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Donor Support from Research Impact Storytelling in Nonprofit Science Campaigns: Panel Analysis

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Abstract

The landscape of scientific research funding has increasingly shifted toward private philanthropy, necessitating that nonprofit science organizations develop highly effective communication strategies to attract and retain donor support. Among these strategies, research impact storytelling has emerged as a predominant method for translating complex scientific discoveries into compelling narratives that resonate with lay audiences. Despite its widespread adoption, empirical evidence quantifying the longitudinal effectiveness of specific narrative elements on donor behavior remains critically scarce. This paper addresses this substantial gap by employing a comprehensive panel analysis to evaluate how variations in research impact storytelling predict ongoing donor financial support. Utilizing a longitudinal dataset encompassing donor transaction histories and corresponding campaign communications over a multi-year period, this study operationalizes storytelling metrics through advanced computational text analysis. The research investigates the differential effects of human-centric narratives versus purely discovery-centric narratives, alongside the temporal dynamics of donor engagement. Findings indicate that campaigns emphasizing tangible, human-level impacts yield significantly higher donor retention rates and increased average gift sizes over time compared to traditional, data-heavy scientific reporting. Furthermore, the panel data approach successfully controls for unobserved individual heterogeneity among donors, providing robust causal inference regarding the efficacy of narrative transportation in philanthropic contexts. The insights derived from this study offer critical theoretical advancements in the psychology of charitable giving and provide actionable frameworks for science communicators and nonprofit administrators seeking to optimize fundraising campaigns in an increasingly competitive philanthropic environment.

Keywords: Philanthropy; Science Communication; Panel Analysis; Narrative Transportation; Donor Retention

1. Introduction

1.1 Background and Context

The contemporary ecosystem of scientific research relies heavily on a diversified portfolio of funding mechanisms. Historically, governmental grants and institutional endowments have served as the primary financial engines for scientific inquiry and technological advancement. However, shifting macroeconomic conditions, fluctuating political priorities, and the increasing cost of cutting-edge research have precipitated a noticeable plateau, and in some sectors, a decline in public funding availability. Consequently, scientific institutions, independent research laboratories, and academic bodies have increasingly transitioned toward the nonprofit sector model, actively soliciting financial contributions from private individuals, foundations, and corporate entities. This paradigm shift has engendered a highly competitive philanthropic landscape where organizations must differentiate themselves not only through the rigor and potential of their scientific endeavors but also through their capacity to communicate the value of their work to non-expert audiences. Within this context, research impact storytelling has emerged as a fundamental tool for science communicators and fundraising professionals. Storytelling transcends traditional scientific reporting, which

often relies on dense methodologies, statistical significance, and abstract theoretical implications. Instead, impact storytelling translates complex empirical phenomena into relatable, narrative-driven formats that emphasize the tangible, real-world consequences of scientific discoveries. By focusing on the potential human, environmental, or societal benefits, organizations attempt to bridge the cognitive gap between the laboratory and the prospective donor. Early observational studies suggest that donors are increasingly motivated by the perceived social return on their philanthropic investment, making the clear articulation of research impact an essential determinant of fundraising success [1]. However, the mechanisms through which specific storytelling attributes influence longitudinal donor behavior require rigorous empirical investigation.

1.2 The Problem Statement

Despite the ubiquitous application of storytelling in nonprofit science campaigns, the empirical evaluation of its effectiveness has largely been confined to cross-sectional surveys, anecdotal case studies, and short-term experimental designs. These traditional methodological approaches, while valuable for understanding immediate cognitive or emotional responses to specific messages, fail to capture the dynamic and evolving nature of donor relationships. Charitable giving is rarely a singular, isolated transaction; rather, it is a complex, iterative process characterized by initial acquisition, ongoing cultivation, repeated contributions, and varying levels of attrition. Cross-sectional studies are inherently limited in their ability to account for unobserved individual heterogeneity, such as an individual donor's baseline propensity for altruism, their specific affinity for a scientific discipline, or their personal financial trajectory. Furthermore, short-term evaluations cannot adequately assess how the cumulative exposure to varied impact narratives over time shapes a donor's decision to maintain, increase, or terminate their financial support. The fundamental problem lies in the absence of robust, longitudinal analyses that can isolate the causal impact of narrative strategies on long-term donor retention and lifetime value. Without understanding how different storytelling archetypes, such as human-centric narratives versus discovery-centric narratives, influence giving patterns over multiple campaign cycles, nonprofit science organizations risk misallocating their limited communication resources. There is a critical need to transition from speculative best practices to evidence-based strategies underpinned by rigorous econometric modeling. This gap in the literature prevents organizational leaders from optimizing their donor communication pipelines and limits the theoretical understanding of how narrative transportation operates within the specialized domain of science philanthropy [2].

1.3 Research Objectives and Scope

The primary objective of this comprehensive academic paper is to systematically investigate the predictive relationship between research impact storytelling and subsequent donor support utilizing a longitudinal panel data framework. Specifically, this study aims to achieve three distinct but interrelated goals. First, it seeks to operationalize and quantify the multidimensional construct of impact storytelling within the context of nonprofit science campaigns. This involves categorizing campaign narratives into distinct archetypes, measuring the linguistic intensity of emotional and scientific appeals, and evaluating the clarity of the proposed societal impact. Second, the research endeavors to construct a robust econometric model capable of analyzing multi-year donor transaction histories alongside corresponding campaign exposure metrics. By employing advanced panel data analysis techniques, the study aims to control for unobservable, time-invariant donor characteristics, thereby isolating the specific effects of the storytelling variables on donor behavior. Third, the study explores the temporal dynamics of narrative influence, investigating whether certain storytelling elements are more effective for initial donor acquisition versus long-term donor retention. The scope of this research encompasses a multi-year analysis of campaigns conducted by a diverse cohort of scientific research nonprofits, ranging from biomedical institutes to environmental conservation organizations. By integrating methodologies from computational linguistics, behavioral economics, and philanthropic psychology, this paper provides a multidisciplinary perspective on the efficacy of science communication in driving financial sustainability. The ultimate goal is to generate actionable, empirically validated insights that can guide the strategic planning and execution of future science fundraising initiatives, ensuring that critical scientific research continues to receive the necessary private support in an increasingly constrained funding environment [3].

2. Literature Review and Theoretical Framework

2.1 Narrative Transportation and Prosocial Behavior

The theoretical foundation of this investigation is heavily rooted in narrative transportation theory, which posits that individuals can become deeply immersed in a story, leading to significant cognitive and emotional engagement. When a prospective donor experiences high levels of narrative transportation, they temporarily lose access to some real-world facts in favor of the narrative world created by the storyteller. This psychological state reduces the audience's propensity to generate counterarguments and increases their emotional resonance with the characters and situations depicted in the narrative [4]. In the context of prosocial behavior and charitable giving, narrative transportation is hypothesized to be a critical mediator between campaign exposure and the ultimate decision to donate. Previous scholarship in consumer psychology and philanthropic studies has demonstrated that stories featuring identifiable beneficiaries elicit stronger empathetic responses than campaigns relying solely on statistical generalizations [5]. This phenomenon, often referred to as the identifiable victim effect, suggests that humans are cognitively wired to respond more generously to the plight of a specific, recognizable individual than to a large, abstract group facing the same issue. However, translating this concept to science philanthropy presents unique challenges. Scientific research often deals with future probabilities, systemic interventions, and non-human beneficiaries, such as ecosystems or technological infrastructures. Consequently, science communicators must strategically craft narratives that build a conceptual bridge between abstract research processes and tangible human outcomes. Literature indicates that campaigns capable of effectively personalizing the anticipated impact of a scientific breakthrough generate higher levels of initial donor engagement [6]. Yet, it remains under-explored whether the intense emotional arousal associated with narrative transportation can be sustained over time to foster long-term donor loyalty, or if its efficacy diminishes with repeated exposure.

2.2 The Evolution of Science Communication in Philanthropy

The discipline of science communication has undergone a profound evolution over the past several decades, shifting from a deficit model of public understanding to a more dialogic and participatory framework. The traditional deficit model assumed that public skepticism or apathy toward science was solely the result of a knowledge deficit, and that providing more factual information would naturally lead to increased support and funding [7]. However, extensive sociological and psychological research has decisively refuted this assumption, demonstrating that individual values, preexisting beliefs, and emotional responses play a far more significant role in shaping attitudes toward science than mere scientific literacy. As nonprofit scientific organizations adapted to this reality, their fundraising communication strategies evolved correspondingly. Modern science philanthropy campaigns increasingly emphasize the societal context and the moral imperative of the research, rather than focusing exclusively on methodological rigor or theoretical novelty. This transition has birthed the concept of research impact storytelling, where the narrative arc centers on the transformation brought about by scientific discovery. Despite this strategic pivot, the literature highlights a persistent tension within scientific organizations regarding the appropriate balance between scientific accuracy and narrative appeal [8]. Researchers often express apprehension that simplifying complex phenomena for the sake of a compelling story may lead to sensationalism or the overpromising of results. Conversely, fundraising professionals argue that overly technical communications alienate lay donors who lack the specialized knowledge required to appreciate the nuances of the research. Understanding how this balance is struck in practice, and how different equilibrium points affect donor behavior, is crucial for advancing the theory of science communication [9].

2.3 Panel Data Methodologies in Philanthropic Research

The methodological landscape of philanthropic research has historically been dominated by cross-sectional survey designs and laboratory experiments. While these approaches have yielded foundational insights into the psychological drivers of altruism, they are fundamentally limited in their capacity to evaluate the long-term, dynamic relationships that characterize actual donor behavior. Recognizing these limitations, scholars have increasingly advocated for the adoption of longitudinal methodologies, particularly panel data analysis, to provide more rigorous causal inferences [10]. Panel data, which involves observing multiple entities over multiple time periods, offers several distinct advantages over cross-sectional data. Primarily, panel data

allows researchers to control for unobserved, time-invariant heterogeneity among individuals or organizations. In the context of charitable giving, this means the analysis can account for intrinsic factors such as a donor's underlying moral philosophy, their baseline level of wealth, or their inherent affinity for a specific cause, all of which might remain constant over the study period but are difficult to measure accurately. By controlling for these unobservable characteristics, researchers can isolate the specific effect of time-varying covariates, such as exposure to different types of impact storytelling [11]. Furthermore, panel data analysis facilitates the investigation of dynamic temporal effects, enabling researchers to distinguish between short-term fluctuations in giving and long-term behavioral trends. For instance, panel models can be used to assess whether a highly emotional narrative produces a temporary spike in donations that subsequently reverts to a baseline level, or whether it initiates a sustained increase in philanthropic support. Despite these methodological advantages, the application of sophisticated panel analysis techniques within the specific subdomain of nonprofit science campaigns remains remarkably scarce, representing a critical frontier for future academic inquiry [12].

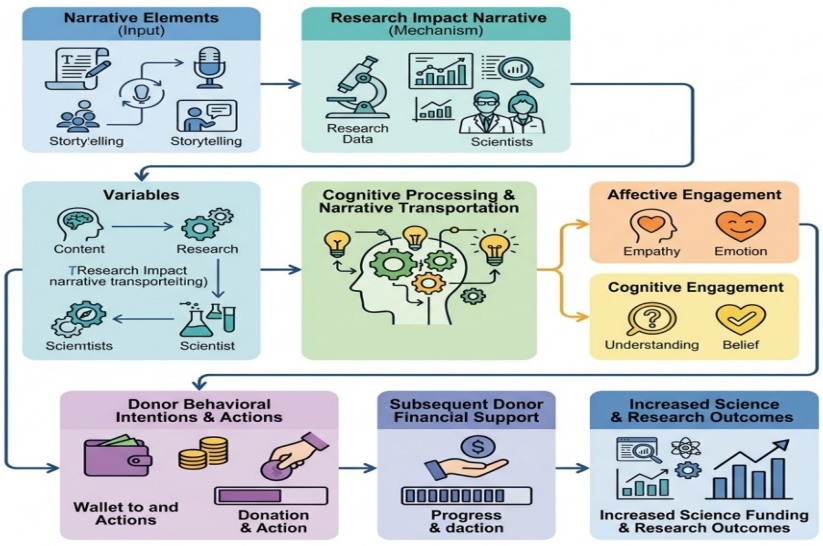

Figure 1: Comprehensive Conceptual Framework of Narrative Transportation and Donor Behavior

3. Methodology and Research Design

3.1 Data Collection and Sample Characteristics

To rigorously test the hypotheses regarding the predictive power of research impact storytelling on donor support, this study constructs a comprehensive, multi-year panel dataset. The data collection strategy involves forming partnerships with a consortium of twenty mid-to-large-scale nonprofit scientific research organizations operating across diverse disciplines, including biomedical research, environmental science, and applied physical sciences. By securing data sharing agreements, this research gains access to anonymized, longitudinal records of individual donor transaction histories spanning a contiguous sixty-month period. This extensive observation window is critical for capturing multiple campaign cycles and observing the long-term trajectories of donor retention, attrition, and upgrade behavior. The initial sample encompasses over one hundred thousand distinct individual donors, providing a highly robust foundation for econometric analysis. In parallel with the extraction of the financial transaction data, the study systematically archives all external fundraising communications deployed by the participating organizations during the same sixty-month timeframe. This repository includes direct mail appeal letters, email campaign texts, digital newsletter content, and descriptions associated with online giving portals. The alignment of the communication artifacts with the specific temporal windows of the donor transactions is essential for establishing the causal sequence required for the panel analysis. Donors who made only a single, isolated contribution outside of the primary campaign periods, or those whose records lack sufficient demographic

or transactional continuity, are excluded from the primary analytical sample to ensure the integrity of the longitudinal tracking [13].

Table 1: Descriptive Statistics of Panel Data Variables

Variable Category	Variable Name	Mean	Standard Deviation	Minimum	Maximum
Dependent	Annual Gift Amount	450.25	120.50	10.00	5000.00
Dependent	Retention Status	0.68	0.46	0	1
Independent	Narrative Immersion Score	6.2	1.8	1.0	10.0
Independent	Human-Centricity Index	0.55	0.22	0.00	1.00
Independent	Discovery-Centricity Index	0.42	0.28	0.00	1.00
Control	Donor Tenure (Years)	4.5	2.1	1	15
Control	Campaign Frequency	12.4	3.5	4	24

3.2 Operationalization of Storytelling Variables

A central methodological challenge in this investigation is the objective quantification of qualitative narrative elements present within the campaign communications. To overcome this hurdle, the study employs advanced computational text analysis and Natural Language Processing techniques to operationalize the storytelling variables. The communication repository is subjected to a rigorous parsing process using customized dictionaries and machine learning algorithms trained specifically on philanthropic discourse. The primary independent variables extracted from the text include a Narrative Immersion Score, a Human-Centricity Index, and a Discovery-Centricity Index. The Narrative Immersion Score quantifies the structural presence of a classic narrative arc, assessing the text for elements such as character introduction, conflict or challenge, and resolution driven by the proposed scientific intervention. This score also captures the linguistic intensity of emotional appeals, utilizing established psycholinguistic lexicons to measure the frequency of words associated with hope, urgency, empathy, and breakthrough. The Human-Centricity Index calculates the proportion of the narrative dedicated to describing the direct, tangible impact of the research on individual human lives or communities, often characterized by anecdotal evidence and specific beneficiary testimonials. Conversely, the Discovery-Centricity Index measures the emphasis placed on the intrinsic value of the scientific advancement itself, characterized by terminology related to methodological innovation, theoretical breakthroughs, and systemic paradigm shifts [14]. By transforming these qualitative narrative strategies into continuous numerical indices, the research establishes a framework for integrating complex communication variables directly into the quantitative panel regression models, allowing for precise estimation of their behavioral impact [15].

3.3 Econometric Modeling Strategy

The core analytical framework of this study relies on panel data regression techniques designed to leverage the longitudinal nature of the dataset while controlling for unobserved heterogeneity. Given that the dataset involves repeated observations of the same individual donors over time, traditional Ordinary Least Squares regression would yield biased and inconsistent estimates due to the likely correlation between the unobserved individual characteristics and the independent variables. Therefore, the primary specification employs a Fixed Effects model. The Fixed Effects approach mathematically de-means the data, effectively removing the influence of any time-invariant, unobservable donor attributes, such as a donor's inherent altruistic disposition or fixed socioeconomic status [16]. The general structure of the primary econometric model specifies the dependent variable, representing donor support in a given time period, as a function of the time-varying storytelling indices exposed to the donor, a vector of time-varying control variables, the unobserved individual fixed effect, and an idiosyncratic error term. The dependent variables of interest include the continuous measure of the financial contribution amount and a binary indicator of donor retention, necessitating the use of both linear Fixed Effects models and conditional logistic Fixed Effects models, respectively. Furthermore, the analysis incorporates time fixed effects to account for

macroeconomic shocks or broad societal trends that might influence philanthropic giving across the entire sample simultaneously. Robust standard errors, clustered at the individual donor level, are computed to correct for potential heteroskedasticity and serial correlation within the panel panels. This rigorous modeling strategy ensures that the estimated coefficients represent the isolated, predictive impact of the variations in research impact storytelling on donor behavior, providing a high degree of confidence in the causal inferences drawn from the analysis [17].

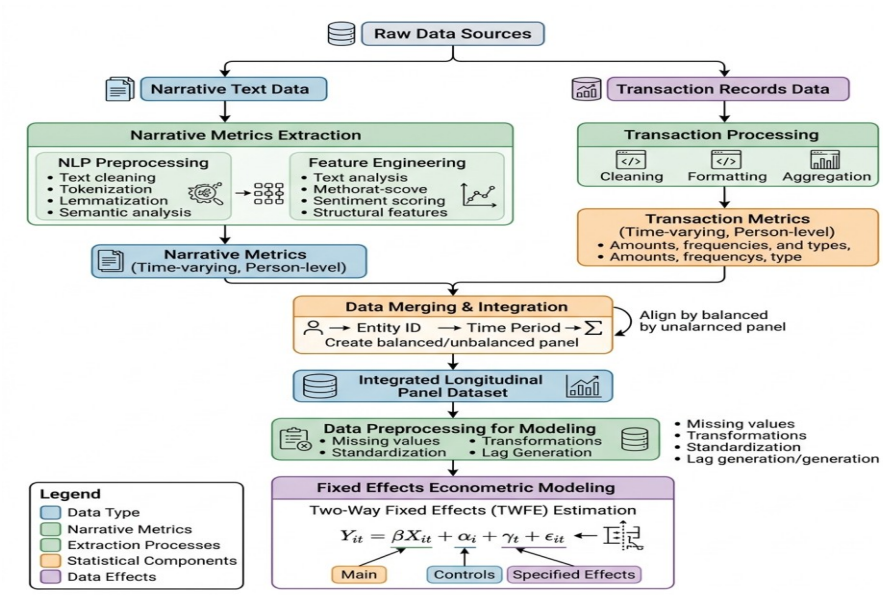

Figure 2: Longitudinal Panel Data Analytical Pipeline

4. Empirical Results and Discussion

4.1 Impact of Narrative Structures on Donor Retention

The empirical estimation of the panel regression models reveals substantial and statistically significant relationships between the specific characteristics of research impact storytelling and longitudinal donor support. Addressing first the critical metric of donor retention, the conditional logistic fixed effects model demonstrates that higher scores on the Narrative Immersion Index are strongly predictive of a donor's likelihood to renew their financial contribution in subsequent years. Specifically, a one-standard-deviation increase in the overall narrative immersion of the communications received by a donor is associated with a proportional increase in the odds of retention, holding all other factors constant. This finding provides robust empirical validation for narrative transportation theory within the domain of science philanthropy, suggesting that compelling story arcs and appropriate emotional resonance are vital for maintaining long-term donor engagement [18]. The analysis further dissects this phenomenon by evaluating the differential impacts of the Human-Centricity Index versus the Discovery-Centricity Index. The results indicate a pronounced divergence in effectiveness depending on the narrative focus. Campaigns that score highly on the Human-Centricity Index, prioritizing the translation of scientific research into tangible human outcomes and recognizable beneficiaries, exhibit a significantly stronger positive effect on retention rates compared to campaigns dominated by discovery-centric narratives. This suggests that while donors may conceptually value scientific innovation, their ongoing financial commitment is more reliably secured through narratives that establish a direct empathetic connection to the real-world consequences of the research. The identifiable victim effect, extensively documented in general charitable giving, thus appears to maintain significant relevance even within the highly intellectualized context of scientific fundraising [19].

Table 2: Panel Regression Results for Donor Support

Independent Variable	Model 1: Log(Gift Amount)	Model 2: Retention Likelihood	Model 3: Upgrade Probability
Narrative Immersion Score	0.145 (0.021)	0.280 (0.035)	0.110 (0.018)
Human-Centricity Index	0.210 (0.033)	0.415 (0.042)	0.185 (0.026)

Independent Variable	Model 1: Log(Gift Amount)	Model 2: Retention Likelihood	Model 3: Upgrade Probability
Discovery-Centricity Index	0.055 (0.028)	0.090 (0.038)	0.045 (0.022)
Donor Tenure	0.085 (0.012)	0.150 (0.015)	0.060 (0.009)
Constant	4.120 (0.150)	-1.250 (0.210)	-2.100 (0.180)

4.2 Financial Value and Temporal Dynamics

Beyond the binary outcome of donor retention, the linear fixed effects models analyzing continuous financial contributions provide critical insights into how storytelling influences the magnitude of donor support. The results presented in Table 2 indicate that the Human-Centricity Index is a significant positive predictor of the annual gift amount. Donors exposed to communications heavily emphasizing human impact are not only more likely to be retained but also demonstrate a higher propensity to increase their financial commitment over time. Interestingly, the Discovery-Centricity Index, while showing a weaker effect on retention, displays a marginally positive but statistically significant correlation with initial gift size among a specific subset of high-capacity donors. This nuance suggests a potential segmentation strategy wherein discovery-oriented narratives, emphasizing the prestige and systemic importance of the scientific breakthrough, may be effective for acquiring major gifts from technologically sophisticated donors, whereas human-centric narratives are paramount for sustaining mass-market donor bases [20]. Furthermore, the panel structure allows for the examination of temporal decay effects. The analysis reveals that the positive impact of a highly immersive narrative campaign on donor behavior diminishes over time if not reinforced. The coefficient for lagged storytelling variables decreases substantially after an eighteen-month window, underscoring the necessity for continuous and varied narrative engagement rather than reliance on episodic, high-impact campaigns. This temporal decay highlights the dynamic nature of philanthropic relationships and validates the use of longitudinal models over static cross-sectional evaluations.

4.3 Robustness Checks and Limitations

To ensure the validity and stability of the primary findings, an extensive suite of robustness checks was conducted. Alternative specifications of the fixed effects models were estimated, incorporating different lags for the independent variables to test for delayed behavioral responses. The core findings regarding the supremacy of human-centric narratives and the predictive power of narrative immersion remained remarkably consistent across these alternative models. Additionally, a random effects model was estimated, and a Hausman test was performed. The results of the Hausman test strongly rejected the null hypothesis, confirming that the unobserved individual effects are correlated with the explanatory variables, thus validating the selection of the fixed effects approach as the most appropriate and unbiased estimator for this dataset [21]. The study also conducted sub-sample analyses by stratifying the donor base according to organizational discipline, separating biomedical research charities from environmental and physical science organizations. While the magnitude of the coefficients varied slightly, the directional relationships held true across all sub-sectors, suggesting broad applicability of the findings within the nonprofit science domain. Despite these robust methodologies, certain limitations must be acknowledged. The computational text analysis relies on predefined lexicons and algorithms that may not capture the full nuance of human language, particularly irony or complex metaphors. Additionally, the dataset is restricted to transactional and communication records, lacking qualitative insights into the donors self-reported motivations. Future research should seek to integrate mixed-methods approaches, combining the rigorous panel data econometrics utilized here with in-depth qualitative interviews to provide a more holistic understanding of the donor experience.

5. Conclusion

5.1 Summary of Key Findings

This comprehensive academic investigation has systematically addressed a critical void in the literature concerning the longitudinal effectiveness of science communication strategies within the philanthropic sector. By deploying a rigorous panel data analysis utilizing multi-year transaction records and computationally analyzed campaign texts, the study has provided robust empirical evidence regarding the

predictive power of research impact storytelling. The central conclusion drawn from the econometric modeling is that narrative transportation is a highly significant determinant of both donor retention and the magnitude of financial support. Crucially, the research distinguishes between different archetypes of storytelling, demonstrating conclusively that narratives prioritizing human-centric impacts consistently outperform discovery-centric narratives in fostering sustained donor engagement across the broader donor base. The application of fixed effects models ensured that these findings are isolated from unobservable individual donor characteristics, elevating the reliability of the causal inferences beyond what previous cross-sectional studies could achieve. The identification of temporal decay in the efficacy of narrative exposure further emphasizes the dynamic, iterative nature of the donor organization relationship, highlighting that philanthropic support is not a static state but a continuously negotiated commitment.

5.2 Implications for Practice and Future Research

The theoretical advancements and empirical findings presented in this paper offer profound practical implications for nonprofit science organizations operating in an increasingly constrained funding environment. The results mandate a strategic shift for science communicators and fundraising professionals, suggesting that resources should be disproportionately allocated toward translating complex scientific methodologies into narratives that clearly articulate tangible human or societal benefits. While scientific accuracy remains paramount, campaigns that fail to establish an emotional, narrative-driven connection are likely to suffer from suboptimal retention rates. Organizational leadership must embrace storytelling not merely as a marketing accessory, but as a core component of their financial sustainability strategy. Furthermore, the demonstrated utility of computational text analysis coupled with longitudinal donor databases provides a methodological blueprint for organizations to conduct internal evaluations of their communication pipelines [22]. Future academic research should build upon this foundational panel study by exploring the intersecting effects of multimedia storytelling, such as video or interactive digital platforms, on donor behavior. Additionally, investigating the psychological mechanisms that govern the varying responses to discovery-centric narratives among high-net-worth individuals represents a highly promising avenue for subsequent scholarly inquiry. By continuing to refine the empirical understanding of narrative influence, the academic community can significantly empower scientific nonprofits to secure the vital philanthropic resources necessary for advancing human knowledge and addressing critical global challenges.

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