BICYCLE DESIGN FOR A THEME PARK

PRODUCT DESIGN PROJECT III

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Project-3 Report

Bicycle design for a theme park

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Approval sheet

The project titled as "Bicycle design for a theme park" by Manu Revi Poovakkat is approved in partial fulfilment of the requirement for the degree of 'Master of Design' in Industrial Design.

Guide:

Chairman:

Internal Examiner:

External Examiner:

Abstract

People tend to remember and cherish the memories of the moments they had fun. Some spaces cater to bringing in such a kind of fun and joy to people mind, through their interaction with it. Theme parks are built to provide such an environment where people could gather to experience the fun and thrill of various rides and games. Each element in a theme park is designed to communicate the same mood. Even the people are sometimes costumed to interact with the subjects as super heroes, cartoon characters etc to bring in the feeling of being in a fantasy world. The project aims to design a bicycle to impart the same emotion and mood that a theme park conveys. The fun elements are brought through both visual and experiential lines. In parallel situations, this could also be replicated in situations like carnival fairs, picnic spots, etc.

Declaration

I, hereby, declare that this written submission represents my idea in my own words and where others' ideas have been included; it has been adequately cited and referenced the original source. I also declare that I have adhered to all principles of academic honesty and integrity and have not misinterpreted or fabricated or falsified any data/idea/facts/ sources in my submission. I understand that any violation of the above entitles the institute to take disciplinary action against me to which I shall be answerable to.

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I am really thankful to Prof. BK Chakravarthy for his guidance and support throughout this project. The knowledge he passed on to me cannot be replaced. I would also like to thank my co-guide Prof. Kumaresan for his guidance and valuable insights he passed on to me. I am also thankful to all the faculty for their support and valuable feedback, which helped me in various difficult situations. I would also like to thank Mr. Faizal Thakur (owner - Pro 9 bicycle studio, Bandra)for his valuable feedback and assistance. I am also thankful to Mr. Vivek (fabricator) and all the studio staff in IDC for the help they had granted in various situations.

I would also like to thank my friends and family for their support and guidance.

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Introduction

Bicycle has always been seen as a mode of human powered transport. Through its evolution spanning almost 2 centuries, it has gone through changes to an extend of becoming one of the most efficient machine ever produced by mankind. Even Though primarily a means of mobility, it has also found its place in being used for fun and leisure. Attempts have been made to tap the fun sides of bicycle ride - through manipulating the movements, frame structure, riding posture, look and feel etc. The project is an effort to promote pedal powered cycling by creating an interest among children and parents through the context of a theme park. The project aims at designing a fun bicycle for ramoji film city where in there is fun and mobility combining into one.

Ramoji Film City

Fig 1. *Entrance to Ramoji Film City*

Ramoji film city is an integrated film studio complex located at Anajpur in Hyderabad, capital city of Telangana state. At a sprawling area of 2000 acres, it is the largest integrated film studio complex in the world. In terms of size and facilities, it is comparable to Universal studios at Hollywood. It is also a popular tourism and recreation center, containing both natural and artificial attractions including amusement park named SAHAS, bird park etc. Every year, the studio attracts approximately 1.5 million tourists.

Why people like Ramoji Film city?

Theme parks are often created as an environment that caters to recreational activity of large number of people, especially in a closed environment. Differentiating itself from amusement parks, theme parks are mostly driven by a particular theme in case of the design direction for their rides and spaces. Ramoji film city is such a theme park which is built over a movie based theme. A set of people, across all age groups were observed and interviewed to understand as to what makes it special for people to experience Ramoji film city.

– *First thing people get amazed at is the scale of the park.*

– *The whole environment gives a feeling of being inside a new world different from the outside.*

– *The variety of experience it delivers for people of all age group*

– *The greenery and topiary of the place. Ramoji houses a lot of gardens - Sanctuary garden, Mughal garden, Japanese garden, Askari garden etc.*

– *The cleanliness of the place*

– *Replicas of iconic architecture, historic places, streets and cities of India as well as hospital setting, railway station, airport terminal, mosques, churches, temples, shopping plazas, palace interiors, rural complexes, urban dwellings. This gives the feeling of seeing all of India in one place.*

– *Hundreds of photo opportunities - through props, costumed characters etc.*

– *Structures from across the world and through different time line, each replicated in minutest of their details.*

– *Use of color in the environment is so vibrant that it gives a fantasy world feeling to the whole setup, and has got all the colors for your mood and temperament.*

– *Indians are always connected to films and ramoji provides an ideal environment where people get to identify the structures through their films.*

– *People were seen spending time near the game and*

garden settings, kids especially were attracted to spaces like Borasura and Fundastan.

– *Getting an opportunity to understand the production aspects of a film.*

Joy in the context of a theme park / ramoji film city

Joy is a human emotion that brings about a sense of happiness. Fun and joy in the setting of a theme park could be attributed to various factors like:

– *Excitement that comes through seeing a world apart from the outside world.*

– *The amusement driven through rides and adventure games*

– *A feeling of curiosity brought by seeing everyday things in different forms.*

– *A fun factor brought by your loved character costumed.*

– *Having a fantasy world in a form that could be experienced.*

– *Having a place to package your memories.*

– *Experience delivered through rides and themed environments*

– *Experiencing things which you could never experience in your daily life.*

– *The vibrancy brought through use of out-of-the world colors.*

– *Seeing your fellow beings having fun.*

– *Having a day different from the usual ones.*

The elements creating joy and fun

Different elements that were used to bring in joy and fun in Ramoji film city was also analyzed. This gave an idea of understanding the context, so that the design could be driven in such a direction and would not appear alien to the context.

1. Gardens

Ramoji film city houses an array of gardens themed to different location, some among them being - Japanese garden, Mughal Garden, Sanctuary garden housing topiaries, bonsai gardens etc.

2. Film themed sets

It houses film themed sets in the form of national and international cityscapes, buildings etc in every detail. This also include replicas of airport terminals, railway stations, trams, markets etc.

3. Architectural replicas

Architectural replicas of iconic buildings are another attraction in Ramoji which are replicated to the minutest of their details.

4. Sculptures

It houses sculptural replicas from across the world, which are displayed along the gardens as well as other recreation corners. The cater to various photo opportunities.

5. Bird park

Ramoji film city also houses a bird park, which is home to a variety of birds, most wonderful among them being the free zone area where people could experience birds at their lively best.

6. Adventure park

Sitting close to Ramoji is SAHAS theme park which contains various adventurous rides and games.

7. Kids area

This is one of the most colorful areas of the theme park filled with games, toys, imaginary worlds, rides and play zone.

8. Color

Amidst all the wide array of experiential spaces available in Ramoji film city, one thing which makes it feel like a fantasy world is the vibrant use of color. A similarity to this could be seen in animation fantasy films, which uses a wide array of colors to show the unreal nature of the world you see, at the same time impart joyous mood to the visuals.

From the above research, it could be seen that Ramoji film city houses a wide array of spaces ranging from greeneries to off road terrains, from beautifully carved sculptures to models of comic superheroes, from vintage cars to Hi-tech all terrain vehicles. It is a mix of mythology and contemporary, monotone and vibrance, vintage and modern, illusion and real.

Mood board: Ramoji

Fig 2. *A collage of Ramoji film city*

Mood board: Ramoji

Fig 3. *A collage of Ramoji film city*

Mood board: Fun, joy, experience

Fig 4. *A mood board created for fun, joy and experience*

Mood board: Fun, joy, experience

Fig 5. *A mood board created for fun, joy and experience*

The scenario into which the bicycle would fit into

Even though Ramoji film city undertakes a vintage bus service to guide people through various spaces, people are allowed to explore certain areas on their own. These places house the garden, rides, games, restaurants, sculptures etc. The bicycle could find its place in these areas where people could take it for a leisurely ride along with their loved ones, or even use it for photo ops. The rides could be carried along a closed environment, most of which happens to be on flat paved terrains.

Design brief

A cycle (pedal driven) concept for a theme park that is:

– *fun and novel in terms of visual experience it delivers*

– *provides the user(s) with an experiential and fun ride.*

– *It could be used to ride around the hop off areas in the park (300 - 500 m ride)*

User profile

The design should be operated by a main rider, who is an adult and the secondary rider could be kids of age 6-8 years.

Understanding bicycle

Bicycle Anatomy

A study of bicycle parts was done to better understand the functionalities of each. Bicycle is a deceptively complex device and only when you start deconstructing it that you get to understand how the harmoniously connected system work together to provide the right stability and ride quality. A bit of study into various gears and drives were also done. A meeting with an expert frame builder was also done in order to understand the bicycle functionalities and the art of frame building.

Bicycle history

1. Cycling

History of bicycle from its origin to the form which we see now can be traced back to the early 1800s. Early bicycles were in the form of running machines driven by feet and it was not until the 1860s that someone got the idea of putting a pedal onto the front feet and in 1890s it settled to the conventional machine that we recognize today. 19th century saw dramatic improvements in design of a bicycle aided by the wide acceptance of bicycling as a sport. These gave rise to a shift in bicycle design by incorporating a steerable front wheel and chain driven rear wheels. Further to mass production

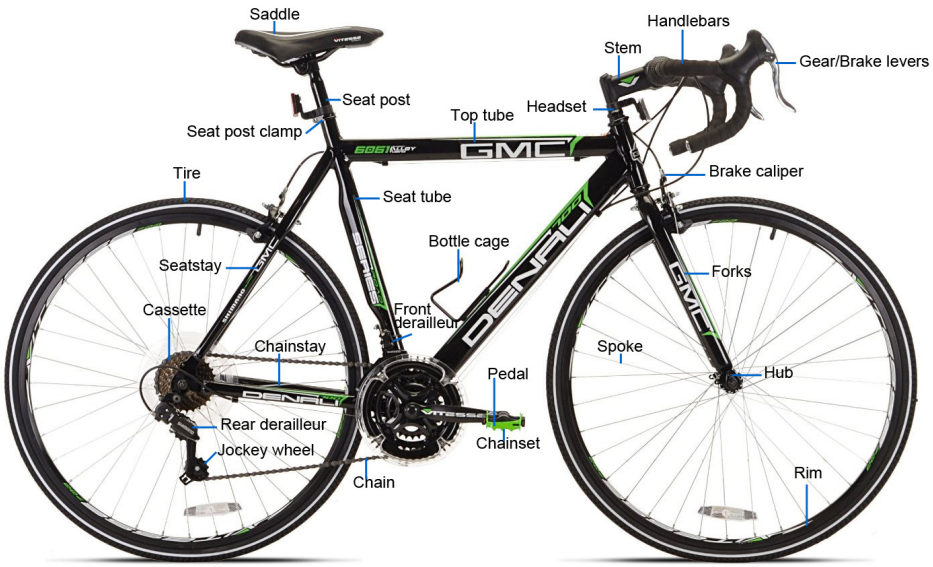


Fig 6. *Bicycle Anatomy*

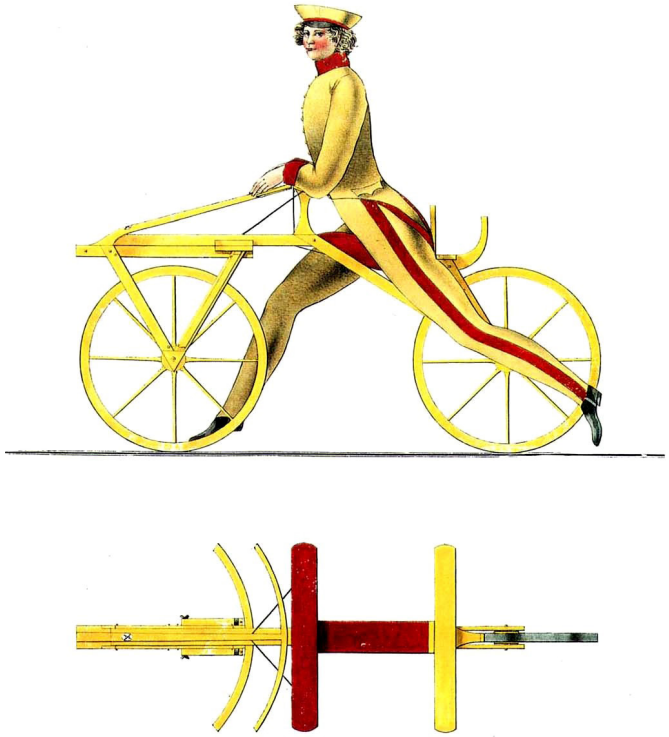


Fig 7. *One of the earliest bicycle designs - Dandy Horse*

Fig 8. *Early cross frame vs diamond frame*

and advent of motorized mobility shifted the bicycles from being a luxury to a common household commodity. During the course of the evolution, bicycle has shifted in its application along various lines like aiding in transportation in farms, a symbol of pride, a sport, a cargo carrier, a recreational ride, a style icon, a trekking equipment, a community ride, an office commuter etc. This in turn has given rise to various classifications of bicycle along different genre of use like Road bikes, Mountain Terrain Bikes, Commuter bikes, Cruiser bikes, Touring bikes, BMX bikes, Hybrid bikes, Tandem bikes, Electric assist bikes etc.

2. Frame

Frame design has also gone through continuous evolution in form of geometry, material and form. Earlier front wheel driven bicycles had a single-spar connection between steering head and rear wheel fork. This made sense as there was no need to support the pedal axle. This was later replaced by cross-frame layout when rear wheel chain drive became a standard, but was described as structurally poor.This lead to the call for more structurally rigid geometry which gave rise to the diamond frames.

3. Materials

Biggest advancements in the bicycle design has come in terms of the use of materials which most of the times came from other industries like automobile, aircraft etc. Steel was initially the most preferred, with its greatest benefit being the durability, but was later replaced by aluminium due to the demand of more performance oriented machines. With hydroforming it was easier to make more complex shapes at the same time it was cheaper, lighter and sturdy. Innovations in TIG welding lead to the acceptance of titanium as a material choice for high end road bikes due to its high strength to weight ratio. It was however difficult to produce, hard to manipulate and hard to machine which made it quite expensive.

The material that holds high values for the future even though limited to high performance bikes at present. It can be argued that carbon fiber revolutionized the road bike industry. Its scores over other materials in terms of weight and stiffness and can be used to create complex wall shapes that would have been otherwise impossible. The downside of carbon fiber is its high manufacturing cost, which restricts it from being used in low end commuter bikes.

Fig 9. *1.Carbon fibre 2.Titanium 3.Steel 4.Aluminum*

Study of previous projects

Initially projects which tried to tackle similar problem on different contexts were studied and analyzed. These helped in understanding the approach to problem solving at the same time how the designs could be further worked upon to bring in the solution pertaining to the current context. The projects which were studied includes:

- *Campus bicycle for IIT Bombay - Alvin P Gopal*
- *Quadricycle - Unni Mohan*
- *Family cycle for Joy Ride - Rajarshi Ray*
- *Electric Hybrid Commuter - Sandesh HD*
- *Design of sheet metal bicycle - Sanbid Goloui*
- *Promoting human powered mobility - Rahul Gujarathi*

Case study and design diaries

In Order to understand how bicycle design is approached on a professional level, various case studies and design diaries of competitions were looked up on. Oregon manifest, a biennale bicycle design competition where design companies team up with local bicycle frame builders in order to come up with ultimate urban commuter bicycle, gave a deep understanding of how the design problem is approached from brief to the final working prototype. These gave an understanding as to how deeply the team went into design each and every detail. Various case studies looked up on include:

Industry designs

Industry's initial focus was to understand what experiences a bike can deliver, what motivates a person to ride a bicycle and what stigmas prevent people from riding a bicycle. The design ideology goes by bringing in the product experience by connecting people, design and story. Stress testing of ideas through rapid ideation and iterative prototyping began at an early stage of the design process. The process later went through redefining what a bicycle can be by focusing on the gestures - visual expression of form and function. This was done by stripping away everything that is unnecessary and creating only its essence. This was further zeroed in on

Fig 10. *Solid by Industry*

Fig 11. *Denny by Teague*

Fig 12. *Merge by Pensa designs*

to bring an idea of seamlessness in bicycle by first looking at the traditional techniques and then trying to bring together what is old and what is new in a seamless way.

Teague

Teague started of with understanding the need of the customer all the way from physical construction, type of ride, gearing and tyre choice. Just like Industry, initial focus also went in to understanding why we love bikes and to deeply understand why these human powered machines are important. Based on these, different concepts were tried upon - something that challenged iconic look of bicycle for utility and something that challenged utility in favour of new icon. All through these, care was taken in preserving the persona of a bike (things that make bike a bike) and fixing things that makes people don't want to ride. Final stage went on to making tangible iterations of the early sketches, everything from custom frame design, handlebar mechanism, cargo storage, power delivery, lighting, color and material finish and finally the name and logo.

Pensa

Pensa design team started of with understanding the specific manner of world in which the solution lives in and building a genuine passion for the subject. Initial phase went through staying big picture, pushing forward and questioning everything. This phase went through repeated cycles of ‘Prototype - Learn - Fail - Rinse’. Second phase started of with understanding the commuter and his space - his needs on day to day basis, items transported, the types of bike he uses and the day to day variance of these factors. Last phase went on to various factors like cargo solutions, lighting and security and understanding of expert views on what makes a beautiful urban bike. After each solution was put forth, questions

were asked as to whether it is truly necessary, rather than making changes for changes sake.

Minimal

Minimal designs went on to understanding what a bike, followed by sketching, debating and collecting inspiration. Further to this “Thinking through making” was emphasised based on the good old philosophy of “You can never really know a thing until you go through the process of making it yourself”. Extensive prototyping was continued in the further stages along with understanding how people get around in the city. Final stage was dedicated to detailing out the components and hitting the prototype on the roads.

Huge

Huge design started of the design process by talking with bikers and bike delivery services and observing them in order to get a perspective of cargo loading, maintenance and ride quality. Understanding of proper ride geometry and build techniques were done on this stage. Manufacturability of the concepts were speculated in the early stages of ideations when looked into pushing the bike frame functionally and in construction. Emphasis was given to produce designs that showed respect to the art of frame building and introducing improvements to the build process at the right time and place. They incorporated Direct Metal Laser Sintering to build the lugs on to which the tubes could be plugged directly and thus reducing the use of jigs to align the bicycle frame.

Fig 14. *Blackline by minimal*

Fig 13. *Evo by Huge design*

Fig 15. *Faraday by Ideo*

Ideo

Ideo started of with drawing inspiration from the bike history and later on getting getting to know the people, observing all types of riders in different settings. An image board was created of tubes wheels and pictures of riders of different types from which they formulated 10 provocations which would act as guiding forces for the coming designs. Post this research was done on to understand why people don't like bicycles followed by mindmaps and brainstorming sessions to bring in wild ideas. These wild ideas were reduced to abstracts and concepts to concrete design directions which were prototyped. Further to this a week long bike trip was carried out to put yourself in the shoes of the user and writing down what they went through. Business and social context in which the bike would live in were also understood and analyzed in order to explore new market sales model and service concepts centered around the bike. During the final stage, design team started seeing bike as a meaningful replacement of motorcycle which resulted in designing an electric bike, but the key was to find the right marriage of technology and utility prior to prototyping the concept.

Bicycles designed for fun

Even though mostly having limited or minimal use in daily commutation, people have experimented with bicycles by playing with its form, movement, way of riding, accessories etc to bring in fun factor to pedaling experience. Following are some pedal powered machines, solely designed for imparting fun to the user.

Artikcar

Artikcar is a pedal powered quadricycle inspired by a child's wooden toy car. It is made of steel tubing with an illuminated profile. It was designed by a British designer Ben WIlson. This could be seen as an example for playing with the frame of the bicycle to impart fun element.

Feats per minute

Fets per minute is a bicycle that allows you to play records on its wheels as you cruise. Designed by Dutch designers Merel Sloother, Liat Azulay and Pieter Frank de Jong, the bicycle could be termed as an example where the sense of hearing was explored to bring in the fun factor.

Fig 16. *Artikcar(top) ; Feats per minute(bottom)*

Fig 17. *From top to bottom : Bicycle experiments by Todd Kundl, Roller shuttle(L) and Shopping cart bicycle (R), Sideways bike*

Bicycle experiments by Todd Kundl

American Todd Kundl has brought in enough imagination on how to rethink the way bicycling is seen - some of which are only seen in fantasy films and cartoons. Following are his designs which include: Bicycle in which wheels are replaced by tennis shoes, multi connected-wheel bicycle, handle less bicycle etc. Examples of how imaginations could impart curiosity and fun into cycling.

Roller Shuttle

The world of strange bicycle and bike mods is too huge that many of them go unnoticed or undocumented. Roller shuttle is such an example where the designer replaced the front bicycle wheels with that of a roller blade giving rise to a handle less trike.

Shopping cart bicycle

Cartrider bicycle is the creation of designer Jaebeom Jeong. It is inspired by scenes in a supermarket where the parents often put their kids onto a shopping cart. An example showing how similar objects could be tweaked to bring in fun and joy to bicycle ride.

Snowboard bike or sideways bike

This is a bicycle that is ridden in a snowboard stance and sideways and comes with independent front and rear steering. It was designed by Michael killian, which apart from being used as a mobility device, is also used to exercise the balance detection and correction mechanisms that a snowboarder would use. This can be sighted as an example where movement and rideability of a bicycle is re invented to bring in fun and curiosity.

Merry go round bicycle

This bicycle carousel by Robert Wechsler is created by attaching 9 bicycles in a circular fashion. The artist envisioned this as an installation in parks or public places where people can join in the fun. This shows how connected bicycles could impart fun along with ride.

Mini Bicycles

There has been several examples where people have played with the scale of the bicycle to bring in the fun factor. The following mini bicycle from 2001 mummers parade is one such example.

Designs by Sudha cars museum hyderabad

India also has its share of people who has invested in wacky and fun driven designs of vehicles. Sudha cars museum houses several fun-driven designs of 4 wheelers, bikes and trikes. The most famous among this being the Guinness world record holder trike that weighs 3-tonne and is driven through a wheel of almost 5.18m diameter. These shows extremes to which designs have be stretched to impart fun elements.

From the above examples, it could be seen that, people have explored several facets for rethinking bicycle as a medium for fun and experience. It goes through playing with the size of the frames, size of tyres, using multiplicity in terms of parts of the bicycle, tweaking of similar products, playing with out-of- context colors, riding posture, bicycle movement etc.

Fig 18. *From top to bottom : Merry go round bicycle; Mini bicycle; Trike built by sudha cars museum*

Fig 19. *Vintage styled bus at Ramoji(Top); Tram at Universal Studios(Bottom)*

Fun and experience in similar contexts

A research was done to understand how mobility is managed in theme parks, film studios and similar scenarios like guided city tours. This gave an insight into the range of solutions employed in different part of the world including ramoji film city and how they brought in the fun and experiential factors to the solution.

Vintage bus at Ramoji Film city

Ramoji film city offers guided tours through their vintage modelled busses, which can house some 40+ people. This gives the user an yesteryear feeling as he is guided through a world made out of replicas of architectural wonders, mythological stages, film sets, theme parks etc.

Universal studios Hollywood

Universal studio offers studio tours through trams that connects 3 bogies, each that could house some 40 people. Rather than going for contemporary design solutions, trams feature a vintage styling which communicates well with the surroundings as well as giving the visitors an experiential guided ride through the film world.

Disneyland

Disney land offers monorail facility which runs along a 2.5 mile path and provides an aerial view of the park through a 13 minute ride at the same time they run guided tours through connected trams, each housing some 20 people. Both are designed by disney imagineers drawing inspiration from disney characters at the same time keeping to the color scheme of red, white and blue.

Guided tours of Paris

Guided tours in Paris is an example where hi-tech options are looked into deliver the experience of seeing the city. They offer guided tours in various forms and the interesting among them being the pre-programmed GPS guided electric car tour and the segway tour.

Trixis in Barcelona

Akin to rickshaws, Barcelona offers pedicabs by the name trixis which are bicycles with small cabs behind them - a modernized version of cycle rickshaws. Trixis are also given a colorful graphical makeup which gives them a unique eye pulling aesthetics - something that grabs the viewers attention to experiencing a ride on it.

Fig 20. *Disneyland Tram(Left); Mono Rail(Right)*

Fig 21. *Paris - Segway tour(Left); GPS assisted electric vehicles(Right)*

Fig 22. *Barcelona - Trixi*

Design process

1st level ideation

Initially the direction was to bring in novelty in terms of the experience the bicycle can deliver to the user in the context. It was done without any constraints to pave for wild ideas. The blue sky ideations were done through direct, indirect and fantasy analogies based on which a mind map was created. This became the basis of initial set of ideation. The analogies used were:

Direct - Motorcycle, 3 idiots film (film based)

Indirect - Haversack

Fantasy - Harry potter broom stick

Mindmap 1

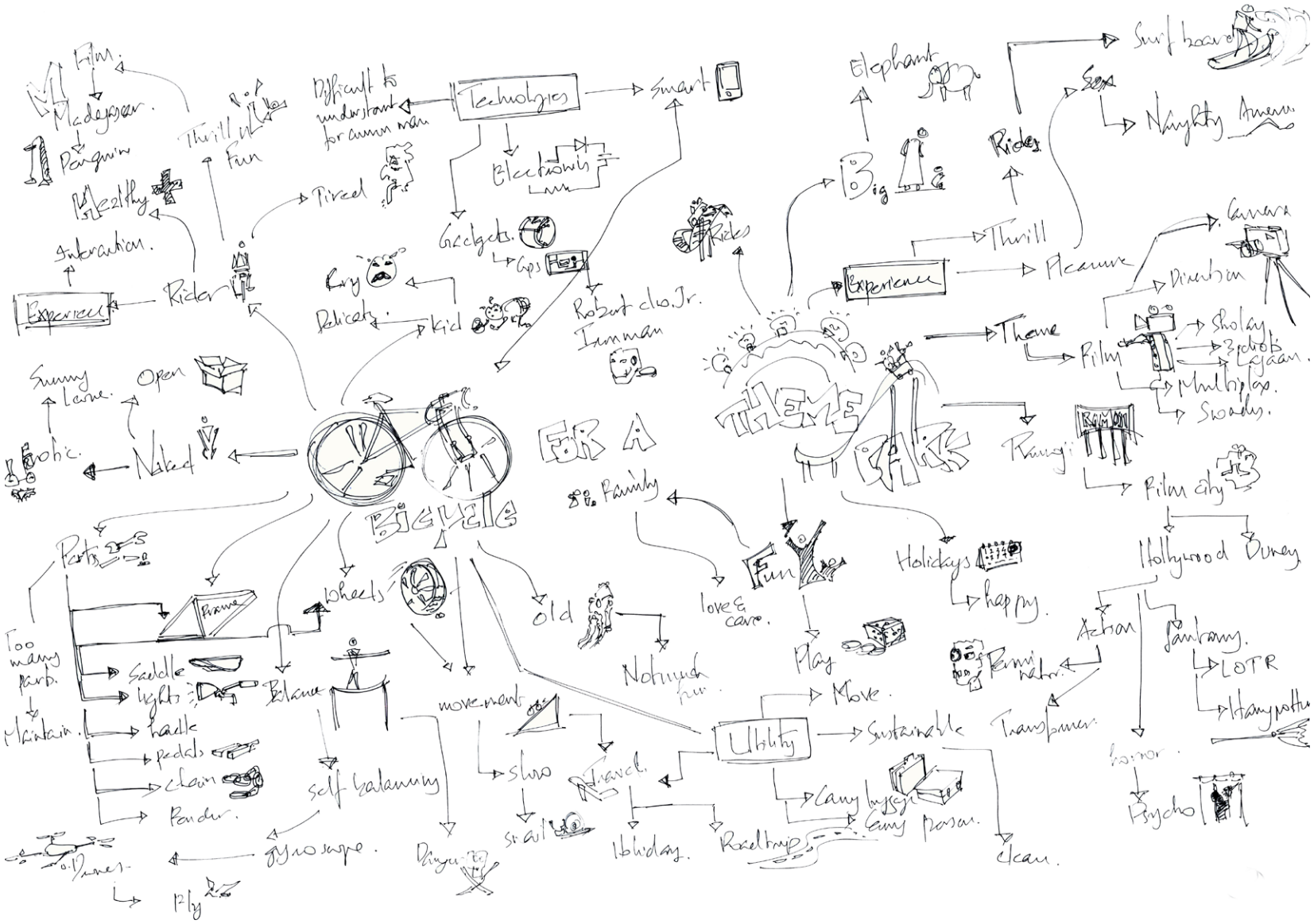


Fig 23. *Mindmap of bicycle in a theme park*

Mindmap 2

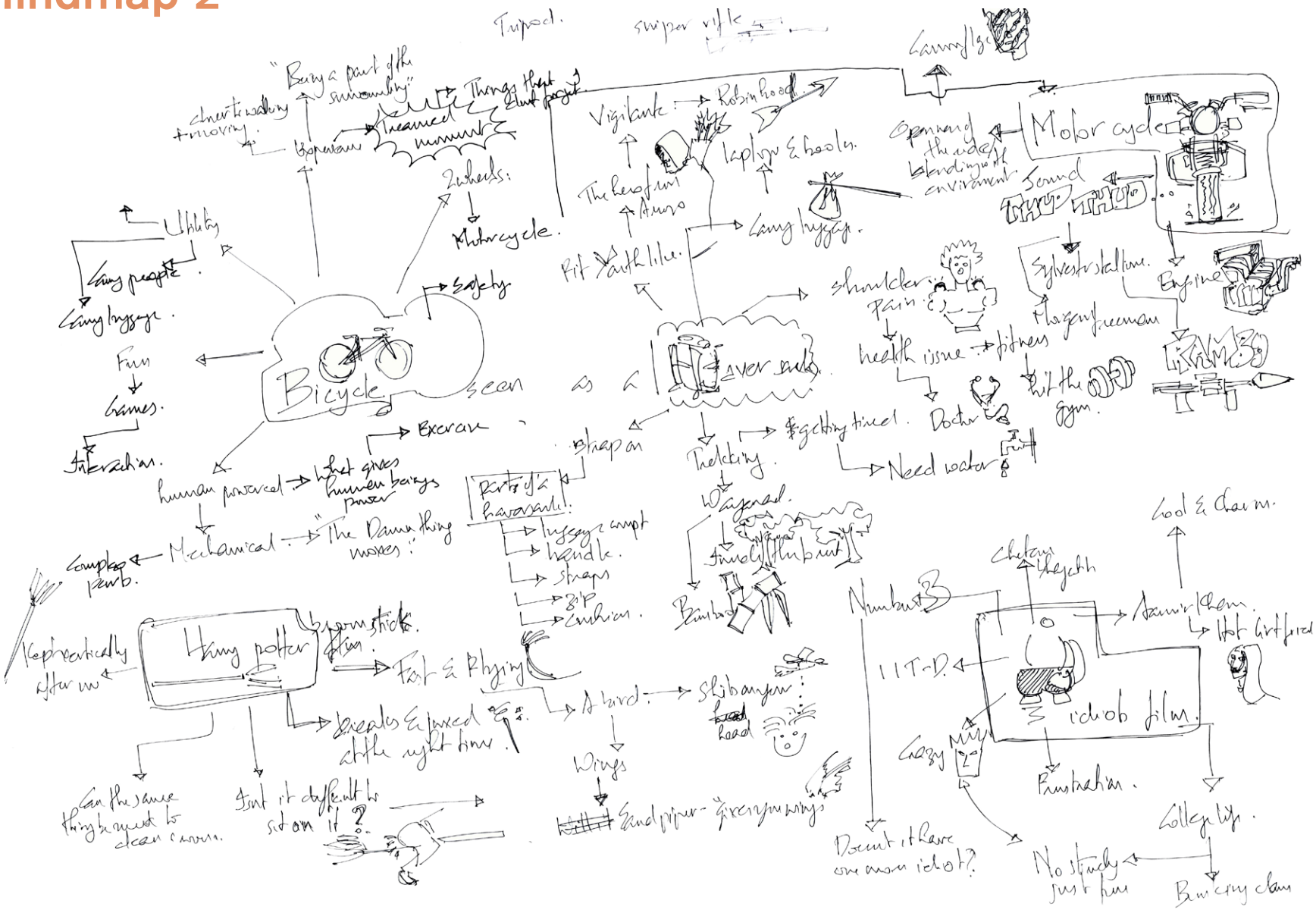


Fig 24. *Mindmap of bicycle with analogies*

Ideation: Analogy - Haversack

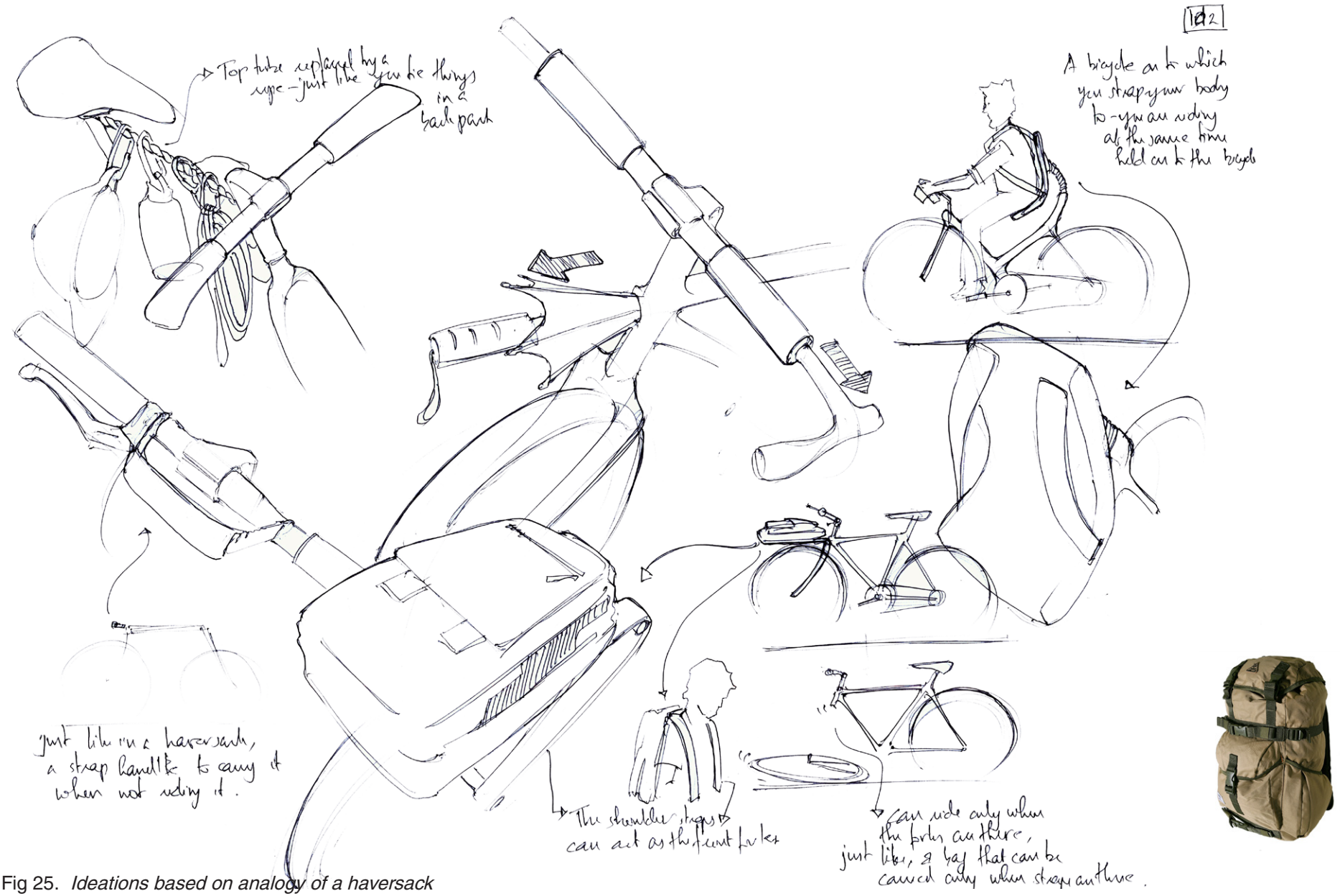


Fig 25. *Ideations based on analogy of a haversack*

Ideation: Analogy - Haversack

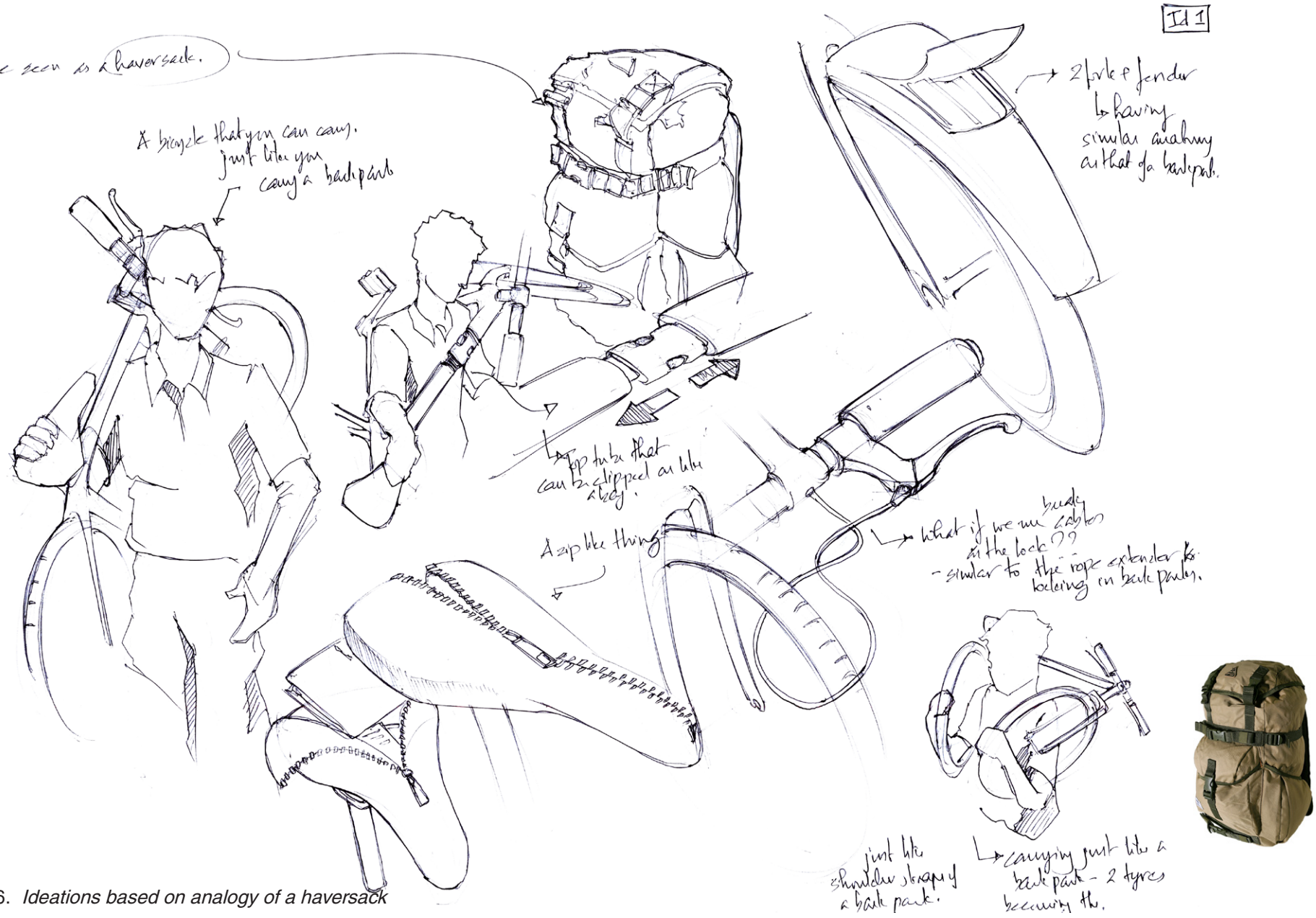


Fig 26. *Ideations based on analogy of a haversack*

Ideation: Analogy - Harry potter broom stick

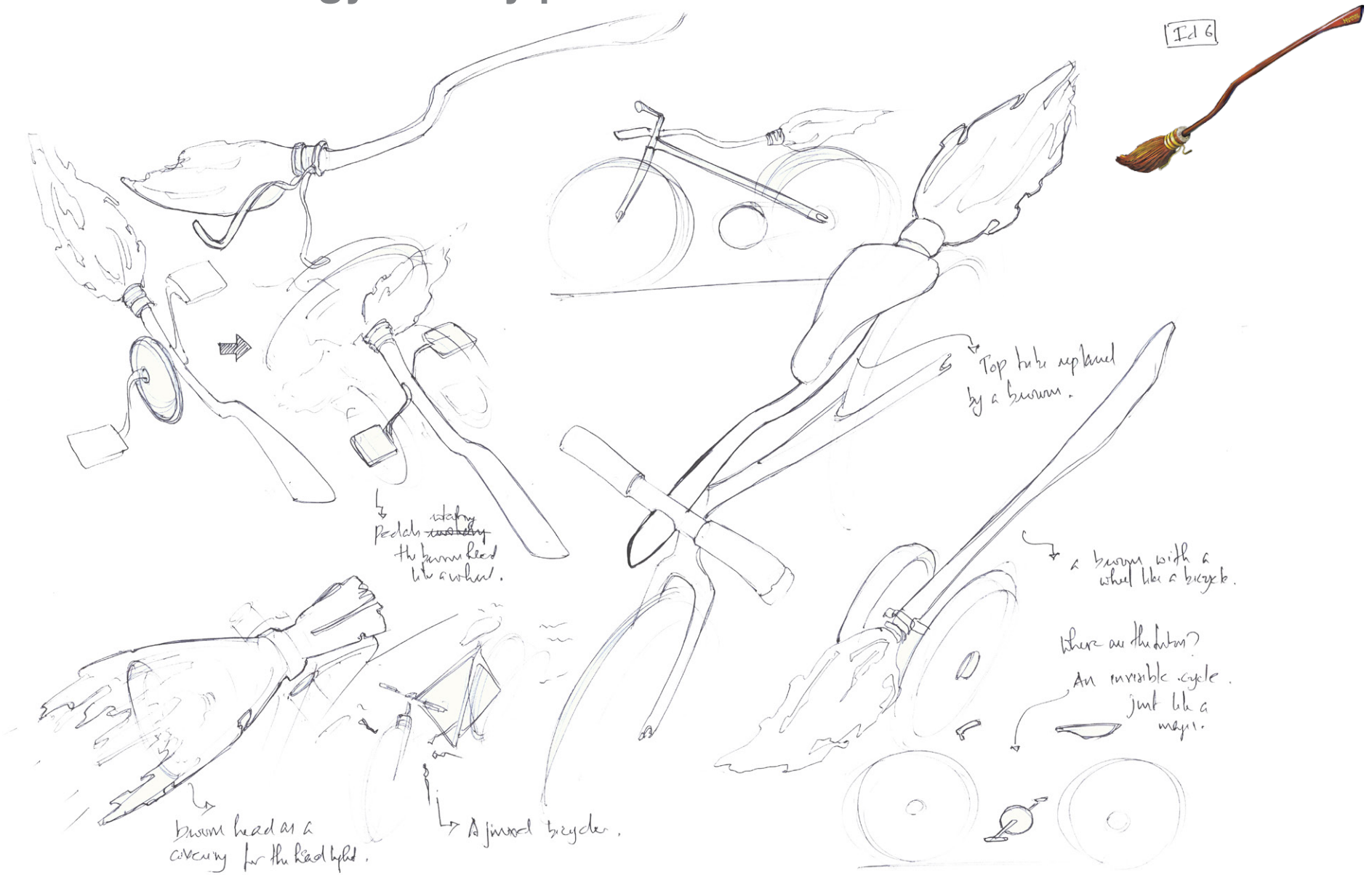


Fig 27. *Ideations based on analogy of a Harry potter broom stick*

Ideation: Analogy - Harry potter broom stick

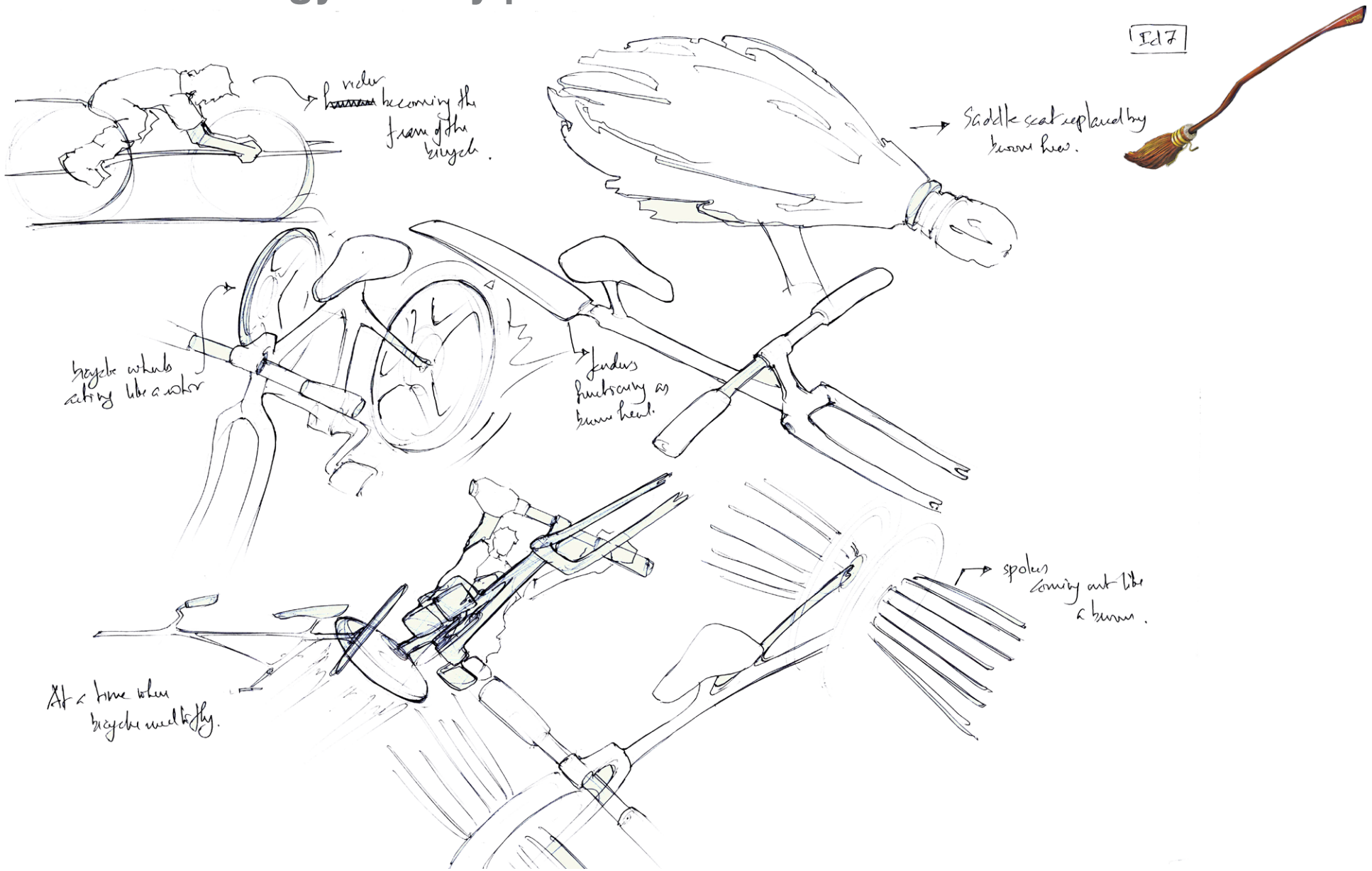


Fig 28. *Ideations based on analogy of a Harry potter broom stick*

Ideation: Analogy - 3 idiots film

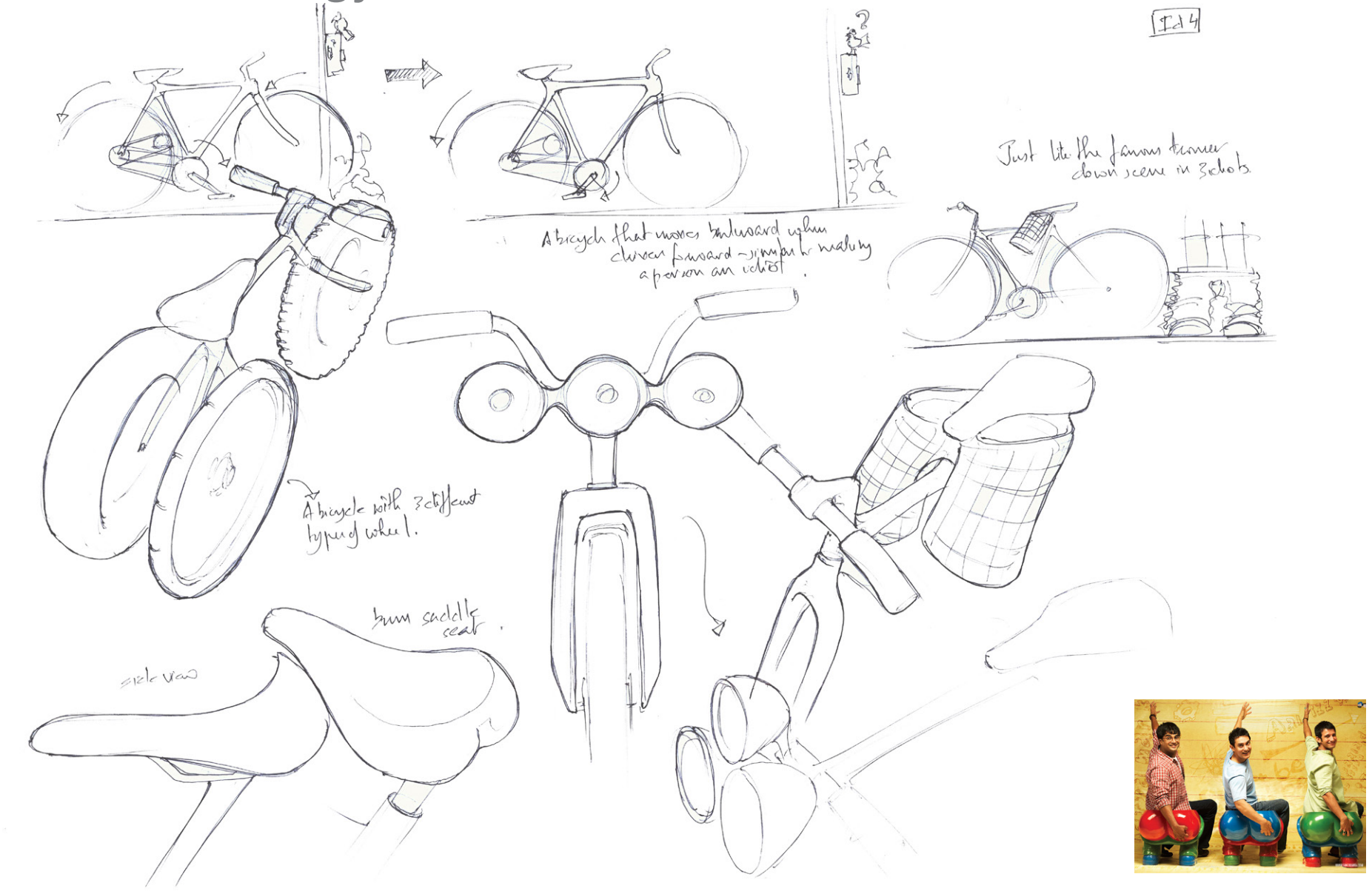


Fig 29. *Ideations based on analogy of 3 idiots film*

Ideation: Analogy - 3 idiots film

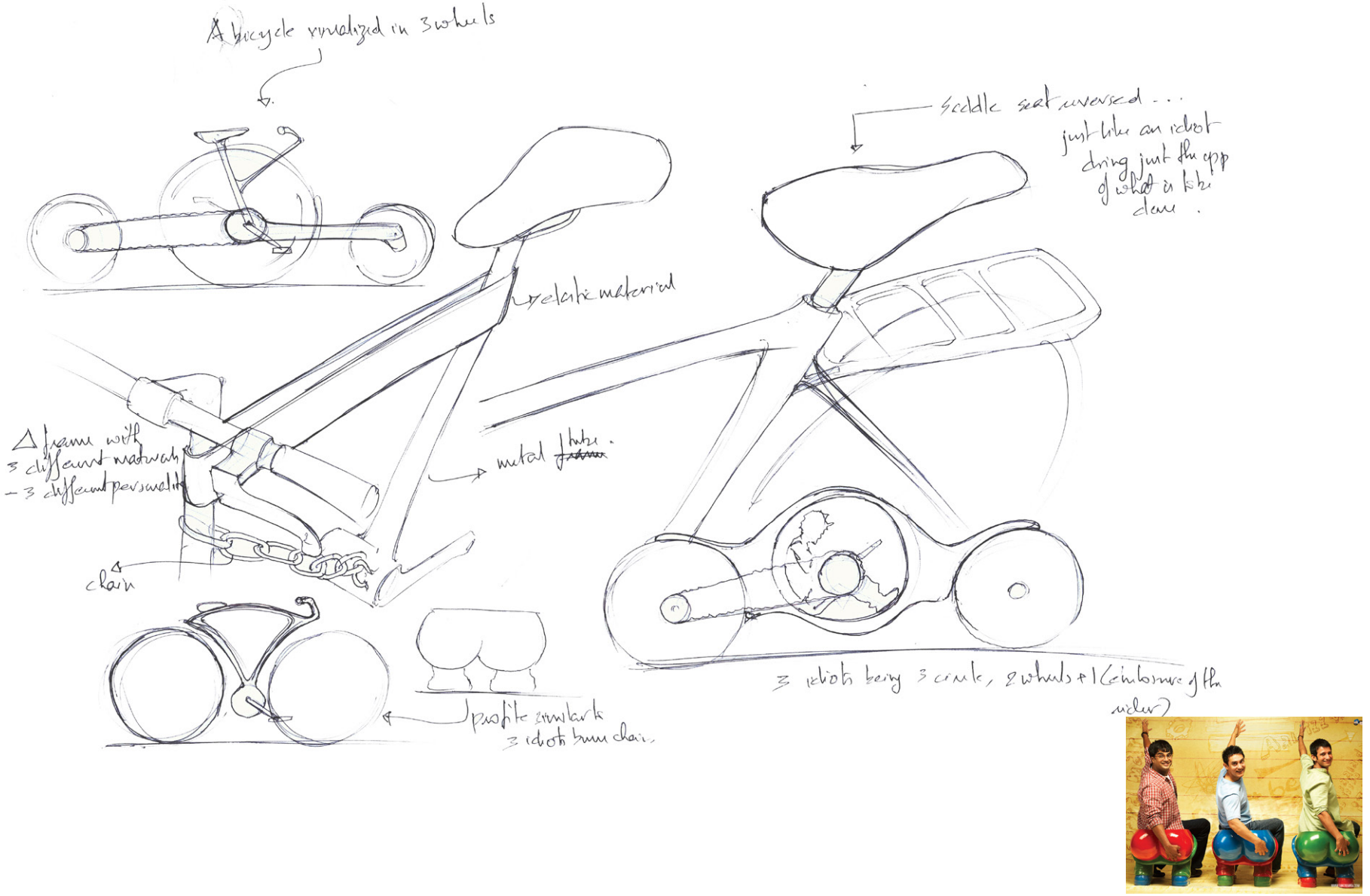


Fig 30. *Ideations based on analogy of 3 idiots film*

Ideation: Analogy - motorcycle

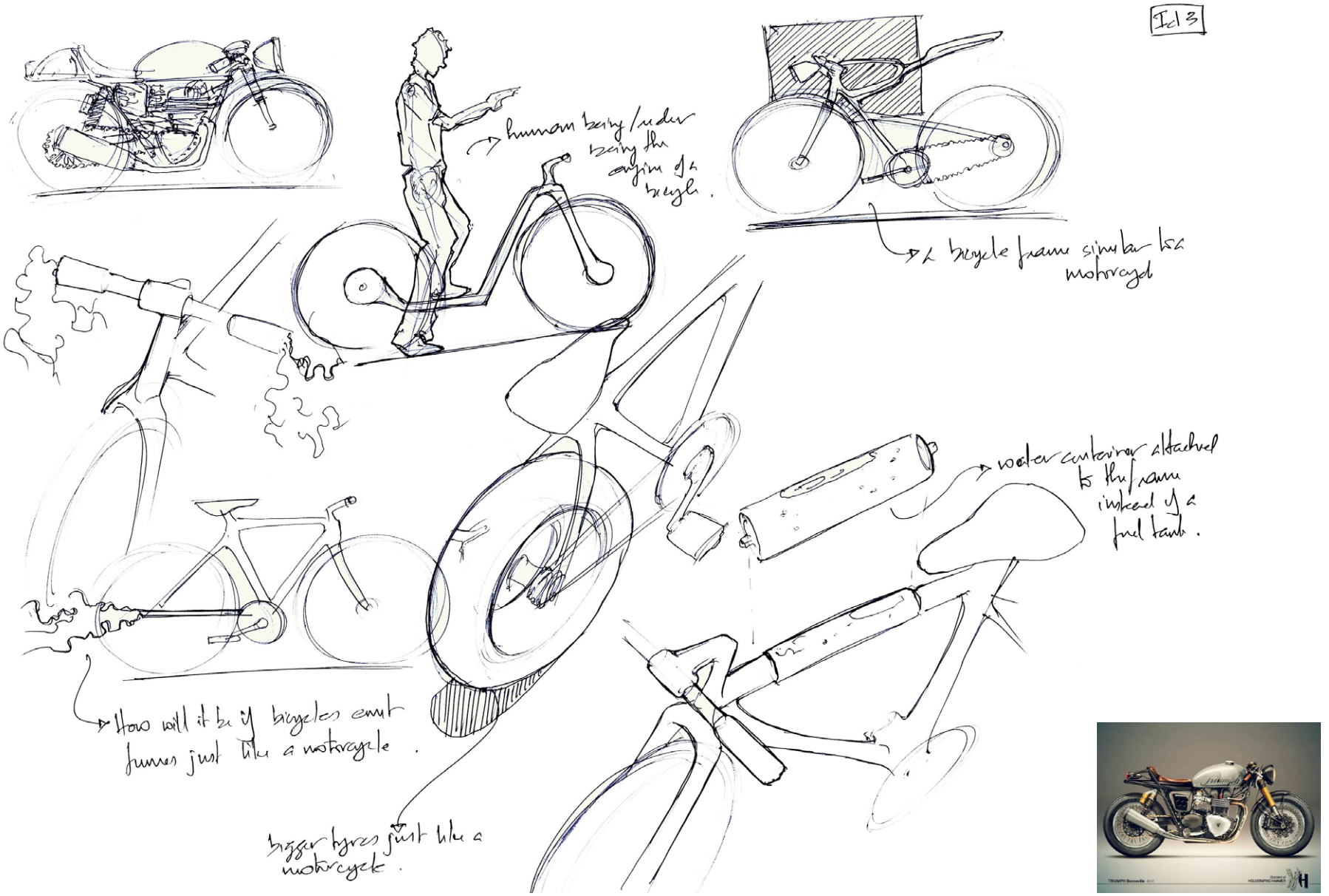


Fig 31. *Ideations based on analogy of a motorcycle*

Fig 32. *Card sorting of initial ideations*

2nd level ideation

1. Clustering

Ideations based on analogies were used to do card sorting, in which the cut out cards based on the ideas were sorted into 4 clusters:

- *Visual aesthetics, structure, theme*
- *movement / ride*
- *experiential*

2. Developing the champion idea

A champion idea was chosen among the clusters and the other ideas in the cluster used to improvise on the champion idea. This led to the development of 3 design directions

2.1. Design direction 1

This concept was developed based on the idea of retro styling of penny farthing bicycle with a scoot drive extension to it (this in turn came as an outcome of single wheel riding). The idea was to have a bicycle which could be ridden by 2 people in which:

- *Pedals, saddle and steering will be attached to the front wheel, ridden by one person.*
- *A scoot like extension is provided with this, which serves as a space for the fellow rider.*

The concept brings in the features of iconic penny farthing bicycle, at the same time adds fun elements to it through group riding and its retro nature.

Ideation: Design direction 1

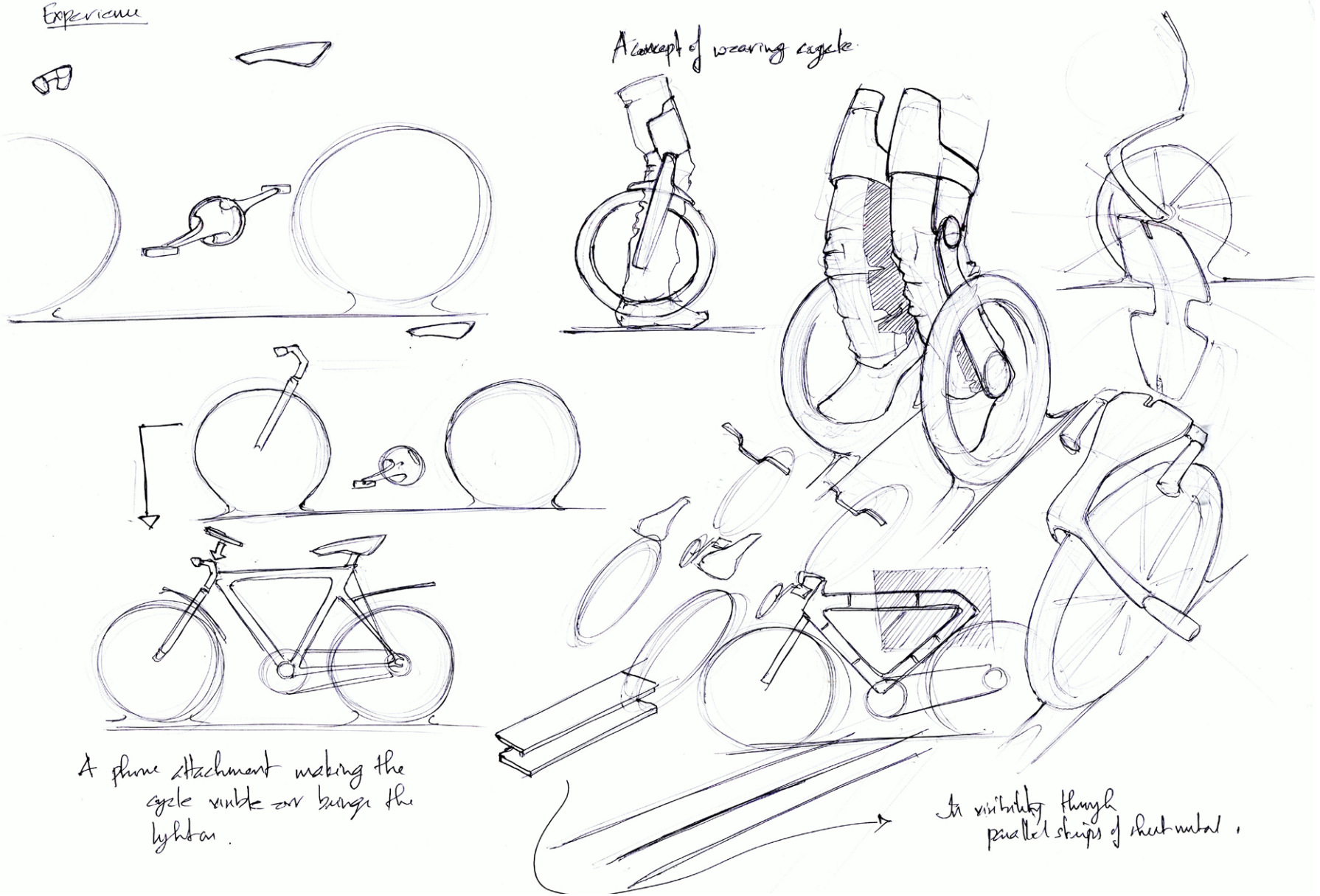


Fig 33. *Invisibility of the bicycle was chosen as the champion idea which further developed into single wheel concept*

Ideation: Design direction 1

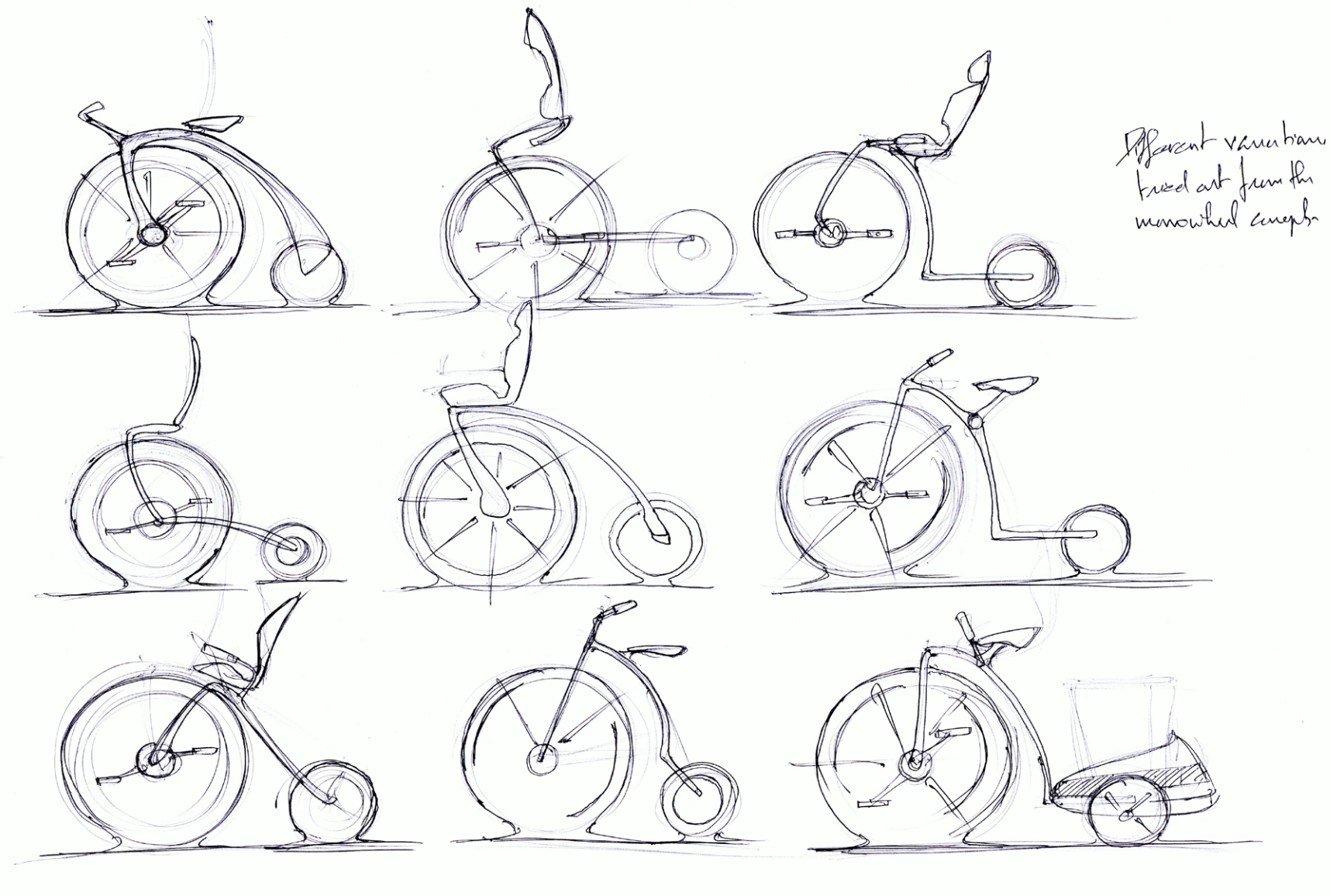


Fig 34. *Single wheel concept was modified into a bigger front wheel and smaller back wheel and variations were explored*

Ideation: Design direction 1

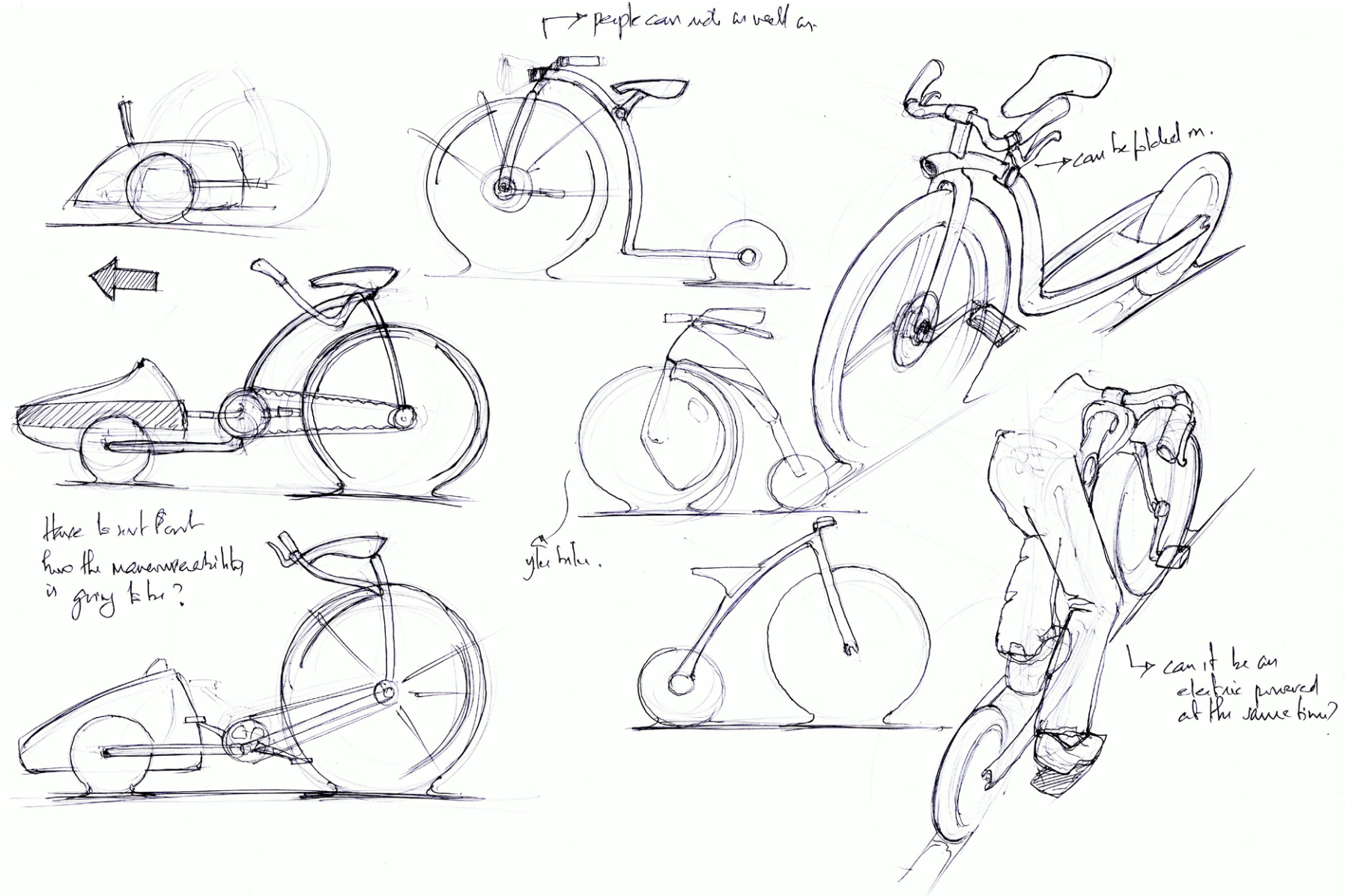


Fig 35. *The explorations got further developed into attachment of a scoot interface between front wheel and back wheel*

Ideation: Design direction 1

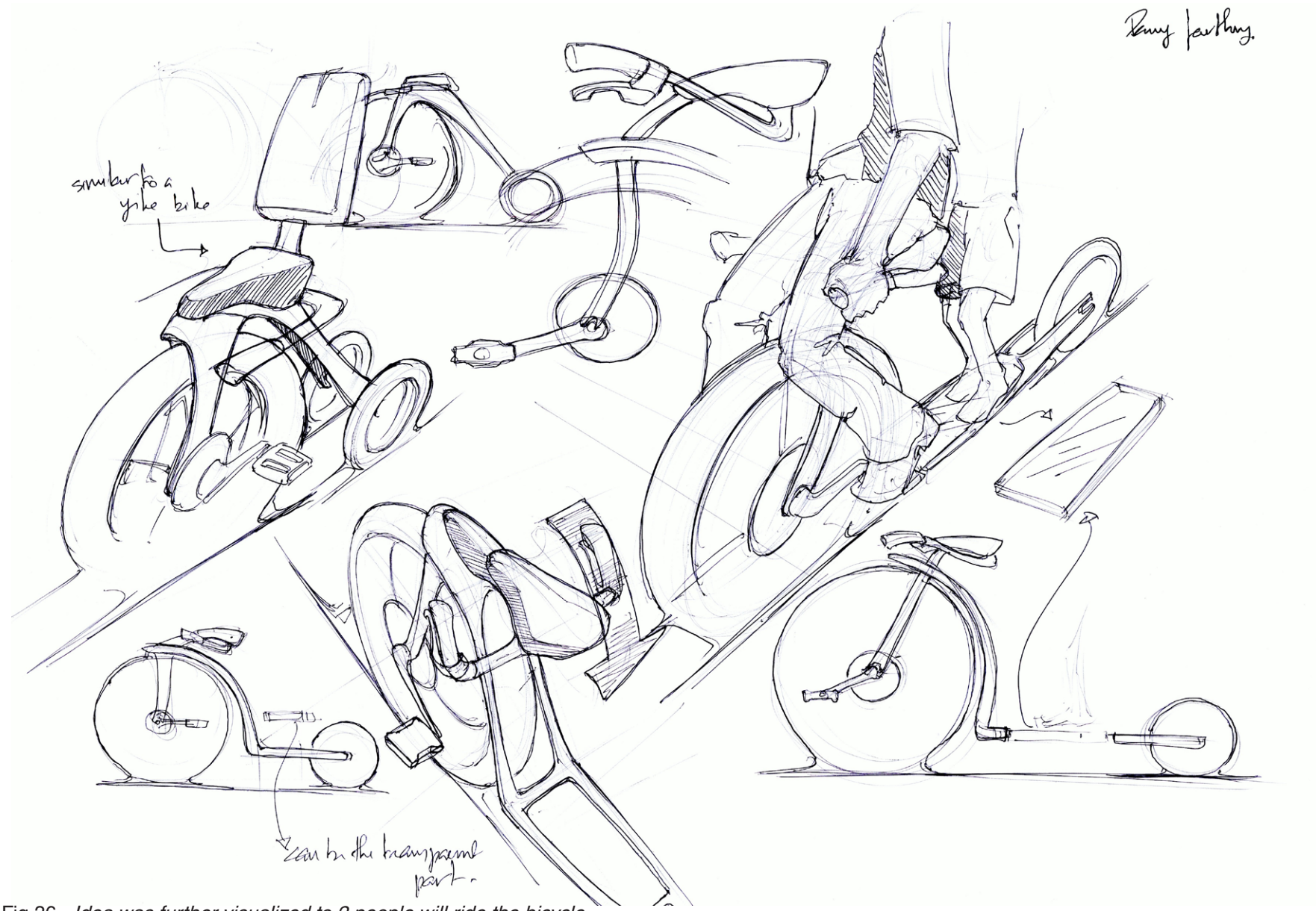


Fig 36. *Idea was further visualized to 2 people will ride the bicycle*

Ideation: Design direction 1- Final

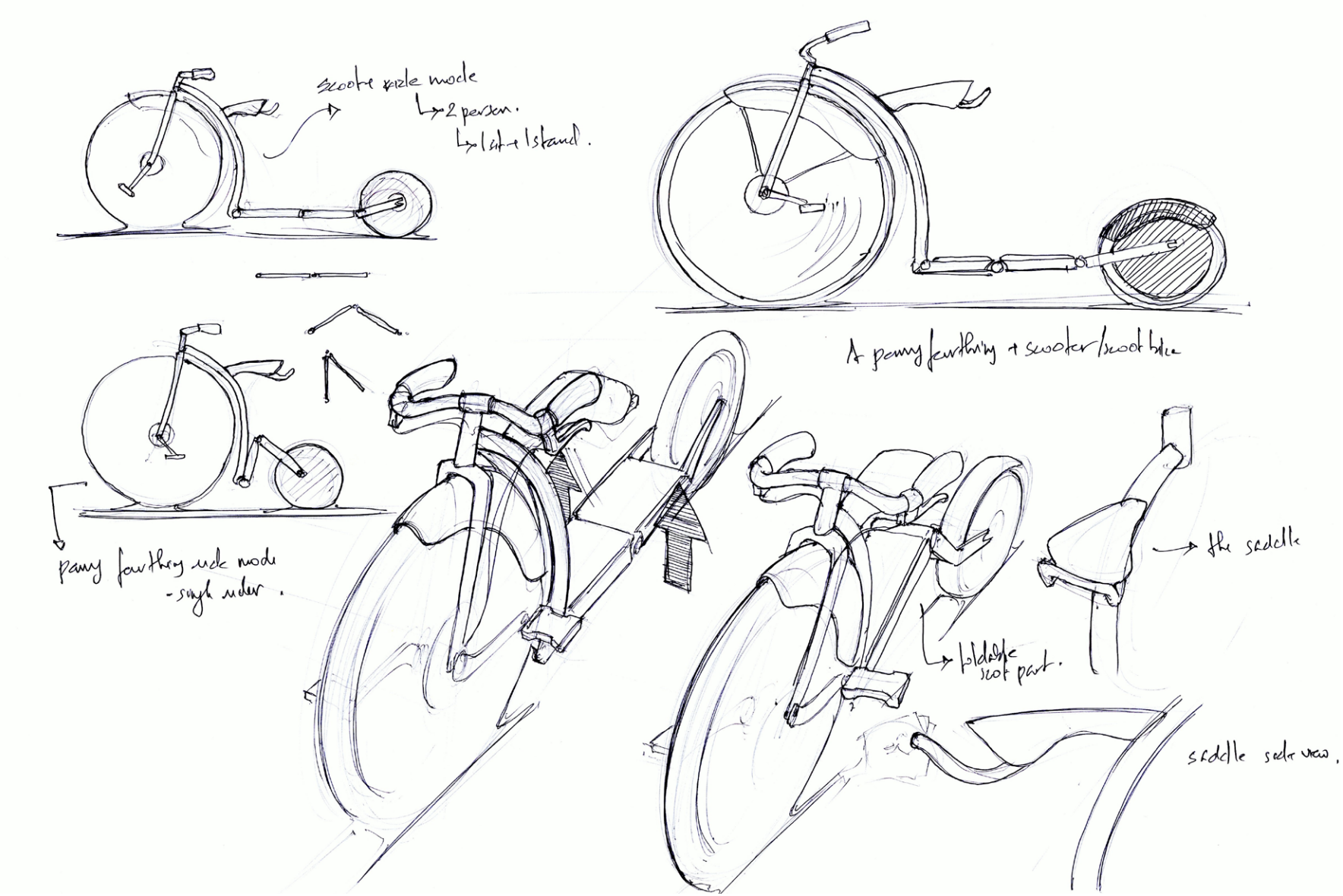


Fig 37. *Scoot interface was further made a folding one - to use it as and when needed.*

2.2. Design direction 2

The following concept was developed based on the idea of a chariot (an outcome of carrying things in a bicycle), where a bicycle could be converted to a trike with a chariot like extension which could carry a person in standing posture.

– *Similar to the previous concept, this also employs one rider and a companion.*

– *Fun factor comes in the terms of chariot like interface provided, which could fit into the context of Ramoji film city, where many of the sculptures were inspired from Indian mythology.*

Ideation: Design direction 2

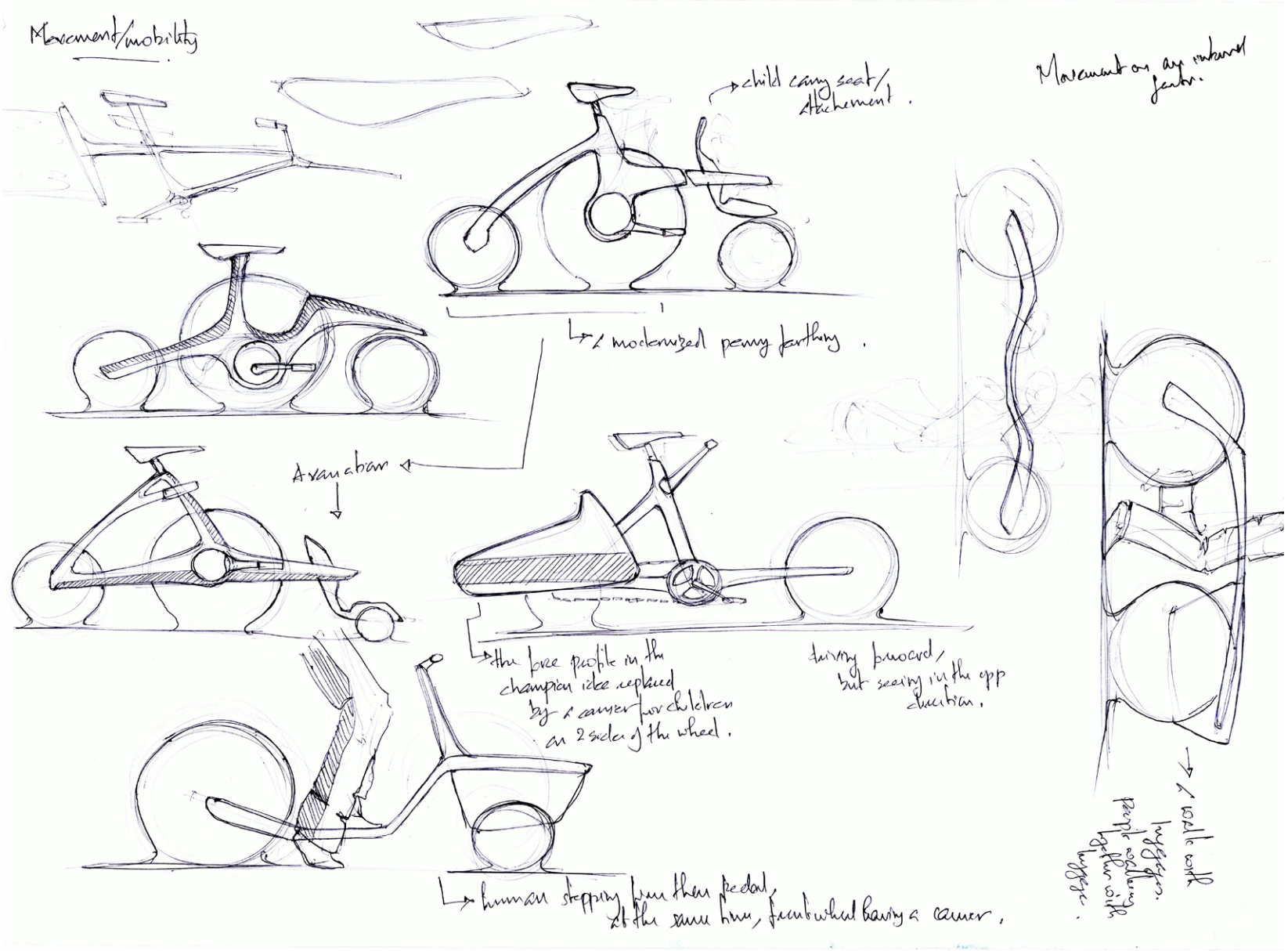


Fig 38. *Second design direction started of with cluster of carrying load in a bicycle as well as its movement.*

Ideation: Design direction 2

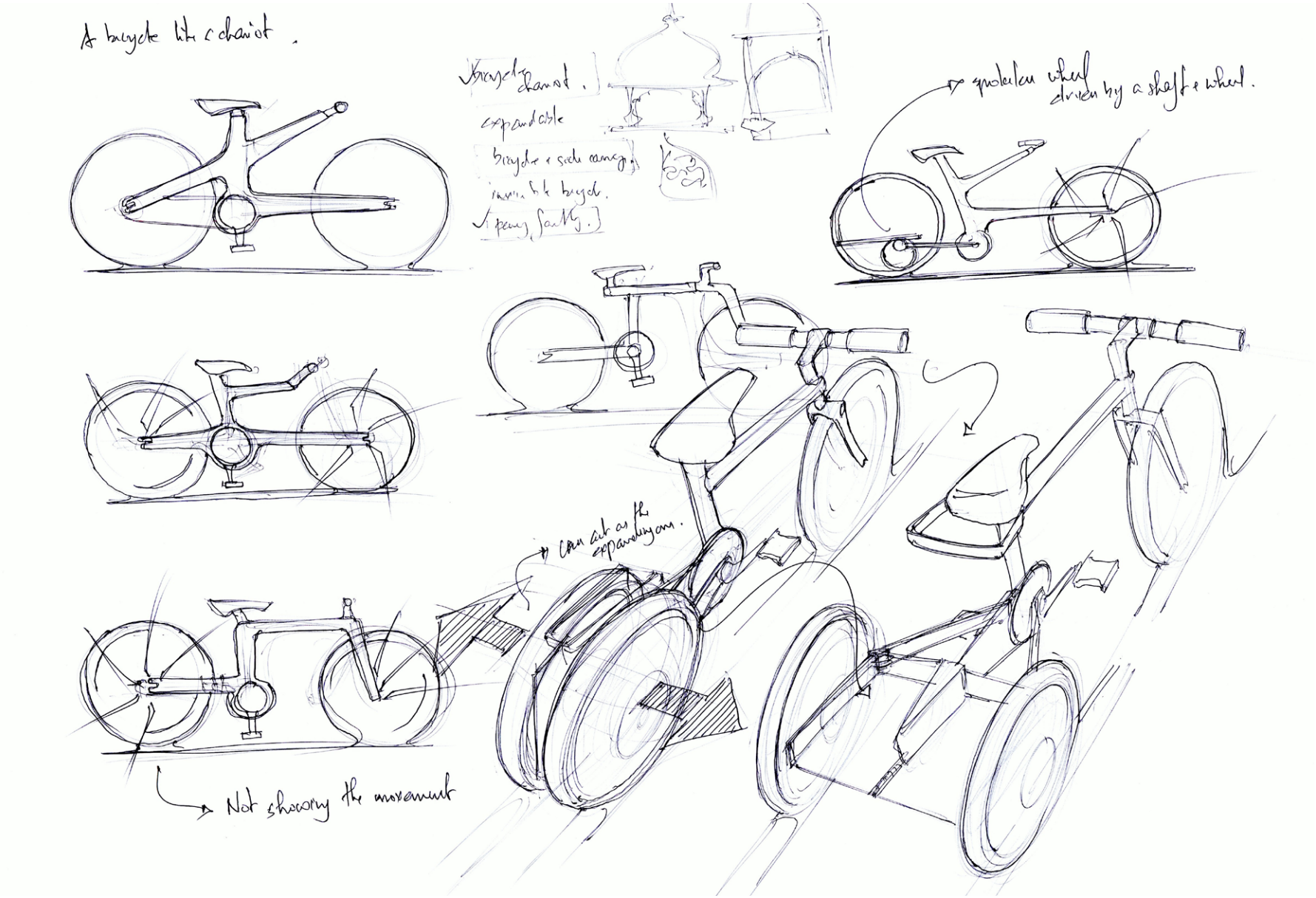


Fig 39. *It went on to getting developed as a chariot concept trike.*

Ideation: Design direction 2 - Final

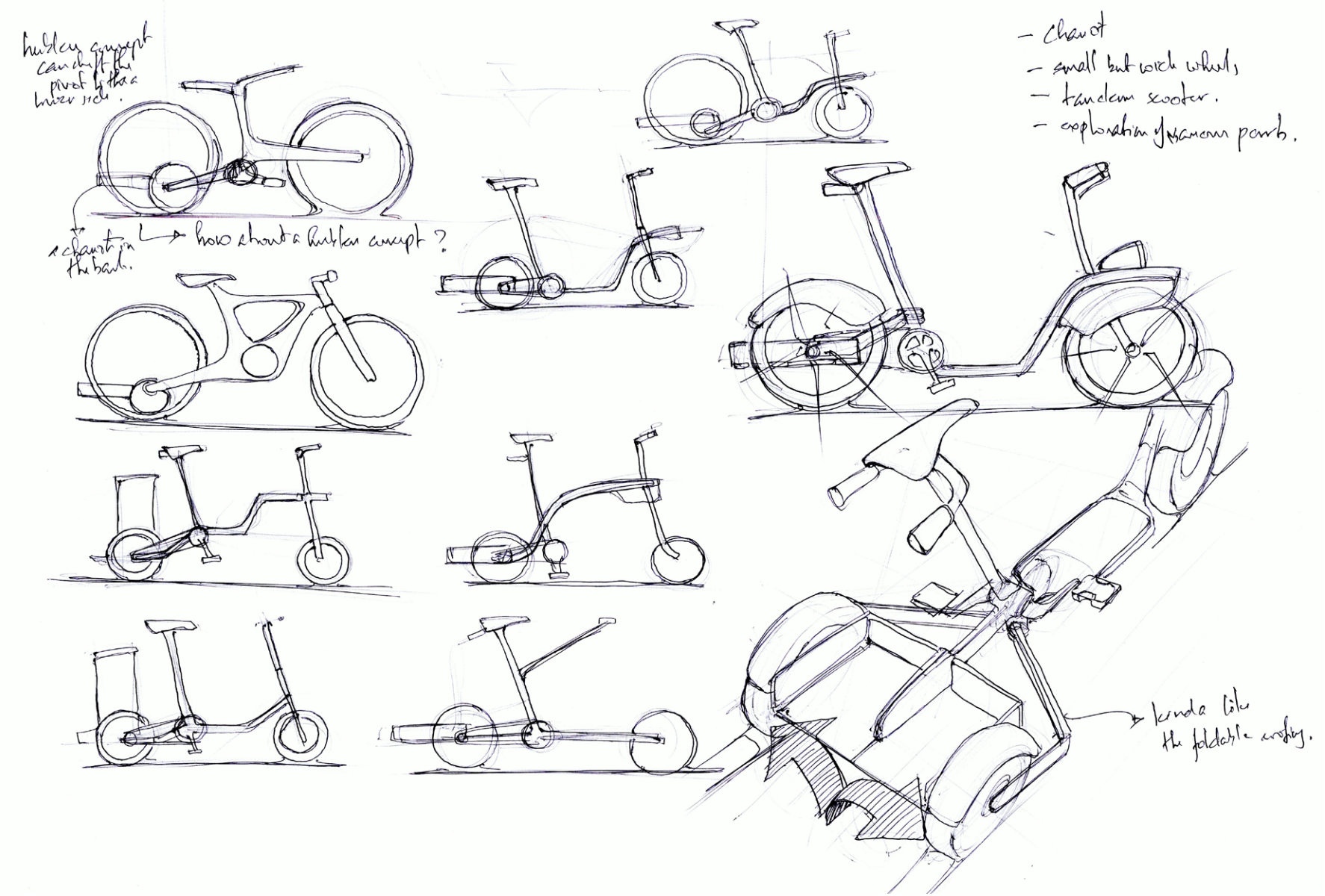


Fig 40. *Variations in the frame was also explored and a scoot interface was added to the rider as an element of fun*

2.3. Design direction 3

The idea started of with defining a new frame aesthetics which is novel in nature at the same time goes with the context. A circular frame was further iterated upon to find interesting formal characters. In Order to bring in contextual elements and fun factor, minions were chosen as a metaphor. This lead to the idea of a curved frame structure which could act as space for the fellow rider.

– *Unlike the previous concepts, this concept gives equal treatment for both rider and fellow rider in terms of visual experience of the space.*

– *Riding experience also provides novelty in terms of group riding, where fellow rider gets the frontal space rather than the rear.*

– *This concept also takes into account the visual experience the frame provides.*

Ideation: Design direction 3

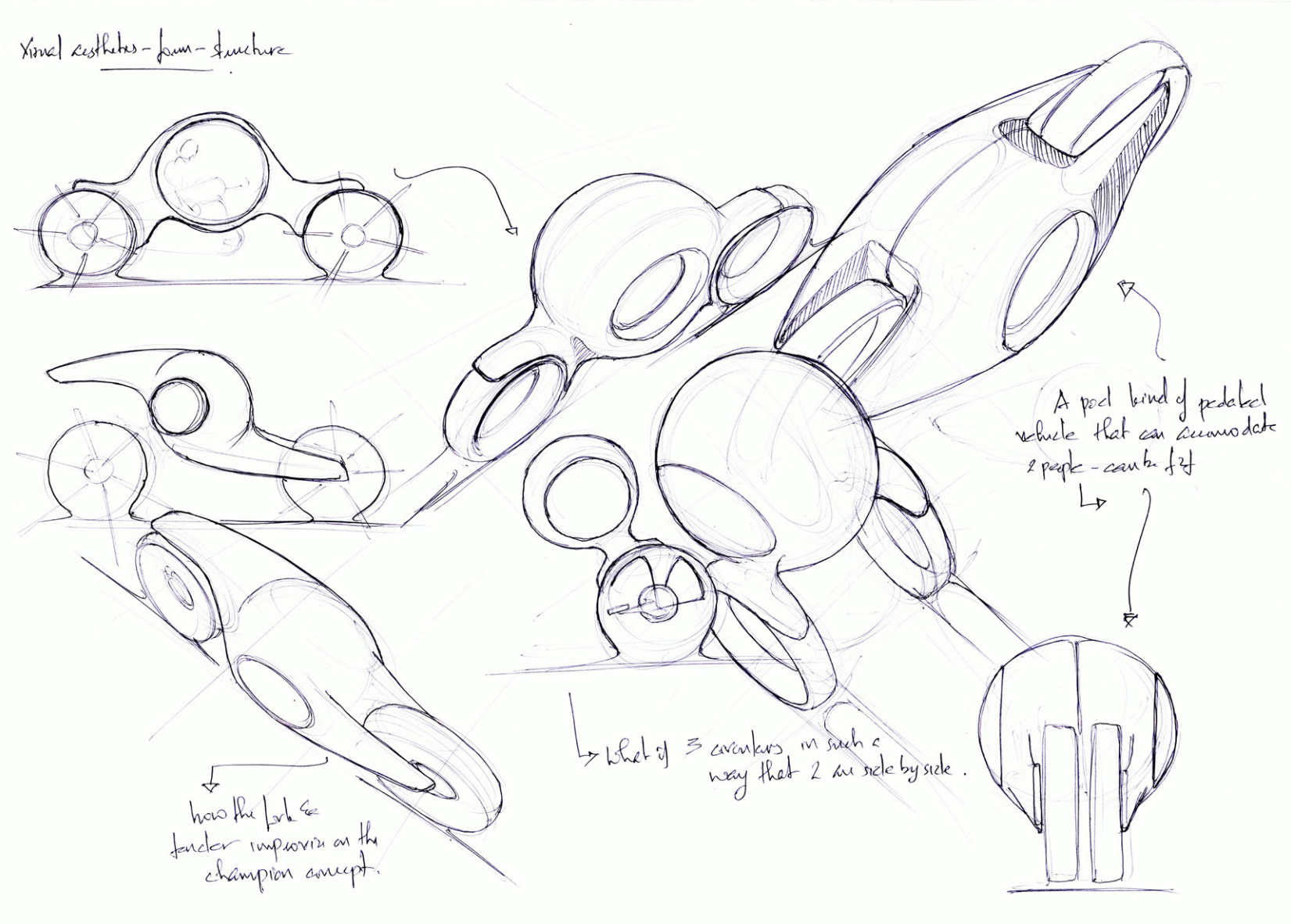


Fig 41. *Ideations started with choosing circular frame as the champion idea and exploring on it.*

Ideation: Design direction 3

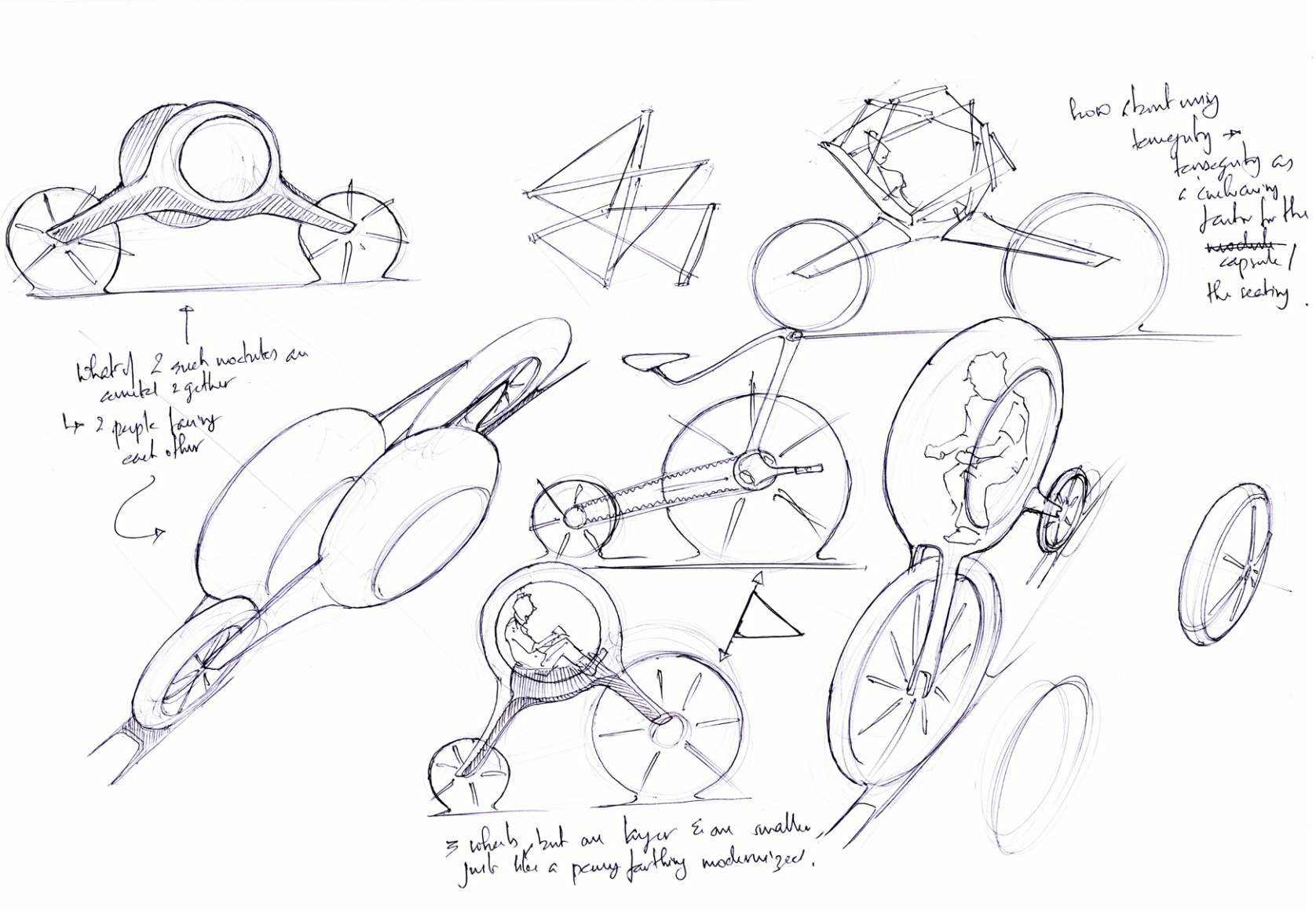


Fig 42. *Variations were tried upon like changing the wheel sizes and adding tensegrity based frames.*

Ideation: Design direction 3

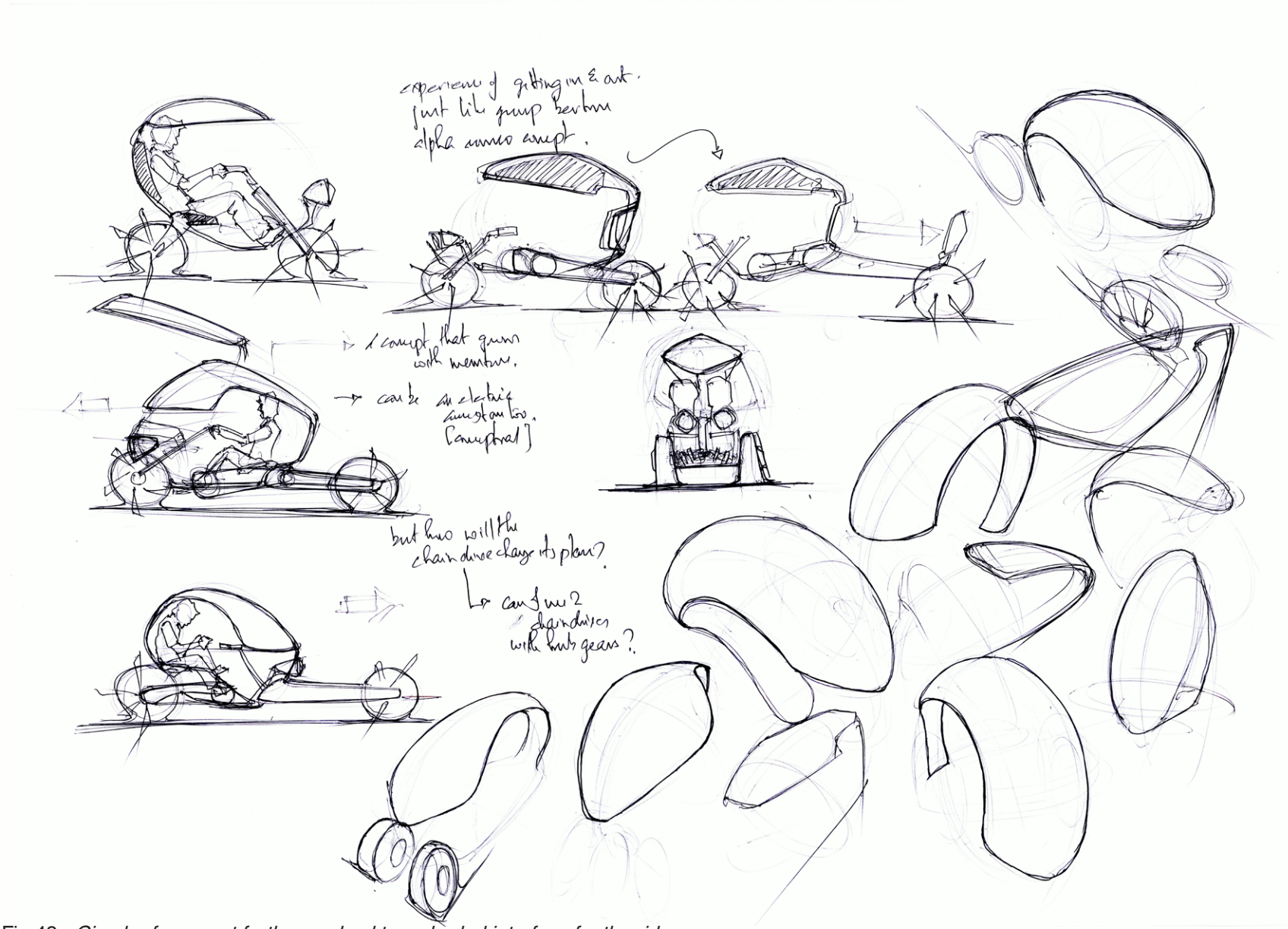


Fig 43. *Circular frame got further evolved to a shaded interface for the rider*

Ideation: Design direction 3

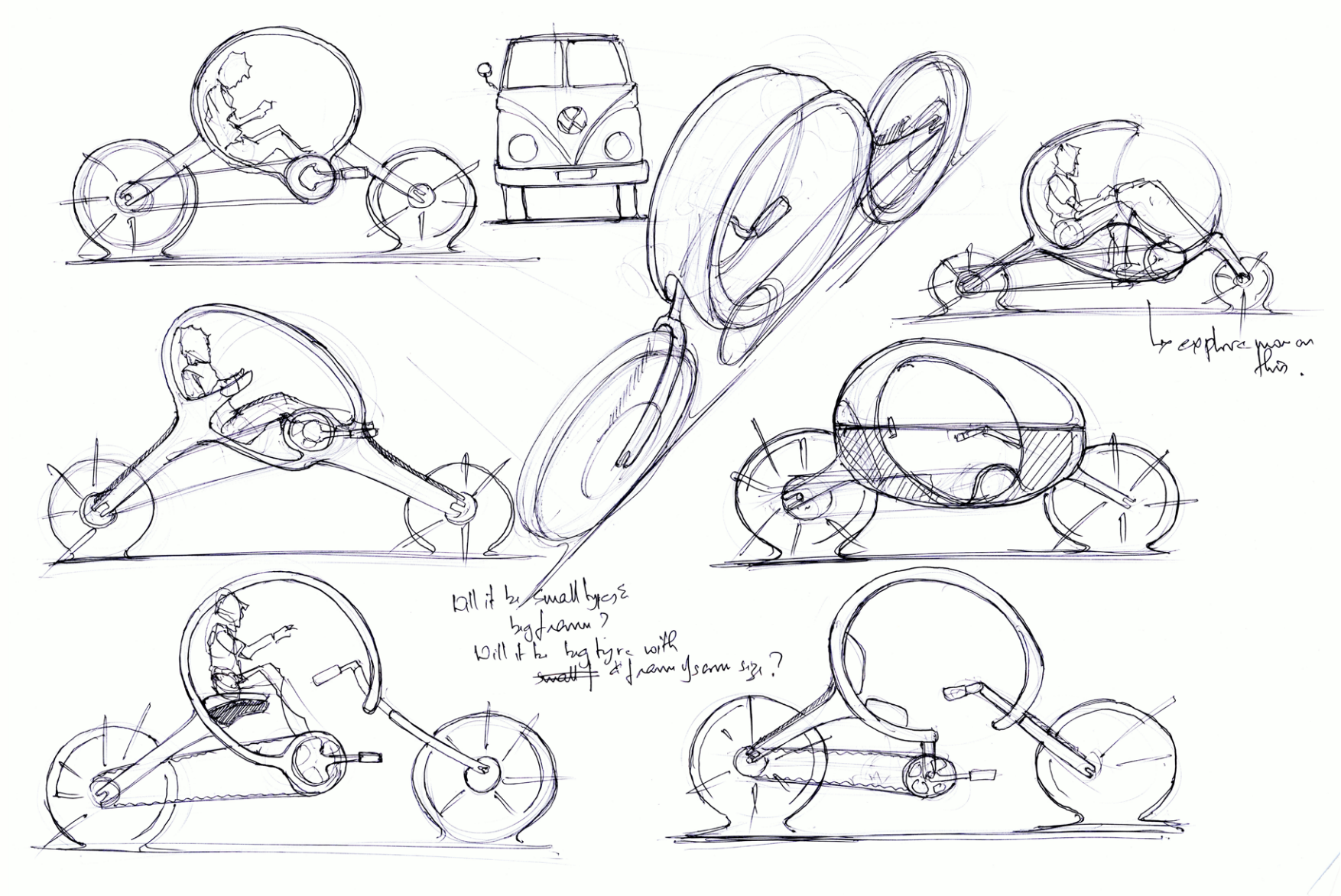


Fig 44. *Further explorations on the circular frame.*

Ideation: Design direction 3

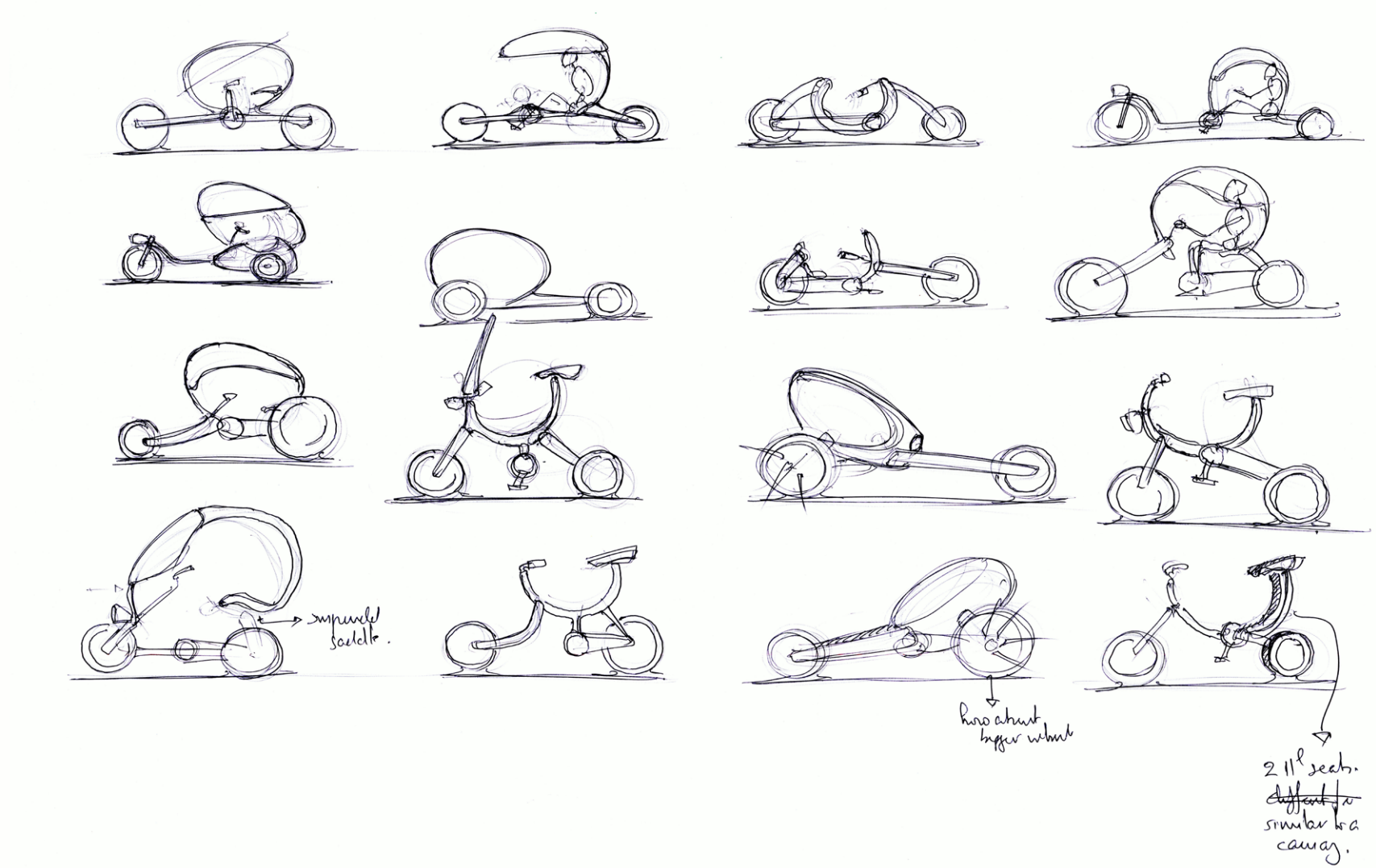


Fig 45. *Further explorations on the circular frame.*

Ideation: Design direction 3 - Final

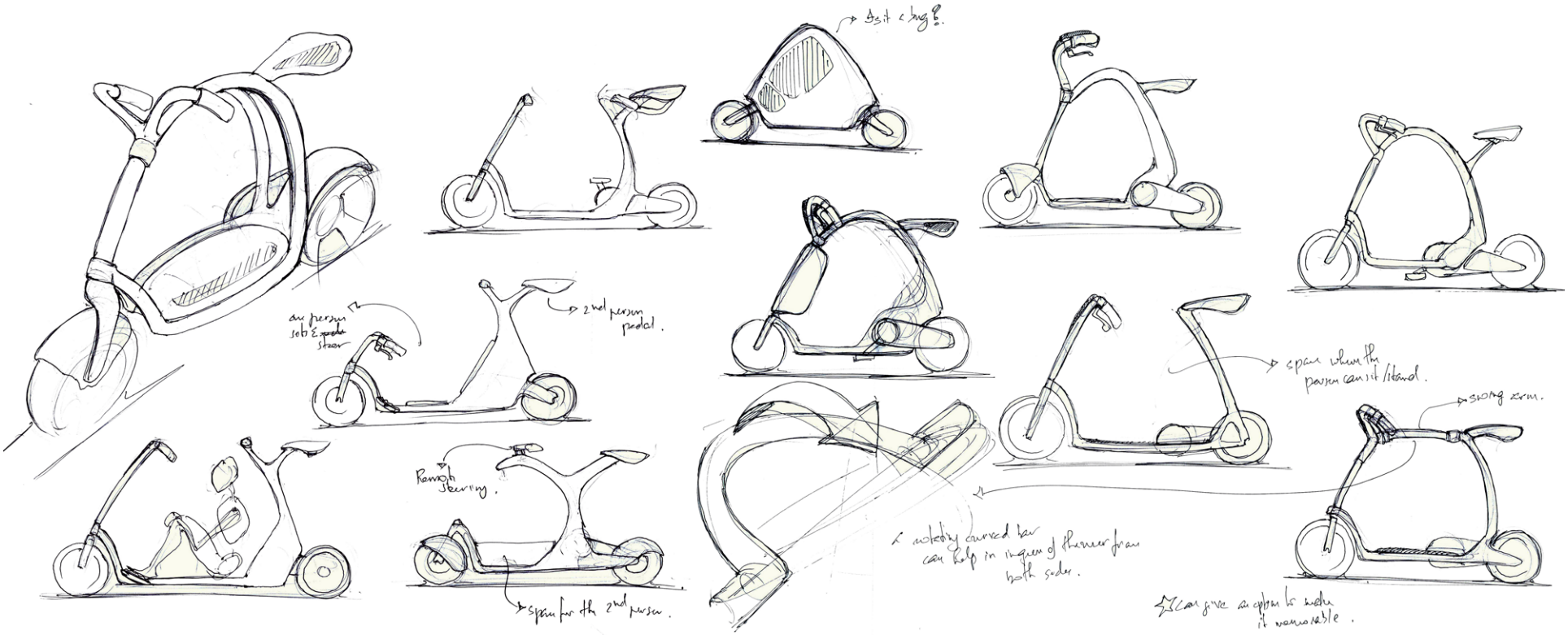


Fig 46. *Exploration on circular frame by adding a space for fellow rider*

Evaluating the concepts

The 3 concept directions were evaluated and the 3rd direction was chosen for further exploration due to the following factors:

– *fun factor in terms of visual aesthetics of the frame structure.*

– *novel ride experience for the fellow rider.*

– *better visibility for both riders*

Brainstorming

After designs directions were chosen, a brainstorming session was organized. This gave a 3rd person insight into the concept and how the design directions could be bettered by adding certain fun elements. Brainstorming also gave ideas of cycling experiments which could be later looked upon.
The following inputs were gathered during the brainstorming session

- *Inspirations from bicycles used in various movies could be taken*
- *Can it be a hover cycle?*
- *A water cycle in a venice like environment*
- *Skatepark - stunt type bicycle*
- *Bicycle as a part of a game - kind of like cycle polo*
- *Glass / Perspex cycle - material themes*
- *Pneumatic charger - sprocket - glide*
- *Users becoming the character - Multiuser bike which can be a 2 person team or 3 person team etc, and each person with a different activity in it*

– *A bicycle that is non pedal powered*

– *A bicycle in the form of a Ferris wheel - people moving like a giant wheel at the same time moving forward like a bicycle*

– *How about a hot air balloon cycle*

– *Can it be a dancing bicycle?*

– *Scooter + cycle concept*

– *Can it be a cycle in air*

– *A concept like make your own cycle and ride*

– *Race and rally system for a bicycle- bicycle with a nitro boost*

– *Light diffraction kind of thing similar to a b2 bomber - making it invisible*

– *Modular units in a bicycle*

– *Accessories attached in a bicycle - for example - a chariot cycle with helmet*

– *A bike taking selfies at checkpoints*

– *A wheel chair segway for a bicycle*

– *Cycle panels that can be attached or detached*

– *Multiple user assisted pedals*

– *A bicycle like a cart*

– *A bicycle like characters travelling on the street*

– *an up - down cycle*

– *A pedal powered music box concept*

– *A conference cycle concept*

– *A modular cycle in which the modules are keepsakes souvenirs - some things that u take and attach when u travel through a game like environment*

– *A check - in kind of concept like a foursquare app in a bicycle.*

– *Some themes which the person can select at the start point*

– *An audio for guiding like explaining the stuffs - bicycle acting as a guide*

– *The bicycle shade can keep changing according to different theme / area*

– *Different routes having different cycles*

– *Attachable parts that can increase the number of people riding the bicycle*

– *Elliptical wheels that can be used*

– *A dual frame bicycle*

– *a bicycle with a different vantage point*

– *A sail cycle like a sail ship*

– *A wheel suit concept*

– *Making familiar to unfamiliar and unfamiliar to familiar*

– *Cycle on a rope*

From the suggested ideas, following were taken to further explore upon in later stages:

– *Accessories attached in a bicycle - for example - a chariot cycle with helmet*

– *Scooter + cycle concept*

– *User becoming the character*

Design process contd.

Working on the scaled up drawing

The concept was rendered on the side view to get a better idea of its visual characteristics and was blown up keeping the tyre size as 12'. A smaller tyre size was chosen mainly considering the small legs of minions, which gave a novel aesthetics to the whole structure. The blown up montage was used to identify the proportions with respect to a human scale. Subjects were made to stand near it in riding posture to identify the changes that needed to be made. Working with montage gave preliminary ideas of how much should the bicycle be scaled for easy ride and to accommodate 2 persons.

Configuring the bicycle

A 50th percentile mannequin was used to fix the triangle (between handle, hip point and bottom bracket) in the bicycle. Before fixing the triangle, a posture had to be chosen for the ride.

1. Fixing the posture

Various postures were analyzed based on available data and the context. Since it was a leisure ride, the posture had to be chosen in such a way that it should

Fig 47. *Side view render (above) ; Life size montage used for exploration (below)*

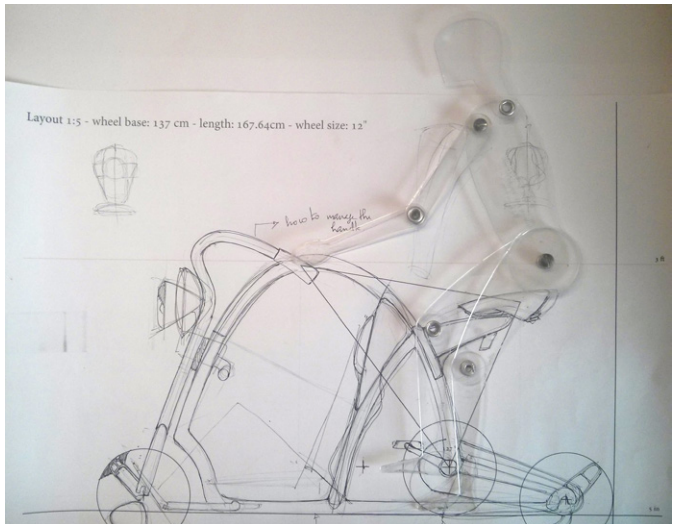


Fig 48. *Working with 50 percentile mannequin for fixing the triangle*

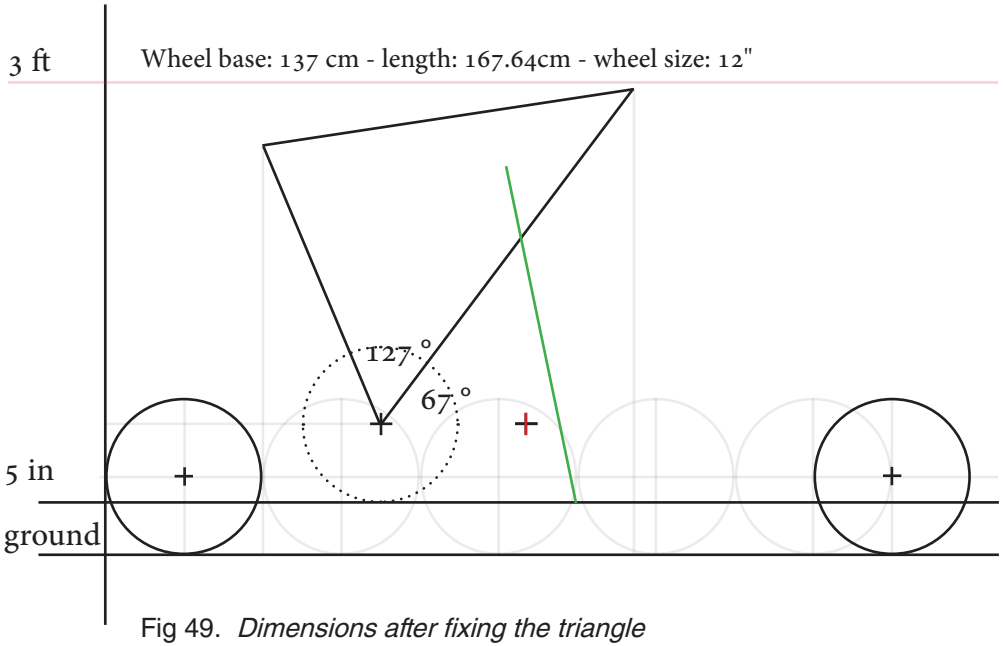


Fig 49. *Dimensions after fixing the triangle*

not be stressful, at the same time aid in enjoying the ride and the surroundings. Based on this an upright posture (with a slight tilt of 10 degrees) was chosen for the ride, as this not only gave better visibility for the rider, but also provides stress free ride (unlike roadbike posture)

2. Fixing the hardpoints

Once the posture was fixed, certain hard points had to be calculated around which the frame was worked upon. These included the triangle (hip point/saddle point, handle, bottom bracket), center point of front and rear wheel, seating for the fellow rider.

3. Fixing the triangle

A 50 percentile male mannequin was chosen to fix the hard points like hip point, handlebar and bottom bracket. This caters to a wider population and adjustability could be given to the saddle point to accommodate the rest. While fixing, it was made sure that the person would be able to rest his foot on the ground (balance the bicycle), when it is in rest, to aid the fellow passenger's ingress.

4. Fixing the seating

The handle point restricted the top tube height to 3ft. This permitted only kids to be accommodated in the frontal area. 50th percentile anthropometric dimensions of a kid (6-8 years) was chosen to calculate the seating point (Fig 46: green line). The space could also accommodate a kid of age 8-10 years, with slightly tighter posture.

Once the triangle was fixed, the next hardpoint to fix was the the seating for the kid.for this knee room was calculated using the mannequin, by fixing the crank radius to a length of 15 cm (6 in).

This helped solve 2 problems in effect:

– *Minimum crank radius ensured reduced knee room.*

– *The whole riding experience appeared like movement of a minion. The person making short steps for his movement (similar to that of a minion character).*

A distance of 5 cm was added as clearance for the shoes and the seat point was fixed.

5. fixing the wheel center

Since fixing the wheel center (wheel base) involved giving optimum chain stay length and enough foot room for the kid, minimum distance for both were chosen to give the bicycle its character. The chain stay length was fixed at 15 in (38.1cm) and the wheelbase fixed at 137 cm (equal to 4.5 wheel length).

Rig testing

A rig was designed to provide adjustability in kids seat position. This was used to test the optimum distance of the seat from the bottom bracket, define optimum knee room and rideability of 15 cm crank drive.

Fig 50. *Rig making*

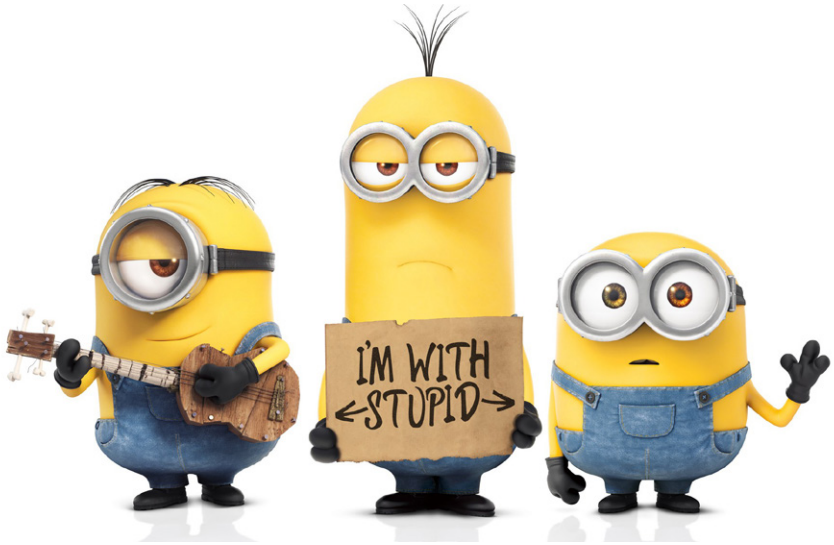


Fig 51. *Minions*

Fig 52. *Minions - color pallette*

Understanding minions

Appearance

Minions are small, yellow cylindrical creatures with one or two goggle like eyes. Minions are a similar size and shape, but have unique features to tell them apart, such as height, number of eyes, roundness or secondary features such as hair, eye/pupil size or clothing. identifying features include the thump like shape with metallic goggles and sprout hair.

Personality

As the story goes, minions have only one aim in life - to serve the most despicable master around. They speak in a strange jabber to communicate among themselves and to their masters. They are portrayed as extremely loved and funny, mainly attributed to their childish sense of humor and varied likes and dislikes.

Color pallette

Minion color palette mainly focus on shade of blue yellow and grey. They detailed one is as shown in the figure 48

Design process contd.

Designing around hardpoints

Once the hardpoints were fixed, the formal aspect of the frame was explored. Exploring the frame in the side-view helps in initial work out of the design, as bicycle is normally worked out as a planar object. In this exploration, care was given to keep the minion character even through manipulation of curves.

Aesthetic factors and lines in the frame

While working on the lines, it was analyzed as to how the change in curve changes the formal characteristics and how different lines and curves communicate with each other. From these, the frame design (rendered) was selected for further detailing due to the following visual features:

– *characteristic top tube curve (minion inspired)*

– *continuity in flow of curve from seatpost to the chainstay*

– *down tube curvature following the wheel profile*

– *better play of lines and curves compared to other designs, yet sticking to its character.*

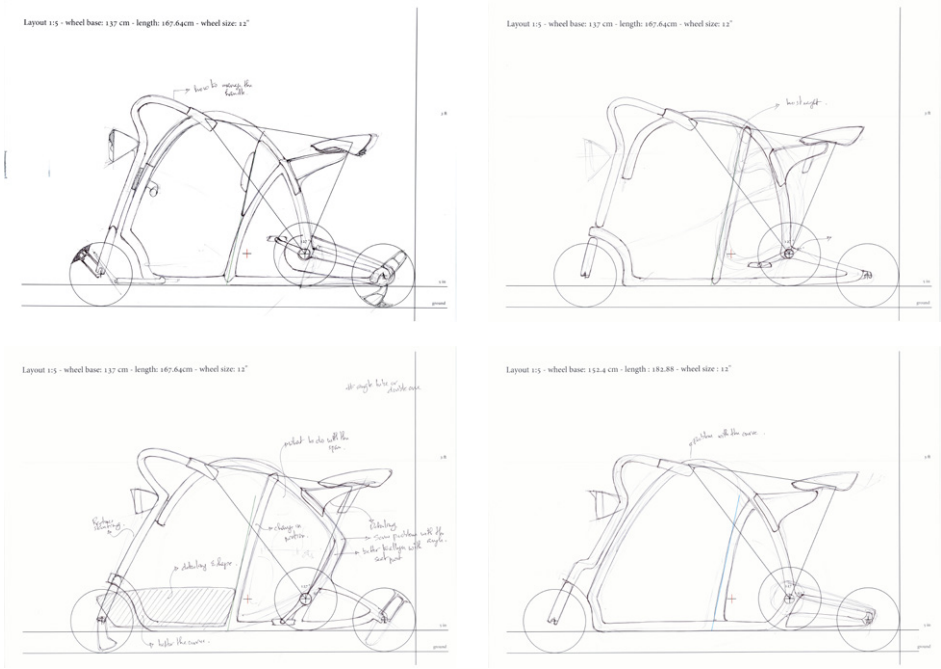
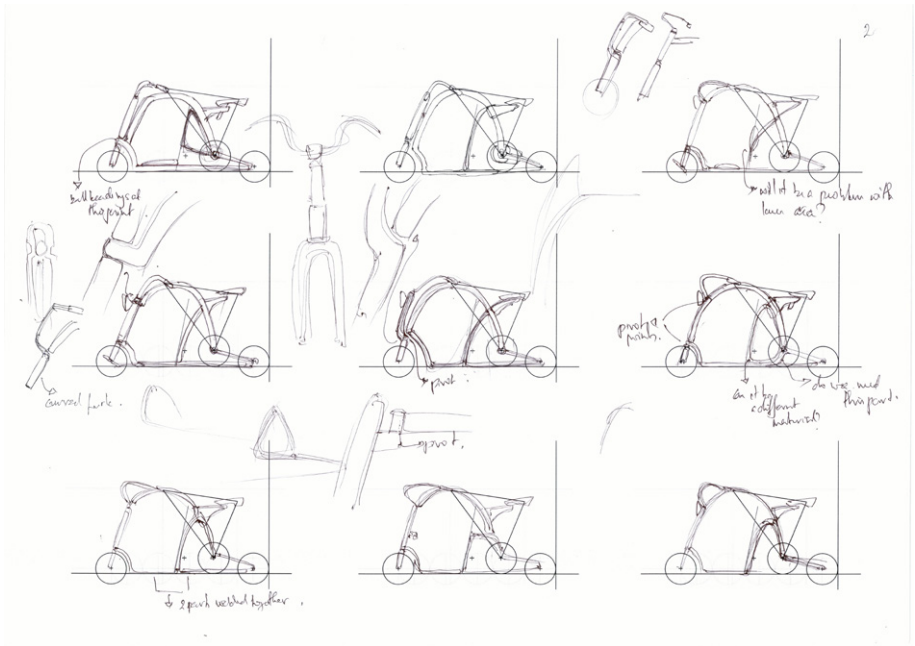
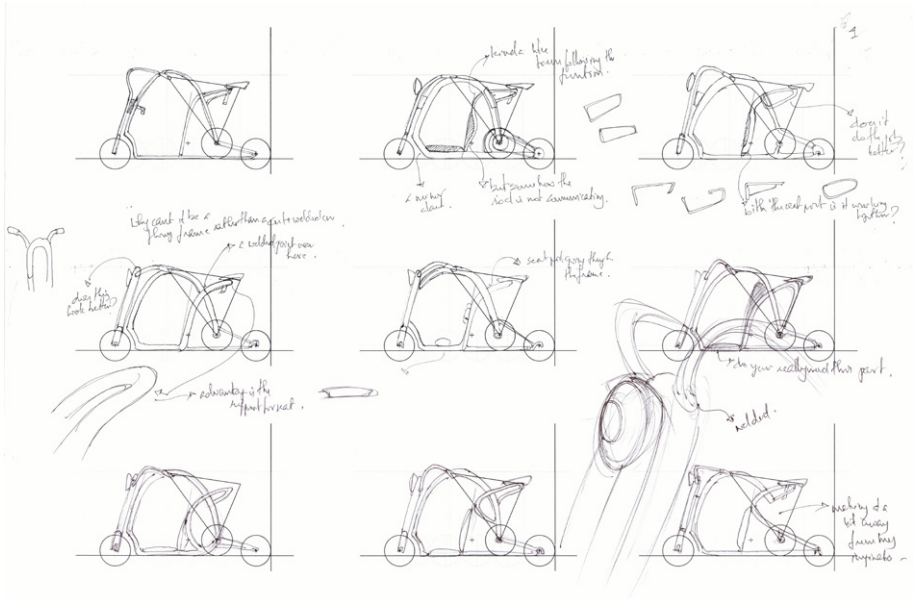


Fig 53. *Explorations around hard points*





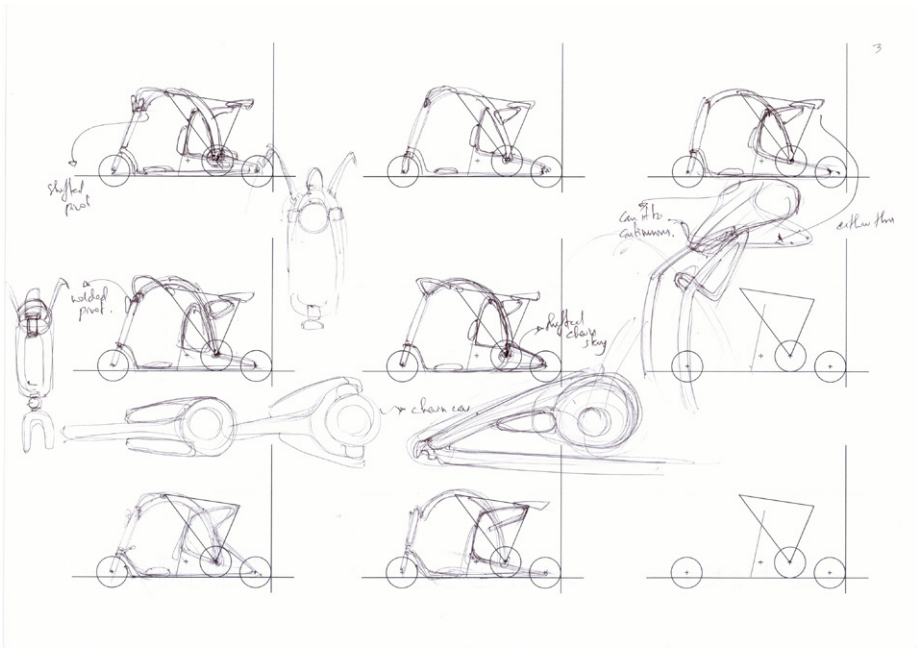


Fig 54. *Further exploration around hard points*

Detailing

Ones the side profile was finalized, components were identified to be detailed. Minion character was studied to bring in characteristical features into the detail, so that the components communicate with each other visually at the same time working together to create the mood and experience of being with a minion.

Frame

Frame detailing was further split into 2 parts - head tube & handle and rest of the frame.

Headtube and handle were explored, taking into consideration a minion face and tentacle like hair. Various options were tried upon using different handle curves and tubular frames. A headlight was also added to bring in a characteristic eye like feature.

Explorations in frame was mainly done by varying the sections and thickness of the pipes, as well as trying out multiple tubes in place of single ones.

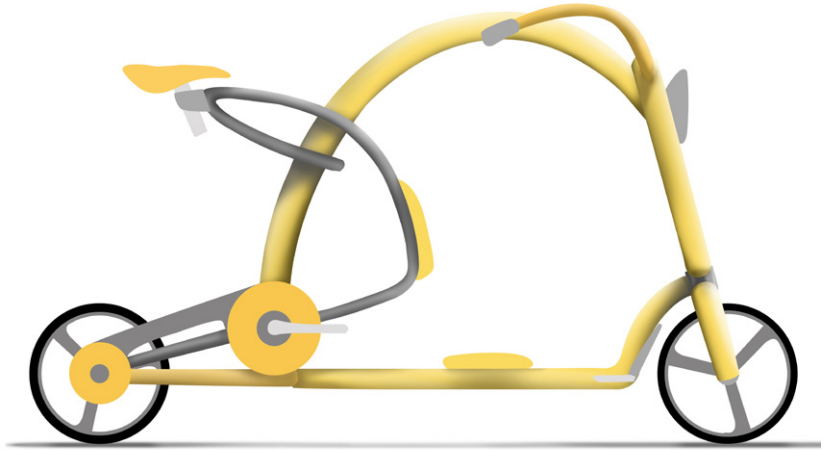


Fig 55. *Finalized side profile render*

Detailing: Head tube

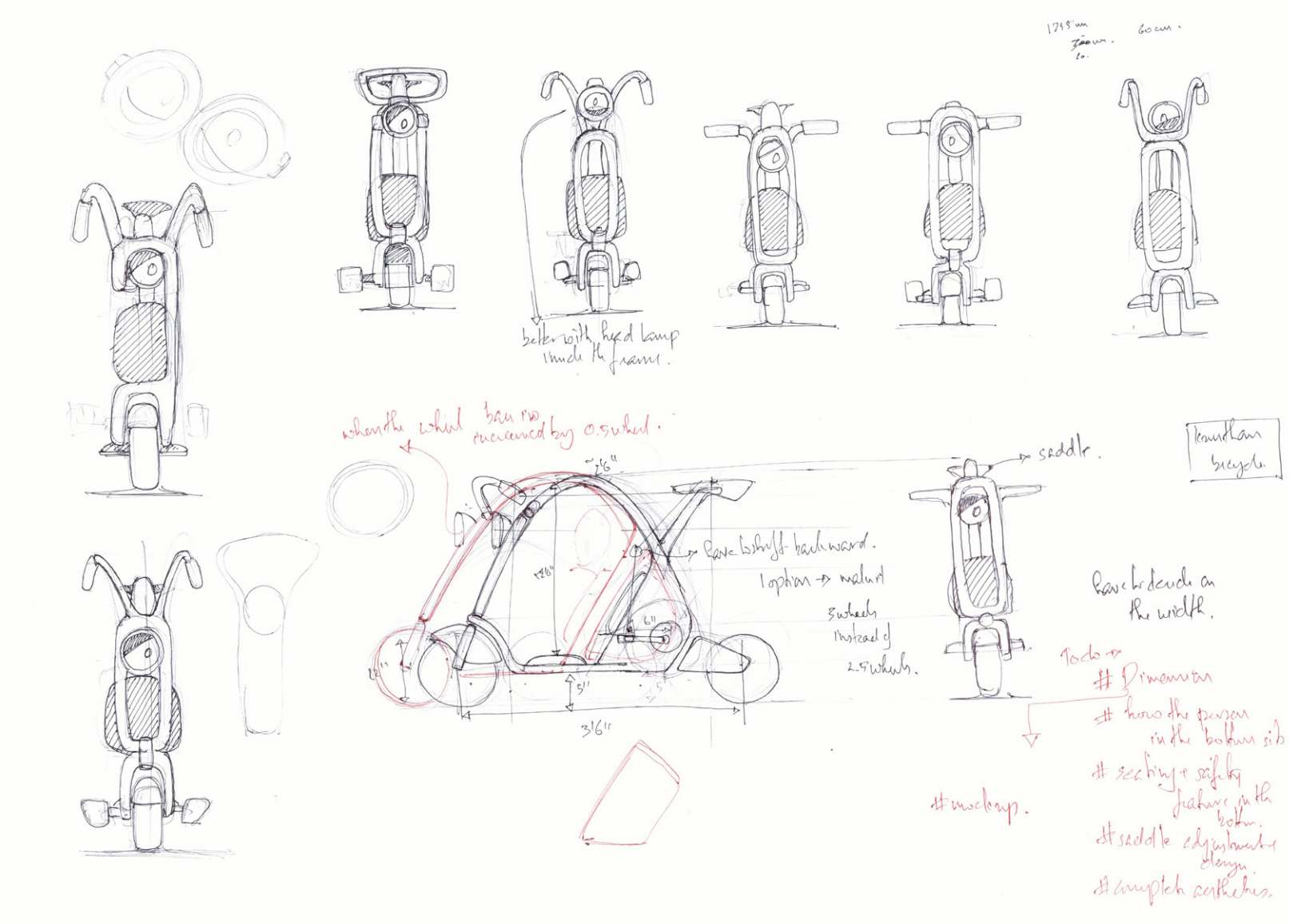


Fig 56. *Head tube detail inprired from minion body*

Detailing: Head tube

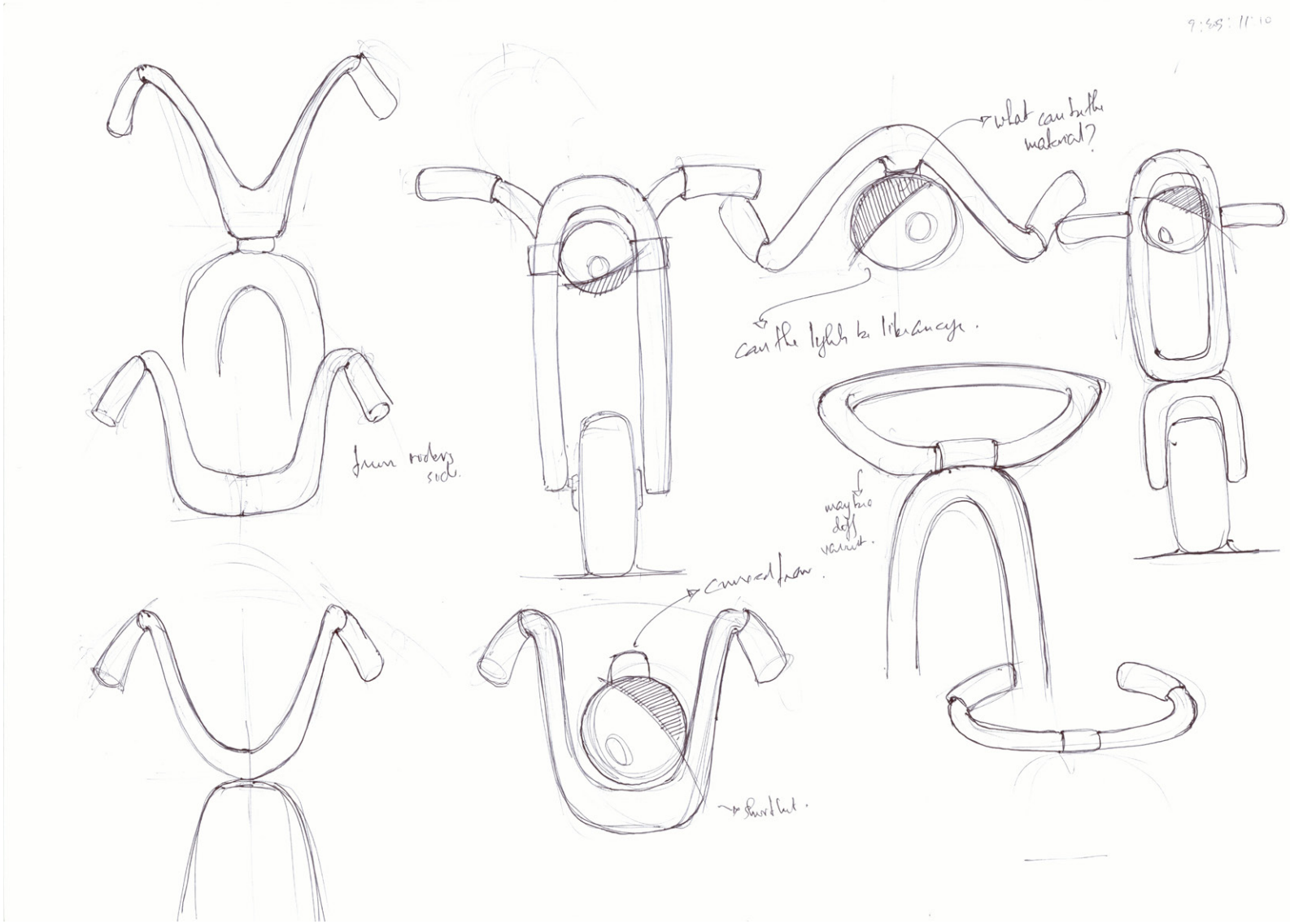


Fig 57. *Handle explorations*

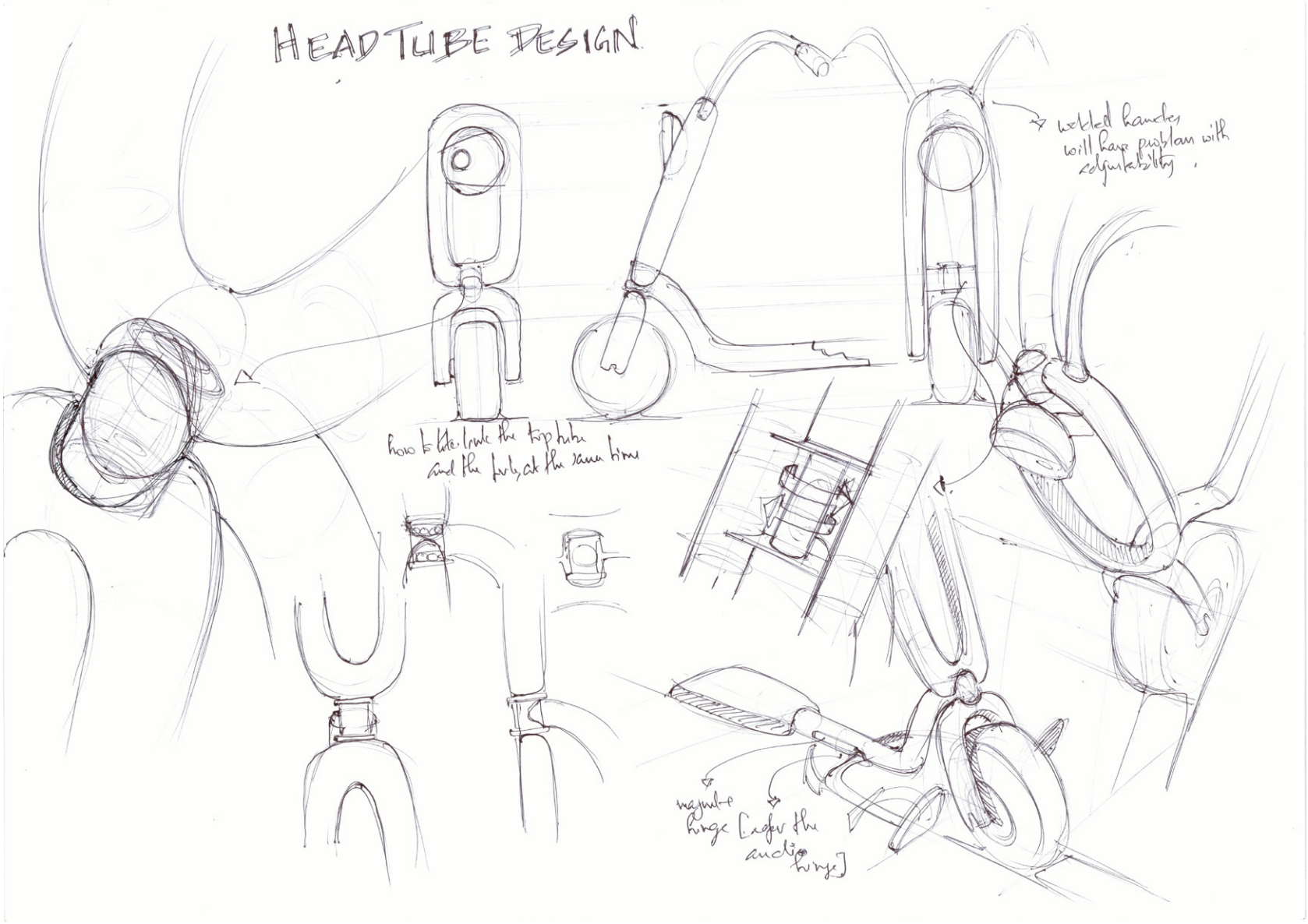


Fig 58. *Head tube - final*

Detailing: Frame & Seat post

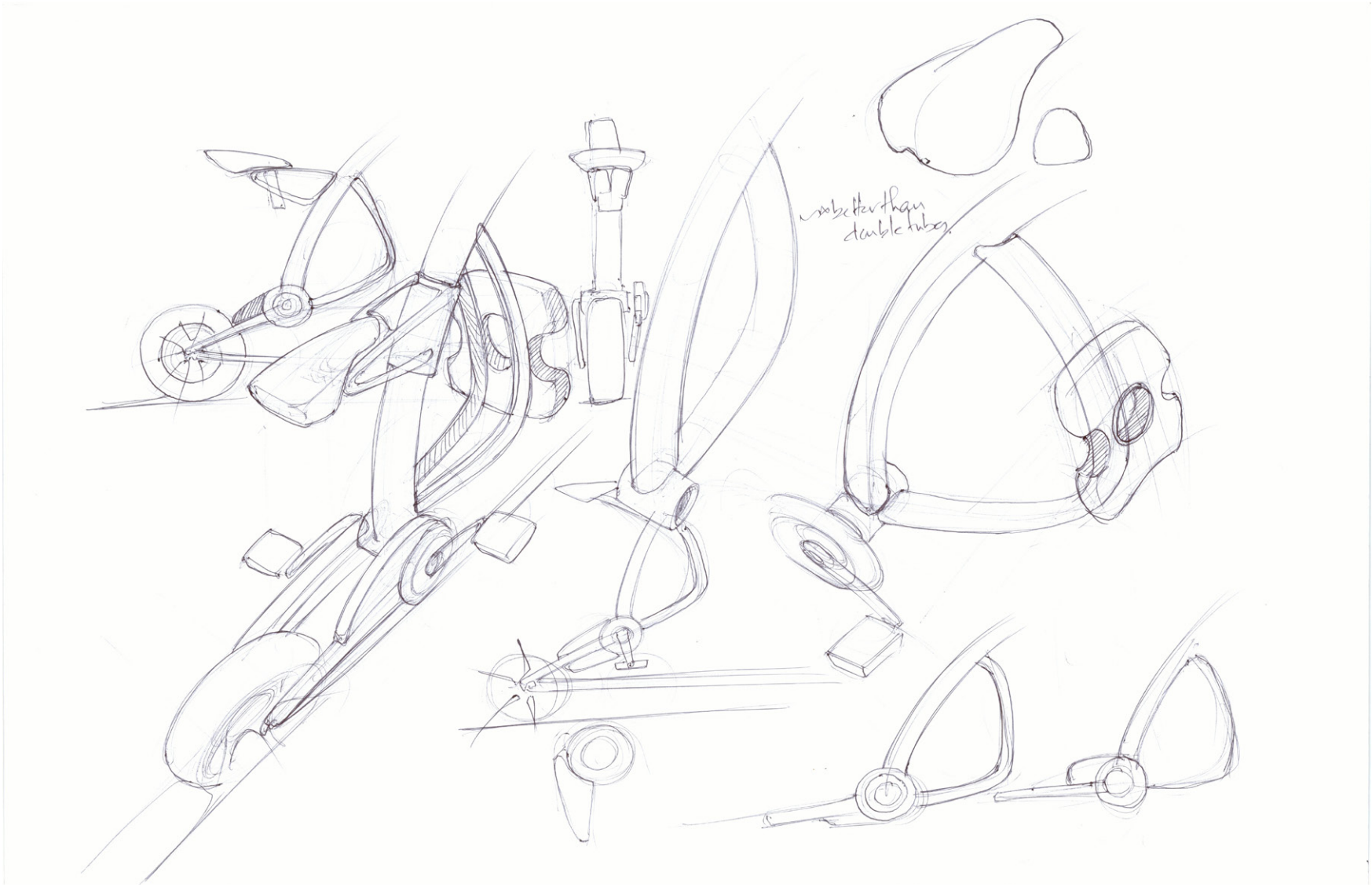


Fig 59. *frame and seatpost detailing*

Detailing: Frame & Seat post

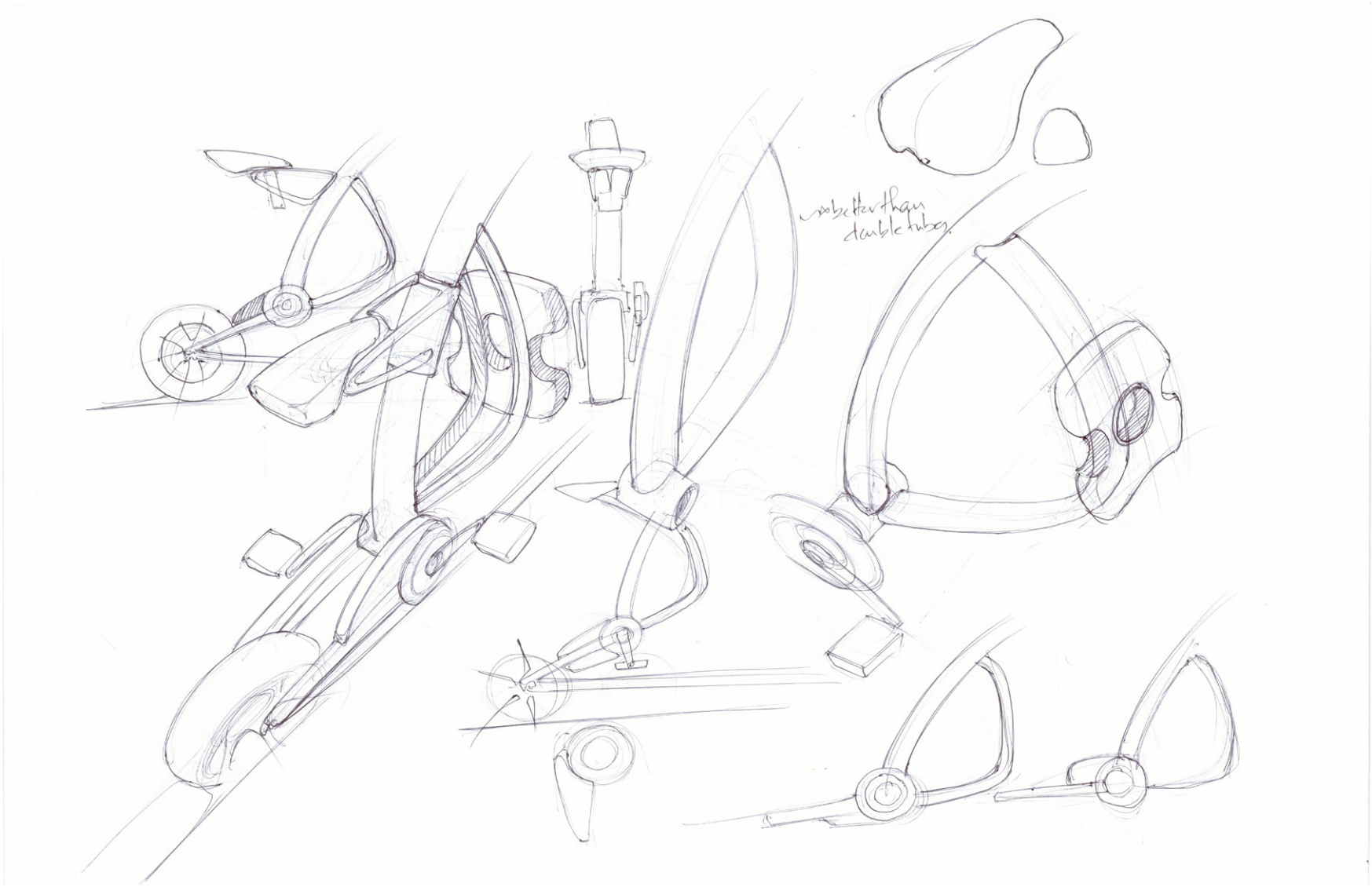


Fig 60. *frame and seatpost detailing*

Kids seat

Kids seat explorations were done to see how play elements could be brought into it. Idea of how the rider could become the character was also explored upon while designing kids seat.

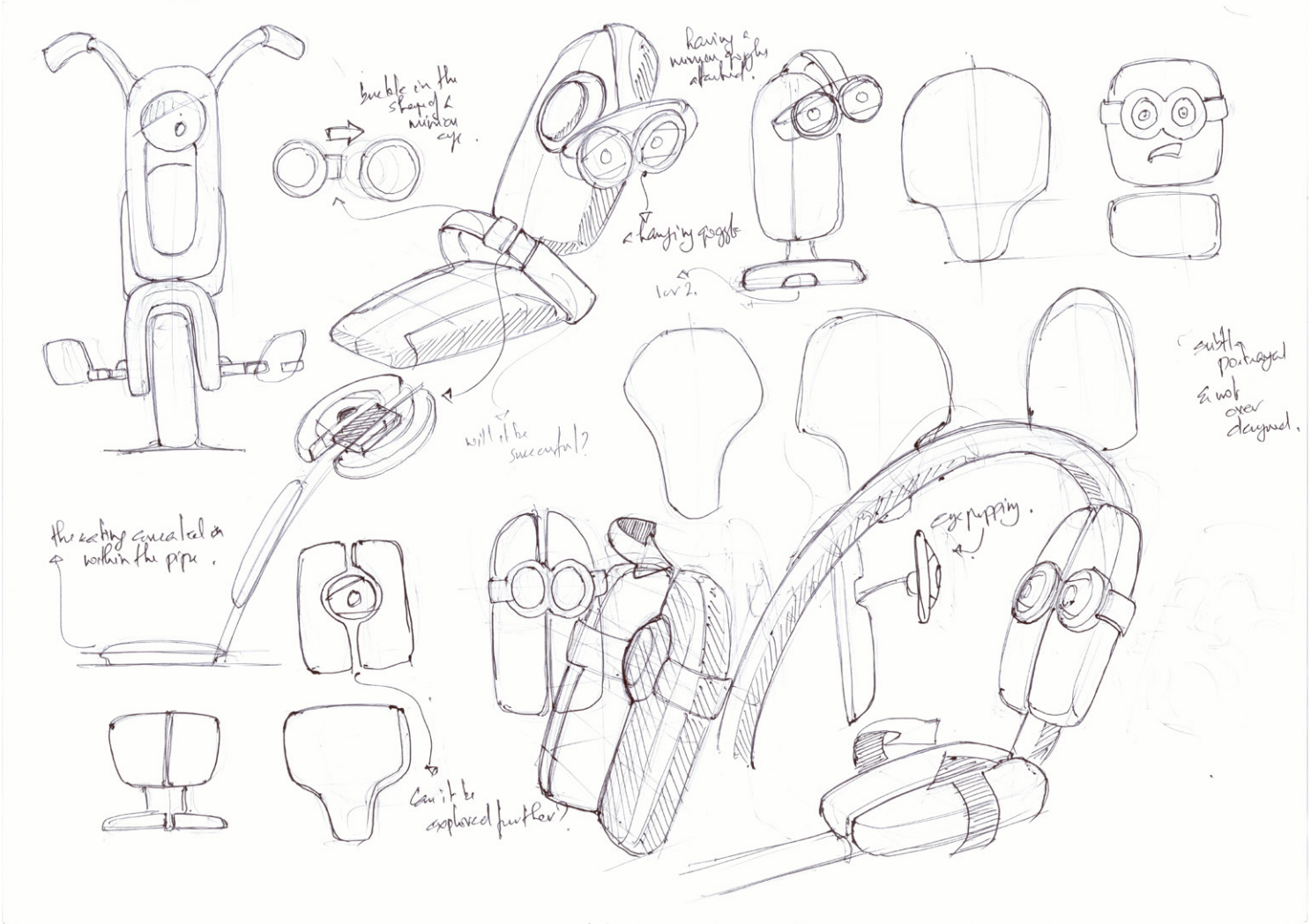


Fig 61. *Kids seat exploration*

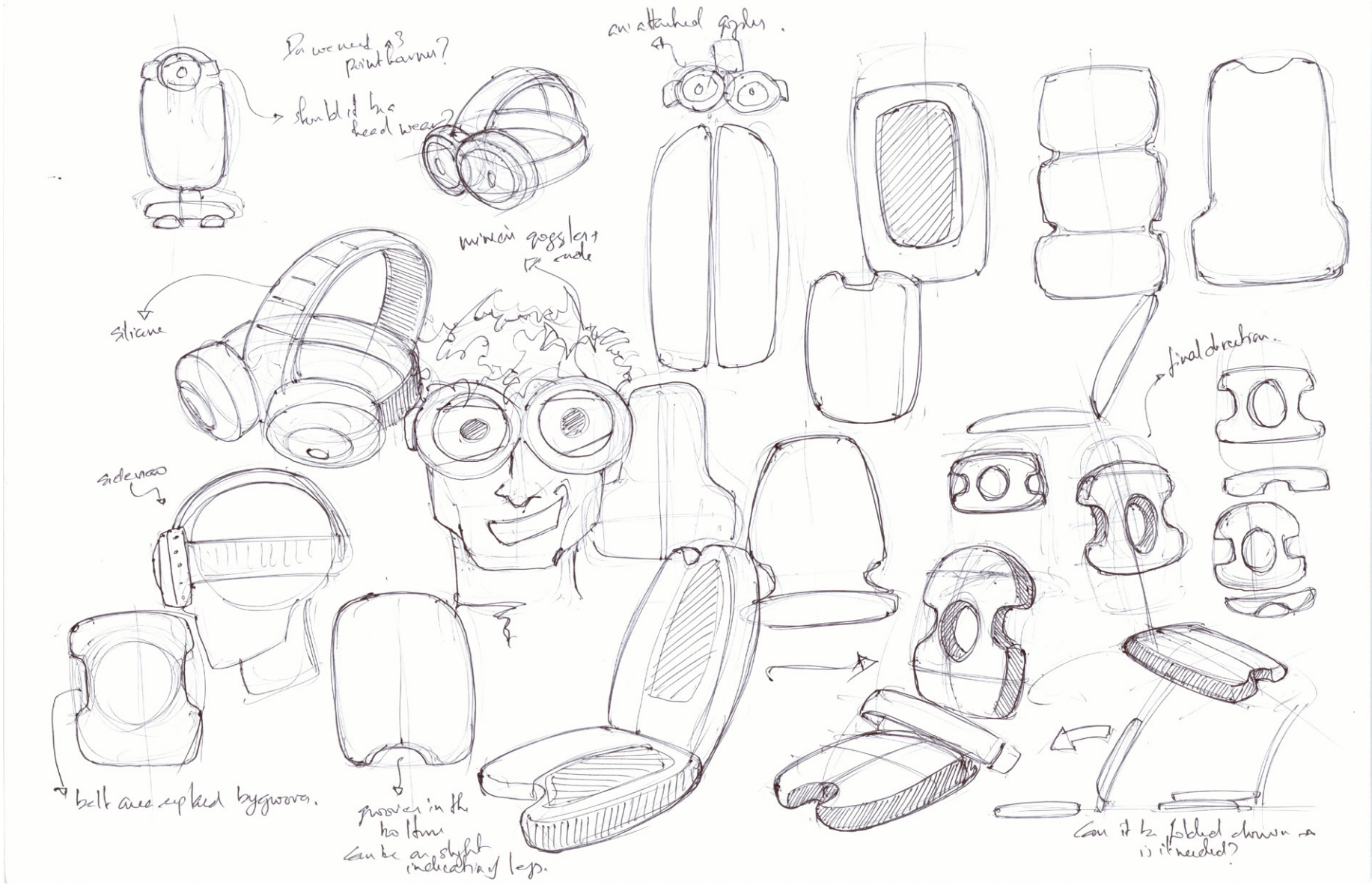


Fig 62. *Kids seat exploration - final*

Spokes

Few shapes which characterised the minions were observed as subtle curves and circular shape. spokes ideations were done to see how similar characteristics could be brought into the design.

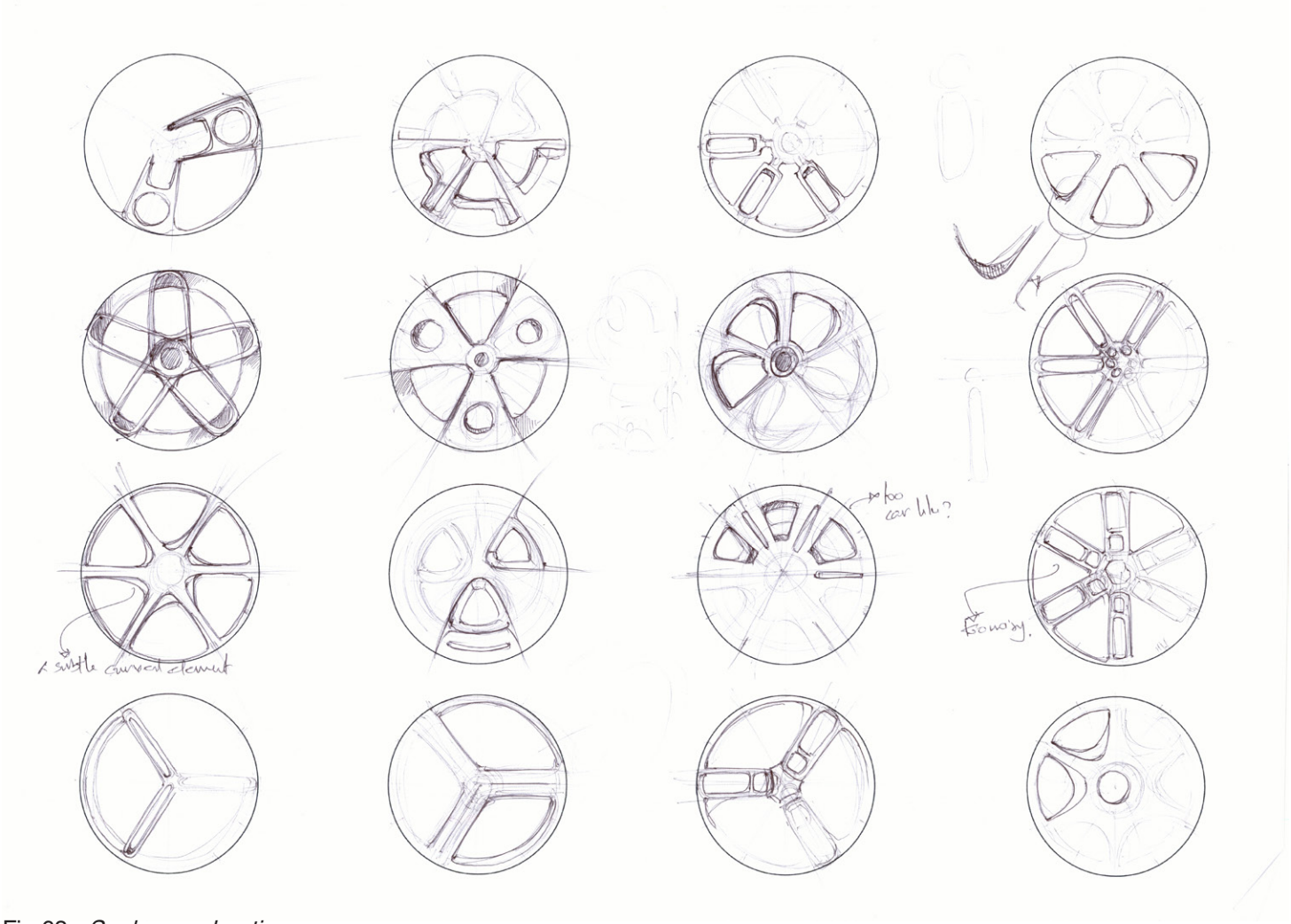


Fig 63. *Spokes exploration*

Detailing: Chain case

Chain casing

Chain casing is one element which are often forgotten as a visual piece to play with, and is often seen just as normal cover. ideations were done to see how similar character could be brought into the design of chain case.

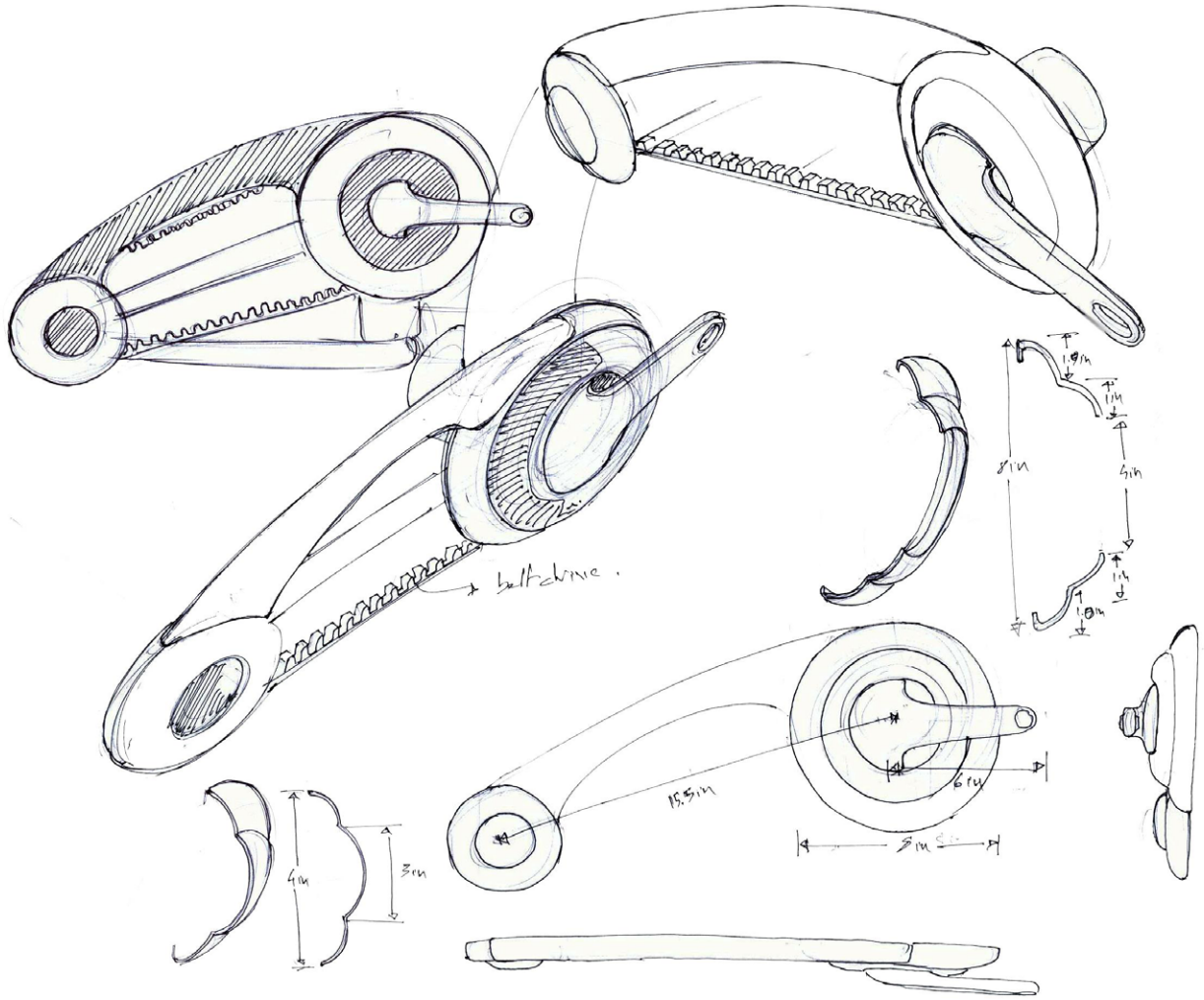


Fig 64. *chain guard details*

Detailing: Joinery

Joinery details

Since the head tube design consist of an elongated closed loop, it had to be split into two - one to connect to the top tube and another to connect to the down tube. Other joinery details that had to be taken care of was the one between curved seat post and the top tube.

Final design: Perspective sketch

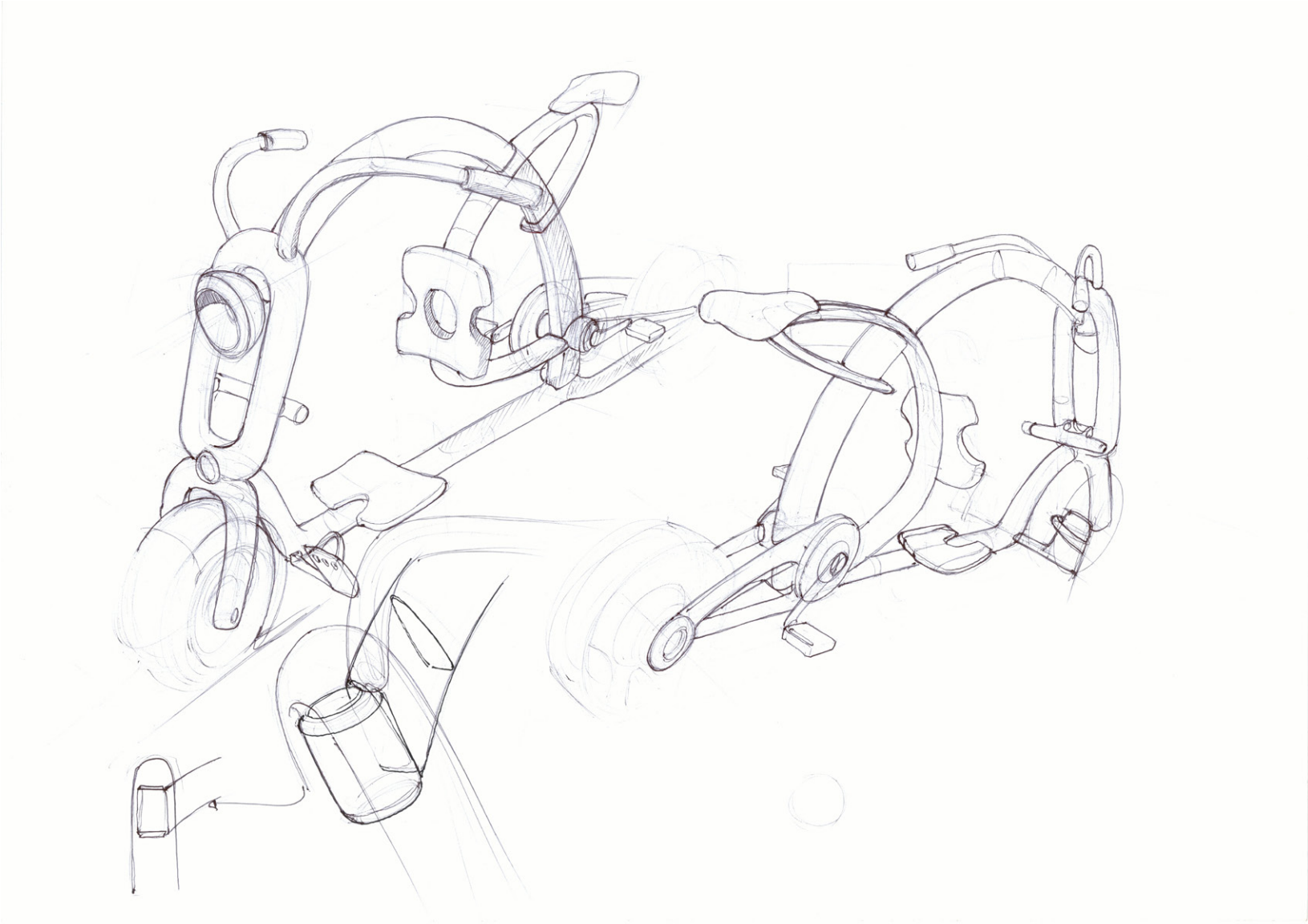


Fig 65. *final design - perspective*

Blue print of the design

A blueprint of the design was made after detailing for consulting with an expert in the field of bicycle fabrication. This was significant in communicating the design as well as getting an understanding of problems in detailing as well as getting an understanding of how the sections could be prototyped.

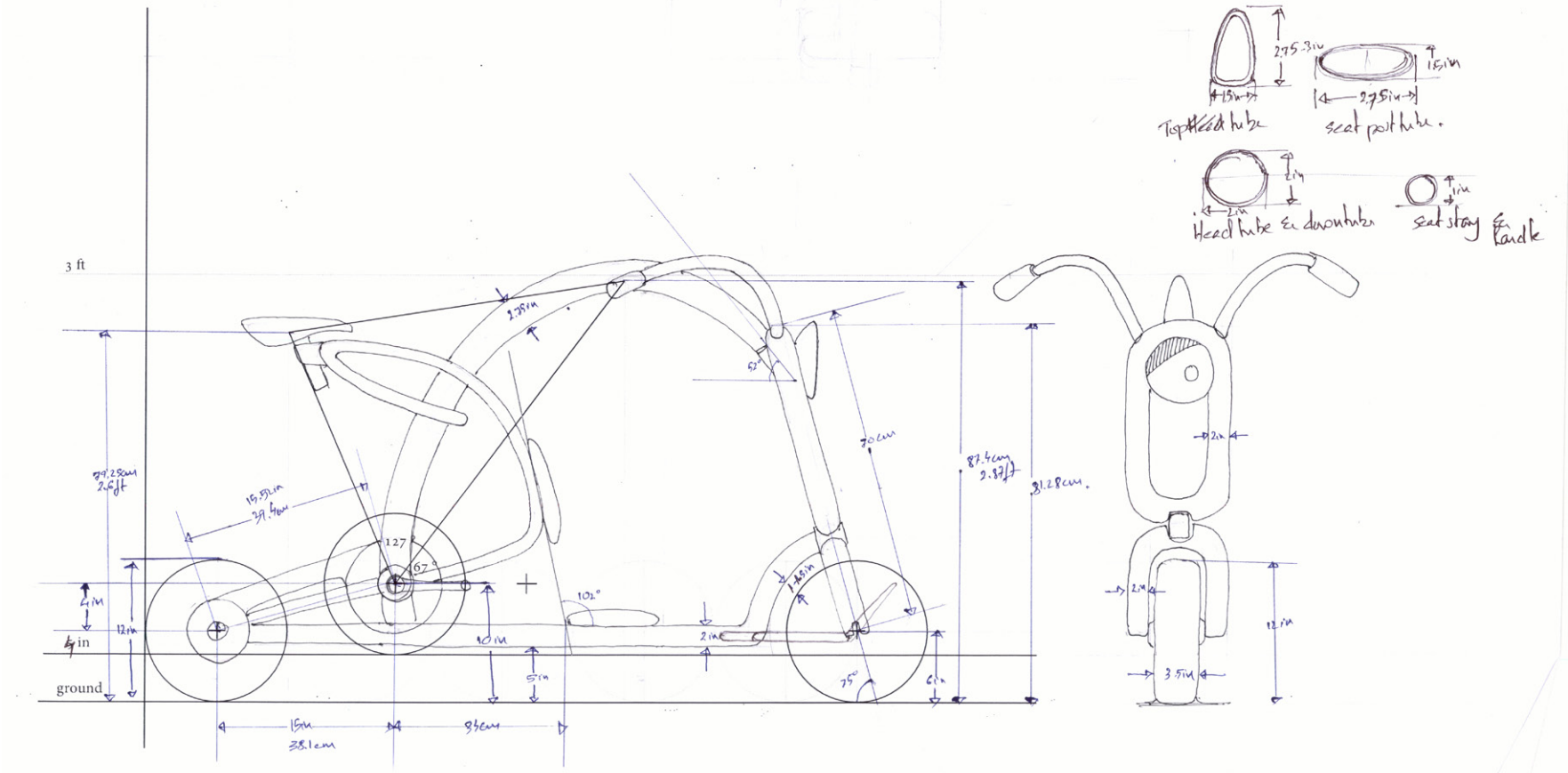


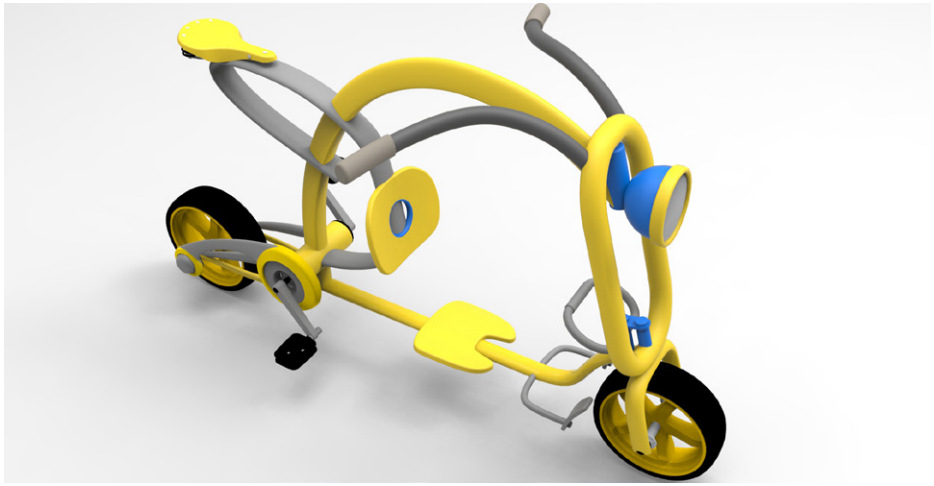
Fig 66. *final design - product dimensions*

Final: CAD

Final design features

- *Minion character inspired aesthetics (fun factor)*
- *Cruiser posture*
- *Reduced pedal radius - minion like pedalling fashion*
- *Single speed belt drive*
- *Frontal space for the child (6-8 years)*
- *Reduced ground clearance provide easy ingress for the child*
- *Minion helmet attached to the kids seat (rider becoming the character)*

Final: CAD



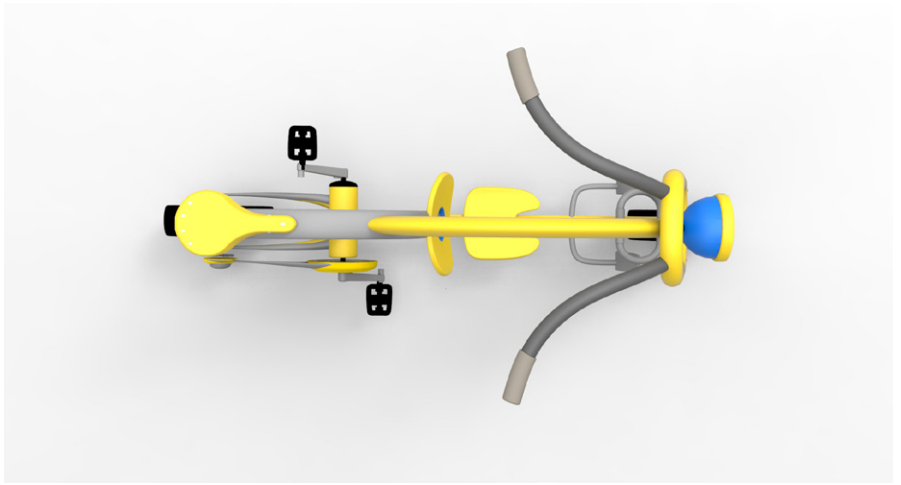


Fig 67. *final design - different views*

Final: CAD

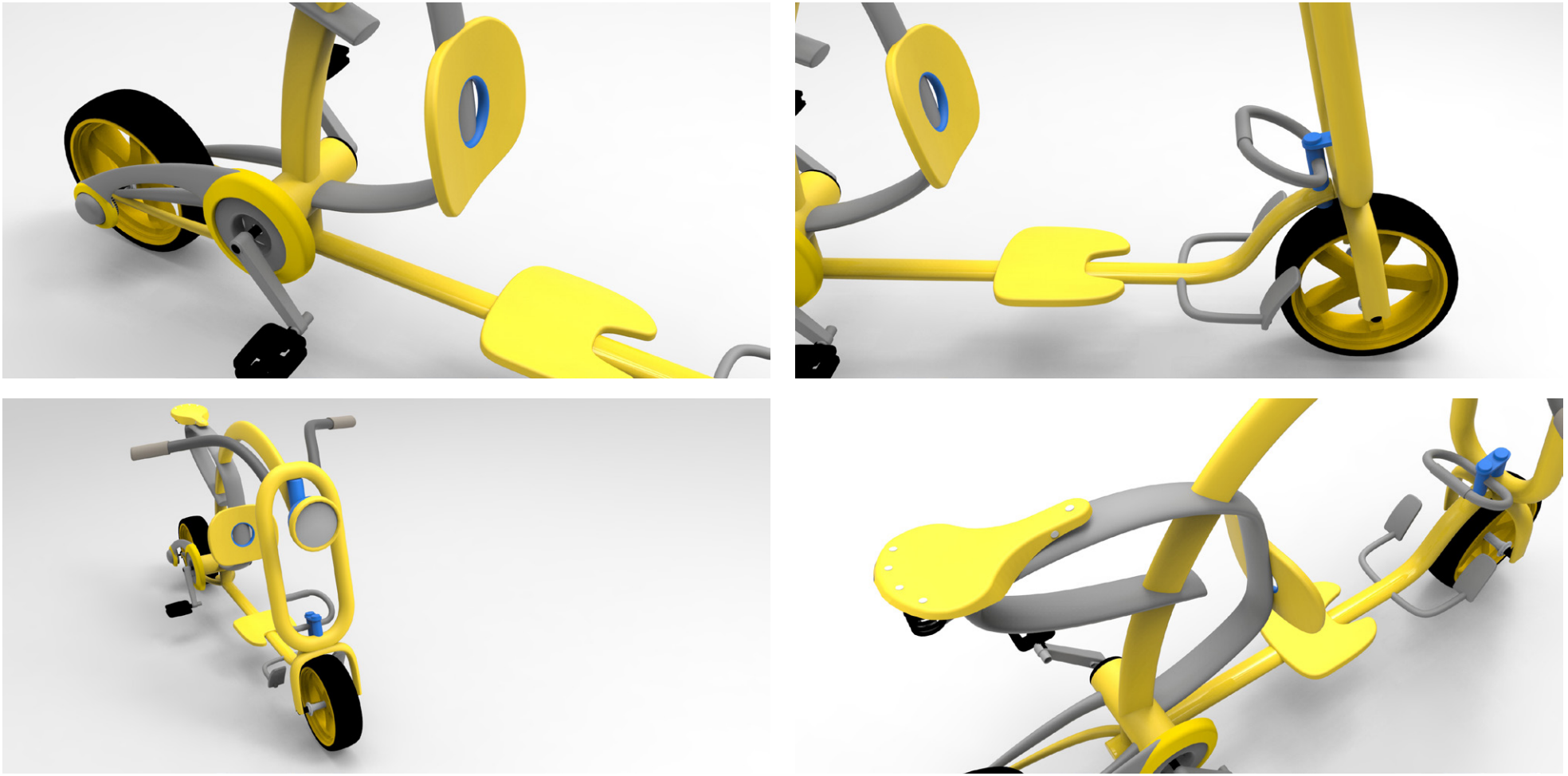


Fig 68. *final design - details*

Expert input

Synergizing with an expert was one of the major learnings in the whole design process. An expert frame builder was consulted to brief the design, so as to gather his insights into the design. This gave an idea of what is right and what is wrong in the detailings as well as understanding how various parts could be prototyped with the given constraints.

One of the major insight gathered during the collaboration was how to approach the prototyping of the bicycle and what all things to keep in mind while adjusting the frame.

Prototyping

Materials and process:

1. Materials

Bicycle frame building normally revolves around steel, aluminium and its alloys, titanium carbon fiber etc as material choices - the details of which are mentioned in the secondary research section (Pg. No 14). Of these, stainless steel was prefered as the material for prototyping mainly for the following reasons:

– *Ease of availability of machinery and expertise*

– *Robust nature of the material makes it apt for an environment which is prone to public abuse.*

– *Choice of various grades of steel which are lighter and stronger.*

2. Processes

Processes followed during bicycle frame building was researched to understand how it is done at an industry level and what all could be adapted from that considering the

unavailability of certain machines locally.

2.1. Hydroforming

Hydroforming uses highly pressurised fluid to form the metal into required shape. This also makes it lightweight, structurally stiff and stronger pieces. Hydroforming is essential in getting the required cross sectional shapes of the top tube (Fig. 66).

2.2. Tube Bending

Stainless steel tubes are exposed to CNC bending for its accuracy and effectiveness. Such a machine calls for huge investment which becomes viable only in case of bulk produce. This made hydraulic bending as the preferred choice for bending the stainless steel tubes (top tube, down tube, head tube and the seat post).

2.3. Tack welding

Tack welding is the process of making small welds at a distance from each other to hold together the edges. This is performed before the final welding as a provisional assembly procedure to fix the alignment if found to be incorrect. Incorrect assemblies are disassembled, realigned and tack welded again.

2.4. Calibrating

Frame building is a complex process which if misaligned even a bit, could seriously affect the maneuverability of the bicycle. In normal cases jigs are used to check the angles and alignment before completely welding the edges.

2.5. MIG welding

Metal inert gas welding is a welding process in which an electric arc is formed between the electrode and the metal which melts the workpieces and joins them together. This is commonly employed welding process for joining stainless steel parts because of higher welding speeds and greater deposition rates.

3. Prototyping

The prototyping went through the following steps unlike the regular manufacturing process:

– *Head tube was done by bending the top and bottom curves and MIG welding 2 straight tubes to get the required rounded rectangular profile. Handle tubes were also welded on to the head tube.*

– *Down tube was bend and welded to the rear forks and calibrated to get wheelbase right.*

– *Head tube was connected to the down tube and wheels were connected to check its movability.*

– *Top tube was bend and attached to the head tube at the top and bottom bracket at the bottom. These are calibrated and welded in position.*

– *A crankset was further fixed to again test the movability while pedalling the bicycle.*

– *Rear tube, once bend was calibrated to get the angle and curves right, further to which it was fixed to the top tube.*

– *Seat post tube which comes as a continuation to the rear tube was cut and welded and the respective position.*

– *An opening was provided in the seat post tube for the saddle to be fitted and adjusted.*

– *Footrest for the kid was welded to the down tube at the respective position, once the frame was completely set.*

– *Once the frame was painted, other parts were assembled (kids seat, saddle, footrest, chain guard, chainset, front and back fender, lighting, brake cabling (inline through the head tube) and brake lever.*

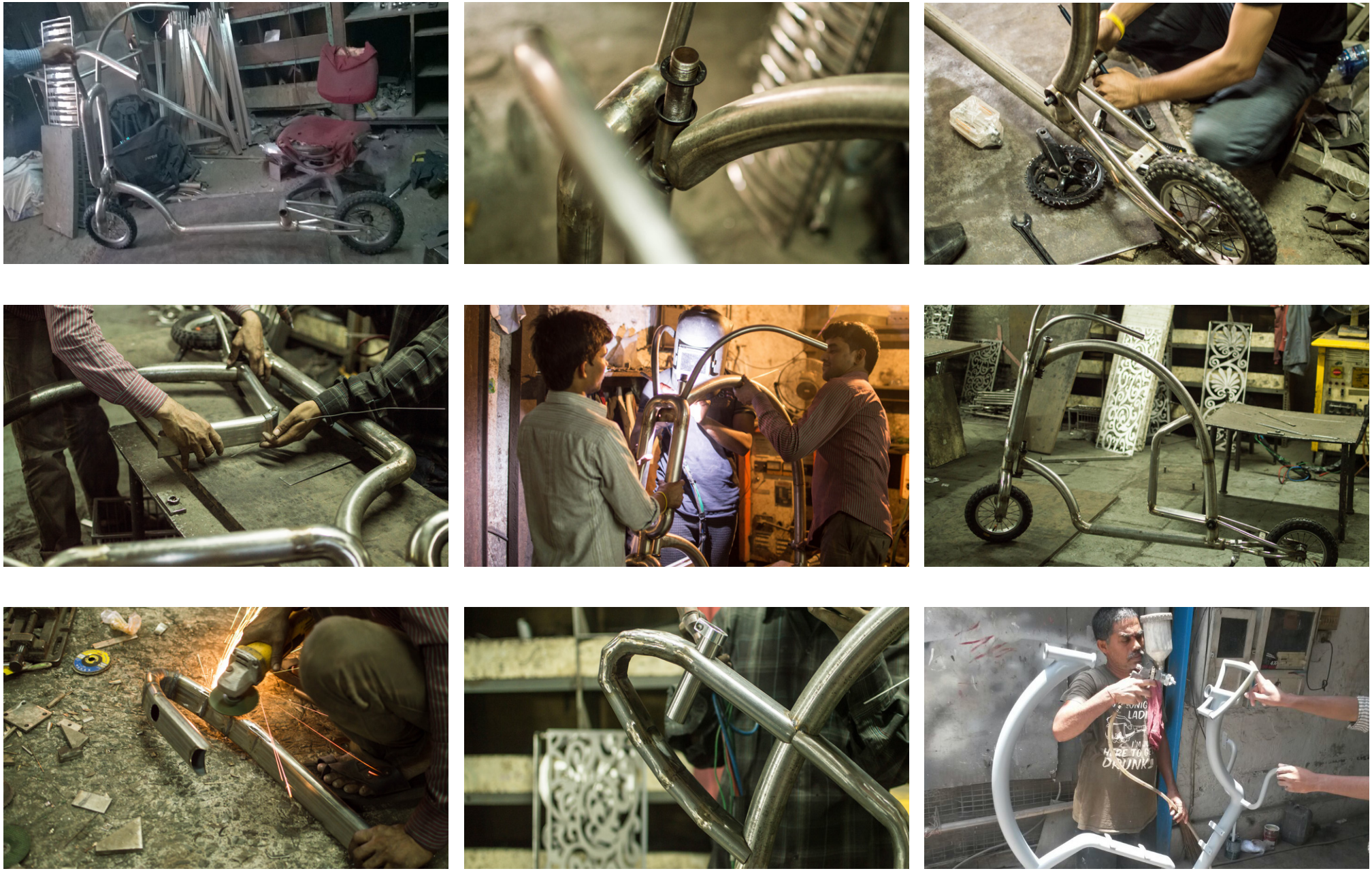


Fig 69. *Prototyping process*

Fig 70. *Final prototype*

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