A Pilot Study of Robot Storytelling for Civic Data Literacy

Raj Korpan
City University of New York
New York USA
raj.korpan@hunter.cuny.edu

Khadeja Ahmar
City University of New York
New York USA
khadeja.ahmar32@myhunter.cuny.edu

Raitah A. Jinnat
City University of New York
New York USA
raitah.jinnat@macaulay.cuny.edu

Jackie Yee
City University of New York
New York USA
jackie.yee@cuny.edu

Abstract

Cities release large volumes of open civic data, but many people lack the time or skills to interpret them. We report an exploratory pilot study examining whether a social robot can narrate stories derived from open civic data to support public understanding, trust, and data literacy. Our pipeline combines civic data analysis, large language model–based narrative generation, and scripted behaviors on the Misty II robot to produce expressive and neutral versions of two stories on noise complaints and COVID-19 trends. We deployed the system at a public event and collected post-interaction surveys from six adult participants. While the small sample size limits generalization, the pilot suggests that participants found the stories relevant and generally understood their main points, though engagement and enjoyment were mixed. Participant feedback highlighted the need for improved vocal prosody, reduced information density, and more interactivity. These findings provide initial feasibility evidence and design insights to inform future iterations of robot civic data storytelling systems.

CCS Concepts

• **Human-centered computing** → **Field studies**; • **Applied computing** → *Collaborative learning*; • **Social and professional topics** → **Socio-technical systems**.

Keywords

Human-Robot Interaction, Civic Data, Storytelling, Data Literacy, Social Robots, Public Interest Technology

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1 Introduction

Data literacy, the ability to access, interpret, and critically evaluate information, is increasingly necessary for civic participation and informed decision-making [15, 43]. Although Open Government Data (OGD) initiatives aim to support transparency and engagement [29, 42], existing platforms often fail to help the broader public make sense of information, particularly outside the context of analytical dashboards [6, 9, 13], because they often demand significant time, motivation, and digital literacy [5, 21, 22]. In contrast, Public Interest Technology (PIT) emphasizes socio-technical systems that support equity and community needs [4, 32], and data storytelling has emerged as a promising approach for helping non-experts interpret data through accessible narratives [20, 24]. Prior work in Human-Robot Interaction (HRI) research suggests that expressive, conversational robots can support engagement and narrative understanding through voice, gesture, and facial expression to make abstract information more concrete [8, 11, 30, 36, 37, 41]. While robot storytelling has primarily been studied in educational and entertainment settings [7, 19, 28, 35, 39], relatively little research examines how robots might support public understanding of civic issues such as inequities or health trends [25, 34]. This gap motivates the exploration of social robot data storytelling approaches grounded in PIT principles for civic data communication.

In this paper, we present a Misty II–based robot storytelling system that translates NYC open data into narrative performances. We

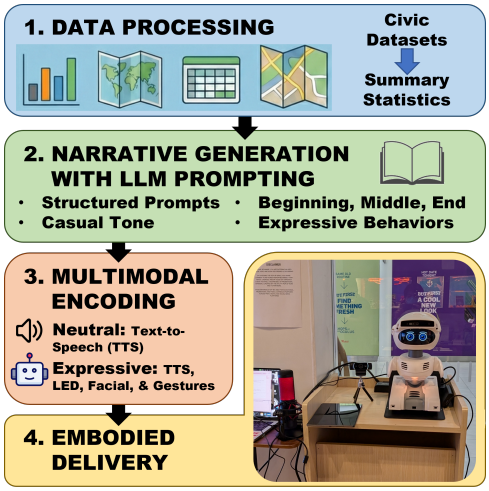

Figure 1: System overview of the four-stage pipeline from civic data processing to LLM-generated, multimodal storytelling delivered by the Misty II robot at the NYC PIT Pop-Up.

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conducted an in-the-wild pilot deployment at the NYC PIT Pop-Up at the Oculus World Trade Center in November 2025 (Figure 1) focused on two socially relevant OGD topics, neighborhood noise exposure and COVID-19 trends. Because the pilot involved a small number of participants, our analysis focuses on evaluating feasibility and identifying early design insights related to comprehension, trust, and engagement, prioritizing participant feedback over generalization. Our findings highlight challenges related to narrative density, vocal prosody, and interactivity, and suggest directions for refining robot civic data storytelling systems. This paper contributes: (1) a pipeline that converts civic data into robot-performed narratives; (2) an in-the-wild feasibility pilot; and (3) design insights for robot civic data storytelling. The remainder of the paper reviews related work and describes the system, pilot study, and findings.

2 Related Work

Research in HRI has shown that social robots can serve as effective storytelling agents by leveraging embodiment to enhance engagement, comprehension, and recall [10, 11, 41]. Experimental studies demonstrate that children interacting with a robot storyteller maintain higher attention and achieve better narrative understanding than those using screen-based media or audio alone [12, 30, 41]. Expressive non-verbal behaviors such as gaze, gesture, and facial expression further strengthen narrative immersion, allowing robots to dramatize content rather than simply deliver it [10, 36, 40]. Much of this work, however, has focused on educational or entertainment contexts, including language learning, classroom activities, and therapeutic settings [7, 8, 19, 28, 35, 39]. Comparatively little research examines how robot storytelling might support public understanding of civic or government data.

Design studies further show that the style of robot delivery strongly shapes user perceptions and learning outcomes [35, 38]. Physical embodiment can increase social presence and empathy, but voice quality, prosody, and personality calibration influence whether information is perceived as credible [11, 31, 33, 44]. Prior work also cautions that expressivity and narrative persuasion can introduce risks: overly enthusiastic or authoritative performances may reduce trust, misalign with serious topics, or create overconfidence in the information presented [27, 35, 38]. These concerns are especially relevant when communicating consequential or data-driven claims.

Parallel research on data storytelling emphasizes narrative as a scaffold for interpreting information rather than passively consuming charts [14, 16, 23, 24]. Story structures guide attention and reasoning and help non-experts contextualize quantitative evidence [23, 26]. Most data storytelling systems, however, rely on screen-based visualizations such as dashboards, comics, or interactive graphics [17], which still require sustained attention and digital literacy. For walk-up public settings, these formats may limit accessibility or engagement. Our work connects these threads by exploring robot storytelling as an embodied alternative to screen-based civic data communication. We investigate whether a physically present, expressive robot can make open civic data more approachable in public environments while accounting for the trust and persuasion risks highlighted in prior research.

3 System Design

The system transforms civic datasets into an embodied narrative performance by the Misty II robot. As shown in Figure 1, the design incorporates four stages spanning data processing, narrative generation, multimodal encoding, and interactive delivery.

We first identified datasets aligned with environmental justice and public health. For the noise story, we analyzed 311 noise complaints from 2010–2023, population data, and contextual demographic indicators [1, 2]. We calculated complaint rates per thousand residents and characterized dominant noise types across communities, summarizing patterns such as Central Harlem's high complaint rate and Bayside's relatively low levels. For the COVID-19 story, we analyzed Department of Health case, hospitalization, and death counts from 2020–2025 [3], highlighting seasonal peaks and borough-level disparities. All datasets were manually cleaned and processed in R or Python before story generation.

Narratives were generated using a large language model (GPT-5) that translated these quantitative summaries into short stories for public presentation. We inserted computed statistics into a standardized prompt that specified a clear beginning, middle, and end, simple, casual language, short sentences, and full use of the provided data. The prompt also instructed the model to "connect the dots" by interpreting patterns in ways that foregrounded issues of justice and equity without overstating causal claims. Because the story would be performed by a robot rather than read by a human audience, the prompt required explicit cues for expressive behaviors, including simple gestures (e.g., pointing, head tilts, arm sweeps), facial expressions (e.g., curiosity, concern, joy), and LED color changes to support emotional framing. For example, the following excerpt from the noise complaint story illustrates the narrative style and behavior cues: *(Misty looks around, LED soft blue.) "Hey there. Let's talk about something we all notice in the city: noise. Last year alone, New Yorkers made over 686,000 noise complaints." (Points outward.) "But the data shows something surprising. Some neighborhoods experience nearly six times more complaints than others."*

Because stories were produced by an LLM, we incorporated a lightweight validation step to reduce hallucinations and factual errors. After generation, authors manually reviewed each story and verified all numerical values and descriptive claims against the computed statistics. Stories were constrained to reference only the supplied data, and the prompt discouraged speculative or causal language beyond what the data supported. No narrative content was added or rewritten after generation; edits were limited to adjusting behavior cues so they matched Misty's physical capabilities. In this way, factual content remained data-derived while the LLM provided narrative framing and accessibility.

The validated narratives were then adapted into four robot scripts corresponding to neutral and expressive versions of each topic. In the neutral condition, Misty delivered the story using text-to-speech without gestures or lighting changes. In the expressive condition, the same narrative was synchronized with coordinated multimodal cues, including LED color shifts, facial animations, and head and arm movements. A timing function estimated speech duration from word count to insert pauses and support more natural

pacing. Stories ranged from approximately six to eight minutes in length to provide sufficient narrative and statistical context.

4 Pilot Deployment

We deployed the system during the NYC PIT Pop-Up event at the Oculus World Trade Center in New York City. The venue is a highly trafficked public space with variable noise, unpredictable foot traffic, and visitors of diverse backgrounds, providing a naturalistic, in-the-wild setting rather than a controlled laboratory. This environment allowed us to evaluate the feasibility and robustness of robot storytelling under realistic public conditions.

Visitors who approached the exhibit were invited to listen to a story delivered by the robot and to complete a brief anonymous survey. A full interaction, including the story and survey, lasted approximately ten to fifteen minutes. The study was approved by an institutional review board, and participants were compensated with $5. In total, six adults completed the full interaction and survey. Although this sample size is small, it is consistent with early-stage HRI pilot deployments in public settings, where the primary goals are to validate procedural flow, usability, hardware reliability, and user comprehension rather than to support statistical generalization. Participation was also constrained by the single-day event format and the time required for each interaction. We plan longer and repeated deployments in future work. Participants represented a range of ages and levels of familiarity with robots and civic data, and each experienced one of the four story variants. Participants were not informed that the narratives were generated using an LLM, allowing us to evaluate reactions to the robot's delivery without introducing expectations about authorship.

The survey, administered in Qualtrics, was custom-designed for this study and informed by prior work on evaluating data literacy and HRI. It combined self-reported measures with objective comprehension checks to assess understanding, engagement, trust in the robot, and data literacy. An initial section used 5-point Likert items to evaluate comprehension and engagement (e.g., understanding the main point, recalling key facts, staying attentive) and whether the robot's tone, gestures, and expressions aided understanding. A short branching quiz tested story-specific knowledge with multiple-choice questions referencing concrete details. Later sections measured perceived trustworthiness, comfort interacting with the robot, broader attitudes toward robots explaining civic data, open-ended feedback, and demographics.

5 Preliminary Findings

Given the small scale of the pilot, we treat the results as descriptive and exploratory rather than evaluative. Because only six participants completed the full interaction, we aggregated responses across story topics and delivery styles to obtain overall impressions of robot civic data storytelling. This necessary simplification limits our ability to distinguish how specific conditions shaped user perceptions, but it provides an initial view of how members of the public respond to robot-delivered data narratives in a naturalistic setting. With such a small sample, we report survey results as counts (e.g., X/6 participants agreed) in Table 1, rather than summary statistics. This representation preserves individual responses and avoids implying statistical precision, though it necessarily collapses the ordinal structure of the Likert scales.

Table 1: Participant agreement (strongly or somewhat) on survey items, aggregated across story topics and delivery styles (N = 6).

	Survey Item	Agreement
Comprehension & Relevance	Understood the main point of the story	4/6
	Recalled at least one specific fact	5/6
	Story felt relevant to NYC issues	6/6
Engagement	Tone and delivery helped clarity	3/6
	Engaged throughout the story	3/6
	Would listen to another story	2/6
	Enjoyed the interaction	2/6
	Felt uneasy interacting	0/6
Attitudes toward Robots	Trusted the robot's accuracy	4/6
	Felt confident relying on the robot	4/6
	Robot seemed dependable	4/6
	Comfortable interacting with the robot	4/6
	Robots might mislead people	4/6
	Robots explaining data could create risks	2/6
	Robots can help society understand data	3/6
	Robots could improve public access	5/6
Self-Report Data Literacy	Can identify relevant civic data	4/6
	Can interpret trends in a dataset	4/6
	Can summarize data for others	5/6

Responses suggest that several participants were able to follow the stories' main points. Four of six reported understanding the central message, five recalled at least one specific fact, and all indicated that the issues felt relevant to New York City. These outcomes indicate that the narratives were interpretable for many participants, though not uniformly so. Engagement responses were more mixed. Approximately half the participants felt that the robot's tone and delivery supported clarity, and engagement ratings were similarly split. Only two participants expressed interest in hearing additional stories. Open-ended feedback reflected this variability: some described the narrative progression as clear and appreciated the storytelling format, whereas others reported difficulty following the flow or found the synthesized voice monotone.

Trust-related responses were also heterogeneous. Four participants indicated that they trusted the robot's accuracy and felt comfortable interacting with it, while others expressed reservations about whether robots might mislead people. No participants reported feeling uneasy during the interaction. Together, these responses suggest that the system was generally acceptable to participants, but did not consistently produce confidence or enthusiasm. Open-ended comments further contextualized these findings. One participant requested more discussion of confounding variables and additional demographic context, while several suggested shorter, more focused stories. One participant expressed optimism about the potential role of informational robots in public spaces.

6 Discussion and Future Work

This pilot explores the feasibility of robot civic data storytelling in a public setting and suggests that such systems appear feasible and warrant further study for supporting public engagement with civic information. Several participants demonstrated comprehension, found the issues relevant, and described the robot as trustworthy and approachable. At the same time, because responses were aggregated across conditions and drawn from a small and opportunistic sample, we interpret these findings as formative rather than evaluative. The observations below therefore focus on design trade-offs, system refinements, and methodological considerations suggested by this early deployment.

Narrative density emerged as a primary challenge. Stories incorporated numerous statistics and neighborhood comparisons, which some listeners found difficult to follow or cognitively demanding. This suggests future iterations may benefit from a layered structure with a concise core narrative and optional on-demand elaborations. Such an approach would allow deeper causal explanations or demographic context without overwhelming those who prefer brevity. Voice quality also proved critical. Despite expressive gestures and facial animations, participants frequently noted the sterility or monotone character of the synthesized speech. Addressing this limitation may involve experimenting with alternative text-to-speech settings, incorporating pre-recorded human narration, or leveraging emerging multi-style TTS systems that can express emotion more naturally [11, 18, 45].

Limited interactivity was another constraint. Participants listened passively to a relatively long, uninterrupted narrative, with few opportunities to adjust pacing or seek clarification. Several comments suggested that moments for repetition, branching, or questioning would have supported comprehension and engagement, particularly given the density of the material and variability in prior knowledge. Future work will explore interactive mechanisms that allow listeners to influence the flow of the narrative, such as selecting among subtopics, requesting shorter or more detailed explanations, or asking the robot to repeat or clarify specific points. Incorporating mid-story check-ins or micro-turns may help regulate cognitive load and make the experience feel more conversational. Beyond improving engagement, these adaptive interactions could also enable more fine-grained study of how different narrative structures affect understanding within robot storytelling.

Participants' attention to potential confounding variables and data limitations suggests that audiences expect civic data stories to acknowledge the complexity of social issues. This finding aligns with definitions of data literacy as a form of critical inquiry rather than passive consumption [23, 43]. Effective data storytelling should not simply smooth over complexity, but instead surface uncertainty, contextualize results, and clarify the limits of available evidence. Future versions may incorporate brief meta-commentary distinguishing correlation from causation or explicitly noting uncertainty ranges and known limitations, while balancing these additions with the need to maintain clarity and accessibility.

The in-the-wild deployment context introduced additional challenges. Background noise, crowd flow, and time constraints often limited sustained attention, while interruptions and opportunistic recruitment created variability in who stopped, how long they stayed, and how deeply they engaged. These factors highlight the trade-offs between ecological validity and experimental control when deploying HRI systems in public spaces and suggest the need for designs that better support fragmented attention. Shorter, self-contained narrative segments, adaptive pacing, and clearer cues for starting, pausing, or resuming stories may help maintain engagement. Pairing the robot's narration with visual displays of the underlying data may further reduce cognitive load: simple charts, maps, or key figures presented alongside speech can anchor attention, support comprehension of numerical information, and enable the robot to gesture toward visual elements, creating a more cohesive multimodal storytelling experience. Exploring how users integrate spoken and visual cues may offer broader insights into the design of accessible civic data interfaces.

The use of LLM-generated narratives also raises ethical and reliability considerations. Although several participants reported trusting the robot, misplaced trust could be problematic if information were inaccurate or misleading. In civic contexts, even minor factual errors or overstated claims may shape public understanding. Our current workflow incorporates prompt constraints and manual verification of statistics, but future deployments will require stronger safeguards, such as clearer disclosure of data sources, automated consistency checks, and thorough human review processes. Designing storytelling systems that balance approachability with appropriate skepticism remains an important challenge.

The next phase of this research will build directly on insights from this pilot by revising narrative content, refining expressive behaviors, and rethinking the overall interaction flow. Longer and repeated deployments with larger samples and balanced experimental conditions will enable more systematic comparisons across delivery styles, story topics, and participant characteristics, moving beyond descriptive impressions toward rigorous evaluation of trust, engagement, comprehension, and retention over time. Where feasible, we will also compare robot-based storytelling with non-robot or screen-based alternatives and incorporate longitudinal follow-up assessments. We also plan to conduct participatory design sessions with community members to co-create future iterations of the system. These sessions will invite stakeholders to critique existing stories, propose alternative framings, and collaboratively design new narrative structures and interaction patterns that better reflect their information needs and lived experiences. By combining empirical evaluation with participatory development, we aim to better understand when and how robots can effectively serve as intermediaries between civic data and the public, supporting clearer, more inclusive, and more accountable communication.

7 Conclusion

This work investigates robot civic data storytelling as a way to make open government data more accessible in public settings. Through a small, in-the-wild pilot of an LLM-driven narrative pipeline delivered by an expressive Misty II robot, we demonstrate initial feasibility and identify design lessons around narrative density, delivery, interactivity, and trust. These findings suggest that socially expressive robots could support civic data literacy, translating complex data into accessible stories that help communities better understand and act on the information that shapes their lives.

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