

Cultural Adaptation in Science Communication: Comparing Meteorological Popular Science Narratives in China and Japan

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Abstract: *Against the backdrop of the global climate crisis, science popularization of meteorology serves as a core bridge connecting professional scientific research and public understanding of science, and its cross-cultural communication effectiveness directly impacts the efficiency of improving public climate literacy. This paper takes 3 representative best-selling meteorological popular science works from China and Japan respectively as research corpora, based on cross-cultural communication and frame analysis theories, compares the narrative framework differences of meteorological popular science texts between the two countries from three dimensions: professional concept translation, disaster narrative tendency, and expert role shaping, and verifies the impact of different narrative characteristics on public reception through public questionnaire surveys. The study finds that the narrative differences in meteorological popular science between China and Japan are essentially strategic choices in the local cultural context, and the conclusions can provide practical references for the cross-cultural adaptation of Chinese local meteorological popular science when expanding to overseas markets.*

Keywords: Climate communication, Meteorological popular science, Cross-cultural adaptation.

1. Introduction

The global climate crisis has become a shared challenge facing humanity in the 21st century. The Sixth Assessment Report of the United Nations Intergovernmental Panel on Climate Change (IPCC) clearly states that human activities since the 19th century have caused the global average temperature to rise by approximately 1.1°C [1]. The frequency of extreme weather events such as extreme high temperatures, heavy precipitation, and typhoons has increased by 1.2 times compared to the mid-20th century, and these events are characterized by growing intensity and continuously expanding impact scopes. Against this background, meteorological science popularization, as the core link connecting professional scientific research and public cognition, is not only a key path to improving the public's climate literacy and enhancing society's disaster response capabilities, but also an indispensable component of public participation in global climate governance.

As neighboring countries in the East both located Asian monsoon climate zone, China and Japan are among the countries most severely affected by extreme weather, and both have accumulated rich practical experience in meteorological scientific research and public science popularization. However, influenced by differences in local cultural traditions, social contexts and communication habits, the meteorological popular science texts of China and Japan present distinctly different narrative characteristics, and the "cultural discount" phenomenon is widespread when they are disseminated to each other's markets: when Chinese meteorological popular science content is disseminated in Japan, it is easily considered "too official and lacking a sense of intimacy", while meteorological popular science content imported from Japan often receives comments of "trivial and unclear focus" among Chinese readers, which directly affects the cross-cultural communication efficiency of high-quality meteorological popular science resources.

Current academic research on meteorological popular science mostly focuses on optimizing communication effects in a single cultural context, and there is still an obvious gap in cross-cultural comparative research on the narrative characteristics of meteorological popular science between China and Japan. Existing studies either focus on language conversion at the translation skill level, or emphasize the construction of the popular science system of a single country, and have not systematically sorted out the differences in meteorological popular science between the two countries and their influence mechanisms on audience acceptance effects from the narrative framework level. Against this background, this study takes 3 best-selling local meteorological popular science works each from China and Japan as the corpus basis, and based on cross-cultural communication theory and framework analysis methods, systematically compares the differences in the narrative frameworks of meteorological popular science texts between the two countries, and verifies the impact of different narrative characteristics on audience information understanding, memory and behavior transformation through public questionnaire surveys. The study aims to answer two core questions: First, what systematic differences exist between Chinese and Japanese meteorological popular science texts at the narrative framework level? Second, how do these narrative differences affect the content acceptance effect of the general public?

The theoretical value of this study lies in filling the gap in cross-cultural comparative research in the field of meteorological communication, and expanding the application scenarios of framework analysis theory in the field of science communication; the research conclusions at the practical level can provide implementable cross-cultural adaptation references for the overseas dissemination of Chinese local meteorological popular science to the East Asian market, and also provide reference ideas for the localization adjustment of high-quality overseas

meteorological popular science resources imported by China. The subsequent structure of the full text is arranged as follows: the second part sorts out the relevant theoretical basis and existing research progress, the third part explains the research design and data sources, the fourth part carries out the core comparative analysis of the narrative characteristics of Chinese and Japanese meteorological popular science, the fifth part presents the empirical verification results of audience acceptance, and finally summarizes the research conclusions and practical implications.

2. Theoretical Foundation and Literature Review

The theoretical foundation of this study mainly covers three major fields: cross-cultural communication theory, framework analysis theory, and narrative studies in science communication, which together constitute the analytical perspective and theoretical support of this study.

Cross-cultural communication theory focuses on the adaptability of information dissemination in different cultural contexts. Hall's (1976) high-context and low-context culture framework points out that East Asian countries generally belong to high-context cultures, where information dissemination is highly dependent on context and cultural background, and the same information may produce distinctly different reception effects in different cultural contexts [2]. Subsequent scholars further expanded the "cultural adaptation" theory, holding that information dissemination for audiences of different cultures requires localized adjustment of expression form and narrative style while maintaining core information accuracy, so as to reduce the negative impact of "cultural discount". Cross-cultural communication studies targeting East Asia show that although China, Japan and South Korea all belong to the Confucian cultural circle, affected by differences in modernization paths and social development models, there are still significant differences in public acceptance preferences for scientific information among the three countries, providing an important theoretical premise for this study.

Framework analysis theory provides operable analytical tools for interpreting the influence mechanism of narrative characteristics. Goffman's (1974) framework theory holds that people understand and interpret social information through specific "frameworks", and information publishers can guide audience focus and interpretation direction by selecting specific narrative frameworks [3]. Entman (1993) further applied framework theory to media communication research, pointing out that framework construction includes four core dimensions: problem definition, cause explanation, moral judgment, and solution proposal [4]. Different framework choices directly affect audience cognitive judgment and behavioral intention. In recent years, framework analysis theory has been widely used in science communication research, and multiple narrative studies have confirmed that framework choice of popular science texts significantly affects public understanding, trust and acceptance willingness of scientific information, providing a direct theoretical basis for this study.

Relevant studies on science communication narratology

provide references for the coding system design of this study. Compared with professional scientific literature, the core feature of popular science texts lies in their "narrativity", that is, reducing the threshold for understanding scientific knowledge through story-based and life-oriented expressions. Existing studies summarize narrative characteristics into three core dimensions: first, translation strategy of professional knowledge, transforming abstract concepts into daily expressions; second, emotional narrative tendency, the selection and presentation of emotional elements; third, shaping of subject roles, image construction of scientists and experts [5]. Different combinations form differentiated narrative styles, affecting public reading experience and content acceptance.

Sorting existing studies reveals that current academic research on meteorological popular science mostly focuses on optimizing communication effects in single cultural contexts, with an obvious gap in cross-cultural comparative research on narrative characteristics between China and Japan [6]. Existing studies either focus on language conversion at translation skill level, or emphasize single-country popular science system construction, without systematically sorting differences in meteorological popular science between the two countries and their influence mechanisms from the narrative framework level, which is exactly the research gap this study attempts to fill.

3. Research Design

This study adopts a mixed research method of "text analysis + audience verification". First, it compares differences in narrative frameworks of Chinese and Japanese meteorological popular science texts through coding analysis, then verifies the impact of different narrative characteristics on audience acceptance effects through questionnaire surveys. The specific research design is as follows.

3.1 Corpus Selection

To ensure corpus representativeness, this study sets three screening criteria: first, works oriented to general public rather than professional readers, belonging to popular meteorological science readings; second, works with over 100,000 copies sold domestically, widely recognized by market and readers; third, publication time between 2018-2023, reflecting latest narrative styles. Based on these criteria, 3 Chinese meteorological popular science works (Myriad Meteorological Phenomena, Extreme Weather Protection Guide, Climate Science for the Public) and 3 Japanese works (Future Forecast of Abnormal Meteorology, Meteorology Around Us, Climate Disaster Response Manual) are selected as research corpus, totaling approximately 240,000 characters, covering extreme weather, climate science, and disaster response themes, fully presenting narrative characteristics of both countries.

3.2 Construction of Coding System

Based on science communication narratology dimensions, this study establishes a unified narrative characteristic coding system including 3 major dimensions and 12 subdivision indicators: (1) Professional concept translation dimension,

including 3 indicators: definition expression method, analogy use frequency, and case type selection; (2) Disaster event narration dimension, including 3 indicators: narrative perspective selection, emotional tendency, and solution presentation method; (3) Expert role shaping dimension, including 3 indicators: expert identity expression, interaction method, and authority presentation method; additionally, 3 control indicators (work theme, length, target reader group) are set to exclude irrelevant variable interference. Coding work is independently completed by two trained coders, with Krippendorff α value of 0.87, higher than acceptable standard of 0.7, indicating good reliability.

3.3 Audience Verification Scheme

To verify the impact of different narrative characteristics on audience acceptance effects, this study designs a simplified audience questionnaire, selecting 100 ordinary people without meteorological professional background as research objects, with 50% male-female ratio, age distribution covering main popular science audience group of 18-60 years old. The questionnaire sets three core evaluation indicators: (1) Information understanding accuracy, testing respondents' information extraction accuracy through 3 objective questions; (2) Content memory degree, testing content memory retention rate through 3 recall questions 72 hours after reading; (3) Intention to engage in disaster preparedness behaviors, testing respondents' intention to adopt meteorological disaster prevention behaviors through five-point Likert scale. All research content removes source identifiers to avoid national prejudice affecting evaluation results.

4. Core Comparative Analysis of Narrative Characteristics of Chinese and Japanese Meteorological Popular Science

Based on the unified coding system analysis, differences in narrative frameworks of Chinese and Japanese meteorological popular science texts are mainly reflected in three core dimensions: translation of professional scientific concepts, emotional narration of disaster events, and shaping of meteorological expert roles. These differences are closely related to the cultural contexts and communication traditions of both countries.

4.1 Differences in Translation Strategies of Professional Scientific Concepts

Chinese meteorological popular science texts generally adopt a rigor-oriented strategy of "authoritative definition + scenario case" for translating professional concepts. Coding results show that 89% of professional concepts are accompanied by standardized scientific definitions upon first appearance, then explained through macro-level cases such as public events and policy implementations. For example, when explaining "El Niño phenomenon", Chinese works usually provide the National Climate Center's standard definition first, then combine actual cases of recent floods in southern China and droughts in northern China to explain its specific impact. The expression is logically clear and highly authoritative, but relatively lacks life-oriented analogies, creating a certain understanding threshold for ordinary readers without scientific background.

Japanese meteorological popular science texts tend to adopt a accessibility-oriented strategy of "daily analogy + personal experience". Coding results show that 76% of professional concepts are explained through analogies with common daily life items, while only 32% are accompanied by strict academic definitions. For example, when explaining "El Niño phenomenon", Japanese works analogize it to "a cold and fever in the Pacific Ocean", lowering the understanding threshold through life-oriented analogies like "abnormally rising seawater temperature is like human fever causing systemic chain discomfort", then explain impacts combined with authors' or ordinary people's actual life experiences. The expression is vivid and easy to understand, but concept definition rigor is relatively weak.

The difference between these translation strategies essentially reflects the positioning of popular science communication in both countries: Chinese meteorological popular science undertakes certain public service functions, emphasizing accuracy and authority of scientific information; Japanese meteorological popular science is more inclined toward market-oriented popular reading attributes, paying more attention to content readability and communication efficiency.

4.2 Differences in Emotional Narrative Tendencies of Extreme Disaster Events

Chinese meteorological popular science texts generally adopt a narrative tone of "collective orientation + constructive guidance" for extreme disaster events. Coding results show that 92% of disaster-related content adopts third-person macro perspectives, focusing on overall disaster impacts, government prevention measures, and public collective responses. Emotional expression tends toward rational and positive guidance, highlighting that disasters are preventable and controllable through societal response. For example, when describing typhoon disasters, Chinese content usually focuses on meteorological department early warning mechanisms, disaster prevention deployment by governments at all levels, and unified public protection requirements, rarely showing negative scenes of individual disasters to avoid causing unnecessary social panic.

Japanese meteorological popular science texts adopt a narrative tone of "individual perspective + factual recounting" for extreme disaster events. Coding results show that 68% of disaster-related content adopts first-person or ordinary individual narrative perspectives, focusing on presenting real experiences, lessons learned, and practical response skills of ordinary people in disasters. Emotional expression tends toward realism and empathy. For example, when describing typhoon disasters, Japanese content usually quotes ordinary people's typhoon experience records, introduces in detail practical skills such as home self-protection and post-disaster self-rescue, while objectively presenting disaster damage and losses, highlighting disaster risks and response necessity.

This difference in narrative tendency is closely related to disaster cultural traditions: China's disaster narrative emphasizes collective strength and institutional advantages, focusing on stabilizing social emotions; Japan, as a country with frequent earthquakes and typhoons, pays more attention to inheritance of individual experience and popularization of

practical skills.

4.3 Differences in Shaping Methods of Meteorological Expert Roles

Meteorological experts in Chinese meteorological popular science texts are generally positioned as “authoritative guides”. Coding results show that when introducing experts, their authoritative identity identifiers such as administrative positions, professional titles, and scientific research achievements are usually emphasized. Experts’ speeches are mostly based on guiding expressions like “suggest”, “require”, and “remind”, maintaining clear professional distance from readers. For example, when introducing meteorological early warning knowledge, experts usually appear as “experts from meteorological departments remind” or “chief forecaster reminds” to provide standardized protection guidance.

Meteorological experts in Japanese meteorological popular science texts are generally positioned as “co-explorers”. Coding results show that when introducing experts, administrative identities are usually weakened, with more emphasis on life-oriented characteristics such as personal research interests and disaster experiences. Experts’ expressions are mostly based on equal and interactive phrases like “I found”, “according to my experience”, and “let’s understand together”, focusing on narrowing distance with readers. For example, when introducing meteorological early warning knowledge, experts usually start with “I have been engaged in meteorological research for 20 years, experienced 12 large typhoons, and summed up several practical early warning identification skills”, delivering knowledge through experience sharing.

The difference between these role shaping methods reflects different science communication concepts: China’s popular science communication emphasizes authority and guidance of professional knowledge, while Japan’s popular science communication pays more attention to equal knowledge sharing and interaction.

5. Analysis of Empirical Results of Audience Acceptance

A total of 100 valid questionnaires were collected in this study. The age distribution of respondents is as follows: 42% are 18-30 years old, 48% are 31-50 years old, and 10% are 51-60 years old, with a male-female ratio of 50% each. None of the respondents have meteorology-related professional backgrounds, which conforms to the group characteristics of ordinary popular science audiences. By comparing the respondents’ evaluation results of popular science content with the two typical narrative frameworks of China and Japan, it can be found that different narrative characteristics have significant impacts on audience acceptance effects.

5.1 Comparison Results of Core Indicators

In terms of the metric for information comprehension accuracy, the average understanding accuracy of content adopting China’s “authoritative definition + scenario case” translation strategy is 72.3%, which is slightly higher than the 68.7% of Japan’s “daily analogy + personal experience”

strategy, indicating that rigorous definition expressions are more helpful for audiences to accurately grasp core scientific concepts. In terms of the metric for 72-hour content retention, the average memory retention rate of content with the Japanese narrative framework is 61.2%, which is significantly higher than the 49.5% of the Chinese narrative framework, indicating that life-oriented analogies and personalized narration are more conducive to the audience’s long-term memory of content. In terms of the metric for disaster preparedness intention, the scores of the two frameworks are relatively close: the average score of the Chinese narrative framework is 3.82 (out of 5 points), and that of the Japanese framework is 3.76, both of which can effectively improve the audience’s willingness to take disaster prevention actions.

Further subgroup analysis shows that there are significant differences in the preferences for narrative frameworks among audiences of different age groups: the younger cohort (18-30) has a higher acceptance of Japan’s life-oriented narrative framework, and their memory score is 18.3 percentage points higher than that of the Chinese framework; while the older cohort (51-60) aged 51-60 prefers China’s rigorous and authoritative narrative style, and their understanding accuracy score is 15.7 percentage points higher than that of the Japanese framework. This indicates that there is no absolute advantage or disadvantage in the effect of narrative frameworks, and appropriate narrative strategies need to be selected according to the characteristics of the target audience group.

5.2 Attribution Explanation of Results

The above results are closely related to the cultural adaptability of the narrative characteristics of the two countries: Chinese audiences have long been influenced by the official popular science communication style, and have a high acceptance of authoritative definitions, and rigorous expression methods are more likely to gain the trust of audiences; while the life-oriented and personalized narrative style is more in line with the content consumption habits of contemporary young groups, and can effectively improve the memory and communication power of content. This also verifies the core hypothesis of this study, that is, the selection of narrative frameworks for meteorological popular science needs to be adjusted adaptively in combination with the cultural background and group characteristics of the target audience, and simply transplanting or copying the narrative mode of a different culture will reduce communication efficiency.

6. Conclusions and Implications

Through the comparison of narrative frameworks of Chinese and Japanese meteorological popular science texts and the analysis of audience verification, this study finds that the narrative differences of meteorological popular science between the two countries are essentially strategic choices under the local cultural context: China prefers the narrative orientation of “authority and rigor”, which has advantages in information accuracy; Japan prefers the narrative orientation of “accessibility and interaction”, which performs better in communication effectiveness. There is no absolute advantage or disadvantage between the two types of narrative

frameworks, and they need to be adjusted adaptively according to the group characteristics of the target audience.

The above conclusions provide clear practical implications for the cross-cultural communication of Chinese meteorological popular science: when going global to East Asian neighboring countries, on the premise of maintaining the accuracy of scientific information, life-oriented analogies and individual narrative elements can be appropriately added to improve the sense of intimacy and communication efficiency of the content; for the creation of meteorological popular science for domestic young groups, the interactive narrative experience of Japan can also be used for reference to improve the acceptance of young audiences. The limitation of this study is that the corpus sample size is relatively limited. In the future, it can be extended to comparative studies of meteorological popular science in more countries to further improve the strategic system of cross-cultural adaptation.

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