* for specific representational tasks" [142]. *Authorial affordances* are "the 'hooks' that the system architecture (processes and data) provides for an author to inscribe their authorial intention in the machine" [142]. They are considered effective when "the author is able to represent desired interpretive affordances in the static process description, and, when executed, the process does indeed provide the desired interpretive affordances for the audience" [142].

2.2.5 Serious and Impact Games

Serious games refer to the use of interactive gameplay primarily for educational purposes, beyond or in addition to entertainment purposes [2, 183]. The use of serious games as an alternative to traditional workplace training and educational interventions have become more and more commonplace within academic and professional settings [35, 36]. Other terms referring to games whose purposes are beyond or in addition to entertainment are *impact games* and *games for change*, which have been used to describe games which focus on investigating, innovating, and cultivating solutions to societal challenges using gaming. Throughout this research, videogames which address, investigate, and cultivate solutions to issues such as racism, racial discrimination, and racial inequity (including *Passage Home*) are referred to as *serious games*.

Gamification and *games for learning* (also called game-based learning) are thriving areas of research and development within the serious games ecosystem. Due to gamification's widespread application across many different industries since its origination

in digital media in 2008, semantic overload has occurred with its use, resulting in contested definitions. Deterding et al. (2011) propose a precise definition of gamification as "the use of game design elements in non-game contexts" [52] through their robust synthesis of HCI research. They describe serious games as "*full-fledged* games for non-entertainment purposes," distinguishing them from gamified applications, which "merely incorporate *elements* of games (or game 'atoms' [31])."

Examples of game elements which can be incorporated into gamified environments include (but are not limited to): game interface elements (e.g., badges, leaderboards, levels), game design patterns and mechanics (e.g., time constraints, limited resources), game design principles and heuristics (e.g., enduring play, clear goals, variety of game styles), game models (e.g., Mechanics-Dynamics-Aesthetics [MDA] framework, challenge, fantasy, curiosity, game design atoms, Core Elements of the Gaming Experience [CEGE]), and game design methods (e.g., playtesting, playcentric design, value conscious game design) [31].

In his book "What Video Games Have to Teach us About Learning and Literacy," psycholinguistics and literacy scholar James Paul Gee argues that game technologies incorporate sound learning principles supported by cognitive science research which can help to support and enhance learning in schools, workplaces, and families [73]. He discusses 36 learning principles that are incorporated in well-designed games. A subset of these principles which were especially relevant to the design of *passage Home* include:

Semiotic Domains

- **Active, Critical Learning Principle**: The game is set up to encourage active and critical, not passive, learning.

Learning and Identity

- **"Psychosocial Moratorium" Principle**: Learners can take risks in a space where real-world consequences are lowered.

- **Committed Learning Principle**: Learners participate in an extended engagement (lots of effort and practice) as an extension of their real-world identities in relation to a virtual identity to which they feel some commitment and a virtual world that they find compelling.

- **Identity Principle**: Learning involved taking on and playing with identities in such a way that the learning has real choices (in developing the virtual identity) and ample opportunity to meditate on the relationship between new identities and old ones. There is a tripartite play of identities as learners relate, and reflect on, their multiple real-world identities, a virtual identity, and a projective identity[2].

- **"Regime of Competence" Principle**: The learner gets ample opportunity to operate within, but at the outer edge of, his or her resources, so that at those points things are felt as challenging but not "undoable."

Situated Meaning and Learning

- **Probing Principle**: Learning is a cycle of proving the world (doing something); reflecting in and on this action and, on this basis, forming a hypothesis; reprobing the world to test this hypothesis; and then accepting or rethinking the hypothesis.

- **Multiple Routes Principle**: There are multiple ways to make progress or move ahead. This allows learners to make choices, rely on their own strengths and styles of learning and problem solving, while also exploring alternative styles.

- **Situated Meaning Principle**: The meanings of signs (words, actions, objects, artifacts, symbols, texts, etc.) are situation in embodied experience. Meanings are not general or decontextualized. Whatever generality meanings come to have is discovered bottom up via embodied experiences.

- **Multimodal Principle**: Meaning and knowledge are built up through various modal-

[2]In the user study conducted with *Passage Home VR* in [160], participants reported "mirroring" their physical-world identities during their first playthrough of the experience and performing "identity play" (making choices in the game that were different than what they might typically do in the physical world) during the second playthrough of the experience. These self-reported explanations of in-game behavior which related the virtual identity, real-world identity, and projective identity were consistent with Gee's Identity Principle.

ities (images, texts, symbols, interactions, abstract design, sound, etc.), not just words.

Telling and Doing

- **Discovery Principle**: Overt telling is kept to a well-thought-out minimum, allowing ample opportunity for the learner to experiment and make discoveries.

Cultural Models

- **Cultural Models about the World Principles**: Learning is set up in such a way that learners come to think consciously and reflectively about their cultural models regarding the world, without denigration of their identities, abilities, or social affiliations, and juxtapose them to new models of learning and themselves as learners.

- **Cultural Models about Semiotic Domains Principle**: Learning is set up in such a way that learners come to think consciously and reflectively about their cultural models about a particular semiotic domain they are learning, without denigration of their identities, abilities, or social affiliations, and juxtapose them to new models of learning and themselves as learners.

2.2.6 XR Systems for Social Impact

Powerful tools for enabling interactivity in museums have been introduced by 21st century emergent technologies, from 2D displays with interactive audio and hyper-realistic visuals, to mixed reality (MR) media forms ranging from augmented reality (AR) (virtual elements augmenting a predominantly physical-world environment), augmented virtuality (AV) (physical-world elements augmenting a predominantly virtual environment), to virtual environments (also referred to as virtual reality or VR, a fully immersive computer-generated environment), as shown in Figure 2-8. Given the rapidly evolving ecosystem of wearables and technologies enabling the combination of virtual and physical world elements to customize users' perceptions of reality, the term extended reality (XR) is used in this paper as an umbrella term to refer to all human-machine interactions resulting from environments combining real and virtual elements, including augmented reality (AR), virtual reality (VR), and mixed reality

(MR).

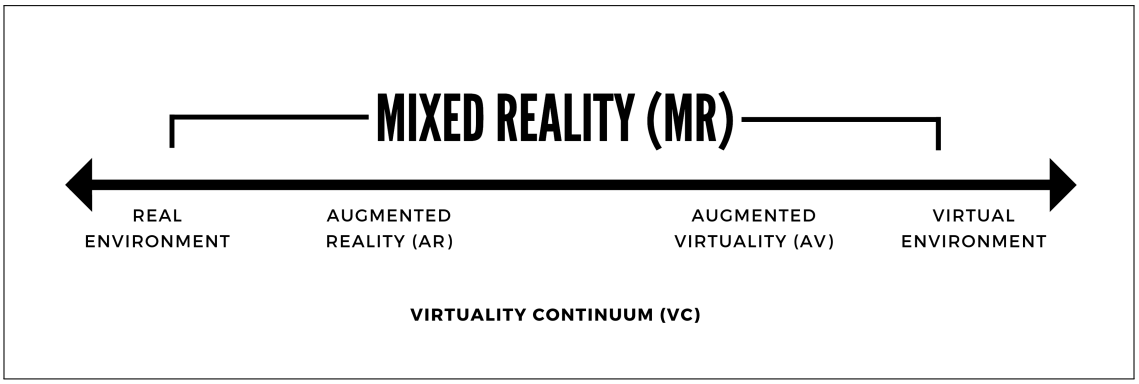


Fig. 2-8: Milgram and Kishino's simplified representation of a "virtuality continuum" [146].

A growing number of scholars and practitioners are using XR as a tool for teaching, learning, and educational design in formal and informal learning environments, and for investigating, innovating, and cultivating solutions to societal challenges. At the MIT Imagination, Computation, and Expression Laboratory (ICE Lab) directed by Professor D. Fox Harrell, Ph.D., researchers have been conducting work in gaming and interactive technologies for over a decade to model and simulate social identity phenomena for cultural analysis, expression, and positive social change. *Passage Home* marks a continuation of a series of system developments including *Loss, Undersea*, an interactive narrative system about a character who loses their humanity while moving through a workday using fantastic Atlantean metaphor and emotion-driven actions [94], *Define Me*, a social media application which allows users to co-construct their own and others' avatars using animal metaphors for human personality [94], *the Gestural Narrative Interactive Expression (GeNIE) Project*, a platform for building culturally-specific, gesture-driven narratives on mobile devices [44], *Chimeria: Gatekeeper*, a playable interactive conversational scenario in which the player must try to get past an NPC guard using a cognitive science grounded model of social category membership [100], and *Chimeria: Grayscale*, an interactive narrative which provokes critical reflection about sexism in the workplace using an "ambivalent sexism" model [164].

In Harrell's lectures on presence and engagement in technologies of virtuality [98],

he explains although researchers across many disciplines have investigated the use of XR applications for developing empathy [26], psychologists make a distinction between *dispositional empathy* and *situational empathy*. As detailed in the Stanford Encyclopedia of Philosophy [200], *situational empathy* refers to empathetic measures in a specific situation and is typically measured through post-hoc interviews about subjects' experiences or by capturing various aspects of empathy-related responding (e.g., heart rate, skin conductance, vocal indices, facial expressions, gesture) [227]. In contrast, *dispositional empathy* is considered a more stable personality trait typically measured through interviews with those who interact with the subject or by using validated instruments [112, 144, 51]. Depending on the aims of an intervention, the measures used to assess the efficacy of empathic training in XR may not be appropriate. Furthermore, the extent to which agency-induced empathy in VR persists outside of the simulation is unclear.

Research organizations such as Stanford University's Virtual Human Interaction Lab (VHIL) have also been researching the opportunities and boundaries of empathy and perspective taking in VR [126]. In the last decade, VHIL has developed VR systems related to social issues including *1000 Cut Journey*, which highlights the social realities of experiencing racism [45], and *Becoming Homeless*, an experience in which you take on the perspective of someone with diminishing resources who transitions from having a home to becoming homeless over the course of several days [109].

Journalism organizations such as The Guardian have even released their own free mobile apps to allow viewers to access immersive journalistic storytelling using their mobile devices and an inexpensive cardboard headset [134]. Guardian VR hosts content such as *6x9: A virtual experience of solitary confinement* and *The Party: A virtual experience of autism*.

A commonly mentioned limitation of XR applications for social impact is that there are not yet set conventions that are as established as in cinema. Many XR practi-

tioners draw on conventions from other media such as videogames and filmmaking to address this gap. Towards the goal of establishing conventions, there has been some work to characterize the medium and establish key design and implementation techniques. Comparative media studies scholar Sutherland's analytical framework on *staged empathy* [202] defines two design techniques unique to the medium that can be used to facilitate users' empathetic engagement with a VR work:

- **Intentional looking**: Techniques that take into account different characteristics of looking, ranging from glancing to gazing to staring, in the VR environment

- **Direct address**: The reflexive process of a user "both seeing and being seen by" the VR system, which produces visuals in response to the position of the viewer's head at the environmental level and the character level

Sutherland purposefully complicates the definition of *empathy* that is frequently overloaded as VR has regularly been referred to as an "empathy machine" [147]. Her framework deconstructs how VR facilitates empathetic feeling in the subject through a reflexive process that is externalized and performed, arguing that empathy is insufficient for gaining complete access to the mind or experience of another, but rather is an "inner imitation for the purpose of gaining knowledge of another" [202].

Harrell and Zhu's work on *agency play* also provides a model for understanding the inseparability between the user and the system. Agency play is defined as "the interaction between human and system agency" [104]. Although there is an implicit assumption in narrative-driven games and interactive works that it is better to provide more agency to the user (which has resulted in a certain level of expectation regarding user control), many authors and developers "seek to provide techniques to balance the two sides of this [narrative] paradox" (i.e., the dilemma between giving users free will to act within a virtual environment and providing narrative structure to the users' experience). Agency play provides an expressive tool for interactive narratives by considering the multiple dimensions of agency and tuning them in an intentional and meaningful way.

The development of VR systems for social impact is an increasingly popular endeavor being undertaken by individuals across many disciplines, from art and journalism to psychology and cognitive neuroscience. Prior work has leveraged the unique perceptual experiences offered by VR to produce empathetic artwork and immersive virtual environments. Research has sought to measure the impact of these experiences on a wide range of outcomes (including but not limited to learning outcomes [41], prosocial behavior [8], racial bias [20, 88], and empathic concern [159]. As summarized by VHIL Founding Director, Professor Jeremy Bailenson, Ph.D., "no medium, of course, can fully capture the subjective experience of another person, but by richly evoking a real seeming, first-person perspective, virtual reality does seem to promise to offer new, empathy-enhancing qualities" [18].

2.2.7 Player Motivations and Avatar Relationships

Videogame scholars have sought to better characterize the wide variation of play motives and thoughts, feelings, and actions towards avatars within the billions of videogame players worldwide. From a study of 3000 Massively-Multiplayer Online Role-Playing Game (MMORPG) players worldwide emerged an empirical model of player motivations grouped into three overarching components [226] which have aligned with the results of subsequent studies with different test groups [27, 21]. The three overarching components characterizing motivations for play are: *Achievement* (advancement, mechanics, competition), *Social* (socializing, relationship, teamwork), and *Immersion* (discovery, role-playing, customization, escapism), which are further described in Table 2.4.

Studies which have focused on the different approaches to videogame avatar creation, customization, and use among players have yielded empirically-based typologies of player avatar relationships (PARs) [181, 99, 22, 21, 102]. Although the contexts of specific studies and the labels corresponding to emergent themes of avatar mediated identity have differed across these studies, the overarching patterns have generally aligned into three dimensions:

Table 2.4: Subcomponents of the empirical model of player motivations in online games [226].

Achievement	Social	Immersion
Advancement Progress, Power, Accumulation, Status	**Socializing** Casual Chat, Helping Others, Making Friends	**Discovery** Exploration, Lore, Finding Hidden Things
Mechanics Numbers, Optimization, Templating, Analysis	**Relationship** Personal, Self-Disclosure, Find and Give Support	**Role-Playing** Story Line, Character History, Roles, Fantasy
Competition Challenging Others, Provocation, Domination	**Teamwork** Collaboration, Groups, Group Achievements	**Customization** Appearances, Accessories, Style, Color Schemes
		Escapism Relax, Escape from real life (RL), Avoid RL Problems

1. **Identification**: how much players identify with their avatar

2. **Emotional attachment**: how emotionally attached they feel towards their avatar

3. **Instrumentality**: how much they perceive their avatar as an instrumental object

Figures 2-9 and 2-10 present two visual representations of the spectrum of avatar mediated identity characterizing these dimensions from two separate study contexts. The former emerged from research on videogame players in a STEM learning context. The latter emerged from a study of World of Warcraft MMORPG players.

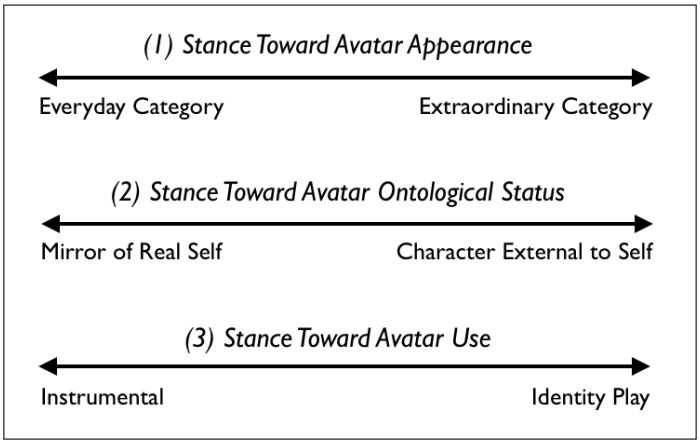


Fig. 2-9: Dimensions of user perception and uses of virtual identity [99].

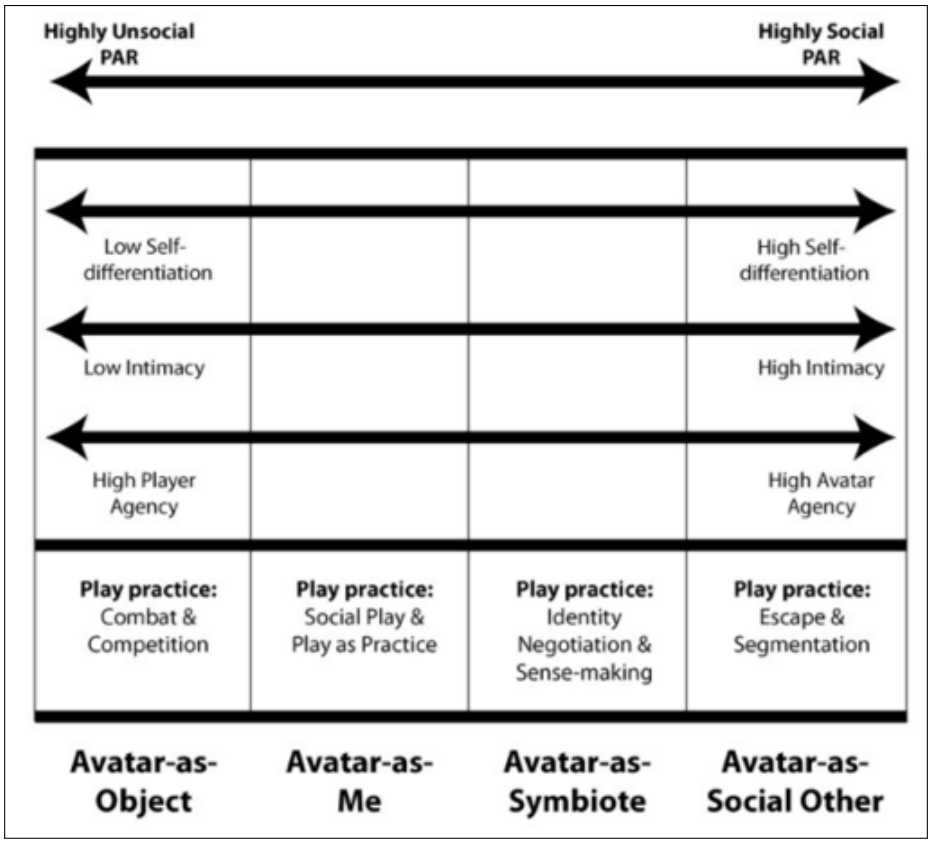


Fig. 2-10: A social typology of player-avatar relationships [21].

The *projective stance* refers to "a double-sided stance towards the world (virtual or real) in terms of which we humans see the world simultaneously as a project imposed on us and as a site onto which we can actively project our desires, values and goals" [73, 74]. As explained by Gee's 36 learning principles, videogames provide a site where players can take on and play with multiple identities and take risks in a space where consequences are lowered. Using conceptual blending theory [58] to build upon this concept to better account for the integration between players' physical-world identities and their virtual identity, Harrell [96] introduced the concept of *blended identity*. As shown in Figure 2-11, this concept can be used to describe how "aspects of a player's physical identity (such as preferences, control, appearance, and understanding social categories) are selectively projected with aspects of the virtual identity onto a blended identity, integrating and elaborating aspects of each" [101].

This dissertation contributes novel approaches to identity representation in videogames

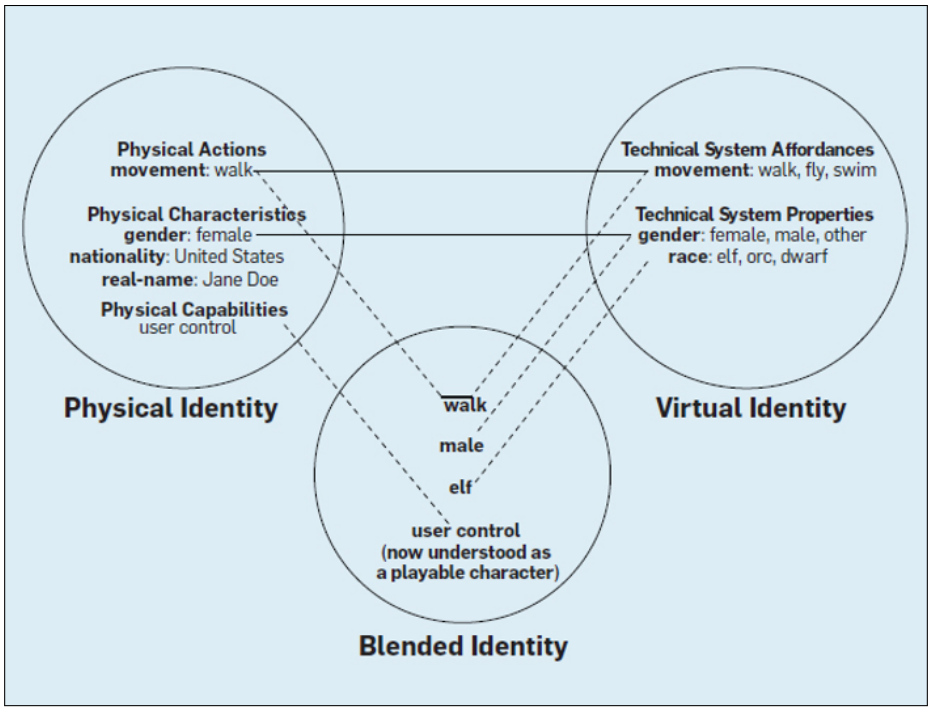


Fig. 2-11: Blended-identity diagram showing mappings between aligned characteristics within the physical and virtual identity input spaces [101]

and VR systems that appeal to as wide a range of players as possible. In accordance with this goal, it takes into account the heterogeneity of social features and play practices across videogame players worldwide, and how aspects of racial and ethnic identity can be selectively projected onto blended identities within virtual environments.

2.2.8 Identity Representation in Videogames and VR Systems

Characters and avatars within games are statistically predominantly white and male (for instance, 89.55% of primary characters in videogames are male, as compared to the 49.1% of actual males in the U.S. census; 80.05% of videogame characters are white, as compared to 75.1% of actual white people in the U.S. census) [222]. Representations of other identities often fall short of adequately serving the needs of the diverse actual demographics of videogame players for a variety of reasons, technical social, and psychological. This highlights the important new opportunities and challenges for game developers and marketers to engage with an increasingly

diverse audience.

Researchers have found that "outside of sports games, the representation of African Americans drops precipitously, with many of the remaining featured as gangsters and street people [such as] in Grand Theft Auto and 50 Cent Bulletproof" [222] which problematically reinforce and perpetuate negative racial stereotypes. In [103], the authors present a systematic analysis of imaginings of Africa and the avatars of African characters in videogames, finding that the six most commonly recurring themes were: Safari & hunting simulations, Sports, Exploration & dark continent adventures, Pan-African (often North African) fantasy role-playing, Transatlantic slavery, and Military Conflict. These themes reflect the prevalence of "old and new stereotypes grounded in [imperialist and] colonial visions" found in videogame representations of Africa [103].

Everett and Watkins [57] refer to the ways in which games heavily rely upon racist discourses, attitudes, and assumptions which are dominant in popular and mainstream culture within interactive games as *racialized pedagogical zones* (RPZs). They explain the ways that "video games teach not only entrenched ideologies of race and racism, but also how gameplay's pleasure principles of mastery, winning, and skills development are often inextricably tied to and defined by familiar racial and ethnic stereotypes."

Lisa Nakamura, a leading scholar in the examination of race in digital media, has studied *identity tourism* and *racial passing* on the internet, revealing the ways in which white videogame players have appropriated stereotyped racial identity representations in gameplay, "[allowing] them to indulge in a dream of crossing over racial boundaries temporarily and recreationally ... without any of the risks associated with being a racial minority in real life" [151]. Playing as a virtual character of a different racial identity and assuming this enables an understanding of what it means to be another blatantly ignores the historical, personal, and societal contexts of race and its inability to be detached from the physical body and lived experiences within physical spaces.

Simply put by Gray and Leonard [86], "from stereotypical representations of hypersexual women to those depicting people of color in stereotypical ways, video games have the power to perpetuate injustice [137]." If left unaddressed, these limiting identity representations have the potential to negatively impact outcomes at the sites were we live, work, and play (e.g., learning outcomes, attitudes, behavior) [88, 188, 120, 41] as the applications of videogames become more pervasive. These deficiencies and what is at stake if they are left unaddressed are a motivation of this research, which aims to offer better strategies to racial identity representation in mainstream videogames.

2.3 Applied Psychology and Family Studies

This section summarizes concepts from the social sciences (including applied psychology and family studies) used to inform this research. Given that the study of racial and ethnic identity is of central importance to this research, it is important to emphasize the many disciplinary traditions encompassed by the work of race and ethnicity scholars including, but not limited to, health and behavioral science, sociology, developmental, clinical, community, and applied psychology. Due to the broad scope of such work, this framework describes theories directly applied to the model implemented in the *Passage Home* system.

2.3.1 Racial Microaggressions

There are a range of discriminatory experiences that individuals from racial and ethnic minority groups may experience in everyday life, including more covert (i.e., subtle) remarks and more overt (i.e., blatant, hostile, even violent) attacks based on an individual's racial or ethnic identity. Table 2.5 presents a set of definitions of key terminology related to racism, prejudice, and discrimination. Research on contemporary racism in the U.S. has found that covert and subtle forms of racism have become much more commonplace than overt forms of racism due to ideologies about racial equality becoming more popularized in the post-civil rights era, which "directly clashed with the long history of racism in the society" [201, 117, 206]. Education and

psychiatry scholar Chester Middlebrook Pierce coined the term *racial microaggressions* to describe the "subtle, stunning, often automatic, and non-verbal exchanges which are 'put downs'" [174]. As elaborated in [201], these "brief and commonplace daily verbal, behavioral, or environmental indignities, [may be] intentional or unintentional" and "communicate hostile, derogatory, or negative racial slights and insults toward people of color." Figure 2-12 provides a visual diagram of three large categories of microaggressions and explanations of the themes for each category.

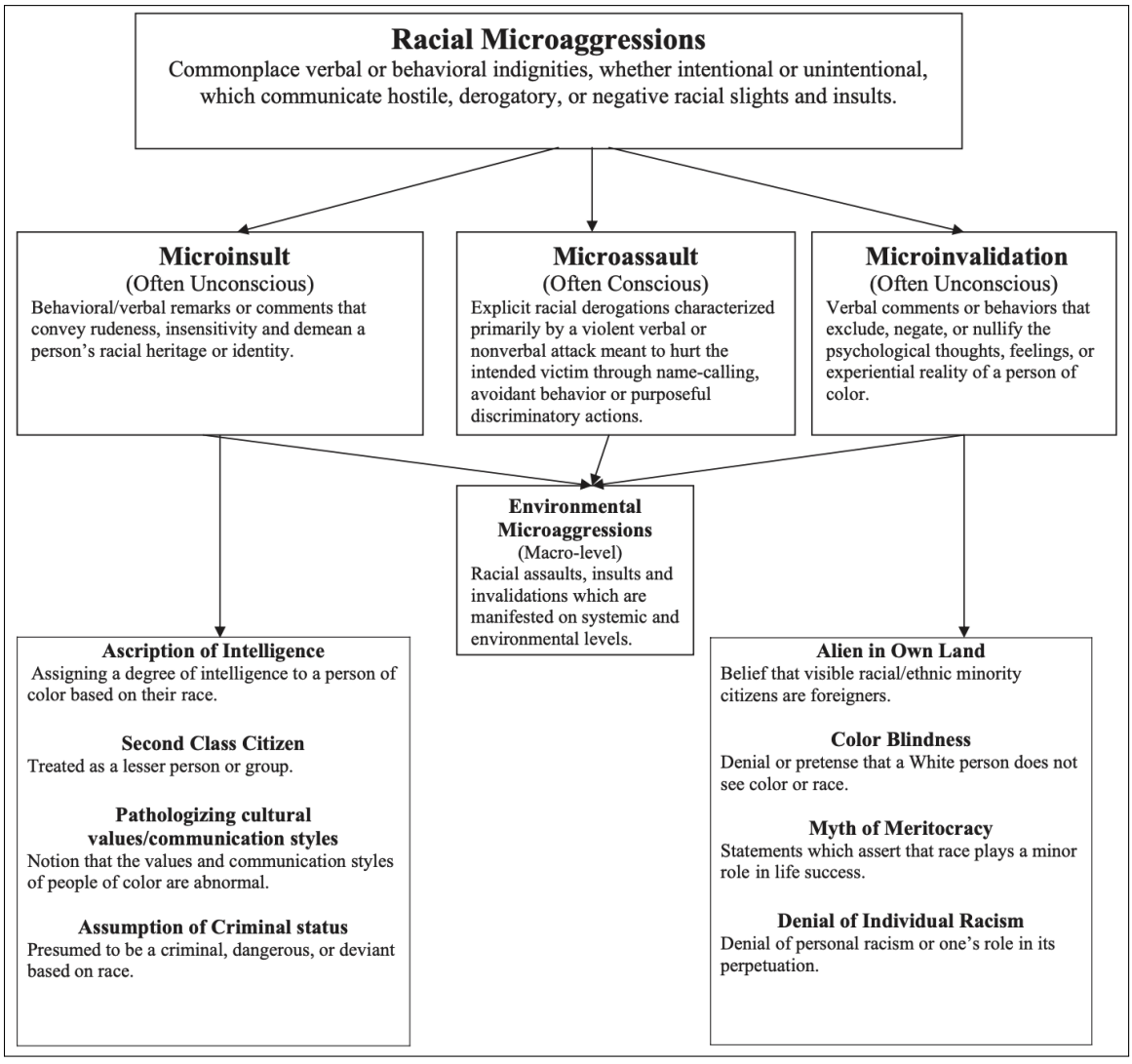


Fig. 2-12: Categories of and relationships among racial microaggressions from [201].

To reflect the kinds of racialized interactions that are most common in the contemporary U.S., the dialogue of the non-player character (NPC; i.e., the teacher, Mrs.

Table 2.5: Key terms and definitions of racism, prejudice, and discrimination, which are quoted from Garcia-Alexander et al. (2017) [72].

Key Term	Definition
Aversive Racism	"More indirect and subtle form of racism that characterizes the racial attitudes of those who may not self-identify as racist, yet persistently avoid interaction with other racial and ethnic groups."
Colorblind Racism	"The avoidance of racial language in an effort to suggest racism is not an issue, and that racial privilege no longer exists, yet endorsing behavior which supports racialized structures and practices."
Covert/Symbolic Racism	"Belief that some groups are culturally inferior. Symbolic racism is characterized as disguised and subtle (rather than public or obvious), yet persistent stereotyping and a tendency to argue that achievement gaps are the result of problems inherent to some groups."
Cultural Competence	"The ability of individuals and systems to respond respectfully and effectively to people of all cultures, classes, races, ethnic backgrounds, and religions in a manner that recognizes, affirms, and values the cultural differences and similarities and the worth of individuals, families, and communities."
Discrimination	"Unequal/differential treatment of people or groups."
Individual, Interpersonal Discrimination	"Unequal treatment reflected in interactions between two or more people."
Institutional Discrimination	"Practices that are built into the structure of a society and act in a systematic way to create barriers and unequal access to services."
Overt Racism	"Intentional and/or obvious harmful attitudes or behaviors reflecting a belief that some groups are biologically inferior."
Prejudice	"Encompasses the attitudes about the character and ability of certain groups."
Racism	"Encompasses prejudice and discrimination; the belief that one's own group is superior to others and provides support for discriminatory practices."
Stereotype	"An oversimplified set of beliefs about members of various minority groups."
Stigma	"A characteristic or trait that sets people apart from others and results in social disapproval."

Smith, who is white) in *Passage Home* features covert racism directed toward the player character (PC; i.e., the student, Tiffany, who is Black). Several of the NPC's comments feature racially *coded language*, which is language that "appears to have a benign meaning to members of the general population but has a negative, specific resonance to a targeted subgroup" [160]. Furthermore, the game environment was designed to feature *environmental microaggressions*, or "macro-level microaggressions, which are more apparent on systemic and environmental levels" [201]. For example, in a university setting, environmental microaggressions may result in "(a) segregation, (b) lack of representation, (c) campus response to criminality, (d) cultural bias in courses, (e) tokenism, and (f) pressure to conform" [148]. Table 2.6 presents examples of several microaggressions featured in *Passage Home*, and the hidden, insulting messages that these microaggressions convey (inspired by the structure used in Sue's seminal work on racial microaggressions in everyday life [201]).

It is important to note that not all individuals who are recipients or bystanders of microaggressions will recognize them as insults. While some individuals have been socialized to recognize various forms of bias in social exchanges (e.g., individuals whose caregivers may have socialized them with an *alertness to discrimination* strategy), some individuals are less attuned to more subtle comments. Although the dialogue in the game was intentionally written to contain racial microaggressions, participants may or may not have correctly appraised them as such. Examining players' socialization with regards to how they have learned to think about race and ethnicity provides a way to understand how players may differently perceive and understand the racialized remarks in *Passage Home*. With this strategy in mind, this dissertation focused on understanding the relationships between players' physical-world socialization experiences and their in-game perceptions and behaviors in response to the discriminatory encounter simulated in the game.

2.3.2 Racial and Ethnic Socialization and Coping

This research provides strategies for representing race and ethnicity in virtual environments by applying social science models of race and ethnicity which encompass the complexity of systemic social structures, history, lived experiences, interpersonal interactions, discourse, and more. This section introduces the theories that were operationalized for this purpose, which encompass factors at multiple levels (i.e., individual, relationship, community, societal) which influence how players may conceptualize race and ethnicity.

Ecological Systems Theory [33] provides a framework for understanding how youth develop within concentric systems (e.g., family and neighborhood microsystems embedded within macrosystems such as racial segregation) that shape one's experiences and perspectives of the effects of race and ethnicity in the world. Building upon this mainstream theoretical framework to better characterize the unique considerations for youth of color, The Integrative Model for the Development of Minority Children [46] identifies eight major constructs influencing specific developmental processes for this population (shown in Figure 2-13). This model takes into account the realities of racialized sociocultural environments impact family systems in utero, birth, and throughout the development of a child [14].

As indicated by this model, social determinants (conditions of the social environment such as racism and discrimination prevalent in schools, neighborhoods, or health care; indicated by constructs #2 and #4 in Figure 2-13) directly influence outcomes such as adaptive culture and family practices. These include the culturally relevant strategies and approaches used by parents and caregivers (indicated by constructs #5 and #7 in Figure 2-13) as protective measures against the effects of racial discrimination, which can include increased psychological distress, depression, and anxiety [176, 214].

The specific practice applied by this research is *racial and ethnic socialization (RES)* which describes the process through which children learn about race and ethnicity, both directly and indirectly [113]. This process takes place in the pathways between

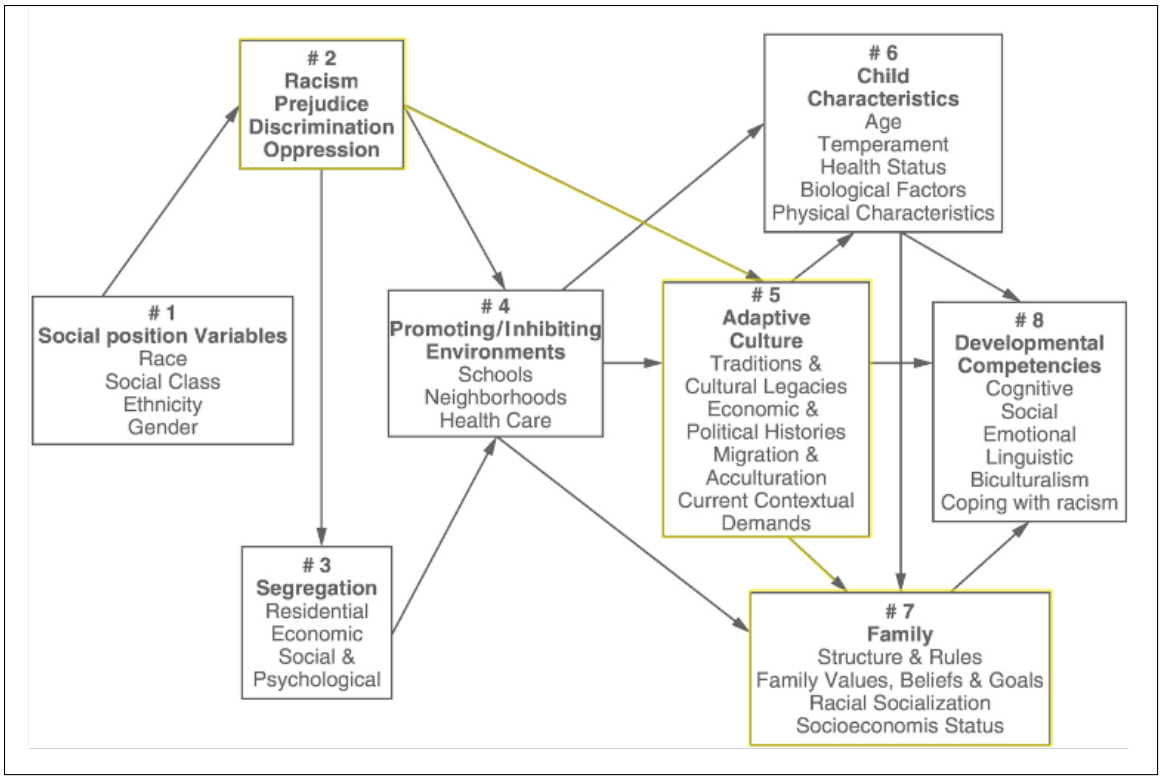


Fig. 2-13: Integrative model for the study of developmental competencies in minority children [46].

constructs #2, #5, and #7, which is highlighted in yellow in Figure 2-13). For example, parents can transmit values and information to their children about race and ethnicity through buying children books with diverse characters, avoiding interaction with people from a different racial or ethnic group, avoiding discussions related to race and ethnicity altogether, or talking about these topics in the context of current events in the news or media.

The majority of Black parents engage in RES practices to prepare and protect children from past, current, and future racial stress and trauma, and to insulate families from the negative impacts of DREs on family well-being. RES has been "identified as a protective factor in a host of academic and emotional well-being outcomes for youth depending on the frequency and type of utilization of its four tenets" [14] which are named and described in Table 2.7.

Researchers have sought to better understand the various coping strategies employed

by Black Americans to defend psychological functioning and well-being in the face of chronic stress and trauma resulting from overt, systematic, daily, and/or ambiguous racial discrimination [14]. Lazarus and Folkman [130] developed an influential theory of coping and adaptation suggesting that the way an individual appraises a stressor (e.g., whether they see the stressor as a threat, a challenge, or in a positive way) significantly impacts how challenging coping is for them. Since then, scholars have challenged this framework with respect to how coping occurs in the face of racially-specific stressors and appraisal challenges. The next section presents theory which addresses this challenge by seeking to characterize the coping mechanisms involved in the face of racial discrimination.

2.3.3 Racial Encounter Coping Appraisal and Socialization Theory

The *Racial Encounter Coping Appraisal and Socialization Theory* (RECAST; [197, 15]) provides a model for understanding the effects of racial and ethnic socialization (RES) on racial coping and self-efficacy for addressing racialized stress. As visualized in Figure 2-14 and explained in [14]:

> "The initial appraisal of racial encounters depends upon one's exposure, experience, and previous application of [RES] and coping skills. The model explains how racial stressors may be conceptualized (e.g., threat, challenge, or insignificant), the extent to which individuals consider themselves able to control or manage the racialized stressor (e.g., coping self-efficacy), the method through which the individual aims to cope with this racialized stressor (e.g., approach-oriented coping), and the extent to which the employed coping strategies manifest desired results (e.g., positive or negative outcomes; [179])."

Based on evidence that approach-oriented RES is beneficial for families in coping with the stressful effects of racial discrimination [11, 13, 14], the *Engaging, Managing, and*

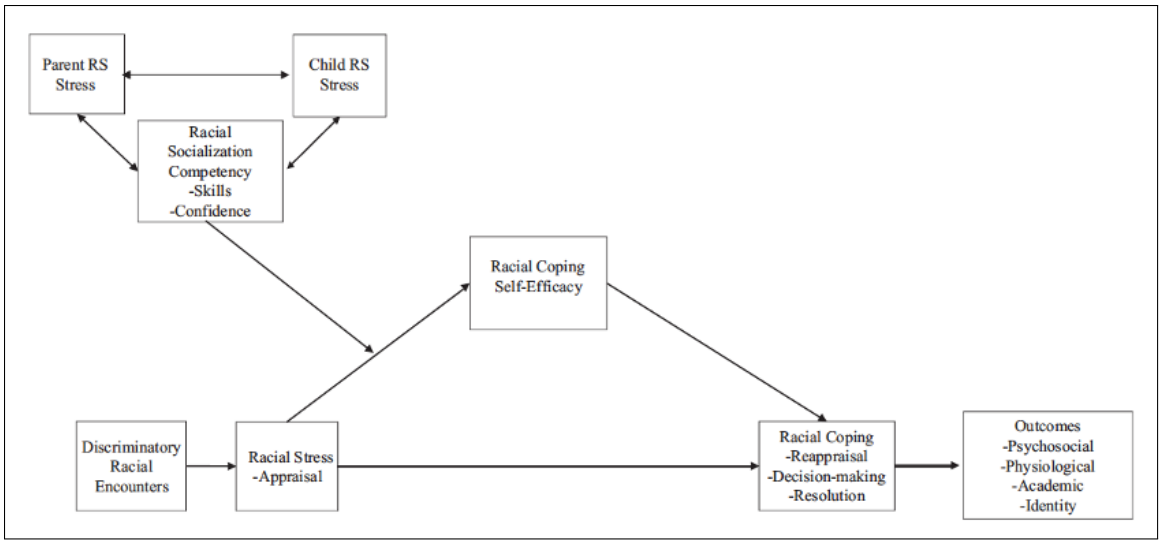


Fig. 2-14: The moderating role of racial and ethnic socialization in stress, self-efficacy, and coping processes through the Racial Encounter Coping Appraisal and Socialization Theory (RECAST) [15].

Bonding through Race (EMBRace) program was developed as a new intervention grounded in RECAST to support Black families in improving their coping skills and socialization practices. The next section describes the structure and goals of EMBRace.

2.3.4 Engaging, Managing, and Bonding through Race

EMBRace is a culturally relevant selective intervention developed by clinicians and researchers for Black families utilizing RES to address stress and trauma resulting from racial encounters [14]. The intervention (further described by Figure 2-15) uses evidence-based practices to address four goals:

1. Reduce racial stress and trauma
2. Improve parent-adolescent communication and RES transmission
3. Strengthen individual and family stress management and racial coping assertiveness
4. Improve academic, psychological, and physiological well-being in families

The EMBRace program recruits youth ages 10-14 with at least one parent identified

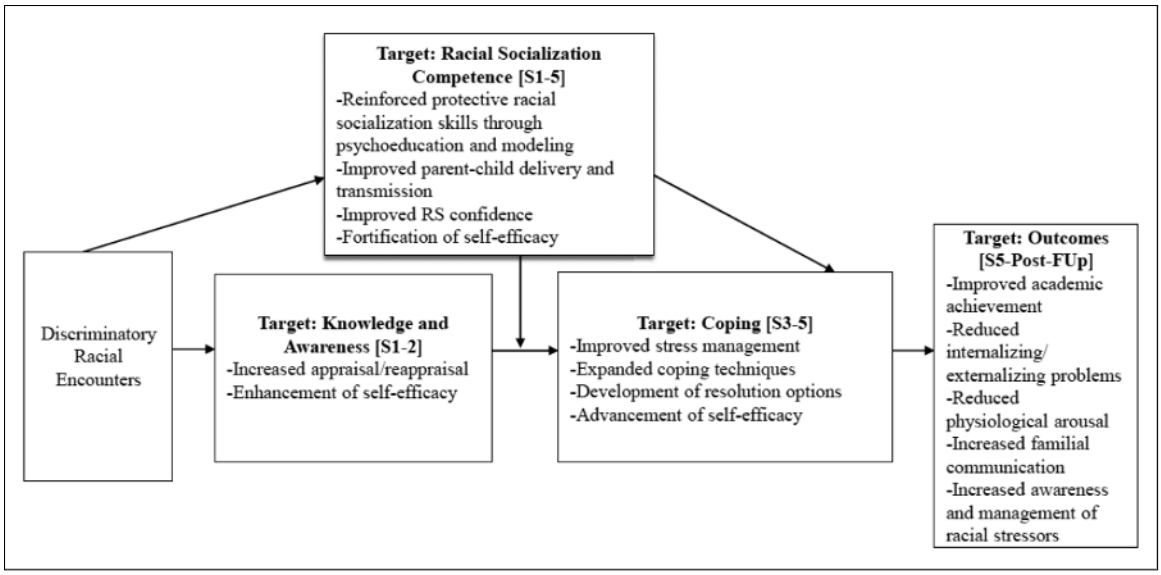


Fig. 2-15: EMBRace intervention as conceptualized through the RECAST model. *Note.* FUp = follow-up; Post = post-test; S = session. [14].

as African-American. This curriculum-based intervention is facilitated by trained clinicians. It begins and ends with a 2-hour assessment measuring racial stress, coping ability, and other well-being outcomes/indicators, and delivery of the curriculum is scheduled across five 2-hour sessions.

EMBRace employs clinical strategies and psychoeducation to support families in increasing RES competence, with role-playing activities being one of many activities within clinicians' clinical toolbox. Audio- and video-recorded role-playing sessions between parent and adolescent dyad with subsequent training and facilitation by clinicians are used in EMBRace to "encourage parent and child communication, modeling correction, and reinforcing positive communication between the dyad" [14].

Interest in utilizing immersive media experiences to support role-playing practices used in the intervention led to the design and development of the *Passage Home* interactive narrative experience developed as a core contribution of this research. While RES theory provides a framework for understanding how adolescents are socialized to think about race, clinicians seek to better understand how these socialization experiences are retrieved during racial encounters. A better understanding of this process

has the potential to further increase the positive impact of interventions such as EMBRace and to assess how EMBRace may make meaningful differences in physical world experiences through virtual world approximation (e.g., simulating a DRE).

By providing a simulation of a racialized encounter with game mechanics that are directly aligned with RECAST, *Passage Home* provides an innovative tool for better understanding the behavioral choices adolescents make when encountered with racial injustice following their completion of the EMBRace intervention. Furthermore, the experience provides a testbed for understanding the potentials of theoretically-informed models of racial identity phenomena for creating engaging videogame experiences.

This chapter has summarized the concepts spanning multiple disciplinary traditions which were used as a gestalt critical theory approach to guide this dissertation work.

Table 2.6: Examples of racial microaggressions expressed through the dialogue of the NPC (the teacher, Mrs. Smith) and game design elements in *Passage Home*. The microaggression themes and implied messages are quoted from [201].

In-Game Example	**Microaggression Theme**	**Implied Message**
"I can't help you until you go back and show me exactly where you cut and paste. We both know you couldn't have written this." "I know students who come from your neighborhood tend to struggle and fall behind when they get here. You may not even know what plagiarism is."	"**Ascription of intelligence:** Assigning a degree of intelligence to a person of color on the basis of their race"	"It is unusual for people of color to succeed."
"I treat my students equally. Everyone has the same chance to succeed in my class if they work hard."	"**Colorblindness:** Statements which indicate that a white person does not want to acknowledge race" "**Myth of meritocracy:** Statements which assert that race does not play a role in succeeding in career advancement or education"	"Race and culture are not important variables that affect people's lives; Your racial experiences are not valid." "People of color are lazy and/or incompetent and need to work harder. If you don't succeed, you have only yourself to blame (blaming the victim)."
"I know the school you come from has a culture problem, but we treat teachers with respect at this school." "Tiffany, there's no need to have such an aggressive attitude with me."	"**Pathologizing cultural values/communication styles:** The notion that the values and communication styles of the dominant/White culture are ideal"	"Assimilate to the dominant culture."
"I've had students like you try to get away with this in the past, and it's unacceptable."	"**Criminality/assumption of criminal status:** A person of color is presumed to be dangerous, criminal, or deviant on the basis of their race"	"You are a criminal; You are deviant."
The classroom has pictures of only white, male authors on the wall. There are no teachers or other students of color at the school.	"**Environmental microaggressions:** Macro-level microaggressions, which are more apparent on a systemic level"	"You don't belong; Only white people can succeed; You are an outsider; You don't exist."
The PC (the student, Tiffany, who is Black) is seated at the back of the classroom.	"**Second-class citizen:** Occurs when a White person is given preferential treatment as a consumer [or student] over a person of color"	"White [students] are more valued than [students] of color."

Table 2.7: Racial and ethnic socialization practices [113].

Strategy	Description
Alertness to Discrimination and Preparation for Bias	"Parents' efforts to promote their children's awareness of discrimination and prepare them to cope with it."
Colorblindness and Egalitarianism	"Parents either explicitly [encouraging] children to value individual qualities over racial group membership or avoid any mention of race in discussions with their children."
Cultural Socialization	"Parental practices that teach children about their racial or ethnic heritage and history; that promote cultural customs and traditions; and that promote children's cultural, racial, and ethnic pride, either deliberately or implicitly."
Promotion of Mistrust	"Practices that emphasize the need for wariness and distrust in interracial interactions."

Chapter 3

Passage Home

A major contribution of this research includes the design and evaluation of *Passage Home*, a videogame system which embeds a novel racial and ethnic identity model. This chapter presents an overview of the development process, the system and narrative design and implementation, background and prior work, and iterations of the system design.

3.1 Design Process

Passage Home was designed and developed through an iterative and interdisciplinary collaboration spanning multiple years. As detailed in [160], the design process for the original system was initiated in 2017 in the MIT Advanced Identity Representation (AIR) course (CMS.628/828)[1] instructed by Professor D. Fox Harrell, Ph.D.[2] The AIR

[1]The AIR course was developed as a part of Harrell's National Science Foundation-supported project: CAREER: Computing for Advanced Identity Representation. It educates students about various approaches to understanding social identity in digital media from the fields of computing, social science, cognitive science, and digital media art. As part of the course, undergraduate and graduate students gain skills in the research and development of virtual identity systems (such as the original prototype of *Passage Home*).

[2]D. Fox Harrell, Ph.D., is Professor of Digital Media and Artificial Intelligence in the MIT Comparative Media Studies Program and Computer Science and Artificial Intelligence Laboratory (CSAIL). He is the director of the MIT Center for Advanced Virtuality. His research explores the relationship between imagination and computation, developing new forms of VR, computational narrative, and videogames for social impact.

course provided prompts structured by morphic semiotics (defined in Chapter 2) to support early design stages of the system. As detailed in [160], the course structure and student collaboration contributed to the development of the initial narrative and underlying theoretical framework underpinning *Passage Home*. The co-design process was conducted with both a team of undergraduate and graduate students in the course (led by the author) and collaborators from the University of Michigan who develop clinical interventions to study racial discrimination and socialization in Black families to reduce racial stress and trauma. The initial *Passage Home VR* prototype was deployed in 2019 as part of a user study to validate the feasibility of building a novel virtual identity model for interactive narrative videogames. This novel identity model was informed by RES theory [160, 161]. The user study findings were used to iterate upon the initial prototype and develop two new web browser-based versions of the system. The browser-based versions of *Passage Home* were deployed in the user studies conducted in 2020. The data collected during the 2020 user studies are presented in this dissertation. Award-winning games scholar Tracy Fullerton's influential *playcentric approach to creating innovative games* [64] was used to guide the design process and foster a structured and interdisciplinary collaboration with RES experts at the University of Michigan. This approach focuses on "designing games with unique play mechanics," "appealing to new players [...] with different tastes and skills than hardcore gamers," and "trying to solve difficult problems in game design such as: the integration of story and gameplay, [and] deeper empathy for characters in games." Following the user studies conducted with the original version of *Passage Home* in 2019, the *Passage Home* narrative was revised in collaboration with Dr. Riana Elyse Anderson[3] and Dr. Nkemka Anyiwo[4] with the goal of more closely

[3]Riana Elyse Anderson, Ph.D., L.C.P. is an Assistant Professor in the Health Behavior and Health Education Department in the School of Public Health at the University of Michigan. In 2015, she developed the EMBRace (Engaging, Managing, and Bonding through Race) intervention (further detailed in Chapter 2 Section 2.3.4). Dr. Anderson and the EMBRace Program played a crucial role in the collaborative process that resulted in the *Passage Home* systems.

[4]Nkemka Anyiwo, Ph.D., M.S.W. is a Vice Provost and National Science Foundation postdoctoral fellow in the Graduate School of Education at the University of Pennsylvania. She is affiliated with the Racial Empowerment Collaborative, where she examines the sociocultural factors that promote the resilience and empowerment of Black youth.

aligning it with the *Racial Encounter Coping Appraisal and Socialization Theory* (RECAST; [197, 15]).

3.2 System Design and Implementation

In this section, the story and characters and narrative structure of the *Passage Home* system are described.

3.2.1 Story and Characters

The narrative in *Passage Home* centers Tiffany, an African American high school student who is a high achiever and works hard in school. During the experience, players take on the perspective of Tiffany (the player character). The player is told that their favorite subject is English and that they have been positively influenced by historical Black writers who have inspired them to pursue their dream of becoming a writer one day. The player is also told that back in middle school, most of the teachers and other students looked like them. Now, they are still getting used to being the only Black person in their classes and not having any Black teachers at their new school. They are informed that they recently had an essay due for their ninth grade Honors English class. The player is given the important details that they put a lot of effort into the essay they turned in, and that this essay was their own original work.

The story modeled in the versions of *Passage Home* used in the 2020 user studies begins with Tiffany in her English classroom, with images of white male authors on the wall. Her English teacher, Mrs. Smith, (a non-player character) announces that the class will receive their graded English papers back after class. Mrs. Smith says she is happy with the majority of the students' work on the essay except for a few students. She says these students didn't take the assignment as seriously as she expected. The school bell rings, and the other students get up to collect their graded essays. At this point, the player is prompted to go to the front of the classroom to collect their graded paper from Mrs. Smith. This is where the discriminatory racial

encounter (DRE) begins. During the encounter, Mrs. Smith falsely accuses the player of plagiarism based on her belief that Black students are incapable of producing high-quality work. For example, Mrs. Smith says multiple racially-charged statements such as "we both know you couldn't have written this," "I know students who come from your neighborhood tend to struggle and fall behind," and "I've had students like you try to get away with [plagiarism] in the past" The player is prompted to make a series of choices to respond to these statements. The choices that the player makes influences Mrs. Smith's dialogue, her body language, and how the story progresses. Figure 3-1 shows the high-level end-to-end story graph from the 2020 web browser-based versions of *Passage Home*.

3.2.2 Narrative Structure

The story and characters described in the previous section were organized using the narrative structure described in this section. Linguist William Labov created a model of narrative analysis [127] which provides a formal structure of narratives (including their distinct components and how they fit together), as described in Table 3.1. This formal structure is based on the analysis of enormous amounts of data collected from spoken and written natural language storytelling. Computer scientist Joseph Goguen formalized Labov's narrative structure as a grammar using extended Backus-Naur Form (BNF) notation [82], resulting in a structure which can be easily translated into a computer program. Goguen and Harrell used this formalization to develop the *Event Structure Machine* (or *Narrative Structure Machine*) which is "an automaton to structure narrative clauses" [93], demonstrating how this structure can be used as "an expressive, relatively simple, framework" for interactive poetry generation. The architecture of *Passage Home* is based Goguen and Harrell's formalization and expansion of Labov's narrative model. This rich foundation helped structure the mapping of the *Racial Encounter Coping Appraisal and Socialization Theory* (RECAST [197, 15]; further defined in Chapter 2 Section 2.3.3) into the story depicted in *Passage Home*.

The sub-components of the RECAST model were integrated into this narrative struc-

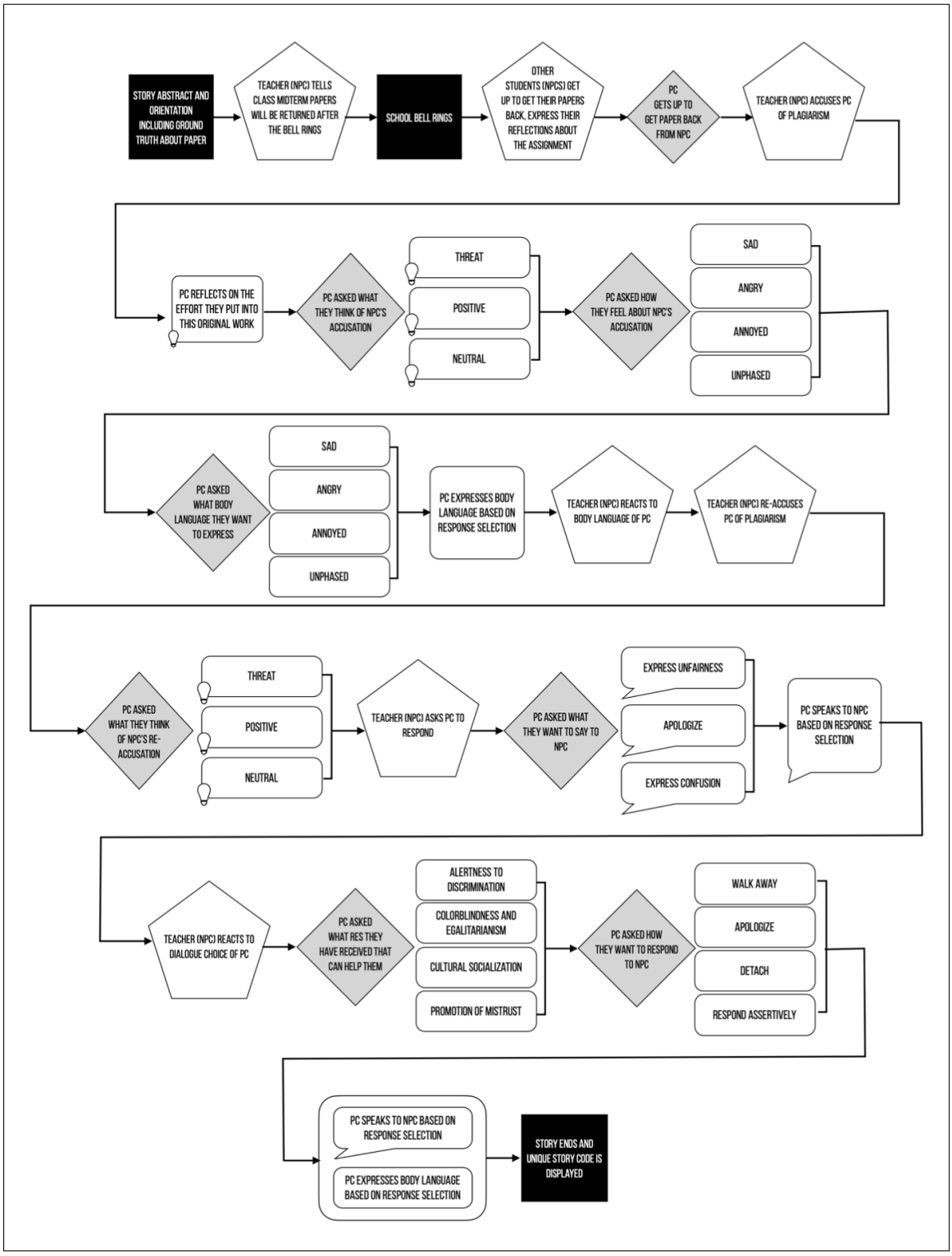


Fig. 3-1: The complete end-to-end story graph in *Passage Home*. Black squares represent system informational dialogs and events, white shapes represent player character (PC) and non-player character (NPC) behavior, and gray diamonds represent choice prompts.

Table 3.1: The components of Labov's model of narrative analysis [82].

Section	Component	Description
Initial Section	**Abstract**	Foreshadows what is coming
Initial Section	**Orientation**	Gives information about what will follow, including time, place, and characters
Main Body	**Complicating Action**	Describes the core events in the story
Main Body	**Resolution**	Describes the final key events of the story
Main Body	**Evaluation**	Provides interpretative or evaluative information which relates the events to the narrator's value system
Closing Section	**Coda**	Summarizes the story which may include a moral

ture. This included the pathway from primary appraisal and secondary reappraisal of the DRE, racial coping self-efficacy, decision-making, and resolution. Every choice that the player could make during the experience was informed by the RECAST model. Each of these components and their resulting choices in the games are described below and image screenshots are shown in Table 3.2.

For the appraisal steps, the game choices were:

- Threat (recognizing that the encounter is racial)
- Positive (evaluating the encounter as a beneficial challenge)
- Neutral (evaluating the encounter as benign or an insignificant occurrence)

For the racial coping self-efficacy step, the game prompted the user to make two choices: what emotions they felt internally, and what body language they wanted to express externally. The game choices for these prompts were:

- Depression and anxiety ("Sad")
- Assertive and demonstrative action ("Angry")
- Dismissive and avoidant behavior ("Annoyed")

- Neutral response ("Unphased")

For the racial coping step, the game prompted the user to make two choices: how they wanted to verbally respond to the teacher and how they decided to end the encounter. The game choices for the verbal response were:

- Expressing unfairness ("This feels unfair")
- Apologizing ("I'm sorry")
- Expressing confusion ("I'm confused")

The game choices for how they decided to end the encounter were:

- Fleeing from the stressor (i.e., "flight" response; walking away)
- Conflict avoidance or people-pleasing (i.e., "fawn" response; apologizing)
- Immobility or inaction (i.e., "freeze" response; detaching or dissociating)
- Standing one's ground (i.e., "fight" response; responding assertively)

Between the two prompts for the racial coping step, the player was prompted to recall their RES experiences from their primary caregiver(s) that might help them in this scenario. The game choices corresponded to the following socialization practices:

- Alertness to discrimination
- Colorblindness and egalitarianism
- Cultural socialization
- Promotion of mistrust

This section has summarized the story, characters, and narrative structure in the *Passage Home* system that was used in the 2020 user studies. The next section briefly reviews each of the design iterations of the system, ultimately arriving at this version.

3.3 Versions of Passage Home

This section briefly reviews each of the versions of the *Passage Home* system which were developed as part of this research agenda beginning in 2018.

3.3.1 VR Experience

Passage Home VR is an interactive VR narrative developed in 2018 which puts the player into the first-person perspective of Tiffany, the player character. The experience was implemented for play using mobile smartphones and low-cost head-mounted displays (HMDs) to reduce accessibility barriers, as shown in Figure 3-2, resulting in a VR experience with three degrees of freedom (3DOF) (i.e., the system could only track rotational motion: pitch, yaw, and roll). The VR experience was designed to be stationary (rather than room-scale) and could therefore be played in standing or sitting position, without need for a dedicated empty space. As shown in Figure 3-3, the experience takes place in a virtual classroom environment navigable through gaze and click interactions [161].

A user study evaluation of the system was conducted with 17 participants [160]. In the study, in-game behavior was captured using screen recordings. Participants' game experience, usability evaluations, RES experiences while growing up, and present-day colorblind racial attitudes were assessed using validated survey instruments [115, 121, 60, 153]. In-depth qualitative data about players' strategies and reflections from the experience were collected through semi-structured interviews. These interviews were recorded, transcribed, and analyzed using coding methods [43]. The results of this initial user study suggested that "players' RES, rather than simply their race, gender, or age, has a significant influence on their in-game behavior and narrative interpretations" [160, 161].

Fig. 3-2: *Passage Home VR* was implemented as a 3DOF stationary VR experience playable using mobile smartphones and low-cost HMDs. Players' in-game behavior was captured using screen recording and later analyzed with the survey data in the 2019 user study.

3.3.2 Graphics and Hypertext Browser Versions

Using the findings of the 2019 research, the next iterations of the *Passage Home* narrative (story, content structure, and characters), game system (environment, mechanics, visual design, and animations), and, most importantly, the computational model embedded within it were designed and built in 2019. To specifically understand the impact of technical system constraints upon this process, two new formats of the *Passage Home* system were developed as web browser-based games[5]: (a) a graphics-based narrative (implemented using TypeScript [145]) and (b) a hypertext-based narrative (implemented using Twine [61]).

The graphics and hypertext versions of *Passage Home* were identical in terms of narrative structure, content, and player choices. The key differences between the

[5]Implementing the system in the web browser-based formats enables the results to generalize to more than one specific encoding of the themes, events, characters such that the resulting typology can be applied across game technologies. Additionally, due to restrictions on user studies due to COVID-19, the web browser-based versions allowed for the user studies to be conducted remotely, given that in-person VR studies were not possible.

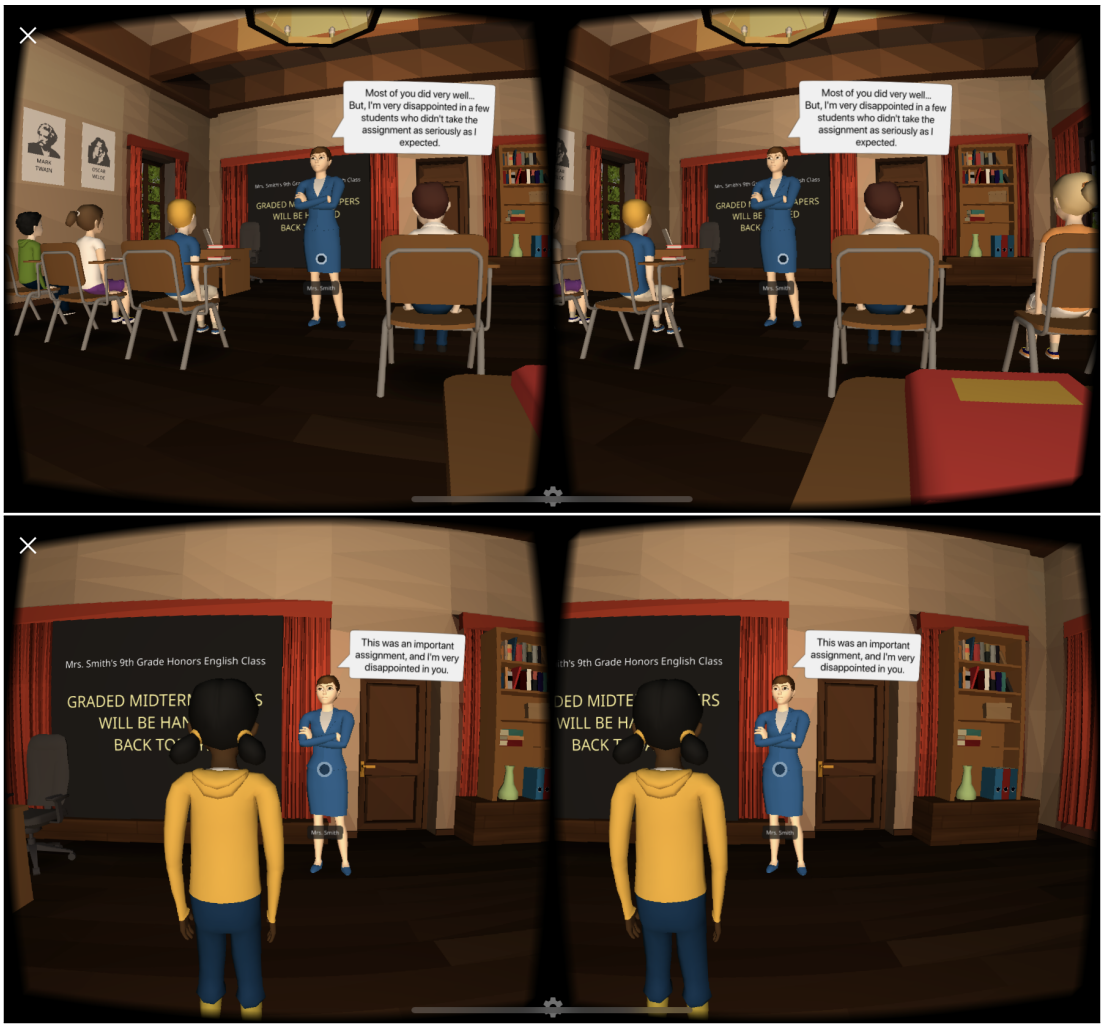
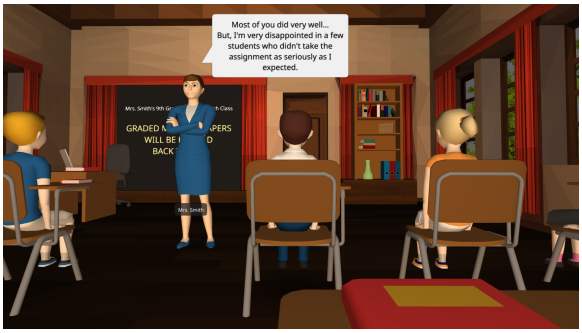
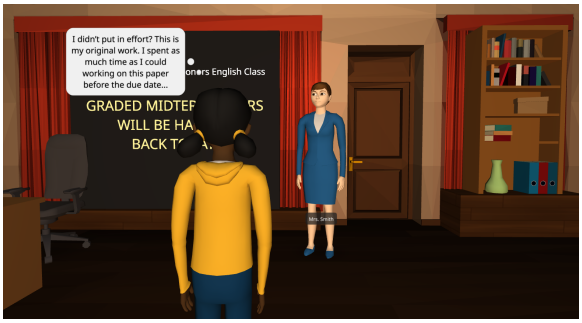


Fig. 3-3: Selected screenshots taken from *Passage Home VR* showing the 3D classroom environment navigable using gaze and click interactions.

two implementations are the core game mechanics. In the graphics version, the user used their mouse and keyboard to change their view within a three-dimensional space and click on dialog buttons and objects (i.e., the PC's English textbook, the bodies, speech bubbles, and thought bubbles of the PC and NPC) to make choices and traverse through the experience. In the hypertext version, the entire story was presented as displayed text and hyperlinks. The user used their mouse to click on hyperlinks to make choices and traverse through the experience. Table 3.2 shows selected screenshots taken from both versions of *Passage Home*, aligned at the same points of the narrative.

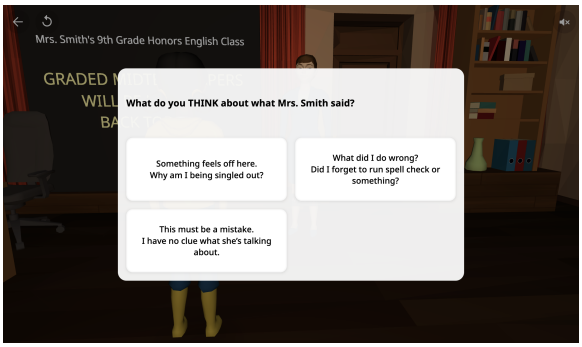
Table 3.2: screenshots from the graphics and hypertext versions of *Passage Home*. The images are aligned showing the same point within the narrative sequence in both versions.

Graphics Version	Hypertext Version
	**Welcome to Passage Home.** Your name is Tiffany Davis. You are a talented 9th grader at a top magnet school in your city. English is your favorite subject and you love to read and write. **continue**
	Mrs. Smith is handing back your graded essays today. It is the end of the school day, and you and your classmates are excited for the bell to ring so you can get your graded papers on the way out. As you look around the classroom, you see posters of the white male authors you have been studying in class such as William Shakespeare, Mark Twain, and Oscar Wilde. **continue**
	**Mrs. Smith says:** "Most of you did well... But, I'm very disappointed in a few students who didn't take the assignment as seriously as I expected." **continue**



You think to yourself: *"I didn't put in effort? This is my original work. I spent as much time as I could working on this paper before the due date..."*

continue

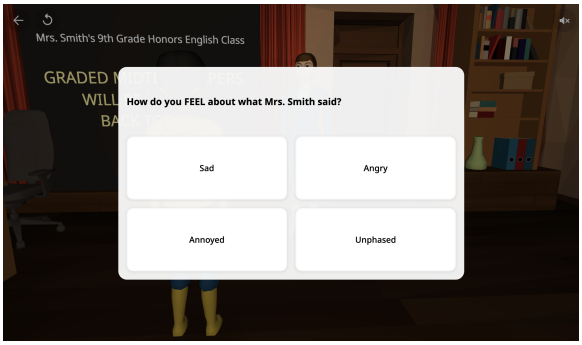


What do you THINK about what Mrs. Smith said?

Something feels off here. Why am I being singled out?

What did I do wrong? Did I forget to run spell check or something?

This must be a mistake. I have no clue what she's talking about.



How do you FEEL about what Mrs. Smith said?

Sad

Angry

Annoyed

Unphased

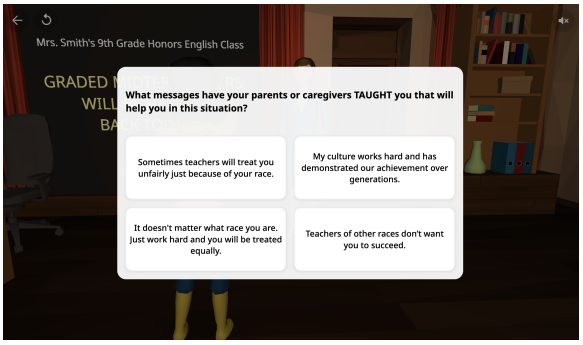
What body language do you want to EXPRESS?

Sad

Angry

Annoyed

Unphased



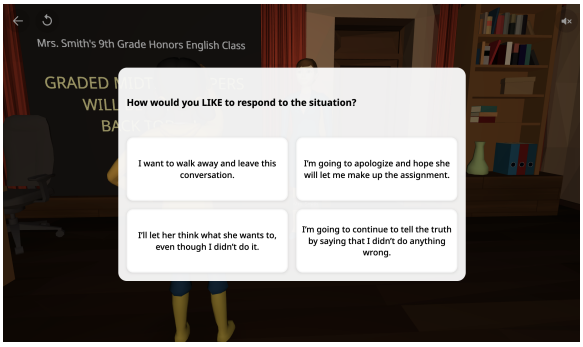
What messages have your parents or caregivers TAUGHT you that will help you in this situation?

Sometimes teachers will treat you unfairly just because of your race.

My culture works hard and has demonstrated our achievement over generations.

It doesn't matter what race you are. Just work hard and you will be treated equally.

Teachers of other races don't want you to succeed.



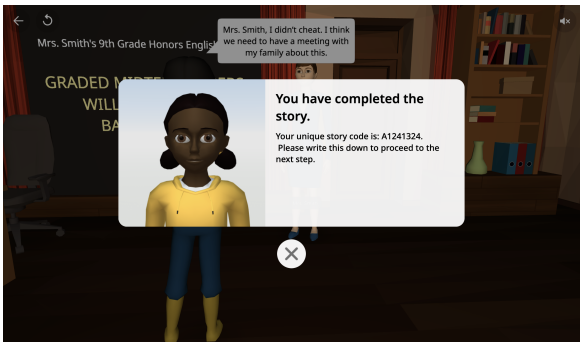
How would you LIKE to respond to the situation?

I want to walk away and leave this conversation.

I'm going to apologize and hope she will let me make up the assignment.

I'll let her think what she wants to, even though I didn't do it.

I'm going to continue to tell the truth by saying that I didn't do anything wrong.

	You have completed the story. **Your unique story code is: B3433333** *Please write down this code before proceeding.*

Unique Story Code

During the 2019 user study evaluations of *Passage Home VR*, participants' in-game behavior was captured using screen recordings. The recordings were manually transcribed to determine the exact sequence of choices the user made during the experience. During the 2020 user study evaluations of the the web browser-based versions of *Passage Home*, unique story codes were used to capture this information more efficiently. This was achieved by generating and displaying an 8-digit alphanumeric code following completion of the experience. Study participants were prompted to write down this code and enter it at the start of the post-experience survey. As shown in Table 3.3, this code represented their assigned study condition and every single choice they made during the experience.

This chapter has described the design and implementation of the *Passage Home* system and its various iterations (i.e., VR and web browser-based versions) in more depth. The next chapter describes how it was deployed in the user study evaluations conducted for this dissertation.

Table 3.3: The key-value pairs associated with participants' 8-digit unique story code presented at the end of *Passage Home*, representing their assigned study condition and every choice they made during the experience.

	A	**B**	**1**	**2**	**3**	**4**
Digit 1	Graphics Version	Hypertext Version	N/A	N/A	N/A	N/A
Digit 2	N/A	N/A	Threat	Positive	Neutral	N/A
Digit 3	N/A	N/A	Sad	Angry	Annoyed	Unphased
Digit 4	N/A	N/A	Sad	Angry	Annoyed	Unphased
Digit 5	N/A	N/A	Threat	Positive	Neutral	N/A
Digit 6	N/A	N/A	Express unfairness	Apologize	Express confusion	N/A
Digit 7	N/A	N/A	Alertness to Discrimination	Colorblindness and Egalitarianism	Cultural Socialization	Promotion of Mistrust
Digit 8	N/A	N/A	Walk Away	Apologize	Detach	Respond assertively

Chapter 4

Methodology

This chapter presents an overview of the methods used to answer the primary research questions (RQs), which were:

RQ1. How can we characterize the interrelationships between individuals' physical-world racial and ethnic socialization, attitudes, and identity development and their choices, interpretations, and experiences within this virtual simulation of racial discrimination?

RQ2. How can racial and ethnic socialization strategies be *operationalized*[1] to represent racial and ethnic identity in simulations?

The first section presents an overview of the setup and procedures used for each of the experiments conducted using the *Passage Home* system. The second section describes the process used to develop a framework for applying social science models to the development of race and ethnicity representation in computational simulations.

[1]In this context, *operationalization* refers to the use of operational logics (OLs) as a strategy for representing social science models of racially stressful encounters in computational simulations. OLs are further defined in Chapter 2.

4.1 RQ1 Methods: Experimental Overview

This section presents the findings in response to research question 1 (RQ1): **How can we characterize the interrelationships between individuals' physical-world racial and ethnic socialization, attitudes, and identity development and their choices, interpretations, and experiences within this virtual simulation of racial discrimination?**

This section focuses on the design and procedures used for each study conducted with the *Passage Home* system, including the measurement instruments used in each study, numbers and demographic profiles of study participants, and data analysis methods. Chapter 5 presents the study findings.

4.1.1 Study Design

Following the development of the study protocol and questionnaires, a full application was submitted to the Committee on the Use of Humans as Experimental Subjects (COUHES) to obtain approval for conducting the study. COUHES was established to act as the Institutional Review Board (IRB) for MIT. The studies were conducted using the following protocol:

1. Participant voluntarily signed up for the study
2. Participant completed required informed consent and/or assent form(s)
3. Participant was randomly assigned to a study condition (i.e., the graphics or hypertext version of *Passage Home*)
4. Participant was sent an email with instructions and a link to the study website
5. Participant completed the study (i.e., reviewed instructions, played game, completed post-game survey)
6. Participant was sent compensation within 72 hours of study completion

The sections below describe the study protocol in further detail.

Recruitment

Once IRB approval was received, information about participating in this research was shared with eligible study participants across the U.S. Existing relationships with members of PreK-12 and out-of-school time learning communities supported the recruitment process, helping to share the opportunity via email, social media, and word of mouth. To be eligible to participate in the studies, individuals were required to be able to hear audio and see visual input, write and read in English, and either be an PreK-12 educator or a student between the ages of 10-18 at a school in a state or territory of the United States. Educators who expressed interest in participation signed an informed consent form. Parent/guardian(s) and/or youth who expressed interest signed an informed consent and assent form, respectively.

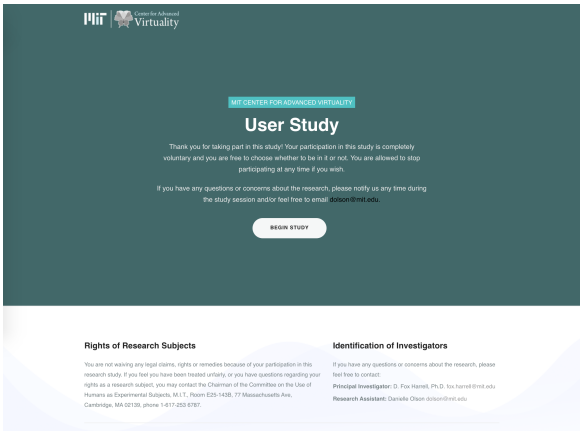
Because the user studies were conducted remotely, we carefully screened participants to ensure they met our study criteria. We manually interacted with each study applicant individually via email before providing them with the consent and assent forms. We requested that each applicant shared brief and non-identifying information on how they learned about the study and/or their eligibility. For example, some applicants referenced their connection to an organization who we had explicitly shared the opportunity with, some educators shared what subjects, grades, or for how many years they have taught, and some parent/guardians shared their children's age or grade level. We inspected email headers as one method to detect email spoofing by individuals who attempted to falsify their identities and participate in the study multiple times (given that participation was compensated). As a final check before sending the study information, we required each participant to complete a Completely Automated Public Turing test (CAPTCHA) before they could begin the study survey. Following study completion, we manually inspected survey responses to screen for low data quality using indicators such as survey completion time and quality of the qualitative responses.

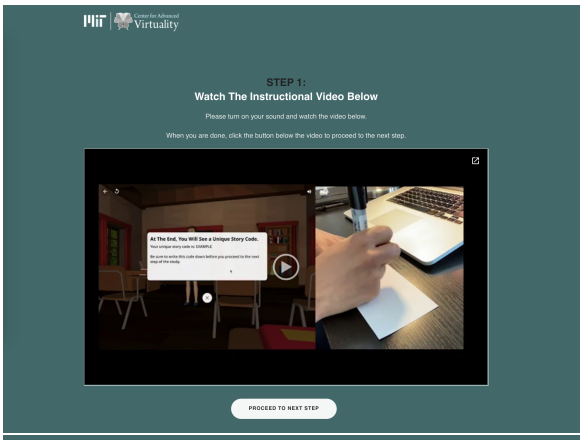
Condition Assignment and Study Protocol

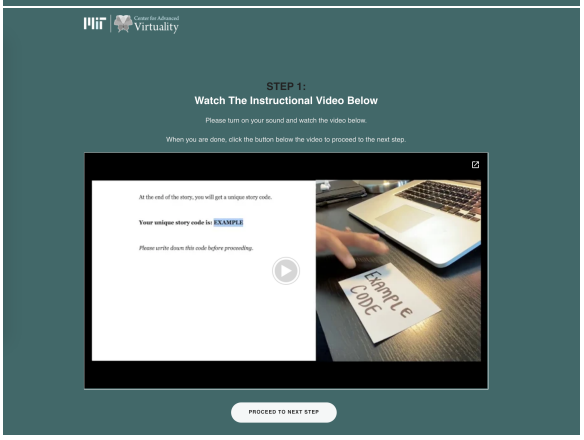
A between-groups study design was used to randomly assign participants to one of the two study conditions (i.e., graphics or hypertext game version) following completion of their informed consent and/or assent forms. Once assigned, participants received instructions via email with a link to a study website corresponding to their study condition.

Table 4.1 presents the core user experience workflow for the websites used to conduct the user studies. On the study website, participants watched an instructional video on how to complete the study and then played through the game. Following completion of the game, they were instructed to write down a unique code corresponding to the sequence of actions they took in the game. They were then navigated to a post-game survey where they entered in their story code and then completed the full study questionnaire. Participants received compensation in the form of a digital gift card emailed to them following their completion of the study.

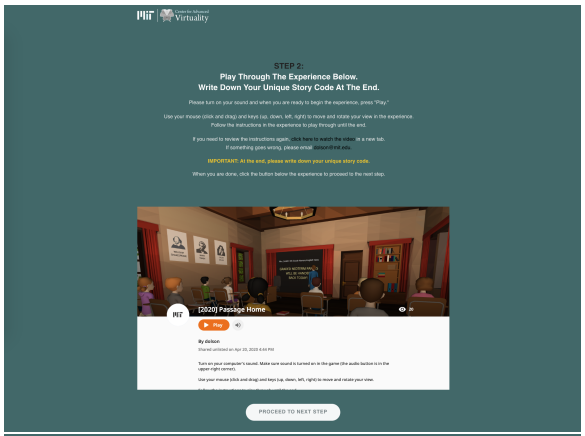
Table 4.1: Screenshots from the website used to conduct the user studies.

Website Screenshot	Description
	User study homepage. Each participant received a link to the website corresponding to their study condition. When they were ready to begin, they could tap "Begin Study" to be navigated to the study instructions page.

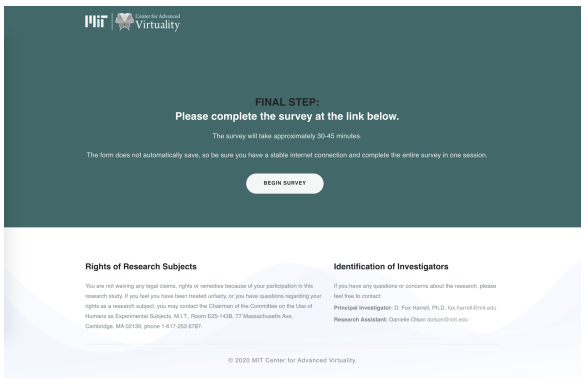




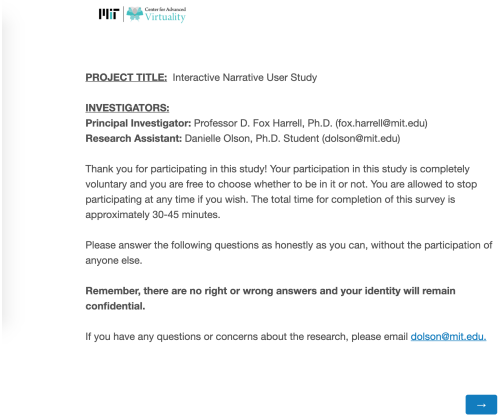
On the instructions page, participants watched a 2-minute video that explained and demonstrated how to go through the *Passage Home* experience (including game mechanics). The top and bottom images show the instruction pages for the 3D graphics-based and text-based versions, respectively. The video reminded them to play through however they would like and to record their unique story code (representing their choices during the experience) at the end. When they were ready to begin going through the experience, they could tap "Proceed to next step" to be navigated to the experience.



On the experience page, the participant was presented with the version of *Passage Home* associated with their study condition. The top and bottom images show the experience pages for the 3D graphics-based and text-based versions, respectively. Instructions were presented as a reminder at the top of the page. Once they finished playing through the experience, they could tap "Proceed to the next step." When they tapped this button, they were presented with a pop-up dialog reminding them to write down their unique story code before they moved on to minimize issues with participants not having this required information to input into the survey.



On the final page of the website, participants were presented with instructions on how to complete the post-experience survey. When they tapped on the "Begin Survey" button, they were navigated to the Qualtrics survey page corresponding to their study group. For details on the surveys administered for each study group, see Table 4.2.



On the Qualtrics survey page, participants could complete and submit their post-experience questionnaire. As soon as their response was submitted, an email notification was sent to confirm their study completion so that their study compensation could be processed.

4.1.2 Measures

This section describes each of the measurement instruments that were used to collect data from study participants. Table 4.2 lists the measures used in each study. In addition to survey and demographic questionnaires which were developed specifically for the studies, the following validated instruments were used:

- Game Experience Questionnaire (GEQ) [115] In-Game and Social Presence Modules
- Colorblind Racial Attitudes Scale (COBRAS) [153]
- Multi-Ethnic Identity Measure (MEIM) [185]
- Racial Encounter Appraisal & Decisioning Scale Youth (RSC-READY) [12]

Table 4.2: Measurement instruments used in each of the studies.

Study	**Measures Used**	**Participants**
1: PreK-12 Educators	GEQ, COBRAS, MEIM, Study Survey	110
2: U.S. Youth	GEQ, MEIM, RSC-READY, Study Survey	60

Details of each of the measurement instruments used are presented below.

Game Experience Questionnaire (GEQ)

The 14-item GEQ In-Game Module [115] produces scores across seven components, each with a range of scores between 0 (low) and 4 (high):

1. Competence (how capable the players felt)
2. Sensory and Imaginative Immersion (how strongly connected with the game players felt)
3. Flow (whether players lost track of their own effort and or the passage of time during the game)
4. Tension (how frustrated participants felt)
5. Challenge (indicate the degree to which players found the game to be difficult or challenging)
6. Negative affect (how boring or tiresome participants found it)
7. Positive affect (how content or good participants felt)

The 17-item GEQ Social Presence Module produces scores across three components, each with a range of scores between 0 (low) and 4 (high):

1. Psychological Involvement – Empathy (how much participants empathized with Mrs. Smith, the non-player character)
2. Psychological Involvement – Negative feelings (how much participants felt the game caused them negative feelings)
3. Behavioral Involvement (how much participants felt their actions affected the game)

These survey instruments were customized to reference the non-player character (Mrs. Smith) or the other students in the game, in place of the GEQ's reference to "the other(s)" in questions. For example, "I empathized with the other(s)" was modified to "I empathized with Mrs. Smith." Additionally, some language in the instrument

was modified to be more comprehensible to youth participants. For example, "I felt schadenfreude (malicious delight)" was modified to "I felt pleasure in being mean (or spiteful) during the game."

Colorblind Racial Attitudes Scale (COBRAS)

The 20-item Colorblind Racial Attitudes Scale (COBRAS) [153] is an instrument that has been used widely for research across racial and ethnic groups with reliable results to examine dimensions of individuals' colorblind racial ideologies. The instrument produces scores across three factors:

1. Unawareness of Racial Privilege (the social, political, and economic advantages that benefit white people over non-white people) with a range of scores between 7 (low) and 42 (high)

2. Unawareness of Institutional Discrimination (the implications of institutional forms of racial discrimination and exclusion) with a range of scores between 7 (low) and 42 (high)

3. Unawareness of Blatant Racial Issues (general, pervasive racial discrimination in society) with a range of scores between 6 (low) and 36 (high)

As indicated in [153], higher scores across these factors are related to greater racial and gender intolerance, racial prejudice, global belief in a just world [135], and sociopolitical dimensions of a belief in a just world [65].

Multi-Ethnic Identity Measure (MEIM)

The Multi-Ethnic Identity Measure (MEIM) is a measure that has been used in dozens of studies producing reliable results across ages and ethnic groups to assess individuals on how important their ethnic identity is to them, how it affects their behavior, and how they feel about it [185]. The original 12-item MEIM was used with educators and the 6-item revised measure (MEIM-R) [173] was used for youth participants. The MEIM produces scores across two factors, both with a range of scores between 1 (low)

and 4 (high):

1. Exploration (a developmental and cognitive component related to learning more about one's ethnic group)

2. Commitment (an affective component related to feelings of affirmation and belonging to one's group)

A total score for the individual is computed by averaging both components. MEIM scores are positively related to self-esteem and psychological well-being, and they are negatively related to depression. Although MEIM scores vary widely across ages and ethnic groups, it serves as a reliable tool for examining correlations between ethnic identity with other variables of interest, which is why it was well-suited for this study [172].

Racial Encounter Appraisal & Decisioning Scale Youth (RSC-READY)

The Racial Encounter Appraisal & Decisioning Scale Youth (RSC-READY) [12] is a measure of how youth feel they would be able to appraise and make decisions in response to discriminatory racial encounters (DREs). Eight questions out of the full 28-item measure were selected and used for the youth study. The following two questions focused on whether or not youth had personally experienced a DRE and their RES frequency:

1. Have you had any experiences of racist acts towards you? (with a "yes" or "no" option)

2. How much does your parent/guardian(s) talk to you about racism and discrimination? (with a 5-point scale: 1 - Not at all, 2 - A little, 3 - Somewhat, 4 - A lot, 5 - All of the time)

The following six questions focused on the youths' confidence in their ability to apply coping strategies in response to DREs (with a 5-point scale: 1 - Not at all, 2 - Unlikely, 3 - Maybe/Maybe Not, 4 - I think I can, 5 - Absolutely):

1. I believe I can share my emotions about my experiences of negative racial encounters

2. I believe I can speak up if I am racially mistreated by an authority figure (for example, a teacher or the police)

3. I believe I can speak up if I witness peers being racially mistreated

4. I believe I can engage rather than walk away from a negative racial encounter with another person

5. I believe I can notice when negative racial encounters have occurred

6. I believe I can ask for help when I am stressed from a negative racial encounter

Study-Specific Survey

The following describes the types of questions contained in the study-specific survey instrument.

In-Game Choices. To begin, participants were required to enter their 8-digit story code, a sequence which was generated and presented to them following their completion of *Passage Home*. This provided a way to link information on each of their in-game choices with their survey data. For more information on how the story code is generated, please see Chapter 3.

Narrative Interpretations Survey. Participants were asked to indicate the extent to which they agreed or disagreed with the following eleven statements (with a 5-point scale: 1 - Strongly Disagree, 2 - Slightly Disagree, 3 - Neither Agree nor Disagree, 4 - Slightly Agree, 5 - Strongly Agree):

1. Mrs. Smith treated Tiffany fairly.

2. Mrs. Smith handled the situation well throughout the experience.

3. Tiffany handled the situation well throughout the experience.

4. The story in the experience is similar to situations that happen or could happen in real life.

5. Mrs. Smith treated Tiffany unfairly.
6. Tiffany ended the situation well.
7. The story in the experience showed discrimination.
8. Tiffany was treated unfairly because of her race/ethnicity.
9. Tiffany was treated unfairly because she is a girl.
10. Tiffany was treated unfairly because of what neighborhood she comes from.
11. Tiffany was treated unfairly because of her age.

Qualitative Responses. The survey contained open-ended questions assessing the following aspects of the participants' game experience and reflections:

- Description of what happened during the experience
- Participants' thoughts and emotions after going through the experience
- How the participant decided to make the in-game choices they made
- How the participant decided to end the experience and why
- Any other comments about the experience
- Any reasoning or evidence from the game for their responses to the narrative interpretations survey questions

Player Avatar Relationship (PAR)

Participants were asked four questions to capture information about their level of identification with the player-character. These questions were adapted from Banks' 2015 evidence-based player-avatar relationship (PAR) social typology [21] which captures the "social characteristics of self-differentiation, emotional intimacy, and shared agency" between players and avatars. This research proposes a four-point typology

along a spectrum from highly non-social to highly social for how players relate with their avatar:

1. Avatar as Object (the avatar is a functional tool for the player; highly non-social)
2. Avatar as Me (the avatar is a mirror or extension of the player; moderately non-social)
3. Avatar as Symbiote (the avatar is intertwined with the player; moderately social)
4. Avatar as Other (the avatar is a distinct social agent from the player; highly social)

Highly non-social PAR is associated with low self-differentiation from the avatar, low intimacy with the avatar, and high player agency. Highly social PAR is associated with high self-differentiation from the avatar, high intimacy with the avatar, and high avatar agency.

The four questions below assessed how players related to the player character (Tiffany), her environment, their sense of control of her, and their sense of care and responsibility for her, with each response option corresponding to the four points along the PAR typology spectrum (i.e., object, me, symbiote, other):

Identification. During the experience, how would you best describe your identification with Tiffany using the scale below?

1. Tiffany was a digital form on the computer
2. Tiffany was me in digital form
3. Tiffany was part of me
4. Tiffany was her own being

Environment. During the experience, how would you best describe the environment using the scale below?

1. Tiffany's environment was a space where I had to master challenges

2. I fit my own views into Tiffany's environment as I played

3. I was able to visit Tiffany's environment as I played

4. Tiffany lives in a digital world that has its own rules

Sense of Control. During the experience, how would you best describe your sense of control of Tiffany using the scale below?

1. Tiffany was a tool for mastering the challenges in the experience

2. Tiffany stood in for me to achieve my social play goals during the experience

3. Tiffany and I used each other to achieve the goals of the experience

4. I was a tool for Tiffany; she told me how to control her to achieve her goals

Sense of Care and Responsibility. During the experience, how would you best describe your sense of care and responsibility for Tiffany using the scale below?

1. Tiffany had no needs

2. Tiffany was me - she needed what I needed

3. Tiffany and I knew each others needs

4. I helped Tiffany get the things she needed in her world

Educator Reflections Survey

Educator study participants were asked to answer "yes" or "no" to the question: "I have been through a situation in real life that is similar to what happened in the experience." If they answered "yes," they were asked to provide a qualitative response to an open-ended question asking them to describe the situation they went through that was similar to the experience.

They were also asked to indicate the extent to which they agreed or disagreed with

the following statements (with a 5-point scale: 1 - Strongly Disagree, 2 - Slightly Disagree, 3 - Neither Agree nor Disagree, 4 - Slightly Agree, 5 - Strongly Agree):

1. The experience caused me to consider a different perspective than I normally would.

2. The experience caused me to reflect on my own practices as an educator.

4.1.3 Data Analysis

The following types of data analysis were performed on the quantitative and qualitative data collected from the studies:

Qualitative Data Analysis

Grounded theory methods [42, 43, 78] were used to systematically analyze the qualitative data collected using the study-specific survey instrument. The goal of this analysis was to identify patterns regarding participants' post-game affect, game play strategies, personal experiences relevant to the game topic, and what aspects of the narrative and game-specific implementations where most influential to participants' interpretations. The data was coded to identify patterns of discourse, actions, and meanings. Next, focused codes were translated into conceptual categories through memoing. Finally, these memos were sorted, grouped, compared, and integrated into the emergent themes presented in this dissertation.

Quantitative Data Analysis

Statistical analysis was performed on the quantitative data collected using the IBM Statistical Package for the Social Sciences (SPSS) version 26. Descriptive statistics were used to generate insights about the overall distributions regarding players' game experience outcomes (e.g., survey questions about the narrative, educator-specific reflections, PAR, GEQ results) and racial and ethnic identities (e.g., MEIM, COBRAS, RSC-READY results). Inferential statistics (i.e., chi-square tests, analysis of variance tests, and Pearson's correlation coefficients) were used to generate insights about the

relationships between players' physical-world racial and ethnic socialization and attitudes and their in-game choices, player avatar relationships, narrative interpretations, and game experience outcomes. These statistical techniques were also used to determine how game condition (i.e., graphics or hypertext version of the game) affected these outcomes.

4.2 RQ2 Methods: Design Framework

This section presents the findings in response to research question 2 (RQ2): **How can racial and ethnic socialization strategies be operationalized to represent racial and ethnic identity in simulations?** The findings are presented as design principles which emerged through creating and deploying the *Passage Home* interactive narrative systems (detailed in Chapter 3). These principles generalize the learnings from this process to support the development of novel computational models representing these theories for virtual experiences portraying race-related phenomena.

4.2.1 Framework Development

To develop the design framework, a comprehensive analysis of existing racial and ethnic identity representations in videogames and VR systems was conducted. This research used a similar methodological approach to Harrell et al.'s 2021 analysis of videogame representations of Africa and avatars of the African diaspora, which focused on identifying broad patterns of representations by investigating both the games themselves and the discourse around these games (e.g., game reviews, social media commentary, forum discussions) [103]. The scope of the representations examined through this analysis was broadened from solely focusing on avatars of the African diaspora to also include other underrepresented racial identities[2]. The systems that were selected for analysis were published in the last two decades and, to provide

[2]Roughly half of U.S. adults play videogames across racial and ethnic backgrounds. However, systematic analyses of player-controlled characters by videogame scholars over the last decade have repeatedly shown an over-representation of white males [132, 63, 222]

breadth in the kinds of representations examined, they spanned four different platforms: web browser games, PC games, console games, and VR experiences.

Given that videogames and VR systems are spaces that "engage American discourses, ideologies, and racial dynamics" [132], they are socializing agents (i.e., sites where RES occurs). The themes which emerged from close examination of these representations were intersected with the four most common RES practices in the U.S. (defined in Chapter 2 Section 2.3.2) to describe how they have been applied along the following four dimensions of computational simulation system design:

- **Environments**: the audio, visuals, spatial design, world maps, and other assets
- **Player Characters (PCs)**: the appearance, dialogue, interactions, backstories, and other relevant features of the PCs
- **Non-Player Characters (NPCs)**: the appearance, dialogue, interactions, backstories, and other relevant features of the NPCs
- **Content Structures**: structural elements of the system including but not limited to narratives, rules, mechanics, and achievement structures

This chapter has summarized the methodology used for conducting the *Passage Home* user studies and developing the novel design framework proposed by this dissertation.

Chapter 5

User Study Results, Findings, and Discussion

This chapter presents the results and findings from the user studies conducted using *Passage Home* with PreK-12 educators and youth to answer **RQ1: How can we characterize the interrelationships between individuals' physical-world racial and ethnic socialization, attitudes, and identity development and their choices, interpretations, and experiences within this virtual simulation of racial discrimination?**

Using the methodology described previously in Chapter 4, user studies were conducted with PreK-12 educators and U.S. youth. Participants played *Passage Home* and had their in-game choices captured, then completed a series of assessments that gathered information about their physical-world racial and ethnic identities and in-game experiences. The social science instruments, game-related instruments, and survey questions that were used in the user studies are each listed below. All of these instruments are also further detailed earlier in Chapter 4 Section 4.1.2:

Social Science Assessments

- Multi-Ethnic Identity Measure (MEIM) [185]

- Colorblind Racial Attitudes Scale (COBRAS) [153] (Educator Study Only)
- Racial Encounter Appraisal & Decisioning Scale (RSC-READY) [12] (Youth Study Only)
- Racial and ethnic socialization (RES) experiences while growing up[1]
- Prior experiences of discriminatory racial encounters (DREs)

Game Assessments

- Game Experience Questionnaire (GEQ) [115] In-Game and Social Presence Modules
- Player Avatar Relationship (PAR) social typology [133] survey questions
- Narrative interpretations survey
- Educator reflections survey (Educator Study Only)
- In-game choices

Each section below presents results, findings, and discussions for the PreK-12 Educator Study and the Youth Study. The chapter begins with a summary of participants' demographic and study conditions. The social science assessment and survey results are described, followed by the game assessment results. Next, the results of performing inferential statistical analyses using both the social science and game assessment results are presented. The chapter ends with the results from the qualitative data analysis performed on the aggregate data for both the educator and youth studies, providing richer context on quantitative findings.

The findings in this chapter provide strong evidence that primary RES experiences, ethnic identity development and colorblind racial attitudes have significant effects on how participants feel and make interpretations during and after games portraying racial and ethnic identity phenomena. These interrelationships between players'

[1]For definitions of each of the four RES practices reported on in this chapter (i.e., Alertness to Discrimination and Preparation for Bias, Colorblindness and Egalitarianism, Cultural Socialization, and Promotion of Mistrust), please refer to Table 2.7 in Chapter 2.

physical- and virtual- world identities encourage researchers and developers to go beyond solely examining the effects of serious videogames and VR experiences about race and ethnicity within the boundaries of participant race. To understand the impact of the medium in more nuanced ways, research and development must consider the effects of these other related, but distinct, factors for individuals' within and across racial and ethnic groups.

5.1 Participant Demographics and Conditions

The following section presents the demographic profiles and the condition assignments of study participants for each of the studies.

5.1.1 Study 1: PreK-12 Educators

A total of 110 participants completed the PreK-12 Educator study.

Game Condition Assignment. A total of 54 participants (49.1%) completed the graphics version of the game and 56 participants (50.9%) completed the hypertext version of the game.

Age. All participants were between the ages of 20 and 57. The mean participant age was 33.46 (SD = 6.97).

Gender. A total of 69 participants (62.7%) were female, 40 participants (36.4%) were male, and one participant (accounting for 0.9%) was non-binary.

Hometown Region. Participants reported the city and state where they grew up and responses were categorized according to the four statistical regions used by the United States Census Bureau. The responses indicated that 39.1% (43) of participants grew up in the South, 23.6% (26) in the Midwest, 21.8% (24) in the Northeast, and 14.5% (16) in the West. One participant (accounting for 0.9%) grew up in the north-central region of England.

Teaching Region. Participants reported the city and state of the school district where they teach and responses were categorized according to the four statistical regions used by the United States Census Bureau. The responses indicated that 38.2% (42) of participants served at school districts in the South, 22.7% (25) in the Northeast, 21.8% (24) in the Midwest, and 13.6% (15) in the West. Two participants (accounting for 1.8%) served at an American, standards based curriculum in Lower Myanmar[2]. One participant (accounting for 0.9%) did not share the geographic region of their school but reported primarily serving Native students. One participant (accounting for 0.9%) did not answer this question.

Race and Ethnicity. Participants selected one or more race categories (from a total of eight categories) and specified their racial and ethnic background(s) in open-ended text. Participants' demographics were as follows:

- 54.5% (60) White
- 30.9% (34) Black or African American
- 6.4% (7) Hispanic, Latine, or Spanish origin
- 6.4% (7) Multiracial (two or more categories)
- 1.8% (2) Asian

5.1.2 Study 2: U.S. Youth

A total of 60 participants completed the U.S. Youth study.

Game Condition Assignment. Half of all participants (30) completed the graphics version of the game and the other half of all participants (30) completed the hypertext version of the game.

[2]Although the study focused on U.S.-based educators, the call for participation was shared with an MIT-affiliated global educator network which includes this school. Both of these educators grew up in the U.S. and many different nationalities are represented in the student body they serve.

Age. All participants were between the ages of 10 and 18. The mean participant age was 13.59 (SD = 2.25).

Grade Level. All participants were between grade levels 3 and entering their freshman year of college. The mean participant grade level was 7.87 (SD = 2.32).

Gender. A total of 33 participants (55%) were female and 27 participants (45%) were male.

Geographic Region. Participants reported the city and state where they live and responses were categorized according to the four statistical regions used by the United States Census Bureau. The responses indicated that 41.7% (25) of participants lived in the Northeast, 21.7% (13) in the South, 18.3% (11) in the West, and 16.7% (10) in the Midwest. One participant (accounting for 1.7%) did not specify their region of the U.S.

Race and Ethnicity. Participants selected one or more race categories (from a total of eight categories) and specified their racial and ethnic background(s) in open-ended text. Participants' demographics were as follows:

- 48.3% (29) White
- 20% (12) Asian
- 20% (12) Multiracial (two or more categories)
- 6.7% (4) Black or African American
- 5% (3) Hispanic, Latine, or Spanish origin

5.1.3 Discussion of Demographic Findings

According to the Institute of Education Sciences (IES) 79% of U.S. public school teachers were white and non-Hispanic and about 76% were female in the 2017–18 school year [156]. This matched the majority demographics for the educator study

for which most participants were white and female. In 2011-2012, the average age for public school teachers reported by IES was 42.4 years old, which is roughly nine years older than the average age for participants in the educator study [157]. No one geographic region accounted for more than 40% of the overall educator study population, but the largest representation of geographic region (for both hometown and teaching region) was in the U.S. South.

According to Pew Research Center, the U.S. Generation Z (those born after 1996, which describes all youth study participants) population is roughly 52% white and non-Hispanic, 25% Hispanic, 14% Black, 6% Asian, and 5% are some other race or two or more races [167]. Although white participants made up the single largest racial subgroup for the youth study, there was a much higher percentage of Asian and multiracial participants relative to the U.S. Gen Z demographics. With regards to the low number of Black and African American participants, it is important to note that these studies occurred during Summer 2020, which was a time marked by an extreme level of racial stress and trauma for Black and African Americans due to both the disproportionate number of Black and African Americans passing away due to COVID-related deaths and the horrific murder of George Floyd and subsequent public discourse [106]. Although this may not fully explain the low number of Black and African American youth participants in the study, Black and African American youth had already been demonstrating a high level of resilience and coping strategies in response to this tragedy. Enrolling in this optional study, which would have asked them to be confronted with additional anti-Black racism in a virtual environment, could have resulted in additional, unnecessary stress. With regards to age, participants played the role of a character who is said to be in ninth grade (between 14 to 15 years old) in *Passage Home*. The average youth participant was roughly one grade and one year younger than the character. Participants living in the U.S. Northeast were over-represented in the study. Because recruitment of youth participants requires parent/guardian consent, it is possible that proximity to the institution (which is also located in the U.S. Northeast) played a significant role in

Table 5.1: The mean and standard deviation values for the educators' MEIM scores. The scores for each factor range from 1 (low) to 4 (high).

MEIM Factor	Mean	Std. Deviation
Total Score	3.39	0.54
Exploration	3.16	0.75
Commitment	3.55	0.52

encouraging families to allow their child to participate in the study.

5.2 Descriptive Statistics for Social Science Assessments

This section presents the descriptive statistics for the data collected using validated instruments from empirical social science research. These measures included the Multi-Ethnic Identity Measure (MEIM), Colorblind Racial Attitudes Scale (COBRAS), and Racial Encounter Appraisal & Decisioning Scale Youth (RSC-READY). It also presents the distribution of participants' self-reported primary racial and ethnic socialization (RES) experiences while growing up (captured by their in-game choice when prompted to recall this) and their self-reported prior experiences of discriminatory racial encounters (DREs).

5.2.1 Study 1: PreK-12 Educators

This section summarizes the results for the MEIM, COBRAS, and primary RES practices self-reported by participants in the educator study.

Multi-Ethnic Identity Measure (MEIM; assesses ethnic identity development). The mean educator scores and standard deviations for each of the factors of the MEIM are shown in Table 5.1. The scores for all components range from 1 (low) to 4 (high).

Colorblind Racial Attitudes Scale (COBRAS; assesses unawareness of racial issues in the U.S.). The mean educator scores and standard deviations for each of

Table 5.2: The mean and standard deviation values for the educators' COBRAS scores. The scores for unawareness of racial privilege range from 7 (low) to 42 (high), unawareness of institutional discrimination range from 7 (low) to 42 (high) and unawareness of blatant racial issues range from 6 (low) to 36 (high).

COBRAS Factor	Mean	Std. Deviation
Unawareness of Racial Privilege	24.9	9.41
Unawareness of Institutional Discrimination	18.55	5.56
Unawareness of Blatant Racial Issues	12.07	4.21

Table 5.3: The percentage and number of total participants in the educator study for self-reported primary RES practice used by their caregivers while growing up.

RES Practice	Number of Participants	Percent
Colorblindness and Egalitarianism	53	50.5%
Cultural Socialization	27	25.7%
Alertness to Discrimination	23	21.9%
Promotion of Mistrust	2	1.9%

the factors of the COBRAS are shown in Table 5.2. The scores for unawareness of racial privilege range from 7 (low) to 42 (high), unawareness of institutional discrimination range from 7 (low) to 42 (high) and unawareness of blatant racial issues range from 6 (low) to 36 (high).

RES Experiences (assesses how one was socialized to think about race and ethnicity while growing up). The distribution of the educators' self-reported primary RES practice used by their caregivers while growing up are shown in Table 5.3. Note that five educators' story codes were corrupted in submission of their survey responses so their results are omitted, resulting in a total of 105 of 110 total participant responses included in these results.

The largest number of educators reported colorblindness and egalitarianism as their primary RES practice and the least number of educators reported promotion of mistrust as their primary RES practice.

Table 5.4: The youths' mean scores and standard deviation values for the MEIM. The scores for all factors range from 1 (low) to 4 (high).

MEIM Factor	Mean	Std. Deviation
Total Score	2.74	0.54
Exploration	2.71	0.54
Commitment	2.77	0.63

5.2.2 Study 2: U.S. Youth

This section summarizes the results for the MEIM, selected questions from the RSC-READY, and primary RES practices self-reported by participants in the youth study.

Multi-Ethnic Identity Measure (MEIM; assesses ethnic identity development). The youths' mean scores and standard deviations for each of the factors of the MEIM are shown in Table 5.4. The scores for all factors range from 1 (low) to 4 (high).

Racial Encounter Appraisal & Decisioning Scale Youth (RSC-READY; assesses socialization experiences and belief in ability to use coping skills for DREs). The distribution of the youths' "yes" and "no" responses to the question "Have you had any experiences of racist acts towards you?" are shown in Table 5.5. The results indicated that a little over one-third (36.70%) of participants reported having had an experience of a racist act toward them.

The youths' mean scores and standard deviations for self-reported frequency of discussing racism and discrimination with their parent/guardian(s) are shown in Table 5.6. The scores, which indicate frequency of discussions, correspond to a 5-point scale: 1 - Not at all, 2 - A little, 3 - Somewhat, 4 - A lot, 5 - All of the time. The results indicated that the majority of participants reported talking to their parent/guardian(s) about racism and discrimination somewhat infrequently.

The youths' mean scores and standard deviations for each of the RSC-READY survey questions that were used are shown in Table 5.7. The scores, which indicate belief in one's ability to use that coping mechanism, correspond to a 5-point scale: 1 - Not

Table 5.5: The percentage and number of total participants in the youth study who answered "yes" or "no" in response to the question "Have you had any experiences of racist acts towards you?"

Response	Percent
No	63.30% (38 participants)
Yes	36.70% (22 participants)

Table 5.6: The youths' mean scores and standard deviations for self-reported frequency of discussing racism and discrimination with their parent/guardian(s). The scores, which indicate frequency of discussions, correspond to a 5-point scale: 1 - Not at all, 2 - A little, 3 - Somewhat, 4 - A lot, 5 - All of the time.

Survey Question	Mean	Std. Deviation
How much does your parent/guardian(s) talk to you about racism and discrimination?	2.9	0.93

at all, 2 - Unlikely, 3 - Maybe/Maybe Not, 4 - I think I can, 5 - Absolutely. The results indicated that the majority of participants believed they could speak up if they witnessed peers being racially mistreated and notice when negative racial encounters have occurred. They also indicated that participants believed that they were unsure about their ability (i.e., may or may not be able) to use coping mechanisms related to sharing their emotions after negative racial encounters, speaking up to authority figures, and engaging (instead of walking away from) during a negative racial encounter.

RES Experiences (assesses how one was socialized to think about race and ethnicity while growing up). The distribution of the youths' self-reported primary RES practice used by their caregivers while growing up are shown in Table 5.8. The youths' most-reported primary RES practice was alertness to discrimination and their least-reported primary RES practice was promotion of mistrust.

5.2.3 Discussion of Overall Social Science Assessment Findings

Findings on Participants' Ethnic Identity Development. For the MEIM, educator participants' mean total score was 0.65 points higher than that of youth

Table 5.7: The youths' mean scores and standard deviations for the RSC-READY survey questions. The scores, which indicate belief in one's ability to use that coping mechanism, correspond to a 5-point scale: 1 - Not at all, 2 - Unlikely, 3 - Maybe/Maybe Not, 4 - I think I can, 5 - Absolutely.

Survey Question	**Mean**	**Std. Deviation**
I believe I can share my emotions about my experiences of negative racial encounters.	3.77	0.7
I believe I can speak up if I am racially mistreated by an authority figure (for example, a teacher or the police).	3.7	0.93
I believe I can speak up if I witness peers being racially mistreated.	4.05	0.85
I believe I can engage rather than walk away from a negative racial encounter with another person.	3.63	0.88
I believe I can notice when negative racial encounters have occurred.	4.05	0.83
I believe I can ask for help when I am stressed from a negative racial encounter.	3.73	0.88

Table 5.8: The percentage and number of total participants in the youth study for self-reported primary RES practice used by their caregivers while growing up.

RES Practice	**Number of Participants**	**Percent**
Alertness to Discrimination	26	43.3%
Colorblindness and Egalitarianism	19	31.7%
Cultural Socialization	9	15%
Promotion of Mistrust	6	10%

participants. Given that this measure is associated with developmental outcomes, this is consistent with expectations. Both groups had relatively higher mean scores for the MEIM commitment factor compared to the exploration factor, which has been described as *the foreclosure state*, "where individuals have not observed the issues by themselves and taken values and others' opinions without questioning (commitment without exploration)" [170, 122, 210].

Findings on Educators' Colorblind Racial Attitudes. For the COBRAS results (associated with the educator study only), participants had the relatively highest mean score for unawareness of racial privilege (RP), slightly lower mean score for unawareness of institutional discrimination (ID), and the lowest mean score for unawareness of blatant racial issues (BRI). This ranking is consistent with the ranking of mean scores with each factor reported in [153] (i.e., unawareness of RP had the highest mean score, unawareness of ID had a lower mean score, and unawareness of BRI had the lowest mean score). Thus, the kinds of colorblind racial attitudes held by participants were relatively consistent with those observed in broader U.S. studies.

Findings on Participants' RES. Empirical research on RES has found discrepancies in the kinds of socialization messages reported by children and their caregiver(s). Hughes et al. (2006) explains that "children can also disagree with, miss, misinterpret, or ignore parents' RES messages [138]. Thus, it is important to conceptually distinguish the messages parents intend to impart from those that children perceive by studying both" [113]. This is important to keep in mind when interpreting the study results, given that we only assessed participants' self-reported primary RES practices while growing up and do not have information about whether or not this aligns or is inconsistent with what their caregiver(s) would have reported.

Findings on the Youths' Socialization and Coping Skills. The RSC-READY results (associated with the youth study only) indicated that most participants had not personally experienced acts of racism and they only speak with their parent/-guardian(s) about racism and discrimination a little bit or some of the time. Nonethe-

less, they generally believed that they could use adaptive coping mechanisms and skills in the face of discriminatory encounters. The self-reported RES experience results for both studies indicated that the fewest number of participants were socialized with promotion of mistrust, which has most often been the least-reported RES practice across racial groups in the literature. Colorblindness and egalitarianism is the most-reported practice used by white parents in the literature [91] and it was the most-reported RES practice in the educator study, which had the largest number of white participants. In contrast to the educators' predominantly colorblind socialization experiences, the most-reported RES practice for youth participants was alertness to discrimination.

5.3 Descriptive Statistics for Game Assessments

This section presents descriptive statistics for the data collected using measures related to the game. These measures included the Game Experience Questionnaire (GEQ) In-Game and Social Presence Modules, survey questions adapted from the player-avatar relationship (PAR) social typology, survey questions about participants' narrative interpretations, and survey questions about the educators' reflections. It also presents the distribution of participants' in-game choices (excluding the one question prompting recall of RES while growing up, which was already presented in the prior section).

5.3.1 Study 1: PreK-12 Educators

This section summarizes the results for the GEQ, survey questions adapted from the player avatar relationship (PAR) social typology, study-specific survey questions on participants' narrative interpretations and reflections, and participants' in-game choices in the educator study.

Game Experience Questionnaire (GEQ; assesses how players felt about playing the game and their psychological and behavioral involvement with the characters in the game). The mean educator ratings and standard deviations

Table 5.9: The educators' mean scores and standard deviation values for the GEQ In-Game Module. The scores for each component range from 0 (low) to 4 (high).

GEQ In-Game Module Component	Mean	Std. Deviation
Competence	2.78	1.10
Immersion	3.45	0.69
Flow	2.02	0.85
Tension	0.70	1.09
Challenge	1.38	1.34
Negative Affect	0.13	0.35
Positive Affect	2.50	1.04

Table 5.10: The educators' mean scores and standard deviations for the GEQ Social Presence Module. The scores for each component range from 0 (low) to 4 (high). Empathy and negative feelings refer to how much empathy and negative feelings participants held toward the NPC.

GEQ Social Presence Module Component	Mean	Std. Deviation
Empathy	1.33	0.87
Negative Feelings	1.61	0.66
Behavioral Involvement	2.67	0.75

for each of the components of the GEQ In-Game Module are shown in Table 5.9. The scores for each component range from 0 (low) to 4 (high). The results indicated that educators felt a very high level of immersion, felt moderately in flow (with higher feelings of competence than challenge), they felt more content and good (i.e., positive affect) than they felt tiresome or bored (i.e., negative affect), and they reported very low levels of tension about the experience.

The mean educator ratings and standard deviations for each of the components of the GEQ Social Presence Module are shown in Table 5.10. The scores for each component range from 0 (low) to 4 (high). The results indicated that educators felt a moderately high level of behavioral involvement and held more negative feelings than empathy toward the non-player character (NPC), Mrs. Smith.

Player-Avatar Relationship (PAR; assesses players' sense of identification with the player character). This section summarizes the educators' responses across four dimensions of the PAR social typology: *identification, game environment, sense of control,* and *sense of care and responsibility.* Participants' responses for how

Table 5.11: The percentage and number of total participants in the educator study who selected each of the PAR types for identification in response to the question "During the experience, how would you best describe your identification with Tiffany using the scale below?" The range of responses correspond to a four-point spectrum: object (highly non-social), me (moderately non-social), symbiote (moderately social), other (highly social).

PAR for Identification	**Number of Participants**	**Percent**
Avatar as Symbiote	34	30.9%
Avatar as Other	28	25.5%
Avatar as Object	27	24.5%
Avatar as Me	21	19.1%

they related with the PC correspond to a four-point spectrum (ranging from highly non-social to highly social): *object* (highly non-social), *me* (moderately non-social), *symbiote* (moderately social), *other* (highly social).

The distribution of the educators' responses for their level of identification with the player character (PC), Tiffany, is shown in Table 5.11, indicating that almost one-third (30.9%) of participants felt that she was intertwined with or part of them. The distribution of the educators' responses for how they related to the game environment is shown in Table 5.12, indicating that almost half (49.1%) of participants viewed the PC's environment as an extension of their own, fitting their own views into the PC's environment as they played. The distribution of the educators' responses for their sense of control of the PC in Table 5.13, indicating that a little over one-third (35.5%) of participants felt that the PC was a functional tool for mastering the challenges in the experience. The distribution of the educators' responses for their sense of care and responsibility for the PC in Table 5.14, indicating that a little over one-third (36.4%) of participants felt that the PC was a distinct social agent from them and that they were helping her get the things she needed in her world.

Using Banks and Bowman's mapping of character attachment to relationship archetypes [22], the results indicate the majority of participants felt a low to mild sense of identification as the PC, mild suspension of disbelief in accepting the digital environment as real space, mild to high sense of control over the PC's in-game actions, and a mild to high sense of care and responsibility for the PC's needs.

Table 5.12: The percentage and number of total participants in the educator study who selected each of the PAR types for the game environment in response to the question "During the experience, how would you best describe the environment using the scale below?" The range of responses correspond to a four-point spectrum: object (highly non-social), me (moderately non-social), symbiote (moderately social), other (highly social).

PAR for Environment	**Number of Participants**	**Percent**
Avatar as Me	54	49.1%
Avatar as Symbiote	29	26.4%
Avatar as Object	19	17.3%
Avatar as Other	8	7.3%

Table 5.13: The percentage and number of total participants in the educator study who selected each of the PAR types for sense of control in response to the question "During the experience, how would you best describe your sense of control of Tiffany using the scale below?" The range of responses correspond to a four-point spectrum: object (highly non-social), me (moderately non-social), symbiote (moderately social), other (highly social).

PAR for Sense of Control	**Number of Participants**	**Percent**
Avatar as Object	39	35.5%
Avatar as Me	34	30.9%
Avatar as Symbiote	24	21.8%
Avatar as Other	13	11.8%

Table 5.14: The percentage and number of total participants in the educator study who selected each of the PAR types for sense of care and responsibility in response to the question "During the experience, how would you best describe your sense of care and responsibility for Tiffany using the scale below?" The range of responses correspond to a four-point spectrum: object (highly non-social), me (moderately non-social), symbiote (moderately social), other (highly social).

PAR for Sense of Care and Responsibility	**Number of Participants**	**Percent**
Avatar as Other	40	36.4%
Avatar as Me	37	33.6%
Avatar as Symbiote	22	20%
Avatar as Object	11	10%

Narrative Interpretation Survey. The mean educator ratings (indicating their level of agreement or disagreement with a statement) and standard deviations for each of the survey questions assessing their interpretations about the narrative in the game are shown in Table 5.15. The ratings, which indicate level of agreement with each statement, correspond to a 5-point scale: 1 - Strongly Disagree, 2 - Slightly Disagree, 3 - Neither Agree nor Disagree, 4 - Slightly Agree, 5 - Strongly Agree.

The results indicated that participants generally agreed that with the following interpretations:

- The PC handled the situation well
- The story in the game featured a situation that is similar to real life
- The NPC treated the PC unfairly
- The PC ended the situation well
- The story in the game showed discrimination
- The PC was treated unfairly because of her race/ethnicity

The results indicated that participants generally disagreed that with the following interpretations:

- The NPC treated the PC fairly
- The NPC handled the situation well
- The PC was treated unfairly because of her gender
- The PC was treated unfairly because of her age

Finally, the results indicated that participants were roughly neutral (with slight disagreement) with regard to whether the PC was treated unfairly because of the neighborhood she comes from. In summary, most participants were able to correctly

Table 5.15: The educators' mean ratings and standard deviations for their interpretations of the narrative in the game. The ratings, which indicate level of agreement with each statement, correspond to a 5-point scale: 1 - Strongly Disagree, 2 - Slightly Disagree, 3 - Neither Agree nor Disagree, 4 - Slightly Agree, 5 - Strongly Agree.

Narrative Interpretation	**Mean**	**Std. Deviation**
Mrs. Smith treated Tiffany fairly.	1.85	1.07
Mrs. Smith handled the situation well throughout the experience.	2.44	1.31
Tiffany handled the situation well throughout the experience.	4.57	0.76
The story in the experience is similar to situations that happen or could happen in real life.	4.81	0.61
Mrs. Smith treated Tiffany unfairly.	4.15	1.14
Tiffany ended the situation well.	4.75	0.60
The story in the experience showed discrimination.	4.32	1.05
Tiffany was treated unfairly because of her race/ethnicity.	4.09	1.06
Tiffany was treated unfairly because she is a girl.	1.94	1.18
Tiffany was treated unfairly because of what neighborhood she comes from.	2.88	1.39
Tiffany was treated unfairly because of her age.	1.77	1.09

recognize that the NPC was treating the PC unfairly because of her race/ethnicity (acknowledging that while this might intersect with her neighborhood background, that was not the primary factor motivating the discrimination), felt that the story was linked to real-world issues, perceived the PC as competent in how she handled and ended the encounter, and perceived the NPC as incompetent in how she handled the encounter.

Educator Reflections Survey. The distribution of the educators' "yes" and "no" responses to the question "I have been through a situation in real life that is similar to what happened in the experience"are shown in Table 5.16. The results indicated that the majority (86.24%) of participants have not been through an experience in real life that is similar to the DRE portrayed in the game.

The educators' mean ratings and standard deviations for each of the survey questions assessing their reflections about the narrative in the game are shown in Table 5.17.

Table 5.16: The percentage and number of total educator participants who responded "yes" or "no" in response to the question "I have been through a situation in real life that is similar to what happened in the experience."

Response	**Percent**
No	86.24% (94 participants)
Yes	13.76% (15 participants)

Table 5.17: The educators' mean ratings and standard deviations for the educator reflections survey questions. The values, which indicate level of agreement with each statement, correspond to a 5-point scale: 1 - Strongly Disagree, 2 - Slightly Disagree, 3 - Neither Agree nor Disagree, 4 - Slightly Agree, 5 - Strongly Agree.

Reflection	**Mean**	**Std. Deviation**
The experience caused me to consider a different perspective than I normally would.	4.31	1.05
The experience caused me to reflect on my own practices as an educator.	4.61	0.79

The ratings, which indicate level of agreement with each statement, correspond to a 5-point scale: 1 - Strongly Disagree, 2 - Slightly Disagree, 3 - Neither Agree nor Disagree, 4 - Slightly Agree, 5 - Strongly Agree. Note that one educator's responses to these questions were corrupted, resulting in a total of 109 of 110 total participant responses included in these results.

The results indicated that most participants have not been through a real-life situation that was similar to the experience. Participants generally agreed that the experience caused them to consider a different perspective than they normally would and caused them to reflect on their own practices as an educator.

In-Game Choices. This section summarizes the educators' in-game choices during the experience. Note that five educators' story codes were corrupted in submission of their survey responses so their results are omitted, resulting in a total of 105 of 110 total participant responses included in these results.

The distribution of the educators' choices regarding how they internally appraised the DRE in the experience is shown in Table 5.18, indicating that over one-third (38.1%)

Table 5.18: The percentage and number of total participants in the educator study who selected each of the possible choices in response to the in-game question "What do you THINK about what Mrs. Smith said?"

First Appraisal	Number of Participants	Percent
Neutral	40	38.1%
Threat	37	35.2%
Positive	28	26.7%

of participants externalized the stressor as neutral (not racialized). The distribution of the educators' choices regarding how they reacted emotionally in response to the DRE is shown in Table 5.19, indicating that almost half (45.7%) of participants had neutral feelings. The distribution of the educators' choices for how they changed their body language expression in response to the DRE is shown in Table 5.20, indicating that a little over half (52.4%) of participants expressed neutral body language. The distribution of the educators' choices regarding how they appraised the DRE the second time in the experience is shown in Table 5.21, indicating that almost half (47.6%) of participants externalized the stressor as neutral (not racialized). The distribution of the educators' choices regarding how they verbally responded to the DRE is shown in Table 5.22, indicating that over half (58.1%) of participants expressed confusion to the NPC. The distribution of the educators' choices regarding how they wanted to respond to the DRE is shown in Table 5.23, indicating that almost all (96.2%) participants decided to respond assertively at the end.

The results indicated that, contrary to what would be expected after witnessing additional racial microaggressions, a fewer number of participants recognized the racially discriminatory nature of the encounter between the first and the second appraisal steps (dropping from 35.2% to 33.3%). Participants mostly aligned their internal feelings with their external body language expression. A similar percentage of participants who appraised the encounter as a racial threat the second time (33.3%) expressed their feelings of being treated unfairly to the NPC (35.2%). Finally, almost every participant chose to respond assertively to the NPC at the end of the encounter.

Table 5.19: The percentage and number of total participants in the educator study who selected each of the possible choices in response to the in-game question "How do you FEEL about what Mrs. Smith said?"

Internal Feelings	Number of Participants	Percent
Unphased	48	45.7%
Sad	26	24.8%
Annoyed	23	21.9%
Angry	8	7.6%

Table 5.20: The percentage and number of total participants in the educator study who selected each of the possible choices in response to the in-game question "What body language do you want to EXPRESS?"

Body Language Expression	Number of Participants	Percent
Unphased	55	52.4%
Sad	27	25.7%
Annoyed	13	12.4%
Angry	10	9.5%

Table 5.21: The percentage and number of total participants in the educator study who selected each of the possible choices in response to the in-game question "What do you THINK about what Mrs. Smith said?"

Second Appraisal	Number of Participants	Percent
Neutral	50	47.6%
Threat	35	33.3%
Positive	20	19%

Table 5.22: The percentage and number of total participants in the educator study who selected each of the possible choices in response to the in-game question "What do you want to SAY to Mrs. Smith?"

Verbal Response	Number of Participants	Percent
Express confusion	61	58.1%
Express unfairness	37	35.2%
Apologize	7	6.7%

Table 5.23: The percentage and number of total participants in the educator study who selected each of the possible choices in response to the in-game question "How would you LIKE to respond to the situation?"

Final Response	Number of Participants	Percent
Respond assertively	101	96.2%
Detach	2	1.9%
Walk away	1	1%
Apologize	1	1%

Table 5.24: The youths' mean scores and standard deviations for the GEQ In-Game Module. The scores for each component range from 0 (low) to 4 (high).

GEQ In-Game Module Component	Mean	Std. Deviation
Competence	2.16	0.82
Immersion	2.52	0.69
Flow	2.00	0.92
Tension	1.83	1.11
Challenge	1.82	0.80
Negative Affect	0.81	0.86
Positive Affect	2.03	0.99

5.3.2 Study 2: U.S. Youth

This section summarizes the results for the GEQ, survey questions adapted from the PAR social typology, study-specific survey questions on participants' narrative interpretations, and participants' in-game choices in the youth study.

Game Experience Questionnaire (GEQ; assesses how players felt about playing the game and their psychological and behavioral involvement with the characters in the game). The youths' mean scores and standard deviations for each of the components of the GEQ In-Game Module are shown in Table 5.24. The scores for each component range from 0 (low) to 4 (high). The results indicated that youth felt a moderate level of competence, immersion, and flow (with much higher feelings of competence than challenge). They felt much more positive and content (i.e., positive affect) than tiresome or bored (i.e., negative affect) about the game and they reported moderately low levels of tension about the experience.

The youths' mean scores and standard deviations for each of the components of the GEQ Social Presence Module are shown in Table 5.25. The scores for each component range from 0 (low) to 4 (high). The results indicated that youth felt a moderate level of behavioral involvement and negative feelings toward the NPC. The youths' empathy toward the NPC was very low.

Player-Avatar Relationship (PAR; assesses players' sense of identification with the player character). This section summarizes the youths' responses across

Table 5.25: The youths' mean scores and standard deviations for the GEQ Social Presence Module. The scores for each component range from 0 (low) to 4 (high). Empathy and negative feelings refer to how much empathy and negative feelings participants held toward the NPC.

GEQ Social Presence Module Component	**Mean**	**Std. Deviation**
Empathy	0.87	0.67
Negative Feelings	1.67	0.65
Behavioral Involvement	1.88	0.67

four dimensions of the PAR social typology: *identification, game environment, sense of control,* and *sense of care and responsibility.* Participants' responses for how they related with the PC correspond to a four-point spectrum (ranging from highly non-social to highly social): *object* (highly non-social), *me* (moderately non-social), *symbiote* (moderately social), *other* (highly social).

The distribution of youth responses for their level of identification with the player character (PC), Tiffany, is shown in Table 5.26, indicating that almost half (45%) of participants felt that she was intertwined with or part of them. The distribution of youth responses for how they related to the game environment is shown in Table 5.27, indicating that over half (55%) of participants fit their own views into the PC's environment as a mirror or extension of themselves as they played. The distribution of youth responses for their sense of control of the PC in Table 5.28, indicating that the majority of participants (80%) were split between feeling the PC stood in for them as a mirror or extension to achieve their social play goals (40%) or feeling that the PC and them used each other to achieve the goals of the experience in a symbiotic way (40%). The distribution of youth responses for their sense of care and responsibility for the PC in Table 5.29, indicating that almost three quarters (73.4%) of participants were split between feeling the PC was a mirror or extension of themselves and needed what they needed (36.7%) or feeling the PC was a distinct social agent from them and that they were helping her get the things she needed in her world (36.7%). Zero participants in the youth study reported feeling that the PC was an object that had no needs.

Using Banks and Bowman's mapping of character attachment to relationship archetypes

Table 5.26: The percentage and number of total participants in the youth study who selected each of the PAR types for identification in response to the question "During the experience, how would you best describe your identification with Tiffany using the scale below?" The range of responses correspond to a four-point spectrum: object (highly non-social), me (moderately non-social), symbiote (moderately social), other (highly social).

PAR for Identification	Number of Participants	Percent
Avatar as Symbiote	27	45%
Avatar as Other	19	31.7%
Avatar as Me	8	13.3%
Avatar as Object	6	10%

Table 5.27: The percentage and number of total participants in the youth study who selected each of the PAR types for the game environment in response to the question "During the experience, how would you best describe the environment using the scale below?" The range of responses correspond to a four-point spectrum: object (highly non-social), me (moderately non-social), symbiote (moderately social), other (highly social).

PAR for Environment	Number of Participants	Percent
Avatar as Me	33	55%
Avatar as Symbiote	19	31.7%
Avatar as Object	4	6.7%
Avatar as Other	4	6.7%

[22], the results indicate the majority of participants felt a low to mild sense of identification as the PC, mild suspension of disbelief in accepting the digital environment as real space, mild sense of control over the PC's in-game actions, and a mild to high sense of care and responsibility for the PC's needs.

Narrative Interpretation Survey. The youths' mean ratings (indicating their level of agreement or disagreement with a statement) and standard deviations for each of

Table 5.28: The percentage and number of total participants in the youth study who selected each of the PAR types for sense of control in response to the question "During the experience, how would you best describe your sense of control of Tiffany using the scale below?" The range of responses correspond to a four-point spectrum: object (highly non-social), me (moderately non-social), symbiote (moderately social), other (highly social)

PAR for Sense of Control	Number of Participants	Percent
Avatar as Me	24	40%
Avatar as Symbiote	24	40%
Avatar as Other	7	11.7%
Avatar as Object	5	8.3%

Table 5.29: The percentage and number of total participants in the youth study who selected each of the PAR types for sense of care and responsibility in response to the question "During the experience, how would you best describe your sense of care and responsibility for Tiffany using the scale below?" The range of responses correspond to a four-point spectrum: object (highly non-social), me (moderately non-social), symbiote (moderately social), other (highly social).

PAR for Sense of Care and Responsibility	**Number of Participants**	**Percent**
Avatar as Me	22	36.7%
Avatar as Other	22	36.7%
Avatar as Symbiote	16	26.7%
Avatar as Object	0	0%

the survey questions assessing their interpretations about the narrative in the game are shown in Table 5.30. The ratings, which indicate level of agreement with each statement, correspond to a 5-point scale: 1 - Strongly Disagree, 2 - Slightly Disagree, 3 - Neither Agree nor Disagree, 4 - Slightly Agree, 5 - Strongly Agree.

The results indicated that participants generally agreed that with the following interpretations:

- The PC handled the situation well
- The story in the game featured a situation that is similar to real life
- The NPC treated the PC unfairly
- The PC ended the situation well
- The story in the game showed discrimination
- The PC was treated unfairly because of her race/ethnicity

The results indicated that participants generally disagreed that with the following interpretations:

- The NPC treated the PC fairly
- The NPC handled the situation well

Table 5.30: The youths' mean ratings and standard deviations for their interpretations of the narrative in the game. The ratings, which indicate level of agreement with each statement, correspond to a 5-point scale: 1 - Strongly Disagree, 2 - Slightly Disagree, 3 - Neither Agree nor Disagree, 4 - Slightly Agree, 5 - Strongly Agree.

Narrative Interpretation	**Mean**	**Std. Deviation**
Mrs. Smith treated Tiffany fairly.	1.67	0.84
Mrs. Smith handled the situation well throughout the experience.	2.02	0.85
Tiffany handled the situation well throughout the experience.	3.77	1.00
The story in the experience is similar to situations that happen or could happen in real life.	4.13	0.95
Mrs. Smith treated Tiffany unfairly.	4.27	0.82
Tiffany ended the situation well.	3.78	1.14
The story in the experience showed discrimination.	4.08	0.93
Tiffany was treated unfairly because of her race/ethnicity.	3.87	0.91
Tiffany was treated unfairly because she is a girl.	2.58	1.06
Tiffany was treated unfairly because of what neighborhood she comes from.	2.93	0.99
Tiffany was treated unfairly because of her age.	2.32	1.00

- The PC was treated unfairly because of her age

Finally, the results indicate that participants were roughly neutral (with slight disagreement) with regard to whether the PC was treated unfairly because of her gender and the neighborhood she comes from. In summary, most participants were able to correctly recognize that the NPC was treating the PC unfairly because of her race/ethnicity (acknowledging that while this might intersect with her gender and neighborhood background, that was not the primary factor motivating the discrimination), felt that the story was linked to real-world issues, perceived the PC as competent in how she handled and ended the encounter, and perceived the NPC as incompetent in how she handled the encounter.

In-Game Choices. This section summarizes the youths' in-game choices during the experience. The distribution of the youths' choices regarding how they appraised the DRE the first time in the experience is shown in Table 5.31, indicating that almost

half (43.3%) of participants externalized the stressor as racialized. The distribution of youth choices regarding how they reacted emotionally in response to the DRE is shown in Table 5.32, indicating that the majority of participants (70%) were roughly split between feeling sadness (36.7%) or annoyance (33.3%). The distribution of youth choices for how they changed their body language expression in response to the DRE is shown in Table 5.33, indicating that the majority of participants (65%) were roughly split between expressing neutral body language (33.3%) or sad body language (31.7%). The distribution of youth choices regarding how they appraised the DRE the second time in the experience is shown in Table 5.34, indicating that the majority of participants (63.3%) externalized the stressor as racialized. The distribution of youth choices regarding how they verbally responded to the DRE is shown in Table 5.35, indicating that almost half (46.7%) of participants expressed unfairness to the NPC. The distribution of youth choices regarding how they wanted to respond to the DRE is shown in Table 5.36, indicating that almost two-thirds (61.7%) of participants decided to respond assertively at the end.

The results indicated that, after witnessing additional racial microaggressions, the majority of participants (63.3%) recognized the racially discriminatory nature of the encounter between the first and the second appraisal steps (20% more participants than the first appraisal). Many participants did not align their internal feelings with their external body language expression. For example, only 8.3% participants felt unphased by the NPC's dialogue but 33.3% expressed unphased body language, and while 33.3% participants felt annoyed by the NPC's dialogue, only 25% expressed annoyed body language. Almost 20% fewer participants who appraised the encounter as a racial threat the second time actually chose to express their feelings of being treated unfairly to the NPC (46.7% compared to the 63.3% who appraised it as a racial threat the first time). Finally, while over half of participants (61.7%) chose to respond assertively to the NPC, 16.7% chose to walk away at the end of the encounter.

Table 5.31: The percentage and number of total participants in the youth study who selected each of the possible choices in response to the in-game question "What do you THINK about what Mrs. Smith said?"

First Appraisal	Number of Participants	Percent
Threat	26	43.3%
Neutral	19	31.7%
Positive	15	25%

Table 5.32: The percentage and number of total participants in the youth study who selected each of the possible choices in response to the in-game question "How do you FEEL about what Mrs. Smith said?"

Internal Feelings	Number of Participants	Percent
Sad	22	36.7%
Annoyed	20	33.3%
Angry	13	21.7%
Unphased	5	8.3%

Table 5.33: The percentage and number of total participants in the youth study who selected each of the possible choices in response to the in-game question "What body language do you want to EXPRESS?"

Body Language Expression	Number of Participants	Percent
Unphased	20	33.3%
Sad	19	31.7%
Annoyed	15	25%
Angry	6	10%

Table 5.34: The percentage and number of total participants in the youth study who selected each of the possible choices in response to the in-game question "What do you THINK about what Mrs. Smith said?"

Second Appraisal	Number of Participants	Percent
Threat	38	63.3%
Neutral	15	25%
Positive	7	11.7%

Table 5.35: The percentage and number of total participants in the youth study who selected each of the possible choices in response to the in-game question "What do you want to SAY to Mrs. Smith?"

Verbal Response	Number of Participants	Percent
Express unfairness	28	46.7%
Express confusion	27	45%
Apologize	5	8.3%

Table 5.36: The percentage and number of total participants in the youth study who selected each of the possible choices in response to the in-game question "How would you LIKE to respond to the situation?"

Final Response	Number of Participants	Percent
Respond assertively	37	61.7%
Walk away	10	16.7%
Detach	9	15%
Apologize	4	6.7%

5.3.3 Discussion of Overall Game Assessment Findings

Findings on Participants' Game Experience. The GEQ In-Game module results were similar between educator and youth study participants, with the most significant differences being the mean tension score, which was 1.13 points higher for youth than educators, the mean immersion score, which was 0.93 points higher for educators than youth, and the mean negative affect score, which was 0.68 points higher for youth than educators. For the GEQ Social Presence module results, educators and youth had a similar mean negative feelings score. There were significant differences for the mean behavioral involvement score, which was 0.79 points lower for youth participants, and the mean empathy score, which was 0.46 points lower for youth participants.

The higher levels of tension and negative affect for youth compared to educators could possibly be due to the game experience being centered around a student being in a threatening position with an authority figure (i.e., their teacher). This could have resulted in higher levels of stress due to the shared social position for the youth participants. Furthermore, since behavioral involvement is associated with higher feelings of agency (i.e., how much participants felt their actions affected the game), youth participants may have scored lower on these due to feeling like they lacked the ability to defend themselves from the teacher's accusations in a meaningful way. The qualitative data analysis (QDA) results (reported in Section 5.5) indicated that many youth participants felt the need to seek social support from their parent/guardian(s) to assist them with self-advocacy and that they felt a stronger sense of power disparity between themselves and the NPC, which could explain this lower score. Empathy is

associated with positive feelings toward the NPC, so it is unsurprising that educator participants would have felt higher levels of empathy toward the NPC. The shared social position and experiences of these participants with the NPC as educators could have insulated their attitudes toward the character, in spite of her behavior toward the PC.

Findings on Participants' Relationships with the PC. The PAR results were similar between educator and youth participants. The only dimension that was slightly different between study groups was sense of control over the PC's in-game actions, for which youth felt a slightly lower level of control. This could be explained by similar reasons as youth participants' lower mean behavioral involvement score, which was due to a higher sense of power disparity with the NPC, leading to lower levels of agency and ability to control the way the narrative unfolded.

Findings on Participants' Narrative Interpretations. The post-game narrative interpretations survey results across both the educator and youth studies indicated the majority of participants correctly recognized the racially discriminatory nature of the encounter (i.e., that the PC was treated unfairly because of her race/ethnicity). The results also indicated that participants connected the game's story to real-world issues. A subset of participants in both studies felt that the discrimination could have intersected with other identity factors, such as neighborhood and gender, but the majority agreed that race/ethnicity was the primary factor.

Between the two study groups, the educators' mean score indicating their level of agreement with the statement "Tiffany was treated unfairly because of her race/ethnicity" was slightly higher (i.e., a greater level of agreement) than the mean for youth participants. Although statistical analyses were not conducted to determine the significance of race as a factor for differences in these results due to the uneven sample sizes of the racial subgroups in both studies (see Section 5.1 for detailed demographics), Figure 5-1 presents the mean scores based on participant race in each individual study (i.e., educator, youth) and combined. The results indicated that, across both

studies, white participants across both studies had the lowest mean score (i.e., a lower level of agreement) in response to this statement. Future work will need to be conducted with larger and more uniform sample sizes across racial groups to determine the significance of these differences, but these preliminary findings suggest that racial group membership, in addition to the other factors examined in this analysis (which are related to, but distinct from, racial group), suggest that individuals' racial group membership influenced whether or not they were able to correctly appraise the racialized nature of the encounter in *Passage Home*.

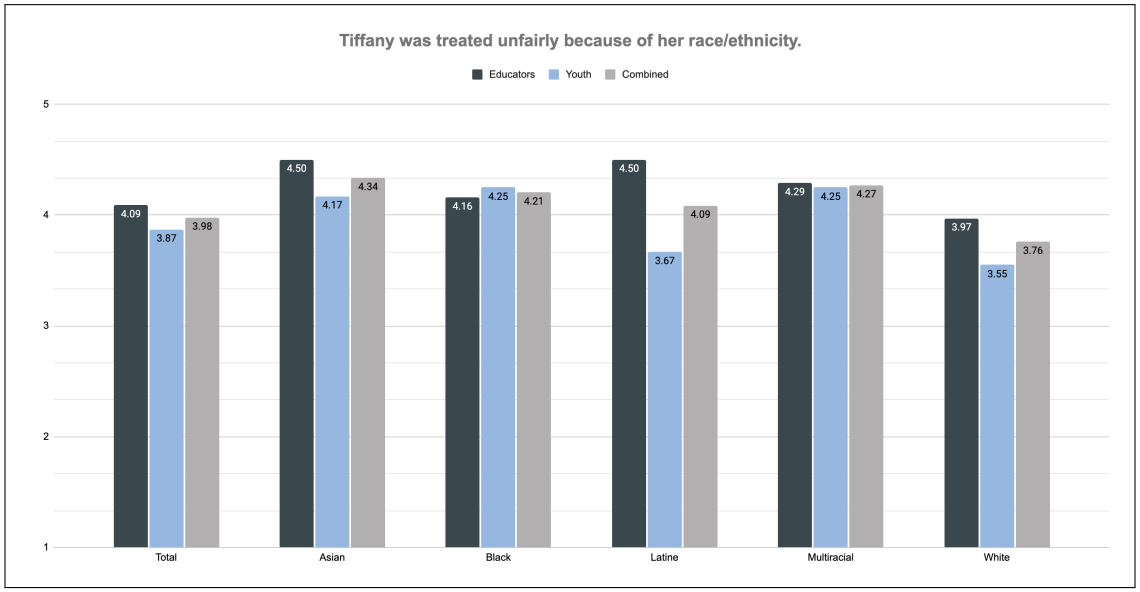


Fig. 5-1: A bar chart plotting the mean scores indicating participants' level of agreement with the following statement: "Tiffany was treated unfairly because of her race/ethnicity." The X-axis presents the results by participant race, with color codes indicating participants' study group (i.e., educator, youth, or combined). The Y-axis indicates the mean score based on Likert item survey responses using the following scale: 1 - Strongly disagree, 2 - Slightly disagree, 3 - Neither agree nor disagree, 4 - Slightly agree, 5 - Strongly agree. The results indicated that, across both studies, white participants across both studies had the lowest mean score (i.e., a lower level of agreement) in response to this statement.

Although the majority of participants across both studies agreed that the NPC treated the PC unfairly and that the NPC didn't handle the situation well, the youths' mean scores indicating their level of agreement with these two statements were slightly higher (i.e., a greater level of agreement) than the educators' mean scores. These results could be explained for similar reasons as to why the educators' mean empathy

score for the GEQ Social Presence Module was higher than the youths' mean empathy score.

Findings on Educators' Reflections. For the educator study only, the reflection survey indicated that while the majority of educator participants have not been through a real-world situation similar to the story in the experience, it nonetheless was an effective tool for prompting them to consider a different perspective and reflect on their practices as an educator. These findings are consistent with expectations, given that interactive narrative games have been demonstrated to be effective tools at provoking critical self-reflection and perspective transformation [164].

Findings on Participants' In-Game Choices. When comparing the post-game narrative interpretations survey results to the data collected on participants' in-game choices, the disparities between the results for the educator study were surprising. While the majority of educator participants did not make choices during the game that indicated they correctly appraised the NPC's racial microaggressions, the majority of educator participants agreed that the experience was racially discriminatory in the post-game survey. This could be due to a variety of reasons, ranging from gaining greater awareness of the nature of the experience in the time between gameplay and survey completion or participant response bias (i.e., participants inaccurately responding to the survey questions based on a desire to give what they perceived would be the "right" answer). Prior work using *Passage Home* found that, when participants were asked to play through the game twice, most would mirror their real-world identity in their first playthrough of the game, and then make in-game choices based on a desire to reach an ideal game outcome (rather than real-world identity mirroring) during the second playthrough [160]. In the present user studies, participants were instructed to play the game however they wanted, but could only play once. Therefore, a possible explanation for this disparity between the educators' in-game choices and post-game responses related to their appraisal of whether or not the encounter was racially discriminatory (i.e., a threat) could be that most of the educator participants decided to use an outcome-driven play strategy (rather than

real-world identity mirroring).

There were significant differences in the in-game choices made between the educator and youth study populations. While the majority of educator participants did not correctly appraise the racial microaggressions as threats during the game, the majority of youth participants did. Given that the majority of youth participants reported alertness to discrimination as their primary RES experience (whereas the majority of educators reported colorblindness and egalitarianism as their primary RES experience), this result is consistent with expectations, given that this socialization tends to result in the increased ability to appraise racialized encounters as threats. Surprisingly, a fewer number of educator participants correctly appraised the encounter as a racial threat when prompted a second time (after additional racial microaggressions had occurred). In contrast, a larger number of youth participants correctly appraised the encounter as a racial threat when prompted a second time. It is unclear what caused this decrease in appraising the encounter as a racial threat. Given that the majority of educator participants agreed the experience was racially discriminatory in the post-game narrative interpretations survey, this is an especially striking result. Next, there were notable differences in how educators and youth did or did not align their internal emotions with their external body language in the game. While the majority of educators aligned their emotions with expression, the majority of youth did not. Because the majority of educator participants either assessed the encounter as neutral or positive, aligning their external body language with their internal feelings (i.e., feeling unphased, which aligns with a neutral appraisal) would likely be associated with lower risk of negative repercussions, so this result is unsurprising. Almost every single educator participant decided to end the experience by being assertive toward the NPC, whereas 16.7% of youth participants decided to detach from the stressor at the end of the experience. This is likely explained by similar reasons to the differences in results for behavioral involvement, empathy, and sense of control (i.e., higher feelings of power imbalance, lower feelings of ability to self-advocate, higher desire to avoid conflict escalation). These reasons would be consistent with

the QDA results (reported in Section 5.5). Because of these feelings, youth participants may have felt more motivated to make choices that were associated with lower risk of escalating the conflict and avoiding negative repercussions with their educator, which would mirror societal expectations of the expectation of deference when students interact with their teachers. In contrast, educator participants may have felt more comfortable being assertive in their decision-making due to their similar social position to the NPC (i.e., both adults in the same vocation).

5.4 Inferential Statistics

This section presents the inferential statistics (i.e., analysis of variance tests, chi-square tests, correlation calculations) for the data collected using the validated instruments from the social sciences and measures related to the game. These statistics were conducted to better understand the relationships between participants' physical-world racial and ethnic socialization, identity development, and attitudes and their in- and post-game behaviors and experiences and answer RQ1.

5.4.1 Study 1: PreK-12 Educators

This section summarizes the results for the inferential statistics that were performed on the results from the educator study.

Effects of Game Condition. One-way analysis of variance (ANOVA) and chi-square tests were conducted to assess the effects of game condition (i.e., graphics or hypertext version) on participants' GEQ, PAR social typology survey, narrative interpretation survey, and educator reflections survey results for the educator study. The one-way ANOVA between game condition and narrative interpretation survey results found a statistically significant difference in response to the following statement: "The story in the experience is similar to situations that happen or could happen in real life," $F(1, 108) = 5.98$, $p = 0.016$. Participants who played the hypertext version of the game indicated a higher level of agreement with this statement ($M = 4.95$, SD

= 0.23) than participants who played the graphics version (M = 4.67, SD = 0.82). Aside from this result, game condition had no other statistically significant effects on the stated outcomes.

Effects of RES Experiences. Chi-square and one-way ANOVA tests were conducted to assess the effects of self-reported primary RES experiences while growing up on participants' GEQ, PAR social typology survey, in-game choices, narrative interpretation survey, and educator reflections survey results for the educator study.

The one-way ANOVA between the GEQ In-Game Module results and educator RES revealed statistically significant differences for competence, immersion, tension, and positive affect:

- **Competence:** There was a statistically significant difference between groups of participants with different primary RES experiences for competence ($F(3, 106) = 6.11$, $p = 0.001$). Tukey post hoc tests revealed that competence was statistically significantly higher for participants whose primary RES experience was Cultural Socialization (3.05 ± 0.93, $p = 0.002$) and Colorblindness and Egalitarianism (2.97 ± 0.97, $p = 0.001$) compared to those whose primary RES experience was Alertness to Discrimination (2.00 ± 1.18). There were no other statistically significant differences in competence between participants whose primary RES experience differed.

- **Immersion:** There was a statistically significant difference between groups of participants with different primary RES experiences for immersion ($F(3, 106) = 10.25$, $p < 0.001$). Tukey post hoc tests revealed that immersion was statistically significantly higher for participants whose primary RES experience was Cultural Socialization (3.57 ± 0.66, $p < 0.001$) and Colorblindness and Egalitarianism (3.61 ± 0.56, $p < 0.001$) compared to those whose primary RES experience was Alertness to Discrimination (2.83 ± 0.68). There were no other statistically significant differences in immersion between participants whose primary RES experience differed.

- **Tension:** There was a statistically significant difference between groups of participants with different primary RES experiences for tension ($F(3, 106) = 9.61$, $p < 0.001$). Tukey post hoc tests revealed that tension was statistically significantly lower for participants whose primary RES experience was Cultural Socialization (0.63 ± 0.87, $p = 0.002$) and Colorblindness and Egalitarianism (0.36 ± 0.80, $p < 0.001$) compared to those whose primary RES experience was Alertness to Discrimination (1.65 ± 1.42). There were no other statistically significant differences in tension between participants whose primary RES experience differed.

- **Positive Affect:** There was a statistically significant difference between groups of participants with different primary RES experiences for positive affect ($F(3, 106) = 11.08$, $p < 0.001$). Tukey post hoc tests revealed that positive affect was statistically significantly higher for participants whose primary RES experience was Cultural Socialization (2.82 ± 0.80, $p < 0.001$) and Colorblindness and Egalitarianism (2.74 ± 0.86, $p < 0.001$) compared to those whose primary RES experience was Alertness to Discrimination (1.52 ± 1.18). There were no other statistically significant differences in competence between participants whose primary RES experience differed.

The one-way ANOVA between the GEQ Social Presence Module results and educator RES revealed statistically significant differences for empathy, negative feelings, and behavioral involvement:

- **Empathy.** There was a statistically significant difference between groups of participants with different primary RES experiences for empathy ($F(3, 106) = 7.06$, $p < 0.001$). Tukey post hoc tests revealed that empathy was statistically significantly higher for participants whose primary RES experience was Cultural Socialization (1.44 ± 0.87, $p = 0.005$) and Colorblindness and Egalitarianism (1.55 ± 0.81, $p < 0.001$) compared to those whose primary RES experience was Alertness to Discrimination (0.67 ± 0.68). There were no other statis-

tically significant differences in empathy between participants whose primary RES experience differed.

- **Negative Feelings.** There was a statistically significant difference between groups of participants with different primary RES experiences for negative feelings ($F(3, 106) = 6.75$, $p < 0.001$). Tukey post hoc tests revealed that negative feelings were statistically significantly higher for participants whose primary RES experience was Colorblindness and Egalitarianism (1.41 ± 0.59, $p = 0.05$) and Promotion of Mistrust (0.60 ± 0.85, $p = 0.042$) compared to those whose primary RES experience was Alertness to Discrimination (1.81 ± 0.64). Tukey post hoc tests also revealed that negative feelings were statistically significantly higher for participants whose primary RES experience was Colorblindness and Egalitarianism (1.41 ± 0.59, $p = 0.004$) and Promotion of Mistrust (0.60 ± 0.85, $p = 0.022$) compared to those whose primary RES experience was Cultural Socialization (1.91 ± 0.63). There were no other statistically significant differences in negative feelings between participants whose primary RES experience differed.

- **Behavioral Involvement.** There was a statistically significant difference between groups of participants with different primary RES experiences for behavioral involvement ($F(3, 106) = 5.26$, $p = 0.002$). Tukey post hoc tests revealed that behavioral involvement was statistically significantly higher for participants whose primary RES experience was Cultural Socialization (2.77 ± 0.74, $p = 0.032$) and Colorblindness and Egalitarianism (2.81 ± 0.69, $p = 0.023$) compared to those whose primary RES experience was Promotion of Mistrust (1.33 ± 1.89). Tukey post hoc tests also revealed that behavioral involvement was statistically significantly lower for participants whose primary RES experience was Alertness Discrimination (2.31 ± 0.57, $p = 0.027$) and Promotion of Mistrust (1.33 ± 1.89, $p = 0.023$) compared to those whose primary RES experience was Colorblindness and Egalitarianism (2.81 ± 0.69). There were no other statistically significant differences in behavioral involvement between

participants whose primary RES experience differed.

The chi-square tests between PAR social typology survey results and educator RES revealed no statistically significant differences.

The chi-square tests between in-game choices and educator RES revealed no statistically significant differences.

The one-way ANOVA between the narrative interpretation survey results and educator RES revealed statistically significant differences in response to the following three statements:

- **How the NPC handled the situation.** There was a statistically significant difference between groups of participants with different primary RES experiences in level of agreement with the statement "Mrs. Smith handled the situation well throughout the experience" ($F(3, 106) = 3.16$, $p = 0.028$). Tukey post hoc tests revealed that level of agreement with this statement was statistically significantly higher for participants whose primary RES experience was Colorblindness and Egalitarianism (2.68 ± 1.30, $p = 0.017$) compared to those whose primary RES experience was Alertness to Discrimination (1.74 ± 1.05). There were no statistically significant differences in level of agreement with this statement between any other groups.

- **Unfair treatment of PC due to gender.** There was a statistically significant difference between groups of participants with different primary RES experiences in level of agreement with the statement "Tiffany was treated unfairly because she is a girl" ($F(3, 106) = 2.83$, $p = 0.042$). Tukey post hoc tests revealed that level of agreement with this statement was statistically significantly lower for participants whose primary RES experience was Colorblindness and Egalitarianism (1.72 ± 1.16, $p = 0.044$) compared to those whose primary RES experience was Alertness to Discrimination (2.48 ± 0.99). There were no statistically significant differences in level of agreement with this statement between

any other groups.

- **Unfair treatment of PC due to age.** There was a statistically significant difference between groups of participants with different primary RES experiences in level of agreement with the statement "Tiffany was treated unfairly because of her age" ($F(3, 106) = 4.83$, $p = 0.003$). Tukey post hoc tests revealed that level of agreement with this statement was statistically significantly lower for participants whose primary RES experience was Cultural Socialization (1.43 ± 0.96, $p = 0.003$) and Colorblindness and Egalitarianism (1.67 ± 1.06, $p = 0.011$) compared to those whose primary RES experience was Alertness to Discrimination (2.48 ± 1.08). There were no statistically significant differences in level of agreement with this statement between any other groups.

Correlations between MEIM and Game Assessment Results. Bivariate (Pearson) correlations were calculated to determine the relationships between the educators' MEIM results and their GEQ, narrative interpretation survey, and educator reflections survey results. Table 5.37 presents all of the Pearson correlation values between the educators' GEQ results and MEIM factor scores and Table 5.38 presents all of the Pearson correlation values between the educators' narrative interpretations survey results and MEIM factor scores. The statistically significant correlations are also further described below.

The results indicated moderate statistically significant correlations between the MEIM scores and the following GEQ results:

- Positive Affect, $r(108) = -.51$, $p < 0.01$ (commitment factor) and $r(108) = .45$, $p < 0.01$ (total factor)

- Immersion, $r(108) = .50$, $p < 0.01$ (commitment factor) and $r(108) = .38$, $p < 0.01$ (total factor)

- Competence, $r(108) = .49$, $p < 0.01$ (commitment factor) and $r(108) = .31$, $p < 0.01$ (total factor)

Table 5.37: Pearson correlation (r) values between the educators' GEQ results and MEIM factor scores. A double asterisk (**) means correlation is significant at the 0.01 level (2-tailed) and a single asterisk (*) means correlation is significant at the 0.05 level (2-tailed).

GEQ Component	MEIM Total Score	MEIM Exploration Factor Score	MEIM Commitment Factor Score
Competence	.31**	0.06	.49**
Immersion	.38**	0.16	.50**
Flow	0.14	0.06	0.19
Tension	-.38**	-.20*	-.47**
Challenge	-0.19	-0.11	-.22*
Negative Affect	-0.13	0.00	-.23*
Positive Affect	.45**	.29**	.51**
Empathy	0.16	0.02	.27**
Negative Feelings	-0.08	-0.05	-0.09
Behavioral Involvement	0.18	0.10	.23*

- Tension, $r(108)$ = -.47, p $<$ 0.01 (commitment factor) and $r(108)$ = -.38, p $<$ 0.01 (total factor)

The results indicated small yet statistically significant correlations between the MEIM scores and the following GEQ results:

- Positive Affect, $r(108)$ = .29, p $<$ 0.01 (exploration factor)
- Empathy, $r(108)$ = .27, p $<$ 0.01 (commitment factor)
- Behavioral Involvement, $r(108)$ = .23, p $<$ 0.05 (commitment factor)
- Negative Affect, $r(108)$ = -.23, p $<$ 0.05 (commitment factor)
- Challenge, $r(108)$ = -.22, p $<$ 0.05 (commitment factor)
- Tension, $r(108)$ = -.20, p $<$ 0.05 (exploration factor)

The results indicated moderate statistically significant correlations between the MEIM scores and the following narrative interpretations:

- "Tiffany handled the situation well throughout the experience," $r(108)$ = .38, p

< 0.01 (commitment factor) and $r(108) = .30$, $p < 0.01$ (total factor)

- "Tiffany was treated unfairly because of her age," $r(108) = -.36$, $p < 0.01$ (commitment factor) and $r(108) = -.31$, $p < 0.01$ (total factor)

- "Mrs. Smith handled the situation well throughout the experience," $r(108) = .35$, $p < 0.01$ (commitment factor)

The results indicated small yet statistically significant correlations between the MEIM scores and the following narrative interpretations:

- "Mrs. Smith handled the situation well throughout the experience," $r(108) = .29$, $p < 0.01$ (total factor)

- "Mrs. Smith treated Tiffany fairly," $r(108) = .26$, $p < 0.01$ (commitment factor)

- "Tiffany was treated unfairly because she is a girl," $r(108) = -.24$, $p < 0.05$ (commitment factor) and $r(108) = -.21$, $p < 0.05$ (total factor)

- "Tiffany ended the situation well," $r(108) = .23$, $p < 0.05$ (commitment factor)

There was a small yet statistically significant correlation between MEIM scores (for both the commitment and total factors) and the following response to the educator reflections survey:

- "The experience caused me to reflect on my own practices as an educator," $r(108) = .20$, $p < 0.05$ (both commitment and total factors)

There were no statistically significant correlations between the MEIM exploration factor scores and any of the narrative interpretations or educator reflections survey results.

Correlations between COBRAS and Game Assessment Results. Bivariate (Pearson) correlations were calculated to determine the relationships between the educators' COBRAS results and their GEQ, narrative interpretation survey, and ed-

Table 5.38: Pearson correlation (r) values between the educators' narrative interpretations survey results and MEIM factor scores. A double asterisk (**) means correlation is significant at the 0.01 level (2-tailed) and a single asterisk (*) means correlation is significant at the 0.05 level (2-tailed).

Narrative Interpretation	**MEIM Total Score**	**MEIM Exploration Factor Score**	**MEIM Commitment Factor Score**
Mrs. Smith treated Tiffany fairly.	0.19	0.07	.26**
Mrs. Smith handled the situation well throughout the experience.	.29**	0.18	.35**
Tiffany handled the situation well throughout the experience.	.30**	0.15	.38**
The story in the experience is similar to situations that happen or could happen in real life.	0.13	0.06	0.17
Mrs. Smith treated Tiffany unfairly.	-0.12	-0.04	-0.16
Tiffany ended the situation well.	0.14	0.02	.23*
The story in the experience showed discrimination.	-0.05	-0.05	-0.05
Tiffany was treated unfairly because of her race/ethnicity.	-0.05	-0.05	-0.04
Tiffany was treated unfairly because she is a girl.	-.21*	-0.13	-.24*
Tiffany was treated unfairly because of what neighborhood she comes from.	-0.11	-0.10	-0.10
Tiffany was treated unfairly because of her age.	-.31**	-0.18	-.36**
The experience caused me to consider a different perspective than I normally would.	.13	0.04	0.13
The experience caused me to reflect on my own practices as an educator.	.20*	0.10	0.20*

ucator reflections survey results. Table 5.39 presents all of the Pearson correlation values between the educators' GEQ results results and COBRAS factor scores and Table 5.40 presents all of the Pearson correlation values between the educators' narrative interpretations results, reflections survey results, and COBRAS factor scores. The statistically significant correlations are also described below, with the specific COBRAS factor for that correlation indicated alongside the r values using the following abbreviations: RP = Unawareness of Racial Privilege, ID = Unawareness of Institutional Discrimination, and BRI = Unawareness of Blatant Racial Issues.

The results indicated moderate statistically significant correlations between the COBRAS scores and the following GEQ results:

- Tension, $r(108) = -.50$, $p < 0.01$ (RP) and $r(108) = -.36$, $p < 0.01$ (BRI)
- Competence, $r(108) = .48$, $p < 0.01$ (RP) and $r(108) = .30$, $p < 0.01$ (BRI)
- Positive Affect, $r(108) = .46$, $p < 0.01$ (RP)

Table 5.39: Pearson correlation (r) values between the educators' GEQ results and COBRAS factor scores. A double asterisk (**) means correlation is significant at the 0.01 level (2-tailed) and a single asterisk (*) means correlation is significant at the 0.05 level (2-tailed).

GEQ Component	**Unawareness of Racial Privilege**	**Unawareness of Institutional Discrimination**	**Unawareness of Blatant Racial Issues**
Competence	.48**	.20*	.30**
Immersion	.45**	0.16	.23*
Flow	0.13	0.05	0.06
Tension	-.50**	-0.13	-.36**
Challenge	-.32**	-0.15	-.31**
Negative Affect	-0.10	0.05	0.02
Positive Affect	.46**	0.11	.24*
Empathy	.40**	.29**	.35**
Negative Feelings	-.19*	-0.11	-0.18
Behavioral Involvement	.39**	0.08	0.03

- Immersion, $r(108) = .45$, $p < 0.01$ (RP)
- Behavioral Involvement, $r(108) = .40$, $p < 0.01$ (RP) and $r(108) = .39$, $p < 0.01$ (RP)
- Empathy, $r(108) = .35$, $p < 0.01$ (BRI)
- Challenge, $r(108) = -.32$, $p < 0.01$ (RP) and $r(108) = -.31$, $p < 0.01$ (BRI)

The results indicated small yet statistically significant correlations between the COBRAS scores and the following GEQ results:

- Empathy, $r(108) = .29$, $p < 0.01$ (ID)
- Positive Affect, $r(108) = .24$, $p < 0.05$ (BRI)
- Immersion, $r(108) = .23$, $p < 0.05$ (BRI)
- Competence, $r(108) = .20$, $p < 0.05$ (ID)
- Negative Feelings, $r(108) = -.19$, $p < 0.05$ (RP)

The results indicated moderate statistically significant correlations between COBRAS

scores and the following narrative interpretations:

- "Tiffany was treated unfairly because of her age," $r(108) = -.50$, $p < 0.01$ (RP) and $r(108) = -.26$, $p < 0.01$ (BRI)
- "Mrs. Smith handled the situation well throughout the experience," $r(108) = .46$, $p < 0.01$ (RP) and $r(108) = .33$, $p < 0.01$ (BRI)
- "Mrs. Smith treated Tiffany fairly," $r(108) = .36$, $p < 0.01$ (RP) and $r(108) = .34$, $p < 0.01$ (ID)
- "Mrs. Smith treated Tiffany unfairly," $r(108) = -.34$, $p < 0.01$ (RP), $r(108) = -.39$, $p < 0.01$ (ID), and $r(108) = -.36$, $p < 0.01$ (BRI)
- "Tiffany was treated unfairly because she is a girl," $r(108) = -.33$, $p < 0.01$ (RP)

The results indicated small yet statistically significant correlations between COBRAS scores and the following narrative interpretations:

- "Mrs. Smith handled the situation well throughout the experience," $r(108) = .28$, $p < 0.01$ (ID)
- "Tiffany was treated unfairly because of her age," $r(108) = -.26$, $p < 0.01$ (BRI)
- "Mrs. Smith treated Tiffany fairly," $r(108) = .25$, $p < 0.01$ (BRI)
- "Tiffany handled the situation well throughout the experience," $r(108) = .21$, $p < 0.01$ (RP) and $r(108) = -.20$, $p < 0.01$ (ID)

The results indicated a moderate statistically significant correlation between COBRAS scores and both educator reflections survey question results:

- "The experience caused me to consider a different perspective than I normally would," $r(108) = .39$, $p < 0.01$ (RP)
- "The experience caused me to reflect on my own practices as an educator,"

Table 5.40: Pearson correlation (r) values between the educators' narrative interpretations results, reflections survey results, and COBRAS factor scores. A double asterisk (**) means correlation is significant at the 0.01 level (2-tailed) and a single asterisk (*) means correlation is significant at the 0.05 level (2-tailed).

Narrative Interpretation	**Unawareness of Racial Privilege**	**Unawareness of Institutional Discrimination**	**Unawareness of Blatant Racial Issues**
Mrs. Smith treated Tiffany fairly.	.36**	.34**	.25*
Mrs. Smith handled the situation well throughout the experience.	.46**	.28**	.33**
Tiffany handled the situation well throughout the experience.	.21*	-.20*	-0.08
The story in the experience is similar to situations that happen or could happen in real life.	0.02	0.11	0.00
Mrs. Smith treated Tiffany unfairly.	-.34**	-.39**	-.36**
Tiffany ended the situation well.	0.11	0.06	0.03
The story in the experience showed discrimination.	-0.04	-0.16	-0.13
Tiffany was treated unfairly because of her race/ethnicity.	-0.10	-0.12	-0.10
Tiffany was treated unfairly because she is a girl.	-.33**	0.04	-0.04
Tiffany was treated unfairly because of what neighborhood she comes from.	-0.16	-0.07	-0.04
Tiffany was treated unfairly because of her age.	-.50**	-0.18	-.26**
The experience caused me to consider a different perspective than I normally would.	.39**	0.17	0.15
The experience caused me to reflect on my own practices as an educator.	.33**	0.11	0.06

$r(108) = .33$, $p < 0.01$ (RP)

5.4.2 Study 2: U.S. Youth

This section summarizes the results for the inferential statistics that were performed on the results from the youth study.

Effects of Game Condition. One-way analysis of variance (ANOVA) and chi-square tests were conducted to assess the effects of game condition (i.e., graphics or hypertext version) on participants' GEQ, PAR social typology survey, narrative interpretation survey results for the youth study. The one-way ANOVA between GEQ results found a statistically significant difference for immersion $F(1, 58) = 4.50$, $p = 0.038$. Participants who played the graphics version of the game indicated a higher level of immersion ($M = 2.70$, $SD = 0.64$) than participants who played the hypertext version ($M = 2.33$, $SD = 0.70$). Aside from this result, game condition had no other statistically significant effects on the stated outcomes.

Effects of RES Experiences. Chi-square and one-way ANOVA tests were conducted to assess the effects of self-reported primary RES experiences while growing up on participants' GEQ, PAR social typology survey, in-game choices, and narrative interpretation survey results for the youth study.

The one-way ANOVA between the GEQ In-Game Module results and youth RES revealed statistically significant differences for immersion and negative affect:

- **Immersion:** There was a statistically significant difference between groups of participants with different primary RES experiences for immersion ($F(3, 56) = 3.04$, $p = 0.036$). Tukey post hoc tests revealed that immersion was statistically significantly higher for participants whose primary RES experience was Cultural Socialization (2.00 ± 0.83, $p = 0.033$) compared to those whose primary RES experience was Promotion of Mistrust (1.58 ± 0.20). There were no other statistically significant differences in immersion between participants whose primary RES experience differed.

- **Negative Affect:** There was a statistically significant difference between groups of participants with different primary RES experiences for negative affect ($F(3, 56) = 4.51$, $p = 0.007$). Tukey post hoc tests revealed that negative affect was statistically significantly higher for participants whose primary RES experience was Cultural Socialization (0.28 ± 0.44, $p = 0.009$) and Colorblindness and Egalitarianism (0.58 ± 0.90, $p = 0.025$) compared to those whose primary RES experience was Promotion of Mistrust (1.67 ± 0.52). There were no other statistically significant differences in negative affect between participants whose primary RES experience differed.

The one-way ANOVA between the GEQ Social Presence Module results and youth RES revealed no statistically significant differences.

The chi-square tests between PAR social typology survey results and youth RES revealed no statistically significant differences.

The chi-square tests between in-game choices and youth RES revealed no statistically significant differences.

The one-way ANOVA between the narrative interpretation survey results and youth RES revealed statistically significant differences in response to the following four statements:

- **How the PC handled the situation.** There was a statistically significant difference between groups of participants with different primary RES experiences in level of agreement with the statement "Tiffany handled the situation well throughout the experience" ($F(3, 56) = 6.31$, $p = 0.001$). Tukey post hoc tests revealed that level of agreement with this statement was statistically significantly higher for participants whose primary RES experience was Colorblindness and Egalitarianism (4.32 ± 0.75, $p = 0.001$) and Cultural Socialization (4.00 ± 0.71, $p = 0.03$) compared to those whose primary RES experience was Promotion of Mistrust (2.67 ± 0.82). Tukey post hoc tests also revealed that level of agreement with this statement was statistically significantly higher for participants whose primary RES experience was Colorblindness and Egalitarianism (4.26 ± 0.93, $p = 0.026$) compared to those whose primary RES experience was Alertness to Discrimination (3.62 ± 1.30). There were no statistically significant differences in level of agreement with this statement between any other groups.

- **How the PC ended the situation.** There was a statistically significant difference between groups of participants with different primary RES experiences in level of agreement with the statement "Tiffany ended the situation well" ($F(3, 56) = 3.85$, $p = 0.014$). Tukey post hoc tests revealed that level of agreement with this statement was statistically significantly higher for participants whose primary RES experience was Colorblindness and Egalitarianism (4.26 ± 0.93, $p = 0.011$) compared to those whose primary RES experience was Promotion of Mistrust (2.67 ± 0.52). There were no statistically significant differences in

level of agreement with this statement between any other groups.

- **Unfair treatment of PC due to gender.** There was a statistically significant difference between groups of participants with different primary RES experiences in level of agreement with the statement "Tiffany was treated unfairly because she is a girl" ($F(3, 56) = 4.35$, $p = 0.008$). Tukey post hoc tests revealed that level of agreement with this statement was statistically significantly higher for participants whose primary RES experience was Alertness to Discrimination (3.00 ± 0.75, $p = 0.007$) compared to those whose primary RES experience was Colorblindness and Egalitarianism (2.00 ± 1.29). There were no statistically significant differences in level of agreement with this statement between any other groups.

- **Unfair treatment of PC due to age.** There was a statistically significant difference between groups of participants with different primary RES experiences in level of agreement with the statement "Tiffany was treated unfairly because of her age" ($F(3, 56) = 4.46$, $p = 0.007$). Tukey post hoc tests revealed that level of agreement with this statement was statistically significantly higher for participants whose primary RES experience was Alertness to Discrimination (2.73 ± 0.83, $p = 0.007$) compared to those whose primary RES experience was Colorblindness and Egalitarianism (1.79 ± 0.98). There were no statistically significant differences in level of agreement with this statement between any other groups.

Correlations between MEIM and Game Assessment Results. Bivariate (Pearson) correlations were calculated to determine the relationships between youth MEIM results and their GEQ and narrative interpretation survey results. Table 5.41 presents all of the Pearson correlation values between the youths' GEQ results and MEIM factor scores and Table 5.42 presents all of the Pearson correlation values between the youths' narrative interpretations survey results and MEIM factor scores. The statistically significant correlations are also further described below.

The results indicated moderate statistically significant correlations between MEIM scores and the following GEQ results:

- Immersion, $r(58) = .60$, $p < 0.01$ (total score), $r(58) = .59$, $p < 0.01$ (commitment score), and $r(58) = .53$, $p < 0.01$ (exploration score)
- Competence, $r(58) = .44$, $p < 0.01$ (total score), $r(58) = .43$, $p < 0.01$ (commitment score), and $r(58) = .38$, $p < 0.01$ (exploration score)
- Negative Affect, $r(58) = -.37$, $p < 0.01$ (commitment score), $r(58) = -.36$, $p < 0.01$ (total score) and $r(58) = -.30$, $p < 0.01$ (exploration score)
- Positive Affect, $r(58) = .35$, $p < 0.05$ (commitment score) and $r(58) = .33$, $p < 0.05$ (total score)
- Challenge, $r(58) = .31$, $p < 0.05$ (total and exploration scores)

The results indicated small yet statistically significant correlations between MEIM scores and the following GEQ results:

- Challenge, $r(58) = .27$, $p < 0.05$ (commitment score)
- Flow, $r(58) = .26$, $p < 0.05$ (commitment score)

There were no statistically significant correlations between MEIM scores and GEQ Social Presence Module results.

The results indicated moderate to strong statistically significant correlations between MEIM scores and the following narrative interpretations:

- "The story in the experience is similar to situations that happen or could happen in real life," $r(58) = .46$, $p < 0.01$ (total score), $r(58) = .43$, $p < 0.01$ (commitment score), and $r(58) = .42$, $p < 0.01$ (exploration score),
- "Tiffany handled the situation well throughout the experience," $r(58) = .40$, $p < 0.01$ (total score), $r(58) = .39$, $p < 0.01$ (exploration score), and $r(58) = .37$,

Table 5.41: Pearson correlation (r) values between the youths' GEQ results and MEIM factor scores. A double asterisk (**) means correlation is significant at the 0.01 level (2-tailed) and a single asterisk (*) means correlation is significant at the 0.05 level (2-tailed).

GEQ Component	**MEIM Total Score**	**MEIM Exploration Factor Score**	**MEIM Commitment Factor Score**
Competence	.44**	.38**	.43**
Immersion	.60**	.53**	.59**
Flow	0.25	0.21	.26*
Tension	0.05	0.05	0.03
Challenge	.31*	.31*	.27*
Negative Affect	-.36**	-.30*	-.37**
Positive Affect	.33**	.26*	.35**
Empathy	-0.21	-0.24	-0.16
Negative Feelings	0.17	0.17	0.14
Behavioral Involvement	0.22	0.17	0.24

$p < 0.01$ (commitment score)

- "Tiffany ended the situation well," $r(58) = .35$, $p < 0.01$ (total score), $r(58) = .34$, $p < 0.01$ (exploration score), and $r(58) = .32$, $p < 0.01$ (commitment score),

- "The story in the experience showed discrimination ," $r(58) = .34$, $p < 0.01$ (commitment score) and $r(58) = .33$, $p < 0.01$ (total score)

- "Mrs. Smith handled the situation well throughout the experience," $r(58) = -.32$, $p < 0.05$ (total score) and $r(58) = -.30$, $p < 0.05$ (exploration score)

- "Tiffany was treated unfairly because of her race/ethnicity," $r(58) = .30$, $p < 0.05$ (total score)

The results indicated small yet statistically significant correlations between MEIM scores and the following narrative interpretations:

- "Mrs. Smith handled the situation well throughout the experience," $r(58) = -.29$, $p < 0.05$ (commitment score)

Table 5.42: Pearson correlation (r) values between the youths' narrative interpretations survey results and MEIM factor scores. A double asterisk (**) means correlation is significant at the 0.01 level (2-tailed) and a single asterisk (*) means correlation is significant at the 0.05 level (2-tailed).

Narrative Interpretation	**MEIM Total Score**	**MEIM Exploration Factor Score**	**MEIM Commitment Factor Score**
Mrs. Smith treated Tiffany fairly.	-0.14	-0.15	-0.12
Mrs. Smith handled the situation well throughout the experience.	-.32*	-.30*	-.29*
Tiffany handled the situation well throughout the experience.	.40**	.39**	.37**
The story in the experience is similar to situations that happen or could happen in real life.	.46**	.42**	.43**
Mrs. Smith treated Tiffany unfairly.	0.20	0.18	0.20
Tiffany ended the situation well.	.35**	.34**	.32*
The story in the experience showed discrimination.	.33**	.27*	.34**
Tiffany was treated unfairly because of her race/ethnicity.	.30*	.28*	.27*
Tiffany was treated unfairly because she is a girl.	-0.05	0.06	-0.14
Tiffany was treated unfairly because of what neighborhood she comes from.	-0.08	-0.07	-0.08
Tiffany was treated unfairly because of her age.	-0.07	0.02	-0.14

- "Tiffany was treated unfairly because of her race/ethnicity," $r(58) = .28$, $p < 0.05$ (exploration score) and $r(58) = .27$, $p < 0.05$ (commitment score)

- "The story in the experience showed discrimination ," $r(58) = .27$, $p < 0.05$ (exploration score)

Correlations between RSC-READY and Game Assessment Results. Bivariate (Pearson) correlations were calculated to determine the relationships between youth RSC-READY survey results and their GEQ and narrative interpretation survey results. Table 5.43 presents all of the Pearson correlation values between the youths' GEQ results and RSC-READY survey responses and Table 5.44 presents all of the Pearson correlation values between the youths' narrative interpretations survey results and RSC-READY survey responses. For brevity, only the strongest statistically significant correlations for each survey question are further described below. A shortened description of the corresponding survey question for that correlation is indicated alongside the r values.

The results indicated moderate statistically significant correlations between RSC-

READY survey results and the following GEQ results:

- Negative Affect, $r(58)$ = -.53, p < 0.01 (notice when negative racial encounters have occurred)
- Immersion, $r(58)$ = .47, p < 0.01 (engage rather than walk away)
- Empathy, $r(58)$ = -.44, p < 0.01 (speak up when peers are racially mistreated)
- Competence, $r(58)$ = .34, p < 0.01 (ask for help)
- Positive Affect, $r(58)$ = .33, p < 0.01 (ask for help)

The results indicated small yet statistically significant correlations between RSC-READY survey results and the following GEQ results:

- Behavioral Involvement, $r(58)$ = .27, p < 0.05 (notice when negative racial encounters have occurred)

The results indicated moderate statistically significant correlations between RSC-READY survey results and the following narrative interpretations:

- "Tiffany ended the situation well," $r(58)$ = .55, p < 0.01 (notice when negative racial encounters have occurred)
- "Tiffany handled the situation well throughout the experience," $r(58)$ = -.53, p < 0.01 (notice when negative racial encounters have occurred)
- "Tiffany was treated unfairly because of her age," $r(58)$ = -.53, p < 0.01 (notice when negative racial encounters have occurred)
- "The story in the experience showed discrimination," $r(58)$ = .52, p < 0.01 (notice when negative racial encounters have occurred)
- "Mrs. Smith handled the situation well throughout the experience," $r(58)$ = -.51, p < 0.01 (ask for help)

- "Mrs. Smith treated Tiffany unfairly," $r(58) = .48$, $p < 0.01$ (notice when negative racial encounters have occurred)
- "The story in the experience is similar to situations that happen or could happen in real life," $r(58) = .47$, $p < 0.01$ (notice when negative racial encounters have occurred)
- "Tiffany was treated unfairly because she is a girl," $r(58) = -.44$, $p < 0.01$ (notice when negative racial encounters have occurred)
- "Tiffany was treated unfairly because of her race/ethnicity," $r(58) = .40$, $p < 0.01$ (notice when negative racial encounters have occurred)

The results indicated small yet statistically significant correlations between RSC-READY survey results and the following narrative interpretations:

- "Mrs. Smith treated Tiffany fairly," $r(58) = -.28$, $p < 0.05$ (engage rather than walk away)

Table 5.43: Pearson correlation values between the youths' GEQ results and RSC-READY survey responses. A double asterisk (**) means correlation is significant at the 0.01 level (2-tailed) and a single asterisk (*) means correlation is significant at the 0.05 level (2-tailed).

GEQ Component	**How much does your parent / guardian(s) talk to you about racism and discrimination?**	**I believe I can share my emotions about my experiences of negative racial encounters**	**I believe I can speak up if I am racially mistreated by an authority figure (for example, a teacher or the police)**	**I believe I can speak up if I witness peers being racially mistreated**	**I believe I can engage rather than walk away from a negative racial encounter with another person**	**I believe I can notice when negative racial encounters have occurred**	**I believe I can ask for help when I am stressed from a negative racial encounter**
Competence	0.10	.27*	.32*	0.23	.28*	0.22	.34**
Immersion	.33**	.40**	.41**	.33**	.47**	0.19	.39**
Flow	0.22	-0.12	0.11	0.00	0.00	-0.19	-0.08
Tension	0.19	-0.03	-0.04	-0.05	0.14	-0.15	-0.12
Challenge	0.21	-0.12	0.14	0.00	0.13	0.05	0.22
Negative Affect	-.27*	-.43**	-.38**	-.46**	-0.25	-.53**	-.50**
Positive Affect	-0.04	0.20	0.25	0.17	0.22	.29*	.33**
Empathy	-0.17	-.36**	-0.22	-.44**	-.28*	-.34**	-.32*
Negative Feelings	-0.18	-0.20	-0.01	0.06	0.17	0.09	0.03
Behavioral Involvement	0.05	-0.04	0.11	0.08	0.16	.27*	0.15

Table 5.44: Pearson correlation values between the youths' narrative interpretations survey results and RSC-READY survey responses. A double asterisk (**) means correlation is significant at the 0.01 level (2-tailed) and a single asterisk (*) means correlation is significant at the 0.05 level (2-tailed).

Narrative Interpretation	How much does your parent/ guardian(s) talk to you about racism and discrimination?	I believe I can share my emotions about my experiences of negative racial encounters.	I believe I can speak up if I am racially mistreated by an authority figure (for example, a teacher or the police)	I believe I can speak up if I witness peers being racially mistreated	I believe I can engage rather than walk away from a negative racial encounter with another person.	I believe I can notice when negative racial encounters have occurred	I believe I can ask for help when I am stressed from a negative racial encounter
Mrs. Smith treated Tiffany fairly.	-0.11	-0.22	-0.20	-.26*	-.28*	-0.24	-0.22
Mrs. Smith handled the situation well throughout the experience.	-0.23	-.39**	-.36**	-.47**	-.42**	-.29*	-.51**
Tiffany handled the situation well throughout the experience.	0.23	.43**	.40**	.35**	.42**	.53**	.45**
The story in the experience is similar to situations that happen or could happen in real life.	0.23	0.25	.34**	.29*	.26*	.47**	.39**
Mrs. Smith treated Tiffany unfairly.	0.15	.32*	0.22	.32*	.35**	.48**	.36**
Tiffany ended the situation well.	0.14	.45**	.45**	.41**	.41**	.55**	.43**
The story in the experience showed discrimination.	0.01	.35**	.33*	0.21	.52**	.37**	.44**
Tiffany was treated unfairly because of her race/ethnicity.	0.06	.30*	.33**	.27*	.40**	.39**	.36**
Tiffany was treated unfairly because she is a girl.	0.11	-0.23	-0.18	-.35**	-.26*	-.44**	-.36**
Tiffany was treated unfairly because of what neighborhood she comes from.	.32*	-0.02	0.00	-0.04	0.01	-0.04	-0.18
Tiffany was treated unfairly because of her age.	0.09	-0.23	-0.04	-0.20	-0.14	-.53**	-0.23

5.4.3 Discussion of Overall Inferential Statistics Findings

Effects of Game Condition on Game Outcomes. It was unexpected that slightly less participants in the graphics condition for the educator study felt that the story was similar to real-world situations, but overall participants in both conditions generally agreed that it was. In contrast, it was unsurprising that participants would feel more immersion in the graphics condition than the hypertext condition (which was the case for the youth study, not the educator study), but unexpected that all other game outcomes would not be affected by game condition. These findings suggest that important outcomes (e.g., game experience, narrative interpretations, reflection, perspective-taking) from interventions using systems like *Passage Home* are not necessarily tied to the specific implementation of the game (e.g., graphics or hypertext). Rather, they appear to be connected to the underlying narrative content and structure (which were common to both versions), demonstrating that simulations can be impactful regardless of the specific technologies they are built with. **These findings suggest that, because both the hypertext and graphics versions of the game are structure-preserving mappings from the same specification space [81, 85], the underlying model (i.e., RECAST) was of more importance than the specific visual style of the game to the outcomes that were measured by these studies.** Consequently, simulation creators should consider the relative importance of representing race and ethnicity using graphics-based representations (e.g., simply giving the player a Black avatar) is a more important investment of resources than developing an underlying game engine informed by empirical social science research. It remains unclear why these specific outcomes (i.e., feeling that the story was similar to real life and level of immersion) were different between the educator and youth study groups. Possible explanations could be due to differences in social position and life experience (i.e., children vs. adults, students vs. teachers) and/or experience and familiarity regarding use and preferences of technology (e.g., Gen Z may be accustomed to game experiences which are more similar to the graphics version of the game), but there is insufficient evidence to argue either explanation

with certainty.

Effects of Participants' RES on Game Outcomes. While RES experiences did not have significant effects on the PAR results or in-game choices, it did have significant effects on the GEQ and narrative interpretations survey results. For GEQ results, it had a significant effect on immersion and affect (positive affect for educators, negative affect for youth) for both groups (and it affected competence and tension for the educator group). For the narrative interpretation results, it had a significant effect on how well participants felt the NPC and PC handled the situation and whether or not they believed the PC was treated unfairly due to her gender or age. **These results suggest that, although the players' RES may not significantly affect their identification with the PC or what choices they make in the game, it has remarkable effects on how they feel during the game, how they feel after the game, and the way they perceive and analyze the events and characters in the game.** This is extremely important to consider when designing interventions related to racial bias using interactive narratives, because an individual's socialization may hinder or assist them in correctly recognizing certain events as being racial in nature. An individual's RES has a significant role in their ability to perceive and understand when racial microaggressions occur; if an individual has not been socialized to be alert to discrimination, they may have difficulty in picking up more subtle forms of racism (like those featured in *Passage Home*). As further explained in Olson and Harrell 2020 [162], interactive narrative interventions should take individuals' RES into account if the intervention requires them to understand certain events as racialized to be effective.

Effects of Participants' Ethnic Identity Development on Game Experience. For both studies, there were numerous statistically significant correlations between participants' MEIM scores and their GEQ results. Based on the directions of the relationships (i.e., positive or negative correlations), it appeared that greater ethnic identity development promoted feelings of immersion, competence, and positive affect in the game while lower ethnic identity development resulted in greater ten-

sion and negative affect. This is unsurprising because research on ethnic identity development has observed that for individuals who have not explored their ethnic identity, being confronted with an event that forces them to reflect on their identity can be shocking and may even "temporarily [dislodge] the person from [their] old world view" [170], which could result in tension or negative feelings. There was only a significant correlation between MEIM scores and the GEQ Social Presence module results (specifically, positive correlations for empathy and behavioral involvement) for educators, not youth. Although it is unclear why ethnic identity was positively correlated to behavioral involvement, the positive correlation to empathy is not necessarily surprising. The majority of educators were white women and the significant correlations were only observed for the commitment factor of the MEIM, which is associated with a strong sense of belonging and positive feelings about part of one's ethnic group. **Therefore, participants who felt a stronger emotional attachment and positive feelings about being white (as indicated by their ethnic identity commitment scores) may have felt more empathy toward the NPC, who is white, which could have explained this relationship.**

Effects of Participants' Ethnic Identity Development on Narrative Interpretations. For youth participants, there was a positive correlation between MEIM scores (across both factors) and feeling that the PC was treated unfairly because of her race/ethnicity. Greater levels of ethnic identity development (both commitment and exploration) is associated with an increased awareness of how various ethnic minority groups are situated within the majority culture. Given that the majority of youth reported alertness to discrimination as their primary RES experience, their ethnic identity development may have overlapped with learning about the role of racial discrimination in their own and others' identity experiences.

Effects of Participants' Colorblind Racial Attitudes. COBRAS scores (which were associated with the educator study only) were significantly correlated with several narrative interpretation results. Specifically, higher levels of unawareness about racism-related topics (e.g., racial privilege, institutional discrimination, blatant racial

issues) were associated with participants feeling more strongly that the NPC treated the PC fairly and that the NPC handled the situation well. Similarly, unawareness of racism-related topics was also associated with lower levels of feeling that the NPC treated the PC unfairly. **It is unsurprising that participants with higher levels of unawareness about racial issues in society tended to feel that the racist accusations of the NPC were fair and unmotivated by her bias that Black students are incapable of high-quality writing.** The QDA results (reported in Section 5.5) support this notion, with many participants with high COBRAS scores (as compared to the mean scores in these studies) (1) refusing to entertain the possibility that the encounter could be racial in nature, (2) justifying the accusations based on the assumptions that students always try to cheat, and (3) generating a justification such as the PC not being up to the standards of the school (in spite of there being no evidence of these ideas in the game) for the teacher's accusations. Examples of each of these three kinds of responses are quoted below:

> (1) "There is nothing that explicitly says why the teacher is making these assumptions and what she means by 'there is no way someone like you could write this.' **For me to say it is because of [the PC's] race or gender is falling into me making assumptions about [the NPC] just because she is a white teacher that she is going to be racist towards me.**"
>
> — Age 23, White, Female
> Hometown and School Region: Midwest
> Primary RES Strategy: Alertness to Discrimination
> Game Version: Hypertext
> MEIM Total Score: 3.08, Developmental Score: 3.20, Commitment Score: 3.00
> Unawareness of RP: 19.00, ID: 27.00, BRI: 14.00

> (2) "I can see how this is a normal situation, as **students will always try and cheat.** In this instance, the student was the only Black student in the class. I thought it was interesting; maybe the teacher was being racist towards Tiffany, but the story didn't provide enough proof [...] **I just didn't feel the teacher was treating Tiffany badly because of her race.**"
>
> — Age 31, African American, Male
> Hometown and School Region: Midwest
> Primary RES Strategy: Colorblindness and Egalitarianism

Game Version: Hypertext
MEIM Total Score: 3.58, Developmental Score: 3.60, Commitment Score: 3.57
Unawareness of RP: 28.00, ID: 20.00, BRI: 19.00

(3) "I believe Tiffany is at a school where she is now the minority. She may feel different and isolated since it's a cultural shock. She could think she's being a target for racism and that is why her essay was not received well by her teacher but **my thought is she is not used to the standards of a top magnet school. This is a top honors English class [...] is it not [possible] to think her effort on the essay was not enough?**"

— Age 41, African American, Male
Hometown and School Region: Northeast
Primary RES Strategy: Colorblindness and Egalitarianism
Game Version: Graphics
MEIM Total Score: 3.25, Developmental Score: 3.00, Commitment Score: 3.43
Unawareness of RP: 36.00, ID: 19.00, BRI: 9.00

There were significant correlations between COBRAS scores and both of the educator reflection survey questions. This suggests that socializing agents who work with youth (namely, educators) who have a higher level of unawareness of racial issues may greatly benefit from the use of games as one tool within a more comprehensive intervention for reflection and perspective-taking about issues related to racial privilege, institutional discrimination, and prevalant racial issues in the contemporary U.S.

Effects of Youths' Socialization Experiences and Coping Skills. RSC-READY scores (which were associated with the youth study only) were significantly correlated with GEQ and narrative interpretations survey results. For the GEQ results, higher RSC-READY scores were positively correlated with immersion, competence, positive affect, and negative feelings (toward the NPC), and behavioral involvement. These results are unsurprising because higher RSC-READY scores indicate a higher level of self-efficacy when it comes to feeling prepared for dealing with DREs in the physical world, which these participants likely projected into their experience in the virtual world. Higher RSC-READY scores were negatively correlated with negative affect, which is also unsurprising given that the literature has observed that individuals with less socialization to be aware of racial bias tend to have more negative emotional out-

comes when confronted with DREs, which could explain this result. For the narrative interpretations, higher RSC-READY scores were positively correlated with feeling the PC handled and ended the situation well, the story was similar to real-world situations, the NPC treated the PC unfairly, and correctly recognizing that the PC was treated unfairly due to racial discrimination. Higher RSC-READY scores were negatively correlated with feeling that the NPC handled the situation well and treated the PC fairly, and that the PC was treated unfairly because of her age or gender. **The findings suggest that the youths' self-reported beliefs in their ability to notice when negative racial encounters have occurred did indeed result in a greater ability to recognize the unfair and racialized nature of the DRE in the game (rather than attribute it to other factors) and understand the skill needed to navigate the PC's threatening position during the interaction.** The next section concludes the chapter with the qualitative results from both studies.

5.5 Qualitative Data Analysis Results

This section presents the emergent themes resulting from an analysis of the qualitative data collected from both the educator and youth studies. The data was analyzed to better understand what details of the system design and narrative were salient to users, the evidence they used to appraise the DRE, and the strategies they used to make decisions during the experience. Descriptions of each theme that emerged consistently from analyzing the qualitative data from both groups are presented and characterized with example quotes from participants' survey responses.

5.5.1 Emergent Themes

Twelve themes emerged from the QDA performed on the qualitative survey data collected from both the educators and youth. These themes were:

1. Oblivious to covert discrimination

2. Minimization or denial of racism
3. Internalization or blame
4. Process of elimination
5. Alertness to discrimination
6. Cultural isolation and marginalization
7. Focus on interpersonal social norms
8. Problem-focused coping
9. Conflict avoidance
10. Preparation for bias and social support-seeking
11. Projection of personal experiences
12. Perspective-taking and reflection

Each theme is described and accompanied by representative quotes from both the educator and youth studies in Table 5.45.

Table 5.45: Emergent themes from qualitative survey responses. Each of the twelve themes is named, described, and accompanied by representative quotes from both the educator and youth studies.

Theme Name	**Theme Description**	**Example Educator Quotes**	**Example Youth Quotes**
Oblivious to Covert Discrimination	Due to the ambiguity of racial microaggressions, these responses focused on players' uncertainty regarding whether or not the interaction was racially-motivated or not. These responses mentioned race as a possible factor but mentioned a lack of overt racism, resulting in their lack of confidence in their assessment of the encounter. As a result, these responses reflected an inability to perceive covert racial discrimination.	"I think the story could have showed discrimination and Tiffany maybe being treated unfairly because of her race. I think this scenario also could have happened to a white student, if the teacher thought the writing was 'good enough.' I did not even consider it being because of her race, or any of the other traits listed. I simply thought maybe it was written that well." – Age 25, White, Female School Region: Midwest Primary RES Strategy: Colorblindness and Egalitarianism Game Version: Hypertext MEIM Total Score: 2.33, Developmental Score: 2.40, Commitment Score: 2.29 Unawareness of RP: 17.00, ID: 19.00, BRI: 14.00	"In the story everyone else is the same age, so that can't be a reason for discrimination. I have a slight hunch it was related to our race because that is the one variable that is 100% different than everyone else but we can't be sure for sure because there is no solid proof." – Age 14, White, Male Grade: 9 Hometown Region: Midwest Primary RES Strategy: Alertness to Discrimination Game Version: Graphics MEIM Total Score: 2.83, Developmental Score: 2.67, Commitment Score: 3.00

Table 5.45: Emergent themes from qualitative survey responses. Each of the twelve themes is named, described, and accompanied by representative quotes from both the educator and youth studies.

Theme Name	**Theme Description**	**Example Educator Quotes**	**Example Youth Quotes**
Minimization or denial of racism	These responses denied, minimized, or did not pick up on any cues leading to the possibility that race was a factor motivating the accusations. Some of these responses did acknowledge the racial nature of the remarks but minimized them or claimed this is no longer a big issue in society today. A subset of these responses contained vehement and defensive remarks rejecting any possibility of the interaction being about race. The majority of these responses were from educator participants.	"As a teacher with a mindset of "I will teach anyone of any background the same," It seemed as if the scenario was trying to make race the issue. While I saw that she was an African-American 9th grader at a Magnet School, race was not the first thing that came to my mind when the teacher stopped me. I believe in certain parts of the country, there is still a lot of bias towards people of different backgrounds and races, but as a younger teacher, it bothers me when a student/parent/administration assumes I have made a decision based on race and not based on an individual student's performance. It was only after I was seeing the options that I had to choose from that it became apparent the direction the story would be taking [...] I also believe that this type of situation does happen in real life, but I also believe the number of cases now are significantly lower than they were even 10 years ago." – Age 33, White, Male School Region: Midwest Primary RES Strategy: Alertness to Discrimination Game Version: Graphics MEIM Total Score: 2.75, Developmental Score: 2.80, Commitment Score: 2.71 Unawareness of RP: 13.00, ID: 11.00, BRI: 11.00	"Mrs. Smith was frustrating to work with in the simulation, though in real life I've dealt with teachers who have made similar mistakes before (mistaking another's work for my own, or being confused by something I had turned in). Therefore I didn't want to jump to conclusions, though the simulation seemed to want to focus heavily on race." – Age 16, White, Female Grade: 11 Hometown Region: Midwest Primary RES Strategy: Cultural Socialization Game Version: Hypertext MEIM Total Score: 2.33, Developmental Score: 2.33, Commitment Score: 2.33

Table 5.45: Emergent themes from qualitative survey responses. Each of the twelve themes is named, described, and accompanied by representative quotes from both the educator and youth studies.

Theme Name	**Theme Description**	**Example Educator Quotes**	**Example Youth Quotes**
Internalizing or blame	These responses assigned blame to the player character or described her from a deficit orientations for the accusations. Some players generated new ideas and/or backstories or justify the non-player character's behavior.	"Plagiarism is often too common for education these days. Some of the answers had me confused. Overall, I don't think race has anything to do whether a student cheats or not." – Age 31, White, Female School Region: South Primary RES Strategy: Colorblindness and Egalitarianism Game Version: Graphics MEIM Total Score: 3.67, Developmental Score: 3.20, Commitment Score: 4.00 Unawareness of RP: 35.00, ID: 23.00, BRI: 12.00	"I think that Tiffany should have reacted differently, in that she should have involved another teacher or adult in the conversation. (she attempted to do this with her parents, but I don't think she pushed for it strongly enough)" – Age 17, White, Male Grade: 11 Hometown Region: Northeast Primary RES Strategy: Colorblindness and Egalitarianism Game Version: Hypertext MEIM Total Score: 2.67, Developmental Score: 2.67, Commitment Score: 2.67

Table 5.45: Emergent themes from qualitative survey responses. Each of the twelve themes is named, described, and accompanied by representative quotes from both the educator and youth studies.

Theme Name	**Theme Description**	**Example Educator Quotes**	**Example Youth Quotes**
Process of elimination	These responses enumerated players' evaluations of the possible causes for the accusations, trying to isolate the potential individual and/or environmental variable(s) which could have resulted in the accusation. The majority of these responses concluded that the interaction was racially-charged.	"Mrs. Smith did not hold back any of the other students, which knocks out discrimination of age and gender as no other girls were held back. The primary reason for Mrs. Smith to hold her back because of discrimination is because of race because Tiffany is the only Black student in the school." – Age 20, White, Female School Region: Midwest Primary RES Strategy: Colorblindness and Egalitarianism Game Version: Hypertext MEIM Total Score: 2.58, Developmental Score: 2.60, Commitment Score: 2.57 Unawareness of RP: 18.00, ID: 12.00, BRI: 8.00	"Mrs. Smith couldn't have treated Tiffany unfairly because of her age or gender, because there were also other kids who were 9th graders, and other female students. The question about her neighborhood could possibly be a reason but I doubt it. The teacher definitely treated Tiffany unfairly because she was the only Black student, she was the only one who got pulled over, and she obviously worked hard on her essay." – Age 11.5, Multiracial, Male Grade: 11 Hometown Region: Northeast Primary RES Strategy: Cultural Socialization Game Version: Hypertext MEIM Total Score: 2.00, Developmental Score: 1.67, Commitment Score: 2.33

Table 5.45: Emergent themes from qualitative survey responses. Each of the twelve themes is named, described, and accompanied by representative quotes from both the educator and youth studies.

Theme Name	**Theme Description**	**Example Educator Quotes**	**Example Youth Quotes**
Alertness to discrimination	These responses indicated players' certainty that the interaction was racialized, reflecting a developed awareness of racial discrimination expressed through implicit racial remarks or microaggressions.	"[The teacher saying] 'I know your last school had culture issues' or something to that effect is coded language for 'you came from a non-white school so I don't trust how you act.'" – Age 26, White, Non-Binary School Region: Northeast Primary RES Strategy: Alertness to Discrimination Game Version: Graphics MEIM Total Score: 2.17, Developmental Score: 2.20, Commitment Score: 2.14 Unawareness of RP: 7.00, ID: 8.00, BRI: 6.00	"Tiffany was being treated unfairly because of her race. Just because she had done well on an essay and she was Black at an all white school, her teacher assumed the work she handed in was not hers. The teacher thought she had cut and pasted her essay instead of writing it herself, just because she was African American. She didn't believe a student of a different race could accomplish anything good." – Age 11, Multiracial, Female Grade: 6 Hometown Region: Not Shared (Lives in U.S.) Primary RES Strategy: Colorblindness and Egalitarianism Game Version: Hypertext MEIM Total Score: 3.17, Developmental Score: 3.33, Commitment Score: 3.00

Table 5.45: Emergent themes from qualitative survey responses. Each of the twelve themes is named, described, and accompanied by representative quotes from both the educator and youth studies.

Theme Name	**Theme Description**	**Example Educator Quotes**	**Example Youth Quotes**
Cultural isolation and marginalization	These responses focused on players' description of cues in the game which contributed to feelings of isolation and marginalization. This included but was not limited to the environmental microaggressions, being seated at the back of the class, being the only student of color. Some responses generated new ideas about the non player-character lacking cultural awareness about non-white authors, which could have contributed to the accusations.	"When I think [about] how Tiffany would [have] felt during the encounter I feel sad and unsettled. Tiffany is still adjusting to her new surroundings in a school environment that is very different then what she has been used to. It's fair to say Tiffany would [have] felt singled out because of her race and I can understand that. When Tiffany looks around her class she is surrounded by only white male author posters. It does not sound like Mrs. Smith is teaching much about Black Authors if she does not include one Black Author poster as well. There is no proof that Tiffany did anything wrong." – Age 33, White, Male School Region: West Primary RES Strategy: Colorblindness and Egalitarianism Game Version: Hypertext MEIM Total Score: 3.33, Developmental Score: 3.00, Commitment Score: 3.57 Unawareness of RP: 33.00, ID: 10.00, BRI: 6.00	"The teacher mentioned her cultural background as if that should have mattered in the situation. Tiffany being the only Black girl in the class was also the only child to be held after. Tiffany stood up for herself and was shamed upon for it." – Age 16, Multiracial, Female Grade: 10 Hometown Region: Northeast Primary RES Strategy: Alertness to Discrimination Game Version: Graphics MEIM Total Score: 3.00, Developmental Score: 2.67, Commitment Score: 3.33

Table 5.45: Emergent themes from qualitative survey responses. Each of the twelve themes is named, described, and accompanied by representative quotes from both the educator and youth studies.

Theme Name	**Theme Description**	**Example Educator Quotes**	**Example Youth Quotes**
Focus on interpersonal social norms	These responses were focused on the scenario at an interpersonal level through the lens of social norms, describing the non-player character's actions as unfair, unkind, rude, or some other negative descriptor (rather than bringing up systemic social issues at a macro-level).	"This teacher was totally rude and this poor girl is being taught how awful people in authority can be. She will likely become jaded, if she doesn't totally want to give up. The teacher should be reprimanded for treating a student this way. Without knowing this student, how does she know what she is capable of?" – Age 39, White, Female School Region: Midwest Primary RES Strategy: Colorblindness and Egalitarianism Game Version: Hypertext MEIM Total Score: 3.08, Developmental Score: 3.20, Commitment Score: 3.00 Unawareness of RP: 9.00, ID: 19.00, BRI: 7.00	"In the story the teacher was very unkind to Tiffany, I don't think that the unfair treatment is because of her race. [...] The experience made me realize [that I should] treat others nice because it can affect how they feel." – Age 14, White, Female Grade: 8 Hometown Region: Midwest Primary RES Strategy: Colorblindness and Egalitarianism Game Version: Hypertext MEIM Total Score: 2.00, Developmental Score: 2.00, Commitment Score: 2.00

Table 5.45: Emergent themes from qualitative survey responses. Each of the twelve themes is named, described, and accompanied by representative quotes from both the educator and youth studies.

Theme Name	**Theme Description**	**Example Educator Quotes**	**Example Youth Quotes**
Problem-focused coping	These responses were focused on the need to prove or disprove the non-player character's accusations and players' displeasure due to the lack of evidence presented during the encounter to justify the accusations. These responses emphasized a desire for the system to allow for a more agentic experience, feeling they didn't have the opportunity to adequately defend themselves.	"I don't think she was necessarily treated unfairly because of her age, race, sex, etc. I think Mrs. Smith went about the situation in [the] wrong way. She should have evidence before accusing someone of cheating. It was wrong of her to distrust Tiffany right off the bat, however, if she had reason to believe she was cheating, she should have looked further into it first." – Age 23, Multiracial, Female School Region: West Primary RES Strategy: Cultural Socialization Game Version: Hypertext MEIM Total Score: 3.83, Developmental Score: 3.60, Commitment Score: 4.00 Unawareness of RP: 26.00, ID: 20.00, BRI: 7.00	"I played dumb because that looked like the best course of action, because in life evidence is everything, and if you cant prove anything there's no point in making accusations." – Age 14, White, Male Grade: 9 Hometown Region: Midwest Primary RES Strategy: Alertness to Discrimination Game Version: Graphics MEIM Total Score: 2.83, Developmental Score: 2.67, Commitment Score: 3.00

Table 5.45: Emergent themes from qualitative survey responses. Each of the twelve themes is named, described, and accompanied by representative quotes from both the educator and youth studies.

Theme Name	**Theme Description**	**Example Educator Quotes**	**Example Youth Quotes**
Conflict avoidance	These players described a strategy of using submissive or conflict-avoidant behaviors to avoid escalation of the situation. Many of the youth participants' responses indicated a keen awareness of the player character's social risks and power imbalance with the non-player character. These players compromised expressing their internal emotions as a strategy for pursuing a favorable outcome.	"I chose to be as professional as possible because that's how I was taught to interact with adults. I wanted to get my point across, but be respectful about it since getting angry about it will only make matters worse." – Age 20, White, Male School Region: Midwest Primary RES Strategy: Alertness to Discrimination Game Version: Graphics MEIM Total Score: 2.50, Developmental Score: 2.20, Commitment Score: 2.71 Unawareness of RP: 24.00, ID: 21.00, BRI: 11.00	"I tried to make decisions that wouldn't escalate the situation, knowing that I was innocent and did nothing wrong." – Age 17, White, Male Grade: 11 Hometown Region: Northeast Primary RES Strategy: Colorblindness and Egalitarianism Game Version: Hypertext MEIM Total Score: 2.67, Developmental Score: 2.67, Commitment Score: 2.67

Table 5.45: Emergent themes from qualitative survey responses. Each of the twelve themes is named, described, and accompanied by representative quotes from both the educator and youth studies.

Theme Name	**Theme Description**	**Example Educator Quotes**	**Example Youth Quotes**
Preparation for bias and social support-seeking	These players described steadfastness in their desire to continue to stand their ground and advocate for themselves with an engagement coping style. For the players who mentioned racial discrimination, these responses reflected preparation for dealing with racial bias. Many of the youth participants described a desire to seek social support and advocacy from family or school personnel to deal with the situation.	"At first I approached the situation purely on confusion knowing how much I had worked on the assignment. I was sad that I was the only one being asked to stay after class and that my hard work was being ridiculed. I was then confused when I was told that I needed to tell her where the copy and pasting happened when I knew this was my original work. It was at that point that the color of my skin and how the teacher was talking made me understand the real reason I was being accused of this was due to my color and how the 'same type of people' in her class had (or wrongly accused) cheated in the past and that I was being lumped into one group instead of being addressed as an individual. I then decided that I would never be able to convince her on my own so I offered to set up a meeting with my parents to hopefully resolve the matter." – Age 33, White, Male School Region: Midwest Primary RES Strategy: Alertness to Discrimination Game Version: Graphics MEIM Total Score: 2.75, Developmental Score: 2.80, Commitment Score: 2.71 Unawareness of RP: 13.00, ID: 11.00, BRI: 11.00	"I ended the situation by getting my parents involved, so I could have a better chance at getting this situation resolved fairly" – Age 16, Asian, Female Grade: 10 Hometown Region: Midwest Primary RES Strategy: Alertness to Discrimination Game Version: Hypertext MEIM Total Score: 2.33, Developmental Score: 2.67, Commitment Score: 2.00

Table 5.45: Emergent themes from qualitative survey responses. Each of the twelve themes is named, described, and accompanied by representative quotes from both the educator and youth studies.

Theme Name	**Theme Description**	**Example Educator Quotes**	**Example Youth Quotes**
Projection of personal experiences	These players analyzed the experience through the lens of present-day social issues, prior experiences, or their observations of the experiences of people in their social network. The majority of these responses described the experience as being similar to situations and issues people deal with in everyday life.	"I felt like I vacillated between my "young adolescent self" identity and the identity I hold today as an adult educator with more then a decade of experience across various layers of intersecting diversity (racial, socio-economic, gender/sex, religious, language, family structure, etc.). Even the "younger version" of myself as an educator would have held different ideas, beliefs, and assumptions in this situation that only have changed with training, experience, and learning to name and validate to these experiences as a POC within various spaces." – Age 35, Multiracial, Female School Region: South Primary RES Strategy: Colorblindness and Egalitarianism Game Version: Graphics MEIM Total Score: 2.83, Developmental Score: 2.80, Commitment Score: 2.86 Unawareness of RP: 20.00, ID: 22.00, BRI: 8.00	"I felt really upset and angry because I am also a person of color, and knowing that this African American girl was being accused of cheating because of her race is unfair. I don't think you have the right as a teacher to judge and hate on your students based on race. I was also upset because she accused Tiffany that she copy and pasted without actually checking if she did. [...] I decided by what I was taught. Because as a person of two minorities, I know how to respond to a situation similar to this one." – Age 15, Multiracial, Female Grade: 9 Hometown Region: Midwest Primary RES Strategy: Alertness to Discrimination Game Version: Hypertext MEIM Total Score: 3.17, Developmental Score: 3.00, Commitment Score: 3.33

Table 5.45: Emergent themes from qualitative survey responses. Each of the twelve themes is named, described, and accompanied by representative quotes from both the educator and youth studies.

Theme Name	**Theme Description**	**Example Educator Quotes**	**Example Youth Quotes**
Perspective-taking and reflection	These players expressed their feelings that the experience was an effective tool for them to take on the perspective of the player character and described that their gameplay strategy was to respond as if they were in her shoes. Some felt that the tool was effective for prompting reflection on the larger societal issue of racial discrimination.	"The RPG-like format of the game was interesting in that it helps facilitate reflection and empathy from another perspective and in another set of circumstances. Knowing from the beginning that my character did not plagiarize in completing her work put me in a defensive state of mind when confronting the teacher (these emotions were not strong, this is just a game). I found myself thinking back on interactions I have had with my own students and the few times in which I have confronted my students for cheating. While deciding how to respond form the perspective of the innocent student, I was also paging through those memories in the back of mind and evaluating my own actions as a student teacher." – Age 30, White, Male School Region: Midwest Primary RES Strategy: Alertness to Discrimination Game Version: Graphics MEIM Total Score: 3.92, Developmental Score: 4.00, Commitment Score: 3.86 Unawareness of RP: 8.00, ID: 9.00, BRI: 6.00	"I am not very surprised [by] what happened, because I know that people of color do get treated very differently than other people. I think it is very upsetting. [...] I thought it was interesting to be in a situation that I had never been in before, and I was able to feel the way a person of color might feel in that situation." – Age 13, White, Female Grade: 7 Hometown Region: Northeast Primary RES Strategy: Alertness to Discrimination Game Version: Hypertext MEIM Total Score: 3.00, Developmental Score: 3.00, Commitment Score: 3.00

5.5.2 Discussion of Overall Qualitative Findings

The QDA results indicated that participants had a range of diverse attitudes toward the game events and characters and strategies for navigating the experience. These attitudes ranged from self-blame or blaming the PC for what happened, justifying or minimizing the impact of the NPC's racism, to recognizing the racialized nature of the encounter and applying adaptive coping techniques such as seeking social support. As a way to visualize these results, Figure 5-2 presents a plot that maps each theme along two dimensions: level of awareness regarding the racial microaggressions that occurred in the experience (with the X-axis ranging from low to high awareness) and coping orientation in response to the stressors (with the Y-axis ranging from internalizing to externalizing behaviors). Placement of a theme on top of an axis means that the theme was observed across a wide range of values for the perpendicular axis. For example, problem-focused coping was associated with a high level of problem externalization, but some participants who used this strategy who were completely oblivious to the racial nature of the experience and some who were aware of it. Being oblivious to covert discrimination indicated a high level of unawareness, but some participants who were oblivious externalized the stressor as the NPC's fault and some attributed it to a fault or mistake of the PC.

This visualization does not aim to assign precise quantitative values to these subjective, qualitative insights. Rather, it offers a strategy for organizing the insights along two dimensions that are relevant to individuals' appraisal and coping abilities when confronted with DREs. Although these themes could be mapped along a number of other dimensions, these two were selected for their relevance to the theoretical foundations of this dissertation and the focus of the qualitative survey questions. Many participant responses spanned multiple themes. Additionally, the location of a specific qualitative response within this two-dimensional space does not necessarily mean the participant themself generally had that corresponding level of awareness (or lack thereof) towards racial issues and that style of coping.

Creators of simulation experiences related to racism can use visualizations like this in a similar way to a user states and contexts diagram, which "is a user modelling tool for conceptualizing, designing, and evaluating the ability of a design to be consumed and operated by users in a wide range of states and contexts. That is, given a design or design idea, will users, in the most inclusive sense, be able to use it?" [178]. A given experience design could be analyzed from the perspectives of many different combinations of positions along these axes (or others, depending on the relevant topics or issues) and improved based on shortcomings the system may have for certain users. For instance, if an individual has a high level of unawareness toward covert discrimination and a high level of internalizing behaviors, how can a simulation be designed to guide them toward recognizing that what they are experiencing is in fact a racial microaggression, and that they are not to blame for it? It could also help to increase creators' awareness of the potential emotional or psychological impacts of the system on individuals. As another example, what might be the unintended consequences of going through a simulation featuring DREs for an individual who is highly unaware of how racial microaggressions manifest in social interactions? The quantitative results (reported earlier in the chapter) provide numerous examples of how ethnic identity development, racial attitudes, and RES significantly impacted game experience outcomes, which can serve as a starting point for theorizing potential impacts. Simulation creators must keep their intended goals in mind when designing for the diversity of participants' backgrounds when it comes to these factors.

This chapter has presented the quantitative and qualitative results collected about participants' RES, ethnic identity development, and racial attitudes as well as their game experiences, reflections, narrative interpretations, and player-avatar relationships for two versions of the *Passage Home* interactive narrative game. The next chapter presents reflections on these findings, their implications for future research based on the insights gleaned from these studies, and concludes with final remarks on these contributions.

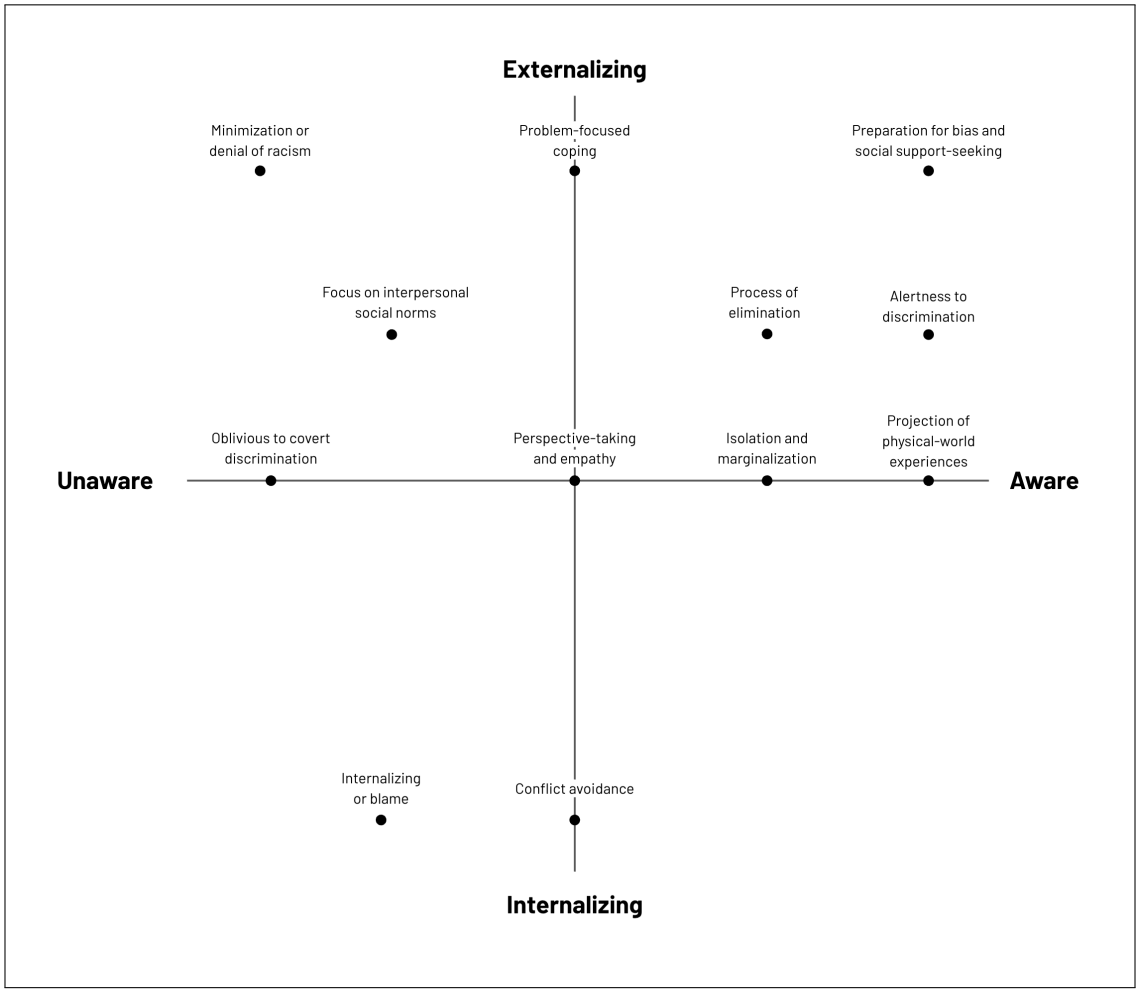


Fig. 5-2: A plot that maps each emergent theme from QDA along two dimensions: level of awareness regarding the racial microaggressions that occurred in the experience (with the X-axis ranging from low to high awareness) and coping orientation in response to the stressors (with the Y-axis ranging from internalizing to externalizing behaviors). Placement of a theme on top of an axis means that the theme was observed across a wide range of values for the perpendicular axis. This is not a quantitative result but rather serves as a tool for understanding the relationships between the various qualitative themes.

Chapter 6

Design Framework

This chapter presents a novel design framework that aids in the analysis of existing and generation of new racial and ethnic identity representations for computational simulations to answer **RQ2: How can racial and ethnic socialization strategies be operationalized to represent racial and ethnic identity in simulations?**

6.1 Framework Purpose

In addition to an individual's family, school, and peers, **media** (including videogames, VR systems, and other computational simulations) are also powerful agents of socialization that affect the race-related beliefs, values, and attitudes one acquires [76]. In 2008, Everett and Watkins introduced the term *racialized pedagogical zones* (RPZs) to describe how videogames reflect, influence, reproduce, and teach dominant attitudes and assumptions about race and racial otherness [57]. Their important contribution revealed how players learn racial narratives, representations, and belief systems from videogames which draw upon mainstream racist discourses. Because RPZs in computational simulations *teach* ideologies of race, they are influential sources of RES messages which influence the racial and ethnic identity development of their users. The goal of this design framework is to provide researchers and practitioners with

a reflective design tool [191] to reveal the RES practices reflected by the racial and ethnic identity representations in their simulations. Given the body of empirical research on the relationships between RES and individual outcomes (e.g., self-esteem, cognitive, behavioral, and achievement outcomes), an awareness of the RES practices enacted by these representations could be used to better understand their potential effects on users. The findings from the *Passage Home* user studies (further detailed in Chapter 5) revealed that players project their physical-world identities (i.e., racial and ethnic socialization, ethnic identity development, and racial attitudes) into the simulation world. Computational simulations also socialize the user with the RES practices embedded in their designs. Figure 6-1 provides a visual representation of this bidirectional process. These systems exist within a *sociodata ecology*, which describes how the "technical infrastructure, specific data-structures and algorithms, and specific code" interacts with social issues "such as embodied experiences, subjective interpretation, power relationships, and cultural values" [96].

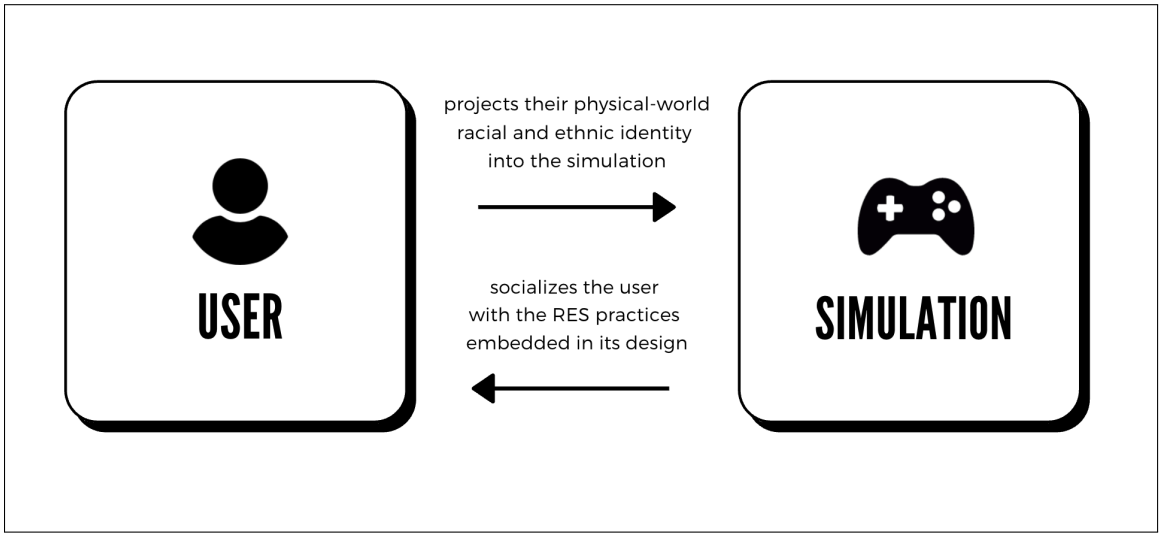


Fig. 6-1: Building on Harrell's concept of blended identity [96], a diagram revealing how players project their physical-world identities (i.e., racial and ethnic socialization, ethnic identity development, and racial attitudes) into the simulation, and the simulation acts as a socializing agent for the user using the RES practices embedded into its design.

6.2 Framework Structure

The structure for this framework was inspired by computer science scholar Batya Friedman's *Envisioning Cards*, "a versatile toolkit for attending to human values during design processes" which "are built upon a set of four envisioning criteria: stakeholders, time, values, and pervasiveness" [62]. Each card in Friedman's toolkit "shows the envisioning criterion, elaborates on the theme, and provides a focused design activity" to aid in many design processes (e.g., "ideation, co-design, heuristic evaluation, critique, and more") [62]. This design framework is organized using the four themes that have emerged most frequently in empirical research on RES in the U.S. [113] (further detailed in Chapter 2 Section 2.3.2) which are:

- **Cultural Endorsement of the Mainstream** (encompassing the themes referred to as *egalitarianism*, *colorblindness*, *color-muteness*, and *silence about race* which avoid confronting topics related to race and promote the idea that equality can be attained through individual character traits like hard work without attention to racial barriers)
- **Promotion of Mistrust** (also referred to as *cultural mistrust*, emphasizing wariness and caution about other groups)
- **Alertness to Discrimination and Preparation for Bias** (which encompass two themes focused on developing awareness of and preparation for the prejudice and discrimination that occur in a racialized world)
- **Cultural Pride and Legacy Appreciation** (also referred to as *cultural socialization*, *cultural pride reinforcement*, *cultural legacy appreciation*, and *integrative/assertive socialization* which promote ethnic pride by transferring knowledge about cultural values, history, and heritage)

Using each of these four themes as a lens, each of the following four macro-level simulation components are examined:

- **Environments**: the audio, visuals, spatial design, world maps, and other assets
- **Player Characters (PCs)**: the appearance, dialogue, interactions, backstories, and

other relevant features of the PCs

- **Non-Player Characters (NPCs)**: the appearance, dialogue, interactions, backstories, and other relevant features of the NPCs

- **Content Structures**: structural elements of the system including but not limited to narratives, rules, mechanics, and achievement structures

The upshot is a framework featuring sixteen strategies for describing and creating racial and ethnic identity representation in computational simulations, which are visually organized in Figure 6-2.

This framework applies Harrell's concept of *critical computing* [95], a developing practice that "refers to the potential for using algorithmic processing and data structuring as a basis for expressing commentary about, and making impactful change upon, the real world – especially to engage disempowering hegemonic norms and socio-technical conditions" [96]. Critical computing is related to, but distinct from, critical technical practices (CTP; further described in Chapter 2 Section 2.1.1). CTP is enabled by methods such as *reflective design* which helps practitioners to "analyze what practices and values are marginalized in HCI practice" [191]. The next section presents a novel, critical computing framework for creating racial and ethnic identity representations.

6.3 A Critical Computing Framework

First, I argue that the dominant metaphors used in the design and implementation of existing racial and ethnic identity representations in computational simulations are shaped by the following two RES practices: (1) *cultural endorsement of the mainstream* and (2) *promotion of mistrust*. Through systematic evaluations of the culture and industry of videogames, critical media scholars have found that portrayals of racial and ethnic groups who have historically been marginalized and oppressed often use "familiar racial and ethnic stereotypes" [57]. For example, "Black and Latino characters [are] often restricted to athletic, violent, and victim roles, or rendered en-

tirely invisible" [79, 57]. Existing racial and ethnic representations often reflect these two RES practices by (1) orienting users toward "developing skills and characteristics needed to thrive in settings that are part of the mainstream, or dominant, culture" and (2) communicate cautions and warnings about the undesirable characteristics of marginalized racial and ethnic groups using familiar racial and ethnic stereotypes [113]. It is important to note that these practices can be applied as intentional design strategies in systems whose primary purpose is to educate users about various forms of racial and ethnic discrimination. However, when unconsciously built into systems, they can result in harmful effects that reinforce hegemonic whiteness (a structure of power relations that maintains the white superiority myth and rationalizes the marginalization and oppression of non-white cultures).

Second, I argue that to shift these representational strategies in a direction that resists mainstream racist discourses, the following two RES practices can be used: (1) *alertness to discrimination and preparation for bias* and (2) *cultural pride and legacy appreciation*. Rather than reinforcing the harmful racist stereotypes and prejudices that are prevalent in society, racial and ethnic identity representations can be designed using strategies that (1) raise users' consciousness about the racial barriers that exist in society while also potentially providing coping skills, and (2) educates users about the cultural practices, knowledge, and traditions of portrayed racial and ethnic groups in a way that promotes the pride and self-esteem of individuals within those groups [113]. By creating representations using these two practices, computational media can serve as tools for resistance that support, rather than continue to harm, historically oppressed racial and ethnic groups.

Mapping the RES practices onto each of the four macro-level simulation components, the following tools are presented for each of the design strategies:

- Pre-design phase processes associated with an intent to apply that RES practice
- Prompts for reflections scrutinizing how that simulation component may use that RES practice

- Examples of existing computational simulations that demonstrate that RES practice
- Potential consequences[1] of using that RES practice on users' real-world outcomes, theorized based on empirical findings on how RES influences individuals' well-being and development [113]

[1]Note that the potential consequences presented in this framework are definitive, nor does it provide an exhaustive list. Rather, they are used to illustrate how RES strategies employed in virtual experiences could impact players' physical-world outcomes, underscoring the importance of conscious and intentional decision-making in the design process.

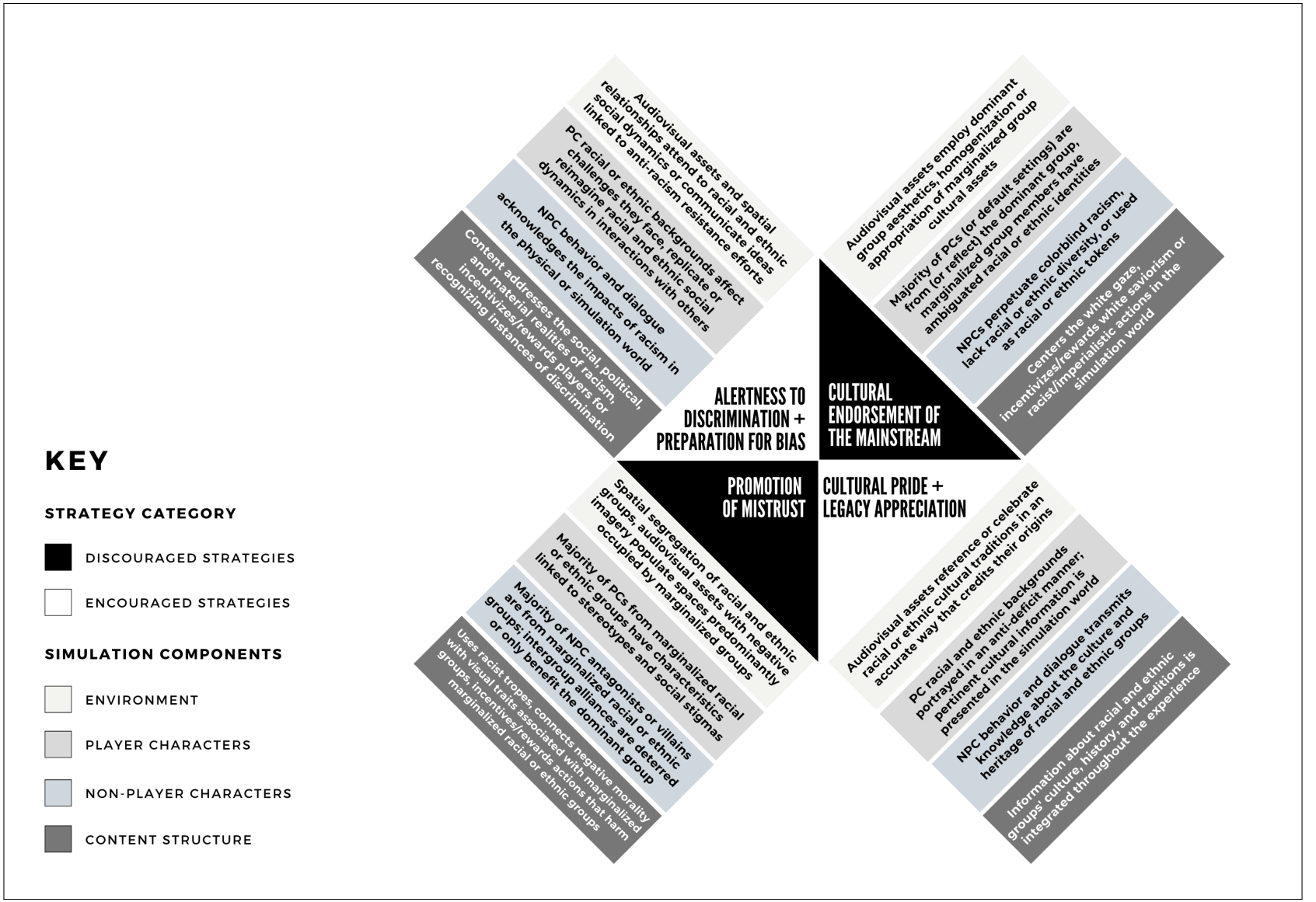


Fig. 6-2: A design framework for analyzing RES strategies employed in computational simulations.

6.4 Discouraged Strategies

The representational design strategies presented in this section apply the RES practices of *cultural endorsement of the mainstream* and *promotion of mistrust*, which typically result in representations that cause further harm to marginalized racial and ethnic groups and reinforce the status quo.

6.4.1 Cultural Endorsement of the Mainstream

When instantiated as a strategy for computational simulation design, cultural endorsement of the mainstream can be enacted through environments, PCs, NPCs, and content structures that reflect or reinforce the mainstream, or dominant, culture.

Pre-Design Phase

The following activities reflect designs that reinforce cultural endorsement of the mainstream as a practice. Since this is a discouraged strategy that promotes harmful racial ideologies, the recommendation is to *avoid* the following activities:

- Gather assets that center aesthetics of the dominant racial or ethnic group or were made only by creators from the dominant racial or ethnic group
- Hire only (or mostly) designers and developers from the dominant racial or ethnic group to work on the development team
- Use the norms of social systems that have been historically controlled by the dominant racial or ethnic group or exclusionary towards marginalized racial or ethnic groups to inform the simulation design

Environment

Cultural endorsement of the mainstream can be enacted as an environmental design strategy by creating visuals, audio, world maps, and other environmental assets that reflect or reinforce the mainstream, or dominant, culture.

- **Prompt for Reflection:** Do the visuals, audio, world maps, or other assets homogenize or appropriate elements from distinct cultural traditions? Do they feature environmental racial microaggressions?[2]

- **Example:** In the videogame *Fair Play*, "players assume the role of a Black graduate student named Jamal Davis [and] experience subtle race bias while completing 'quests' to obtain a science degree" [89]. While Jamal is on campus at his predominantly white university, he walks past a wall displaying the headshots of faculty who are all white males, as shown in Figure 6-3. This is an example of an environmental microaggression, as it makes apparent the systemic lack of racial diversity amongst university faculty members.

  In *Call Of Duty: Modern Warfare* [4], there is a lack of cultural accuracy in environmental visuals associated with the geographic context. Figure 6-4 shows a screenshot from the game in which the letters do not link properly on a poster displaying Arabic text. Game critics have also pointed out that the game features a map of Karachi (the largest city in Pakistan) that "inaccurately has signs in both Urdu, Pakistan's official language, and Arabic" [131]. This is an example of how cultural assets can be appropriated for use as backdrops in games without attention to cultural specificity or accuracy.

- **Potential Consequence:** This strategy could lead players from marginalized racial or ethnic groups to feel as though they do not belong in a virtual space. In an educational videogame, this could result in a reduction of the overall time spent in the simulation, number of learning modules completed, and decreased player performance.

Player Characters

Cultural endorsement of the mainstream can be enacted as a PC design strategy by creating PCs whose appearance, dialogue, interactions, backstories, and other relevant

[2]For details on *racial microaggressions*, see Chapter 2 Section 2.3.1.

Fig. 6-3: A screenshot taken from the videogame *Fair Play* [89] in which Jamal, the player character, walks past a wall displaying the headshots of faculty who are all white males.

characteristics reflect or reinforce the mainstream, or dominant, culture.

- **Prompt for Reflection:** Do the appearance, dialogue, interactions, backstories, or other features of the player character default or conform to the norms of the dominant racial or ethnic group? Do they ambiguate the race or ethnicity of non-white representations?

- **Example:** *This Land is My Land* is a stealth action videogame in which players "experience the journey of a chief of a small Native American tribe resisting the changing world" [128], as shown in Figure 6-5. Created by Game Labs, a studio that has released numerous historically-themed videogames (e.g., Ultimate General: Civil War, Naval Action, Ultimate General: Gettysburg [66]), the game centers an Indigenous protagonist yet makes "no reference to any specific tribe or time period" [221]. Critics of the game called out "its stereotypical, Karl May inspired portrayal of indigenous peoples as a homogenous people rather

Fig. 6-4: A screenshot taken from the videogame *Call of Duty: Modern Warfare* [4] of a poster displaying Arabic text under a fist symbol. In his review of the videogame, journalist Ahmed Ali Akbar discusses its lack of cultural accuracy, pointing out that "the Arabic doesn't link properly" which he says would be similar to "if an Arab sitcom had English sentences on a sign and there were absolutely no spaces between the letters" [9].

than a varied group of peoples with different cultures" and the game developers wrongfully "profiting off of [Indigenous] cultures without consulting any Indigenous people beforehand" [221]. In April 2021, the game developers responded to this criticism over social media by posting the following tweet, which has since been deleted from their page: "Though we have no indigenous people in our development team, we have some in our community, and we are always open to feedback to improve our game. We have researched our projects for years before making them known and respected for making historical-based games on Steam" [211].

Videogame protagonists who are non-white are often light-skinned, mixed-race, or racially ambiguous, as shown in Figure 6-6, a pattern that has been critiqued for continuing to reinforce Eurocentric beauty myths by picking and choosing which "desirable" visual traits associated with marginalized racial and ethnic groups to exaggerate and which "undesirable" visual traits to lessen. Protag-

onists Alyx Vance in *Half-Life 2* [215] and Clementine in *The Walking Dead: Season Two* and *The Walking Dead: Season Four* [71] are both half Asian and half African American. The race and ethnicity of Jade, the protagonist in *Beyond Good and Evil* [212], is unclear and has been heavily debated by players and game critics [123].

- **Potential Consequence:** This strategy could reinforce dominant cultural myths about racial and ethnic groups that have contributed to their historical oppression. For players who belong to these racial or ethnic groups, this could cause feelings of erasure, derision, devaluation, rejection and result in depressive symptoms.

Fig. 6-5: A screenshot from *This Land is My Land* [128] a stealth action videogame that "[lets] you experience the journey of a chief of a small Native American tribe resisting the changing world" [128] and was created by a team with no Indigenous developers.

Non-Player Characters

Cultural endorsement of the mainstream can be enacted as an NPC design strategy by creating NPCs whose appearance, dialogue, interactions, backstories, and other relevant characteristics reflect or reinforce the mainstream, or dominant, culture.

- **Prompt for Reflection:** Do the appearance, dialogue, interactions, backstories, or other features of the NPCs lack diverse racial or ethnic representation,

Fig. 6-6: Images of protagonists Alyx Vance from *Half-Life 2* [215], Clementine from *The Walking Dead* [71], and Jade from *Beyond Good and Evil* [212]. All three protagonists are light-skinned with racially ambiguous features [205, 220, 77].

use NPCs from marginalized racial or ethnic groups as racial tokens[3], or perpetuate colorblind racism by pretending that race and ethnicity does not matter when racism or ethnicity-based bias occurs or is referenced?

- **Example:** *Red Dead Redemption 2* [70] takes place in America in the year 1899. In many ways, the game does not ignore racism (and therefore does not reflect this strategy). In fact, it features artifacts reflecting the historical realities of that era. For example, the player may encounter an enslaver's holding pen, discover an old newspaper clipping featuring a wanted ad for the capture and return of a runaway enslaved person, or run into outlaw gang members wearing Confederate uniforms.

  However, a three-minute YouTube video clip of the game called "What Happens If You Bring Black Man To KKK?" [192] demonstrates a boundary of the game with regards to how it ignores race as a meaningful attribute when a Black

[3] *Tokenism* is defined as "the practice of making only a perfunctory or symbolic effort to do a particular thing, especially by recruiting a small number of people from underrepresented groups in order to give the appearance of sexual or racial equality" [158, 119]. Racial tokens are "often treated as representatives of their category, as symbols rather than individuals" [116], pressured to assimilate or blend into the dominant group's culture, and "invariably relegated to a degrading stereotyped, caricatured role" [158, 116].

Fig. 6-7: A screenshot from a YouTube video called "What Happens If You Bring Black Man To KKK?" [192] featuring a scene from *Red Dead Redemption 2* [70].

man is taken into a scene with cross-burning Klansmen. Figure 6-7 shows a screenshot from the video, which was published in 2018 and has since been viewed over 9 million times. A 2019 article about the video noted that "the top comment on the footage [at the time], which has 11,000 upvotes, bemoans that Rockstar didn't account for a player forcing a Black man and a KKK member to meet," and posed the question of whether or not this type of possibility should exist in a game [108]. This boundary condition (regardless of why it exists) is a notable example of how this strategy manifests in a game that otherwise does not ignore race as a meaningful aspect of players' identities.

- **Potential Consequence:** For some players, this strategy could serve a protective function by insulating them from graphic images of violence which may prompt traumatic memories. For others, this strategy could contribute to reducing the horrors and injustices of racism to a cosmetic or narrative backdrop, which is a common theme identified by Harrell et. al (2021) [103] in videogames representing avatars of the African diaspora. By presenting this kind of imagery without any supports in place for psychological or emotional processing, this could result in increased feelings of bewilderment, depression, and anxiety.

Content Structures

Cultural endorsement of the mainstream can be enacted as a content structure design strategy by creating narratives, mechanics, or achievement systems that reflect or reinforce the mainstream, or dominant, culture.

- **Prompt for Reflection:** Do the narratives, themes, mechanics, achievement systems or other features of the content structure center the white gaze[4], reinforce white savior narratives[5], or reward player behavior that abets racism or imperialism?

- **Example:** In *Metal Gear Solid V: the Phantom Pain* [124], the protagonist Punished "Venom" Snake is a lieutenant and former combat medic. Venom Snake, a white American, travels to the Angola-Zaire border region of central Africa where he begins taking missions. The game features a hidden game mechanic called "Demon Points" which "are increased for immoral actions and decreased for moral ones" [219]. Demon Points cause the PC's appearance to change (e.g., if a user reaches a high number of Demon Points, Venom Snake will grow horns and appear covered in blood). For example, the player can remove 240 Demon Points for extracting a child soldier [219]. Figure 6-8 shows Venom Snake returning a squad of child soldiers who were captured while fighting in the Angola-Zaire border region to the operations base for an American-founded private military company. This mechanic reflects this strategy, rewarding the player for performing actions associated with the *white savior narrative*.

- **Potential Consequence:** This strategy could promote the myth of white superiority, reinforcing the positioning of white people as messianic figures and

[4]The *white gaze* refers to representations that center white ethnocentrism and assume the audience, user, or player is white. Representations of marginalized racial and ethnic groups constructed for the white gaze often result in "controlling images" that "[construct] the Black body into [their] own colonial imaginary" [87] (e.g., representing Black women with "controlling imagery, such as the mammy, jezebel, matriarch, and welfare queen").

[5]The *white savior narrative* describes a self-serving liberal humanist vision in which white people "believe they can and/or must save disadvantaged people, often Brown and Black" and "parachute into communities of color that they deem need saving" [186, 190].

Fig. 6-8: In *Metal Gear Solid V: the Phantom Pain* [124], the protagonist Punished "Venom" Snake can remove Demon Points for moral actions such as extracting child soldiers [219].

people of color as inferior and in need of white stewardship. This could result in increased bias in the hiring and promotion of people of color into leadership positions.

6.4.2 Promotion of Mistrust

When instantiated as a strategy for computational simulation design, promotion of mistrust can be enacted through environments, PCs, NPCs, and content structures that signal caution and wariness about other racial or ethnic groups.

Pre-Design Phase

The following activities reflect designs that reinforce promotion of mistrust as a practice. Since this is a discouraged strategy that promotes harmful racial ideologies, the recommendation is to *avoid* the following activities:

- Reference prevalent negative social stigmas and stereotypes associated with the racial or ethnic group being portrayed by the simulation
- Hire only (or mostly) designers and developers who do not belong to the racial or ethnic group(s) being portrayed in the simulation

- Use common tropes used by mainstream media when discussing and representing marginalized racial or ethnic groups to inform the simulation design

- Use information authored by people or communities that have historically contributed to the marginalization and oppression of the racial or ethnic group(s) being portrayed in the simulation

Environment

Promotion of mistrust can be enacted as an environmental design strategy by creating visuals, audio, world maps, and other environmental assets that signal caution and wariness about other racial or ethnic groups.

- **Prompt for Reflection:** Do the visuals, audio, world maps, or other assets simulate racial segregation? Do they associate negative qualities with certain racial or ethnic groups?

- **Example:** *Grand Theft Auto: San Andreas* [69] features housing segregation with ghettoized depictions of Black and Brown inner-city neighborhoods, as shown in Figure 6-9. It is contrasted with San Fierro, a fictitious city based on San Francisco, which has a majority Asian population and features markers of wealth such as a country club and golf course.

- **Potential Consequence:** This strategy could increase players' vigilance when exploring spaces within a virtual environment associated with certain racial or ethnic groups. This could lead to a reduction in how much of the game map the player explores, overall time spent in the game, and player satisfaction. In multiplayer games, this could lead to increased social distance between groups, differentiated behaviors within gameplay, and lower peer self-esteem.

Player Characters

Promotion of mistrust can be enacted as a PC design strategy by creating PCs whose appearance, dialogue, interactions, backstories, and other relevant characteristics sig-

Fig. 6-9: A screenshot from *Grand Theft Auto: San Andreas* [69] showing a group of African American men in a gang (recruited by the player to help in carrying out missions) holding firearms walking down the street of an inner-city ghetto [17].

nal caution and wariness about other racial or ethnic groups.

- **Prompt for Reflection:** Do the appearance, dialogue, interactions, backstories, or other features of the player character reinforce harmful stereotypes or social stigmas about racial or ethnic groups?

- **Example:** In *Street Fighter 2* [38], two PCs, Ken and Ryu, who hadn't been featured in the franchise for almost 15 years returned in the form of two evil alter egos, "Violent Ken" and "Evil Ryu." In the game, these characters appeared as darker-skinned versions of their original forms [92] (show in Figure 6-10). Evil characters portrayed with dark skin is a frequent trope in videogames that reinforce *colorism*, or "why we see light skin as good and dark skin as bad, no matter the race" [92]. Şengün et al.'s systematic, mixed methods analysis of fighting videogames (including the *Street Fighter* [39] and *Tekken* franchises [198]) identified a phenomena they termed *virtual enfreakment* to describe how avatars are "exaggerated or stereotyped in their ethnic identities" using "hyper-

Fig. 6-10: Side-by-side comparisons of the original Ken and Ryu next their evil alter egos, "Violent Ken" and "Evil Ryu," portrayed as a brown-skinned villains in *Street Fighter 2* [38, 92].

charged cues such as body type, attire, aggressiveness, stern demeanor, combat accessories, brutal fighting techniques, and tattoos" [229]. Their analysis "disappointingly but not surprisingly, [found] racism and sexism manifest as stark differences in character design by gender and skin color," with characters' dark skin often being associated with evilness, even in game contexts with fictional races and ethnicities [229].

- **Potential Consequence:** This strategy could promote colorism, resulting in the increase of players' negative biases against people with darker skin tones following the simulation.

Non-Player Characters

Promotion of mistrust can be enacted as an NPC design strategy by creating NPCs whose appearance, dialogue, interactions, backstories, and other relevant characteristics signal caution and wariness about other racial or ethnic groups.

- **Prompt for Reflection:** Do the appearance, dialogue, interactions, backstories, or other features of the non-player characters pathologize certain racial or ethnic groups? Do they deter intergroup alliances?

- **Example:** In *Call Of Duty: Modern Warfare* [4], Khaled Al-Asad is one of two main NPC villains, shown in Figure 6-11. He is a Middle Eastern military commander and warlord who leads the Al-Qatala, an anarchist terrorist

Fig. 6-11: A screen capture taken from *Call Of Duty: Modern Warfare* [4] featuring Khaled Al-Asad, an NPC villain who is a Middle Eastern military commander, warlord, and leader of a terrorist organization.

organization based in Urzikstan (both a fictional organization and country). On depictions such as these, Rami Ismail, a Dutch-Egyptian videogame developer, says they "only help reinforce the mainstream stereotype that Muslims, regardless of nationality, are terrorists that need to be killed" [131].

- **Potential Consequence:** This strategy could contribute to players associating other racial or ethnic groups with negative qualities, contributing to increased social distance, animosity, and a negative social climate.

Content Structures

Promotion of mistrust can be enacted as a content structure design strategy by creating narratives, mechanics, or achievement systems that signal caution and wariness about other racial or ethnic groups.

- **Prompt for Reflection:** Do the narratives, themes, mechanics, achievement systems or other features of the content structure use racist tropes, omit pertinent historical facts, or encourage harm or violence based on racial or ethnic

Fig. 6-12: A screenshot from *The Walking Dead: Season One* [71] featuring PC Lee Everett handcuffed in the back of a police car [50].

group?

- **Example:** Lee Everett, the protagonist in *The Walking Dead: Season One* [71], is an African American man who was a History Professor for the University of Georgia before the apocalypse. The episode begins with the player as Lee handcuffed in the back of a police car on his way to an Atlanta prison. During the scene, the car crashes due to a zombie wandering in front of the car. The scene culminates into Lee eventually shooting the officer in the head with a shotgun (with no option to avoid this), relegating the player to a performance of violent Black masculinity, a racist trope that contributes to police violence and brutality towards Black men in the U.S.

- **Potential Consequence:** This strategy could lead to decreased performance and achievement for players who are vulnerable to negative stereotypes associating Blackness with violence and aggression and the internalization of such stereotypes.

6.5 Encouraged Strategies

The representational design strategies in this section apply the RES practices of *alertness to discrimination and preparation for bias* and *cultural pride and legacy appreciation*, recognizing the barriers that exist due to racial and ethnic stratification and celebrating the cultural assets of racial and ethnic groups as means of cultural resistance.

6.5.1 Alertness to Discrimination and Preparation for Bias

Pre-Design Phase

The following activities reflect designs that reinforce alertness to discrimination and preparation for bias as a practice:

- Recruit, hire, and fairly compensate individuals from the racial or ethnic groups affected by the forms of discrimination in the simulation to lead design efforts for embedding knowledge about these issues into the simulation
- Conduct extensive research using credible sources on the forms of racism (i.e., individual, interpersonal, institutional, and structural) that are prevalent in the context(s) of the simulation
- Conduct extensive research using credible sources on different forms of resistance (e.g., coping strategies, protest, legal efforts, community organizing) used by people affected by the forms of discrimination in the simulation

Environment

Alertness to discrimination and preparation for bias can be enacted as an environmental design strategy by creating visuals, audio, world maps, and other environmental assets that reflect an awareness of racism and racial barriers in the physical world.

- **Prompt for Reflection:** Do the visuals, audio, world maps, or other assets acknowledge or address pertinent information related to dynamics of race and

ethnicity in the simulation world? Do they inform the user about physical world discrimination or strategies for dealing with it?

- **Example:** Publishers of massively multiplayer online games (MMOGs) (e.g., Riot Games' *League of Legends* [68]) have invested in efforts to combat toxic behavior given their awareness of the prevalence of sexist, homophobic, and racist behavior within the community. Suggested strategies have included rewarding positive behaviors with in-game incentives, invoking more severe and permanent offender penalties, improving reporting and moderation capabilities, and featuring in-game tutorials which explain acceptable behavior [19].

  In 2020, the National Film Board of Canada released *The Book of Distance* [155], a room-scale interactive VR narrative about the real-life story of writer and creator Randall Okita's grandfather. Okita's grandfather was imprisoned by the Canadian government after immigrating to the country in the 1930s because he was Japanese. The experience uses family archives (e.g., family photos), real audio conversations, "2D and 3D hand-crafted sets reminiscent of Japanese woodblock prints, evocative character design, and seamless choreography [combined] with surprising moments of interaction" to guide the user through an emotional journey about how Okita's family history was altered by war and state-sanctioned racism. The environmental design of the experience (including the audio narration, the visual artifacts, and the transportation of the user through space and time) lead the user "through an emotional geography of immigration and family to recover what was lost," to promote an awareness of the systemic racism that Japanese people endured in the 1930s at the hands of the Canadian government [155]. A screenshot from the experience is show in Figure 6-13.

- **Potential Consequence:** This strategy could give players access to proactive strategies for dealing with racism in virtual and physical-world environments (e.g., reporting abusive behavior, seeking support from community moderators).

Players might demonstrate more effective strategies for coping with it as a result, leading to a reduction in the negative psychological and physiological symptoms associated with racial stress. It could also promote a greater level of awareness of how racism has shaped history around the world, contributing to a greater level of ethnic identity development in individuals.

Fig. 6-13: A screenshot from *The Book of Distance* [155] showing Okita's family, who is Japanese, being confronted with Canadian authorities who took their possessions away and were imprisoned due to state-sanctioned systemic racism in the 1930s.

Player Characters

Alertness to discrimination and preparation for bias can be enacted as a PC design strategy by creating PCs whose appearance, dialogue, interactions, backstories, and other relevant characteristics reflect an awareness of racism and racial barriers in the physical world.

- **Prompt for Reflection:** Do the appearance, dialogue, interactions, backstories, or other features of the player character meaningfully reflect dynamics of oppression and privilege? Do they intentionally replicate or reimagine these dynamics? Are there actions available to the PC for dealing with discrimination?

Fig. 6-14: A screenshot from *Mafia III* [1] featuring protagonist Lincoln Clay, a half-Black man living American South in the 1960s [209].

- **Example:** *Mafia III* [1] centers around the experience of protagonist Lincoln Clay (shown in Figure 6-14), a half-Black man living American South in the 1960s. The game's developers conducted extensive research of firsthand accounts from African Americans who lived in that context because they explicitly "did not want to make a character whose race could be generically swapped in and out with no story effect" [209]. In doing so, the experience of the PC reflects many of the realities of racialized American society.

- **Potential Consequence:** This strategy could help players to develop higher levels of emotion and behavior regulation in race-related conflicts, leading to higher feelings of self-efficacy for coping with racial stress.

Non-Player Characters

Alertness to discrimination and preparation for bias can be enacted as an NPC design strategy by creating NPCs whose appearance, dialogue, interactions, backstories, and other relevant characteristics reflect an awareness of racism and racial barriers in the physical world.

- **Prompt for Reflection:** Do the appearance, dialogue, interactions, backstories, or other features of the non-player characters meaningfully reflect dynamics of oppression and privilege? Do they intentionally replicate or reimagine these dynamics? Do the NPCs demonstrate any strategies for dealing with discrimination?

- **Example:** *1000 Cut Journey* [45] is an immersive VR experience which puts players in the perspective of a Black man named Michael Sterling during several encounters of racism in childhood, adolescence, and adulthood. As shown in Figure 6-15, one of the scene involves the player having a discriminatory racial encounter with two police officers who prompt the player to get down on their knees and put their hands up. In a 2018 presentation, Dr. Courtney Cogburn, Associate Professor of Social Work at Columbia University and lead creator of the experience, explained that during the development of *1000 Cut Journey*, they wanted to create different narrative threads based on players' behavior and body language. She describes a possible narrative thread during the scene where the player encounters the police: "If you look at the officers in their face or you don't follow the instructions to get down on the ground and to put your hands in the air, then the officers become more aggressive" [45]. Although it was edited out of the final version, personalizing the NPC behavior in this way would demonstrate this strategy, reflecting the power dynamics that Black Americans grapple with when responding assertively during encounters with police and law enforcement in the physical world.

- **Potential Consequence:** This strategy could help players to develop a better understanding of systems of racial stratification and systemic racial barriers, resulting in fewer internalizing symptoms (e.g., sadness, anxiety, and loneliness).

Content Structures

Alertness to discrimination and preparation for bias can be enacted as a content structure design strategy by creating narratives, mechanics, or achievement systems

Fig. 6-15: A screen capture next to an image of a player in the *1000 Cut Journey* immersive VR experience [45]. The player is kneeling with their hands up, facing two police officers who are yelling at Michael Sterling, a Black man whose perspective they take on during the experience.

that reflect an awareness of racism and racial barriers in the physical world.

- **Prompt for Reflection:** Do the narratives, themes, mechanics, achievement systems or other features of the content structure accurately reflect the social, political, and material realities of individual or structural racism in society? Do they provide information about how to deal with discrimination when it occurs?

- **Example:** *Hair Nah* [175] is an independent game created by Momo Pixel, a Black multidisciplinary artist and video game designer. Momo Pixel designed the game as a response to "the perverse action of touching a Black woman's hair without permission" and "the micro-aggression of assumed authority and ownership of Black bodies" [175]. In the game, the player takes the role of Aeva, a Black woman who loves to travel but feels hesitant to because of people who invade her personal space. After customizing their hair and skin tone and selecting their travel destination, the player is prompted to "help Aeva catch her flight and protect her hair by stopping the reaching hands" [175]. The player can use their mouse or arrow keys to swat the hands away to increase "The Nah! Meter" which must be filled before time runs out. In each level, white hands with fingernails painted in bright colors appear from the sides of the screen to reach for Aeva's hair, which the player must swat away (as shown in Figure 6-16).

Various audio clip play on loop, with women's voices making comments such as "So fluffy!", "Can I touch it?", and "Is it attached to your head?". Hands begin appearing more frequently with each level, making it increasingly difficult for the player to maintain Aeva's personal space. The game mechanics masterfully evoke the aggravating and overwhelming feelings associated with having one's personal space and body invaded. They also give the player an action and reward cycle for asserting their agency and reclaiming their space in response.

In *Fair Play* [89], a videogame intended to "[increase] awareness about different sorts of microaggressions and [teach] techniques for overcoming them," the player accumulates entries in their "Bias Almanac" as they encounter and learn about different examples of bias in everyday life (e.g., microaggressions, color-blind racial attitudes, tokenism). As the player progresses, the game features a mechanic called a "Bias Incident" (as shown in Figure 6-17). The system prompts the player to select the correct name for the type of bias associated with a racialized incident they have encountered, assessing their understanding of the concepts in their Bias Almanac. This mechanics reflects this strategy, rewarding players' racial literacy and ability to applying their understanding to examples in the game.

South Park: The Fractured But Whole [213], a videogame intended to be satirical in nature, features a scene with the PC (i.e., Political Correctness) Principal who wants to train the player as a *social justice warrior (SJW)*. SJW is a term often used to disparage and ridicule individuals who espouse socially progressive views [169]. At the start of the scene, the PC Principal is portrayed in a manner that is meant to mock his virtue signaling. He appraises a statement by a white person towards a person of color as racist. After he attacks the white person who made the statement, the person of color states that he didn't feel the statement was racist. As a response, he then attacks the person of color. Following this bit, the player is prompted to complete a combat challenge called "Catch the Microaggressions." The PC Principal makes a series of statements

Fig. 6-16: A screenshot from *Hair Nah*, "a travel game about a Black woman who is tired of people touching her hair" [175].

and instructs the player to strike him if they detect that the statement is a microaggression. After each statement, a visual timer appears on the screen indicating how much time the player has to respond. If the player incorrectly classifies a statement as a microaggression, the PC Principal strikes and yells at them. If the player correctly classifies a statement as a microaggression they can strike the PC Principal (as shown in the left image in Figure 6-18), who gives the player positive feedback and explains why the statement was a microaggression. Each microaggression that the player catches is added to a game mechanic called a "Master Privilege Checker" which is a numerical value associated with the number of correct answers. If they win the combat, they are rewarded with a "Social Justice Warrior Certificate" (as shown in the right image in Figure 6-18) which is associated with currency and experience points (XP).

- **Potential Consequence:** This strategy could help develop players' ability to correctly appraise and name when racialized incidents have occurred. This increase in appraisal ability could result in fewer internalizing symptoms (e.g., sadness, anxiety, and loneliness) and higher peer self-esteem.

Fig. 6-17: *Fair Play* [89] features a mechanic called a "Bias Incident" which prompts the player to select the correct name for the type of bias associated with racialized incidents they encounter in the game.

Fig. 6-18: In *South Park: The Fractured But Whole* [213], there is a combat scene called "Catch The Microaggressions" where the player must hit the PC Principal each time they make a statement that is a microaggression, shown in the image on the left. If they win the combat, they are rewarded with a "Social Justice Warrior Certificate" associated with currency and XP, shown in the image on the right [180].

6.5.2 Cultural Pride and Legacy Appreciation

When instantiated as a strategy for computational simulation design, cultural pride and legacy appreciation can be enacted through environments, PCs, NPCs, and content structures that aid in the transmission of cultural values, knowledge, and practices.

Pre-Design Phase

The following activities reflect designs that reinforce cultural pride and legacy appreciation as a practice.

- Recruit, hire, and fairly compensate individuals from the racial or ethnic groups portrayed in the simulation to lead design efforts for embedding cultural artifacts and knowledge into the simulation
- Conduct extensive research using credible sources about the culture and heritage of individuals within a racial or ethnic group written by members of that group to inform the simulation design
- When using cultural assets associated with a particular racial or ethnic group, check their source and accuracy, ensure the creator(s) of that work belong(s) to that group, give credit and compensation for its use, and ensure it serves a communication purpose beyond an aesthetic backdrop

Environment

Cultural pride and legacy appreciation can be enacted as an environmental design strategy by creating visuals, audio, world maps, and other environmental assets that aid in the transmission of cultural values, knowledge, and practices.

- **Prompt for Reflection:** Do the visuals, audio, world maps, or other assets make reference to or celebrate racial or ethnic cultural assets in an accurate way that credits their origin?

- **Example:** Hyphen-Labs' *NeuroSpeculative AfroFeminism* [114] virtual reality experience presents a positive and engaging portrayal of Black women which blends the historic and futuristic using cultural symbols. Participants are transported to a "neurocosmetology lab" for women of color, as shown in Figure 6-19, where they are placed into the role of a young Black girl who is the lab owner. The cutting edge technology featured in the experience involves both hair extensions and brain-stimulating electrical currents, painting a speculative future which centers cultural assets of the African diaspora.

- **Potential Consequence:** By showcasing positive representations of Black women in science, technology, engineering, and mathematics (STEM) leadership roles, this strategy could help to increase players' self-esteem and identity development in STEM-related videogames, resulting in improved learning outcomes.

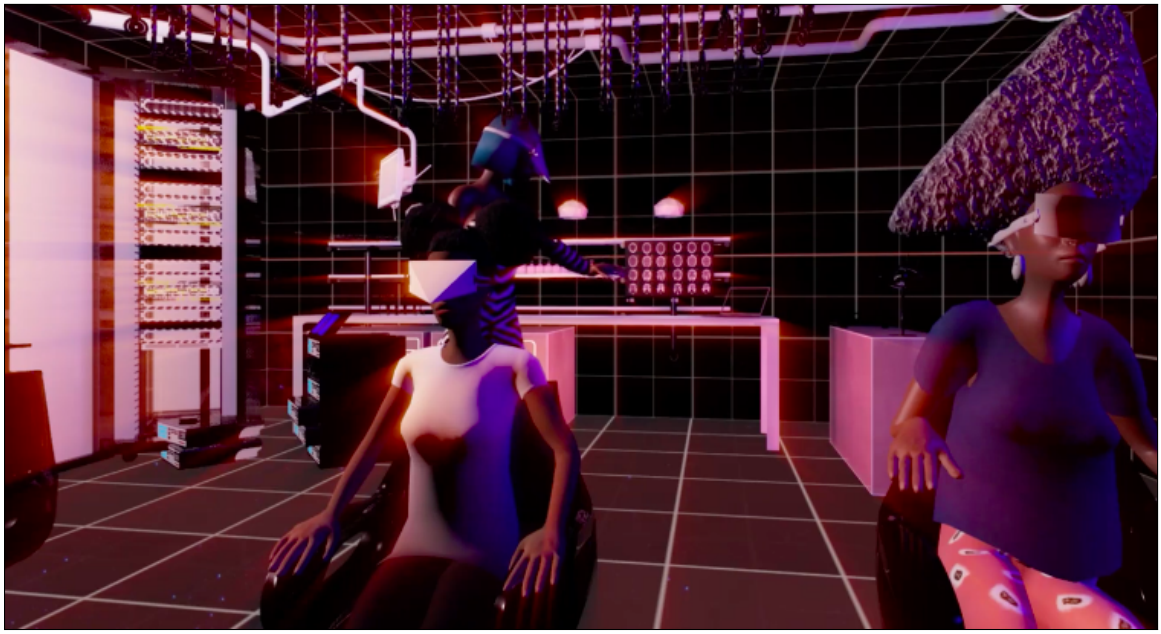


Fig. 6-19: A screenshot taken from the *NeuroSpeculative AfroFeminism* virtual reality experience [114] in which the user is transported to a futuristic and stylish beauty salon for women of color.

Player Characters

Cultural pride and legacy appreciation can be enacted as a PC design strategy by creating PCs whose appearance, dialogue, interactions, backstories, and other relevant characteristics aid in the transmission of cultural values, knowledge, and practices.

- **Prompt for Reflection:** Do the appearance, dialogue, interactions, backstories, or other features of the player character draw upon racial and ethnic cultural practices in an anti-deficit manner that is pertinent to the simulation world?

- **Example:** In *SMITE* [199], Yemoja is a playable God portrayed as a caring, wise, and powerful Yoruba Orisha of Rivers [207] (shown in Figure 6-20). The game designers used modern Nigerian clothing attire to inspire her visual appearance, and "specifically chose to focus on her West African origins for her abilities and portrayal in SMITE" with the intention to "display an impressive level of fantasy, while still being clearly inspired by African culture" [207].

- **Potential Consequence:** This strategy could enhance players' promote greater knowledge, awareness, and positive views of the racial or ethnic group associated with the PC, leading to advancements in their ethnic identity development.

Non-Player Characters

Cultural pride and legacy appreciation can be enacted as an NPC design strategy by creating NPCs whose appearance, dialogue, interactions, backstories, and other relevant characteristics aid in the transmission of cultural values, knowledge, and practices.

- **Prompt for Reflection:** Do the appearance, dialogue, interactions, backstories, or other features of the non-player characters draw upon racial and ethnic cultural assets in an asset-based, anti-deficit manner that is pertinent to the simulation world?

Fig. 6-20: A screenshot from *SMITE* [199] featuring PC Yemoja, Yoruba Orisha of Rivers [207].

- **Example:** *Marvel's Spider-Man: Miles Morales* [67] introduced a new NPC to the Spider-Verse named Hailey Cooper. Hailey is a street artist and a community organizer in East Harlem who is Black and Deaf. Natasha Ofili, the actress who plays Hailey, said that her role as Hailey "was groundbreaking for our community, the Black Deaf community, because they don't see themselves represented on TV or [in other forms of media]" [228]. Hailey Cooper's character celebrates Black Deaf culture while remaining multidimensional as an artist and activist who wants her work "to move people and raise awareness about issues or causes that they should know about" [228].

- **Potential Consequence:** This strategy could facilitate players' competence and confidence in interacting with peers across cultural and language barriers, resulting in increased feelings of social connection and peer self-esteem.

Content Structures

Cultural pride and legacy appreciation can be enacted as a content structure design strategy by creating narratives, mechanics, or achievement systems that aid in the

Fig. 6-21: A screen capture taken from *Marvel's Spider-Man: Miles Morales* [67] of Hailey Cooper communicating with Miles in American Sign Language (ASL).

transmission of cultural values, knowledge, and practices.

- **Prompt for Reflection:** Do the narratives, themes, mechanics, achievement systems or other features of the content structure accurately and relevantly integrate information on racial and ethnic culture, history, and traditions?

- **Example:** *I Am A Man* [90] is an award-winning interactive VR experience that is "set during the events of the African American Civil Rights Movement, exploring the 1968 Memphis Sanitation Workers Strike and the events leading up to the assassination of Dr. Martin Luther King, Jr." [125]. The experience, which is planned to be installed in The National Civil Rights Museum, put players in the first-person perspective of the people who fought for freedom and equality in this era. It makes use of historical film, photograph, and audio archives from Civil Rights activists. *I Am A Man* (shown in Figure 6-22) demonstrates this strategy by promoting public awareness of African Americans' rich historical legacy of leadership and resistance.

  Never Alone (Kisima Ingitchuna) [143] is a puzzle platformer world game that

Fig. 6-22: A screenshot from *I Am A Man* [90], an award-winning interactive VR experience that educates people about the African American Civil Rights Movement using historical film, photographs, and audio archives from that era.

was co-designed with "nearly 40 Alaska Native elders, storytellers and community members [who] contributed to the development of the game" and "[shared] stories and wisdom about their culture, values and the amazing Arctic world encountered by players" through interviews [143]. The player is put into the role of a young Iñupiat girl and their arctic fox companion (who they can switch between throughout the game to use the unique skills of each character) who must trek through the frozen tundra to save their village from an eternal blizzard, guided by Helping Spirits. As the first game ever developed in collaboration with the Iñupiat, "*Never Alone* leverages the power of videogames to share, celebrate and extend culture. These World Games will empower indigenous communities around the world to share their stories in an authentic, engaging, and entertaining way" [143].

- **Potential Consequence:** This strategy could assist in advancing player's racial and ethnic identity development, increasing their positive group attitudes and group-oriented behaviors.

Fig. 6-23: A screenshot from *Never Alone (Kisima Ingitchuna)* [143], a puzzle platformer world game that was developed in collaboration with Alaska Native storytellers and elders and explores the traditional lore of the Iñupiat people.

6.6 Toward a Set of Best Practices

The current framework focuses primarily on providing a tool for critical reflection on the design and implementation of racial and ethnic identity representations. To make it more amenable to use by development teams, it has also been adapted into a set of prescriptive set of design guidelines and best practices. This section describes actionable steps practitioners that are informed by each of the framework's prompts for reflection. Figure 6-24 provides a visual representation of these best practices.

6.6.1 Summary of Discouraged Strategies

This section provides actionable steps to help practitioners avoid the use of cultural endorsement of the mainstream and promotion of mistrust as RES practices in simulation designs.

Cultural Endorsement of the Mainstream

To avoid using this RES practice in simulation design:

- Be specific and accurate when using elements from cultural traditions
- Identify and remove environmental microaggressions embedded into the environment
- Be specific (not ambiguous) when designing attributes related to the racial and ethnic identities of non-white characters
- Provide diverse racial or ethnic primary (not only secondary) character representations with a wide array of identity expressions

Promotion of Mistrust

To avoid using this RES practice in simulation design:

- Critically examine the world map to determine if characters from different racial or ethnic groups are spatially segregated
- Determine if portrayals of antagonists are connected to a specific racial or ethnic groups or characteristics associated with those groups
- Identify and remove uses of harmful stereotypes or social stigmas about racial or ethnic groups in character portrayals
- Critically examine the mechanics to determine if the simulation encourages or rewards harm to characters based on race or ethnicity

6.6.2 Summary of Encouraged Strategies

This section provides actionable steps to help practitioners apply the RES practices of alertness to discrimination and preparation for bias and cultural pride and legacy appreciation in simulation designs.

Alertness to Discrimination and Preparation for Bias

To apply this RES practice to simulation design:

- Be intentional about the way the simulation mirrors or reimagines social dynamics of race and ethnicity in the physical world
- Critically examine events and interactions in which race and ethnicity would be relevant in the physical world to determine whether or not the simulation acknowledges or ignores these issues
- Use simulation components to communicate information to inform and educate the player about discrimination when it occurs
- Provide the player with actions and/or mechanics that give them ways to cope with race or ethnicity related discrimination in the simulation

Cultural Pride and Legacy Appreciation

To apply this RES practice to simulation design:

- Hire, fairly compensate, and follow the leadership of individuals from the racial or ethnic groups portrayed in the simulation
- In places where it is relevant, reference to or celebrate racial or ethnic cultural assets in an accurate way that credits their origin
- Communicate knowledge about culture, history, and traditions through the portrayals of characters from marginalized racial and ethnic groups
- Incentivize or reward players for investing effort and taking actions to learn about

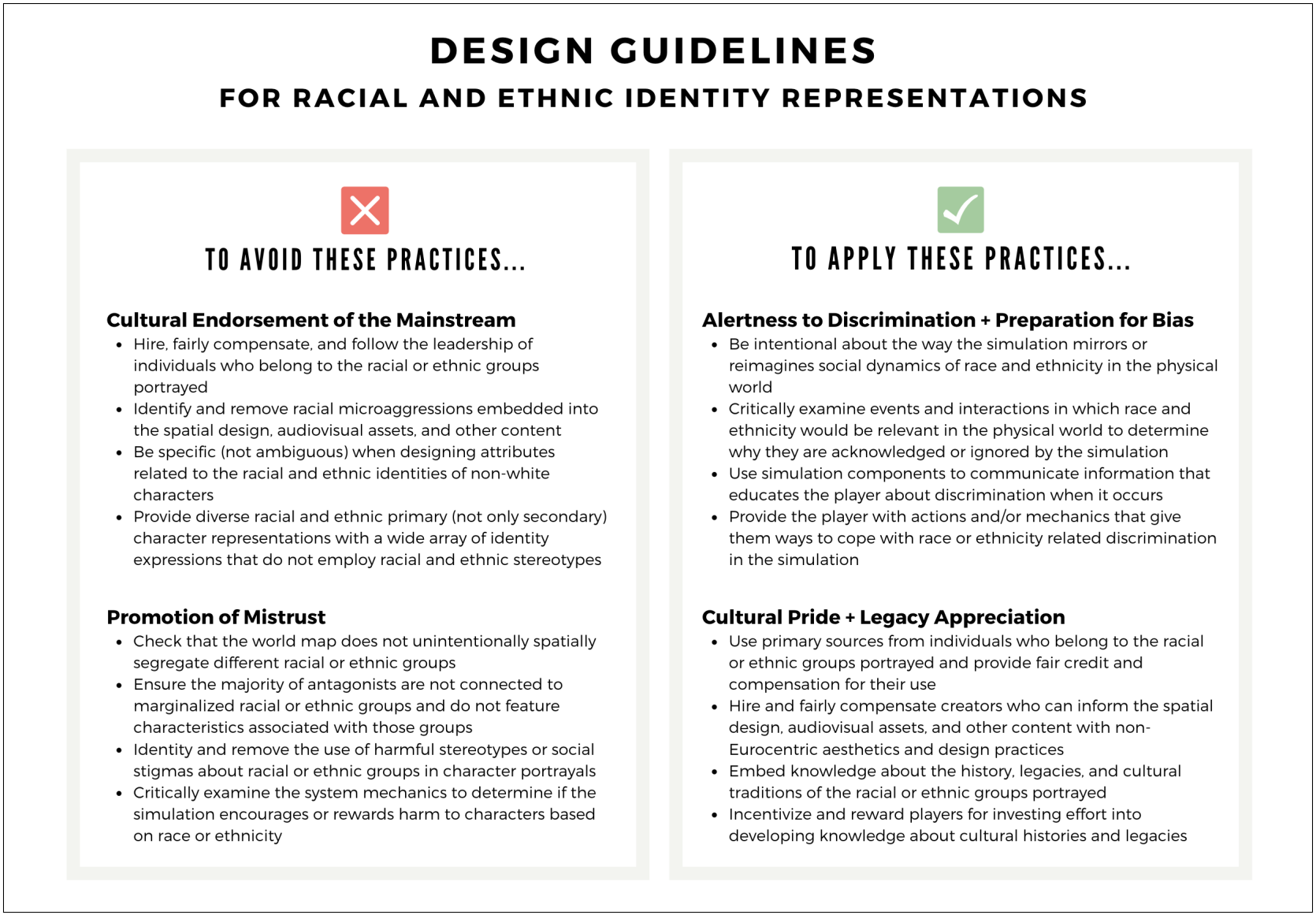


Fig. 6-24: An adaptation of the design framework into a prescriptive format to guide the creation of new strategies for racial and ethnic identity representation in computational simulations.

This chapter has presented a novel design framework which uses RES strategies as a lens for examining how ideas about racial and ethnic identity phenomena are mapped onto computational simulation components. The framework provides a critical design tool for practitioners and researchers to (1) identify and name the RES practices that are embedded in computational simulation portrayals of race and ethnicity and (2) generate new ideas for racial and ethnic identity representations using RES practices. Each of the sixteen design strategies in this framework offers a prompt for critical reflection on how their systems might socialize players to think about race and ethnicity, one or more examples of that strategy in existing systems, and theorizes potential consequences of that strategy on real-world outcomes. This framework does not provide an exhaustive list of all possible ways simulations employ RES strategies in their implementation. Rather, it is a starting point for simulation creators to apply RES theory to their design and technical practice and create more thoughtful portrayals of racial and ethnic identities.

Chapter 7

Conclusion

This chapter summarizes the key findings of the research questions investigated by this dissertation. Implications and recommendations for how these findings can be applied in practice, important limitations, and directions for future work are discussed.

7.1 Key Findings and Recommendations

Current mainstream approaches to depicting race and ethnicity in computational media such as videogames and VR experiences typically rely on visual/graphical and uniform dialogue customizations, uniform dialogue modifications, to represent racial and ethnic groups. Furthermore, much of the human-computer interaction (HCI) research on computational simulations of racial and ethnic identity phenomena assume that most, if not all, individuals belonging to a particular racial group will interpret and respond to these systems in a similar way. This is evidenced by much of the HCI research on these systems categorizing empirical results using politically salient categories such as racial or ethnic group [59, 203, 20, 168, 225], which ignores the heterogeneity of racial ideologies and level of ethnic identity development existing within these groups. Furthermore, critical media scholars' examinations of dominant representations of non-white racial and ethnic groups in videogames often rely on

harmful stereotypes [79, 57].

Motivated to contribute racial and ethnic representational strategies that move away from these assumptions and harmful depictions, this dissertation contributes user study findings and a novel design framework resulting from the development and deployment of *Passage Home*, an interactive narrative videogame informed by the *Racial Encounter Coping Appraisal and Socialization Theory* (RECAST; [197, 15]).

7.1.1 User Study Findings

The aim of the *Passage Home* user studies conducted with PreK-12 educators was to answer RQ1 (How can we characterize the interrelationships between individuals' physical-world racial and ethnic socialization, attitudes, and identity development and their choices, interpretations, and experiences within this virtual simulation of racial discrimination?). The primary quantitative findings suggested that players' physical world RES experiences, colorblind racial attitudes, and ethnic identity development have statistically significant relationships with their game experience and interpretations. Differences were observed between the PreK-12 educator and youth study groups.

One-way ANOVA tests revealed that participants' RES had significant relationships to the following GEQ and survey results:

- **PreK-12 educator study:** Competence, immersion, tension, positive affect, empathy toward the NPC, negative feelings, behavioral involvement, how they felt the NPC handled the situation, if they believed the PC was treated unfairly due to gender or age, if the experience caused them to consider a different perspective than they normally would, and if it caused them to reflect on their own practices as an educator

- **Youth study:** Immersion, negative affect, how they felt the PC handled and ended the situation, whether they believed the PC was treated unfairly due to gender or age

Pearson correlation coefficients were calculated and revealed that participants' colorblind racial attitudes and measures of ethnic identity development had significant relationships on game outcomes.

The strongest effect sizes were observed between the MEIM results and the following GEQ and narrative interpretation results:

- **PreK-12 educator study:** positive affect, immersion, competence, tension, how they felt the PC handled the situation, whether they believed the PC was treated unfairly due to age
- **Youth study:** Immersion, competence, negative affect, positive affect, challenge, how similar they felt the experience was to real life, whether they felt the experience showed discrimination, how they felt the NPC handled the situation, and whether they believed the PC was treated unfairly due to race/ethnicity

For the educator study, only the commitment and total factors for the MEIM had significant effects on these outcomes (the exploration factor did not). For the youth study, MEIM factors only had significant relationships to the GEQ In-Game Module results (not the GEQ Social Presence Module results).

The COBRAS was only administered in the PreK-12 educator study. The strongest effect sizes were observed between the COBRAS results and the following GEQ and narrative interpretation results: tension, competence, positive affect, immersion, behavioral involvement, empathy toward the NPC, challenge, whether they believed the PC was treated unfairly due to age, how they felt the NPC handled the situation, whether they felt the NPC treated the PC fairly or unfairly, and if the experience caused them to consider a different perspective than they normally would, and if it caused them to reflect on their own practices as an educator.

The RSC-READY survey questions were only administered in the youth study. The strongest effect sizes were observed between the RSC-READY survey question results and the following GEQ and narrative interpretation results: negative affect, immer-

sion, empathy toward the NPC, competence, positive affect, how they felt the PC handled and ended the situation, whether they believed the PC was treated unfairly due to age, gender, or race/ethnicity, whether they felt the experience showed discrimination, how well they felt the NPC handled the situation, whether they felt the NPC treated the PC fairly or unfairly, and how similar they felt the experience was to real life.

Players' physical world RES experiences, colorblind racial attitudes, and ethnic identity development did not appear to have significant relationships on their in-game choices or level of identification with the player character (PC; the student, Tiffany, who is Black), her environment, their sense of control over her, or their sense of care and responsibility for her.

The visual format of the game (i.e., graphics vs. hypertext versions) did not have significant effects on the majority of game outcomes, although educators' who played the hypertext version felt the game was more similar to real life and youth who played the graphics version had higher levels of immersion. Examination of the qualitative data demonstrated that participants' narrative interpretations ranged from lacking awareness of the racially discriminatory nature of the encounter in the game to being acutely aware of the covert racial messages in the dialogue of the non-player character (NPC; the teacher, Mrs. Smith, who is white), and their affective responses ranged from internalizing to externalizing the challenges they were faced with in the game.

7.1.2 Design Framework

In response to RQ2 (How can racial and ethnic socialization strategies be operationalized to represent racial and ethnic identity in simulations?), the novel design framework presented in this dissertation offers a structured approach to describing and generating new racial and ethnic identity representations in computational simulations using racial and ethnic socialization (RES) theory. Media, such as videogames, VR systems, and other popular forms of computational media, are powerful socializing agents which influence how individuals acquire beliefs, values, and attitudes

about race and ethnicity. This novel framework provides a reflective design tool for practitioners to (a) critique how existing computational media systems embed RES practices and understand the range of potential consequences of these design strategies and (b) be more intentional about the RES practices they are using when constructing simulation environments, characters, and content.

7.1.3 Recommendations

Recommendation 1: Apply Empirical Social Science Research to Designing and Implementing Computational Simulations

The novel design framework presented in this dissertation can be applied to improve the racial and ethnic representational strategies used by videogame and VR system developers. If existing strategies do not improve, they could have negative impacts on today's increasingly ethnically and racially diverse gaming population [40], as theorized in Chapter 6. Rather than reinforcing negative stereotypes about the racial and ethnic groups that a growing number of videogame players belong to, these systems can become sites where people across different racial and ethnic backgrounds can gain knowledge and awareness of the rich cultural backgrounds, traditions, and experiences of other groups.

It appears that designing an underlying narrative model informed by empirical research on racial and ethnic identity phenomena was an effective strategy for creating a compelling narrative experience. It is recommended that simulation creators consider leveraging the rich body of empirical social science research on social phenomena they seek to portray. Across both study populations (i.e., PreK-12 educators and youth), participants found *Passage Home* highly immersive and felt the game kept them in flow, which are two highly important game experience outcomes for designers of playable media. The 2019 user study of *Passage Home* [160] had a sample size that was roughly ten times smaller and used the virtual reality (VR) version of the game. The present user studies had a significantly larger sample size and deployed two web browser versions of the game, providing evidence for the generalizability of these game

experience outcomes.

Recommendation 2: Prioritize the Design and Implementation of the Narrative Engine According to Intended Audiences and Outcomes

The user study findings have implications for the recommended priorities for the relative importance of different aspects of simulation design. Given that the majority of game outcomes were not affected by the visual format of the game, it appears that the underlying RECAST-informed narrative engine in the system were more significant on participants' experience and interpretations. The recommendations based on these findings are for simulation creators to shift the relative priorities of developing the underlying narrative engines and the visual/graphical layer of their systems, depending on their intended audiences and target game outcomes.

Recommendation 3: Personalize Simulations Using Models About Players' Racial and Ethnic Identity Development

The findings of these studies can be applied to a number of domains related to the research and development of computational simulations including player modeling, narrative personalization, and problem scaffolding. An understanding of how players think about racial issues, their stage of ethnic identity development, and their RES experiences could be used to personalize subsequent aspects of their experience. For educational applications (e.g., simulations used to educate people about racial issues), this information could be used to tailor the kind of discrimination that is portrayed, or to inform users about the phenomena being modeled. For instance, if a user has high levels of racial colorblindness, they may emerge from a serious game about racism-related topics that feature dialogue with more covert racial discrimination with significantly different learning outcomes than a user who is highly alert to discrimination.

Existing entertainment-focused videogames already widely model social dynamics related to racial and ethnic identity. For example, in *The Walking Dead* [71], protagonist

Lee Everett (shown on the left side of the image in Figure 7-1) faces a discriminatory racial encounter in which Larry, an older white man, makes racist statements towards him. He physically attacks Lee, calls him "boy," and accuses him of being interested in his daughter, Lilly. During a later scene, an NPC asks Lee (the player) about why they think Larry dislikes them. The player can choose from four options reflecting the range of how individuals may appraise discriminatory racial encounters in the physical world, ranging from failing to recognize the racial nature of the comments (i.e., "I have no idea") to calling out Larry's racism (i.e., "He's an old racist asshole").

Fig. 7-1: In *The Walking Dead* [71], protagonist Lee Everett (shown on the left side of the image) faces a discriminatory racial encounter. Following the event, an NPC asks Lee (the player) about why they think Larry dislikes them. The player can choose from four options reflecting the range of how individuals may appraise discriminatory racial encounters in the physical world.

Another example from existing entertainment games which model racial and ethnic identity phenomena can be found in *Star Wars: Knights of the Old Republic* [28]. The game features a discriminatory encounter in which two humans attack a non-humanoid character because of its species. The encounter occurs in the Upper City, in which an Ithorian (a fictitious alien species) is attacked and injured by two children with anti-alien sentiments [224]. As shown in Figure 7-2, the children hurl insults which mirror racially-motivated physical and verbal insults which occur towards peo-

ple of color in the physical world. In the scene, the player is prompted to decide whether or not they want to help the Ithorian. The player can choose from several options, ranging from not doing anything (i.e., "Fine - I don't want to get involved") to being an active bystander (i.e., "Just because he's different doesn't give you the right to attack him!"). These choices reflect the range of how individuals' racial identity development may cause them to understand their privilege and how it may benefit them while disadvantaging people from other races.

Similar to *Passage Home*, systems can use narrative choice prompts similar to this to inform a backend model of the player's level of colorblindness, skillfulness at appraising discriminatory racial encounters (DREs), or their primary coping strategies for dealing with DREs. The user study findings suggest that this kind of model could be used to account for potential differences in how the players might perceive the actions of or empathize with the perpetrators of racial discrimination in the game (e.g., Larry in *The Walking Dead* [71] or the children in *Star Wars: Knights of the Old Republic* [28]). The game experience could be modified according to the kinds of messages game developers aim to communicate to players.

In summary, the study findings provide strong evidence that players' racial and ethnic socialization, attitudes, and identity development shape their game interpretations and experience. Simulation creators can use the following "Four Cs" to apply the implications of these findings to their work:

1. **Consider a spectrum** of intensity when presenting racialized content in the narrative which takes into account whether or not players have been socialized to be alert to discrimination

2. **Contextualize scenarios** within societal realities so that players with high levels of colorblind racial attitudes understand that the challenges in the game are linked to real-world racial barriers which cannot be escaped or "won" by individuals who have embodied, racialized experiences in the physical world

Fig. 7-2: In *Star Wars: Knights of the Old Republic* [28], a discriminatory encounter in which two humans attack a non-humanoid character because of its species [224]. The player is prompted to make a decision on whether or not they want to help the target.

3. **Connect racial phenomena** portrayed at the individual and interpersonal levels to the institutional and structural levels to educate players who have been socialized with colorblindness and egalitarianism to shift the blame and

responsibility from targets of discrimination to the larger systems embedded with racist ideologies

4. **Critically design and evaluate** game narratives, mechanics, reward, and penalty systems to understand whether the system is reinforcing dominant tropes and stereotypes which further marginalize racial and ethnic minority groups

7.2 Limitations and Future Work

While this dissertation resulted in important findings such as those described above, there are several limitations relevant to external validity. First, the *Passage Home* system was informed by RECAST, a model that was developed using research on Black adolescents and families in the U.S., and the user study only included participants in the U.S. Furthermore, the RES-informed design framework was primarily developed using research on racial and ethnic groups in the U.S. It is unclear how the design framework and the study findings apply to international contexts which have different social dynamics related to race and ethnicity than the U.S. Future work should aim to understand the outcomes of deploying the system in international contexts. To begin this expansion to other countries, an initial user study has been conducted using the graphics version of the game with 33 youth at Rothaugen Middle School, the largest middle school in Bergen, Norway. The narrative in *Passage Home* was modified to fit the Norwegian context in collaboration with an English teacher from the school. The updated system was built upon the same underlying RECAST-informed narrative model. The new story portrayed a DRE between a PC named Fatima (in place of Tiffany), a Black Norwegian high schooler whose family immigrated to Norway from Somalia when she was young, and the NPC named Mrs. Hansen (in place of Mrs. Smith), her teacher who is white and holds racist views about the skills and abilities of Black students. Environmental cues in the classroom were updated to feature white male Norwegian authors commonly taught in primary schools in Norway (in place of the white male authors commonly taught in primary

schools in the U.S.).

Secondly, both the PreK-12 and youth user study populations in the present studies were predominantly white and female. There were uneven sample sizes between racial subgroups, and only one non-binary participant in the educator study. These demographics aligned with the current racial/ethnic and gender demographics of teachers in the U.S., but did not align with the broader racial/ethnic demographics of Generation Z. It would be beneficial to understand how the results generalize to a more racially and ethnically diverse study population. Additionally, although the goal of these studies was to focus on the relationships between racial and ethnic identity development factors and game outcomes, it is unclear if racial or ethnic group had a stronger relationship to these outcomes than the racial and ethnic identity development factors examined by this work (which are related to but distinct from racial or ethnic groups). Future work should aim to conduct research on the system with a larger and more demographically diverse study population and conduct a multiple regression analysis to determine the relative strength of the relationships between these various identity-related variables on game outcomes.

It will be especially important to broaden the study to include more Black and African American youth, given that the narrative centers the experience of an African American high school student. In collaboration with the University of Michigan's Engaging, Managing, and Bonding through Race (EMBRace) laboratory, Institutional Review Board (IRB) approval was obtained in 2020 to conduct studies with Black youth in Detroit, Michigan, using *Passage Home* as part of their clinical intervention which supports Black families (further detailed in Chapter 2 Section 2.3.4). However, these in-person studies were cancelled due as a result of the COVID-19 pandemic. Once in-person research can be resumed, the goal is to understand how these youth perceive and respond to this system. This work will also help to further contribute to the literature on the clinical efficacy of computational simulations as intervention tools, which is a growing field of interest [184].

Another consequence of the constraints that surfaced from the pandemic was the need to shift from an in-person user study protocol which used the VR version of the system to a remote user study model which used two web-browser versions of the system. Although the benefits of this change in protocol included a larger study population (because it was unmoderated), potentially decreased participant response bias (because the researchers were not present while the participants completed the study), and the ability to demonstrate the flexibility of the underlying narrative model to adapt to different visual formats, the effects of the VR condition and how it compares to the hypertext and graphics web browser versions of the game are unknown. Future work should use the same user study protocol with the VR version of *Passage Home* and determine whether this condition results in statistically significant differences in game outcomes.

The design framework presented in this dissertation has not yet been evaluated by practitioners. As a first step toward understanding how effective it is as a design tool and what opportunities exist for improving it, the framework is being used as part of a collaborative research endeavor between the MIT Center for Advanced Virtuality and the University of Michigan EMBRace Lab. Through this endeavor, a 10-week out of school time (OST) program curriculum has been developed to collaboratively design and develop videogame and VR systems with Black high school students that center stories about their prior experiences of police encounters. The program pilot was launched (remotely due to COVID-19) in March 2021 with a group of four students from Marygrove High School in Detroit Public Schools Community District and used *Passage Home* and the novel design framework as tools. This participatory design effort will provide an initial site for the evaluation of the framework.

An initial adaptation of the design framework into a prescriptive set of recommendations has been proposed as a stepping stone toward the development of best practices that can be used by practitioners. Future work on the framework will aim to develop it to have more generative power, providing guidance on how the RES practices and macro-level simulation components can be composed together to facilitate the

creation of new racial and ethnic identity representations.

Finally, the design framework solely focuses on racial and ethnic identity representation and does not include guidelines for representing these phenomena in a way that acknowledges the unique ways that they intersect with other identity factors (e.g., gender, sexual orientation, disabilities, socioeconomic status). In her seminal 1989 paper, lawyer, civil rights advocate, and critical race theory scholar Kimberlé Crenshaw created the term *intersectionality* [49]. Intersectionality describes how multiple forms of oppression from individuals' social identities (e.g., race, gender, sexual orientation) converge and result in complex forms of oppression which do not exist independently of each other (i.e., the oppression faced by Black women cannot be understood through the lenses of being "Black" or "women" alone) [49]. She termed this phenomena in response to the "the tendency to treat race and gender as mutually exclusive categories of experience and analysis" [49]. The design framework is a stepping stone towards future work that must consider the unique convergence of race and ethnicity with other aspects of characters' identities.

7.3 Concluding Remarks

Current prevalent racial and ethnic identity representations in computational media and research methodological approaches often treat racial and ethnic groups as monoliths. Race and ethnicity involve systemic social structures, histories, cultural practices, lived experiences, interpersonal interactions, and discourse, which cannot be reduced down to a brown-colored avatar or strings of text that contains vernacular associated with a particular culture. Computer scientists and designers who create and study simulations of racial and ethnic identity phenomena would greatly benefit from learning from the work of social scientists who have been studying the complex and nuanced dynamics of race and ethnicity for decades. The theory and models that have been developed as a result of their empirical research can be used to inform representational strategies which map these concepts into computational structures that make up these simulations. Furthermore, the findings of this research demon-

strate that individuals bring their racial socialization, ethnic identity development, and racial attitudes into virtual spaces. Serious game developers who create experiences about racial issues must attend to these identity factors, which may hinder or help them understand the events and themes being portrayed in these experiences.

Finally, computational media are powerful agents of socialization which may influence individuals who use these systems to acquire beliefs, attitudes, and behaviors related to race and ethnicity. Designers and developers of these systems embed their values and ideologies into technical systems, which can be communicated through the environment, characters, and content featured in a simulation. The novel framework presented in this dissertation provides a way to expose and name the RES practices embedded into systems. It makes a connection to the social science literature examining the effects of RES on individual outcomes as a stepping stone to understand how these design choices may have real-world consequences on users. This framework can empower creators who are committed to being more intentional and conscious about how they portray race and ethnicity and model social phenomena in their simulations. Given the RES practices creators would like to reflect in their system design, it offers an initial set of activities for the pre-design phase and simulation design strategies to reflect these ideologies in their technical practice. In doing so, computational media can live up to its potential as a tool for positive social change which resists, rather than reinforces, the racist ideologies that are prevalent in computational simulations today.

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