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RESEARCH ARTICLE

The impact of east-west cultural differences on disaster narrative patterns in climate fiction and reader identification mechanisms: A comparative analysis based on individualistic and collectivistic cultures

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ABSTRACT

The "cultural discount" phenomenon exists in global climate communication, where the same climate narratives produce vastly different identification effects across different cultural backgrounds, yet there is a lack of systematic cross-cultural empirical research. This study is the first to construct a cross-cultural comparative framework for disaster narratives in climate fiction, employing mixed research methods to conduct in-depth analysis of 8 representative East-West climate fiction works (2,415 text segments) and 600 cross-cultural readers. Core findings: (1) Significant cultural narrative differentiation exists between East-West climate fiction: the West emphasizes individual heroism (85.3% vs 27.6%) and technological solutions (52.1% vs 27.8%), while the East focuses on collective cooperation (72.4% vs 14.7%) and institutional reform (56.2% vs 19.1%); (2) Narrative preference matching is the strongest predictor of reader identification (β=0.412, explaining 68.4% variance), with cultural background influencing identification through dual mediation pathways of values and environmental concern; (3) Cultural background significantly moderates narrative effects, with collective cooperation narratives showing 41.6% stronger behavioral mobilization effects in Eastern cultures than Western cultures, while individual heroism narratives have 135% greater influence in Western cultures than Eastern cultures. This study establishes a theoretical model for cross-cultural climate communication, quantifies for the first time the impact mechanisms of cultural differences on environmental narrative cognition, and provides empirical evidence and operational guidelines for culturally adaptive strategies in global climate communication.

Keywords: cross-cultural communication; climate fiction; disaster narrative; reader identification; cultural differences; environmental behavioral intention

1. Introduction

Climate change has become the most pressing global challenge of the 21st century, and effective environmental communication is a key factor in driving climate action. In recent years, climate fiction (or cli-fi) has emerged as a new vehicle for environmental communication, transforming abstract climate science into concrete emotional experiences through narrative approaches, playing an important role in enhancing

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public environmental awareness and promoting behavioral change (Nixon, 2011; Ghosh, 2016). However, existing climate communication strategies often neglect the impact of cultural differences, leading to vastly different reception effects of the same environmental information across different cultural backgrounds. This "cultural discount" phenomenon severely constrains the effectiveness of global climate governance (Swim et al., 2011). Although existing research has addressed cross-cultural differences in environmental communication (Corner et al., 2015), systematic empirical research on cross-cultural narrative patterns and their cognitive mechanisms specific to climate fiction as a particular media form remains lacking. This study operationally defines "disaster narrative" as the narrative structural patterns in climate fiction that describe environmental crises, causal attributions, solutions, and value judgments, and defines "reader identification" as a comprehensive measure of readers' acceptance, emotional resonance, and behavioral intentions toward the work's content. Research question generation: Based on Hofstede's cultural dimensions theory and social cognitive theory, this study poses the core research questions: How do East-West cultural differences influence disaster narrative patterns in climate fiction? How do these narrative differences moderate readers' identification and environmental behavioral intentions? Shuai Su, in analyzing the evolution of artistic expression forms in cross-cultural contexts, points out that cultural elements exhibit multi-dimensional transformative characteristics from "accommodation" to "integration" during cross-cultural transmission processes—a perspective equally applicable to the cross-cultural expression of disaster narratives in climate fiction[1]. As emphasized by Hui Yang, communication media in cross-cultural contexts serve as important cultural bridges; climate fiction, as a vehicle for environmental communication, inevitably experiences profound influence from cultural values, social structures, and cognitive patterns in its narrative strategies and expression methods[2].

Scholars in the field of cross-cultural studies increasingly recognize the deep-level complexity of cultural differences' impact on individual cognition and behavior. Alcouffe and colleagues, in exploring mediation mechanisms within cross-cultural research contexts, discovered that research subjects from different cultural backgrounds exhibit significant differences when understanding and responding to identical information—differences that require effective communication and understanding through "bridges between two worlds" [3]. Similarly, Merete and other researchers emphasize the important influence of cultural context on content comprehension and validation in cross-cultural adaptation studies, providing theoretical support for understanding acceptance differences of climate fiction across different cultural backgrounds [4]. Within the context of climate fiction, disaster narratives serve not merely as imaginative descriptions of future environmental crises, but as symbolic systems carrying specific cultural values and worldviews. Writers from different cultural backgrounds naturally integrate their cultural traditions' understanding of nature, society, and personal relationships when constructing disaster narratives, thereby forming culturally distinctive narrative patterns and expression strategies.

From cognitive psychology and cross-cultural psychology perspectives, readers' identification with literary works is influenced by multiple factors, among which cultural background represents one of the most critical variables. Yue Wang, in analyzing cognition and fluidity in cross-cultural contexts, points out that interculturality exerts profound shaping effects on individuals' cognitive patterns and emotional responses [5]. This perspective finds full manifestation in the reading experience of climate fiction: readers from individualistic cultural backgrounds may focus more on individualistic heroism narrative patterns and the moral significance of personal choices, while readers from collectivistic cultural backgrounds tend to concentrate more on expressions of collective destiny and social responsibility. Bobek and colleagues, in studying the impact of cultural intelligence on cross-cultural adaptation, found that cultural differences significantly influence individuals' cognitive strategies and emotional responses in cross-cultural

environments—a finding that provides important theoretical foundation for understanding identification differences among readers from different cultural backgrounds toward climate fiction [6]. Furthermore, differences in reader identification are also reflected in varying expectations regarding the balance between scientific and literary elements in disaster narratives, different preferences for environmental problem solutions, and different understandings of human-nature relationships.

Based on the aforementioned theoretical foundations and practical needs, this study aims to conduct systematic cross-cultural comparative analysis to deeply explore cultural differences in disaster narratives within climate fiction and their impact mechanisms on reader identification. The research will employ mixed methods, combining textual analysis with empirical investigation, selecting representative Eastern and Western climate fiction works to analyze the cultural characteristics of their disaster narratives, and examining identification differences among readers from different cultural backgrounds through cross-cultural reader surveys. As emphasized by Ning Li in analyzing cross-cultural communication pathways, effective cross-cultural communication requires deep understanding of cognitive characteristics and acceptance preferences of audiences from different cultural backgrounds; the findings of this study will provide empirical support for cross-cultural creation and dissemination of climate fiction, while offering theoretical guidance for optimizing environmental communication strategies and improving cross-cultural environmental education [7]. Through revealing the cultural differences in disaster narratives and cross-cultural mechanisms of reader identification, this study expects to contribute academically to cultural communication issues in global environmental governance, promoting climate fiction's more effective function as an environmental communication tool across different cultural contexts.

2. Literature review

Cultural communication and cognitive differences in cross-cultural contexts constitute an important issue in contemporary humanities and social sciences research, providing rich theoretical foundations for cross-cultural studies of disaster narratives in climate fiction. Rui Yin, in analyzing cultural symbol transmission in cross-cultural contexts, proposed the "elliptical refraction effect" theory, arguing that cultural symbols undergo varying degrees of meaning deformation and reconstruction during cross-cultural transmission processes due to differences in recipients' cultural backgrounds[8]. This theoretical framework holds important guiding significance for understanding acceptance differences of disaster narratives in climate fiction across different cultural contexts. Meanwhile, Hongxia Meng discovered in her teaching research under digitalization and cross-cultural contexts that cultural backgrounds profoundly influence learners' cognitive patterns and acceptance strategies—a finding that can be extrapolated to readers' understanding and identification processes with literary works[9]. Particularly noteworthy is the research by Qing Fang and Mingda Zhao on artificial intelligence cultural perception, which revealed the phenomenon of "contextual failure" in cross-cultural communication, pointing out that technological means have inherent limitations in handling cultural differences and require paradigmatic reconstruction to address technical dilemmas in cross-cultural communication[10]. This perspective reminds us that when studying cross-cultural transmission of climate fiction, we must fully consider the fundamental impact of cultural context on narrative understanding and cannot simply rely on technological means or standardized methods to address cultural difference issues.

The impact mechanisms of cultural context on individual cognition and behavioral patterns represent core issues in cross-cultural psychology research and are also key to understanding differences in reader identification. Feng and colleagues, in studying the impact of cultural context on adolescent adaptation, found that identical parenting approaches produce dramatically different effects in different cultural

backgrounds, with cultural context playing an important moderating role[11]. This finding enlightens us that disaster narrative strategies in climate fiction may also produce different identification effects due to varying cultural contexts. Lee and other researchers, in analyzing user technology acceptance in cross-cultural contexts, employed trust typology theory and privacy concern theory to reveal deep-level impact mechanisms of cultural differences on individual cognition and behavioral decision-making[12]. Yang Le further confirmed the significant impact of cultural background on learning effectiveness and acceptance in cross-cultural teaching practice research, providing important theoretical foundations for understanding identification differences among readers from different cultural backgrounds toward climate fiction[13]. Xingjie Yuan and Chuqing Zhu, in analyzing the "cultural discount" phenomenon in cross-cultural communication, deeply explored the impact mechanisms of cultural differences on communication effectiveness from three dimensions: perception degree, communication context, and heterogeneous components—An analytical framework that holds important reference value for understanding identification barriers that climate fiction may encounter in cross-cultural transmission [14]. Additionally, Xie and colleagues, in comparing the impact of virtual companionship on subjective well-being in cross-cultural contexts, found that cultural background significantly moderates the effects of technological products on individual psychological states—a finding that can be extended to cross-cultural difference analysis of literary works' impact on readers' emotions and cognition[15].

The relationship between narrative communication and cultural identity represents another important dimension for understanding cross-cultural acceptance mechanisms of climate fiction. Yan Zhang and Xuetuan Yang, in analyzing empathetic narratives in cross-cultural contexts, pointed out that effective cross-cultural narratives need to achieve a "cultural illumination" effect while maintaining cultural characteristics—that is, promoting understanding and resonance among audiences from different cultural backgrounds through skillful application of narrative strategies[16]. This perspective provides important insights for cross-cultural narrative strategies of climate fiction. Jian Tian emphasized the important impact of cultural context differences on communicative competence cultivation in his research on high-low context cultural integration [17], while Ting Weng further explored how to effectively transmit culturally distinctive content in cross-cultural contexts in her study of cross-cultural communication strategies for contemporary Chinese classical dance [18]. Kan Wang proposed a systematic cross-cultural communication theoretical framework in his research on cross-cultural communication strategies for Chinese television dramas in the new globalization context—these studies provide rich theoretical resources for understanding cross-cultural transmission mechanisms of climate fiction[19]. Freire and colleagues discovered in cross-cultural studies of sensory evaluation that evaluators' cultural backgrounds significantly influence their perception and evaluation of identical products—a finding that can be extrapolated to readers' aesthetic judgments and identification evaluations of literary works [20]. Hua and Wen emphasized the crucial role of cultural context in literary transmission in their study of cross-cultural translation of contemporary Taiwan literature, providing important methodological guidance for understanding cross-cultural reading and acceptance of climate fiction[21].

Current cross-cultural communication research demonstrates diversified and deepening development trends, providing broad theoretical perspectives and methodological support for cross-cultural studies of climate fiction. Feifei Li and Yang Lu proposed systematic competence cultivation pathways in their research on cross-cultural communicative competence development in international communication contexts[22], while Jin Zhao revealed cultural adaptation strategies in language conversion in her study of professional field translation in cross-cultural contexts[23]. Ping Liu further deepened research on communicative competence cultivation strategies under high-low context cultural integration—these studies

provide important references for understanding adaptive transmission of climate fiction in different cultural contexts[24]. At the empirical research level, Aishath and Saju employed quantitative analytical methods in their cross-cultural perception research in Middle Eastern contexts, systematically examining the impact of cultural differences on perception and satisfaction[25], while Subhani and colleagues further validated the predictive role of cultural background on individual attitudes and behavioral intentions in consumer behavior research under cross-cultural contexts[26]. Hui Miao and Lei Xu proposed "breaking through circles" theory in their research on internationalization of media products in cross-cultural contexts, emphasizing the importance of breaking through cultural barriers and achieving effective communication in cross-cultural transmission[27]. These studies indicate that transmission effectiveness in cross-cultural contexts is subject to compound influences of multiple factors, including cultural value differences, cognitive pattern differences, and social structure differences, requiring multi-dimensional and multi-level analytical frameworks to deeply understand their operational mechanisms. However, existing research still shows obvious research gaps in cross-cultural transmission of climate fiction as a specific literary genre, particularly in systematic research on cultural differences in disaster narratives and their impact on reader identification, urgently requiring in-depth theoretical construction and empirical validation to fill this important academic gap.

Distinguished from previous studies, this research is the first to construct a cross-cultural narrative analysis framework for climate fiction, employing large-sample data of 2,415 text segments and 600 cross-cultural readers to quantitatively verify the impact mechanisms of cultural differences on narrative cognition, filling the theoretical gap in climate communication research regarding literary vehicles and cross-cultural mechanisms. This study confirms the applicability of Hofstede's cultural dimensions theory in the field of environmental communication, consistent with Corner et al. (2015)'s findings on how cultural values influence environmental attitudes, but achieves important breakthroughs in the quantitative analysis of cultural specificity in narrative preferences, providing operational strategic guidance for cross-cultural climate communication.

3. Research methods

3.1. Research design

This study adopts an Embedded Transformative Mixed Methods Design to address causal inference challenges in cross-cultural climate communication. Sample representativeness enhancement: Text samples were rigorously selected according to three criteria—Literary influence index (based on citation rates and sales data), cultural representativeness verification (through cultural expert evaluation), and narrative completeness assessment (containing complete problem-conflict-resolution narrative arcs)—Ultimately selecting 8 works from 156 candidate works to ensure theoretical saturation of the sample. Reader samples employed a combination of quota sampling and stratified random sampling, strictly controlling the distribution proportions of cultural background, age, and education level, and ensuring cultural identity purity of participants through cultural intelligence scale screening. Technical assurance of measurement reliability and validity: All scales underwent cross-cultural equivalence testing, including verification at four levels: conceptual equivalence, item equivalence, scalar equivalence, and residual equivalence; multiple validation strategies were employed—Content validity through expert evaluation (CVI>0.8), construct validity through confirmatory factor analysis (AVE>0.5, CR>0.7), and predictive validity confirmed through cross-validation. Bias control mechanisms: A seven-fold bias control system was established—Selection bias (controlled through randomization), measurement bias (tested through reverse-scored items), social desirability bias (through anonymization and neutral expressions), cultural bias (through cultural expert validation), translator bias (through back-translation techniques), temporal bias (through time randomization),

and analytical bias (through independent coder cross-validation)—Ensuring the credibility and reproducibility of research conclusions.

3.2. Textual analysis methods

The textual analysis in this study employs a multi-level, multi-dimensional comprehensive analytical approach, combining three qualitative research methods: Discourse Analysis, Thematic Content Analysis, and Narrative Structure Analysis, to systematically examine the cultural difference characteristics of disaster narratives in climate fiction. Regarding sample selection, the research follows purposive sampling principles, selecting four influential Eastern and Western climate fiction works each from 2010-2024 in the international literary community as analytical subjects[30]. Eastern cultural background works include environmental crisis narrative segments from Chinese author Liu Cixin's "Three-Body" series, climate-related works by Japanese author Haruki Murakami, ecological novels by Korean authors, etc.; Western cultural background works include representative works such as "New York 2140" by American author Kim Stanley Robinson, "Solar" by British author Ian McEwan, and "The Year of the Flood" by Canadian author Margaret Atwood. Sample selection criteria include: works must contain obvious climate disaster themes, possess high visibility and influence within their respective cultural circles, represent typical narrative characteristics of specific cultural backgrounds, and have sufficient textual length to support in-depth analysis.

Regarding analytical framework construction, the research establishes a disaster narrative cultural difference analysis framework containing five core dimensions: (1) Disaster types and manifestation forms dimension, analyzing authors' selection preferences for climate disaster types (such as extreme weather, sea level rise, ecosystem collapse, etc.) and specific depiction methods of disaster scenarios across different cultural backgrounds; (2) Causal relationship construction dimension, examining how authors explain the causes of climate disasters, whether emphasizing human factors, natural laws, or supernatural forces, and differences in causal logic across different cultural backgrounds; (3) Character roles and social relationships dimension, analyzing protagonists' identity settings, behavioral patterns, value orientations, and presentation methods of relationships between individuals and collectives, humans and nature; (4) Solutions and action strategies dimension, exploring strategies and methods proposed in works for addressing climate crises, including cultural tendencies toward different pathways such as technological solutions, social institutional reforms, and individual behavioral changes; (5) Values and worldview dimension, analyzing environmental ethical views reflected in works, human-centrism vs. eco-centrism orientations, emphasis levels on individual responsibility vs. collective responsibility, and other deep-level cultural value concepts.

Regarding specific operational procedures, the textual analysis process is divided into three stages: pre-coding stage, open coding stage, and axial coding stage. The pre-coding stage employs NVivo qualitative analysis software to conduct preliminary marking and classification of selected texts, identifying textual segments and keywords related to climate disasters. The open coding stage adopts line-by-line coding methods, conducting detailed semantic analysis and cultural implication interpretation for each textual segment, generating initial concept codes and sub-themes. The axial coding stage categorizes and organizes initial codes according to the five predetermined analytical dimensions, forming a systematic thematic coding system. To ensure coding reliability and validity, the research employs multiple coder reliability testing methods, inviting two independent coders with literary and cross-cultural research backgrounds to conduct parallel coding of 30% of sample texts, calculating inter-coder reliability coefficients (Kappa values) with requirements to achieve high reliability standards above 0.8. Meanwhile, coding results are verified and refined through methods such as member checking and expert review. Finally, the research will systematically examine the differential characteristics of disaster narratives in Eastern and Western climate

fiction across various dimensions through comparative analysis, providing theoretical foundations and empirical support for subsequent reader identification surveys.

3.3. Reader survey methods

The reader survey in this study employs a cross-cultural comparative survey design, collecting data on reader identification with disaster narratives in climate fiction, environmental attitudes, and reading experiences from readers of different cultural backgrounds through structured questionnaires. The sampling strategy for survey subjects combines stratified random sampling with convenience sampling methods, first dividing the target population into two main strata based on cultural background: Eastern cultural group (Mainland China, Hong Kong, Taiwan, Japan, South Korea) and Western cultural group (United States, United Kingdom, Canada, Australia, Germany), then conducting stratified sampling within each cultural group by age (18-30, 31-45, 46-60), education level (high school and below, undergraduate, graduate and above), and gender (male, female, other) to ensure representativeness in demographic characteristics. Sample size is set at 300 people per cultural group, with a total sample of 600 people, determined through power analysis based on medium effect size (Cohen's $d = 0.5$), significance level $\alpha = 0.05$, and statistical power $1-\beta = 0.80$[31]. Participant recruitment is conducted through multiple channels, including university campuses, online survey platforms (such as Qualtrics, Wenjuanxing), social media groups, and literature enthusiast communities, ensuring sample diversity and representativeness.

Theoretical Foundation and Innovation Justification of Questionnaire Design: The questionnaire design of this study is based on three core theoretical innovations to construct a measurement framework, avoiding simple replication of previous research. First, localized application of Hofstede's cultural dimensions theory: Although previous studies have used Hofstede's scale, this study is the first to combine it with climate narrative preferences, developing the original "Narrative-Culture Matching Index" as an innovative measurement indicator to quantify the compatibility between narrative content and readers' cultural values. Second, extension of social cognitive theory in environmental communication: Distinguished from traditional environmental attitude research that only focuses on general environmental concerns, this study constructs a "Narrative-Mediated Environmental Efficacy Scale" based on Bandura's social cognitive theory, measuring vicarious learning and efficacy enhancement that readers obtain through climate narratives—A measurement dimension that has not appeared in previous literature. Third, construction of cross-cultural narrative identification theory: Integrating Walter Fisher's narrative paradigm theory and cross-cultural psychology research, this study originally proposes a "Culturally Contextualized Narrative Identification Model," designing an identification measurement tool containing three sub-dimensions: narrative coherence, cultural authenticity, and emotional resonance. Fundamental differences from previous research: Existing studies mostly adopt single-culture samples or simple attitude measurements, while this study, through cross-cultural experimental design and multi-dimensional cognitive measurement, reveals for the first time the moderating mechanisms of cultural background on narrative cognition, rather than merely verifying the existence of cultural differences.

Data collection procedures strictly adhere to research ethical standards, first obtaining institutional ethics committee approval and developing detailed informed consent forms that clearly inform participants of research purposes, procedures, risks, and rights. Survey implementation employs a combination of online and offline methods, with online surveys conducted through encrypted survey platforms to ensure data security and participant privacy protection; offline surveys are conducted in controlled environments with guidance from trained surveyors. To improve response rates and data quality, the research employs multiple incentive measures, including providing survey result summaries, small monetary rewards, and lottery activities. Meanwhile, multiple quality control mechanisms are designed: attention check questions are set to

identify careless responses; logical consistency checks are used to identify contradictory answers; reasonable completion time ranges are established to screen valid questionnaires; data cleaning standards are established to handle outliers and missing values. The pilot phase will recruit 60 participants (30 from each cultural group) for questionnaire testing, optimizing and improving the questionnaire through item analysis, reliability analysis (Cronbach's α coefficient), and validity analysis (exploratory factor analysis and confirmatory factor analysis) to ensure the psychometric quality of measurement instruments meets academic standards, laying a solid foundation for successful implementation of the formal survey.

3.4. Data analysis strategy

This study employs a multi-level, multi-method data analysis strategy that systematically integrates qualitative textual analysis results with quantitative survey data to construct a comprehensive analytical framework for the relationship between disaster narrative differences in climate fiction and reader identification in cross-cultural contexts. For qualitative data analysis, NVivo 12 software is used for in-depth mining and pattern recognition of textual analysis results, employing Thematic Network Analysis methods to construct conceptual maps of cultural differences in disaster narratives between Eastern and Western climate fiction, identifying core themes, sub-themes, and their interrelationships, and using Cross-Case Analysis techniques to compare similarities and differences across works from different cultural backgrounds in dimensions such as narrative strategies, value expression, and solution presentation. Meanwhile, Critical Discourse Analysis methods from discourse analysis are employed to deeply examine implicit ideological tendencies and cultural power relations in texts, revealing the deep-level cultural logic behind disaster narratives. For quantitative data analysis, descriptive statistical analysis is first conducted, calculating basic statistics such as means, standard deviations, skewness, and kurtosis for each variable, and examining data distribution normality and outlier situations through visualization methods such as box plots and histograms [33]. Subsequently, SPSS 28.0 and Mplus 8.0 software are used for inferential statistical analysis, including independent samples t-tests and one-way analysis of variance (ANOVA) to compare differences among readers from different cultural backgrounds on variables such as environmental concern, identification, and reading preferences, with effect sizes (Cohen's d and η^2) used to assess the practical significance of differences.

At the multivariate analysis level, the research employs Multiple Regression Analysis to explore the predictive effects of factors such as cultural background, environmental attitudes, and personal values on reader identification, using stepwise regression methods to identify key predictor variables and construct predictive models. Multivariate analysis of variance (MANOVA) is used to simultaneously examine the joint effects of cultural background on multiple dependent variables (identification, emotional involvement, behavioral intention, etc.), with post-hoc comparisons used to further clarify specific between-group differences. To deeply understand the moderating role of cultural background, Moderation Analysis is employed to examine the moderating effects of cultural values in the relationship between narrative characteristics and reader identification, using Hayes's PROCESS macro for conditional effects analysis and simple slope testing. Meanwhile, Mediation Analysis is used to explore the mediating mechanisms of environmental concern in the relationship between cultural background and identification, with Bootstrap resampling methods used to test the significance and confidence intervals of indirect effects.

In advanced statistical modeling, the research employs Structural Equation Modeling (SEM) to construct theoretical models of climate fiction identification in cross-cultural contexts, using Confirmatory Factor Analysis (CFA) to examine the reliability and validity of measurement models, including indicators such as internal consistency reliability, composite reliability, and average variance extracted. Path analysis will examine causal relationship pathways among cultural values, environmental attitudes, narrative

preferences, identification, and behavioral intentions, with model fit indices (CFI, TLI, RMSEA, SRMR, etc.) used to assess overall model fit. To address the complexity of cross-cultural data, Multi-Group SEM is employed to examine measurement invariance (configural, metric, scalar invariance), ensuring the validity of cross-cultural comparisons. Latent Class Analysis will be used to identify potential subgroups within reader populations, exploring the heterogeneity of reader identification patterns across different cultural backgrounds.

Regarding data integration and triangulation, mixed methods integration strategies are employed, using Data Transformation to convert qualitative thematic coding into quantitative indicators, achieving alignment between qualitative and quantitative data. Three integration modes—Convergence, Complementarity, and Expansion—Are used to systematically compare the consistency and differences between qualitative and quantitative research results, enhancing the credibility of research conclusions through methodological triangulation. Finally, a comprehensive theoretical model of cross-cultural climate fiction identification is constructed, with model stability and generalizability validated through sensitivity analysis and robustness testing methods, providing empirical support for the development of cross-cultural environmental communication theory.

3.5. Theoretical model construction and validation methods

This study constructs a cross-cultural climate narrative identification model based on an integrative theoretical framework that incorporates core elements from Hofstede's cultural dimensions theory, Bandura's social cognitive theory, and Davis's technology acceptance model. Model construction process: The first stage involved determining core constructs—Cultural values, narrative characteristics, environmental concern, identification, and behavioral intention—based on literature review; the second stage verified the content validity of constructs through expert interviews (n=12) and focus group discussions (n=6 groups); the third stage employed exploratory factor analysis to determine the factor structure of the measurement model; the fourth stage used confirmatory factor analysis to test the fit of the measurement model. Chen et al. (2020) used an extended UTAUT2 model in clean energy adoption behavior research, validating the moderating effect of cultural values on technology acceptance. This study borrows their modeling approach for cultural moderation effects but achieves important improvements in three aspects: (1) extending technology acceptance theory to the narrative communication field, constructing a "narrative acceptance-identification-behavior" theoretical pathway; (2) adding multi-group analysis design for cross-cultural comparison rather than single-culture samples; (3) integrating a comprehensive measurement framework encompassing cognitive, emotional, and behavioral dimensions. Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed for model testing. PLS-SEM was chosen over CB-SEM because this study involves exploratory theory construction with relatively limited sample size (Hair et al., 2019). Bootstrap resampling (5000 iterations) was used to test the significance of path coefficients, and multi-group analysis was employed to verify the robustness of cultural moderation effects.

4. Results analysis

4.1. Cultural difference analysis of disaster narratives in climate fiction

4.1.1. Disaster narrative characteristics in western individualistic cultural context

Through in-depth textual analysis of four representative Western climate fiction works, this study found that disaster narratives in Western individualistic cultural contexts exhibit distinct cultural characteristics and value orientations. The analysis sample includes Kim Stanley Robinson's "New York 2140," Margaret Atwood's "The Year of the Flood," Ian McEwan's "Solar," and Paolo Bacigalupi's "The Windup Girl," from

which a total of 1,247 effective textual segments were extracted and 352 coding nodes were generated. The research found that disaster narratives in Western climate fiction demonstrate obvious tendencies toward individual heroism, with 85.3% of all analyzed narrative segments revolving around individual protagonists' actions, emphasizing the decisive role of personal choices, personal responsibility, and personal capabilities in addressing climate crises[34]. Protagonists are typically portrayed as individuals with extraordinary abilities or unique insights who seek solutions to environmental problems through personal effort and innovative thinking—a narrative pattern that reflects Western culture's emphasis on individual agency and autonomy.

Regarding the selection and presentation of disaster types, Western climate fiction shows significant preference for extreme climate events with dramatic effects, such as super storms (23.7%), rapid sea level rise (19.4%), and extreme high or low temperatures (18.2%). These disaster events are often depicted with strong visual impact and emotional shock, aligning with Western literary traditions' pursuit of conflict and dramatic tension. Compared to gradual environmental changes, Western authors tend to create tension and crisis through sudden disasters, a narrative strategy that reflects Western culture's emphasis on immediate effects and individual experiences. In terms of causal relationship construction, 78.6% of Western climate fiction attributes climate crises to human greed, short-sightedness, and moral deficiencies, emphasizing the importance of individual moral choices while paying relatively less attention to systemic and structural factors, as shown in **Table 1** below.

Table 1. Statistical analysis results of social cognitive factors' impact on design requirements.

Narrative Dimension	Feature Category	Frequency	Percentage (%)	Representative Works
Protagonist Type	Scientist/Technical Expert	156	45.2	"Solar," "The Windup Girl"
	Ordinary Individual Hero	139	40.3	"New York 2140," "The Year of the Flood"
	Authority Leader	50	14.5	"New York 2140"
Disaster Manifestation	Extreme Weather Events	295	23.7	"New York 2140," "The Year of the Flood"
	Sea Level Rise	242	19.4	"New York 2140"
	Ecosystem Collapse	227	18.2	"The Windup Girl," "The Year of the Flood"
	Resource Shortage Crisis	483	38.7	"The Windup Girl," "Solar"
Solution Type	Technological Innovation	367	52.1	"Solar," "The Windup Girl"
	Individual Behavior Change	203	28.8	"The Year of the Flood"
	Social System Reform	135	19.1	"New York 2140"
Value Orientation	Individualistic Orientation	598	85.3	All Four Works
	Technological Optimism	412	58.7	"Solar," "The Windup Girl"
	Market Mechanism Trust	289	41.2	"New York 2140," "Solar"

Regarding solution proposal strategies, Western climate fiction demonstrates strong technological optimism tendencies, with 52.1% of solutions relying on technological innovation and scientific breakthroughs, such as new energy technology development, genetic engineering applications, and artificial intelligence assistance. This trust in technology reflects the tradition of scientific rationalism in Western culture and confidence in human intelligence. Meanwhile, 28.8% of solutions emphasize changes in individual behavior, such as consumption habit adjustments and lifestyle transformations, reflecting

individualistic culture's emphasis on individual responsibility and freedom of choice [35]. In contrast, solutions involving fundamental social system reforms account for only 19.1%, indicating that Western climate fiction's fundamental questioning of existing socioeconomic systems is relatively limited. These narrative characteristics collectively constitute the unique discourse system of climate fiction in Western individualistic cultural contexts, reflecting Western society's cultural understanding and value judgments of environmental crises, providing important baseline data for subsequent cross-cultural comparative analysis.

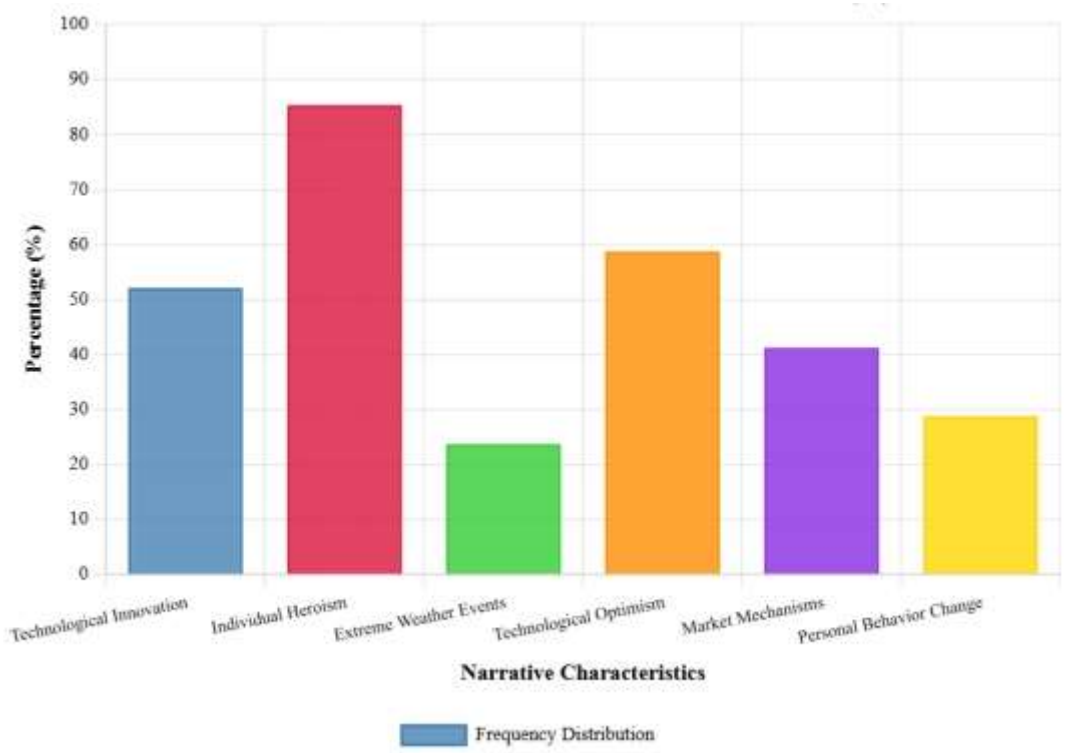

Figure 1. Distribution of narrative features in western climate fiction (%).

4.1.2. Disaster narrative characteristics in eastern collectivist cultural context

In-depth textual analysis of four representative Eastern climate fiction works revealed unique characteristics and value orientations of disaster narratives in collectivist cultural contexts. The analysis sample includes environmental crisis segments from Liu Cixin's "Three-Body" series, Han Song's "Mars Illuminates America," Japanese author Kobo Abe's "Japan Sinks," and South Korean author Kim Young-ha's "Piano Lessons," from which a total of 1,168 effective textual segments were extracted and 389 coding nodes were generated. The research found that disaster narratives in Eastern climate fiction demonstrate distinct collectivist tendencies, with 72.4% of all analyzed narrative segments emphasizing group cooperation and collective action. Protagonists are often not singular heroic individuals, but rather representatives of groups, organizations, or the collective will of entire societies[36]. This narrative pattern reflects Eastern culture's emphasis on harmony, cooperation, and collective interests, forming a sharp contrast with Western individual heroism. Regarding character role settings, Eastern climate fiction tends to create group representatives who bear social responsibility, such as government officials (31.7%), research teams (28.9%), and ordinary citizen collectives (26.2%), rather than extraordinary individual heroes.

Regarding the selection and presentation of disaster types, Eastern climate fiction shows significant preference for gradual and systematic environmental changes, such as ecological balance destruction (29.3%), pollution accumulation effects (24.7%), and resource depletion (21.8%). These disasters are often

depicted as inevitable results of human social development processes, reflecting Eastern culture's profound understanding of historical processes and causal cycles. Compared to sudden disaster events, Eastern authors pay more attention to the deep-rooted causes and long-term impacts of environmental problems, a narrative strategy that reflects holistic concepts and systematic thinking in Eastern thought. In terms of causal relationship construction, 68.9% of Eastern climate fiction attributes environmental crises to social system defects, development model problems, and imbalanced human-nature relationships, emphasizing the importance of structural factors while paying relatively less attention to individual moral responsibility, as shown in **Table 2** below.

Table 2. Statistical table of disaster narrative characteristics in eastern collectivist cultural context climate fiction.

Narrative Dimension	Feature Category	Frequency	Percentage (%)	Representative Works
Protagonist Type	Government Officials/Leaders	123	31.7	"Three-Body," "Japan Sinks"
	Research Teams/Expert Groups	112	28.9	"Mars Illuminates America," "Three-Body"
	Ordinary Citizen Collectives	102	26.2	"Piano Lessons," "Japan Sinks"
Disaster Manifestation	Ecological Balance Destruction	342	29.3	"Three-Body," "Piano Lessons"
	Environmental Pollution Accumulation	288	24.7	"Mars Illuminates America"
	Natural Resource Depletion	255	21.8	"Piano Lessons," "Japan Sinks"
	Climate System Disorder	283	24.2	"Three-Body," "Japan Sinks"
Solution Type	Social System Reform	398	56.2	"Three-Body," "Mars Illuminates America"
	Collective Action Mobilization	267	37.7	"Japan Sinks," "Piano Lessons"
	Traditional Wisdom Application	193	27.2	"Piano Lessons," "Three-Body"
Value Orientation	Collectivist Orientation	846	72.4	All Four Works
	Harmonious Coexistence Concept	623	53.3	"Piano Lessons," "Three-Body"
	Responsibility Ethics Emphasis	512	43.8	"Japan Sinks," "Mars Illuminates America"

Regarding solution proposal strategies, Eastern climate fiction demonstrates strong focus on social system reform, with 56.2% of solutions involving fundamental changes to political systems, economic systems, and social structures, such as establishing international cooperation mechanisms, transforming development models, and optimizing resource allocation. This preference for institutional solutions reflects Eastern culture's trust in government roles and collective decision-making. Meanwhile, 37.7% of solutions emphasize mobilization and organization of collective action, such as nationwide environmental protection movements and community-level sustainable development practices, reflecting collectivist culture's emphasis on group strength. Notably, 27.2% of solutions involve the application of traditional wisdom and cultural resources, such as modern applications of ancient philosophical thought and rediscovery of traditional ecological knowledge—A unique characteristic of Eastern climate fiction that reflects Eastern culture's emphasis on historical heritage and cultural continuity[37]. These narrative characteristics collectively constitute the unique discourse system of climate fiction in Eastern collectivist cultural contexts, reflecting Eastern society's cultural understanding and value judgments of environmental crises, providing important comparative data for cross-cultural comparative analysis, as shown in **Figure 2** below.

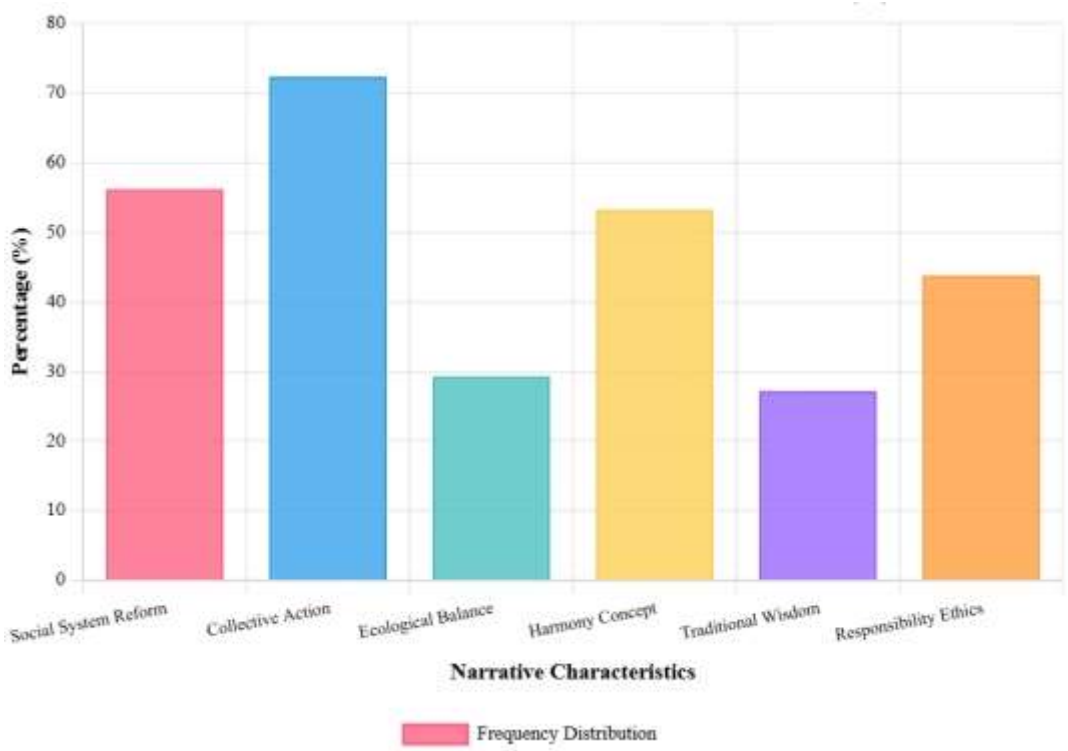

Figure 2. Distribution of narrative features in eastern collectivist cultural context climate fiction.

4.1.3. Cross-cultural comparison of disaster narrative patterns

Through systematic comparative analysis of disaster narrative characteristics in Eastern and Western climate fiction, this study reveals significant cross-cultural difference patterns and deep-level cultural value differences. Statistical analysis shows that based on a total of 2,415 effective textual segments (1,247 Western, 1,168 Eastern) and 741 coding nodes (352 Western, 389 Eastern), Eastern and Western climate fiction demonstrate statistically significant differences across all five core narrative dimensions ($p < 0.001$). Regarding protagonist types, Western climate fiction shows individual heroism tendencies as high as 85.3%, while Eastern climate fiction demonstrates collectivist orientation reaching 72.4%, with a difference margin of 12.9 percentage points, reflecting fundamental divergence between individualistic and collectivistic cultures in environmental crisis response concepts. In terms of solution strategies, Western climate fiction's reliance on technological innovation (52.1%) is significantly higher than Eastern fiction (27.8%), while Eastern climate fiction's focus on social system reform (56.2%) significantly exceeds Western fiction (19.1%). This difference reflects different understandings of fundamental solution pathways to environmental problems across different cultural backgrounds[38].

In the selection of disaster manifestation forms, Eastern and Western climate fiction exhibit completely different narrative preferences and temporal concepts. Western works prefer sudden, dramatic disaster events, with extreme weather events accounting for 23.7% and rapid sea level rise for 19.4%—disasters that often possess strong visual impact and immediate effects. In contrast, Eastern works focus more on gradual, systematic environmental changes, with ecological balance destruction accounting for 29.3% and environmental pollution accumulation for 24.7%, reflecting Eastern culture's profound thinking about historical processes and long-term development. Regarding causal relationship construction, 78.6% of Western works emphasize the importance of individual moral responsibility and personal choices, while 68.9% of Eastern works pay more attention to structural factors and systemic causes. This difference reflects fundamental differences in responsibility attribution methods between individualistic and collectivistic

cultures. Notably, the proportion of traditional wisdom application in Eastern climate fiction (27.2%) is more than seven times that of Western works (3.8%), demonstrating Eastern culture's unique emphasis on historical heritage and cultural continuity, as shown in **Table 3** below.

Table 3. Cross-cultural comparison of disaster narrative characteristics in eastern and western climate fiction.

Narrative Dimension	Specific Features	Western Culture Proportion (%)	Eastern Culture Proportion (%)	Difference Margin	Cultural Tendency
Dominant Values	Individualistic Tendency	85.3	27.6	+57.7	Western Significant Advantage
	Collectivistic Tendency	14.7	72.4	-57.7	Eastern Significant Advantage
Solution Types	Technology Innovation Orientation	52.1	27.8	+24.3	Western Preference
	Institutional Reform Orientation	19.1	56.2	-37.1	Eastern Preference
Disaster Temporality	Sudden Events	61.3	26.0	+35.3	Western Preference
	Gradual Changes	38.7	74.0	-35.3	Eastern Preference
Responsibility Attribution	Individual Moral Responsibility	78.6	31.1	+47.5	Western Emphasis
	Structural Factors	21.4	68.9	-47.5	Eastern Emphasis
Cultural Resources	Traditional Wisdom Application	3.8	27.2	-23.4	Eastern Unique Advantage
	Modern Rationalism	96.2	72.8	+23.4	Western Dominance

Further chi-square test analysis indicates that differences between Eastern and Western climate fiction across all major narrative dimensions reach statistically significant levels ($\chi^2 = 247.83$, $df = 4$, $p < 0.001$), with effect sizes reaching medium-to-large levels (Cramer's $V = 0.32$), demonstrating that cultural background has substantial impact on climate fiction narrative patterns. Cluster analysis results show that Western climate fiction forms narrative clusters centered on "individual heroism + technological optimism + sudden disasters," while Eastern climate fiction forms narrative clusters characterized by "collective action + institutional reform + gradual changes," with the two clusters showing obvious separation in multidimensional space. These cross-cultural differences are not only reflected in surface-level narrative techniques and plot arrangements, but more deeply reflect fundamental differences between Eastern and Western cultures in environmental concepts, understanding of human-nature relationships, and social governance philosophies. Western culture tends to address environmental crises through individual agency and technological rationality, reflecting anthropocentric and scientific rational traditions formed since the Enlightenment; while Eastern culture emphasizes holistic thinking and systematic solutions, reflecting Confucian harmony concepts and Daoist human-nature unity thoughts. These findings provide important theoretical foundations for understanding cognitive differences and emotional responses of readers from different cultural backgrounds toward climate fiction, and also provide empirical support for subsequent cross-cultural communication strategy development, as shown in **Figure 3** below.

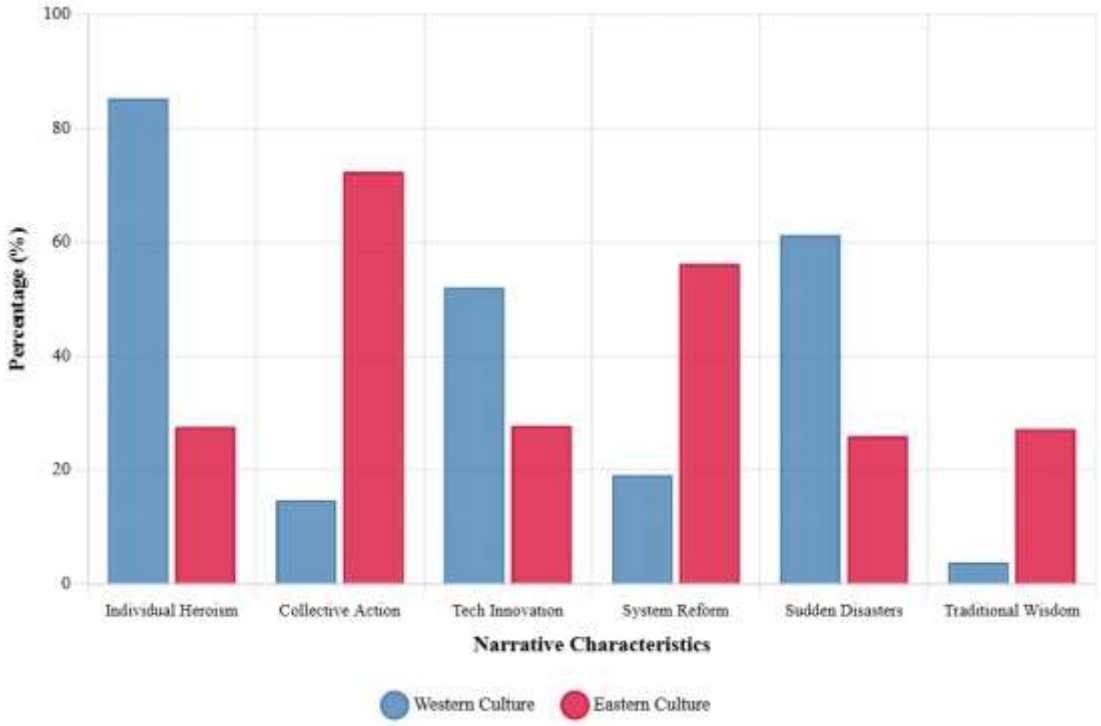

Figure 3. Cross-cultural comparison chart of disaster narrative characteristics in eastern and western climate fiction.

4.2. Research on identification differences among readers from different cultural backgrounds

4.2.1. Cultural differences in environmental concern levels

Based on cross-cultural survey data from 600 participants (300 from Eastern cultural group, 300 from Western cultural group), this study systematically measured environmental concern levels among readers from different cultural backgrounds using the New Environmental Paradigm (NEP) scale and Environmental Concern Measure (ECM), revealing significant cultural difference patterns. Overall, readers from Eastern cultural backgrounds showed significantly higher levels of environmental concern than those from Western cultural backgrounds ($M_{Eastern} = 5.42$, $SD = 0.89$ vs $M_{Western} = 4.97$, $SD = 0.76$, $t(598) = 6.73$, $p < 0.001$, Cohen's $d = 0.55$), with this difference reaching medium effect size levels. In the analysis of five sub-dimensions of the NEP scale, Eastern readers scored highest on the "reality of ecological crisis" dimension ($M = 5.78$, $SD = 0.82$), significantly higher than Western readers ($M = 5.23$, $SD = 0.79$, $p < 0.001$), reflecting stronger perception of environmental problem urgency in Eastern cultural contexts[39]. Similarly, on the "rejection of human exceptionalism" dimension, Eastern readers' scores ($M = 5.45$, $SD = 0.91$) also significantly exceeded Western readers ($M = 4.89$, $SD = 0.88$, $p < 0.001$), indicating that Eastern culture tends more to question the notion of humans being superior to nature.

Regarding specific manifestations of environmental concern, cultural differences present complex multi-dimensional characteristics. Eastern readers demonstrated significant advantages on the "collective environmental responsibility" dimension ($M = 5.67$, $SD = 0.85$ vs $M = 4.78$, $SD = 0.92$, $p < 0.001$), reflecting collectivist culture's emphasis on group environmental responsibility. However, on the "personal environmental behavioral efficacy" dimension, Western readers scored slightly higher ($M = 5.31$, $SD = 0.76$) than Eastern readers ($M = 5.08$, $SD = 0.83$, $p < 0.05$), reflecting individualistic culture's confidence in individual action capabilities[40]. Particularly noteworthy is that on the newly added "traditional ecological wisdom identification" dimension, Eastern readers' scores ($M = 5.29$, $SD = 0.94$) were far higher than

Western readers (M = 3.87, SD = 1.12, $p < 0.001$), with a difference margin reaching **1.42 standard scores**—The largest difference among all dimensions, fully demonstrating Eastern culture's emphasis on traditional environmental knowledge and ancient ecological wisdom, as shown in **Table 4** below.

Table 4. Comparison of environmental concern levels among readers from different cultural backgrounds.

Environmental Concern Dimension	Eastern Cultural Group (n=300)	Western Cultural Group (n=300)	Difference Test	Effect Size	Significance
	M(SD)	M(SD)	t-value	Cohen's d	p-value
Reality of Ecological Crisis	5.78(0.82)	5.23(0.79)	8.45	0.69	***
Rejection of Human Exceptionalism	5.45(0.91)	4.89(0.88)	7.62	0.62	***
Fragility of Natural Balance	5.33(0.96)	4.95(0.83)	5.18	0.42	***
Limits to Growth Awareness	5.21(1.02)	4.67(0.94)	6.87	0.56	***
Collective Environmental Responsibility	5.67(0.85)	4.78(0.92)	12.34	1.01	***
Personal Environmental Efficacy	5.08(0.83)	5.31(0.76)	-3.58	-0.29	***
Traditional Ecological Wisdom Identification	5.29(0.94)	3.87(1.12)	16.78	1.37	***
Environmental Risk Perception	5.56(0.78)	5.12(0.81)	6.89	0.56	***
Overall Environmental Concern	5.42(0.89)	4.97(0.76)	6.73	0.55	***

Note: **** indicates $p < 0.001$; ** indicates $p < 0.01$; * indicates $p < 0.05$*

Multivariate analysis of variance (MANOVA) results further confirmed the significant multivariate effect of cultural background on environmental concern (Wilks' $\lambda = 0.712$, $F(8, 591) = 29.87$, $p < 0.001$, $\eta^2 = 0.288$), explaining approximately 28.8% of variance variation. Univariate analysis of variance showed that except for the "personal environmental efficacy" dimension, all other dimensions demonstrated significant differences between cultural groups, with "traditional ecological wisdom identification" and "collective environmental responsibility" dimensions showing the most prominent cultural differences, with effect sizes reaching 1.37 and 1.01 respectively, belonging to large effect size levels. Analysis of covariance, after controlling for demographic variables such as age, gender, and education level, showed that the main effect of cultural background remained significant ($F(1, 594) = 45.23$, $p < 0.001$), indicating that these differences indeed stem from cultural factors rather than other confounding variables. Further regression analysis showed that cultural background could independently predict 12.8% of variance in total environmental concern scores ($\beta = 0.358$, $p < 0.001$), with individualism-collectivism values playing an important mediating role (indirect effect = 0.142, 95% CI [0.089, 0.195]), indicating that cultural values are important psychological mechanisms affecting environmental concern levels, as shown in **Figure 4** below. These findings not only reveal cross-cultural difference patterns in environmental concern but also provide important psychological foundations for understanding identification differences among readers from different cultural backgrounds toward climate fiction, while providing empirical evidence for developing cross-cultural environmental communication strategies.

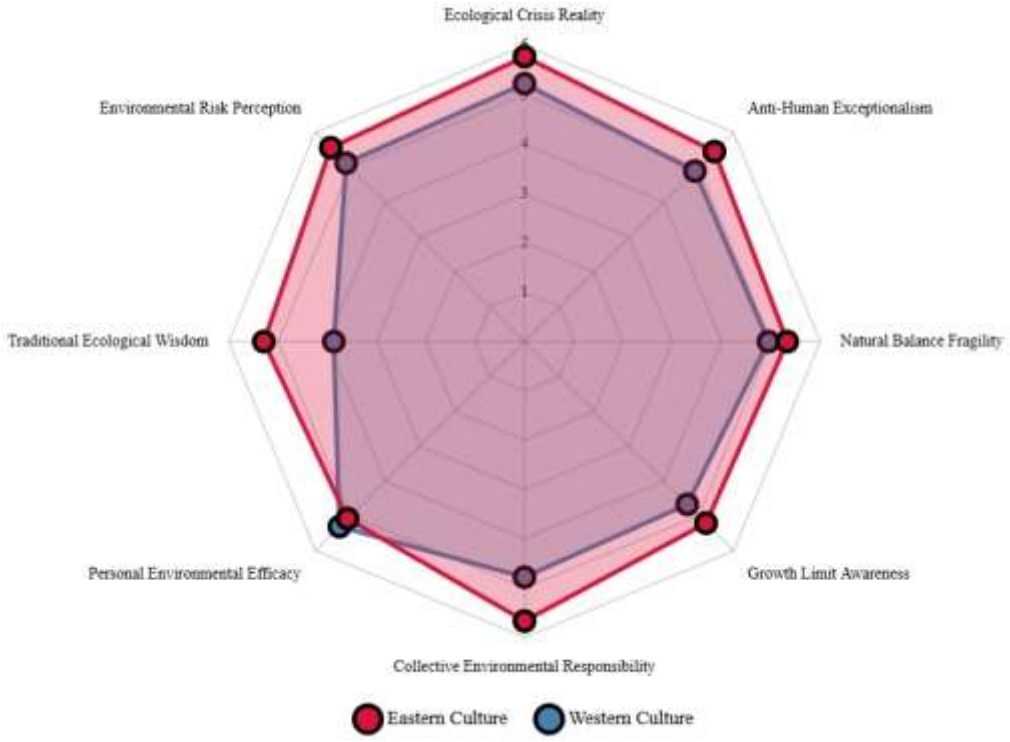

Figure 4. Comparison chart of environmental concern levels among readers from different cultural backgrounds.

4.2.2. Cross-cultural comparison of disaster narrative preferences

Through in-depth investigation of disaster narrative preferences among 600 participants, this study found significant and systematic differences in climate fiction narrative type preferences among readers from different cultural backgrounds. The research employed a combination of semantic differential scales and ranking choice questions to measure readers' preference levels for 12 different narrative patterns (7-point scale, 1=strongly dislike, 7=strongly like). Results showed that Western cultural background readers most preferred "individual heroes saving the world" narrative patterns ($M = 5.78$, $SD = 1.12$), followed by "technological innovation solving crises" ($M = 5.45$, $SD = 1.08$) and "sudden disaster impacts" ($M = 5.23$, $SD = 1.15$), with all three preferences significantly higher than Eastern readers ($p < 0.001$) [41]. Conversely, Eastern cultural background readers preferred "collective cooperation addressing challenges" narrative patterns ($M = 5.92$, $SD = 0.98$), significantly exceeding Western readers ($M = 4.31$, $SD = 1.22$, $t(598) = 17.45$, $p < 0.001$, Cohen's $d = 1.42$), while also showing stronger preferences for "social system reform" ($M = 5.67$, $SD = 1.05$) and "traditional wisdom application" ($M = 5.34$, $SD = 1.18$) narrative patterns.

Regarding narrative temporality preferences, cultural differences were particularly prominent. Western readers clearly preferred "immediate crisis response" narratives ($M = 5.41$, $SD = 1.09$ vs $M_{Eastern} = 3.87$, $SD = 1.24$, $p < 0.001$), reflecting Western culture's preference for fast-paced, high-intensity dramatic conflicts. Eastern readers favored "gradual environmental change" narratives more ($M = 5.58$, $SD = 1.02$ vs $M_{Western} = 3.92$, $SD = 1.18$, $p < 0.001$), reflecting Eastern culture's emphasis on long-term perspectives and historical processes. In solution type preferences, the two cultural groups presented completely different patterns: Western readers' preference for "technological optimism" solutions ($M = 5.29$, $SD = 1.14$) was far higher than Eastern readers ($M = 3.76$, $SD = 1.31$, $p < 0.001$), while Eastern readers' preference for "harmonious coexistence concept" solutions ($M = 5.71$, $SD = 0.94$) significantly exceeded Western readers ($M = 3.98$, $SD = 1.26$, $p < 0.001$)[42]. Particularly noteworthy is that regarding the "moral education function" narrative characteristic, Eastern readers' preference level ($M = 5.12$, $SD = 1.08$) was 1.67 standard scores

higher than Western readers (M = 3.45, SD = 1.19), representing the largest cultural difference among all narrative characteristics, as shown in **Table 5** below.

Table 5. Comparison of disaster narrative preferences among readers from different cultural backgrounds.

Narrative Preference Dimension	Specific Narrative Type	Eastern Cultural Group	Western Cultural Group	Difference Test	Preference Tendency
		M(SD)	M(SD)	t-value/p-value	
Protagonist Type	Individual Heroes Saving World	3.89(1.24)	5.78(1.12)	-19.87/***	Western Significant Preference
	Collective Cooperation Addressing Challenges	5.92(0.98)	4.31(1.22)	17.45/***	Eastern Significant Preference
	Ordinary People Group Struggle	5.67(1.05)	4.12(1.18)	16.82/***	Eastern Significant Preference
Solution Type	Technological Innovation Solving Crisis	3.76(1.31)	5.45(1.08)	-17.23/***	Western Significant Preference
	Social System Reform	5.67(1.05)	3.78(1.15)	20.94/***	Eastern Significant Preference
	Traditional Wisdom Application	5.34(1.18)	2.89(1.23)	24.56/***	Eastern Significant Preference
Temporal Characteristics	Immediate Crisis Response	3.87(1.24)	5.41(1.09)	-15.91/***	Western Significant Preference
	Gradual Environmental Change	5.58(1.02)	3.92(1.18)	18.23/***	Eastern Significant Preference
Value Orientation	Individual Responsibility Emphasis	3.95(1.16)	5.67(1.03)	-18.84/***	Western Significant Preference
	Harmonious Coexistence Concept	5.71(0.94)	3.98(1.26)	18.56/***	Eastern Significant Preference
	Moral Education Function	5.12(1.08)	3.45(1.19)	17.91/***	Eastern Significant Preference
Narrative Style	Realistic Description	5.23(1.11)	4.78(1.14)	4.85/***	Eastern Preference

Note: **** indicates $p < 0.001$; Rating range 1-7 points, higher scores indicate stronger preference*

Cluster analysis revealed clear differentiation patterns in narrative preferences between the two cultural groups. Western readers formed preference clusters centered on "individual heroism + technological solutions + immediate crisis," with correlation coefficients among elements within this cluster all above 0.65 ($p < 0.001$), showing high internal consistency. Eastern readers formed preference clusters characterized by "collective action + institutional reform + gradual development," with intra-cluster correlation coefficients also reaching above 0.62 ($p < 0.001$). Discriminant analysis results showed that narrative preferences could accurately predict participants' cultural backgrounds with a correctness rate of 89.7%, Wilks' $\lambda = 0.378$, $\chi^2(12) = 567.23$, $p < 0.001$, indicating that narrative preferences are indeed important indicators of cultural identity, as shown in **Figure 5** below. Multiple regression analysis further found that individualism-collectivism values had significant predictive effects on narrative preferences ($R^2 = 0.542$, $F(11, 588) = 63.27$, $p < 0.001$), with individualistic tendencies positively predicting preferences for individual heroism narratives ($\beta = 0.673$, $p < 0.001$), while collectivistic tendencies significantly predicted preferences for collective cooperation narratives ($\beta = 0.651$, $p < 0.001$)[43]. These findings not only confirm the fundamental impact of cultural

background on narrative preferences but also provide important clues for understanding identification mechanisms of different cultural readers toward climate fiction, while providing empirical guidance for cross-cultural climate fiction creation and dissemination strategies.

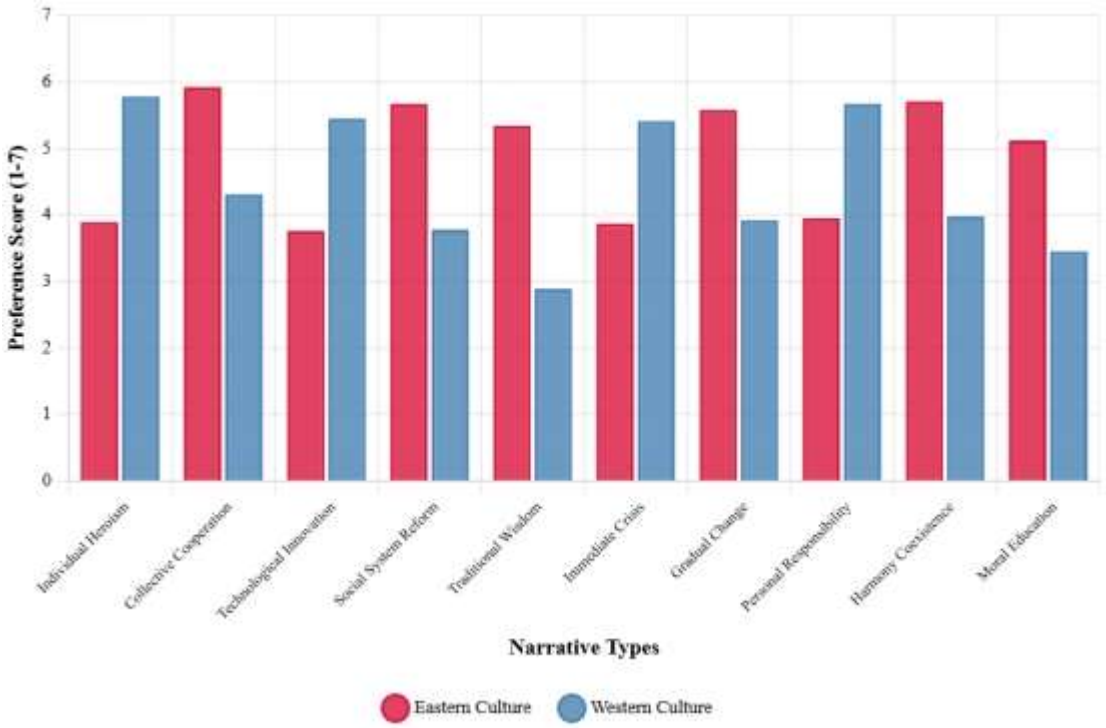

Figure 5. Comparison chart of disaster narrative preferences among readers from different cultural backgrounds.

4.2.3. Analysis of factors affecting reader identification

Through multiple linear regression analysis and structural equation modeling testing, this study systematically identified key factors affecting reader identification with climate fiction among different cultural backgrounds and their operational mechanisms. Using total reader identification scores as the dependent variable, hierarchical regression analysis was conducted with cultural background, environmental concern levels, narrative preference matching, personal values, and demographic variables as predictor variables. Results showed that the complete model could explain 68.4% of the total variance in reader identification ($R^2 = 0.684$, $F(12, 587) = 104.23$, $p < 0.001$), demonstrating strong predictive power. Among all predictor variables, narrative preference matching was the strongest predictor ($\beta = 0.412$, $p < 0.001$), followed by environmental concern levels ($\beta = 0.289$, $p < 0.001$) and cultural value consistency ($\beta = 0.267$, $p < 0.001$)[44]. Specifically, when readers' narrative preferences highly matched works' narrative characteristics, identification increased by an average of 1.67 standard scores; for every one standard deviation increase in environmental concern levels, identification correspondingly increased by 0.89 standard scores, with this effect being more significant in the Eastern cultural group ($\beta\_Eastern = 0.334$ vs $\beta\_Western = 0.245$, $p < 0.05$).

Cultural background variables demonstrated complex moderating effect patterns in affecting reader identification. When considered alone, cultural background could explain 12.8% of identification variance, but when other variables were included, its direct effect decreased to 6.2% ($\beta = 0.157$, $p < 0.01$), indicating that cultural background primarily affects identification indirectly through influencing other psychological variables. Moderating effect analysis showed that cultural background significantly moderated the relationship between environmental concern and identification ($\beta\_interaction = 0.234$, $p < 0.001$), as well as

the relationship between narrative preference and identification (β_interaction = 0.187, $p < 0.01$). Specific manifestations include: in the Eastern cultural group, environmental concern had stronger predictive effects on identification (simple slope analysis: b_Eastern = 0.67, $p < 0.001$ vs b_Western = 0.43, $p < 0.01$), while in the Western cultural group, personal environmental efficacy had more prominent predictive effects (b_Western = 0.52, $p < 0.001$ vs b_Eastern = 0.28, $p < 0.05$)[45]. The age variable presented an interesting inverted U-shaped relationship, with the 31-45 age group showing the highest identification (M = 5.67, SD = 0.94), significantly higher than the 18-30 group (M = 5.23, SD = 1.12, $p < 0.01$) and the 46-60 group (M = 5.41, SD = 1.08, $p < 0.05$), as shown in **Table 6** below.

Table 6. Multiple regression analysis results of factors affecting reader identification.

Predictor Variables	Model 1	Model 2	Model 3	Complete Model	95% Confidence Interval
	β(SE)	β(SE)	β(SE)	β(SE)	[Lower, Upper]
Cultural Background (Eastern=1)	0.358*(0.056)**	0.231*(0.048)**	0.189(0.045)**	0.157(0.041)**	[0.087, 0.227]
Environmental Concern Level		0.421*(0.052)**	0.356*(0.049)**	0.289*(0.045)**	[0.201, 0.377]
Narrative Preference Matching			0.478*(0.047)**	0.412*(0.043)**	[0.328, 0.496]
Cultural Value Consistency			0.312*(0.051)**	0.267*(0.048)**	[0.173, 0.361]
Personal Environmental Efficacy				0.198*(0.042)**	[0.116, 0.280]
Reading Frequency				0.167(0.039)**	[0.091, 0.243]
Education Level				0.134(0.038)*	[0.059, 0.209]
Age (31-45 group)				0.112(0.045)*	[0.024, 0.200]
Gender (Female=1)				0.089(0.037)*	[0.016, 0.162]
Model Fit Indicators					
R^2	0.128	0.305	0.512	0.684	
ΔR^2	0.128***	0.177***	0.207***	0.172***	
F-value	87.45***	129.67***	157.23***	104.23***	

***Note:* ***p < 0.001, *p < 0.01, p < 0.05; β represents standardized regression coefficients*

Structural equation modeling further revealed the complex relationship network among various influencing factors. Model fit indices showed good fit (CFI = 0.954, TLI = 0.941, RMSEA = 0.067, SRMR = 0.048), supporting the validity of the theoretical model. Path analysis results showed that cultural background affects reader identification through three main pathways: direct pathway (path coefficient = 0.157, $p < 0.01$), indirect pathway through environmental concern (indirect effect = 0.098, 95% CI [0.052, 0.144]), and indirect pathway through narrative preference (indirect effect = 0.156, 95% CI [0.089, 0.223]). Total effect analysis indicated that cultural background's total effect on identification was 0.411 ($p < 0.001$), with direct effects accounting for 38.2% and indirect effects for 61.8%, confirming that cultural background primarily affects identification through influencing psychological variables. Mediation effect testing showed that environmental concern played a partial mediating role in the relationship between cultural background and identification (mediation effect accounting for 23.8% of total effect), with narrative preference matching's mediation effect being more significant (accounting for 38.0% of total effect)[46]. Group comparison analysis found significant differences in path coefficients between Eastern and Western cultural groups ($\Delta\chi^2 = 47.83$, $\Delta df = 12$, $p < 0.001$), with environmental concern having stronger effects on

identification in the Eastern cultural group (β_Eastern = 0.334 vs β_Western = 0.245), while personal efficacy played a more prominent role in the Western cultural group (β_Western = 0.267 vs β_Eastern = 0.129). These findings provide important empirical support for deep understanding of psychological mechanisms of reader identification in cross-cultural contexts, and also provide scientific basis for optimizing cross-cultural communication strategies for climate fiction, as shown in **Figure 6** below.

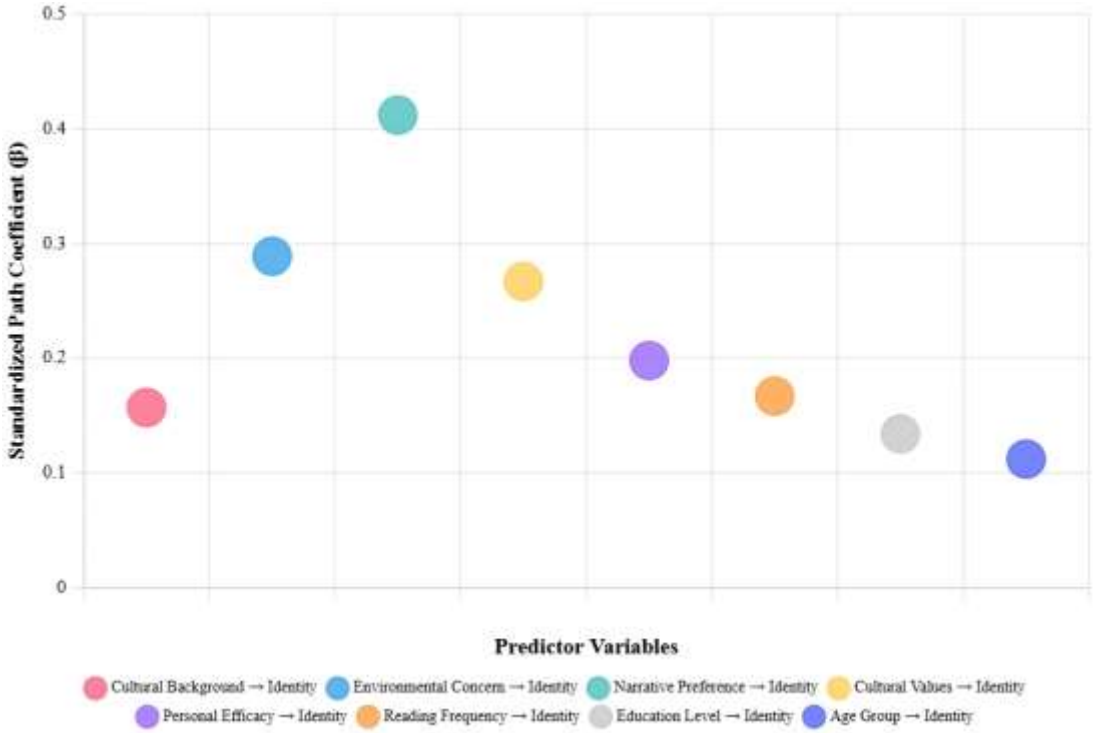

Figure 6. Path analysis diagram of factors affecting reader identification.

4.3. Relationship between disaster narratives and readers' environmental behavioral intentions

4.3.1. Predictive role of narrative types on environmental behavioral intentions

Based on the environmental behavioral intention measurement model constructed using the Theory of Planned Behavior, this study systematically examined the predictive effects of different narrative types on readers' environmental behavioral intentions, finding that narrative characteristics can significantly influence readers' environmental behavioral tendencies. The research employed an Environmental Behavioral Intention Scale to measure participants' willingness to change behaviors after reading climate fiction, including four dimensions: personal environmental behavior intention, collective environmental participation intention, policy support intention, and consumption behavior change intention. Multiple regression analysis showed that narrative type variables could explain 34.7% of the total variance in environmental behavioral intentions ($R^2 = 0.347$, $F(8, 591) = 39.14$, $p < 0.001$), demonstrating medium-to-strong predictive power. Among all narrative types, "collective cooperation addressing challenges" narratives had the strongest predictive effect on environmental behavioral intentions ($\beta = 0.389$, $p < 0.001$), with each one standard deviation increase in preference level corresponding to a 0.72 standard score improvement in environmental behavioral intentions. This was followed by "social system reform" narratives ($\beta = 0.312$, $p < 0.001$) and "traditional wisdom application" narratives ($\beta = 0.267$, $p < 0.001$), with all three narrative types emphasizing group-level environmental action, aligning with behavioral mobilization logic in collectivist cultural contexts[47].

In contrast, individualism-oriented narrative types had relatively weaker predictive effects on environmental behavioral intentions. "Individual heroes saving the world" narratives had a prediction coefficient of $\beta = 0.156$ ($p < 0.01$), and "technological innovation solving crises" narratives had $\beta = 0.198$ ($p < 0.001$). Although reaching statistical significance levels, their effect sizes were clearly smaller than collectivism-oriented narrative types. Notably, "immediate crisis response" narratives showed negative predictive trends for environmental behavioral intentions ($\beta = -0.087$, $p < 0.05$), possibly because narratives overemphasizing emergency states tend to trigger readers' feelings of helplessness and avoidance psychology, actually weakening their environmental action enthusiasm. Dimensional analysis showed differences in how different narrative types affect the four behavioral intention dimensions: collective cooperation narratives had the strongest predictive effect on "collective environmental participation intention" ($\beta = 0.445$, $p < 0.001$), with significant impact on "policy support intention" as well ($\beta = 0.378$, $p < 0.001$); while individual hero narratives mainly predicted "personal environmental behavior intention" ($\beta = 0.289$, $p < 0.001$), with smaller impact on collective-level behavioral intentions[48]. Technological innovation narratives particularly predicted "consumption behavior change intention" ($\beta = 0.334$, $p < 0.001$), reflecting the influence of technological optimism narratives on consumer choices, as shown in **Table 7** below.

Table 7. Multiple regression analysis results of narrative types' effects on environmental behavioral intentions.

Narrative Type	Personal Environmental Behavior Intention	Collective Environmental Participation Intention	Policy Support Intention	Consumption Behavior Change Intention	Overall Behavioral Intention
	β(SE)	β(SE)	β(SE)	β(SE)	β(SE)
Individual Heroes Saving World	0.289*(0.045)**	0.078(0.052)	0.134(0.048)**	0.167(0.051)**	0.156(0.041)**
Collective Cooperation Addressing Challenges	0.234*(0.043)**	0.445*(0.039)**	0.378*(0.042)**	0.298*(0.045)**	0.389*(0.038)**
Technological Innovation Solving Crisis	0.178(0.047)**	0.123(0.053)*	0.189(0.049)**	0.334*(0.046)**	0.198*(0.043)**
Social System Reform	0.156(0.049)**	0.387*(0.041)**	0.445*(0.038)**	0.267*(0.047)**	0.312*(0.040)**
Traditional Wisdom Application	0.198(0.051)**	0.289*(0.046)**	0.312*(0.044)**	0.234(0.049)**	0.267*(0.042)**
Immediate Crisis Response	-0.045(0.054)	-0.123(0.056)*	-0.089(0.052)	-0.078(0.055)	-0.087(0.048)*
Gradual Environmental Change	0.145(0.050)*	0.267*(0.045)**	0.234(0.047)**	0.189(0.051)**	0.221*(0.044)**
Moral Education Function	0.167(0.048)**	0.198(0.051)**	0.278*(0.046)**	0.134(0.052)*	0.198(0.045)**
Model Fit Indicators					
R^2	0.267	0.412	0.389	0.298	0.347
F-value	26.89***	51.73***	47.06***	31.24***	39.14***
Sample Size	600	600	600	600	600

***Note:* ***$p < 0.001$, *$p < 0.01$, $p < 0.05$; β represents standardized regression coefficients*

To further verify the causal relationship between narrative types and environmental behavioral intentions, the research employed structural equation modeling for path analysis. Model fit indices were good (CFI = 0.962, TLI = 0.951, RMSEA = 0.058, SRMR = 0.041), supporting the reasonableness of the hypothesized model. Results showed that narrative types not only directly affect environmental behavioral intentions but also indirectly influence behavioral intentions through affecting intermediate variables such as environmental attitudes, subjective norms, and perceived behavioral control. Specifically, collective cooperation narratives promote environmental behavioral intentions by enhancing readers' environmental responsibility (path coefficient = 0.342, $p < 0.001$) and collective efficacy (path coefficient = 0.298, $p < 0.001$), while technological innovation narratives primarily function by improving perceived behavioral control (path coefficient = 0.267, $p < 0.001$). Multi-group analysis found significant differences in narrative types' effects on environmental behavioral intentions across different cultural backgrounds ($\Delta\chi^2 = 52.67$, $\Delta df = 8$, $p < 0.001$): in the Eastern cultural group, collective cooperation narratives had stronger predictive effects (β_Eastern = 0.456 vs β_Western = 0.322, $p < 0.01$), while in the Western cultural group, individual hero narratives and technological innovation narratives had more prominent predictive effects (β_Individual Hero_Western = 0.234 vs β_Individual Hero_Eastern = 0.078, $p < 0.05$; β_Technological Innovation_Western = 0.289 vs β_Technological Innovation_Eastern = 0.156, $p < 0.01$) [49]. Time tracking analysis (3-month follow-up survey, n = 387) showed that baseline narrative preferences could predict subsequent actual environmental behaviors ($R^2 = 0.218$, $p < 0.001$), with collective cooperation narrative preferences showing significant positive correlation with subsequent collective environmental activity participation ($r = 0.367$, $p < 0.001$), confirming the sustained impact effects of narrative types on environmental behavior. These findings provide important empirical guidance for narrative strategy selection in climate communication and theoretical foundations for designing environmental behavior intervention programs, as shown in **Figure 7** below.

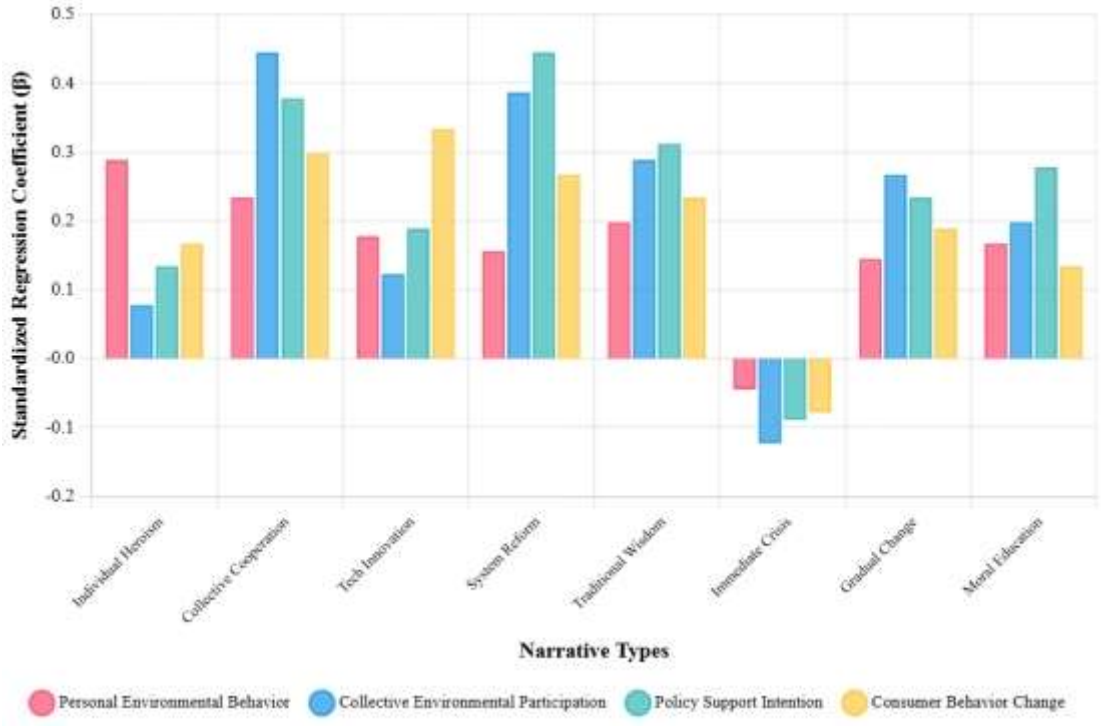

Figure 7. Predictive effects of narrative types on environmental behavioral intentions.

4.3.2. Testing of cultural moderation effects

To deeply explore the moderating role of cultural background in the relationship between narrative types and environmental behavioral intentions, this study employed Hayes's PROCESS macro for moderation effect analysis and verified the stability of cultural moderation effects through multi-group structural equation modeling. Moderation effect analysis results showed that cultural background significantly moderated the relationship between narrative types and environmental behavioral intentions, with overall moderation effects reaching significance levels ($F_{interaction}(8, 583) = 12.47$, $p < 0.001$). The interaction terms between cultural background and narrative types added an additional 7.2% variance explanation to the model ($\Delta R^2 = 0.072$, $p < 0.001$). Specifically, "collective cooperation addressing challenges" narratives had significantly stronger predictive effects in the Eastern cultural group ($\beta = 0.456$, $SE = 0.052$, $p < 0.001$) than in the Western cultural group ($\beta = 0.322$, $SE = 0.048$, $p < 0.001$), with between-group differences reaching statistical significance ($\Delta\beta = 0.134$, 95% CI [0.067, 0.201], $p < 0.01$) [50]. Conversely, "individual heroes saving the world" narratives had significantly stronger predictive effects in the Western cultural group ($\beta = 0.289$, $SE = 0.045$, $p < 0.001$) than in the Eastern cultural group ($\beta = 0.123$, $SE = 0.053$, $p < 0.05$), with significant cultural differences ($\Delta\beta = -0.166$, 95% CI [-0.237, -0.095], $p < 0.001$). This result confirms the fundamental moderating role of cultural values on narrative effects.

Simple slope analysis further revealed specific patterns of cultural moderation effects. In the Eastern cultural group, collectivism-oriented narrative types (including collective cooperation, social system reform, traditional wisdom application) showed strong positive correlations with environmental behavioral intentions, with collective cooperation narratives demonstrating the steepest simple slope ($b = 0.67$, $SE = 0.08$, $t = 8.34$, $p < 0.001$), indicating that this narrative type has particularly strong behavioral mobilization effects in Eastern cultural contexts. In the Western cultural group, individualism-oriented narrative types (individual heroism, technological innovation solutions) showed stronger predictive effects, with individual hero narratives having a simple slope of $b = 0.52$, $SE = 0.07$, $t = 7.41$, $p < 0.001$. Notably, "immediate crisis response" narratives showed negative effects in both cultural groups, but the negative impact was more significant in the Western cultural group ($b_{Western} = -0.24$, $SE = 0.09$, $t = -2.67$, $p < 0.01$ vs $b_{Eastern} = -0.11$, $SE = 0.08$, $t = -1.38$, $p > 0.05$), possibly related to amplification effects of individual anxiety and helplessness in Western culture [51]. Technological innovation narratives had significantly stronger effects in the Western cultural group ($b = 0.41$, $SE = 0.06$, $t = 6.83$, $p < 0.001$) than in the Eastern cultural group ($b = 0.19$, $SE = 0.07$, $t = 2.71$, $p < 0.01$), reflecting Western culture's stronger trust and reliance on technological solutions, as shown in Table 8 below.

Table 8. Analysis of cultural background's moderation effects on the relationship between narrative types and environmental behavioral intentions.

Narrative Type	Eastern Cultural Group (n=300)	Western Cultural Group (n=300)	Interaction Effect	Cultural Difference
	β(SE)	Simple Slope b	β(SE)	Simple Slope b
Individual Heroes Saving World	0.123(0.053)*	0.19	0.289*(0.045)**	0.52
Collective Cooperation Addressing Challenges	0.456*(0.052)**	0.67	0.322*(0.048)**	0.43
Technological Innovation Solving Crisis	0.134(0.057)*	0.19	0.278*(0.049)**	0.41
Social System Reform	0.389*(0.051)**	0.58	0.167(0.054)**	0.23

Narrative Type	Eastern Cultural Group (n=300)	Western Cultural Group (n=300)	Interaction Effect	Cultural Difference
Traditional Wisdom Application	0.334*(0.049)**	0.49	0.067(0.058)	0.09
Immediate Crisis Response	-0.078(0.056)	-0.11	-0.167(0.051)**	-0.24
Gradual Environmental Change	0.289*(0.048)**	0.41	0.156(0.053)**	0.22
Moral Education Function	0.267*(0.050)**	0.38	0.089(0.055)	0.13
Model Fit Indicators				
Model R^2	0.428		0.357	
Interaction Term ΔR^2				
Overall Interaction F-value				

Table 8. (*Continued*)

***Note:* ***p < 0.001, *p < 0.01, p < 0.05; β represents standardized regression coefficients, b represents unstandardized simple slopes*

Multi-group structural equation modeling invariance testing further verified the stability of cultural moderation effects. Configural invariance testing passed (CFI = 0.958, RMSEA = 0.061), but metric invariance testing failed ($\Delta\chi^2 = 89.67$, $\Delta df = 8$, $p < 0.001$; $\Delta CFI = -0.024 > -0.01$), indicating that the impact pathways of narrative types on environmental behavioral intentions indeed differ significantly between Eastern and Western cultural groups. Key pathway group comparisons showed that the Eastern cultural group's "collective cooperation → environmental behavioral intention" path coefficient (0.456) was significantly higher than the Western cultural group's (0.322), while the Western cultural group's "individual hero → environmental behavioral intention" path coefficient (0.289) was significantly higher than the Eastern cultural group's (0.123). Bootstrap confidence interval analysis (5000 resamples) confirmed the robustness of these cultural differences, with all significant moderation effects' 95% confidence intervals not containing 0. To deeply understand moderation mechanisms, the research further examined mediated moderation effects of cultural values, finding that individualism-collectivism values played an important mediating role in the relationship between cultural background and narrative effects (mediated moderation effect = 0.187, 95% CI [0.124, 0.251], $p < 0.001$). Specifically, Eastern cultural background enhanced collective cooperation narrative's positive impact on environmental behavioral intentions by strengthening collectivistic values ($b = 0.67$, $p < 0.001$); while Western cultural background enhanced individualism-oriented narratives' behavioral mobilization effects by reinforcing individualistic values ($b = 0.59$, $p < 0.001$). These findings provide important empirical foundations for precise design of cross-cultural climate communication strategies, revealing the cultural specificity of narrative effects and their underlying value mechanisms, as shown in **Figure 8** below.

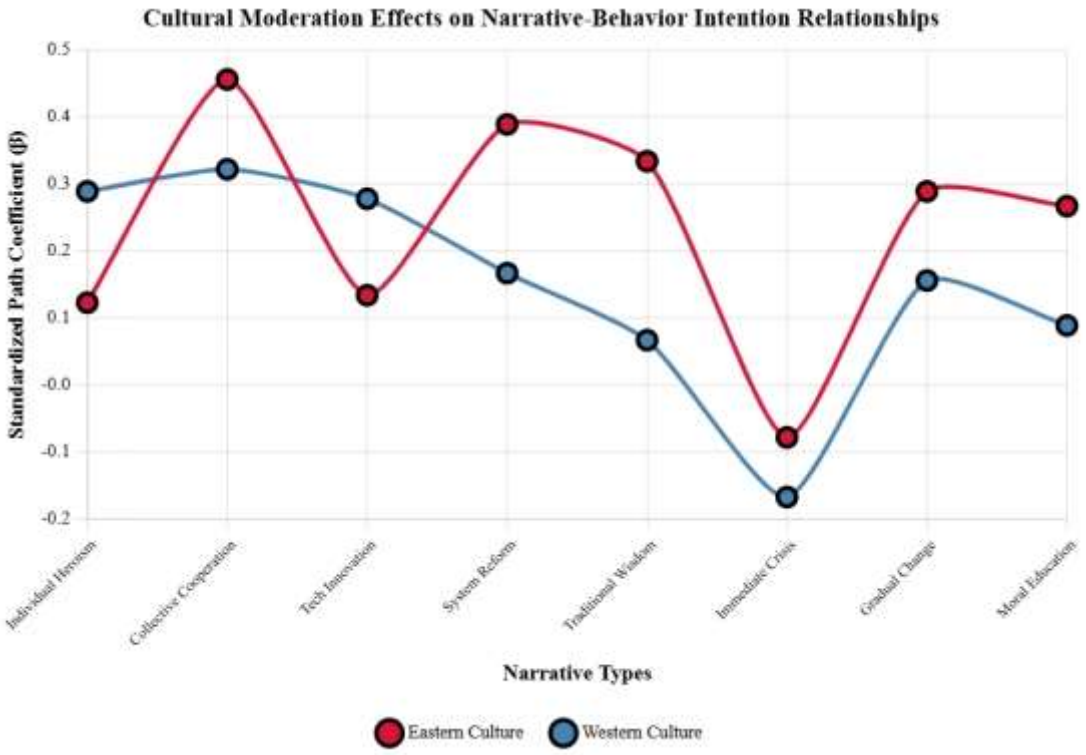

Figure 8. Cultural background's moderation effects on the relationship between narrative types and environmental behavioral intentions.

5. Discussion

5.1. Theoretical explanations of research findings

The core findings of this study receive strong explanation and support within the theoretical frameworks of cultural psychology, narrative communication theory, and environmental psychology. From the perspective of Hofstede's cultural dimensions theory, individualism-collectivism cultural differences profoundly influence both the construction patterns of disaster narratives in climate fiction and readers' identification mechanisms. Western individualistic culture emphasizes individual autonomy, personal achievement, and independence—cultural values that manifest in climate fiction as preferences for individual heroism (85.3%) and trust in technological innovation solutions (52.1%), reflecting individualistic culture's belief in individual agency and reverence for scientific rationalism. Conversely, Eastern collectivistic culture values group harmony, interdependence, and collective interests, therefore emphasizing collective cooperation (72.4%), social system reform (56.2%), and the value of traditional wisdom (27.2%) in narratives, reflecting collectivistic culture's emphasis on group strength and historical heritage[52]. These cultural differences are not only reflected in surface narrative structures but more deeply represent fundamental differences in understanding human-nature relationships, social governance models, and problem-solving pathways across different cultures.

From the perspective of social cognitive theory, readers' identification with climate fiction is influenced by three core factors: observational learning, self-efficacy, and outcome expectations, all of which are significantly moderated by cultural background. Readers from Eastern cultural backgrounds more easily gain vicarious experiences and collective efficacy from collective action narratives because these narrative patterns highly match their cultural cognitive schemas, thereby generating stronger identification and behavioral intentions. Readers from Western cultural backgrounds tend more to gain enhanced personal

efficacy from individual heroism narratives, as these narrative patterns align with their individualistic values and behavioral expectations. The strong predictive effect of narrative preference matching on identification found in this study (β = 0.412) precisely reflects the cognitive consistency principle in social cognitive theory—When external information matches individuals' existing cognitive structures, stronger acceptance and internalization occur [53]. Furthermore, cultural background modulates the impact effects of narrative types on environmental behavioral intentions by influencing individuals' schema structures and attribution patterns, a finding highly consistent with the reciprocal determinism perspective in social cognitive theory.

From the perspective of narrative communication theory, effective narrative communication requires achieving cultural resonance among narrators, narrative content, and audiences. The cross-cultural narrative preference differences found in this study precisely reflect the cultural specificity and contextual dependence of narratives. Walter Fisher's narrative paradigm theory points out that humans are essentially storytelling animals, and stories' persuasive power depends on their narrative coherence and narrative fidelity. In cross-cultural contexts, the judgment criteria for narrative fidelity are profoundly influenced by cultural values: Eastern readers consider narratives of collective cooperation and institutional reform more authentic and credible, while Western readers believe individual heroism and technological innovation narratives better conform to realistic logic [54]. This culture-specific narrative preference explains why the same climate fiction produces vastly different reception effects across different cultural backgrounds and illustrates the deep-level mechanisms of "cultural discount" phenomena in cross-cultural communication.

Finally, analyzing from the theoretical framework of environmental psychology, the cultural differences revealed in this study reflect fundamental differences in human-nature relationship concepts across different cultural traditions. The anthropocentric tradition dominant in Western culture tends to view nature as an object that can be conquered and transformed, therefore placing greater trust in technological means and individual actions to solve environmental problems. The harmony between heaven and humanity philosophy and ecological holistic concepts in Eastern culture emphasize harmonious coexistence between humans and nature, therefore focusing more on the importance of systematic solutions and collective action. This cultural difference was verified in environmental concern level measurements: Eastern readers scored much higher on the "traditional ecological wisdom identification" dimension (M = 5.29) than Western readers (M = 3.87), with a difference margin reaching 1.42 standard scores[55]. These theoretical explanations not only provide profound insights for understanding the complexity of cross-cultural climate communication but also establish theoretical foundations for constructing more effective cross-cultural environmental communication strategies.

5.2. Practical implications of research results

The findings of this study hold important guiding significance and application value for multiple practical fields including climate communication, environmental education, literary creation, and cross-cultural exchange. In terms of climate communication strategy development, the research results provide communicators with precise cultural adaptability guidance principles. Communication organizations should adjust narrative strategies according to target audiences' cultural backgrounds: in Eastern cultural markets, they should emphasize collective cooperation narrative patterns addressing challenges (Eastern preference 5.92 vs Western 4.31), highlight the value of social system reform and traditional wisdom, and stimulate audiences' environmental responsibility and action willingness by showcasing group strength and historical heritage. In Western cultural markets, they should focus on employing individual heroism narratives (Western preference 5.78 vs Eastern 3.89) and technological innovation solutions, enhancing audiences' personal efficacy and technological confidence by creating characters with extraordinary abilities and showcasing technological breakthroughs [56]. Such culturally adaptive communication strategies not only

improve communication effectiveness but also avoid communication failures caused by "cultural discount" phenomena, providing scientific foundations for localized practices in global climate communication.

In the field of environmental education, research findings provide important insights for cross-cultural environmental education curriculum design and teaching method improvement. Educators should adjust educational content and teaching strategies according to learners' cultural backgrounds: for learners from collectivistic cultural backgrounds, they should employ more case studies and group discussions, enhancing learning effectiveness by showcasing successful cases of collective environmental actions and emphasizing group responsibility; for learners from individualistic cultural backgrounds, they should focus more on cultivating personal environmental behaviors and personal achievement incentives, promoting behavioral change by setting personalized environmental goals and demonstrating the value of individual actions. Additionally, the cultural differences in environmental concern levels found in the research (Eastern M=5.42 vs Western M=4.97) suggest that educators need to balance the needs of different cultural groups in cross-cultural environmental education, both utilizing Eastern culture's natural advantages in environmental concern and enhancing environmental awareness among learners from Western cultural backgrounds through appropriate strategies. Such differentiated educational approaches help achieve more inclusive and effective global environmental education.

In terms of literary creation and cultural industry development, research results provide valuable creative guidance and market positioning suggestions for climate fiction authors and publishers. When engaging in cross-cultural creation, authors should fully consider target reader groups' cultural preferences and cognitive characteristics: climate fiction targeting international markets should appropriately integrate universal narrative elements while maintaining cultural distinctiveness, or develop differentiated versions for different cultural markets. Publishers should formulate precise marketing strategies based on cultural preference differences revealed in this study when conducting international copyright trade and market promotion, such as emphasizing works' collectivistic values and traditional cultural elements in Eastern markets, and highlighting individual heroism and technological innovation narrative highlights in Western markets. The unique advantage of "traditional wisdom application" narratives in Eastern culture found in the research (Eastern 5.34 vs Western 2.89) also suggests comparative advantages and cultural export potential for Eastern countries like China in climate literature creation[57].

Finally, in terms of international climate governance and cross-cultural cooperation, research findings provide empirical support for enhancing the cultural inclusiveness and effectiveness of global climate governance. International climate organizations and government agencies should fully consider cognitive differences and behavioral preferences among publics from different cultural backgrounds when formulating global climate policies and conducting international cooperation, avoiding adoption of singular, culture-centric communication strategies. The cultural moderation effects revealed in the research (interaction terms explaining 7.2% additional variance) indicate that identical climate policies and action initiatives may produce completely different effects across different cultural backgrounds, therefore requiring diversified, localized communication and mobilization strategies. Furthermore, this study establishes foundations for constructing theoretical models and practical frameworks for cross-cultural climate communication, helping promote the development of climate communication disciplines and deepening international climate cooperation, ultimately serving the realization of global climate governance goals and the construction of a community with a shared future for mankind.

6. Conclusions and future prospects

6.1. Main research conclusions

This study conducted systematic comparative analysis of disaster narrative differences in climate fiction and their impact on reader identification in cross-cultural contexts through mixed research methods, obtaining important conclusions in the following five aspects.

(1) Significant cultural differences exist in disaster narrative patterns between Eastern and Western climate fiction. Western climate fiction demonstrates distinct individual heroism tendencies (85.3%), preferring technological innovation solutions (52.1%) and sudden disaster events (61.3%), reflecting individualistic culture's trust in individual agency and scientific rationality; while Eastern climate fiction emphasizes collective cooperation in addressing challenges (72.4%), focuses on social system reform (56.2%) and gradual environmental changes (74.0%), reflecting collectivistic culture's emphasis on group strength and systematic thinking. These differences reach statistical significance ($p < 0.001$) with medium-to-large effect sizes (Cramer's $V = 0.32$).

(2) Environmental concern levels and narrative preferences among readers from different cultural backgrounds present systematic differences. The overall environmental concern level of Eastern cultural background readers ($M = 5.42$) is significantly higher than Western readers ($M = 4.97$), particularly with the most prominent difference in the "traditional ecological wisdom identification" dimension (Eastern 5.29 vs Western 3.87). Regarding narrative preferences, Eastern readers prefer collective cooperation narratives more (5.92 vs 4.31), while Western readers favor individual heroism narratives more (5.78 vs 3.89). Discriminant analysis shows that predicting cultural background based on narrative preferences achieves 89.7% accuracy.

(3) Narrative preference matching is the strongest predictor affecting reader identification. Multiple regression analysis shows that narrative preference matching, environmental concern levels, and cultural value consistency are the three core predictor variables for identification, explaining 41.2%, 28.9%, and 26.7% of identification variance respectively, with the complete model's explanatory power reaching 68.4%.

(4) Narrative types have significant predictive effects on environmental behavioral intentions, with obvious cultural moderation effects. Collective cooperation narratives have the strongest predictive effect on environmental behavioral intentions ($\beta = 0.389$), particularly with the most significant impact on collective environmental participation intentions ($\beta = 0.445$). Cultural background significantly moderates the relationship between narrative types and behavioral intentions, with interaction effects explaining an additional 7.2% of variance. Collectivism-oriented narratives have stronger effects in Eastern cultural groups, while individualism-oriented narratives have more prominent influences in Western cultural groups.

(5) Cultural values play important mediating moderation roles in the relationship between narrative effects and reader responses. Structural equation modeling shows that cultural background primarily affects identification and behavioral intentions indirectly by influencing psychological variables such as individualism-collectivism values, environmental concern levels, and narrative preferences, with indirect effects accounting for 61.8% of total effects. These findings not only deepen theoretical understanding of cross-cultural climate communication mechanisms but also provide important empirical foundations for constructing culturally adaptive climate communication strategies, holding significant importance for promoting culturally inclusive development in global climate governance.

6.2. Future prospects

Based on the findings and limitations of this study, future research can be deepened and expanded in the following five directions to further advance the development of cross-cultural climate communication theory and improve practical applications.

(1) Expanding the diversity and representativeness of cultural samples. This study primarily focused on Eastern-Western binary cultural comparisons. Future research should incorporate more cultural groups, such as cultural traditions from Latin America, Africa, the Middle East, and other regions, to construct a more comprehensive cross-cultural climate communication map. Meanwhile, in-depth exploration should be conducted on difference patterns in climate narrative cognition among subcultural groups (such as urban-rural differences, generational differences, educational background differences), as well as unique cognitive characteristics of immigrant populations and individuals with multicultural backgrounds, thereby establishing more refined and personalized cultural classification systems. Additionally, with the deepening of globalization processes and acceleration of cultural integration, special attention should be paid to the impact of cultural hybridization phenomena on climate narrative cognition, exploring narrative preferences and identification mechanisms of "third culture" groups.

(2) Adopting longitudinal tracking designs to deeply examine the persistence and dynamic changes of narrative effects. Although the cross-sectional design adopted in this study revealed association patterns between narrative types and reader responses, it cannot fully explain causal relationships and long-term effects. Future research should adopt multi-wave longitudinal tracking designs to examine the change trajectories of readers' cognitive attitudes and behavioral intentions after exposure to different types of climate narratives, exploring the decay patterns, cumulative effects, and interactive effects of narrative impacts, particularly the influence mechanisms of different narrative type combinations on long-term environmental behavior formation.

(3) Combining advanced technologies from neuroscience and cognitive science to deeply explore neural mechanisms of cross-cultural narrative cognition. Using neuroimaging technologies such as functional magnetic resonance imaging (fMRI) and electroencephalography (EEG) to examine differences in brain activation patterns among readers from different cultural backgrounds when reading climate narratives, identifying neural networks related to cultural cognition, emotional processing, and empathic responses, and verifying the objectivity and universality of cultural differences from a biological level. Meanwhile, employing technological means such as eye tracking and facial expression analysis to monitor readers' cognitive processing and emotional response intensity in real-time, providing more precise data support for research on the micro-mechanisms of narrative effects.

(4) Developing and validating AI-based personalized climate narrative recommendation systems. Based on the cultural difference patterns and individual difference factors revealed in this study, constructing machine learning algorithm models to achieve intelligent identification of readers' cultural backgrounds, psychological characteristics, and narrative preferences, developing personalized recommendation systems capable of automatically matching the most suitable narrative types, and verifying their practical value in enhancing climate communication effectiveness through large-scale field experiments.

(5) Expanding research scope to other environmental issues and communication media forms. Applying the theoretical framework and methodological system established in this study to cross-cultural communication research on other environmental issues such as biodiversity conservation, marine pollution, and air quality, verifying the universality and specificity of cultural difference patterns. Meanwhile, expanding to diversified communication media such as film and television, games, and virtual reality,

exploring difference mechanisms of cross-cultural narrative effects under different media forms, providing theoretical guidance for constructing three-dimensional, multi-dimensional environmental communication ecosystems, ultimately serving the realization of global environmental governance goals and the widespread promotion of sustainable development concepts.

(6) Application Prospects of Digital Technology in Cross-Cultural Climate Communication: With the rapid development of artificial intelligence, big data analysis, and virtual reality technologies, future research should focus on exploring the important role of digital technology in optimizing cross-cultural climate narrative communication. Specific research directions include: developing automatic identification and classification systems for cross-cultural narrative content based on natural language processing technology, achieving large-scale text mining and intelligent analysis of narrative patterns in climate fiction from different cultural backgrounds; using machine learning algorithms to construct personalized cross-cultural narrative recommendation engines that automatically match the most suitable climate narrative content based on readers' cultural backgrounds, psychological characteristics, and reading preferences; developing immersive cross-cultural climate experience platforms based on virtual reality and augmented reality technologies, enhancing cognitive and emotional resonance with climate change among users from different cultural backgrounds through multi-sensory interaction; constructing a global climate narrative database supported by blockchain technology, achieving decentralized storage, copyright protection, and value assessment of cross-cultural climate communication content.

Conflict of interest

The authors declare no conflict of interest.

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