



News, Entertainment, Stories, and Tales (N.E.S.T.): An Interactive Graphic Narrative on the Declining Sparrow Population in India

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Abstract. This paper examines the effectiveness of sequential art, or graphic narratives, in evoking environmental empathy among pre-teens, teenagers, and other explorative readers. The impact and effectiveness of visual storytelling in relaying complex information through personified accounts has been validated by several studies. This paper explores graphic narrative as the visual storytelling medium to illustrate the disappearance of sparrows and how it is a matter of environmental concern. Three mediums were explored for the graphic narrative: a newspaper-inspired medium, a journal, and a hybrid interactive medium. The hybrid interactive medium consists of comics, articles, mini-games, and posters to engage the reader while unveiling the environmental concerns related to the topic through them. Preliminary testing among readers of ages 9-16 years shows the most positive responses towards this hybrid interactive format, with significant engagement from the readers with its diverse and interactive content types. This study highlights the potential of a hybrid interactive graphic narrative to create awareness about the declining sparrow population and its overall environmental impact. This paper also attempts to identify the scope of treating the developed medium as a periodical that could be used as a framework for covering more cases of endangered species and other environmental stories. This research encourages further experiments with visual storytelling formats to address current environmental concerns.

Keywords: Common House Sparrow; Graphic Narrative; Interactive Storytelling; Environmental Education.

1 INTRODUCTION

As digital media and consumption keep evolving with progressing technology, children too are increasingly growing up with screens around them every day. Recent studies show that children and adolescents are getting increasingly exposed to digital media for extended periods to mostly short-form content [1]. This excessive screen exposure is associated with negative developmental outcomes, including reduced attention span, language delays, and impaired cognitive and social functioning [2]. Studies have further found a correlation between increased screen time and difficulties with attention as well

as weaker executive functioning in children [3]. They have also been linked to emotional and behavioural problems, including anxiety and reduced psychological well-being [3].

To address this concern, this paper examines how a printed interactive graphic narrative can be used to tell an environmental story to children. Instead of trying to replicate the speed of digital media, the project takes advantage of the slower and more tactile quality of print. At the same time, it uses visual strategies and activity-based elements that feel familiar to children who are used to varied and dynamic media.

This paper adopts a practice-based research approach and a practice-led inquiry [4] as it integrates iterative prototyping, expert consultation, and comparative testing to explore how narrative design can be used further to communicate an environmental case for future generations. This led to the creation of the three narrative formats through a design process that involved developing and reviewing and iterating different graphic narrative versions to gather insights from them. The study examines how these formats support engagement and how they might fit into the broader discussion on current media habits, where images travel quickly across digital platforms. This process provided a foundation for understanding the decisions, methods, and observations discussed, while eliminating assumptions, which will be highlighted in the paper.

Having outlined the methodological approach to exploring the possibilities of interactive narrative design in a digital age, it also becomes important to situate the environmental subject at the centre of this study. Studying the ecological significance of sparrows is necessary for this context to first understand why their story is worth communicating through such narrative forms.

1.1 The Role of Sparrows in Ecosystem

Bioindicator species, as the name suggests, are the living indicators of the environment. They are often used in assessing the health of an ecosystem and serve as a measure of the biodiversity of a region. Sparrows are one such bioindicator species that have been crucial in studying urban pollution and heavy metal poisoning [5]. These factors help to determine the overall status of natural pest control, pollination, and the food web [6].

The changes brought about by altering lifestyles and rapid urbanization made it difficult for certain species to cope. Sparrows have been challenged by these human-induced changes and the resulting consequences, like pollution and deforestation. They have been unable to adapt to the quickly changing landscapes, the loss of green cover, modern architecture, pollution, noise, overuse of pesticides, and the resulting decline in insect populations. This is fueled further by claims that these birds are rather pests that damage crops and should be exterminated, especially in countries where they are invasive. On the contrary, studies point out the complexity of human-induced changes that are instead responsible for majorly disturbing the ecosystems. For example, Anderson [7] mentions how sparrows were introduced to North America by humans in steamships that over time led to problems like disturbing the native bird populations, crop damage due to sparrows, and more. Hence, more insights and empathy are necessary, as human society needs to be equally aware of the consequences of its actions and the disruptions they often lead to.

Apart from this role, sparrows contribute to seed dispersal and insect control. They help maintain local ecological balance in subtle, but important ways. When sparrow

numbers change, the relationship among insects, vegetation and human created spaces can also shift. This makes the sparrow a meaningful species for environmental storytelling aimed at children because it helps connect everyday life with larger ecological questions.

1.2 The Current Scenario of Sparrows

For thousands of years, sparrows have lived close to humans and adapted themselves to the gradual changes even in lifestyles. To understand this scientifically, it was found that the same genetic sequences and their mutations enabled humans and dogs to adapt to a starch-based diet; a result of agricultural practices, were observed in sparrows too [8]. This helped them adapt to the diet of humans, specifically to a grain-based one in addition to being insectivorous. However, recent changes have no longer left sparrows in conducive environments to sustain themselves. These have resulted in a drastic drop in their numbers by a staggering 60% [9] globally and close to 70% [10] in India, in the last three decades. Thus, the once common sight in balconies is now a rarity that one may encounter only in a few untouched areas.

1.3 Causes for Decline

As discussed, numerous reasons contribute to the disappearance of sparrows. These reasons can be direct and indirect and can be classified into four major ones as below:

1. **Loss of habitat:** The adverse effects of urbanization include changing land-use patterns, deforestation, the introduction of tall, inhospitable structures, and the loss of favorable structures with crevices that sparrows usually prefer [11].
2. **Loss of food source:** While the area devoted to agricultural practices has fluctuated over the years, the reliance on pesticides has increased manifold. Pesticides can be target-specific and also result in direct poisoning of the birds. On the other hand, the widespread use of insecticides and herbicides has also depleted their food sources, leaving them unable to rear their young as they depend on insects for growth and sustenance [12].
3. **Pollution:** Pollution of every possible source, such as water, soil, air, and noise, is a concern. Sparrows are prone to discomfort from high decibels of noise, which impacts their nesting and reproductive rates [13].
4. **Competition from Invasive Species:** As resources decline, competition from aggressive non-native species makes it even more difficult to thrive amidst the existing situations. House sparrows face increasing competition in urban environments from other synanthropic bird species such as rock pigeons, particularly for nesting sites and food resources, often placing them at a disadvantage due to their smaller size and lower aggression levels [14].
5. **Lack of Concern:** Though the status of sparrows is marked as “Least Concern” by the International Union for Conservation of Nature (IUCN), their staggering decline is rather concerning. Their reducing numbers indicate the lack of general concern and awareness of the need for their conservation. However, efforts of individuals and non-governmental organizations (NGOs) in this direction [15] have yielded positive results in restoring and stabilizing their numbers in some areas. These show that human intervention is necessary for their conservation.

1.4 Contemporary Media Trends and Challenges for Environmental Awareness

While the factors discussed above contribute directly to the decline of sparrows, emerging trends in digital media consumption among younger audiences also pose challenges for how such environmental issues are understood and engaged with. In recent years, children's preferences have shifted toward highly dynamic and fast changing visual formats, especially on digital platforms. These trends create certain challenges for environmental communication because such topics depend on slow observation and steady attention. The decline of sparrows is one of those changes that cannot be seen in a single moment. It becomes noticeable only when one reflects on how common the bird used to be. This makes it important to explore formats that can hold children's attention long enough for the message to settle, without relying on the speed and constant novelty that characterize most digital media today.

2 LITERATURE REVIEW

In the Secret Network of Nature [16], every living entity is described as a cogwheel in a giant interconnected clockwork-like system. Similarly, the sparrow is also one of the cogs in a larger clockwork mechanism that comprises vegetation, the insect world, itself, and other preying animals. Here, the sparrows' inherent roles, such as controlling pest populations, seed dispersals, and pollination, are vital for the local ecosystem. Sparrows have often been considered a pest to food crops and agricultural fields. However, the Great Chinese Famine of 1958 is a testament to what their mass extermination can lead to [17]. Furthermore, with the increase in demand for agricultural produce and the reliance on artificial pesticides, sparrows face the loss in terms of the quantity and quality of the available food; being ground-feeding, granivorous birds. Additionally, a lack of nesting places, modern matchbox-style architecture, pollution, and less awareness or concern have further led to their decline.

2.1 Storytelling and Narratives

Terry Tempest Williams, an educator, environmentalist, and widely recognized figure in the sphere of nature writing or environmental literature, quotes, "Storytelling is the oldest form of education" [18]. Her work, *Refuge: An Unnatural History of Family and Place* (1991), recounts her tragedy of losing her mother and several other female family members to downward radiation poisoning during nuclear testing by the US Government in the 1950s and 1960s [19]. Being an environmental activist and educator herself, she dives deep into the complex web of nature and the side effects of pollution by humans. She builds up the narrative based on her personal experiences while backing up the causes with her expertise on the subject. Thus, along with the facts, storytelling is integral in conveying a point and connecting to the central theme.

Similarly, in the context of sparrows, the purpose of narrating their story should be such that the target audience or reader can understand and empathize with them. Stories

can be an effective medium to simplify complex data into easy-to-understand pieces that people can connect with, retain, and think about further individually.

As storytelling can form an integral part of conveying information and connecting human beings towards a central theme, this study investigates the potential of visual storytelling [20] as a practice-based [4] research method to evoke environmental empathy. Human beings have a natural urge for stories, especially ones that are relatable. Scientific evidence describes that while witnessing a narrative, people tend to focus on the strongest characters, their states, and corresponding actions. The theory of mirror neurons mentions that brain cells activate in people, not just while doing an action, but also when perceiving someone performing the same [21]. Similarly, graphic narrative provides a visual perspective of a topic in addition to the prevailing text material. While comics, a type of graphic narrative, can be used to research the different aspects of comic writing [22] and illustrate, the approach can be further applied in other contexts such as journaling events and other accounts [23]. As the potential of comics as a research tool [20] for a practice-led and journalistic approach has been established in the past, it will be further examined in the context of the declining population of house sparrows and its impact on younger audiences. This study seeks to answer the following question. Could an interactive form of tangible graphic narrative evoke environmental empathy within the young generations?

2.2 Examining Selected Graphic Narratives related to Migration, Climate Change, and Species.

To better understand how similar themes have been approached, it is useful to examine selected works that align with the intent, subject, or mode of presentation of this study. This section examines selected projects that are relevant to the theme of this paper. Every work has a specific narrative type and structure, and a different medium of publication. However, all of the projects communicate the stories effectively.

“The Arrival” is a graphic narrative with no written text, but detailed sequential frames through which Tan describes the experiences of a migrant worker through surrealism [24]. The protagonist is a man who sets out to a distant land for work, having to leave his family behind in a troubled place. Everything seems unfamiliar and strange in this new place. The book resembles a photo journal with the papers bearing brown textures and blotch marks. The cover emulates a leather-bound diary, giving the sense of an antique personal journal. Overall, the visual language of the book yields a personal touch that the reader can resonate with. The surrealistic representation of real-life events makes it more impactful as the associated experiences are exaggerated and make it an interesting perspective. This quality is incorporated in the hybrid graphic narrative, especially in posters.

“An Ode to the House Sparrow” personifies house sparrows through a photo story [25] as the author draws the commonalities between them and senior citizens. The comical nature of the artwork adds warmth, wit, and humour. However, the storytelling takes a devastating turn in the last two slides as he exposes the similarities between the experiences of an elderly person and a bird, both facing a hard time adjusting to new

and changed times. The slides have a linear narrative which is understood from the transformation of the younger male character from a boy to a young man across ten web slides. The author also uses expositions and comparisons to convert informations or facts into relatable stories. The narrative structure appears incomplete in the end, which might have been done deliberately to imply and communicate the need for some action. Hence the story could be considered an inciting incident, waiting for a heroine/hero to rescue. Alternatively, it could also be straightforward to suggest just a tragic ending for the sparrows. The personification of animal characters is utilised in all the medium explorations of this paper for context and relatability.

“New York Journal” presented Outcault’s first successful newspaper comic strip in 1896 for Pulitzer’s New York World [26]. His comic strip featuring a street urchin wearing a bright yellow nightshirt featuring some text on it led it to be named ‘The Yellow Kid’. It originated as Outcault’s medium to portray life in slums, political satires, or content just for entertainment. The Yellow Kid presented whimsical, sensational stories, often intended for mature reading. Its success and widespread circulation made the other competitors follow the same route which gradually paved the path for the entry of comics into newspapers [26]. While Outcault did not necessarily present a fact but his opinion, the unfiltered nature of the comics made them thought-provoking with text blending into the background elements of the illustrations, often in perspective. Similarly, this paper explores the use of illustrations, blending text, and other layouts to depict the stories, while also considering the importance of sharing opinions responsibly.

“Gobar Times.” [27] is a monthly magazine published as a supplement to Down To Earth Magazine in India that targets young and curious readers. Its production and publication are looked after by the Centre for Environment and Science (CSE). The Young Environmentalist is an initiative of CSE and Gobar Times, which hosts these publications online. Each issue focuses on a different topic and prints different reports, stories, accounts, case studies, facts, comics, activities, and campaigns, just like a magazine. The content is crisp, engaging, and with a sense of humour. Due to its diverse art style, an element of surprise arises in anticipation of what could be expected from the next issue. Gobar Times is an interesting initiative and approach to introducing school-going children to Environmental Science and other related areas. While the initiative is noble, the lack of consistent visual language might impact on the association and strong identity. The medium is more like a magazine, intended to appeal to specific readers only.

“But I Like It!” is a graphic journalistic account of author Sacco’s tour with the European punk-rock groups in the early 90s [28]. He recounts his time and experiences using the techniques of comics fused with other forms of presentations like posters, illustrations, articles, and a few pages from his sketchbook. The storytelling is depicted through a journalistic approach fused with his finesse of art. The viewpoint narrative recounts his perception of the events and the close encounters with the characters in real life. He also adds his illustrative works, posters, and sketches from that period. This

variety in content type has been borrowed for this project in a hybrid interactive graphic narrative medium exploration to increase engagement in readers.

“Naturalist Ruddy” is a graphic novel authored by Chakraborty [29] in which he develops the character of a mongoose named Ruddy, an anthropomorphic detective on a mission to uncover “Environmental crimes.” The storytelling happens through this central character as he engages the readers with different creatures in trouble and at the root of their problems. The comics and engaging exercises enhance the storytelling and deliver necessary facts interestingly and crisply. The book can help inculcate a sense of responsibility in the readers as the storytelling necessitates the latter’s involvement in “solving crimes” or “investigating natural occurrences” throughout the book to share interesting facts and other environmental concerns while discussing the effects of pollution and other human-induced activities on animals. While this medium covers the stories of several species, this paper proposes a similar approach for just one species.

These reviews lead to the following gaps and opportunities for intervention. Mediums containing one type of content might appear redundant to young readers. Different types of content can create a breathing space between the textual and visual sections and also add elements of surprise and anticipation. Graphic journals with interactive segments containing mini-games and short activities could improve engagement along with the story and content. On a different note, the text heaviness and non-linearity of some of the mediums might deter some readers, and a preference for visuals over text could be assumed here. Additionally, creating a framework for a periodical publication about stories of different endangered animals could be considered. While certain environmental mediums cover several species, a similar approach could be used to cover the story of a single one and its role in the environment. This leads to the question: Can an interactive form of tangible graphic narrative evoke environmental empathy within the young generations amidst shifting patterns of attention and perception in this evolving digital age?

2.3 Examining Selected Graphic Narratives related to Migration, Climate Change, and Species.

Children and adults alike now have easy access to short forms of digital content for rapid consumption and views generation. These brief visual fragments encourage constant shifting from one item to another, impacting sustained focus and retention with a particular topic. Recent research using EEG methods shows that frequent use of short-video platforms influences attention control while making it harder to remain focused on slower tasks [1].

This raises questions about how children respond to subjects where learning and cognition develop gradually. Environmental topics usually unfold over long periods and not in a single moment.

On the other hand, printed reading encourages a different kind of pace where readers usually spend more time on a page because nothing on it moves by itself. Studies comparing print and screen reading show that the former supported better comprehension and recall, as the reading experience is more stable and less interrupted [30]. This steadier rhythm can also be helpful when children are trying to follow the

slow and layered story of a species like the sparrow, whose gradual disappearance is a recent subject of environmental concern.

3 METHODOLOGY

This paper experiments with an interactive graphic narrative to sensitize young and curious readers to the plight of sparrows so they can be more aware, empathetic, and motivated to care for the species and their environment. The study follows a practice-based and exploratory approach rather than a strictly hypothesis-driven model. The findings are indicative and are meant to offer insights into narrative engagement, rather than establish general conclusions. The design process involved multiple iterations along with user testing, which helped in exploring and refining the outcomes. While developing a graphic narrative, it is essential to develop the narrative structure, which helps the story flow in a specific order. In a medium like a newspaper, this flow is mostly nonlinear where the reader is free to explore the content in any order. There is no predetermined manner, order, or reading here. On the other hand, graphic narratives and other sequential forms commonly have a linear narrative where events, even if shuffled, are ordered or set in a particular way by the author, who determines how the story progresses. As this paper intends to address a concerning situation regarding sparrows, it was necessary to decide on and shape the graphic narrative to encourage environmental empathy among pre-teens, teenagers, and curious readers. The methodology is divided into 3 sections: a subject matter expert interview, graphic narrative design, and user testing through surveys.

3.1 A Subject Matter Expert Interview

From the literature review, certain questions arise that could be best answered by an expert in the field. Mohammad Dilawar, the founder and CEO of the Nature Forever Society (NFS), has been at the forefront of the conservation of sparrow habitats and is credited with initiating the celebration “World Sparrow Day” on March 20th globally. Insights from the interview reveal that every being has a role in nature, including sparrows, but conditions are not conducive to their adaptation to natural habitats presently. Sparrows are not a pest in their native habitats and have a purpose in the ecosystem. Hence, it is important to teach the ABCs of conservation to all. Sparrows can be considered a keystone species of urban ecosystems, and a healthy number of sparrows is considered to be good. Also, one should avoid rumours and speculation like their reappearance during COVID-19, which is a myth. Changes happen over time. People were likely more observant and reported about what was already there. Lastly, it is unlikely that they will completely disappear. Conservation efforts and human intervention can further prevent that.

3.2 Graphic Narrative Design

A suitable outreach to this issue could happen at primary and secondary education levels, which include the appropriate and wide age group of students, to inspire and motivate individuals to be conscious and caring. The target audience was set at 9–16 years old. This corresponds to how Environmental Education (EE) is introduced in

stages across primary to higher secondary levels. The concepts of EE are introduced in grades 3–5, and advanced topics of environmental conservation in grades 9 and beyond, as observed in the National Curriculum Framework (NCF), 2005 [31]. This aligns with the age bracket of the target audience mentioned of this paper.

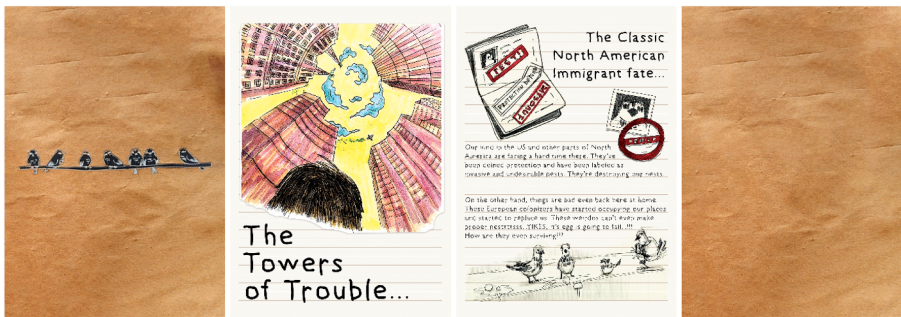
The insights from the literature review and subject matter expert interview were incorporated into the narrative and storytelling. Three narrative formats were identified. First, a newspaper-inspired medium that uses the same aesthetic features, and diversity in the content of newspapers. Outcault's Yellow Kid series' intriguing composition and layout inspired it, along with the magazine-like content on environmental topics in Gobar Times. Next, a journal from the point of view of a sparrow recording its life events, experiences, and thoughts. Lastly, a hybrid interactive graphic narrative medium inspired by graphic journals and newspapers. This medium contains comics, posters, articles, and activities in sections that are part of the narrative structure, to engage readers to uncover underlying information. For example, the topic of pollution could be aided by a maze game containing winding paths through deforestation lands, factories, and more.

Graphic Narrative Medium Explorations. Three mediums and formats were explored based on different inspirations. Depending on the format, the sizes varied from A5, A4, and A3. Visual explorations were done in various mediums such as watercolour, pastels, graphite, and also on digital applications. The artworks were later composited and edited digitally for printing and testing. Each medium also has a variable amount of text, ranging from heavy to moderate to less. The narrative structure and flow also vary between linear and non-linear in the three formats.

1A:



1B:



1C:



Fig. 1. Three graphic narrative explorations. 1A: Newspaper. 1B: Diary Journal.
1C: N.E.S.T. Interactive Hybrid Graphic Narrative.
(Personal Documentation)

Newspaper Hybrid Medium. Figure 1A shows a newspaper-inspired medium consisting of sections with daily stories, facts, articles, and leisure activities. The stories were based on facts and fiction. The fiction, however, is inspired by real-life facts and events. This is done to transform complex data into easy-to-understand substories that help to form the big picture. For example, the actual inter-species competition for resources is converted into a sports article depicting a rivalry between a rock pigeon and a sparrow in a fighting arena. Similarly, other stories like those of mass food poisoning and a fictional need for migration (against their natural sedentary lifestyle) are done to represent the dire situation of the subject. Iteration review through convenience sampling revealed that the non-linearity and wordiness of the content impacted its engagement and clarity.

Journal Medium. Figure 1B is a medium that explores a diary entry from the perspective of a sparrow recording its encounters, experiences, and thoughts through sketchy illustrations and text. A combination of daily accounts, poems, and sketched illustrations lends a personalized feel to the medium and its reading experience. The cover pages are made from upcycled paper obtained from brown paper bags for environmental reasons and to emulate the simple and rustic nature of the sparrows. The narrative is dated fictitiously to build the order of events along a virtual timeline. This medium also consists of small jingles, imaginations, and fictional accounts inspired by real facts surrounding the topic. Iteration review through convenience sampling revealed the need for consistent visual language for connectedness in storytelling.

Hybrid Graphic Narrative Interactive Medium. Figure 1C is an interactive hybrid graphic narrative inspired by various media like graphic novels, graphic journals, newspapers, and weekly supplements. It includes comics, articles, and interactive sections like a maze game and a crossword. The storytelling is linear as there is an order in the progression of events, and the two parallel character arcs and stories converge to connect the loose ends eventually. The articles add further context to the comics, and the interactive segments are designed to engage the readers in a more playful way to understand the environmental concern. The purpose of each activity is to lend more insight into the preceding story while breaking the monotony of one type of content. The title is “Where’s your N.E.S.T. Dear Sparrow?”. In the context of this study, ‘N.E.S.T.’ is an acronym for news, entertainment, stories, and tales.

3.3 User Testing through Surveys

44 children aged 9–16 years participated in exploring the three different mediums of graphic narratives. User testing was done using convenience sampling in two areas: a private school in Hyderabad and a private and a public school in Agartala. The data was collected through mixed-method surveys to understand the users’ preference for graphic narrative medium. The observations were made with the consent of guardians. The responses were recorded based on the parameters of awareness of the issue beforehand, ease of following through the mediums, level of engagement with the respective samples, comprehensiveness of the contents, preference for medium, and opinions if any. The results indicate varied preferences and some common patterns.

The newspaper-inspired medium was the preference of 4 students out of the overall sample. They cited its detailed coverage, ease of understanding, and interesting format as reasons for making it preferable of the three formats. Further, this group of students remarked that the journal medium was slightly difficult to follow, compared to the other two formats.

On the contrary, the journal medium was the preference of 14 students out of the overall sample. They mentioned its visual-heavy style consisting of more illustrations and less text as their reasons for choosing it. 13 of this particular group mentioned that the rest of the two mediums were slightly difficult to follow compared to the journal medium.

Lastly, the N.E.S.T. medium was the preference of 26 students from the overall sample. They cited its entertaining comics and engaging activities as the reasons for making it their choice out of the rest. 3 of these students further mentioned that the newspaper medium appeared intriguing, but its text-heaviness deterred further exploration. According to 15 of these students, the journal medium was slightly difficult to follow. 8 additionally expressed sadness, pity, sympathy, and concern towards the subject in the survey. Furthermore, 1 student expressed a preference for coloured illustrations over the existing monotone, while 1 more expressed a preference for more activities.

4 DISCUSSIONS, LIMITATIONS, FUTURE SCOPE.

This paper considers that converting complex environmental topics through visual storytelling into graphic narratives enables a wider reach by specifically targeting young and curious readers who could be vital in environmental conservation efforts in the future. People involved in environmental protection and conservation can help answer the need to educate the masses on environmental concerns and other related questions. Hence this paper's research is based on subject expert Mohammad Dilawar's insights, a sparrow conservationist for 18 years. This was crucial in developing the narrative of the mediums. Further analysis of existing mediums inspired the explorations of three different mediums. The first is a newspaper-inspired medium, for its aesthetics and diverse content type. Iteration review revealed that the non-linearity and wordiness of the content impacted engagement and clarity. This led to exploring the second medium, inspired by a personal journal emulating a sparrow recording its experiences and thoughts. This time, the iteration review revealed the need for consistent visual language for enhanced storytelling. Lastly, the N.E.S.T. medium was explored with a linearly structured narrative, consistent visual language, and varied content. This design process also helped to investigate the different target users' needs to eliminate assumptions based on a single kind of user.

User testing of all the explorations with the target audience provided more insights into the types of engagement and future scope. Ways of improving engagement through reading the newspaper-inspired medium and the journal medium need further exploration. The former's text heaviness and the latter's oversimplified content contribute poorly to inculcating reading habits. One solution could be the use of consistent visual language and design cues to guide the readers from connections as necessary. The N.E.S.T. medium outdid the other two, being the preferred type by more

than half of the sample size. Certain feedback from the survey points out the additional preference for coloured visuals and more activities, which, if incorporated, could enhance its outreach further. However, the N.E.S.T. medium stood out for its diverse content type, linear narrative, and engaging activities.

The findings presented in this study should be interpreted as exploratory observations derived from a limited sample and specific design context. While they indicate clear patterns of engagement, they are not intended to be generalized across broader populations without further validation. Overall, the explored mediums appear promising, with the participants in the survey mentioning an openness towards reading more of such environmental stories, especially the N.E.S.T. medium as observed in testing. Hence, such mediums should be explored further to cover more such stories that need to be brought to the attention of young readers and curious explorers.

The study further generated responses that revealed patterns, such as awareness of the topic beforehand, enhanced engagement due to comics and activities, a preference for less text and more visuals, mixed preferences about coloured visuals over monotone, and openness to reading more such environmental stories in the future.

Since most of the readers have migrated to digital platforms, a tangible reading product might be less accessible to readers. However, outreach could be increased by offering supplements via institutions. On a side note, along with the participants, a few parents shared their feedback in which they expressed a preference for a tangible medium over digital to inculcate healthier habits and regulate screen time for their children.

Educating young readers through engaging storytelling about their environment can benefit the present and future generations. The mediums are initial explorations of this "idea," in this study, that encourage the potential of the N.E.S.T. medium as a positive step towards sustainable education. It could result in motivated individuals who might work for the cause of the environment in the present or future.

The findings also suggest that readers do not respond in the same way, and that there are different kinds of preferences in terms of visuals, amount of text, and level of interaction. Some seemed more drawn to image-heavy formats, while others engaged more with structured or activity-based content. This opens up scope to look more closely at how such differences play out across reader groups, especially when communicating serious subjects like environmental issues. Studying these variations further could help in shaping more suitable narrative approaches for similar contexts. At the same time, the N.E.S.T. medium explored here can be extended beyond this case and has the potential to act as a framework for developing a series of narratives around other species and environmental concerns. Hence, this paper opens up new ways to explore media and education through N.E.S.T., an interactive graphic narrative that creates awareness of the declining sparrow population and its effect on humans and the environment.

5 CONCLUSION

This paper investigated if an interactive form of tangible graphic narrative could evoke environmental empathy among young generations. Sparrows being the bioindicators of urban ecosystems are essential for studying urban biodiversity. Unfortunately, non-

conductive conditions have made their survival difficult in present times and caused a staggering decline in their numbers. Thus, it becomes necessary that young and curious readers become aware of such environmental concerns and develop concerns for addressing them in the future.

This research aimed to address the following question: Can a tangible interactive graphic narrative encourage young readers to be sensitive towards environmental concerns? A subject matter expert emphasised the importance of the basics of environment conservation, and his gathered insights were crucial in exploring and developing the narrative structure in 3 stages. Therefore, to evoke environmental empathy by building awareness, the 3 different mediums explored were: a newspaper-inspired medium, a journal, and a hybrid interactive graphic narrative called “News. Entertainment. Stories and Tales (N.E.S.T.)”. These mediums were also inspired by various existing mediums that were studied in the literature review.

The 3 mediums were tested with 44 children aged 9–16 years, and the survey results recorded the most positive responses for the N.E.S.T. interactive graphic narrative approach, thus validating its effectiveness over the other two. Further, the openness to explore more of such graphic narratives on environmental stories as seen from the testing proves that the audience is interested in and sensitive towards such subjects. The N.E.S.T. Graphic narrative was designed such that the reader could engage with the story not just through comics, but also through its activities and overall diverse content. These help to enhance the storytelling and better interaction of the reader with the medium and successfully empathise with stories of environmental concerns.

This project highlights the potential of a visual storytelling method of graphic narratives towards environmental issues and demonstrates how Graphic Narratives can be presented in a more interactive format. It unfolds new possibilities to further explore the N.E.S.T. interactive graphic narrative approach in other environmental-related issues. This project encourages more visual storytellers to contribute towards environmental concerns.

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