

Communication Design Project II

Collision Course

A graphic novel on the life of galaxies

By

Shreya Kondvilkar | 206450012

Guided by

Prof, Prasad Bokil



IDC School of Design

Indian Institute of Technology, Bombay



**“The cosmos is within us. We are made of star-stuff.
We are a way for the universe to know itself.”**

– Carl Sagan

List of Contents

1. Introduction	01
1.1 Context and Inspiration	02
1.2 Objectives	05
2. Primary Research	06
3. Secondary Research	08
4. The Process	12
4.1 The Story	13
4.2 Character Design	15
4.3 Storyboards	16
4.4 Future Work	21
5. Bibliography	23

1. Introduction

Space is everything in the universe beyond the Earth's atmosphere, which consists of the Moon, around which the GPS satellites orbit, the Sun and other stars, and planets revolving around them, galaxies, black holes, and distant quasars. Space is also what's between planets, moons, stars - the near-vacuum otherwise known as the interplanetary medium, the interstellar medium, the inter-galactic medium, the intra-cluster medium, etc. In simpler words, space consists of very low-density gas or plasma. At such low density with no air to scatter sunlight and produce a blue sky, space appears as a black blanket dotted with stars.

Humans have always observed the vast sky and wondered about the nature of the objects seen in the nearby space. With the development of rockets and the advances in electronics and other technologies, it has become possible to send machines, animals and people

above Earth's atmosphere into outer space. While astronauts have undertaken the responsibility to explore outer space, it should not be mistaken as a concern of only astronauts, scientists, mathematicians or astronomers. It is interesting to learn about the Universe and how it came into being, how it works, the existence of life, and ultimately, the existence of each one of us.

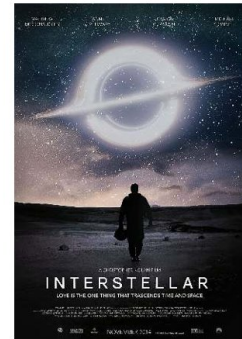
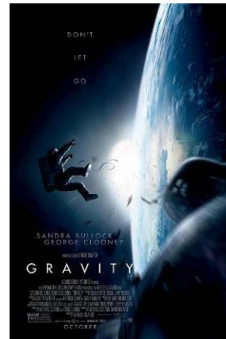
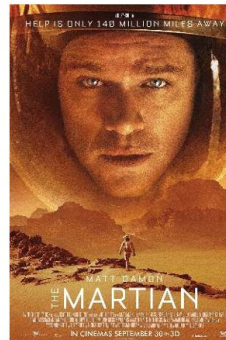
"Space is for everybody. It's not just for a few people in science or math, or for a select group of astronauts. That's our new frontier out there, and it's everybody's business to know about space."

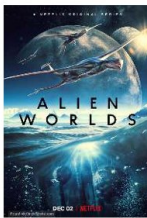
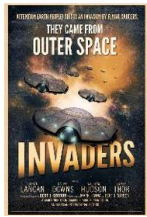
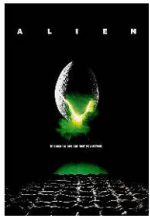
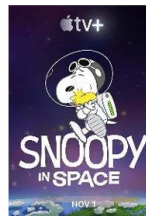
- Christa McAuliffe, Astronaut.

1.1 Context and Inspiration

Us humans, are fascinated by the concept of space and the content that revolves around it. Space - "the final frontier" as it is said to be, is the place where Star Wars are fought, odysseys are traveled, and extra terrestrials must inevitably return. Space has fascinated both filmmakers and audiences alike for generations, be it young or old. Even five decades after landing on the moon, it is still as much of a mystery to us now, as it was back then. The possibilities are immense and perhaps that is what draws us towards space.

In the year 2019 alone, three of the five highest grossing films in hollywood were based on space. Humans are obsessed with the unknown and in some ways, space and the life beyond it, besides being cool, is the ultimate mystery of life that we percieve. The unknown also gives way for numerous possibilities and theories that fiction based on space creatively explores.





Personally, I am no exception to the above mentioned tendency. I have grown up watching and being mesmerised by movies like *Koi mil gaya*, *Zathura*, *Space sweepers*, etc. As a child, I used to paint numerous watercolor paintings of the night skies and galaxies full of stars of various colors. I barely even understood what galaxies were back then. My understanding of space went only as far as a solar system consisting of eight planets revolving around a sun. The fact that our galaxy has multiple solar systems like our own was way too much for my child brain to process. Let alone the fact that even our galaxy is one of many, and that the universe is only constantly expanding.

As I grew up, the watercolor galaxies stopped but the attraction of space remained. As internet became more and more available, YouTube channels and Netflix shows that revolved around space became my most preferred kind of content to consume. I finally learnt about the beginning of the universe, the hierarchy of space and received answers to questions I never knew I had. It was only then when I was able to comprehend

the sheer vastness of space and I haven't stopped exploring since then.

When I got to know about the collaboration of ASI with IDC and its intention of creating books for children to educate them about space and astronomy, I realised how wonderful it would have been to have access to such sources of information at the early stages of my life. I wouldn't have had to wait for internet to show up and do its thing.

I was instantly inspired to take up this project for the following reasons:

1. I am particularly interested in designing for children and this project required me to design for an audience of roughly high school children.
2. I was myself unaware of the astonishing qualities and characteristics that galaxies have. My own lack of knowledge and curiosity to know more are my best inspirations to work on the topic - The life of galaxies

1.2 Objectives

The primary goal of the ASI, for which they approached IDC, is to bridge the gap between scientific researchers and common people through these astronomy themed illustrated books. The intention is to keep the audience up to date with the recent astronomical discoveries and make the transfer of information engaging and attractive. The ASI plans to distribute these books to students in order to provide them with reliable sources of information. The ASI will further translate this material into various Indian languages for better reach and understanding of the desired audience irrespective of race and geographical region.

The aim of this project is to educate students about various aspects of astronomy (in this case, galaxies) in a fun and engaging manner, in order to make them curious and interested about space. For the same, the information should be woven in the form of a narrative

in such a way that information transfer happens without having to actively "study" about the topic. The flow of the story should be in such that the information is given out periodically and smoothly to avoid the reader from zoning out of the story into a section of pure information.

2. Primary research

In a survey I conducted for middle school children of 10 - 16 years of age, I found that 65% of the participants prefer consuming video content in the form of films, TV shows, YouTube videos, documentaries etc. which is where the majority of their exposure to space comes from. 25% of the participants rely on books, newspapers and other textual mediums for knowledge whereas only 9% get knowledge about space from their school's curriculum.

Although video format was the most consumed medium by students of this age, I refrained from making an animated video due to time constraints. Besides, considering the purpose of the project which is conveying information, it is better to have a medium that can be gone back to to refer to the information as and when required.

When asked what makes them interested in space, the answers I received were interestingly similar.



Evidently, the mysterious and unexplored nature of space is what makes it the most appealing and open to mind blowing possibilities.

On asking further questions about space, I found that most of them were devoid of the basic knowledge of space or had self-made theories based upon incomplete information about a particular topic. This can be a result of lack of exposure or lack of interest. Another possibility can also be the lack of a good source that enables information transfer effectively as well as engagingly.

From the survey, I concluded that information received through school textbooks is not enough to keep students interested and feed their curiosity. There is a need for a different approach that will educate them about space and astronomy without it being counted as "study", for better engagement and effective knowledge transfer.

3. Secondary research

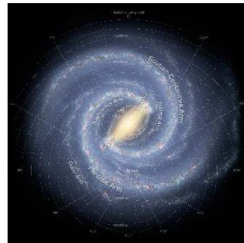
from the internet

What are galaxies?

Galaxies are massive, gravitationally bound systems consisting of stars, stellar remnants, an interstellar medium of gas and dust, and dark matter. The word galaxy is derived from the Greek word 'galaxias' meaning "milky", a reference to the Milky Way. Galaxies contain varying numbers of star systems, with as few as ten million stars called dwarfs to giants with a hundred trillion stars. In between these is a sparse interstellar medium of gas, dust, and cosmic rays. A supermassive blackhole resides at the center.



The Andromeda Galaxy



The Milky Way Galaxy (Illustration)

The Milky Way Galaxy is where our Solar System resides. Its name "milky" springs from its appearance as a dim glowing band arching across the night sky, its individual stars undistinguishable by the eye. When viewed from Earth, the Milky Way appears as a band because its disk-shaped structure being viewed from within.

The Milky Way is a barred spiral galaxy containing 100–400 billion stars and is likely to contain at least as many planets as well. The Solar System is located within the disk, about 27,000 light-years away from the Galactic Center, on the inner edge of one of the spiral-shaped concentrations of gas and dust called the Orion Arm. The center of the Milky Way is marked by an intense radio source, named Sagittarius A*, which is a supermassive black hole. The Milky Way Galaxy has two major satellite galaxies: the Large Magellanic Cloud (LMC) and the Small Magellanic Cloud (SMC). A number of dwarf galaxy satellites also orbit the Milky Way Galaxy.

Galaxies are categorized according to their apparent shape as follows.

Spiral galaxies have a flat, spinning disk with a central bulge surrounded by spiral arms.



Lenticular galaxies are an intermediate between elliptical and spiral galaxies. They're called "lenticular" because they resemble lenses.

Elliptical galaxies are the most common form, which has an ellipse-shaped light profile.



Irregular galaxies appear misshapen and lack a distinct form, often because they are within the gravitational influence of nearby galaxies.

Barred spiral galaxies can be identified by bar like centre and spiral arms that emerge from the ends of the bar or from a circular ring external to the bar.



Peculiar galaxies are of unusual size, shape, or composition. These galaxies are usually undergoing a collision.

Galaxies are grouped together in groups known as clusters. Some clusters are extraordinarily large, containing over thousands of galaxies, called Superclusters while others are much smaller. The Milky Way lies within a smaller cluster of only 50 galaxies known as the Local Group.

Occasionally, galaxies collide into one another, merging their stars and dust together. This is an important phenomena in the evolution and growth of galaxies. Galactic collisions do not lead to collisions of individual stars but the influx of dust and gas leads to a burst of star formation in interacting galaxies, leaving a new generation of stars in a galaxy where normal star formation may have stopped long ago.

Galaxies affect each other even when they don't actually collide. When two galaxies pass close to one another, the gravitational force they exert on each other can cause both the galaxies to bend out of shape. Both crashes and near misses between galaxies are called "interactions."

It takes thousands of millions of years for galaxies to collide, hence they cannot be witnessed by humans in one lifetime. However, astronomers use computer simulations to predict what would happen if two galaxies collided in a certain way. The Milky Way is on a course to collide with the Andromeda galaxy in about 4 billion years.



Hierarchy of space

Space > Superclusters > Clusters > **Galaxies** > Solar systems > stars, planets, satellites, etc.

After studying about galaxies, I realised that it is an intermediate concept between Space - that galaxies reside in, and the contents inside of a galaxy. In order to provide a complete 360 degree information about galaxies and its life, it is important to present an overview of the above mentioned topics, as an introduction. Thus covering an overview of the entire space and its contents and only providing deeper information about galaxies.

“Galaxies are situated midway between the domains of Universal Cosmology and the astrophysics of Individual bodies.”

The origin and Evolution of Galaxies,

4. The Process

Target Age group - 10 years and above

The target age group will be secondary school students from grade 5 to 10, that is 10 - 15 years of age as this age is when children have the time to learn new things and explore. A good knowledge of space will also help students to make an informed decision for choosing their careers.

Dividing the information in chunks

- Introduction to Space
- Introduction to Galaxies
- Types of galaxies
- Clusters of galaxies
- Contents of Galaxies
- Well Known galaxies
- How galaxies are formed
- How galaxies grow

4.1 The Story

Pre-requisite:

All of the characters are of 15 years of age, in their 9th grade. Mayank is Mihira's younger brother, 11 years old, 5th grade. Mayank and Mihira live in Mumbai, in an old house with their grandparents. Ajoba (Grandfather) is an astronomer and has been in his lab, in his study room almost all his life, and Mihira's too. Mayank loves to hangout with Grandpa sometimes and listen to his theories, even though he understands nothing. Mihira has never been interested in what Grandpa does, she absolutely hates science and believes that it's a waste of time. Also, science and astronomy has kept Ajoba away from them all her childhood, she has been grown only by Ajee (grandmother).

The Story:

Bhaskar and Tara have come over to Mihira's house to study for a Science test the next day. They usually visit each other's houses a lot, to hangout, create instagram reels, gossip about other schoolmates and plan pranks on them. This evening, however, they are together to study. Which they do for the first 10 minutes. Mihira is bored already. Ajee brings them garam garam Pakode. Bhaskar reminds them they have to study, so, after 5 more minutes, Tara remembers that Neesha's sister Chandani has gone to the US and she has the best fashion sense ever. So, Mihira and Tara start stalking her on Instagram. When Bhaskar reminds them about the test again, they ask him to have a look at her insta profile as well. But Bhaskar is determined, he keeps insisting to study and reminds them how important the test is. But they are too busy to pay attention. They find an interesting reel made by a classmate and start to

recreate the same themselves. When Bhaskar scolds them once again, they ask him to teach them. So he asks them questions about Space from the Science textbook, from the chapter - The Milky Way Galaxy.

Their laughing and giggling disturbs Ajoba in his study so he bashes into the room, annoyed, and scolds them to study and not waste time. Or waste their time somewhere else, not in his house. Ajee interferes to save the kids but Ajoba tells her it's her over-affection that has spoiled the girl. Ajee tells him to not let it affect him so much and instead, suggests he goes and buys some groceries for her from the market. Ajoba leaves while shaking his head. Mayank runs into the room, scared of the angry Ajoba. Mihira looks away with a frown. Ajoba has never understood her, or been there for her, so why should she care about him? She feels angry about Ajoba scolding her in front of her friends and plans a prank on him with them.

They wait for Ajoba to leave and then sneak into his lab. Little Mayank does not approve of this but he quietly follows the group. The lab is completely

different from the rest of the house. It immediately transforms one into a world of space and science. Bhaskar and Tara are awestruck while Mihira rolls her eyes. She has hated this place since forever. They roam around the room, checking out charts on the walls, peeping through telescopes and under the tables to come up with a potential prank idea. But when Bhaskar picks a few encyclopedias from the bookshelf to check them out, they find that what was supposed to be a wall is actually not. Is the bookshelf hiding something? They move the bookshelf to discover another room connected to it. Mihira had never known such a room existed in the house. It had bigger computers and space suits in big glass cages, 3 big ones and a smaller one, as though the room was expecting the four of them. Everyone was mesmerised. Bhaskar was in awe of the suits and could not take his eyes off them. He insisted on wearing the suit, he wanted to feel like a superhero. After refusing a few times, Mihira finally gave in. After all it wasn't such a bad idea, she could post it on Instagram and start a trend. So, all of them wear the suits and pose for a selfie.

Suddenly, all of them hear a voice, it's a mechanical voice from a computer which welcomes them and asks them where they were all this time? The disaster is going to happen in T-12 days. All of them look at each other in turns, only to find the others equally puzzled as themselves. When Mihira asks "what disaster?", the voice informs them about a Galaxy that has gone wild. This galaxy is eating up other galaxies like a cannibal and has become bigger than any galaxy ever. It has eaten Andromeda, the Milky Way's neighbouring galaxy and is now coming towards our Milky Way. Once it does, it's the end of the world for us. With the news being broken to them, everyone is horrorstuck. Did they just hear that the world is going to end?

The children ask multiple questions about why and how this is happening, and the computer answers them. It makes them sit in their respective chairs and pulls out a semi-transparent screen in front of them floating in midair. The voice then goes ahead and provides insight on the birth and death of galaxies.

Mihira shakes her head in disbelief saying that this is

not possible, that a galaxy cannot move this fast and collide with other galaxies. Doesn't it take millions of years for that to happen? Bhaskar however, boasts about having read somewhere that this is indeed possible. The computer then informs them that they, however, are destined to save the world from this disaster. Their spaceship is ready and they have to travel to space right away, before it's too late.

Panic spreads across the room as the children realise that this is indeed the end of the world. Just a while ago, they were studying for their Science test which did not feel important at all, and now they are facing the challenge of the end of the world. How are they, mere 15 year olds supposed to save the planet? What will be their plan of action? Should've paid more attention in Science classes, thinks Mihira. She also regrets being mad at Ajoba for no reason.

Just then Ajoba walks into the room. "What is happening here?" He asks in his cold deep voice. "Didn't I tell you to study somewhere else?" Mihira runs to him and hugs him. She apologises for being rude to

him. She stutters and barely manages her tears when she tells him that the world is going to end. Ajoba smiles and takes the helmet off of her suit. He then tells them that the world is not going to end, they were in a simulation game that made them feel so. It was a game that he has been designing for the four of them as a birthday gift to Mihira. They were not supposed to find it yet since it's incomplete.

He also goes ahead to explain why such a situation cannot occur in real life. All of them take a sigh of relief and go back to seriously study for their Science test.

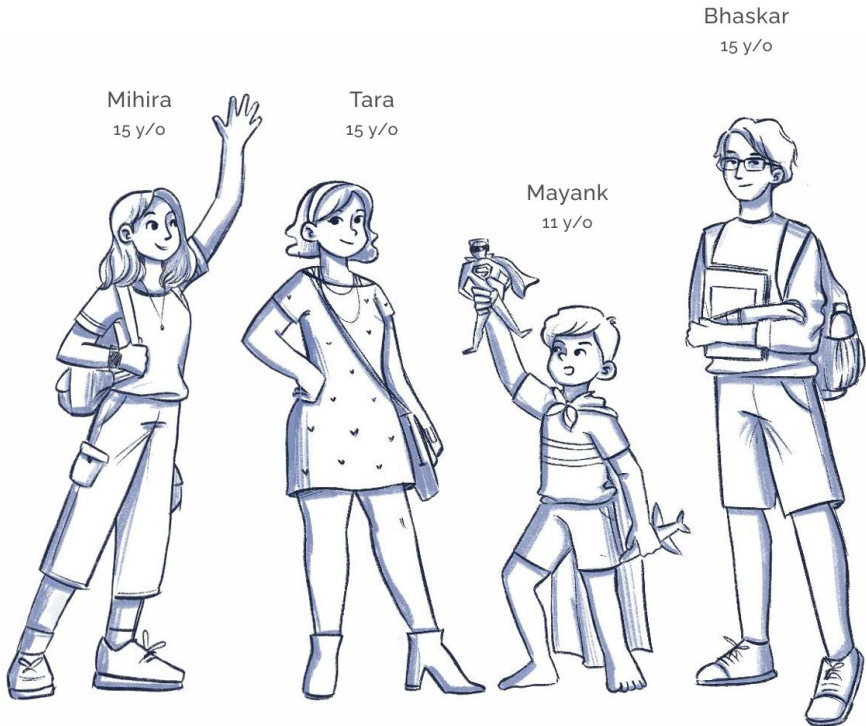
4.2 Character Design

Mihira is a cheerful and bubbly girl who believes in enjoying life. She is smart but often driven by emotions.

Tara is addicted to social media and loves to gossip. She enjoys dressing up and ignores anything that requires brains.

Mayank is a brave boy who loves to collect superhero figures and fight villains. He believes his Grandpa is a superhero.

Bhaskar is a nerd who loves to show off his knowledge. His hobby is studying. He is responsible when required.





Ajoba
65 y/o

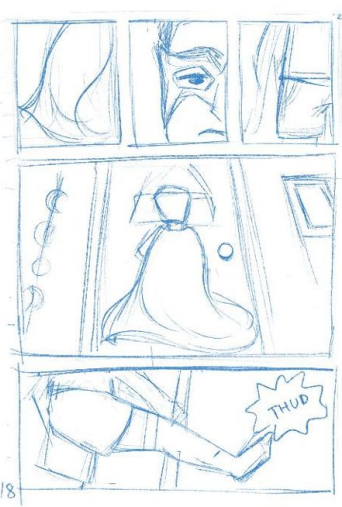


Aaji
62 y/o

Ajoba is an astronomer who is extremely strict as a grandfather. He is highly disciplined and wants his grandchildren to think logically, not emotionally.

Aaji is the exact opposite of Ajoba. She showers her grandchildren with loads of love and affection in the form of food and stories.

4.3 Storyboards



18

4.4. Future Work

User Testing

The next step after finishing the book will be to test it with students within the desired age group. This will be done by observing how they react to the flow of the story and the information in it. A short test can be taken to evaluate whether or not they have grasped the information embedded in the book successfully. Accordingly, more iterations in the book can be done.

Improved Visuals

Due to time constraints, the illustrations in the book are currently monochrome. I plan to color these illustrations in the future to make the book visually more appealing and space representations mesmerising.

A sequel to the book

Since one book can accommodate limited amount of information to avoid information overload, there can be sequels to the same story more focused on topics like the Milky Way Galaxy alone, or a detailed representation of how stars and galaxies are formed.

More books in the series

The goal of the ASI is to create a series of illustrated books that cover a range of topics in astronomy. For the same, there can be more books in the series featuring the same characters as in this one in different situations, giving information about various topics of space through different stories.

**“To confine our attention to terrestrial matters
would be to limit the human spirit. ”**

– Stephen Hawking

5. Bibliography

Amazing Space (2021, April 25). *The Milky Way Galaxy Planets | Space Documentary*. <https://www.youtube.com/watch?v=jeaON6SPTZo>

CrashCourse Academy (2015, August 15). *Galaxies, part 1: Crash Course Astronomy*. https://www.youtube.com/watch?v=I8zADyJC7wE&list=PL_HsPnbs6VagHswv8BldSYSz7lw8JK7H2&index=2

CrashCourse Academy (2015, November 06). *Galaxies, part 2: Crash Course Astronomy*. https://www.youtube.com/watch?v=_O2sg-PGhEg&list=PL_HsPnbs6VagHswv8BldSYSz7lw8JK7H2&index=4

Seeker (2017, January 13). *What Happens When Galaxies Die?*. https://www.youtube.com/watch?v=wWvJVE5nio4&list=PL_HsPnbs6VagHswv8BldSYSz7lw8JK7H2&index=4

Seeker (2017, November 22). *What Really Happens When Galaxies Collide?*. <https://www.youtube.com/watch?v=eWqETkudZXo>

What If (2018, November 06). *What If the Milky Way and Andromeda Galaxies Collided?*. <https://www.youtube.com/watch?v=nKyganN-kD4>

Kosmo (2020, September 06). *A journey beyond the milky way*. <https://www.youtube.com/watch?v=5eqPpconL6o&t=346s>

Factnomenal (2021, September 16). *The Most Fascinating Galaxies Ever Discovered*. <https://www.youtube.com/watch?v=hPNcWlsoX4&t=318s>

Professor Dave Explains (2018, July 24). *Star and Galaxy Formation in the Early Universe*. <https://www.youtube.com/watch?v=n4vvuzlWOTE&t=27s>

Kurgazagt - In a Nutshell (2014, March 3). *The Beginning of Everything -- The Big Bang*. <https://www.youtube.com/watch?v=wNDGgL73ihY&t=264s>

Professor Dave Explains (2018, September 20). *The Formation of the Milky Way Galaxy*. <https://www.youtube.com/watch?v=BcjmoEspoRI&t=19s>

Jillian Tamaki, Mariko Tamaki. (2014, May) *This one Summer*. First Second

Scott McCloud (2006). *Making Comics*. HarperCollins

Martin Rees. (2012, September). *Universe: Definitive Visual Guide*. Dorling Kindersley Publication

NASA (2021, Feb 17). *Beyond the solar system*. <https://solarsystem.nasa.gov/solar-system/beyond/overview/>

Planetary Science. Inc. (n.d.) *Galaxies 101*. <https://planetary-science.org/astrometry/galaxies-4/>

National Schools' Observatory (n.d.) *Galaxies*. <https://www.schoolsobservatory.org/learn/astro/gals>