



The Status and Issues of Science and Technology Communication Under Multimodal Discourse

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Abstract. In the era of smart media, video has become the mainstream mode of technology communication. Science and technology communication is the process of transmitting scientific and technological knowledge between different communicators and spreading it to society. Although technology knowledge disseminated through video on social media platforms has a greater reach, the rapidly increasing and uncontrollable complex information in the communication process has created some ethical issues, such as unclear identity attribution of content producers, strong competition for user attention in the combination of multimodal content, and lax regulation of video communication platforms.

Keywords: Science popularization · multimodal discourse analysis · technology communication ethics

1 Introduction

The development of internet technology has led to the rise of citizen science, where professionals and amateur technology enthusiasts participate in the process of science and technology communication, becoming the subject of science and technology communication. As contemporary scientific knowledge becomes more specialized, the involvement of citizen science also brings about certain ethical issues in science and technology communication, especially on social media platforms dominated by video communication. Based on the characteristics of videos on different platforms, this article analyzes the current situation of science and technology communication in China and the ethical issues that need to be addressed, focusing on two popular video platforms: Tiktok and Bilibili, and the popular means of science and technology communication through videos. Using a multimodal discourse analysis perspective, the article provides reasonable opinions and suggestions from the perspective of science and technology communicators and video communication platforms.

2 Literature Review

2.1 Multimodal Discourse Analysis

In the early 1950s, American linguist Zellig Harris proposed discourse analysis as a research direction. However, some of the series of discourse studies conducted at that time focused only on language as the object of study, paying attention to linguistic systems

and semantic structures and their relationship with social, cultural, and psychological cognition. (Zhu, 2007) [1] In the 1990s, multimodal discourse analysis began to emerge in the West. Multimodal discourse refers to the phenomenon of using multiple sensory modalities, such as auditory, visual, and somatosensory. (Zhang, 2009) [2] A typical multimodal discourse mode is one where a modality of discourse cannot fully convey its meaning, and another modality is needed to supplement it. The relationship between these modalities is called a ‘complementary relationship’. In modern communication, video is a typical example of multimodal discourse.

Currently, research on multimodal discourse analysis mainly focuses on several areas. Firstly, from a semiotic perspective, Kress, and van Leeuwen combined systemic functional grammar, Saussure, and Halliday’s semiotic ideas, as well as critical discourse analysis theory, and developed Social Semiotics based on visual grammar. Visual grammar can explain how characters, places, and objects constructed by visual symbols make up a certain visual statement. (Kress, 2006) [3] Various frameworks for multimodal discourse analysis have been established in international academia, including the social semiotic framework for website interactive multimodal analysis, the holistic analysis framework for multimodal meaning representation in scientific education (Tang, 2014) [4], the social semiotic analysis framework for science museum exhibitions, the multimodal discourse theory for visual narration (Bateman, 2014) [5], and the new method framework for critical discourse analysis of news discourse. (Bednarek, 2014) [6].

Video has become the main form of communication, whether it is medium-length video or short video. In dynamic video discourse, the cooperation and interdependence of visual and auditory modalities are mainly manifested in three types of collaborative relationships: the prompting communication mode, the information-providing communication mode, and the attention-seeking communication mode. (Zhang, 2018)[7] When images and text are juxtaposed on the same page or in the same text, they work together to reflect the ‘conceptual meaning’, ‘interpersonal meaning’, and ‘discourse meaning’ of the discourse.

2.2 Differentiating Concepts of Science Communication and Popularization

The earliest paradigm of science communication was science popularization. The basic viewpoint of popularization is that science and technology have significant influences on society, and it is necessary to transfer scientific knowledge, scientific methods, and scientific spirits from scientists to the public through popularization work to help people better understand science. In the 1950s, the second paradigm of science communication, public understanding of science, emerged.

In the 1980s, a new paradigm of science communication, namely the participatory paradigm (PEST), emerged. This paradigm is also known as the ‘dialogue mode’ or ‘democratic mode’, emphasizing that the public should participate in the scientific process. Many scholars in China have defined science and technology communication. Science and technology communication is further divided into four categories according to the communication channels: professional communication, science and technology exchange, science and technology popularization, and technical communication.

‘Science popularization’ is a shortened term for the popularization of science and technology. There is a concept that regards the communication of scientific and technological knowledge to the unknown as science popularization. From the perspective of communication, a science popularization is an act that promotes the communication of technology, with its audience being public.

2.3 Ethical Issues in Science and Technology Communication

Since the 1990s, with the promotion of higher education and its emphasis on the cultivation of modern civic spirit, the civic science movement of ‘public participation in science’ has begun to rise. (Liu, 2018) [8] The new ‘digital world transcends geographical, conceptual, and cultural boundaries, creating diverse online communities’, which further stimulates the rise of civic science research. Different technological communication purposes, contents, or the organizations and media on which technological communication relies, have created diverse communicators in technological communication practice. As each producer and receiver of information may have different levels of expertise and professional ethics, some information creators and disseminators with inadequate qualifications have led to the alienation of information communication content.

According to the results of the 11th National Survey on Chinese Citizens’ Scientific Literacy, (He et al., 2021) [9] Chinese citizens have a high level of interest in information related to the development of science and technology. In the process of communication, mainstream media emphasize the reinforcement of scientific knowledge in reporting on scientific issues, but neglect the discussion of related social issues, creating a gap between mainstream scientific communication and the risk perception of the public. (Yang, 2014) [10] When there is a discrepancy between technical risks and perceived risks, the social amplification of risks occurs, mainly focusing on the information concerning the development of science and technology that Chinese citizens are most concerned about. Some self-media, tempted by the benefits of traffic and business, publish short video content that is unverified or inherently false without considering the source and channel of information, resulting in a proliferation of low-quality popular science content on the internet and misleading the public. (Guo & Zhao, 2022) [11] Some media workers in China, driven by their career interests, often focus more on the sensational reporting of issues rather than meeting the time-sensitive and process-oriented requirements of scientific knowledge problems. (Chen, 2011) [12].

3 Research Methodology

Based on the characteristics of science and technology communication videos, this article selects relevant accounts on the Bilibili bullet screen website and Tiktok for case analysis. Searching for ‘science’ on the Huitun website, there were 6,513 accounts and 7,914 popular short videos, and searching for ‘technology’, there were more than 9,999 accounts and 4,419 popular short videos. Searching for ‘science’ on the new website shows that there are 2056 Bilibili video accounts and searching for ‘technology’ shows that there are 4378 Bilibili video accounts under this category. Based on the popularity of the accounts, their relevance to ‘technology’ and ‘science popularization’, official

ID	Total number of fans	Popular Short Videos in the Last 90 Days	Video length	Forward volume	Number of replies	Number of comments	Number of collections
Infinite (Xiaohongshu) Science Popularization Daily	2319.7w	Network heat transfer, biomimetics, etc.	Long video	11.1w	148.3w	5.5w	5.0w
Director of the Top Secret Research Institute	1601.9w	Deliberate and terrifying coincidences, with a probability of one in ten million (1) If all can medicine human labor, will we be unemployed?	Short video	8936	14.8w	1896	1.3w
Director of the Supernatural Research Institute	713.8w	Disigning cigarettes as "boys" and selling them to children? I secretly investigated the dark factory and uncovered the gang behind it.	Middle video	3406	12.5w	1.2w	5494
Dad's evaluation	400.16w	We all underestimated GPT-4's when dreams start. Hat is thousand enemies, self harm a thousand.	Short video	2.16w	28.39w	3305	8.32w
Director Lin Chao	367.75w	10 year old boy with low back pain. Is his stomach full of milk tea and pearls? Did you catch it when you were a child? Do you still remember its name?	Long video	2.26w	5.21w	2249	4.17w
Cicada Decompression Sports	324.63w	19 year old boy with low back pain. Is his stomach full of milk tea and pearls? Did you catch it when you were a child? Do you still remember its name?	Long video	1.19w	17.3w	1948	2.03w
China Food News Financial Media	204.19w	China Food News Financial Media	9:58	3133	5.23w	2258	5323
Phylogia Brother's Brain Science	182.5w	Every step of this place is indeed a surprise! Have you learned the secret of writing every bet after watching this video?	Short video	1170	5232	4009	286
Craftsman Jia	143.71w	The dog who cheated during pregnancy has caused all the dogs in the village to become pregnant. Don't look at those with irregularities, prehistoric marine organisms have a large comb in size, and the fruit one is too huge (3)	Middle video	296	6.8w	619	1639
Hard Core Science Popularization	134.9w	The dog who cheated during pregnancy has caused all the dogs in the village to become pregnant. Don't look at those with irregularities, prehistoric marine organisms have a large comb in size, and the fruit one is too huge (3)	Short video	3.7w	5.4w	6468	1.8w
Wonders of Nature	132.0w	The dog who cheated during pregnancy has caused all the dogs in the village to become pregnant. Don't look at those with irregularities, prehistoric marine organisms have a large comb in size, and the fruit one is too huge (3)	Short video	9.4w	12.3w	3.2w	4484
Science Popularization Research Institute	118.3w	The dog who cheated during pregnancy has caused all the dogs in the village to become pregnant. Don't look at those with irregularities, prehistoric marine organisms have a large comb in size, and the fruit one is too huge (3)	Middle video	3731	6.8w	2417	1.3w

ID	Total number of fans	Popular Short Videos in the Last 90 Days	Video length	Forward volume	Number of likes received	Number of comments	Number of collections
The Beauty of Plants	100.2w	Shoot 30 types of Chinese herbal medicines in the wild, how many do you know?	Short video	3.6w	9.2w	3820	9.3w
Large candle	92.65w	UL94-0 encoders when Japan is shocked? History of Japan's richest man's rise Adjusted from the "high scoring" financial film	Long video	363	1.37w	190	3221
The Miracle of Compound Interest ETF Fund Management	87.66w	"Outsider", the most amazing trader in history, earning 1.5 billion overnight! Important transactions must be seen!	Long video	5014	2.92w	790	5.46w
Dater's Food Science Popularization Daily	80.04w	Plaintiff, Dutyman Suit Bread!	Long video	5651	26.45w	8728	6.16w
Woodblock Laboratory	66.58w	Violent destruction of Ford shows, really easy to decompose. I've skip up something good, if you can't sell any ink, come and take a look.	Short video	116	6811	294	563
Compendium of Materia Medica	52.66w	I've skip up something good, if you can't sell any ink, come and take a look.	Short video	413	1.12w	258	990
Creator's Diary	40.1w	The next tabs on Christmas Island in Australia are everywhere and no one wants them. How old can a baby cat be? Why doesn't the crocodile show bite accept?	Short video	28	342	53	17
Strict selection of parenting	39.0w	Why does the sun that cannot be grasped? We put it in a bucket.	Short video	16	24	1	8
Chinese Academy of Sciences China Science Popularization Expo	33.45w	Why doesn't the crocodile show bite accept?	Long video	103	2692	126	427
Kawayama's insect World	33.87w	Why doesn't the crocodile show bite accept?	Short video	164	4.60w	401	2554
Window to the World's TOP	28.0w	What is the first disease? 7 diseases in the restaurant has been exposed! Cooks never eat, the first place in a hospital of many people!	Short video	8.6w	3.9w	4080	1.6w
Kyushu Secret History Record	8.2w	Laotianing Aurido robot, used for five years and can be satisfied by drinking low water every day. After the earthquake, the doctor uncovers the mystery.	Short video	2009	2.2w	395	5268

Fig. 1. Summary of analysis cases

certification of the accounts, and audience acceptability, a total of 87 valid accounts were ultimately selected for analysis.

Record and analyze the total number of followers, likes, and the most popular video within the past 90 days, as well as the number of likes, comments, shares, and favorites for that video. The total number of followers and likes intuitively shows the level of trust that users have in the account and reflects the account's level of professionalism and recognition. Videos can be classified into three categories: videos that are less than 3 min long as short videos, those between 3–5 min as medium videos, and those over 5 min long as long videos. The final table is shown in Fig. 1:

4 Ethical Issues of Science and Technology Communication

4.1 Blurred Identity Attribution of Content Producers

The development of the internet has driven the rise of citizen science, while the development of social media has provided a wider platform for its communication. Although the boundary between technology communication and science communication has become increasingly blurred in the new media era, technology workers still have higher authority and credibility. Video sharing platforms give technology communication accounts platform authentication, which can be seen as official authentication of the account by the platform. Professional science and technology communication accounts will use this official authentication to indicate their professional identity to users, to gain user trust and attention. Therefore, some non-professionals will forge their identities, or sign contracts with certain MCN institutions to package their identities, creating many pseudo-insiders who claim to be professional practitioners. Users find it difficult to uncover the truth behind the hidden network, and the science knowledge they receive is also mixed with true and false information.

When users discover that they have received unprofessional science information, they will lose trust in the communicator, and this distrust will further extend to other related accounts, thereby impacting the communication of professional technology information.

4.2 Content Combination Competes for User Attention

In multimodal applications, the selection of modality involves optimal pairing, which is not completely free and arbitrary. The principle of modality pairing should be to increase positive effects. Through the analysis of science communication videos on Tiktok and Bilibili video websites, a phenomenon was found that creators often add exaggerated and frightening sound effects to the video or use popular music provided by the platform as background music to increase the watchability and abundance of the video. The addition of this auditory modality can greatly interfere with the audience's focus on the video content, causing a negative impact on science communication and causing the audience to choose to block such videos, which impedes science communication.

Unlike the long and complete narrative methods used in television, movies, and documentaries, the communication of video formats, especially short videos, requires a description of events or things to be completed in a very short time frame. Therefore, the videos presented on most social media platforms do not fully reflect the meaning of the content. Due to limitations set by the publishing platform, the duration of short videos is mostly between 30 s to 1 min. This fragmented and animated form of presentation breaks down the coherence and completeness of professional scientific knowledge. Furthermore, the visually striking and salient images that appear in short videos also distract audiences from textual knowledge or commentary. In contrast to short videos, long videos often require creators to fill the allotted time with meaningless content, adding irrelevant film and television images and pictures to the narrative of professional scientific knowledge, causing a certain degree of cognitive dissonance in audiences who may mistake the presented visual imagery as the actual background or process of scientific knowledge.

A good title and thumbnail can capture the audience's visual attention at first sight. However, analysis has revealed that many videos employ 'clickbait' tactics where the title and thumbnail differ from the actual content of the video. The proliferation of these tactics has made it an increasingly common ethical issue in content communication. Whether done by industry professionals, amateur science communicators, or teams, the use of provocative or suggestive language in titles has become a widespread phenomenon. Such titles not only compete for users' attention but also impact the user's purpose for clicking on the video.

4.3 Relaxation of Oversight on Video Platforms

According to an analysis of science and technology communication video accounts, many accounts do not actually disseminate technology or popular science content. Although the platform provides the 'science popularization' label, the content disseminated by these accounts belongs to pan-knowledge communication, rather than technology communication or popular science. As the main regulator of these accounts, the platform has blurred the attributes of the accounts, which may mislead the audience and

cause them to mistake ‘unofficial history’ as ‘official history’ or ‘life hacks’ as ‘professional knowledge’. This also reflects to some extent the lack of professional knowledge among platform reviewers and the absence of ‘gatekeepers.’

Technological knowledge is different from entertainment content on platforms. The threshold for watching videos on technological knowledge is lower, but this does not mean that video review personnel do not need the threshold. The absence of professional platform review personnel can also lead to the proliferation of false technological information, which will then impede the protection of intellectual property rights. The relaxation of platform reviews has led to frequent incidents of plagiarism, false information, and marketing mixed in with technological information, seriously damaging the seriousness and rigor of technological information.

5 Conclusion

In technology communication, there is a fuzzy and indistinct identity attribution of content producers, and the real identity of technical communicators is questionable. The boundary between professionals and non-professionals is blurred, and users find it difficult to distinguish the authenticity of account identities with just a short video. At the same time, video platforms are lackadaisical in regulating account identity and content, with a lack of professional gatekeepers, and false technology information floods, leading to various copyright infringement incidents. These ethical issues in science and technology communication seriously weaken the influence of China’s science and technology communication. In the era of new media, science, and technology communication should focus not only on the essence of content but also on how to turn this communication behavior into effective communication. Finally, video platforms should fulfill the responsibility of gatekeepers, and set up professional science and technology communication reviewers, not only to verify the authenticity of account identities, but also to have a clear distinction between science and technology communication, science popularization, and pan-knowledge communication subjects, and strengthen content review, respect knowledge labor, and protect intellectual property rights. In addition, this study also has some limitations: the sample size of each platform is insufficient, which may cause some measurement errors; the study subjects have limitations, and whether the research results can be generalized to information in other scientific fields requires further testing.

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