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Waves of Erosion
An Exploration into Data Storytelling

by

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A Dissertation Submitted to
Indian Institute of Technology, Hyderabad
In Partial Fulfilment of the Requirements for
the Degree of Master of Design

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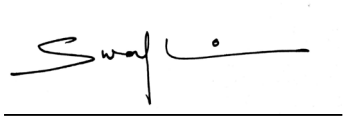
Declaration

I Swadhin Ray, declare that the MDes thesis, titled “**Waves of Erosion: An Exploration into Data Storytelling**” contains no materials that have been submitted previously, in whole or part, for the award of any academic degree or diploma. Except where otherwise indicated, this thesis is my own work.



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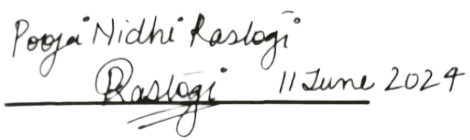
Approval Sheet

This thesis titled " **Waves of Erosion: An Exploration into Data Storytelling** " by Swadhin Ray is approved for the degree of 'Master of Design' from the Indian Institute of Technology, Hyderabad.'

Prof. Seema Krishnakumar
Project Supervisor

Internal Examiner



External Examiner

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“Five months every year, for the last fifty-three years, I have been visiting Gahirmatha beach.
With hearts filled with joy and curiosity, people from nearby villages like Kanhupur, Satabhaya, Mohanpur, used to welcome me while I was in my nesting period.
But, since last five years, number of people visiting me have decreased exponentially and to my shock no one was there this year! was it because of the sea? or air? or something else?
Feels as if something drew them away from here.”

Taking a deep breath she wondered why and with a heavy shell she swam away in the vastness of the sea.

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Abstract

The rise in sea level is a severe threat to humanity, especially to the communities in coastal areas. One such critical case is of a village situated along the eastern coastline of India -Satabhaya, Odisha that has been deeply affected by coastal erosion since the 1971 Odisha cyclone. It was once a cluster of seven villages and is now filled with nothing but sand. This project aims to address the impact of coastal erosion on human loss, livelihood shift, climate migration, loss of properties, etc. by creating a digital database of the impact of climate change on Satabhaya and to educate people about the seriousness of such an issue. A data journalism approach was used along with research methods including ethnographic inquiry, overlaying images, side-by-side photograph comparisons, historical vs current scenario study, and oral-history inquiry to build the content for data narrative. The project yields a long-form single scrollable webpage that contributes to making complex data related to this issue relatable and archival of the catastrophic disaster. This project is an effort made through data storytelling to sensitize people about this chain of events happening in remote coastal places in Odisha so that the upcoming generation can look at such critical situations through a more conversant lens, make well-informed decisions, and prepare better adaptation techniques in advance.

Keywords
Odisha coastline, coastal erosion, Satabhaya, data storytelling, data Journalism, scrolly-telling, digital storytelling

Coastal erosion and it's imapct.

01 Overview

1.1 Project proposal
1.2 Project Brief
1.3 Scope of Work
1.4 Project Timeline

1.1 Project proposal

A major long-term effect of climate change, namely the rise in sea level, is a severe threat to humanity, particularly to the communities in coastal areas. One such critical case is of a panchayat situated along the eastern coastline of India - Satabhaya, Odisha, which has been deeply affected by coastal erosion since the 1971 Odisha cyclone and numerous other subsequent cyclones that followed until today. All that remains there now is sand, which was once a cluster of 7 thriving villages.

Over the years, this event has often been presented as textual and other media-rich narratives, such as journals, documentaries, photographs, films, and news articles.

The available data on the event needs to have a bridge of relatability to better the communication between available statistics and emotions. This thesis project proposes a retelling of the above climatic chain of events through a journalistic approach through a data-centric narrative aka data storytelling, aiming for relatability and accessibility of gathered data which in turn would provide a wider perspective on the phenomenon. The final output, deployed as a data visualization webpage with author-driven interactive elements such as text and multi-media, is set to

be shared online to experience, communicate, and archive the information about the event for a wider audience including policymakers and the general public alike. The evaluation takes observations, feedback, and suggestions for further improvements of the article in terms of interaction, content and narration.

1.2 Project Brief

The project is to communicate the phenomenon of coastal erosion through the story of Satabhaya, Odisha, via a web-based interactive visual data narrative in a journalistic approach to make it accessible to a broader audience.

1.3 Scope of Work

Over the years, the impact of the coastal erosion on Satabahaya has been growing, this makes the available data a complex weave of multiple threads of data sets. The project's scope of work primarily includes a data-centric story out of those threads of data, that revolves around shoreline shift over the years, amount of land eroded/ accreted, houses submerged, people affected, climate migration, shift in livelihood, and other events happening in parallel. These provided multiple opportunities to represent and interact with the data threads to make the content of the story relevant to the audience and increase message retention. Furthermore, research methods including field study, overlaying images, side-by-side photograph comparisons, historical vs current scenario study, and oral history inquiry were explored to create the content to build a data narrative and represent the above data. The project also aims at archiving the threads of data by bringing together previously scattered data related to the event into a single page for a wider audience to experience. The effort is to communicate emotions through impartial numbers.

1.4 Project Timeline

The project was planned out over a time of 22 weeks with reviews scheduled at regular intervals.

10th January - 1st March	Secondary Research Onsite Data Collection Data Analysis
1st March - 5th April	Data Representation and Ideation
5th April - 1st May	Design and Development
1st May - 31st May	Documentation and Final Outcome
1st June - 10th June	Testing

Ruins of a temple lost to coastal erosion.

02 Introduction

2.1 Understanding Coastal Erosion

2.2 Introduction to Satabhaya through Climate Change

2.3 Proof of the event

2.4 How the story is told so far

2.1 Understanding Coastal Erosion

Coastal erosion is a worldwide natural phenomenon that, as the name suggests, is observed along coastlines and nearby coastal areas. It involves the process of losing parts of a coastline, washed away by intruding sea waves. The material is later deposited elsewhere or nearby in another process called accretion. Coastal erosion and accretion are cyclic processes that have been taking place in nature since forever. However, in light of recently aggravating climate change due to human intervention, this process is exacerbated to disastrous levels, creating severe imbalances in the regions.

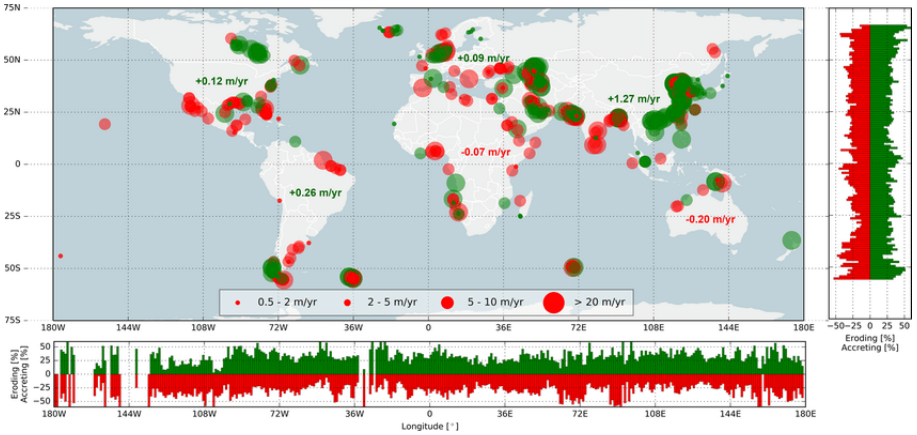

Figure 1: Global hotspots of beach erosion and accretion; the red (green) circles indicate erosion (accretion). Image Source: ***(Luijendijk et al., 2018)***

A host of other connected phenomena have caused the process to accelerate at unprecedented rates, wreaking havoc on coastal communities. Human interventions have exacerbated the impact of climate change and resulted in cyclones of higher intensity and frequency. Human-induced climate change is also responsible for the rise in sea levels globally. These factors have directly influenced the rate at which we are losing our coastlines to erosion.

Climate change, being an interconnected global phenomenon, causes the actions of one to have far-reaching consequences for the other. Similarly, we need to look out for the stories of people and other lifeforms from the remotest corners of the world who are at the forefront of such negative consequences despite having nothing to do with disrupting the natural cycles of the planet or probably even having the least carbon footprint than that of other accountable entities of another geography and location altogether.

2.2 Introduction to Satabhaya through Climate Change

'Samudrika Jhada' the colloquial term for the tropical cyclonic storms in the Eastern regions of India, generally occur during the months between May to October. They visit Odisha's coastlines too, bringing in winds reaching speeds up to 100 km/h along with torrential rains. The frequency and intensity of these storms depend on several climatic factors which have worsened since the 1971 Odisha cyclone due to the global sea level rise, creating more destruction in coastal Odisha than ever.

Odisha has a coastline of approximately 480 km across the coastal districts of Balasore, Bhadrak, Ganjam, Jagatsinghpur, Kendrapara, and Puri. Of this long stretch, almost 28% of the coastline has been lost to coastal erosion between 1971 and 2016 **(OdishaBytes, 2022)**, with Kendrapara alone losing 31 km of coastline **(Ministry of Environment, Forest and Climate Change, 2023)**. It was identified that many of the villages in Odisha were vulnerable to sea erosion, and of those, Kendrapada district itself has 49 villages, Balasore and Bhadrak districts each with 8, Ganjam with 4, and Puri and Jagatsinghpur districts with 1 village each, which are vulnerable to sea erosion **(OdishaBytes, 2022)**.

One such occurrence of coastal erosion is from a remote region consisting of a cluster of coastal villages in the Kendrapara district of Odisha named 'Satabhaya'.

Also spelled ‘Satavaya’. This paper chooses to move forward with the spelling ‘Satabhaya’ in the interest of preserving the original dialect of the region.

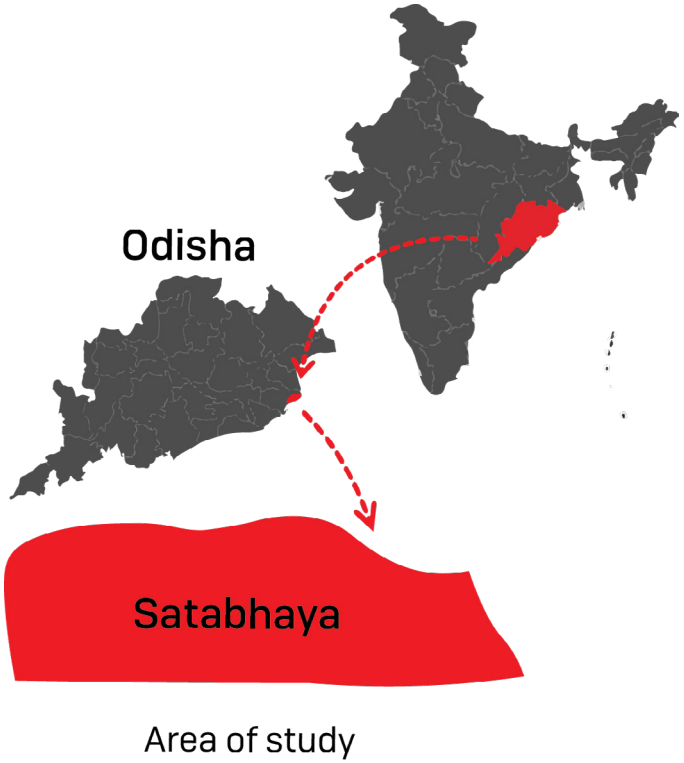

Figure 2: Mapping Satabhaya, Odisha and India. Image Source: Composite images created for academic use. Original images from VectorStock.

As the name suggests, Satabhaya translates to Seven Brothers (‘sata’- seven, ‘bhaya’- brothers), referring to the seven hamlets in the cluster, viz. Sanagahiramatha, Mohanpur, Habeli Chintamanipur, Govindpur, Kaduanasi, Sahebnagar, and Paramanandapur hamlets. The shoreline of Satabhaya is approx. 17 km **(OdishaBytes, 2022)** and is located near one of the biggest National Parks, Bhitarkanika National Park which is known for its rich mangrove cover. These act as buffers against the force of strong winds and waves. They are crucial in protecting the coasts from erosion due to strong currents. However, partial destruction of these natural covers has taken place due to unchecked construction and other human development activities **(Chachra et al., 2023)**. Without the mangroves, the coasts face a harder impact with the landing of cyclones, thereby increasing their vulnerability to extreme weather events. Furthermore, the effects are not just limited to erosion of the coastline but also have a high impact on the coastal communities residing there. These come in the form of loss of near and dear ones, climate migration, climate trauma, loss of livelihood and occupation, Salt water intrusion in agricultural lands, infrastructural damages, ecological losses, and cultural losses, thus taking the place behind by several years. Since 1971, Satabhaya has been visited by more than 10 severe cyclonic storms which has taken it from a thriving cluster of 7 hamlets to a no man’s land now.

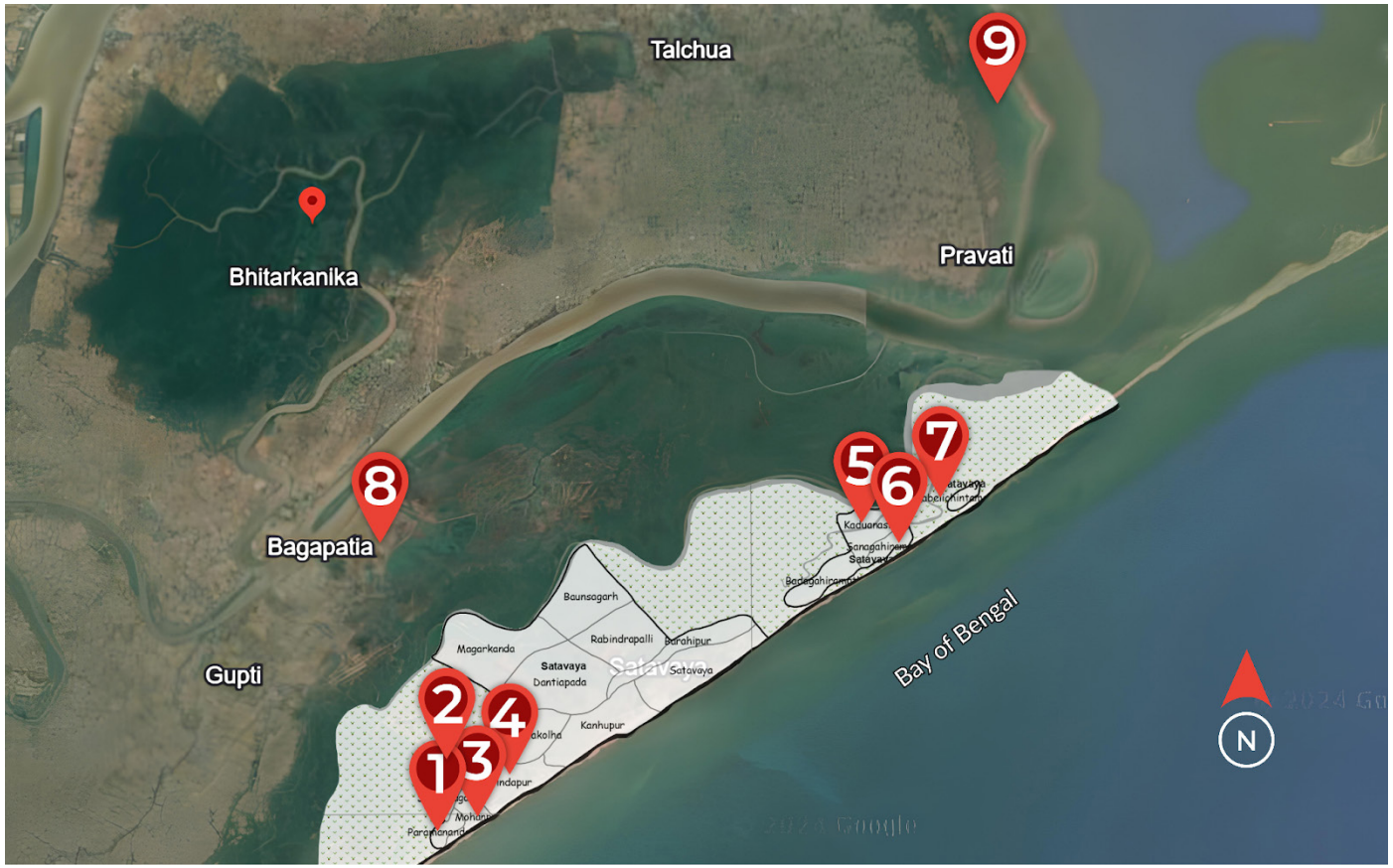

Figure 3: Hamlets 1- Paramanandapur, 2- Sahebnagar, 3- Mohanpur, 4- Govindpur, 5- Kaduanasi, 6- Sanagahiramatha, 7- Habeli Chintamanipur, 8- Bagapatia, and 9- Bhitarkanika National Park. Image Source: Composite images created for academic use. Original images from Google Earth, and Orissa Remote Sensing Application Centre.

To know a little history about the region, an instance of sea erosion occurred in 1971 when a very severe cyclonic storm flooded the houses of the villages forcing people to be displaced inland out of fear. They formed new villages, namely Satabhaya, Kanhupur, Magarakanda, and Barahipur. Among these, Satabhaya was the gram panchayat for all administrative activities (Sahu, 2019).

2.3 Proof of the event

To understand the aftermath of the chain of events in Satabhaya as discussed above, the photographic evidence below serves the purpose by showing the ground level drop that took place between 1971 to 2018 and continues to date. This thesis report will delve deeper into the details of the handpump story i.e. location, demography etc. and other related pieces of evidence in the later stage.

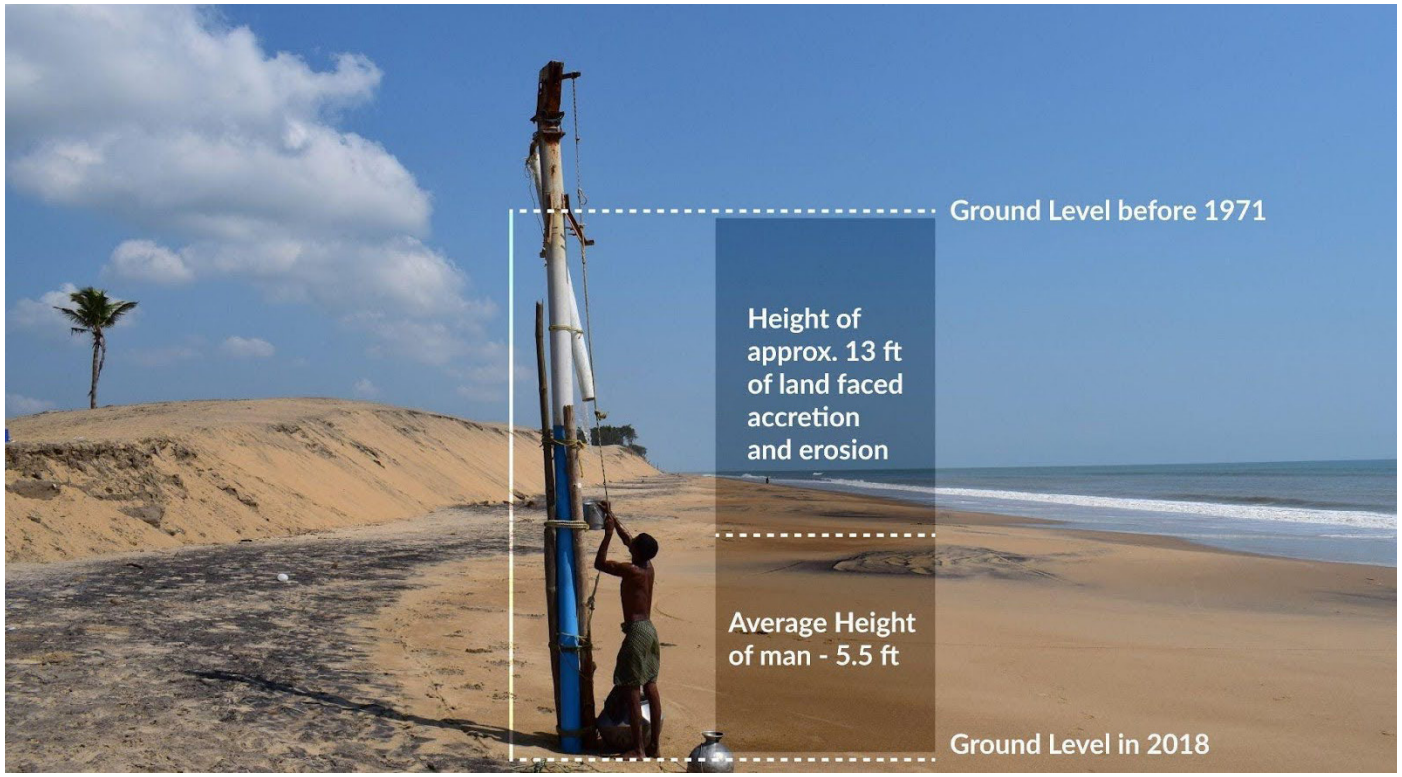

Figure 4: A thirteen-foot-tall handpump which was once in the middle of the Satabhaya village, today stands alone. A capture that depicts the amount of land lost to erosion and accretion, causing a massive ground-level drop. In the 6 coastal districts of Odisha, a total of approx. 4069 hectares of land faced erosion and accretion. In Kendrapara alone, 1058 hectares of land faced erosion and accretion ***(IANS, 2023)****. To get an image of the land lost, we can imagine 4.5 times the area of the IIT Hyderabad campus, 286 times the area of the Jagannath Puri Temple Complex, or 1511 times the area of a Soccer field. Image source: Priya Ranjan Sahu.*

2.4 How the story is told so far

The 1971 cyclone and 1999 Super cyclone had some of the most devastating effects on Satabhaya, Odisha, India. The severity and scale of the chain of events that followed the cyclonic falls have made it one of the most journaled climatic phenomena due to coastal erosion. It has been the subject of an award-winning film and also of many blogs & vlogs. Many local, national, and international news channels have also covered and published these events both offline and online.

Below is an analysis of a few of the online published works to understand the gravity of the situation in terms of narration, interaction, storytelling, proof, pieces of evidence, tools, and techniques used to narrate the same.

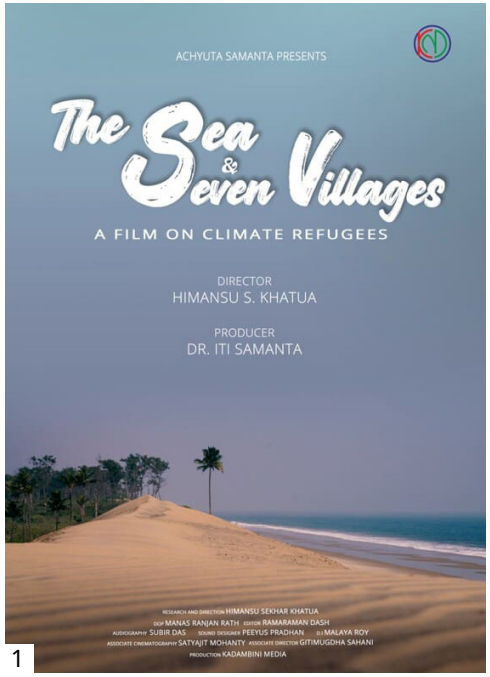

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*Figure 5: 1- Poster of a documentary **(Khatua, 2023)**, 2- Poster of an award-winning movie - Yesterday's Past **(Panda, 2020)**, 3- Tweet by environmentalist Ranjan Panda dated 9th June, 2020, 4- A local newspaper article, 5- Article by Subhashree Bannerjee **(Banerjee, 2016)**.*

Analysis of event coverage by **local** news channels.

Satabhaya news - article analysis by local new channels						
Name, Link, Time and Editor	**Title**	**Keywords/Data**	**Media Elements and dominating element**	**Structure**	**Interactions**	**Remarks**
Odisha Connect 19th Nov, 2022 (Connect, 2022)	Satabhaya - villages that went into the sea	destruction includes appx. 600 houses, 2400 acres of cropland, temples, 125 yr high school destroyed, the summer palace of the royal family	Photograph **Video** Text	non-linear	scroll click	In the video uploaded, the photographs do not match the textual description
Kanak News Feb 14, 2019 Tapas Parida (Parida, 2019)	Irregularities In Satabhaya Rehabilitation Program Create Problems for Villagers	Problems faced due to the cyclone in Satabhaya,	**video**	non-linear	click	Old aerial footage of Stabhaya settlement

Analysis of event coverage by **national** news channels.

Satabhaya news - article analysis by national news channels						
Name, Link, Time and Editor	**Title**	**Keywords/Data**	**Media Elements and dominating element**	**Structure**	**Interactions**	**Remarks**
Infochangeindia.org April 2008, Richard Mahapatra (Mahapatra, 2008)	Climate change: Satabhaya village in Orissa goes under	In 2008 - Sea is a few meters away from Panchayat office 93 families left Kanhupur village, 25 families left Satabahay village In 2006 - the sea was 200 m from the Panchayat office In sept. 21 - the sea came 10 ft into Kanhupur village	Photographs **Text**	Non-linear	Scroll	not able to relate due to lack of location
Down To Earth 22 Oct. 2018, Ashis Senapati (Senapati, 2018)	Climate change in India: Odisha all set to redraw its map	10 handpumps in the last 20 years, Installed appx. 18 years ago, Total land loss - 6 hectares The rehabilitation was done according to the 2011 census	Photograph **Text**	Linear - 3rd person POV narration	scroll	Handpump story to highlight, Search for the latest census
Scroll.in Dec 23, 2018, Priya Ranjan Sahu (Sahu, 2018)	Despite the advancing sea, Odisha's coastal erosion refugees keep returning to their old homes	Coastal erosion - Paradeep Port and Falling Mangroves Seven Brother Dying - 20 yrs - 10 tubewells damaged Resettlement Process Youth Migrate - gov declared Satabhaya wildlife zone	Photograph **Text**	non-linear, 4 parts of the story, Coastal Erosion, Seven Brothers dying, Resettlement process, Youth migrate	scroll	long form of journalism

Name, Link, Time and Editor	Title	Keywords/Data	Media Elements and dominating element	Structure	Interactions	Remarks
Down To Earth 08 July 2019, DTE Staff (DTE, 2019)	Odisha's climate refugees: Activists urge proper rehabilitation policy	Climate migration - people displacement, Recommendations for mitigation	Photographs **Text**	Linear - 3rd person POV narration	scroll	displacement timeline needs to be verified, recommendations need to be further addressed
Down To Earth 09 July, 2019, Priya Ranjan Sahu (Sahu, 2019)	Odisha's climate refugees: Last Man Standing at Satabhaya	Prafulla Lenka's last stand, In 2011 - Kanhupur disappeared last	Photographs Text **Video**	Non-linear, 3rd person POV narration, 2 parts story, Seven Brothers, Lenka's last stand	Click scroll	data from the video can be burrowed, after before scenario evidence, many proofs
Down To Earth 11 July 2019, Pragati Prava (Prava, 2019)	Odisha's climate refugees: Satabhaya's cattle farmers suffer in new homes	premature cattle babies are born, I possess a Patta for my 8 acres of land at Satabhaya and pay taxes for submerged land It was a livestock-dependent community	Photographs **Text**	Non-linear	scroll	
Down To Earth 30 June 2022, Ranjan Panda (Panda, 2022)	Going under: Coastal Odisha under existential threat	Lost 153.8 km, about 28%, of its coastline to seawater ingression, Inadequate Policy Support by gov.	Photograph **Text**	Linear - 3rd person pov narration, 3 parts story, Satabhaya: a reluctant relocation, Next in line, Inadequate policy support	scroll	comparison between similar events, a rough timeline of the chain of events, Mitigation solutions

Name, Link, Time and Editor	Title	Keywords/Data	Media Elements and dominating element	Structure	Interactions	Remarks
The New Indian Express 10 Feb 2020 (Express, 2020)	Rehab eludes 65 families of erosion-hit Satabhaya	Satabhaya coast - 17km stretch	Photograph **Text**	Linear	scroll	
News Click Rakhi Ghosh, 10 Feb 2020 (Ghosh, 2023)	Odisha Climate Migrants: In Satabhaya, Resettled Women Left to Fend for Themselves	Odisha Livelihood Mission (OLM), PM Awas Yojna, Biju Pucca Ghar Yojna, 80 % of men and many women go to Kerala for jobs, People still go back to Satabhaya to catch fish, Pregnant women had to go to Community Health Centres (CHC) in Rajnagar Block which is approx. 3km away, Initially, Sunei Rupei near Rajnagar was selected then 100 acres in Bagapatia, 400 sqm + Rs 1.35 lakh to construct houses, Regional Centre for Development Cooperation (RCDC), a non-profit org. started Project Pragati and formed SHGs,	Photograph **Text**	Linear 3rd person pov, Parts of the story, Struggling to get Record of Rights, Patta, Panchubarahi temple shifted to Bagapatia from Satabhaya, No livelihood option, Resentment over resettlement, Interventions from NGOs.,	scroll	reference for the aftermath part of the story, Project Pragati by RCDC - image from Twitter, Along with NGOs suggesting local business opportunities for women, Cottage industries

Name, Link, Time and Editor	Title	Keywords/Data	Media Elements and dominating element	Structure	Interactions	Remarks
Down To Earth 15 May 2023, Sandeep Chachra, Debabrat Patra, Koustav Majumdar (Chachra et al., 2023)	Odisha's model colony for climate refugees in Kendrapara should be emulated across India	22 cr under the Adarsh Colony initiative,	Photograph **Text**	linear	scroll	Reference for suggestions and future scope, The article was written along with Down To Earth
Action Aid 26th March 2024, Debabrat Patra, Esther Mariaselam, Ashok Kumar Nayak (Patra et al., 2024)	People's agenda for coastal, river erosion: Local climate efforts need not be stalled for want of global action	system considerations during such critical events	Photograph **Text**	linear	scroll	Reference for suggestions and future scope, The article was written along with Down To Earth
Hindustan Times Apr 30, 2023, Debabrata Mohanty (Mohanty, 2023)	Odisha to build India's first resettlement colony for climate change victims	About gov. funds to this place	Photograph **Text**	Non-linear	scroll	

Analysis of event coverage by **international** news channels.

Satabhaya news - article analysis by international news channels						
Name, Link, Time and Editor	**Title**	**Keywords/Data**	**Media Elements and dominating element**	**Structure**	**Interactions**	**Remarks**
Earth Journalism Network 03 January 2019, Priya Ranjan Sahu (Sahu, 2019)	Despite the advancing sea, coastal-erosion refugees in Odisha keep returning to their former homes	Coastal erosion - Paradeep Port and Falling Mangroves Seven Brother Dying - 20 ys - 10 tubewells damaged Resettlement Process Youth Migrate - gov declared Satabhaya wildlife zone	Photographs **Text**	non-linear, 4 parts of the story, Coastal Erosion, Seven Brothers dying, Resettlement process, Youth migrate	Scroll	taken by scroll.in the article by the same journalist
Trouw 11 August, 2021, Aletta André (André, 2021)	The temple of Satabhaya used to stand a kilometer from the sea. Now the remains are literally on the beach	Erosion explained, People interviews	Photographs **Text**	non-linear, 4 parts of the story, To a new village, twelve kilometers away, Too small piece of agricultural land, 'Afraid of the advance of the sea', Climate change is not the only cause	scroll	

Analysis of event coverage by other mediums.

Other mediums in which the story of Satabhaya is depicted						
Details	**Title**	**Keywords/Data**	**Media Elements**	**Structure**	**Interactions**	**Remarks**
Feature Film Nila Madhav Panda 2021, 1h23m, Odia (Panda, 2020)	Kalira Atita - Yesterday's Past	The protagonist visits his village to find out his residence is encroached by the sea. He then spends days in his old damaged house by the coast remembering his family and one night gets caught in a cyclone and dies.	video	non-linear, Inspired by true events, Drama	click	cyclone is a "dress rehearsal", according to the director
Photo Essay The Bastion Anvita Dulluri, Sept. 14, 2020 (Dulluri, 2020)	Shifting Sands: The Story of Adapting to Rising Sea levels in Odisha	Overall story coverage, includes nearby areas facing the same issue	Photographs Text	non-linear	scroll	reference for narration
Documentary CEEW Sept. 14, 2020 04:17 minutes (CEEW, 2022)	Lost in Satabhaya Relocated Odisha villagers call for climate-proofing livelihoods	Story of resettlement through the POV of Sudarshan Rout, a villager, Video Includes in-between analysis done by the CEEW team	Video Photographs Text	non-linear 3rd person pov	scroll click	good aerial shots

Details	Title	Keywords/Data	Media Elements	Structure	Interactions	Remarks
Documentary XCOMM Sep 17, 2019 06:02 minutes (Mohapatra, 2019)	Satabhaya - The story unfolds	Students Project Documentary, Talks about Odisha cyclones overall and problems faced by Satabhaya	Video	non-linear, Narration - from climate change to Odisha to sSatabhaya to the rest of the world	click	good aerial shots
Documentary WORLD BANK BLOGS KARIN KEMPER NOV. 09, 2017 (Kemper, 2017)	Swallowed by the Sea...Where coastal infrastructure and jobs meet climate change	very similar events in West Africa, visuals are very relatable	Video	non-linear	click	West Africa Coastal Areas Management Programs
Video log Youtube - Dream Okilapal Aug 31, 2021 (Okilapal, 2021)	Story of Satabhaya	Personal blogging of Satabhaya village along with a friend	Video	linear, 1st person POV	click	Close-up shots of the temple

Insights from the tables above are as follows:

- Multiple sources/channels have covered different segments of the same event in various publications. This has resulted in a lack of understanding of the whole picture.

- Some articles are misleading as there is a mismatch between the photograph and their descriptions.

- More effort is necessary to make the scientific data easier for a layman to understand and relate to.

- Due to the complex nature of the event, the data published by different entities are not coherent with each other.

- Due to the scale and complex timeline of the event, non-linear storytelling is more common in the published articles.

- Very few pieces of content have provided event locations pinpointed with respect to a map.

- Expert's recommendations for mitigation of such events need to be highlighted more.

- The unorganized availability of data lacks credibility.

- Readability issues due to advertisements on websites, thus compromising the seriousness of the issue.

- Out of all the channels, DownToEarth has been consistent in publishing the story through different perspectives.

- Text and photographs are the commonly used formats/ medium to represent the chain of events.

- Scroll and click are the widely used interactions when digital platform is considered.

- Most of the articles are published in English and Odia languages.

- In many articles, the story is divided into substories for the audience to distinguish between events.

- Accessibility issues eg. - articles for the blind.

A submerged handpump as a proof of Satabhaya's tragedy.

03 Context

3.1 Data Storytelling and Data Journalism.
3.2 Interactivity in Journalism and Scrollytelling.
3.3 Case studies

3.1 Data Storytelling and Data Journalism

To understand Data Storytelling, we need to first differentiate between the root words 'Data' and 'Story'. Data is information that has undergone technical procedures like data cleaning, structuring and sorting, to make the information suitable and easier for the application of visualization techniques to further convert the complex information and facts into stories that are easier for people to understand and form opinions about. Thus, "Story is an interactive form of communication, where information is brought into a context that people can understand, remember, discuss and tell others about" **(Segel & Heer, 2010)**. Segel and Heer identified two approaches of narrative techniques observed in the visualizations of news media, which are author-driven and reader-driven approaches. Author-driven narratives are non-interactive and structured linearly which is ideal for effectively communicating the stories. On the other hand, reader-driven narratives are interactive and non-linear without a structure, where the story unfolds in a path that is not predetermined and offers the scope of discovering information and forming new hypotheses. Even strictly reader-driven narrative strategies need authoring

to determine the interactions while reader-driven offer the scope of exploration to the reader once they have completed and processed the intended narrative and visualization **(Segel & Heer, 2010)**.
Journalism that utilizes the above-mentioned processes of data storytelling and visualizations is known as Data Journalism. We can say that Data Journalism is a process that follows the steps of filtering the data, visualizing a story, and subsequently increasing the value of information to the public **(Rodríguez et al., 2015)**. Data journalism is different from traditional journalism in the sense that it is newer and has come around as a result of the increased availability of digital information which opened up new possibilities for journalists to tell complex stories. Furthermore, even newer types of journalism have emerged, namely multimedia journalism with the added possibility of utilizing multimedia content in recent times. Thus it can be said that the product of Data Journalism is a story that contains a substantial element of narratives and data visualization.

Veglis and Bratsas structured the workflow of Data Journalism as a process into the following stages **(Veglis & Bratsas, 2017)**.

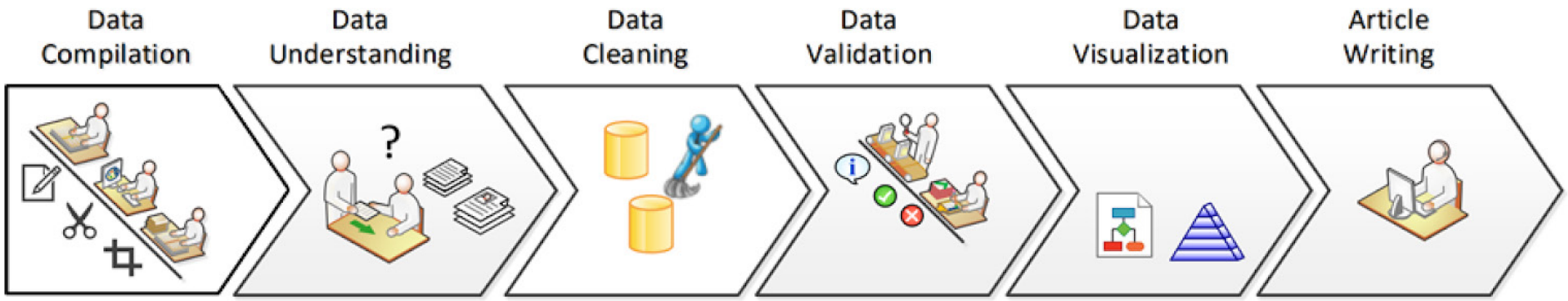


Figure 6: Data Journalism stages. Image source: ***(Veglis & Bratsas, 2017)***

Data Compilation- Collection and compilation of data sets from sources for the necessary information.
Data Cleaning- Cleaning up data that is not coherent or is incorrect and riddled with errors.
Data Understanding- To enhance the knowledge about the data and use newer data if necessary for areas not understood.
Data Validation- Cross-checking the original data with data from other sources to support its reliability.
Data Visualization- Visualizing the data through graphics and other abstractions.
Article Writing- This stage depends on the intended medium of publication and the supported content format of that medium.

3.2 Interactivity in Journalism and Scrollytelling

Journalism, often comes in the 'long-form', with long and detailed articles and a large amount of content. With the advent of Online journalism and Digital storytelling, new ways of presenting such complex issues are preferred by journalists as they can incorporate multimedia content and find other ways of expression. This digital long-form is often called scrolly-telling. Scrollytelling being the combination of "storytelling" and "scrolling" takes advantage of animated graphics, audio and video content, spoken text in addition to images, and written text in scrollytelling. Scrollytelling is typically complex feature-type stories that can use Internet-specific features: selectivity, interactivity, linking, multimedia, and participation, letting the user decide the depth of the story by themselves **(Seyser & Zeiller, 2018)**. On the other hand, the scroll experience can also be author-driven which might have a direction. The complexity of scrolly-telling articles can be identified by their level of selectivity and the narrative structure which can be linear, elastic, or alternative in nature.

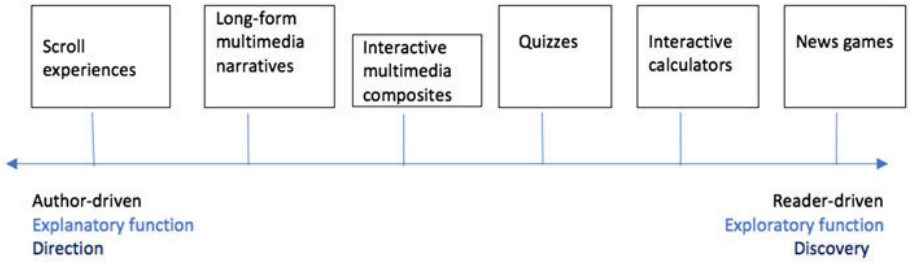


Figure 7: Author-driven/reader-driven UX design, function, and semantic operations of data journalism stories. the interactiveness of an online publication lies in the middle of being fully author-driven or being reader-driven. Image source: ***(Anderson & Borges-Rey, 2019).***

3.3 Case studies

This section analyzes different kinds of climatic data storytelling and the techniques used by them to convey their stories.

3.3.1 Oh, that house? It's in the sea now – there!

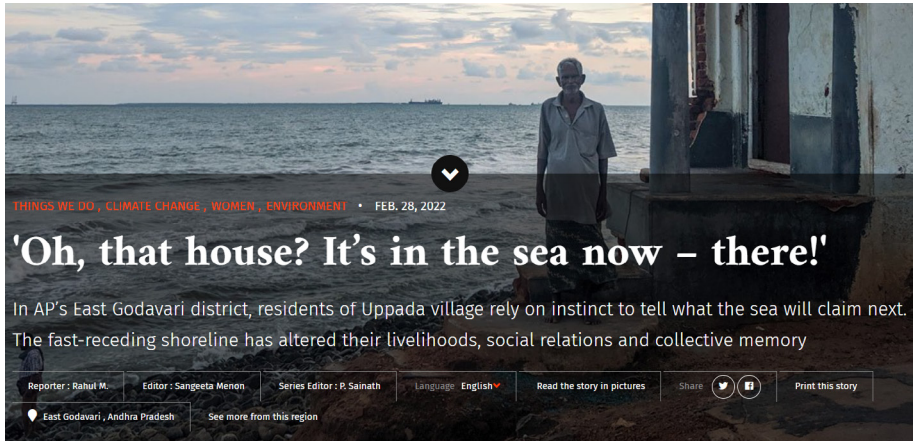


Figure 8: 'Oh, that house? It's in the sea now – there!' February 28, 2022, by Sangeeta Menon, Rahul M. Image source: People's Archive of Rural India.

Synopsis - The chain of events described in this article is similar to what has been happening in Satabhaya which is the encroaching of sea and receding shoreline bringing havoc to people of coastal communities.

Key features - Usage of hyperlinks in terms of reporter, editor, location, date, etc, to go to related articles, available in 13 Indian languages, read the story in pictures mode, the whole story through pictures and some text explaining the photograph, images can be zoomed to view in the whole screen, hyperlinks to an external party is used in the text, particularly where proof of data is necessary, sharing options to the readers on Twitter and Facebook.

Elements - Minimal layout with photographs and text given equal importance. The fonts - serif font for the title and sans serif for the body. Narration is done in 3rd person POV.

Interactions - clicks and scroll is used to convey the story.

3.3.2 Voices from the Frontlines

Figure 9: Voices from the Frontlines - Clever Franke. Image source: Global Centre for Climate Mobility, Africa Climate Mobility Initiative.

Synopsis- An award-winning data visualization interactive microsite and data portal regarding forced climate migration in Africa due to many climatic reasons.
Key Features- Use of animation and micro-interactions throughout the microsite, an Interactive map of Africa with clickable elements to explore different parts of geography; the menu, home, and back buttons are legible on every page.
Elements- Usage of bold, colorful, vibrant color combinations. Usage of bold and playful typography, Usage of 3D interactive maps. Use of photographs, videos, and graphs to create 11 stories. The collected data set is immense with share and copy link options at every page
Interactions- click, scroll.
Remarks- Due to the complex nature of data and stories, confusion regarding the flow of the microsite, and too many colors sometimes get overwhelming.

3.3.3 How the train crash in eastern India unfolded

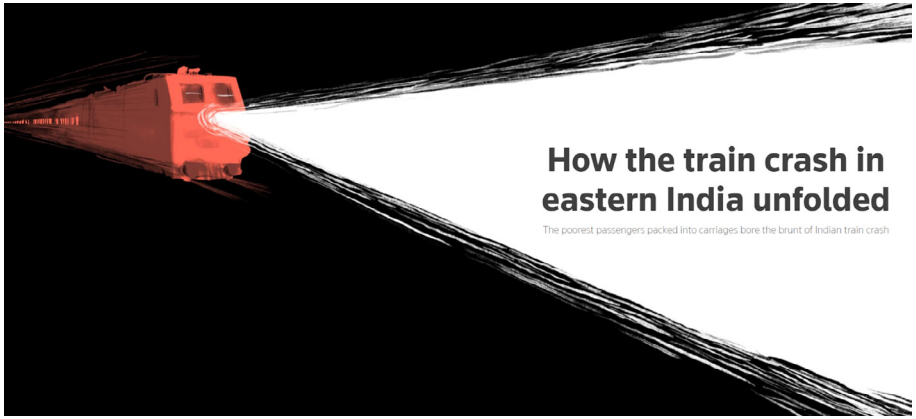


Figure 10: How the train crash in eastern India unfolded by Adolfo Arranz, et al. June 14, 2023. Image source: Reuters Graphics.

Synopsis - This Reuters Graphics interactive data visualization unfolds the infamous Coromandel Express train accident.
Key Features - Map of the train route, illustrated animation of the train accident, which can be accessed by scroll, interactive photograph scroll depicting the details and analysis of the photograph, aerial video footage to better visualize the scale of the event, sources information.
Elements - Use of serif fonts for body and san serif for title.
Interactions - Scroll.

Over a period of time, sand is all that remains at Satabhaya.

04 Design Process

4.1 Data Collection
4.2 Data Analysis
4.3 Data Representation

Data Journalism remained as the approach for achieving the goal of Data Storytelling. Using the processes associated with Data Journalism as discussed in section 3.1, the below steps were observed which line closely but not strictly.

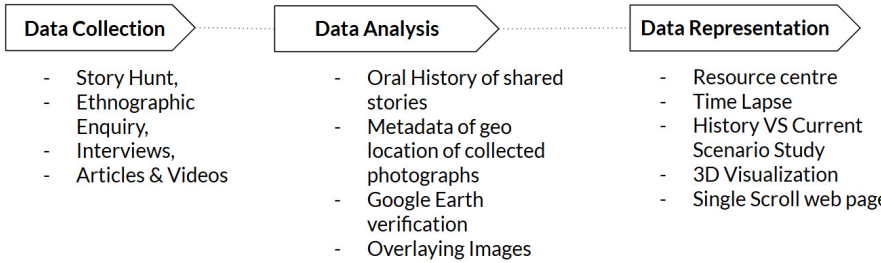


Figure 11: Overall Design Process observed for this thesis, keeping in line with the processes of Data Journalism.

4.1 Data Collection

The Data Collection stage was conducted for the contextual inquiry about the region of interest and to gather evidence in the form of Photo journals, Interviews for audio Journals, video journals, and copies of official documents. Due to the remoteness of the location and necessary paperwork for permission to enter the region, this stage required two visits that spanned over a duration of two weeks. This stage made possible the availability of a large amount of data and possible evidence necessary for the following stages of the research.

4.1.1 Photo and Video Journals

Photo and video journaling helped record the first visual evidence of the scale of destruction that the place had gone through and continues to experience. They helped strengthen the insights from secondary research and literature reviews done earlier.

The following were observed:

- Evidence of shoreline shift keeping Panchubarahi Temple as a reference point, unstable sandhills, and loss of vegetation cover.
- Evidence of soil erosion from the presence of 12 feet tall handpump exposed and eroded handpump in the middle of the sea.
- Evidence of Saline water infiltration and loss of agricultural land.
- Evidence of mass migration to resettlement region.

Loss of livelihood and change in occupation caused migration to other states through busses for transport.

- Evidence of efforts for temporary workaround to the situation by Sub-Division Officer - Rajnagar, like plantation of mangroves in barren agricultural lands and presence of artificial sand embankments.

Figure 12: 1- Geographical losses, 2- Handpump, 3- Saltwater infiltration, 4- Resettlement region, 5- Busses to Kerala proving the shift of livelihood and occupations, 6- Artificial Sand embankments.

4.1.2 Analysis of on-field audio recordings

A comparative analysis of data collected from semi-structured and open-ended interviews with the people of Satabhaya affected by the repeated cyclonic events, through audio recordings was done to find patterns and repeating stories that could indicate essential data.

Pabitra Kumar Sahoo (Male to the right, 37y)

Quote- "It is the end of the world! Satabhaya is a no man's land now."

Summary- Giving a little history about the place, Pabitra Kumar Sahoo mentions that Raja Sailendra Kumar Bhanjadev gave this land to the people and established the Gods here. It is now a barren place with weak vegetation and a vulnerable shoreline. The waves are unpredictable too these days. He has some sentiment attached to his birthplace and comes to visit and spend some time from his new settlement in Bagapatia which is 5 km away. Mentioning the history, he says that the sea has advanced by 1km near the old village temple since 1982, which is now sadly lost and has been eroded away by the sea.

Elderly member of Muduli Family (Female, 60y)

Quote- "We have no agricultural land anymore and can't produce our own rice."

Summary- A senior female member from the Muduli family expressed discontent against the condition of the roads and the allocated area in the resettlement zone. She mentions

that her family is unable to meet the expenses or pay taxes due to the loss of livelihood. This has pushed her son to migrate out of his homeland to another state for work. Her son Pramod says that he travels to and fro between Bagapatia and Kerala for work and needs to manage all expenses at a meagre earning of ten thousand rupees per month. It is apparent from her statements that local produce has suffered a blow after the events

Sudarshan Rout (Male, 55y)

Quote- “Sea made us, sea ruined us.”
Summary- Narrating his story, Sudarshan Rout mentions how he had to migrate thrice. The first happened in 1971 when he was two years old and moved from Govindpur to Satabhaya(which was still unaffected back then). The second migration happened after the Super cyclone of 1999 when his family again had to move to Barahipur(currently inhabited). The third and largest migration happened in 2018 when seventy-five percent of the families had to resettle in Bagapatia. He adds that the construction of the Paradeep port aggravated the situation. He recalls the horrors of the loss of farming land, the advancing sea near their door, and the deaths of thousands. He mentions how the government had been reluctant and slow to respond to their appeals but finally provided aid once the resettlement region’s geography was found to be suitable in 2018.
He affirms the previous comments that the youth in the community have started venturing out to other states for jobs. Sudarshan provides more insights on the current state of affairs in the resettlement colony like the poor condition of the roads during monsoon, insufficient land for irrigation, irregular clean water supply, improper drainage, lack of electricity, and lack of facilities for education and medical needs. Sudarshan ends by recalling how they used to be self-sufficient earlier.

Neeranjan Swain (Male, 68y)

Summary- Neeranjan Swain talks about the mythology; passed down by four generations, of how the place was discovered and the temple was built. He is able to trace back and pinpoint four major cyclonic events in 1962, 1971, 1981, and 1999 in addition to 2018, and blames it on global warming. He again comments like the others before on how the youth were moving out for work, especially since the 1999 Supercyclone. He further mentions that the Lost Temple went through construction changes from being a thatched hut to a puccha construction. He adds that it had been rebuilt in the resettlement region and was renamed the same before- 'Panchubarahi'.

Prabhakar Behera (Male, 57y)

Experiment- Experimented with him by showing him the interactive scroll webpage of the How the Train crash in Eastern India unfolded (as he was already aware of the same news) coverage by Reuters to see his response to it and it was found that the data representation through animation helped him understand how exactly the accident happened and why general compartment people suffered the most.

Summary- Prabhakar Behera says that the eroded remains of the temple reveal how wood, mud tile, chuna guda, etc were used way back before, during the construction of the temple. His family is one of the two or three who reside still in Satabhaya.

An Elderly Senior (Male to the left, 62y)

Quote- “Some were rich, some poor, we all are equal now.”
Summary- This elderly senior recounts the same incidences of cyclones identified before in 1971, 1982, 1999, and 2018 and how he had to see his own birthplace go under the sea. Tracing back to the story of Satabhaya, he mentions that it was visited by “the Gods” in the 18th century. He uses the word ‘mauja’ (possibly referring to a cluster of villages making a panchayat) and how the whole of it had to vacate. Picturing the gradual advance of the shoreline through the years, he uses the temple and his house as references as being 2km and 1.5km away in 1971 respectively (distance from his house to the temple being 500 m). Currently, the temple is lost and the remains of his home lie just 500m away from the shoreline. He mentions that there was no proper corridor provided for relocating to the new resettlement area movement through the creek with heavy goods was difficult.

Retired Journalist - Bhaskar Routray (Male, 62y)
Quote- “Gods went, the temple remains”
Summary- As a local journalist, Bhaskar Routray shares a lot of his insights about the place. Starting with history, he mentions that the Bay of Bengal was previously called the Kalinga Sagar and that the shoreline was as far as 40 km. . He also mentions the same story of God’s visiting the place in the 18th century wearing masks named Barahamukhi or Panchubarahi (baaraha - local name for a kind of wild dog). Once a spot for a one-day retreat to outsiders, now it’s come face to face with climate change and global warming. Resettlement efforts were stalled in 1990 after the then-environment minister’s petition claimed that resettlement would impact the biodiversity of the Bhitarkanika National Park. This is unique also to the water of the delta which is a mix of nearby soft water and hard water from the sea. Lilavati used to be the variety of local rice grown in the fields.

4.1.3 Analysis of Government Documents

Official Government Documents dates from 2008 to 2021 reveal the process and duration of land allocation and completion of the construction of houses and other infrastructure in the resettlement zone.

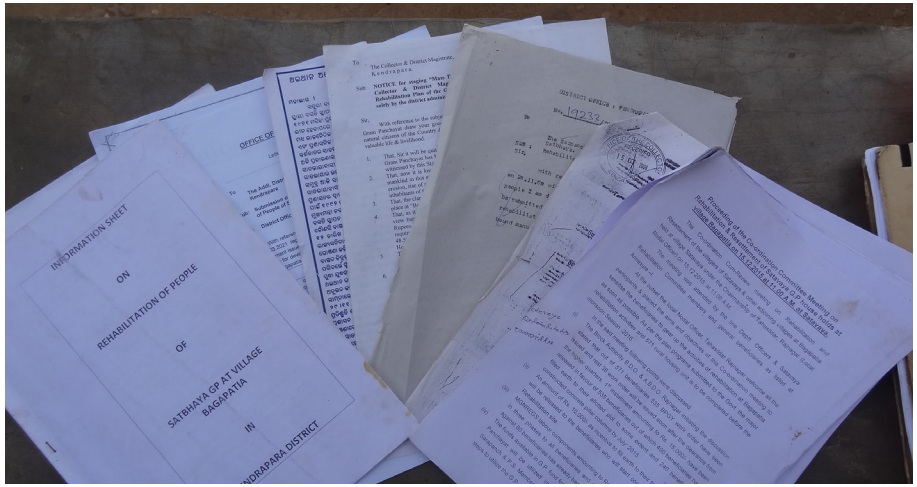


Figure 13: Government documents collected from the villages.

Minutes of the meeting dated August 2008 with Ministry, Revenue & Disaster Management, Principle Secretary, Forest and Environment, Commissioner-cum-Secretary, Revenue & Disaster Management, Collector, Kendrapara and Divisional Forest Officer, Mangrove Forest Division, Rajanagar:

Reveals that the resettlement of the people of Satabhaya and Kanhupur from the affected regions of Bhitarkanika Sanctuary to the fringes of Bhitarkanika National Park was identified as a threat to the latter which required further approval from the Government of India. It also mentions how the people weren't willing to resettle somewhere far away.

Letter by the Additional Distric Magistrate, Kendrapara, November 2008:

Memorandum to rehabilitate the people of Satabhaya was directed to be started by December 2008. One report from 2014 issues by regarding the progress of resettlement work in Bagapatia reveals how previously approved draft land records prepared in respect of both the tenanted and the government were endorsed as canceled by the then Assisstant Section officer, without any such instruction or order notified. The report further mentions that on scrutiny, it was understood that the allocated land had been removed from consideration for the survey settlement operation by the Tehsildar of Rajnagar.

Updated information sheet, Collector, Kendrapara:
Regarding rehabilitation mentions the gradual process of acquiring the land area for resettlement purposes after approval from the respective tehsildars. It also mentions that 521 of the total 571 families had been delivered the possession of land.

Proceeding, December 2015:
Mentions the facilitation of 80% of the completion of the housing units by the end of March 2016. It further mentions the progress of the rest of the amenities like the construction of tube wells, roads, and power lines in Bagapatia. It also expressed concern over the need for funds for the building of a proper drainage system as the resettlement area was low-lying and prone to water logging.

Information report, March 2021:
Mentions the total number of households at 571 with a population of 3243. It further mentions the status of completion of the housing units standing at 368 and other infrastructural work that is completed.

4.2 Data Analysis

The Data Analysis stage was to see for any incoherence between the different forms of recorded data and the patterns repeating from them. It helped form the parameters for further analysis and cross-checking validation.

Below is a list of identified repeating patterns from the observation and analysis of the data after filtration:
- Geography of the region- weak vegetation, unpredictable and un-receding waves, shoreline moving inward, soil erosion, sand hills breaking.
- Shoreline shift registered at 5 km, 1.5 km, 1 km, and 500m through the years.
- Demography- Inhabitants mostly farmers, now migrants, domestication/farming and rearing, used to be self-sufficient, economically challenged.
- Land and livelihood loss (most commonly reported incidence).
- Local produce affected- the Lilavati variety of rice.
- Common sentiments- fear and discontentment with the newly allocated region.
- Unchecked construction of port- Paradip Fort.

- Land unavailability- Absence of grazing land for cattle in the new area.
- Cultural losses- Like the loss of the Pachubarahi Temple. Awareness among the inhabitants about the mythology and history of Satabhaya.
- The number of villages submerged in the cyclones of 1962, 1971, 1981, 1999 and 2018.
- Deaths during the cyclones of 1962, 1971, 1981, 1999 and 2018.
- Disaster-induced migration and number of times migrated. Slow government response and reluctance.
- Youth migrating in seven hundreds and thousands to other states for work.
- The resettlement region has amenity and infrastructural problems.
- Lost or abandoned belongings including livestock.

Other recorded data and parameters identified from Data Analysis:

- The number of recorded major incidences of cyclones prompting migration- 5 1962, 1971, 1981, 1999 and 2018.
- After 1999 Cyclone people started to move out of the village for work and livelihood.
- Data of number of settlements intact and populations:

Satabhaya Villages and population after cyclonic events		
Year	**Population**	**Villages**
After 1962 Cyclone	5000 approx.	7
After 1971 Cyclone	3000 approx. death 2000 approx.	2 remained
After 1999 Cyclone		2
After 2018 Cyclone	Approx. 571 families and 3243 population	0

- Shoreline shift in km through the years using the temple as a reference point or settlements against years - 5 km (1900), 2 km (1971), 1-1.5 km (1999), and 500 m (2023).
- After 1999 Cyclone people started to move out of the village for work and livelihood.
- 700 - 1000 apporx. number of Youth migrated outside of the state.
- Condition of the corridor for moving into Bagapatia- poor
- Amenities in new settlement areas and their condition- Poor or under construction.
- Earning of working person per family- approx. 10000 INR.
- Occupation before and after- farmer to plywood handlers.

The analysis of the data lead to the discovery of seven most common or bigger groups in which the different data could lie. These seven categories could be converted into sub-stories in order to move forward with the narration. These seven are the crucial parts that give the whole picture of the event-

- Shoreline Shift
- Introduction to Satabhaya
- Eroded Temple
- Hand Pump Analysis
- Lost and Abandoned Memories
- Climate Migration
- Aftermath

The metadata from images helped recover their location data and determine their distance from a point of reference, as the region undergoes rapid changes due to the recent state of events and the information helped identify and record the present state there.

Data validation for the above sub-stories is as follows.

Sub-Story	Photo/Video Journal Data	Audio Journal Data	Official Documents	Media
Shoreline Shift	y	y	y	y
Satabhaya	y	y	n	y
Eroded Temple	y	y	n	y
Hand Pump Analysis	y	y	n	y
Lost and Abandoned Memories	y	y	y	y
Climate Migration	y	y	y	y
Aftermath	y	y	y	y

Metadata of certain images whose location was not known.

METADATA OF IMAGES FROM ONLINEEXIFVIEWER.COM					
IMAGE	IMAGE SOURCE	DESCRIPTION	LATITUDE & LONGITUDE [appx]	ALTITUDE [appx]	DATE
	self	eroded panchubarahi temple	20.638483333333333,86.93381666666667	17.297 m	2023:07:13
	self	submerged handpump	20.638984166666667,86.93525083333334	10.17 m	2023:07:13

4.3 Data Representation

This stage involved exploring the scope of representing the data for storytelling. Below are a few of the possible representations identified for the seven sub-stories for the overall storytelling:

Intoduction to Satabhaya- Utilizing the zoom-in feature of Google Earth Studio to establish the location of the place.

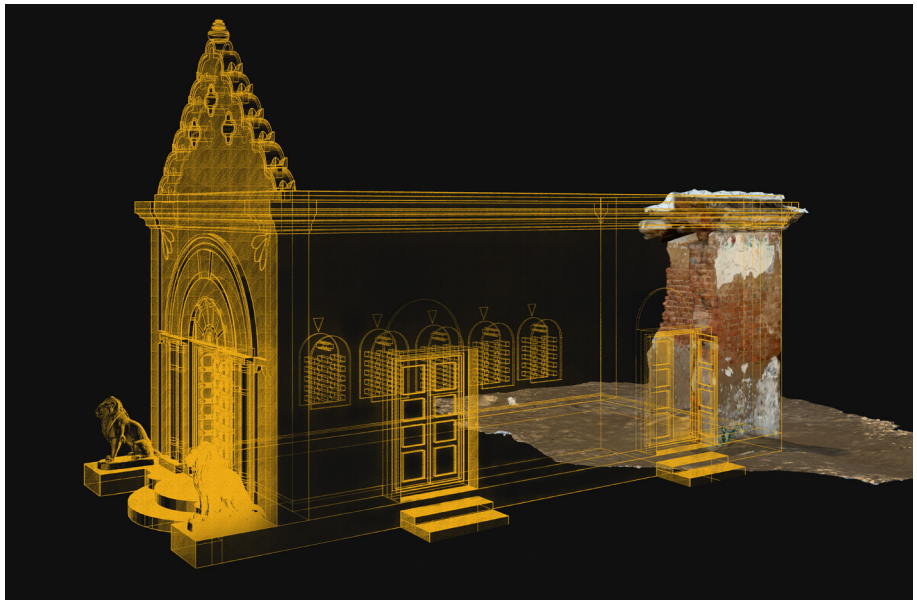
Eroded temple- Gradual erosion of the temple along with data information through scrolling.

Hand Pump Analysis- For telling the depth of sand lost in the process if erosion.

Lost and abandoned memories- Before/after studies on images to capture the loss of infrastructural and goods.

Climate Migration- To emphasize the displacement of the people and the number of times using animated infographics.

Aftermath- Role of government in the who event.



Visualization of extent of loss due to coastal erosion.

05 Design for Data Visualization

5.1 Problem Statement
5.2 Design Direction
5.3 Ideation
5.4 Visual Design
5.5 Web Development
5.6 Testing

5.1 Problem Statement

From the research methodology conducted for intended data storytelling, the below problem statement arises-

How might we design an interactive scroll webpage to communicate the severity of the phenomenon of coastal erosion through the story of Satabhaya in a journalistic approach, that serves as a central resource to understand, visualize and archive the episodic events to make it accessible to a broader audience including both readers and non readers alike.

It also takes into account the gaps identified after the research and prompts the below:

- How do we make a central resource centre for shared understanding and archiving?
- How to bridge the connection between scientific data and emotions?
- How to make abstract statistics relatable?
- How to visualise data to highlight impact?
- How to Simplify complex data?

5.2 Design Direction

Data Analysis boils down the events to seven sub-stories as seen in section 4.2 which together form the complete narration. This along with the insights from the previous stages of research helped to determine the narrative structure and order for storytelling. It was further important to decide the approach (author or reader-driven) and thus the linearity of the narrative. Considering the scale of information available and the intention of data journalism, a desktop-centric web based storytelling, or more specifically scrollytelling becomes the direction for this thesis.

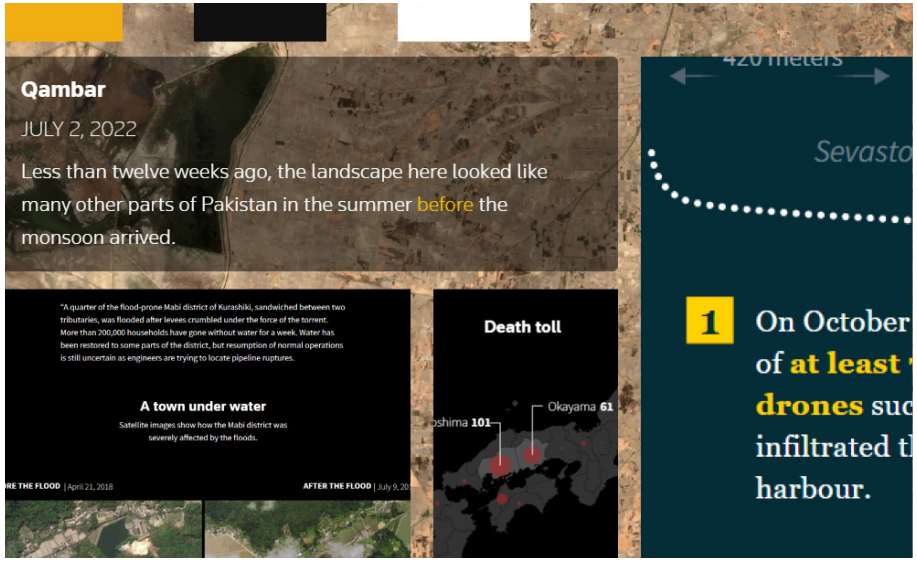


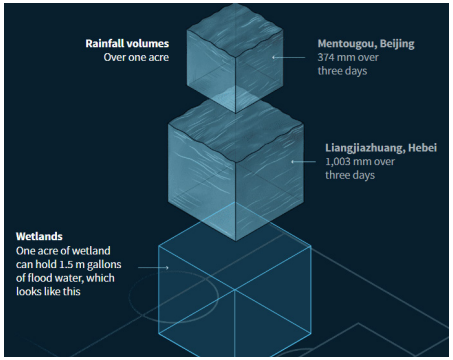
Figure 14: Initial inspiration and direction for Visual Design.

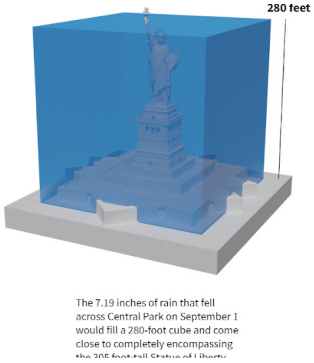
Along with order and structure, **Data Storytelling techniques** were also necessarily identified for the visualization of the sub-stories.

Below are some of the techniques from similar storytelling articles like People's Archive of Rural India, New York Times, Reuters, etc:

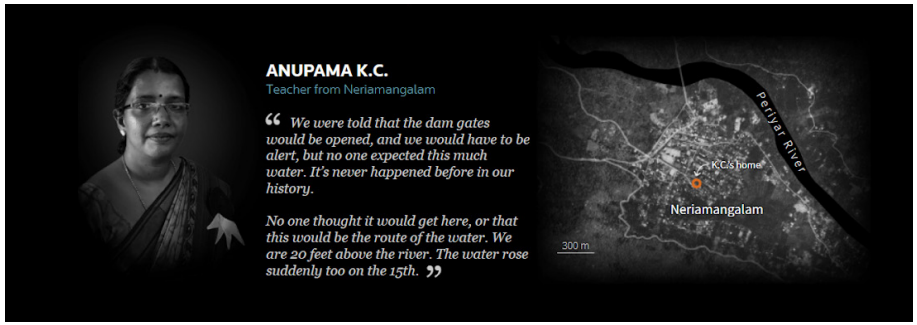
Overlaying Images

Contrast through comparison



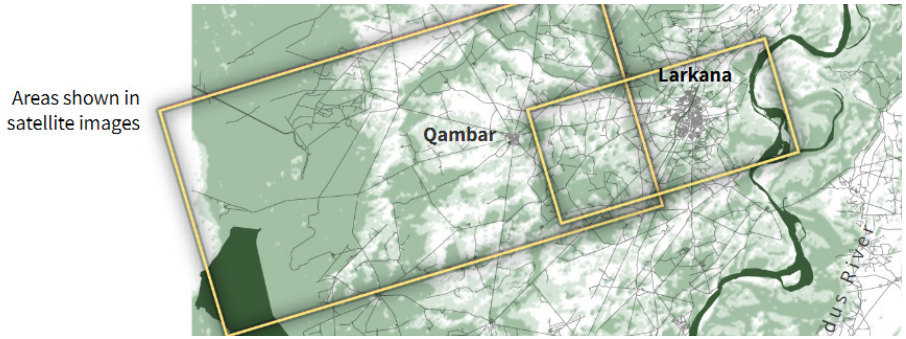


Testimonial Styles

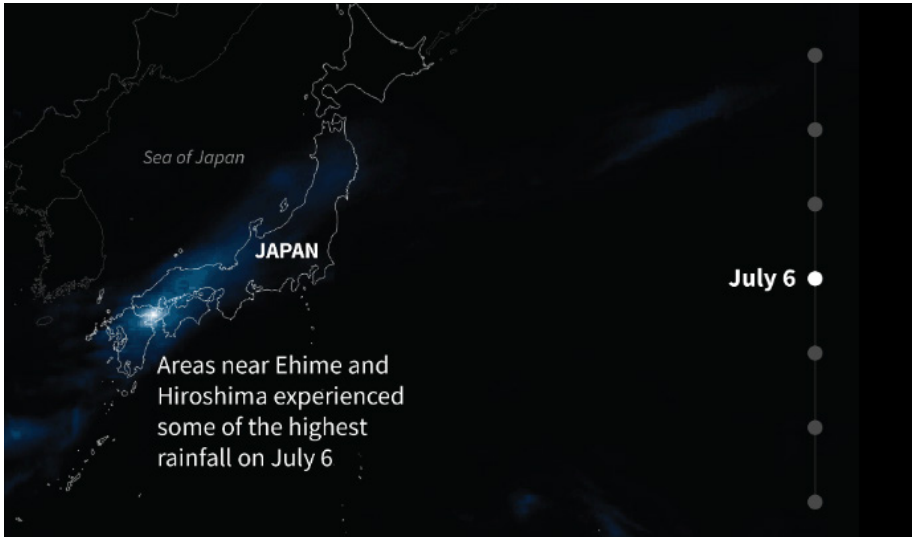


Before vs. After

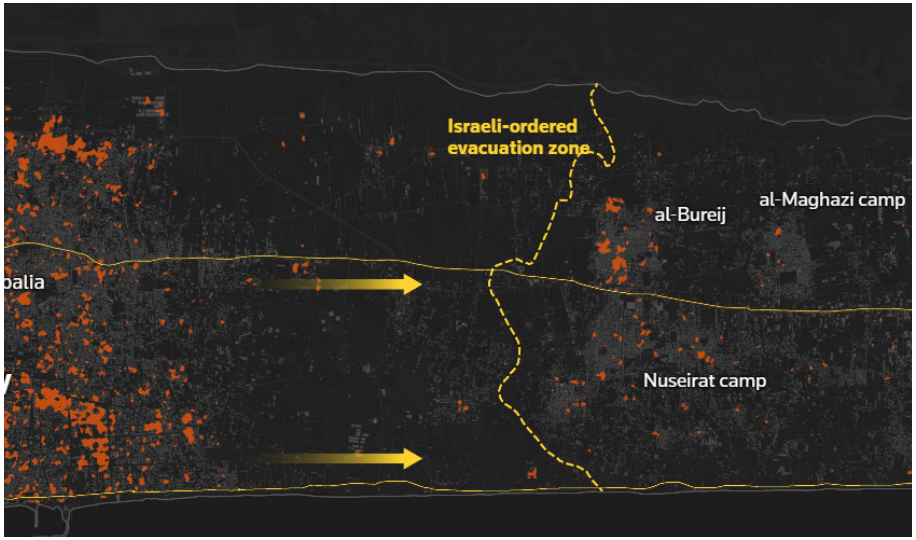
Map Manipulation and Demarcation



Timeline Study



Horizontal Scroll



5.2 Ideation

This stage is concerned with the deciding the flow of the narrative and decide the visual language for the data visualization. As an exploration of the approaches, the below two possibilities were in-line with the story:

1 - **Reader-driven**: Reader is face -to-face with a map and can interact through clicks to open a section(out of seven) in any order. This open, or elastic narrative storytelling technique might compromise the build of the gravity of the situation or empathy.
2 - **Author-driven**: Reader has to scroll though a fixed narrative, with segments flowing in a direction set by author. Each segment offer/might not offer some interaction and here the reader has some degree of freedom given by the author without compromising the intended flow decided by the author for in the interest of effective communication of the story.

This thesis moves forward with the second approach thereby using a narrative structure that is largely linear and author-driven but has segments that allow the reader to explore in few places, thus leaving it partially non-linear.

This is in-line to lying in the middle of the spectrum of narrative structures as discussed before in Section 3.2 and seen in Figure 7. Below is the order of the flow of the seven sub-stories, setting the direcion for the story and forming it's beginning, middle and the end.
Points 1,2 describe the beginning, points 3 to 6 the middle and point 7 is the ending.

Introduction to Satabhaya- The affected place whose shoreline is moving inwards. Satabhaya needs to be established for people to know the context and who's the shoreline from the point 2 are we covering in our story.

Shoreline Shift- The visible geographical feature of the region that has plenty of data to convert to a story and being the face of destruction in Satabhaya's case.

Eroded Temple- It serves to represent the eroded culture of the place, it's own existence as well as the reference point of the substory that we started with.

Hand Pump Analysis- Another hallmark of the event and serves something similar to the point above. It can also be

used as a scale to denote the amount of soil cover eroded in that region.

Lost and Abandoned Memories- Powerful imagery that implies what the inhabitants had to go thorough and make the reader curious about their present condition.

Climate Migration- Serving to answer the questions arising in point 5 and informing about immediate consequence of the disaster and what the survivors did.

Aftermath- Their present condition and what have they been reduced to. This section might also beg to ask if there is any hope for the resettled inhabitants along with addressing government interventions.

Using the points above along with the suitable interactions for the non-linear areas inside the sub-stories as discussed in the Data Representation section 4.3, the storyboards as below are created along with a concept frame for the webpage.

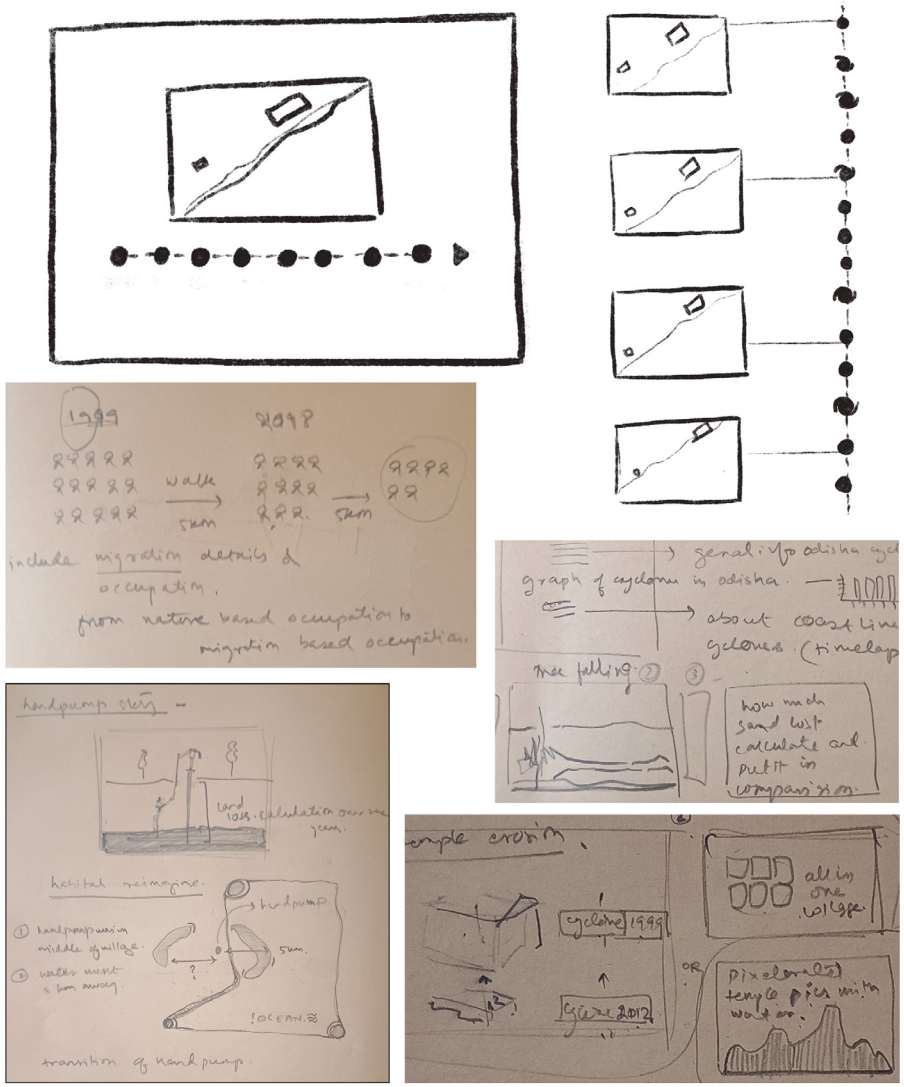


Figure 15: Rough Concept Sketches Collage ,storyboard cut to the width of a webpage, one designed asset image for webpage. Image source: Self.

5.3 Visual Design

This stage brought together the necessary visuals and multimedial assets for building prototypes. 12-column grid was used to set the layout of the elements and develop the composition, taking cues from the the Ideation stage. The colors used are white, Coda Black and yellow. Compatible font pairing of Noto Serif font and Noto San Serif font is used as the same font also has a variant in Odiya. Since multi media is in use, there is a combination of different kinds of assets like 3D renders, 2D vector assets, map graphics, images, photographs and video journals.

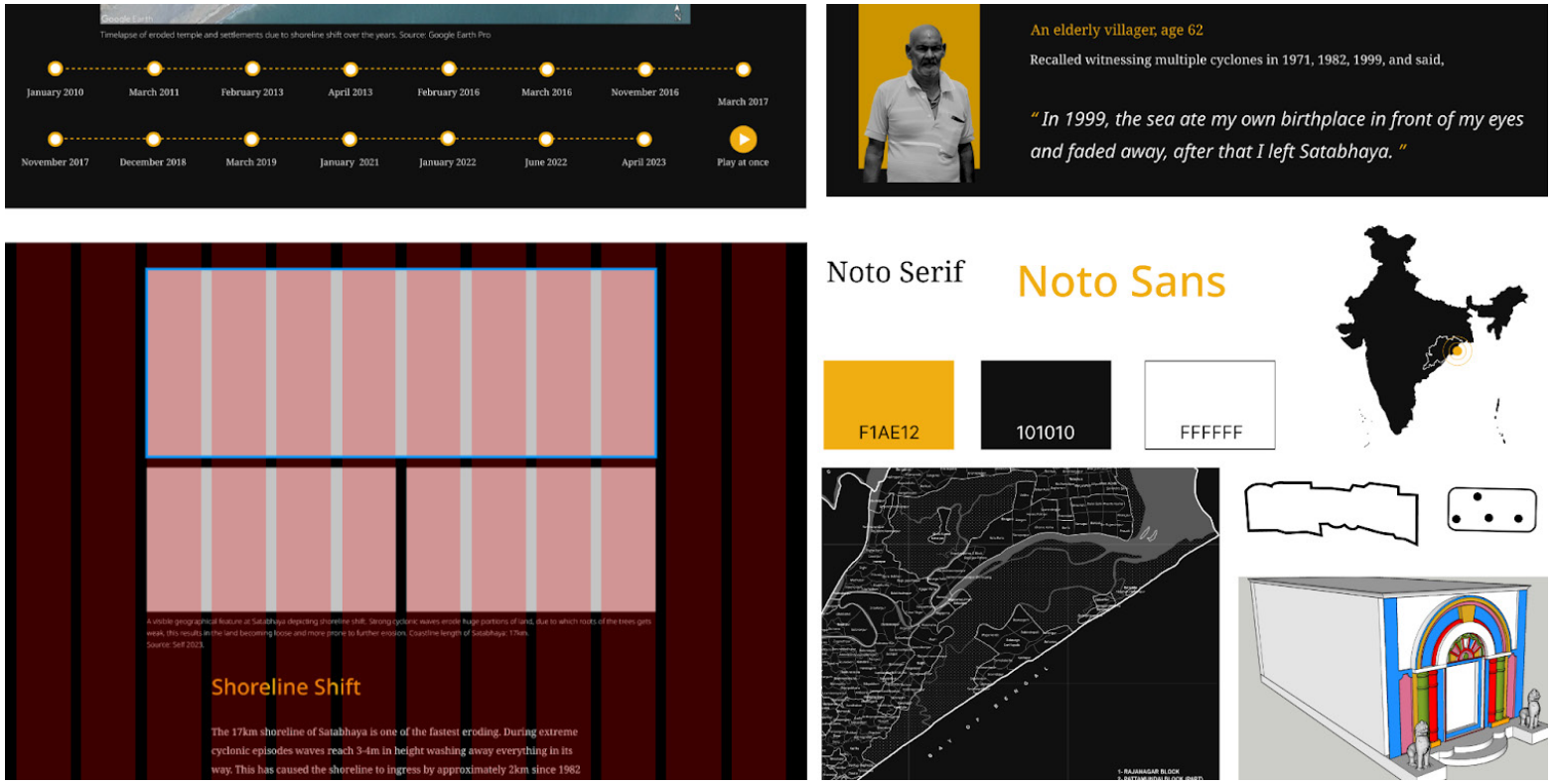


Figure 16: Overall webpage visual design in terms of 3D render, manipulated map, graphic, accent colours, etc. source: Self.

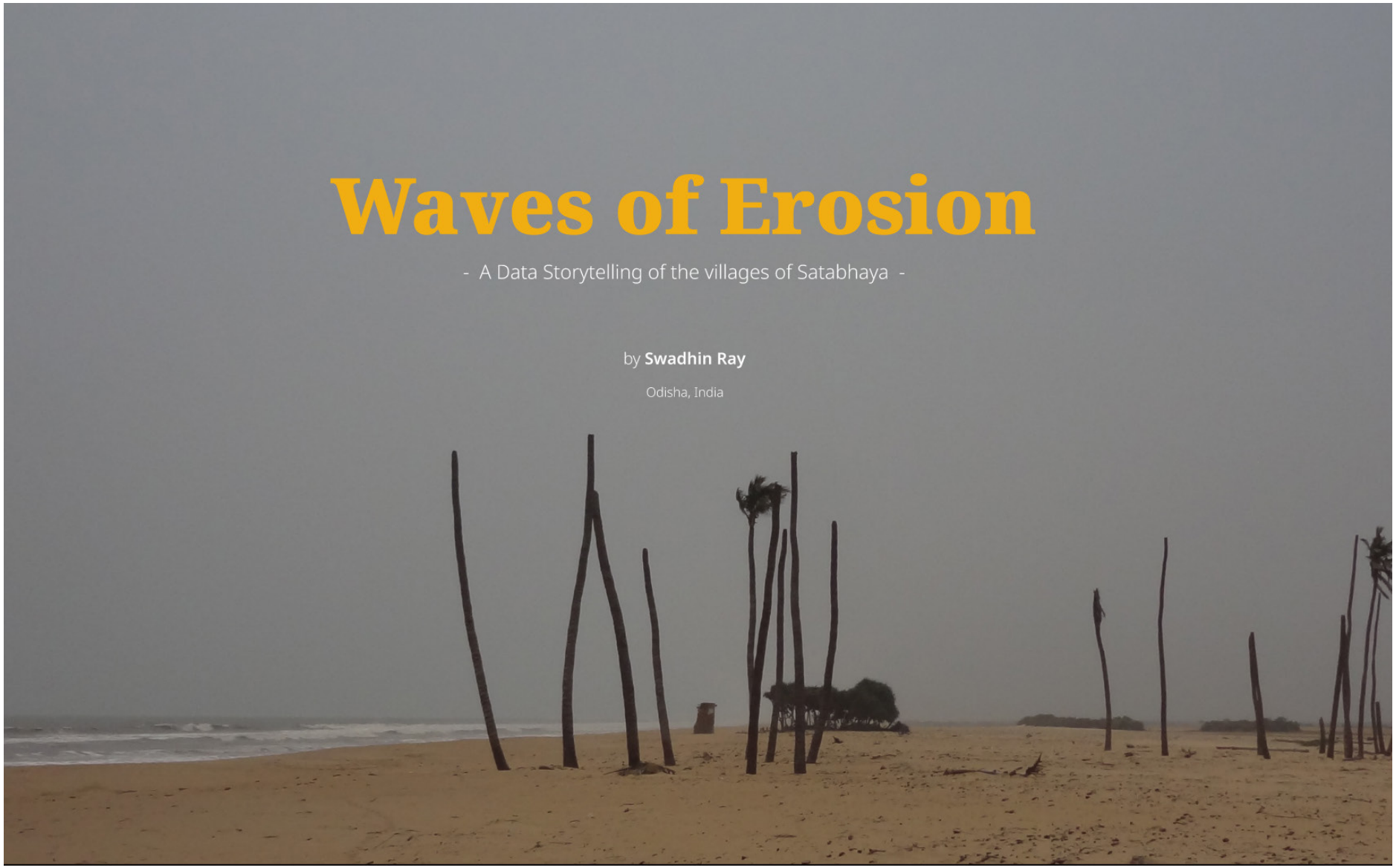
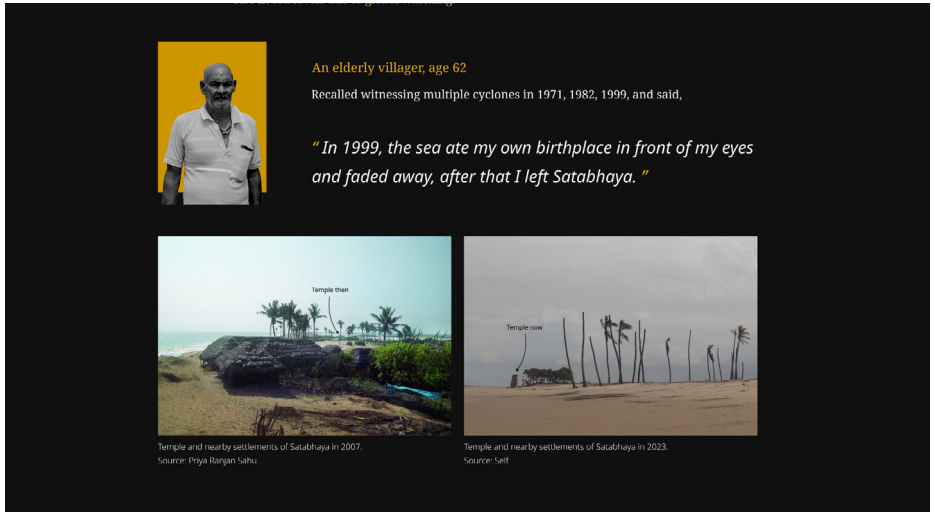


Figure 17A: Hero image with title from final design.

Manipulated Maps and Demarcations

Timeline Study from Google Earth

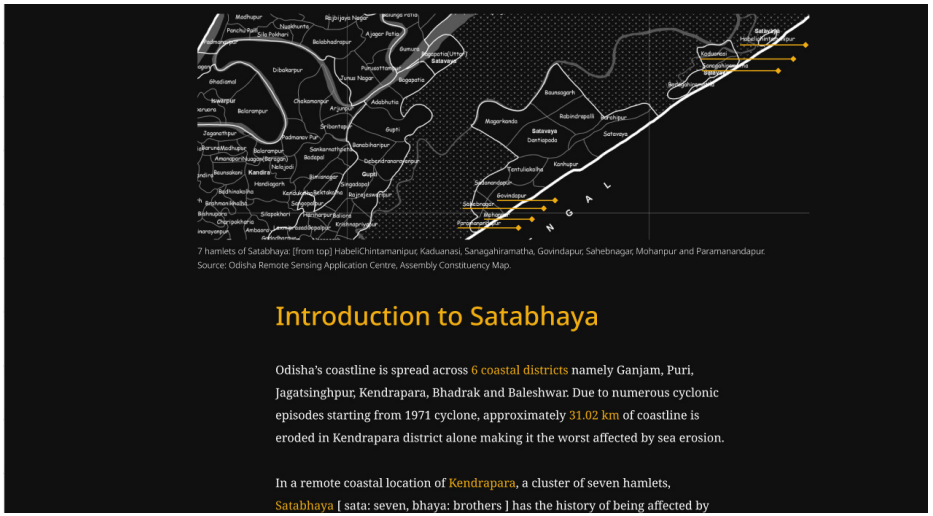
Testimonial Styles and Before vs After



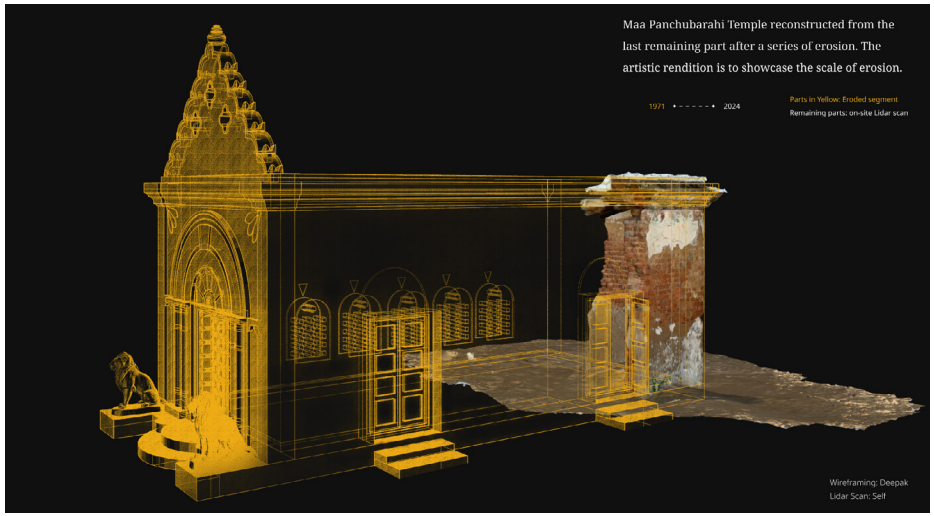
Comparison

Figure 17B: Final Design created and prototyped in the software Figma.

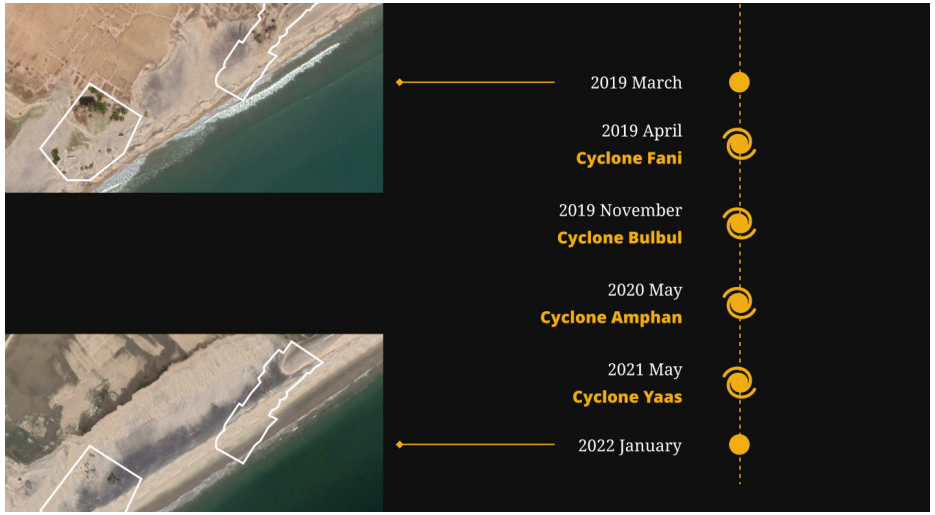
Area of study and textual styles



Temple reconstruction



Settlement timeline with respect to yearly cyclones



Historic evidences through photographs

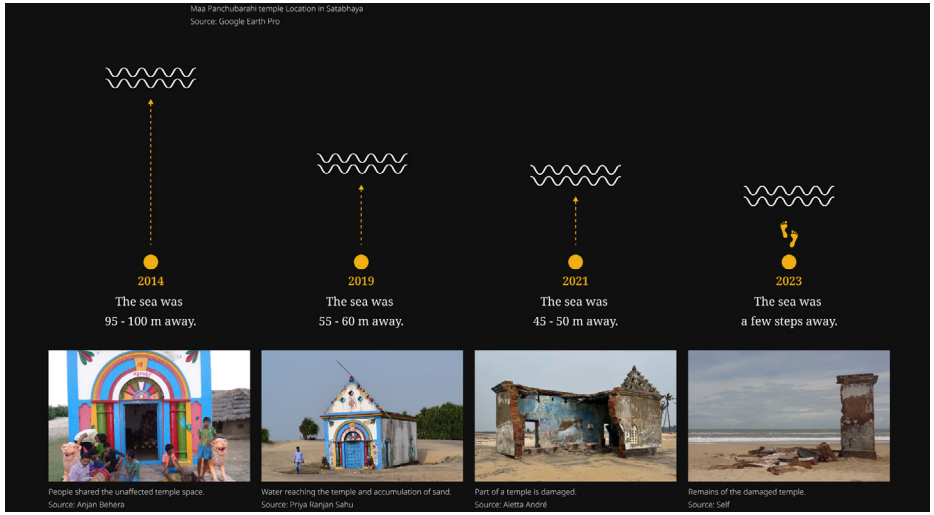


Figure 17C: Final Design created and prototyped in the software Figma.

5.5 Web Development

This stage was in parallel to the Visual Design stage and the assets and elements were supplied to be coded for local hosting in HTML, C# and Javascript. The features were tested out and checked for performance issues while scrollying and adjusting the parameters accordingly. One common problem encountered with online data storytelling articles is that of lagging pages with poor syncing of the scroll and movement of the contents.

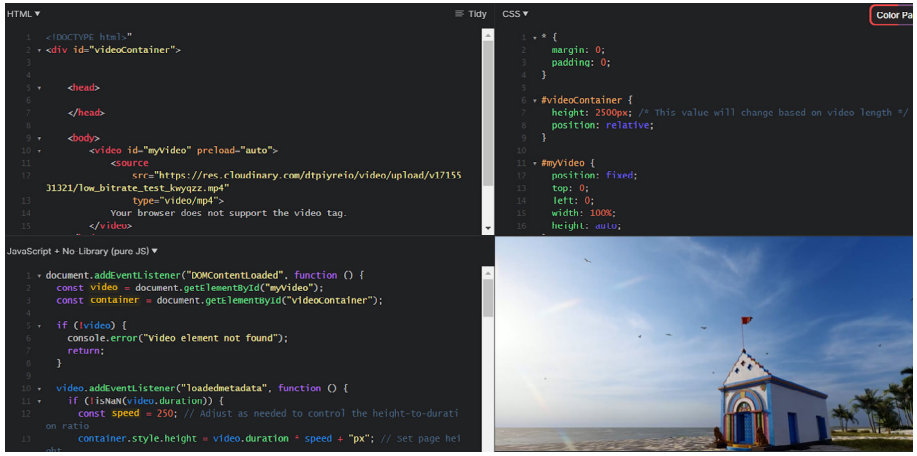


Figure 18A: Scroll based video playback trail codes on JSFiddle.

A similar situation was noticed here as well with scroll controlled video playback which was later identified to be affected by the bit rate and size of the videos. Trials were done to test for the optimal limits that provided decent quality of the video and the near to expected scroll experience.

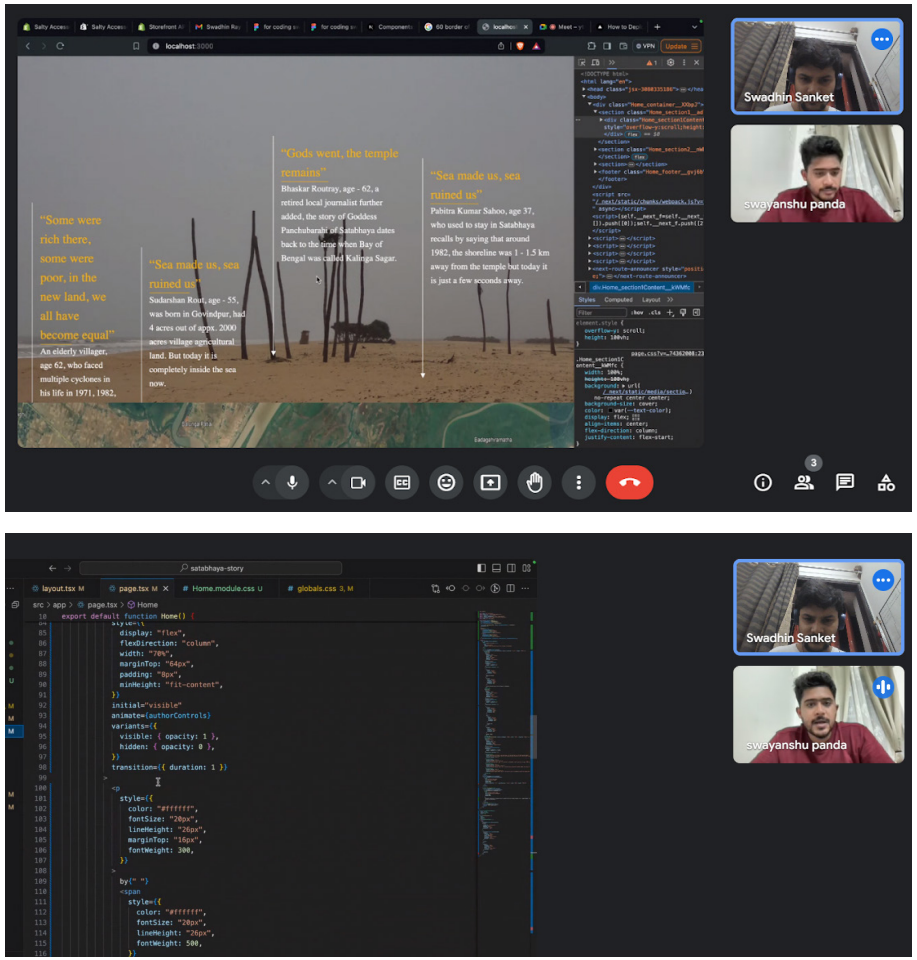


Figure 18B: Construction of 1st layer of code structure in collaboration with a developer (Swayanshu).

5.6 Testing

The crucial part of testing is set to be with SME [Subject Matter Expert] feedback - which should include the staff from climate change department from IIT Hyderabad and the journalists who covered Satabhaya stories in various news channels in terms of visual narrative, story narrative, content analysis and message retention.

With users:

- On a scale of 1 to 5, how comprehensive was the storytelling?
- On a scale of 1 to 5, how engaging was the story? (if you read till the end.)
- Rate the ease of interactions from a scale of 1 to 5.
- Gist of the story in a few keywords.
- Most memorable part.
- Did the story evoke any emotion?
- What emotions did the story evoke?
- Would you like to read similar climate related data stories around India from an archive?
- Would you like to share similar experiences? If at all you have gone through such or heard from people around you.

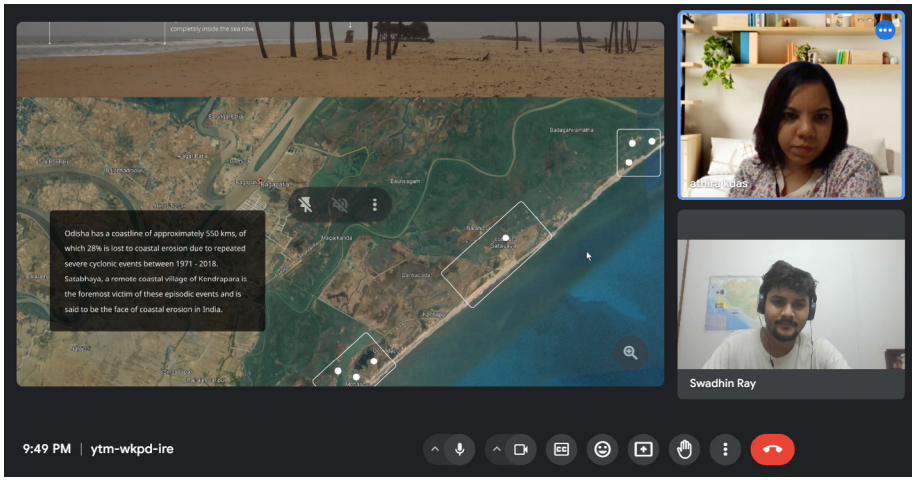


Figure 19: User feedback from Ms. Athira, 29 years - a rugular reader and visual design professional.

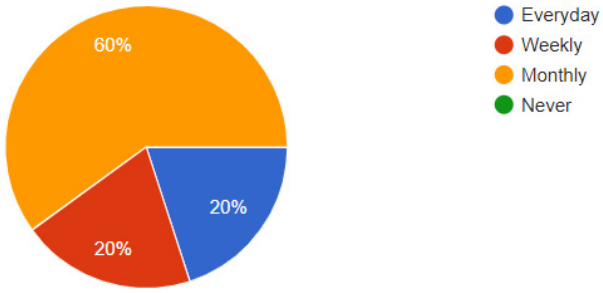
With Journalists:

- On a scale of 1 to 5, how comprehensive was the storytelling?
- On a scale of 1 to 5, how engaging was the story? (if you read till the end)
- Rate the ease of interactions from a scale of 1 to 5.
- Did the story evoke any emotion?
- What emotions did the story evoke?
- What did you think of the accuracy of the information shared?

The feedback received by 5 users after going through the article were recorded in google forms as follows:

How often do you read long journalistic articles/news?

5 responses



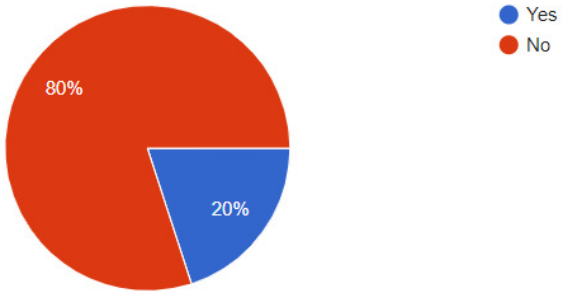
What do you think is the story about, in a few keywords.

5 responses

How Climate change and coastal erosion lead to changing human settlements and its impact in future
Soil erosion, climate change, devastation of temple
More than just a story of climate change impact, it was very interesting because of the quotes from the people who stayed or experienced it
The data comprehensively talks about erosion of the coast over a period of time
The story revolves around the human struggle to preserve their identity.

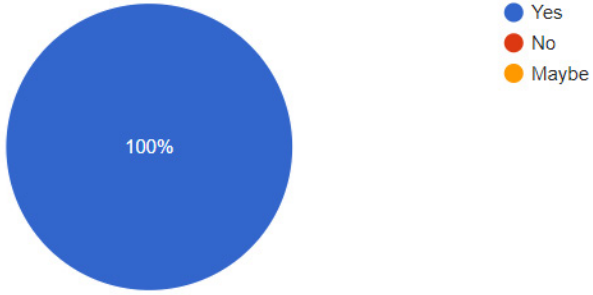
Were you aware of Satabhaya and Coastal Erosion before reading this story?

5 responses



Did the story evoke any emotion?

5 responses



What emotions did the story evoke?

5 responses

- Create awareness and take action on climate change.
- Sympathy, grief, astonishing
- Sad for the people who experienced it and scared for what is yet to come in different places in India
- Curiosity, surprise, fear
- Painful lose

If you would like to share similar experiences?

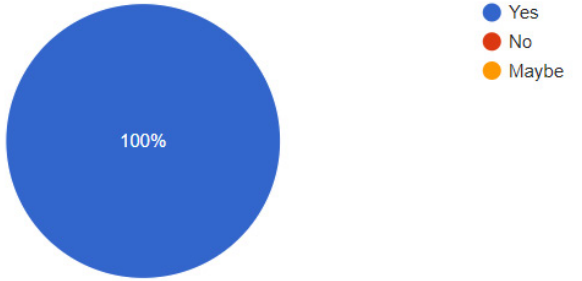
If at all you have gone through such an experience or heard from people around you.

5 responses

- Not that much
- On similar lines, mangrove deforestation in and around Mumbai Suburban creeks due to aggressive land encroachment
- I experienced something similar when I was in Chennai during a flood. The water level infront of my home raised by morning and couldn't go anywhere for 2 days
- Yes
- You can research and illustrate the struggles faced by people living in slum areas of modern cities.

Would you like to read similar climate related data stories around India from an archive?

5 responses



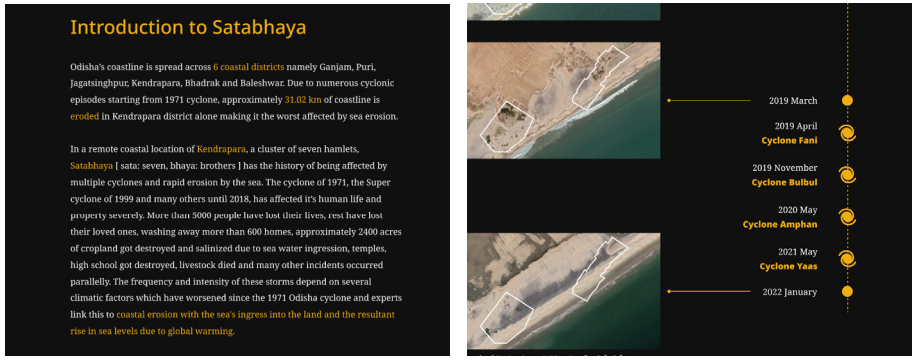


Figure 20: Left: Time spent more. Right: Time spent less.
Users spent more time on where content was visualization heavy and very less on the part where content was text heavy. Hence further iteration is necessary in terms of making the content with less yet relevant information.

06 Discussions

Throughout the project many possibilities and limitations were observed which are mentioned below:

There are limitations in the availability of high resolution 3D map data as it is still not available for many regions of the world, specially remote coastal areas along with not much availability of old photographs of a remote locations.

Further, there are still limited optimizations available in developement that can support the use of heavy media and footage to provide a seamless scroll experience.

The level of digital interactions should be lessened in order to avoid user distraction and focus should be more on the narration and appropriate interaction should be used.

While this thesis is a desktop first approach, the scope can be extended to other digital platforms that are provided by other digital devices like mobile and tablet browsers, digital interactive newspaper booth in public spaces etc.

There is even a wider scope that goes beyond the seven critical human-centred stories covered in this project. For example the environmental impact stories of the domesticated and wild life (Olive Ridley Turtles) in the same region.

Last but not the least, data storytelling using multimedia is undoubtedly a modern way of understanding complex problems such climate change with many possibilities that yet remain to be exploited. This project uses certain limited techniques to understand coastal erosion, further other different techniques can be incorporated to understand other complex climatic events. As the world advances to big data, journalists, designers and other climate enthusiasts should use data storytelling techniques and learn necessary skills to provide desired communication to the audience.

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