

Higher Design Assignment: Educational Toy

Robert Veitch —

Candidates must only submit a design proposal for one Design Assignment task.

With reference to the *Product Design Higher, Design Assignment Guidance* document, the individual candidate should, **on no more than 8 single sided sheets of A3 paper:**

- produce a wide range of diverse ideas (15 marks);
- extensively develop the ideas towards a design proposal (30 marks);
- effectively communicate the idea generation and development throughout the folio (10 marks);
- clearly justify the reasons for decisions taken throughout the folio (10 marks);
- effectively communicate the proposed solution (5 marks).

Total 70 marks

Original (ie, not photocopied or scanned) **full size** work must be submitted.

Context:

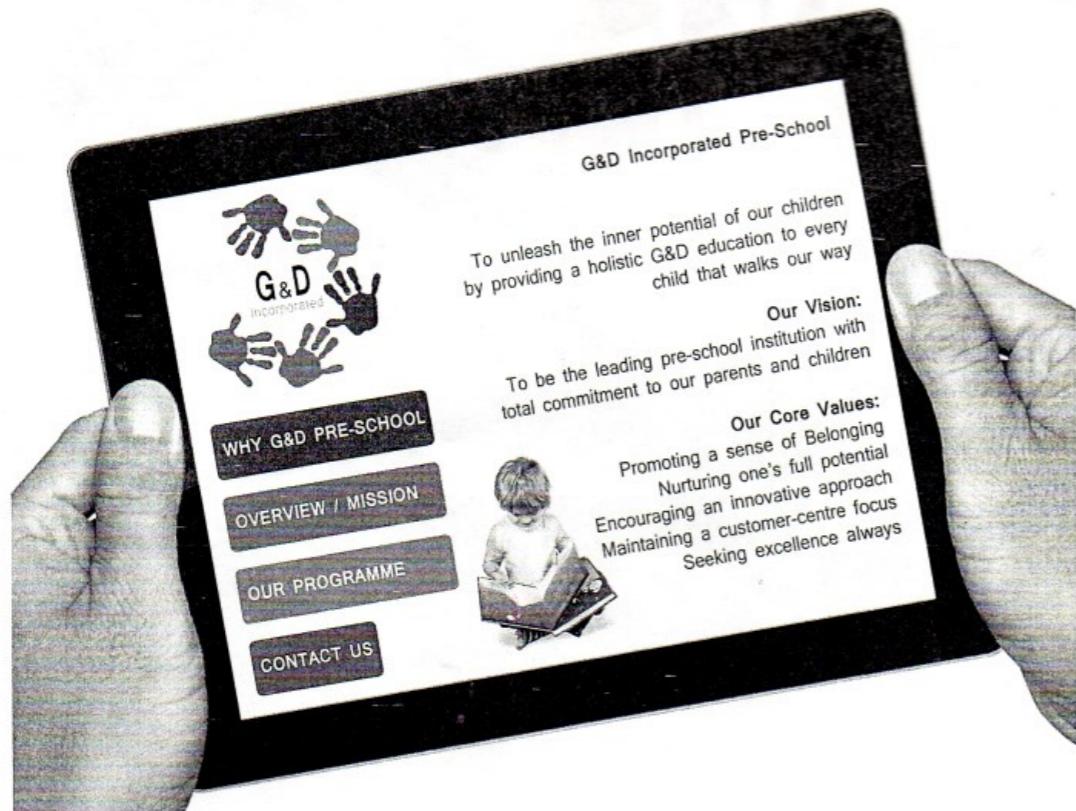
As part of the higher product design course in Scotland, we are required to complete a Design Proposal and a Design assignment.

The format of each is essentially the same but the Assignment is marked by the SQA (Scottish Qualifications Authority) as 50% of the final exam grade while the Proposal serves as a 'dry run', marked internally. Each time we are given a brief with four specifications for products which we must solve over eight A3 pages in a limited amount of time. Shown here is the front page of the assignment, outlining very briefly, the requirements of the folio.

For my design assignment, the task was to create an educational product for the faux company G&D who specialise in childcare and development who are looking to introduce a new system of integrated educational products for infants similar to the 'Curriculum for Excellence' scheme in use in the UK. The choices of products to design were; Educational Toy, Educational Seating, Item storage and an Outdoor Play Area. I choose lighting design as I saw it to have the most potential for innovation and engineering ability.

In this document I have scanned and photographed each of the eight sheets and added annotations with explanations of annotations which are too small to read and the format of a proposal/ assignment by Eastwood High School's standards. At the back pages I have scanned in sketch work and early development.

This assignment scored full marks making it the highest scoring assignment of any Eastwood Student.



As the needs of parents and society have changed, the demand for pre-school provision has increased. Owing to this increased demand, G&D Incorporated have decided to expand their network of pre-school centres in Scotland.

G&D's pre-school network caters for all children from the age of 2 to 4½.

Our Vision

To ensure that children and young people develop the knowledge and understanding, skills, capabilities and attributes which they need for mental, emotional, social and physical wellbeing now and in the future.

Learning enables children and young people to:

- make decisions in order to improve their mental, emotional, social and physical wellbeing
- experience challenge and enjoyment
- experience positive aspects of healthy living and activity for themselves
- apply their mental, emotional, social and physical skills to pursue a healthy lifestyle
- make a successful move to the next stage of education.

In order to realise the G&D vision, a number of products are needed for our centres.

CHOOSE ONE OF THE FOLLOWING DESIGN TASKS

DESIGN TASK 1—Educational Toy



Letting a child play with an educational toy or game can help develop their physical, social, emotional, and cognitive skills. It can also enhance creativity. Some toys can expand other skills such as spelling, reading, language and mathematics.

An educational toy is required to form part of the play equipment used by the children.

The specification for this product is as follows:

1. Function

- 1.1 It must have an educational value.
- 1.2 It must be able to be stored easily.

2. Safety

- 2.1 It must be easy to clean and maintain.
- 2.2 Any moving parts must avoid finger traps.

3. Materials and Manufacture

- 3.1 Materials must be durable but lightweight.
- 3.2 Materials and finishes used must be non toxic.
- 3.3 It must be suitable for commercial production.

4. Ergonomics

- 4.1 It must be suitable for the intended users.

5. Aesthetics

- 5.1 It must come in colours, patterns and shapes that appeal to young children.
- 5.2 It must incorporate the G&D logo.



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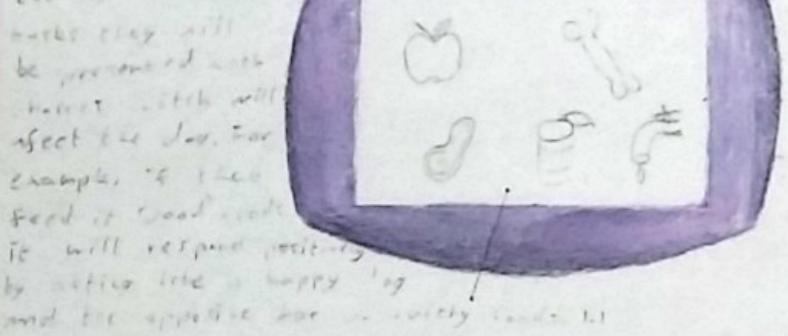
This design aims to educate children about health and well-being aspects of a dog's behaviour in a controlled manner. 1.1

The dog has the ability to walk, move its head and tail and make sounds to fully simulate a real dog. 1.1

The head is equipped with two cameras and infrared sensors so that it can awareness its environment. Its software includes motion-sensor software similar to Microsoft's Kinect sensor to allow it to interpret and respond to gestures and actions as well as movement obstacles. 1.1, 1.2

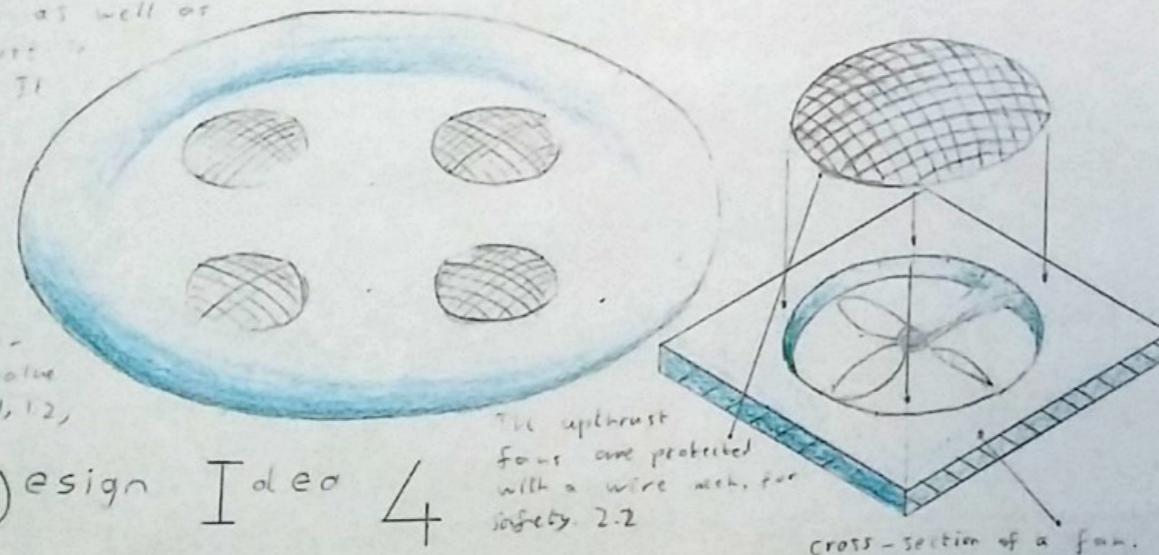
It is also equipped with facial recognition to ensure it does not single out one child software will try to regulate the attention of people to individuals. 1.1

Computer controlled software allows the teacher or caretaker to activate and deactivate features. A rugged tablet such as this allows children to interact with it by completing such tasks as feeding it. In such



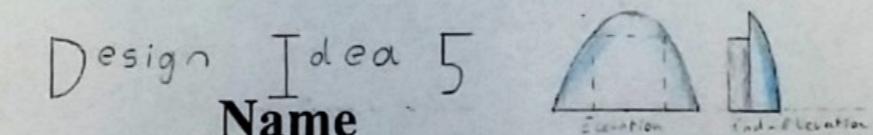
This design aims to teach health and well-being, as well as promoting an interest in physical activity. It can be used as a flying disc but uses four fans to slow its fall to the ground for use as a throw-and-catch toy or simply for comic value for the child. 1.1, 1.2

Design Idea 4



The upthrust fans are protected with a wire mesh for safety. 2.2

Design Idea 5



Name _____

Design Task No _____ Page _____

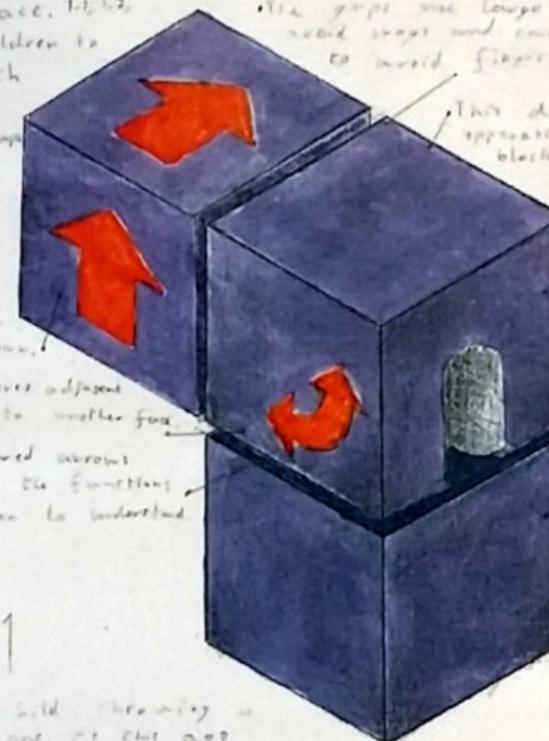
This design aims to give children an insight into simple physics and mechanics as well as stimulating an interest in mechanics and engineering. Made up of modular blocks which can be joined together, each block will have a specific action such as moving an adjacent block or moving another block to a different face. 1.1, 1.2

It encourages children to experiment with what they can create, for example a multi-moving vehicle. 1.1

This block rotates adjacent blocks in the direction shown.

This block moves adjacent blocks 90° to another face.

Large, coloured arrows make clear the function for children to understand 1.1.

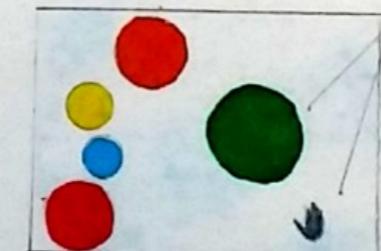


Design Idea 1

Shown here is a diagram of a ball throwing a regular flying disc and this one. At this age children have little motor control and are incapable of playing with just two, but the additional upthrust allows them to. 1.1

Design Idea 2

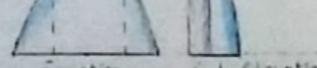
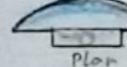
This design teaches children a range of emotions depending on their ability. It utilises sensory technology similar to Microsoft's Kinect sensor to allow children to interact with a projected image. 1.1



This image demonstrates a plastic program which uses standing infrared sensor in front of an open hand or an open palm moves in sync with them and can interact with bubbles in a weighted manner. 1.1.

Sensory equipment is concealed behind an opaque strip cover. 3.3

This unit could be used to develop autistic children and increase environmental awareness. 1.1, 1.2



This design teaches children motion and not static by utilising a parallel slanted pad and a car train which will follow after the child draws. 1.1

A small camera mounted under the train can differentiate between what the child draws and the white background to change direction accordingly. 1.1

The paint technology is the same as 'show-me' white board and pens. 1.1, 1.2 can be wiped off with cloth. 2.1, 3.1

The mat can be rolled for ease of storage. 1.2

Design Idea 3

DI 6 can be used in a number of ways, each of the six may be assigned to a person represented by a small tag, one with minor imperfections such as a clear difference between each. 1.1, 1.2

Design Idea 6

Children could be asked to separate healthy emotions from unhealthy and to show emotional development and control. 1.1

They could also be used to teach children to identify emotion in others.

stimulation social development 4.1



These two show anger and happiness, the two most commonly recognized 4.1



The 'emotions' we associate with bean-bags, felt filled with small, irregular balls. Contained within each is a small button that when pressed will make a noise to be associated with that emotion. 3.1, 3.2, 3.3

Candidate No _____

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This design aims to educate children about health and well-being and animal care through this interactive, robotic dog which will simulate aspects of a dogs behaviour in a controlled manner. 1.1

The dog has the ability to walk, move its head and tail and make sounds to fully simulate a real dog. 1.1

The head is equipped with two cameras and infrared sensors to give it an awareness of environment. It's

software includes motion-sensor software similar to Microsoft's Kinect sensor to allow it to interpret and respond to gestures and actions as well as

maneuver obstacles. 1.1, 4.1

It is also equipped with facial recognition to ensure it does not single out one child; software will try to regulate the attention it pays to individuals. 4.1

Computer controlled software allows the teacher or caretaker to activate and deactivate features. A rugged tablet such as this allows children to interact with the dog completing such tasks as

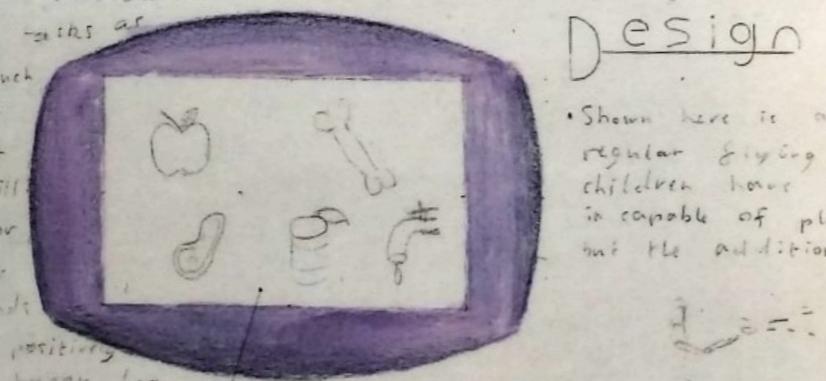
feeding it. In such tasks they will be presented with correct switch will affect the dog. For example, if they feed it bread rolls it will respond positively by acting like a happy dog and the opposite for unhealthy foods. 1.1

This design aims to teach basic motor skills, hand-eye coordination and sociability as well as

promoting an interest in physical activity. It can be used indoors

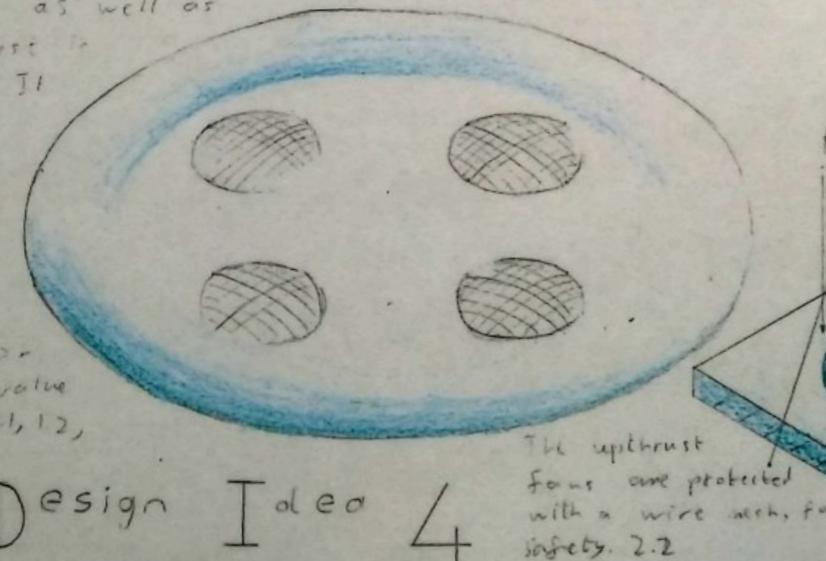
lying, sitting but uses your joints to allow it's fall to the ground for use as a throw-in-a-basket toy or simply for comic value for the child. 1.1, 1.2,

Design Idea 4



Design

• Shown here is a design idea for children have little in capable of playing but the additional

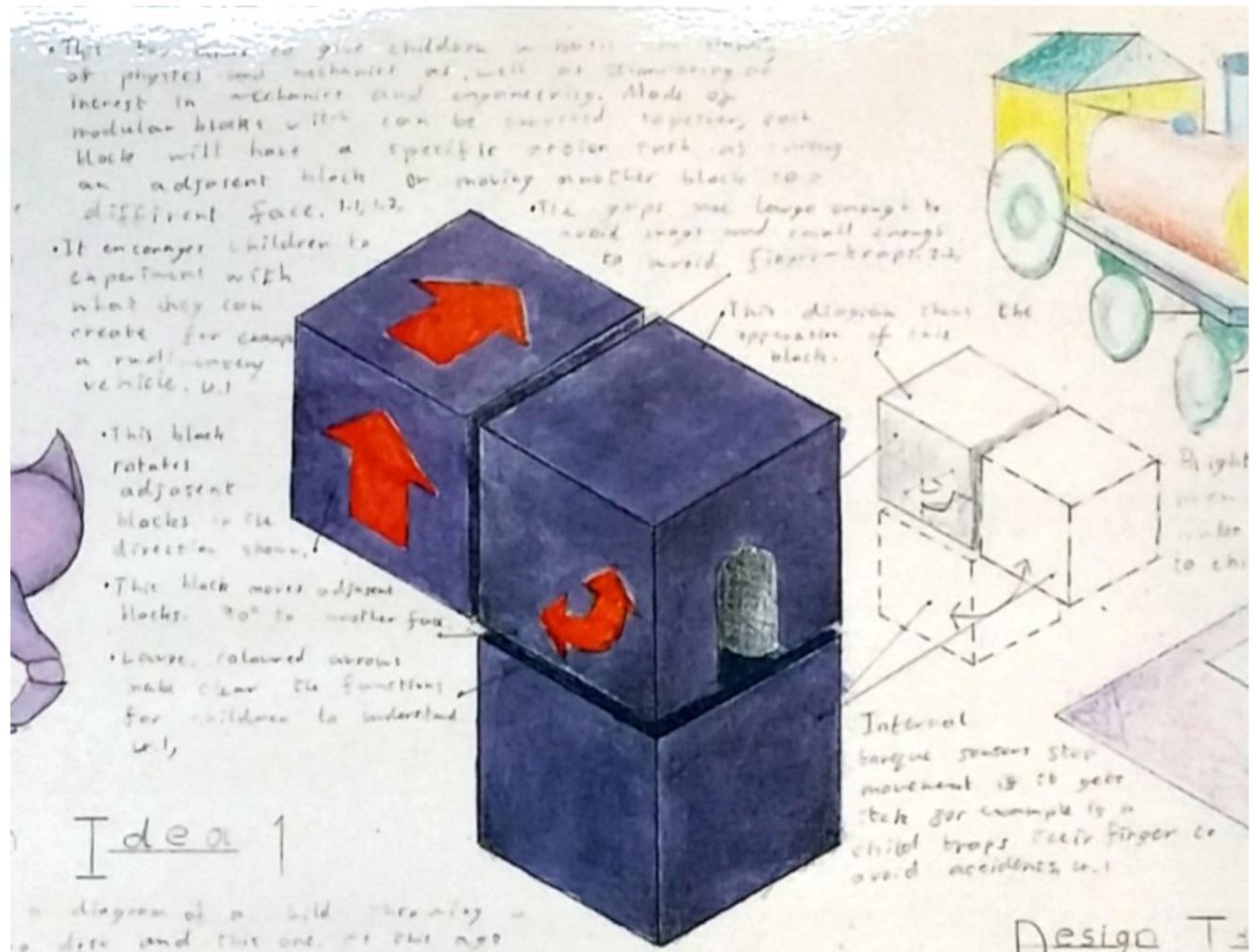


The upthrust fans are protected with a wire mesh, for safety. 2.2

The first of my six initial ideas was in essence, a toy robot dog which would remain active permanently during the day and interact with the children in much the same way a real dog would but under controlled conditions. During my research I noted how, in the specified age group, toys which build empathy and social interaction were very popular and useful. I also noted the effect which animals had on developing these skills and traits was considerable, especially if the child has a mental disorder such as autism so I conceived of a way to emulate this effect without the unpredictability and danger of a real animal.

The initial idea involved little direct interaction with the dog, the user would interact with the small tablet included and the dog would act with limited responses.

Also shown here is design idea four, a physical activity toy which used rotors to create up thrust, allowing it to stay in the air for longer periods of time. I noticed during my research that there were few physical activity toys for children of that age range (2–4.5 years old), understandably. Children of that age have very little motor control and are mostly unable to use such toys which I saw as an opportunity. The up thrust on this design allows the child to throw it without much requirement for effort or coordination to give them the opportunity for physical exercise and engage an interest in physical activity from a young age.

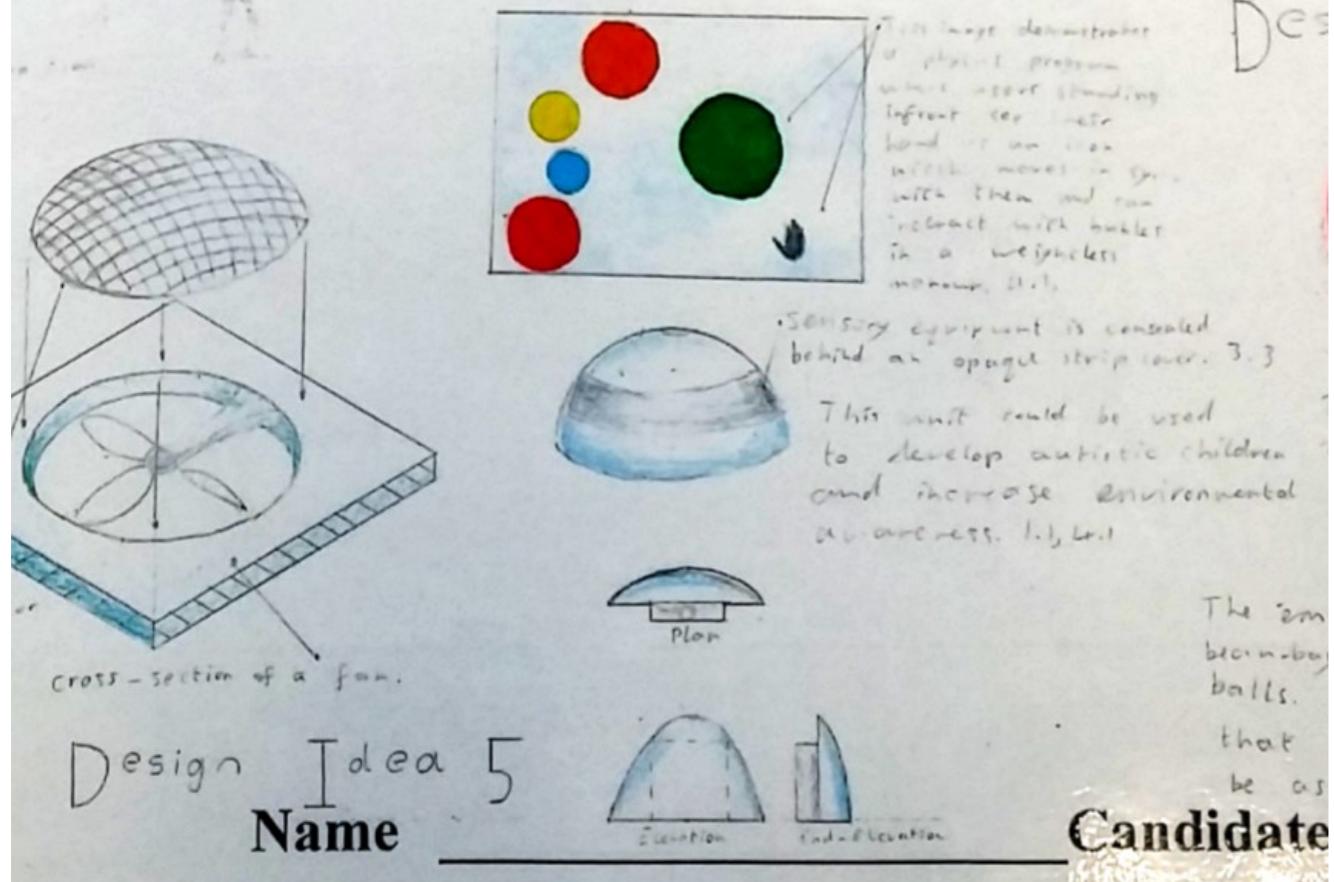


Idea 1

A diagram of a child swimming in a pool and this one. It has a soft little water control and one playing with just feet. 6, 7, 8.

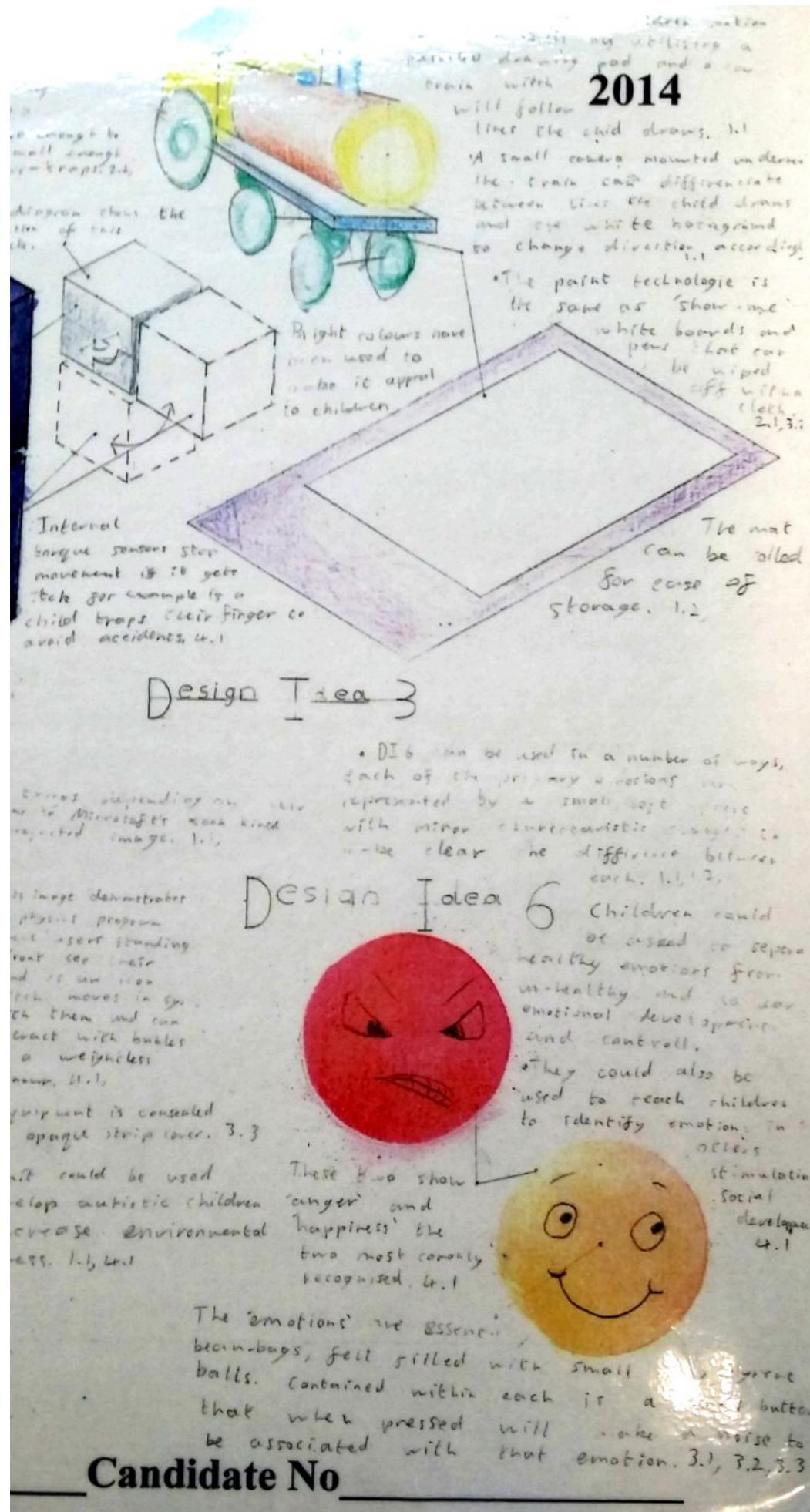
Design Idea 2

This design teaches children a range of zones according to their ability. It utilises sensory technology similar to Microsoft's Kinect to allow children to interact with projected images. 1, 2, 3.



Design idea two involved using modular components, each with a specific function such as rotating, pivoting, extending and retracting etc. to give the children a basic understanding of and interest in physics and engineering. The idea was eventually rejected due to the number of moving parts and finger traps which I thought made it unsuitable for younger children.

Design idea five is similar in that it utilises motion tracking technology to allow the children to interact with basic programs which would be projected onto a screen or wall. The programs would range in difficulty and function to serve different purposes, the example given here being a physics program where shapes float weightlessly, bouncing off each other and the walls. Users can push or grab them with the hand icon representing their real hand's relative position in the air. This develops very early motor skills as well as hand-eye coordination and understanding of physics.



Design idea three aimed to develop the child's creativity in a way which would yield immediate results to improve esteem. The unit would comprise of a mat which uses inkless colour drawing similar to current drawing mats on the market currently. The second component would be a small train, which would follow lines drawn on the matt. This allows the child to be artistically creative while giving the immediate satisfaction of watching the train follow their determined path.

Design idea six again focusses on conditions like autism where children have difficulty interacting with people or other children. In essence, it consists of small circular objects, each representing a different emotion, two basic examples, 'happy' and 'angry' are shown here. Each type would have a different expression and colour based around the same basic theme as well as being constructed from different materials and different textures. The result of this would be physical representations of emotions which the child could associate with. This could then allow their carer to use them as games, or to explain emotions to the child or for the child to communicate emotion.

EHS Higher Design Assignment

2014

Specification	Design Ideas											
	Idea 1	Idea 2	Idea 3	Idea 4	Idea 5	Idea 6						
1.1 It must have an educational value.	This unit promotes children's social as well as physical development as well as emotional development and relaxation.	This unit develops a child's understanding of objects and artistic motor control.	This design features a central development component of objects and artistic motor control.	This unit helps social development and motor control development through regulated rotational play.	This design promotes social and emotional development through play.	This design promotes social and emotional development through play.						
1.2 It must be able to be stored easily.	The unit is roughly 200 x 200 x 20 so it could be difficult to store.	This design features many individual parts that could be hard to store.	The board is wide so cannot be stored easily.	The board is roughly two-dimensional for permanent pieces and storage is made easy.	This design is useful for permanent pieces and storage is made easy.	This design can be easily stored in a large container as each is 50mm in size.						
2.1 It must be easy to clean and maintain.	The unit is relatively waterproof so can be wiped clean.	The units rotors are made from plastic which cannot be cleaned easily.	The units rotors can be partly disassembled for cleaning.	This design is technical in nature and cannot be repaired or maintained.	This design can be stored in a roller carrying case to maintain.	This design can be stored in a roller carrying case to maintain.						
2.2 All moving parts must avoid finger traps.	The units moving components move perpendicular to surfaces so avoid finger traps.	The blocks are spaced apart and may still cause finger traps.	The moving parts (the rotors) are safely covered to avoid accidents.	There are no moving parts in this design.	There are no moving parts in this design.	There are no moving parts in this design.						
3.1 Materials must be durable but lightweight.	The unit shell is mostly ABS which is durable but relatively heavy.	Each block is small and has an outer coating of high density polyethylene (HDPE).	This design is made of polycarbonate and is durable and somewhat light.	This design does not involve direct interaction.	This design is made of polycarbonate and is durable.	This design is made of polycarbonate and is durable.						
3.2 Materials and finishes used must be non-toxic.	ABS is non-toxic and there is no surface finish.	The hub may be made of metal.	There are no surfaces finishes and polycarbonate from blocks.	This unit is rarely interacted with and is non-toxic.	There are no finishing materials like cables or non-toxic.	There are no finishing materials like cables or non-toxic.						
3.3 It must be suitable for commercial production.	The use of the unit are to be out of abundance price range.	The unit utilises existing tools as most ubiquitous techniques are used.	The shape is sympathetic and uses standard components are used.	The shape is very simple but lost techniques already used in other products.	The shapes are very simple on 50 centimetre.	The shapes are very simple on 50 centimetre.						
4.1 It must be suitable for the intended users.	The reason is sympathetic to can be understood by most children but requires 10th grade strength to operate.	The reason is easy to use and engaging for young children.	The core principle of this design is to make physical activities available to all children.	The interface needed may be beyond the ability of all children.	The interface is not suitable for all children.	The interface is not suitable for all children.						
5.1 It must come in colours, pattern and shapes that appeal to young children.	The colours are quite dull however children will eventually recognise and engage with it day shape.	The shapes are simple but the colours are appealing.	The base is cartoon styled and features a range of colours.	The unit is normal in a range of bright colours to appeal to young children.	This unit may not appeal to children as it depends on age.	This unit corresponds bright colours and geometric shapes to appeal to young children.						
5.2 It must incorporate the GED logo.	This unit does not incorporate the GED logo.	This unit does not incorporate the GED logo.	This unit does not incorporate the GED logo.	This unit does not incorporate the GED logo.	This unit does not incorporate the GED logo.	This unit does not incorporate the GED logo.						
Total	34 50	68%	35 50	70%	29 50	58%	31 50	78%	23 50	46%	41 50	82%



Design Task No _____ Page 2

Name Robert Leitch Candidate No _____

On the second page I evaluated each idea in a conversion matrix to find the best or most promising solution. Each idea is a column in the grid and each specification point is a row. For each design and specification, a comment is written about how well the design fulfils that particular specification and is given a score out of five. The scores are then added up and a percentage can be calculated about how well the design fulfils the specification overall. There were 10 specifications in total so the designs were scored out of 50. This allowed me to pick the two ideas which we will take forward and develop, not necessarily the highest scoring ones but also not usually the lowest as they will likely never fulfil the specification fully. We then write an extended comment on the two ideas we have selected. As you can likely see here, design ideas three and five scored lowly while six scored the highest but I decided that idea one and four had the most potential.

Functional	through	5/5
be	on	0/5
as	is	16
in	be	5/5
ssary.	ssary.	5/5
o	o	0
is on	is on	0
made	made	5/5
and	and	5
5	5	0
cl and	cl and	5
5	5	0
ave	ave	5/5
so	so	5/5
to	to	5
parates	parates	5/5
and	and	5
9 to	9 to	5/5
does	does	5/5
rate	rate	5/5
%	%	0

Detailed Idea One scored 38 out of 50 initially. It scored 4/5 for its educational value as it was somewhat unspecific in function. It scored 2 out of 5 for ease of storage as it is an unusual shape. It scored 5 for being a simple, easy to clean shape. It scored 5 again for having no finger traps and 3 for its materials which were durable but not very suitable for specific softwear and component. The material makes it not suitable for high costs for specific softwear and component. The interface makes it not suitable for the intended users, so scored 2 out of 5 points. It scored 4 for the colours which were light and not very appealing to young children. It gained no points for not having a GED logo.

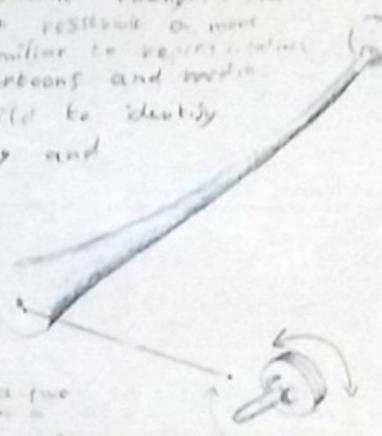
Design Idea Four scored 40 out of 50. It scored 5 for having a clear, educational value and 4 for being easy to store. It scored 5 for being a simple shape. It scored 5 for being light and durable. Due to the spinous rotors, cleaning is somewhat difficult - it scored 5 for not having any finger traps. The unit then scored a further 3 sets of 5 points for being light and durable, non-toxic and suitable for commercial production. While being somewhat unsuitable for the intended users, it may need to be less active to reduce risk of injury. The unit is only available in set colours so may be unappealing to some children. The unit scores 5 points if it does not feature the GED logo.

EHS Higher Design Assignment

In order to visualise the unit, I decided to sculpt a polymorph model to help. This scale model helped me to draw the unit from multiple angles and ensure sketches are consistent and accurate.

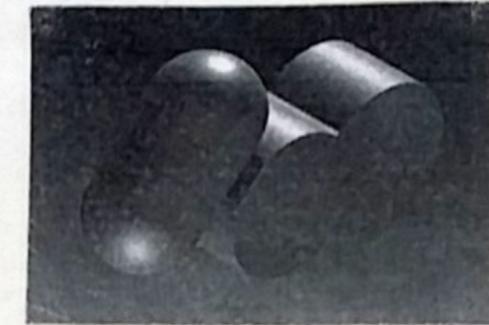


Along with the new aesthetic changes, the tail was changed to resemble a more cartoon-like shape similar to characters seen in popular cartoons and movies. This helps the child to identify the unit as a dog and make it appear friendly.



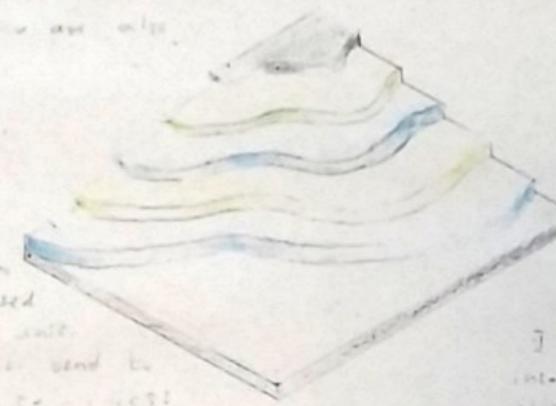
The tail is rotated as a five point universal motor as it rotates smoothly allowing it to wag or摆动 depending on its needs.

A simplified body shape will make the unit easier to produce and will make the unit more appealing to children. The new design is much simpler and funnier while exemplifying the muscle tone and general shape of a dog. **2014**



The drive from the motors housed in the main body is transferred by rubber band drive to the knee mechanism.

Casing
Insulator
Gel hole
Hinged



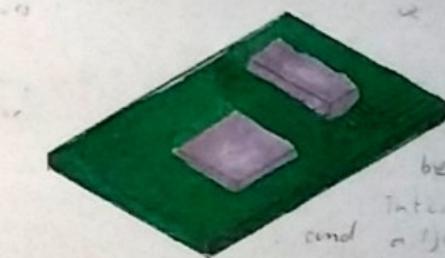
These changes reduce the unit's cost of manufacture by utilising simplicity and standard components.

With the new leg design, wheels can't used.

The legs will need to be low cost to keep the unit's cost down. Using it will use the wheels. This change improves stability around but is less precise movements and is less intimidating to younger and more sensitive children.

The wheels, like the joints, will be powered by standard component motors to keep costs down.

The motors will be low powered so that the wheel is a child friendly - to avoid accidents.



This will greatly improve interaction with the unit and adjust settings which was not previously possible.

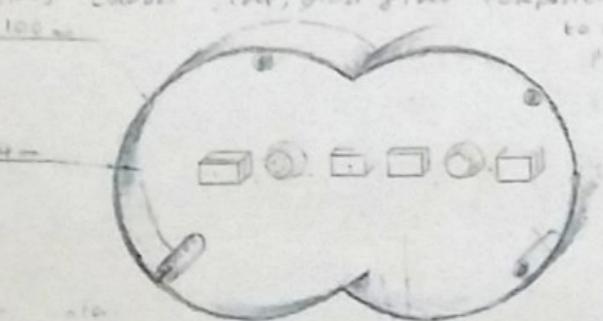
Polypropylene is a rigid, light plastic with lower resistance to impact and damage. It has the ability to be melted and has higher resistance.

HIPS is tough, resists chemicals and feels waxy. This would be a suitable choice for the shelf as using it is a certain depth.

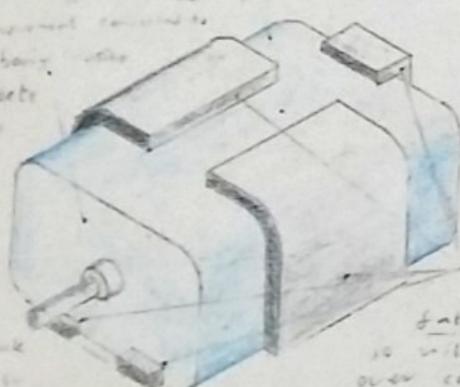
Acrylonitrile Butadiene Styrene is a very light, durable and strong, relatively resistant so would be very suitable for the shell of the unit as it will be treated roughly by children.

Small motors, sourced as standard components, were used to greatly reduce cost. The gears were made of polyamide so that lubrication is not necessary and weight is kept low.

The new body design is equally simple to keep cost of manufacture as low as possible. I narrowed the choice of materials to three options: Carbon fibre, glass fibre composite and ABS. I decided to use ABS as it is a thermoplastic plastic to minimise the process of injection moulding making it better for mass production.

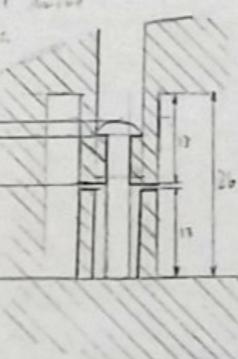


Standard motor will drive the leg and knee movement. A metal clip holds each motor apart as shown. They have been made of polypropylene as it is rigid so will hold the motor but has resilience to fatigue and bending. It will not wear out over continuous removal and replacement of the motors.



Using two motors will drive the leg and knee movement.

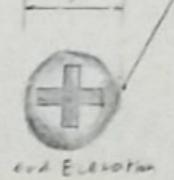
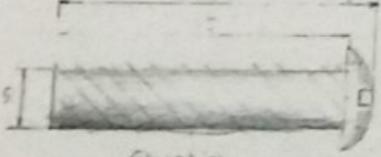
Stiff polypropylene clip holds each motor apart as shown. They have been made of polypropylene as it is rigid so will hold the motor but has resilience to fatigue and bending. It will not wear out over continuous removal and replacement of the motors.



The wheels will be polyamide so that lubricant is not required as they are durable on rough surfaces.

Glass-fibre epoxy resin composites are robust and brittle but very light. For their weight, while this would due the durability required for low cost, it may not be adequately impact resistant.

Carbon fibre composites offer the best strength of these three as well as the lightest weight however its high cost may prove difficult to manufacture it.



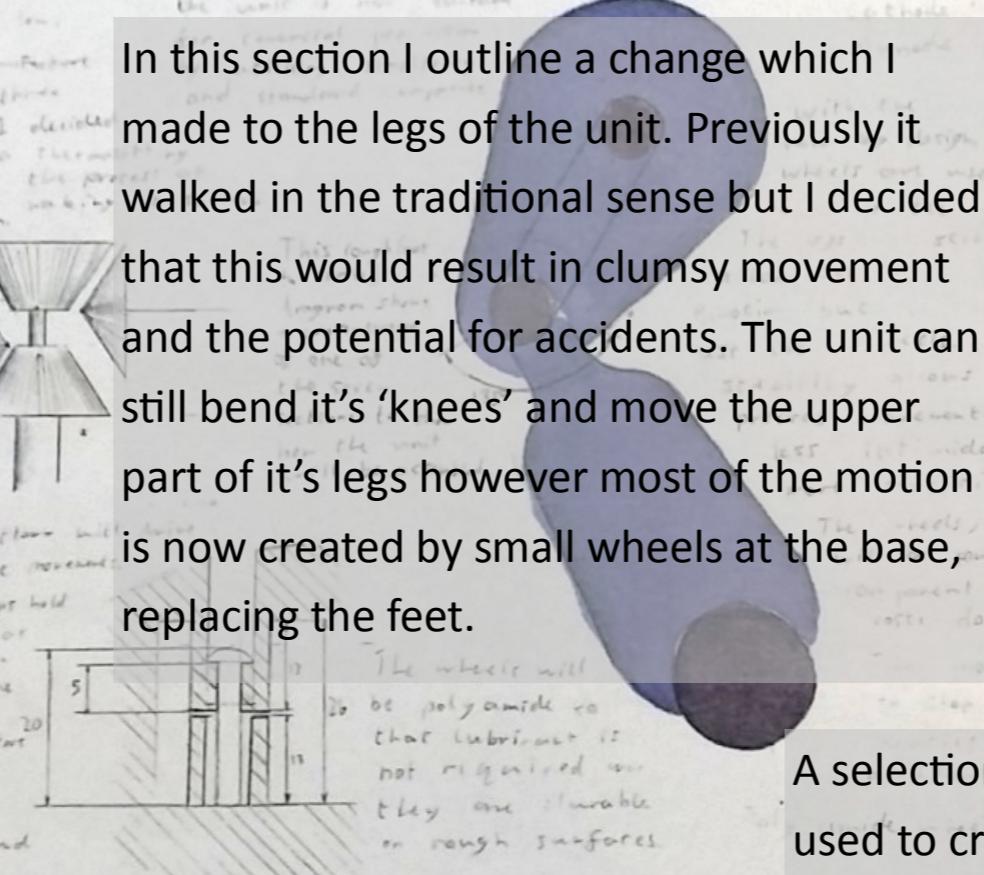
Standard component cross-head screws of dimensions shown would be used to secure the various components. They will be made from stainless steel so that it will not corrode and rust inside. Stainless steel's strength will ensure the gear is secure.

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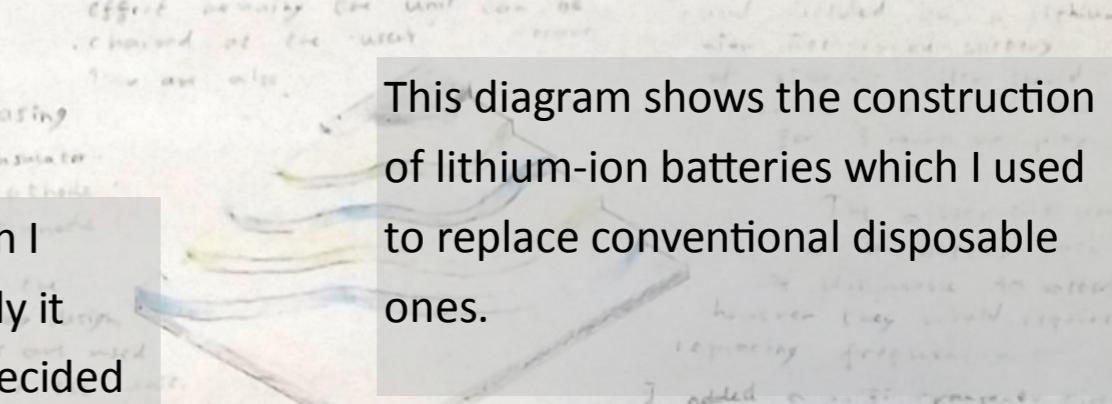
A small model I made from polymorph plastic to visualise the product in three dimensions.



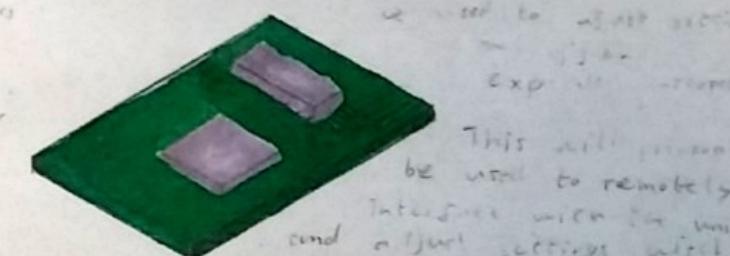
This section gives minor details about the construction of the unit, giving engineering specifications and showing how I intend to control the legs via small motors which could be replaced easily. It also gives exact dimensions and tolerances for manufacture.



In this section I outline a change which I made to the legs of the unit. Previously it walked in the traditional sense but I decided that this would result in clumsy movement and the potential for accidents. The unit can still bend its 'knees' and move the upper part of its legs however most of the motion is now created by small wheels at the base, replacing the feet.

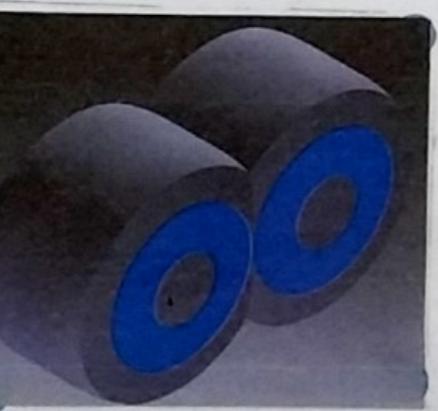
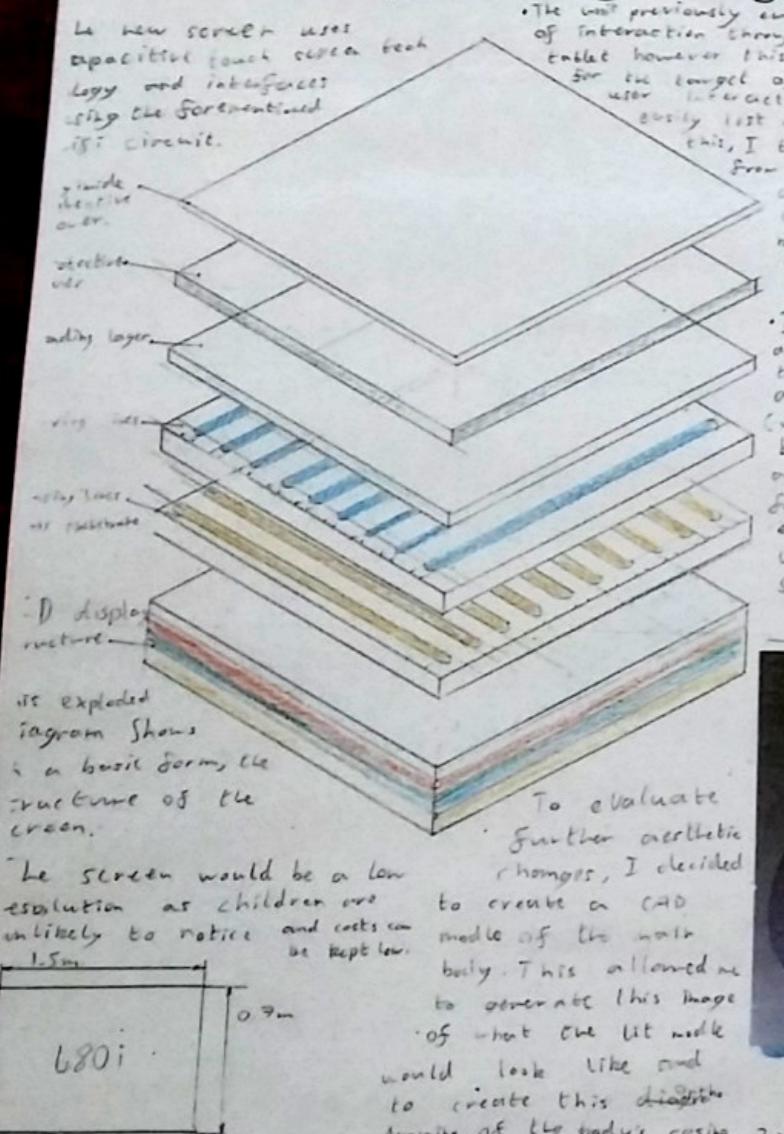


This diagram shows the construction of lithium-ion batteries which I used to replace conventional disposable ones.



A selection of different materials and samples which could be used to create the outer shell and a comparison in which I explain my reasons for using ABS and PLA. PLA is a biopolymer making the unit easier to recycle once it's lifespan has elapsed and ABS provided the shock resistance necessary for a nursery environment.

EHS Higher Design Assignment



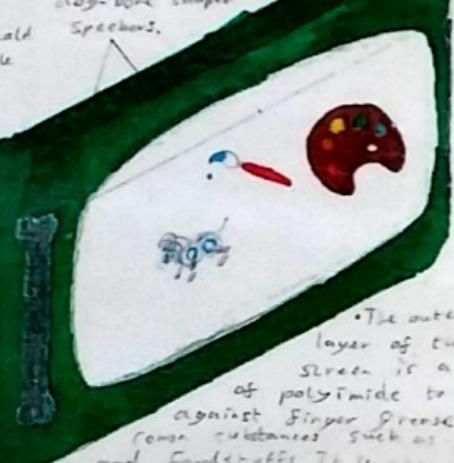
In some sections of the casting, I made the walls deliberately thick to increase the unit's impact resistance.

In some areas such as the corners, there were weaker points due to the curved shape so strengthening ribs were included in the inside.

This shows half of a cross-section of one side of the casting and where the LEDs are placed. This will allow the user to colour the unit through the interactive display/program, shown above.

Design Task No _____ Page 4

The screen has been designed to appeal to the intended user with curved, rounded edges such as the dog-bone shaped speakers.

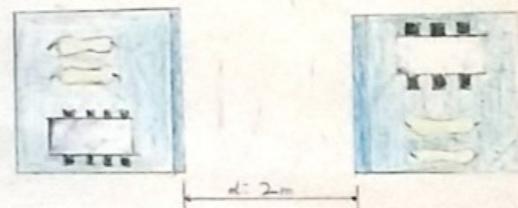


The outermost layer of the screen is a sheet of polyimide to protect against finger grease and common substances such as paints and foodstuffs. It is chemically resistant to cleaners making it can be wiped clean.

This addition could also be used for such features as the light-up LED cutting them below.

In order to make the unit easier to store, I decided that the legs should fold in allowing it to be placed flat on a surface within a cupboard or shelf.

I added a small infrared tag sensing circuit into the unit's motherboard. The tag circuitry it is designed to interact with the small antenna and emit a short range IR signal with a certain frequency. The receiver circuit can identify different circuits based on this emission. This can be used to add accessories such as toys and foodbowls, expanding its educational potential and general functionality.

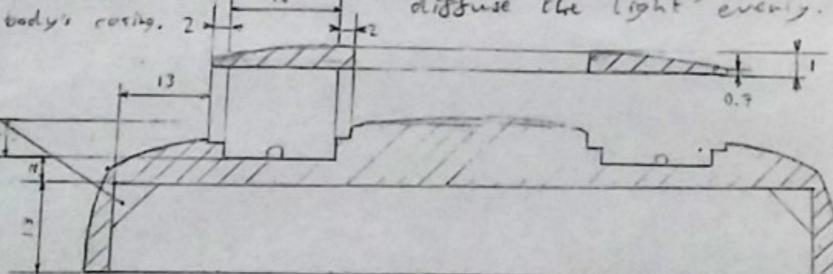


If $d \leq 1\text{m}$ activate

Shown here is a tag circuit and sensor. The tag is emitting a frequency at short range. Once it comes within a meter of the sensor, the dog will recognise the accessory.

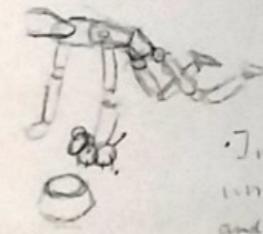
A small proximity sensor integrated into the unit allows it to detect when a child is near (within 1.5m). At this point the unit will react to encourage to avoid collisions.

This screen shows the radius it would cover. In this case the two children in close proximity will render it mobile.



This section is polycarbonate infused with light diffusing particles to diffuse the light evenly.

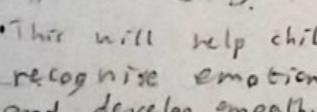
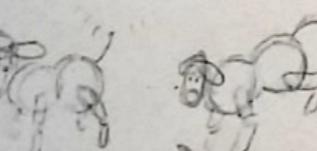
LED's of 1.7v, 15mA will be placed evenly to maximise the light



In tandem with these changes, I added a completely imobile mode where the unit will only make small movements to allow the children to use it as a regular toy with their imagination.

This ensures that the unit is suitable for any child user and excludes noise.

In this 'free play' mode, the unit could still recognise activity and respond as such. Shown here is a child manually 'feeding' it.



To incorporate the G&D logo, I decided that either a small sticker could be pasted on the body under near the head. Alternatively the logo could be injection moulded into the body directly. This second option would be more durable.

This will help children in the long term recognise emotion and develop empathy.

Name _____

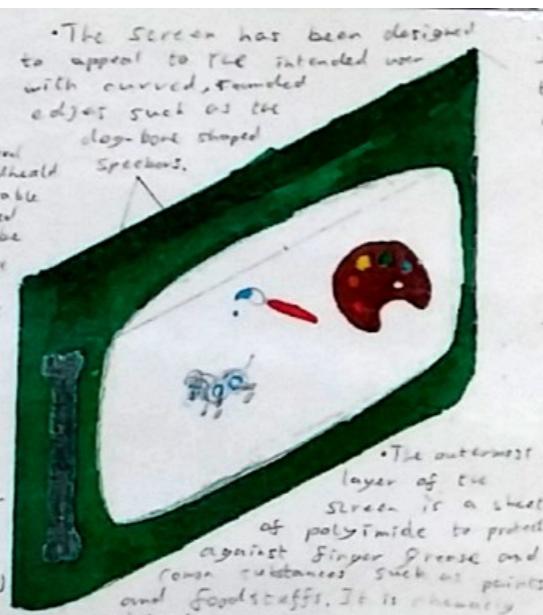
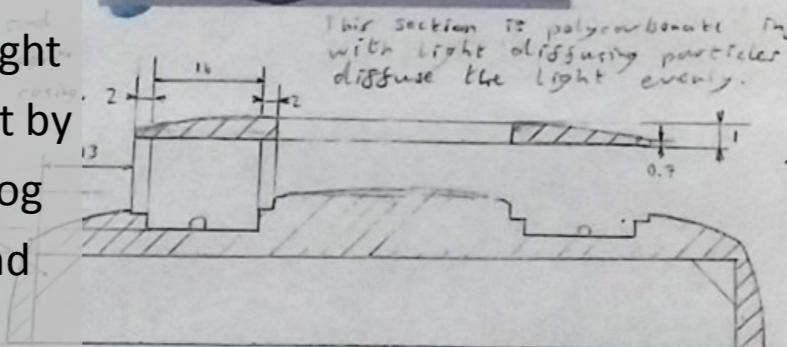
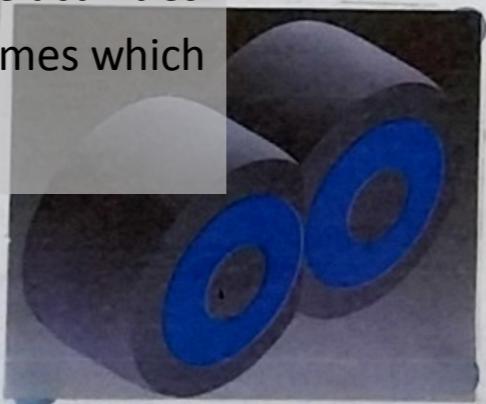
Candidate No _____

2014

EHS Higher Design Assignment

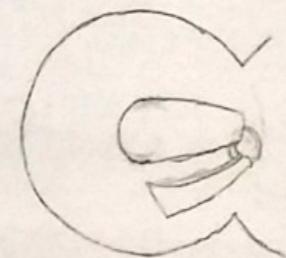
Shown here is the structure of a capacitive touch screen which I intended to use in replacement of the small table. The fact that it is capacitive touch rather than resistive means that multiple children can interact with it at once. This would serve in much the same way as the tablet did, allowing the user to interact with the dog in multiple ways, for example completing care activities and playing virtual educational games which the dog would respond to.

I altered the outer shell of the unit to incorporate a circular pattern of light diffusing acrylic which would be lit by multi-colour LED's to colour the dog based on the user's preference and add to its geometric aesthetic theme. The colour of this feature would, by default, be selected using a program on the screen.

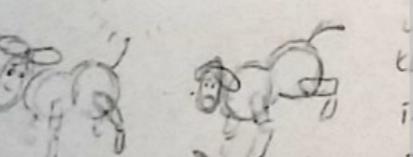


This addition could also be used for such features as the light-up, LED cutting them below.

In order to make the unit easier to store, I decided that the legs should fold in allowing it to be placed flat on a table or shelf.



The units educational value revolves around caring for a fractionally of a dog but this was not enough. I decided to utilise the humanoid nature of the unit to allow it to respond to and simulate emotion by moving parts of its body in certain ways. Shown here are two basic happy and sad moods.



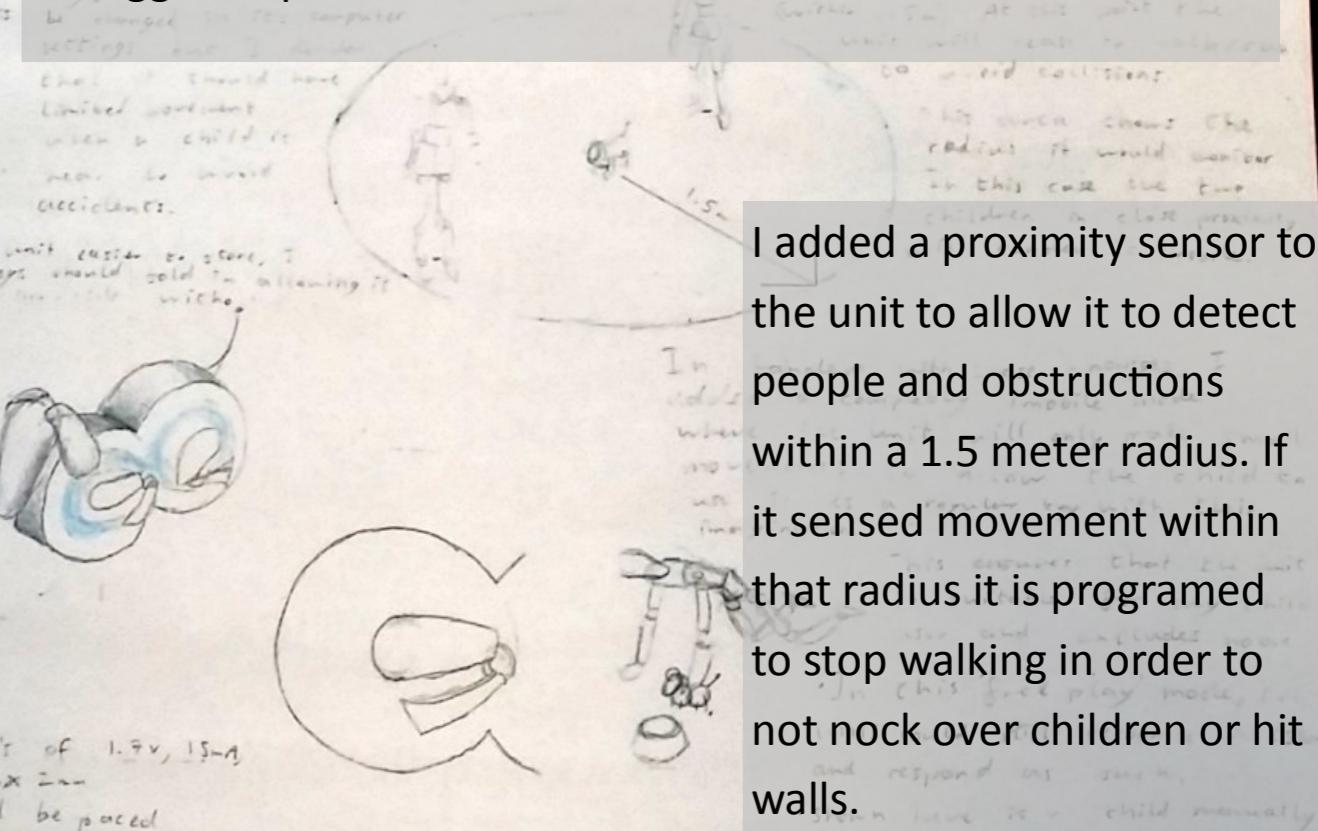
This will help children recognise emotion and develop empathy.

Design Task No _____ **Page** _____

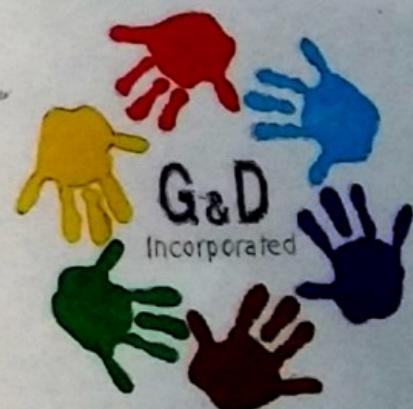
Name _____

Candidate No _____

I added infrared capabilities to the unit via a small, standard component IR transceiver to allow expansion via additional products which could interact with. For example, the unit would become 'hungry' and exhibit behavioural changes which the children would pick up on and have to feed it. This could either be done using an interactive program on the screen or by moving the unit close to a food bowl with a similar chip inside to trigger responses.



I added a proximity sensor to the unit to allow it to detect people and obstructions within a 1.5 meter radius. If it sensed movement within that radius it is programmed to stop walking in order to not knock over children or hit walls.



To incorporate the G&D logo, I decided to make it a sticker. The logo could be injection moulded into the body of the unit. This would make it more durable in the long term.

EHS Higher Design Assignment

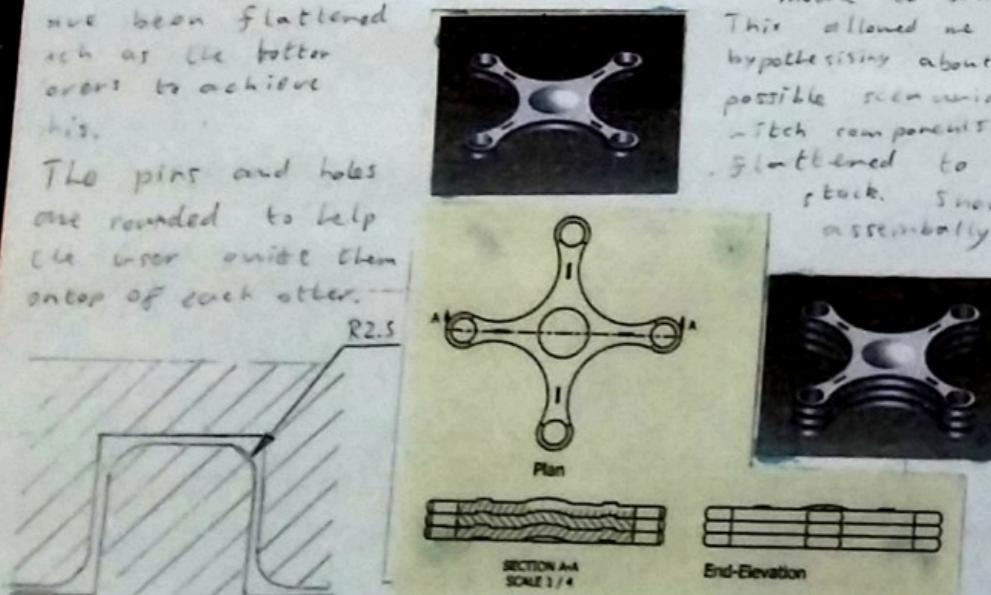
The old design functionality revolved around its ability to glide allowing the user access to activities and sports play usually without their ability. However the rotors were too close to the center causing stability issues and general maneuverability. The solution I devised would be to remove the excess material on each side the rotors would be out at arms' length which allows the design to incorporate some flying aspect as the unit is now similar to a quad-rotored 'copter.

The new spindles greatly reduce the mass and surface area as well as spacing out the areas of upthrust resulting in greater aerodynamic functionality.

In addition to the previously stated functions, the body casing features new pins on the top section, at the end of each spindle and holes of the same size underneath allowing the unit to be stacked.

All extraneous components have been flattened such as the bottom covers to achieve this.

The pins and holes are rounded to help the user slide them onto of each other.



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Page 5

Name _____

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Alternatively the unit could be made an upright shape enabling the use of a single rotor. A slight weight at the bottom would mean the unit would be kept upright while a single rotor would spin around the body causing lift. While this change would provide the required stability, a radical redesign would be necessary rendering most the original function of the unit.

The rotor would angle slightly to allow directional control.

This exploded assembly shows how the rotors will attach.

These two covers will be connected to the casing which will be constructed in two halves.

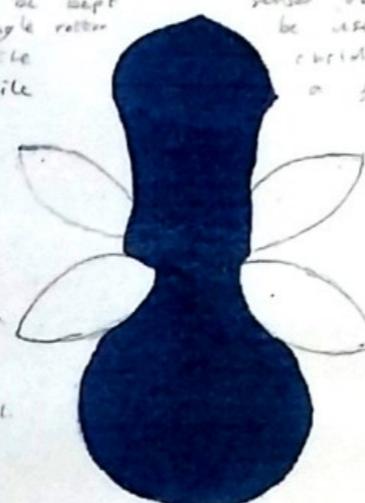
A series of gears will allow transfer of motion from motors concealed in the arms.

In order to test the effectiveness of these changes, I decided to create the following CAD model to simulate the unit. This allowed me to duplicate it, hypothesising about a range of possible scenarios. This told me which component needed to be flattened to make the unit stack. Shown here is an assembly where I stacked three units to test this and rotate this orthographic.

As you can see, the drawing confirmed that the changes were successful.

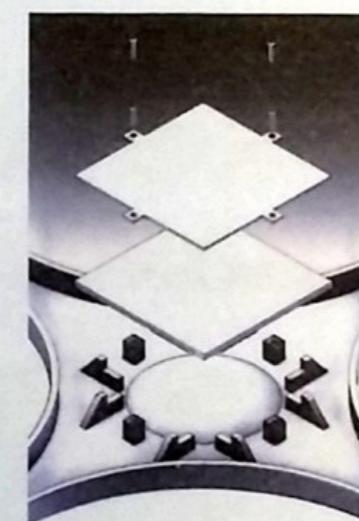
Strengthening was evident the rounded corners, compensating for weak spots in the casing.

This shows a cross section of part of one of the arms.



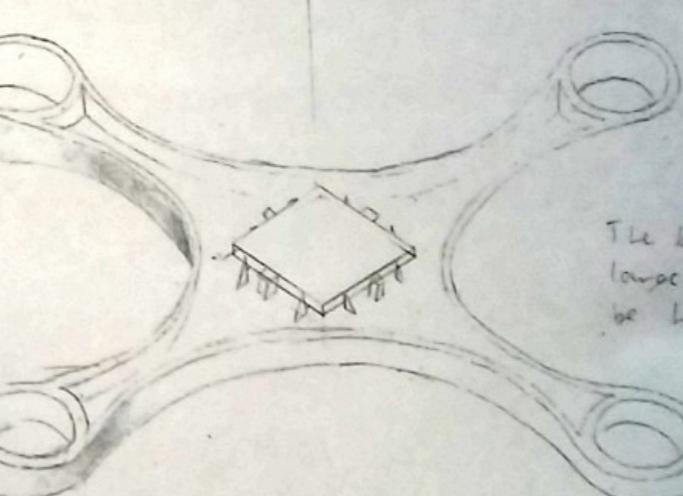
If the unit is to incorporate flying functionality in tandem with its use as a physical activity, I decided it would require an infrared sensor to control the user. This first solution uses an infrared sensor to detect movement below it. This could be used to either 'fly' from or 'gaze' downwards by compensating its position at a fixed altitude.

In order to keep the unit balanced, I decided the components should be stacked near the center with weights to balance out circuitry and miscellaneous components.



This is the same model, here illustrating how the components will fit.

Battery cover secures it.
Lithium-ion Battery
Screw fixings and Super Glue to provide support.



Motors will be positioned in the arms to drive the rotors.

The battery and other large components will be held in the center.

Weights will counterbalance circuits and other miscellaneous components.

This method of user detection is non-specific meaning that the unit will follow the greatest overall movement, not an individual following for group play or individual.

2014

In this instance, when individual turns left while one turns right, this results in the unit going left as this is the greater movement.

An alternate solution would be to create controllers with one side up to allow a child to easily recognise the unit. This would allow parents to control our unit with ease.

The casing would be polypropylene to make it impact resistant and wear and tear resistant.

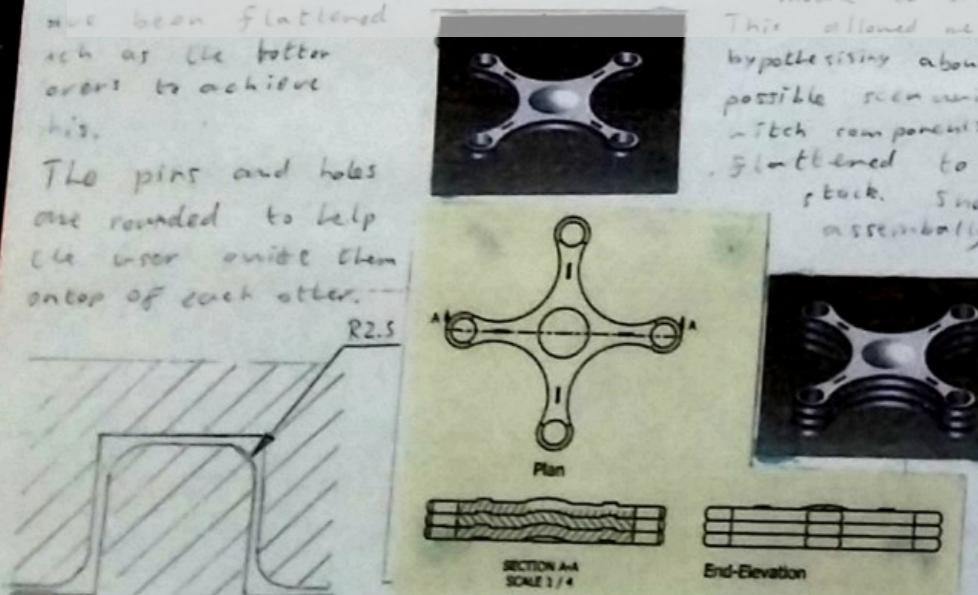
Even though I decide not to include a child's controller, I will still include the ability to switch between adult controllers to allow the unit to be controlled by adults.

EHS Higher Design Assignment

In this section, I considered two possible methods for developing the second idea. The first involved moving the rotors out and removing excess material, in effect turning it into a quad-rotor similar to most drone configurations. The other involved making the unit vertical in shape with only one rotor allowing it to float and maneuver however its functionality would be limited to just that so I decided to use the first idea going forward.

The new spirals greatly reduce the mass and surface area as well as spacing out the areas of upthrust resulting in greater aerodynamic functionality.

In addition to the previously stated features, the body casing features I then altered the shape of the unit and the outer casing to allow them to stack easily. Shown here is a CAD model demonstrating this and specific dimensions given.



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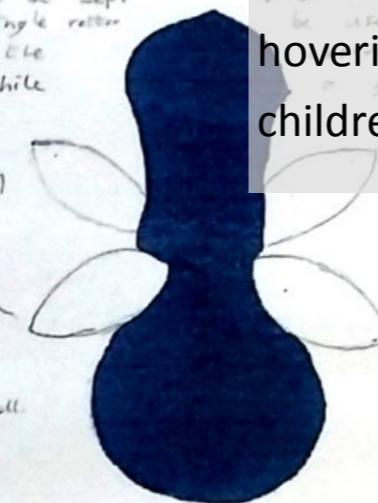
Name _____

Candidate No _____

Alternatively the unit could be made an upright shape enabling the use of a single rotor. A slight weight at the bottom would be kept while a single rotor would turn around the lift while this changed would required stability, a radical design would be necessary rendering most the original parts.

These two covers will be connected to the casing which will be constructed in two halves.

A series of gears will allow transfer of motion from motors concealed in the arms.

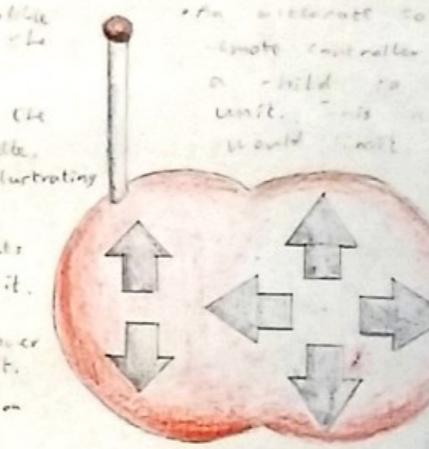
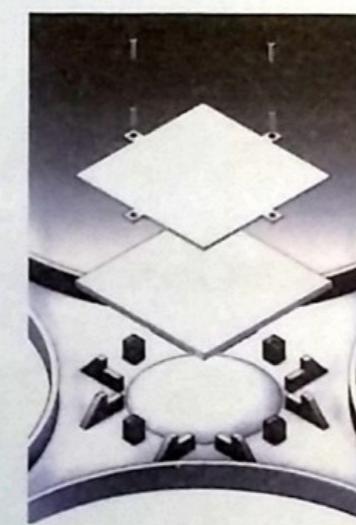


Here, I described a mode in which the unit would hover in the air and respond to ground gestures, for example, hovering a certain distance between a child or group of children to encourage them to move about.

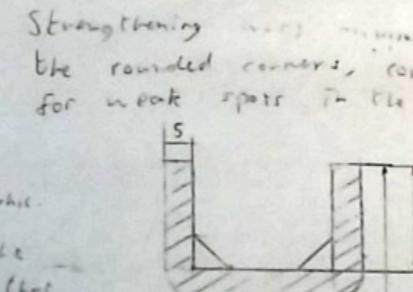
In order to keep the unit balanced, I decided the components should be stacked near the center with weights to balance out circuit and miscellaneous components.



In addition, I added the ability for the unit to be controlled in hovering mode via a simple remote controller to give the children an understanding of special awareness.



This section, including the CAD render details how the internal components of the unit are to be arranged, most specifically, the lithium-ion battery, the heaviest component which will be placed in the centre to keep the weight distribution centred.



This shows a cross section of part of one of the arms.

Weight counterbalance circuits and other miscellaneous components.

EHS Higher Design Assignment

While being safer aerodynamically and providing better upthrust the new design is difficult to grasp / throw. For this reason, I decided some form of structural modification was necessary.

An outer layer of PVC provides chemical and dirt resistance. PVC has been chosen for its

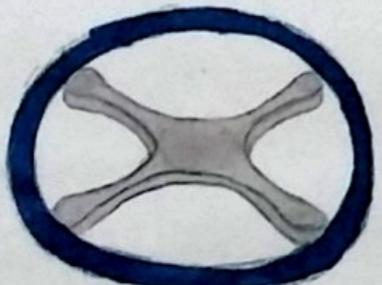
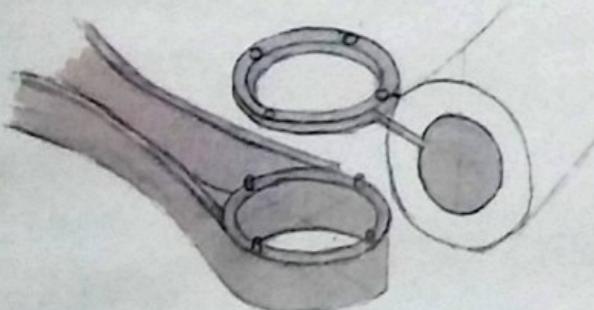
grip quality should a child attempt to eat it.

1 layer of foam provides comfort of grip as well as safety.

The frame is made of polypropylene in order to be rigid but have some flexibility when impacting with a surface.

As with the rest of the unit, it is thin with strengthening webs to reduce weight and material cost but retain strength.

This solution is to add a some grip to the edge of the unit. This would provide the necessary ability to grasp as well as being safe on impact.



While the shape of the unit is somewhat appealing to young children as well as being functional, the colour of the new impact polypropylene is dull.

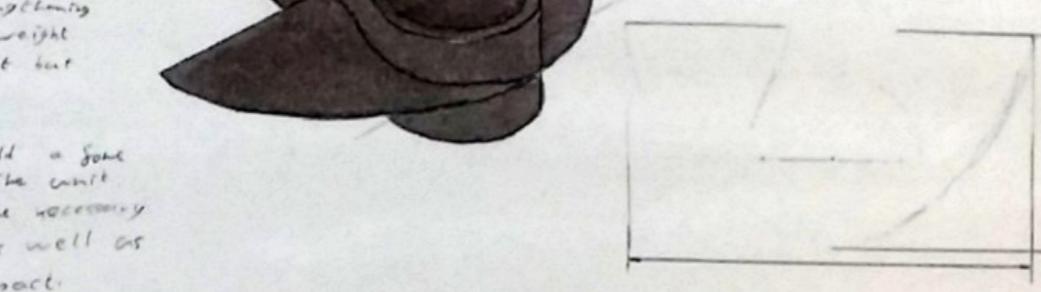
A solution would be to paint the unit post manufacture but there would need to be a wide variety of colours to fill the market base.

Alternatively, I could use thermochromic painting in the plastic to change the colour depending on temperature.

Shown here is an example of a child placing their hand on a section to change its colour on that particular section. This would provide amusement and a range of colours.



The alternative solution would be to add a thin sheet to the edge of each rim as shown to allow the user to grip and throw the unit. This is an aesthetically pleasing solution but less aerodynamic and does not provide the safety advantages of the rings.

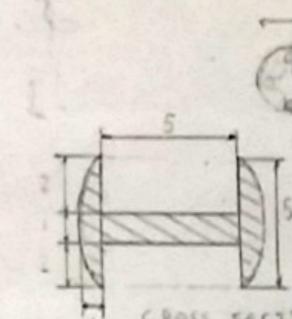


Shown here is a diagram of how a child may find to interactively use the product by rolling the wheel using the ring. This demonstrates the added versatility of the new design as well as safety.

2014

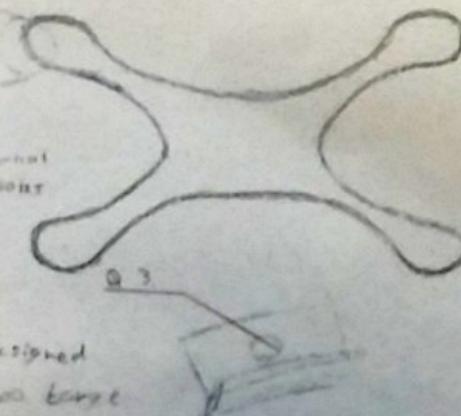
As the unit will likely be used outdoors much of the time, I found it necessary to ensure it is waterproof. The material used is water-resistant but there is a risk of water getting through component gaps.

To solve this, I decided a thick rubber bumper would be used to seal gaps. It would run along the edge of the unit, sealing all gaps, allowing the unit to remain watertight when interrupted.

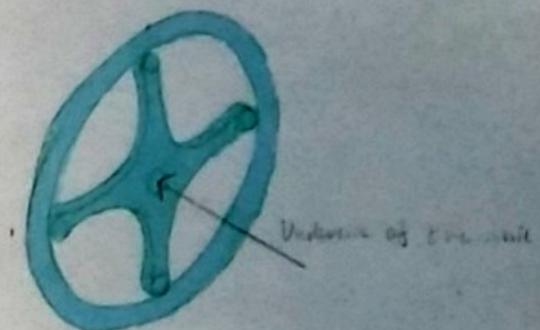


CROSS SECTION

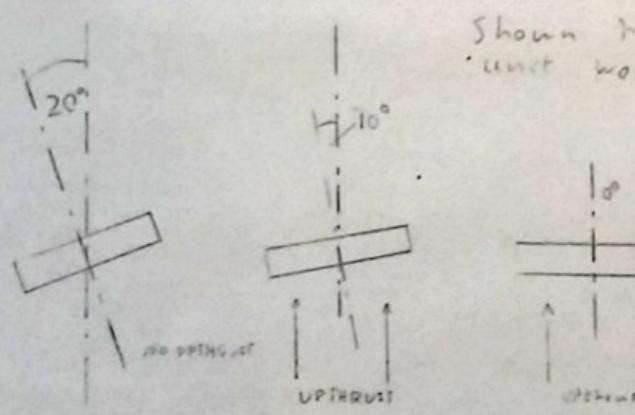
This cross section shows what the rubber bumper looks like if cut at any point to show how it is sealed.



The rubber is designed to be slightly too large to compress when sealed to ensure water-tightness.



Shown here is how the unit would do so.



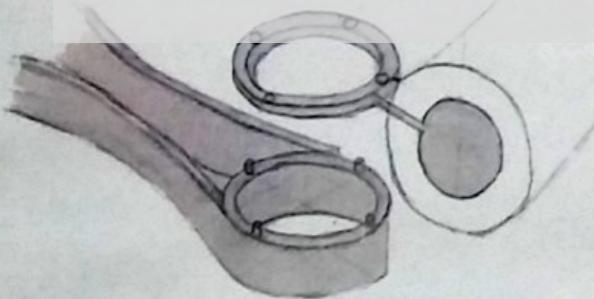
Pitch angle $\leq 20^\circ$ Rotors cutout

In order to include the ADL logo as part of the specification requirements, I decided that the logo should be injection moulded into the underside of the unit as shown during manufacture as a sticker would likely corrode under water conditions.

EHS Higher Design Assignment

During my testing of an initial model, I realised that the target market is highly irrational in they way they interact with products and that it was unlikely that this unit would be used the way it is intended to most of the time. For example, with one prototype, one of the children attempted to roll the toy on its side. I devised two modifications which could solve this particular problem. The first involved using a cushioned ring which would protect the unit and any user it impacts which also allows it to be rolled and survive many other forms of miss-use. The second was a series of small rubber tabs to do much the same function but allow for better grip.

I decided on balance that the ring was the safer option.



I decided to add a thermo-chromatic pigment to the plastic outer casing meaning that the unit would present a range of different colours depending on ambient temperature and contact by the user not only to entertain the children but to allow cater for a range of colour preferences.

shown here is an example of how I placed them and on a section to change the colour on that particular section. This would provide amusement and a range of colours.

The alternative solution would be to add a thin sheet to the edge of each rim as shown to allow the user to grip and turn the unit. This is an aesthetically pleasing solution as it is more dynamic and does not provide the safety advantages of

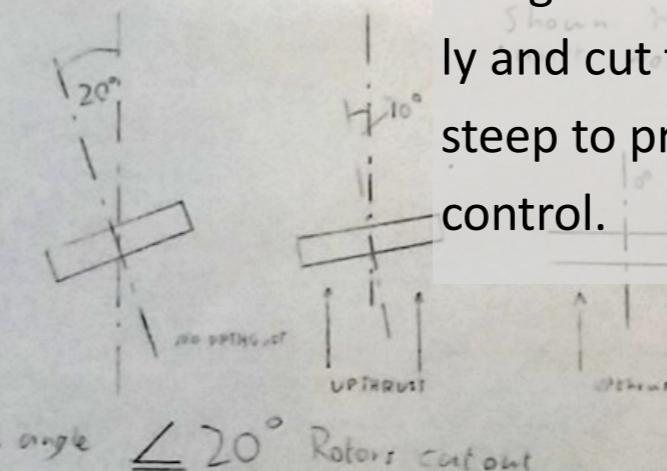
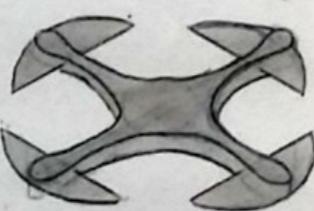
shown here is a diagram of how a child may find to interactively use the product by rolling the wheel using the ring. This demonstrates the added versatility of the new design as well as safety.

2014

As the unit will likely be used outdoors much of the time, I found it necessary to ensure it is waterproof. The material used is water-resistant but there is a risk of water getting through component gaps.

To solve this, I decided a thin rubber ring would be used to seal gaps. It would run along the edge of the frame, allowing the frame to sit and seal the unit.

I added a rubberised ring to line the connecting edges of the outer shell in order to give the unit a degree of waterproofing for outdoor use.



To avoid causing accidents when in lower modes I decided to include a gyroscope and sensor combination. If the unit is not upright.

I included an accelerometer and gyroscope to the design to allow it to monitor pitch more accurately and cut the rotors off if the pitch angle was too steep to prevent accidents or the unit going out of control.

In order to include the logo as part of the specification requirements, I decided that the logo should be injection molded into the underside of the unit as shown during manufacture as a sticker would likely corrode under either condition.

EHS Higher Design Assignment

2014

Design Idea 1

Design Idea 1

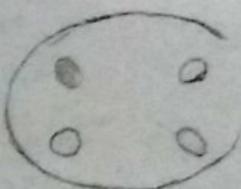
Before



After



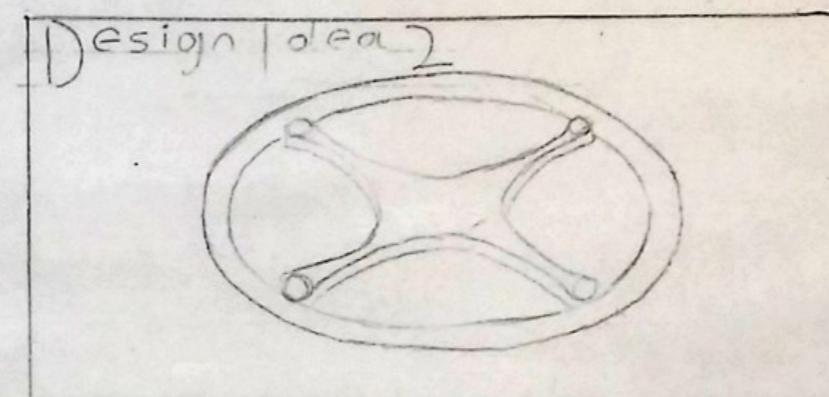
BEFORE



AFTER



Design Idea 1		
1.1	The unit previously aimed to educate children through its simulation of a dog. I improved upon this to raise the score from 4 to 5 by adding a closer overall and new interactability as well as a new shape and new methods of play interaction.	5
1.2	The slanted leg shape was unwanted in order to make it look like a real dog. I solved this by changing it to conform to more geometric forms. In addition the legs now fold in to allow for easier storage.	5
2.1	The old unit could not be opened or disassembled in any way so was difficult to clean and maintain. The design is now manufactured in two component halves and features removable components to allow for cleaning and maintenance.	5
2.2	The unit did not previously have many finger traps; now, all the moving components have finger shields covering them and friction sensors to cut out if a component should get stuck or a child's finger component should get stuck on it.	4
3.1	The unit was previously comprised of an epoxy resin and glass fiber composite which provided the required durability but was deemed too heavy. The unit is now made of ABS which provides the required durability and strength-to-weight ratio.	4
3.2	The unit has no surface finish and ABS is non-toxic as is epoxy resin composite so the score remains unchanged.	5
3.3	The unit was previously very expensive but through the use of standard components and the fact that the unit shapes and materials are easier to manufacture, the cost is now suitable for mass-production.	4
4.1	The movements were previously aimed to keep within a dog's behaviour but now it is much harder and configurable to respond to select children if necessary. In addition, the new play mechanics is suitable for all kinds of children.	4
5.1	The colour and patterns were previously dull and unappealing. Now with the unit's new shape, it is far more aesthetically pleasing. In addition to the configurable colours.	5
5.2	The unit did not previously feature the ABS logo at all but now will have it injection moulded onto the body section, just under its head in order to be retrievable and re-usable.	5



Design Idea 1		
1.1	This unit previously offered motor skill development as well as social development as it was essentially an indoor activity toy. This functionality has been expanded as it can act as a bending quad-sectioned crust or thrower, rolled over. The arms are curved and imaginative play.	5
1.2	The unit's state of storage has been altered by flattening the top and bottom surfaces and folding joint so allow it to be stacked.	5
2.1	The unit was previously sealed at joints and assembled in two halves; the bottom 'body' section houses all the components while the top acts as a cover to allow for ease of cleaning and maintenance.	4
2.2	The only moving parts; the rotters, are safely covered by small grills to prevent finger traps and accidents.	5

Design Idea 1		
3.1	The unit was previously made of polypropylene which was resistant to impacts but not light enough. I changed it to mostly an impact polymer which is more durable, lighter and has a better strength to weight ratio.	5
3.2	There are no surface finishes used and both materials, before and after are non-toxic.	5
3.3	The unit is easier to produce due to the improved shape and use of more standard components.	4

Design Idea 1		
4.1	Previously, the unit had one purpose/intended of play which was only suitable for older children and more able children. Now this, the ability to be used constructively or intuitively makes it suitable for all users.	5

Design Idea 1		
5.1	The unit was previously available in a range of colours to make it appealing to children however this would require many colours to be manufactured and possibly conflicts to those amongst the children regarding choice of colour. Now, the unit features chem-resistant pigments to be an environmental.	5
5.2	The unit did not previously feature the ABS logo, nor it will have the logo injection moulded during manufacture, onto its underside.	5

Design Idea 1

Initially, this toy scored 76 out of a possible 100, after development it scored 46 out of 50. I improved 76's education value by adding more methods of interaction raising specification 1.1 from 4 to 5. Previously the units shape made it difficult to store. Its new, smaller more geometric form in tandem with the folding leg made storage easier, raising 1.2 from 4 to 5. The unit was previously quite safe to clean, minor adjustments have ensured this is still the case, keeping the state of 5 at 5. The unit previously had a broken wire moving parts having the potential to cause accidents, now, covers and/or automatic movement prevents this, this is not the rate elevating the score of 2.2 from a low 5 to a solid 5. The unit was previously made of an other-rich composite which was durable but too heavy. I improved the ease of 1.6 by changing the material to ABS, raising the score of 3.1 from 4 to 5. The units suitability for commercial production has been improved with a new material choice as ABS is a thermo-setting plastic allowing for it to be injection moulded, raising 1.8 from 2 to 4. The 1.8's safety and sustainability for the intended users by adding new ways of interaction and user selective safety, to raise the score of 1.1 from 2 to 4. The units shape has been changed and new colouring, this includes young children raising the unit's education value 3.1 from 4 to 5. I added the 4 to 5 to satisfy specification 3.2, raising 3 points.

Design Idea 4

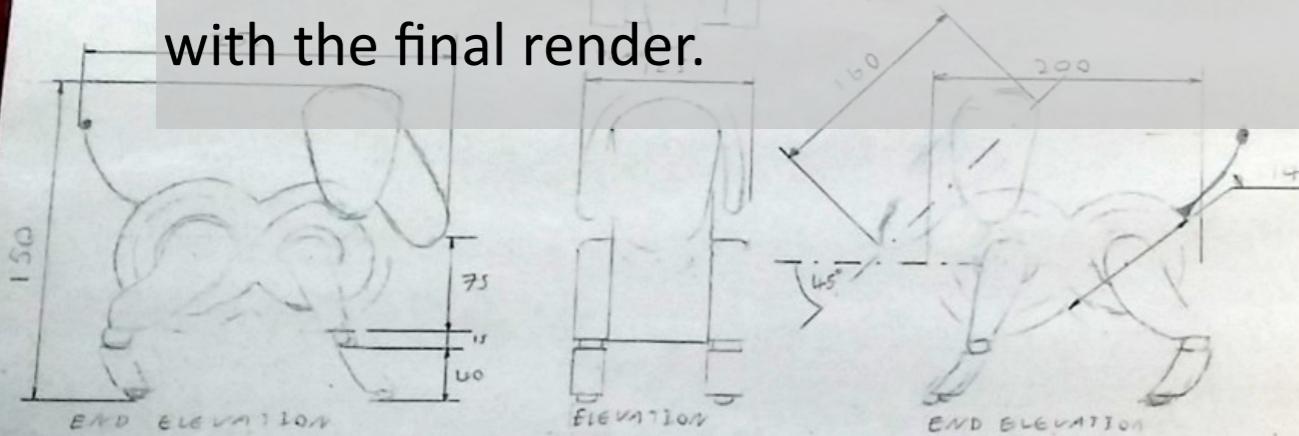
Preciously this toy scored 37 out of a possible 100. After development, it obtained a score of 46 out of 50. I raised 37's educational value by including more ways of interacting with it. The units' active environment value is raised of specification 1.1 from 4 to 5. I improved its ease of storage by making it stackable, 1.2 from 4 to 5. I changed the material to a more durable material to allow the user to do, change the unit for cleaning and maintenance. 1.8 from 4 to 6. The unit has covers over the rotters (the only moving parts) to make it a lot safer, this adds to the score of 2.2 of 3. The unit is now made of ABS. The unit's durability and strength is raised, ratio testing 3.1 at 5. The units material is an impact and no surface finishes are used except 3.2 at 5. The unit has been made more funable for the intended users by adding more options to suit of play to a low for 3.1 to 5. Children of varying ages to benefit using this unit from 4 to 5. The unit was a one-size-fits-all pigmenting in the material used to make it more aesthetically pleasing to children raising 3.1 from 4 to 5. The unit now features the ABS logo injection moulded into the underside to satisfy the branding requirements and raises 4 from 0 to 5.

I have decided to use Idea One at 4 to 5 a more original idea with more potential for play.

EHS Higher Design Assignment

2014

The final page involves a paragraph explaining why the design is suitable to satisfy the brief, major dimensions in orthographic form and a final render. Due to the time constraints of the assignment, I was somewhat rushed to complete this page on time and I am personally unsatisfied with the final render.



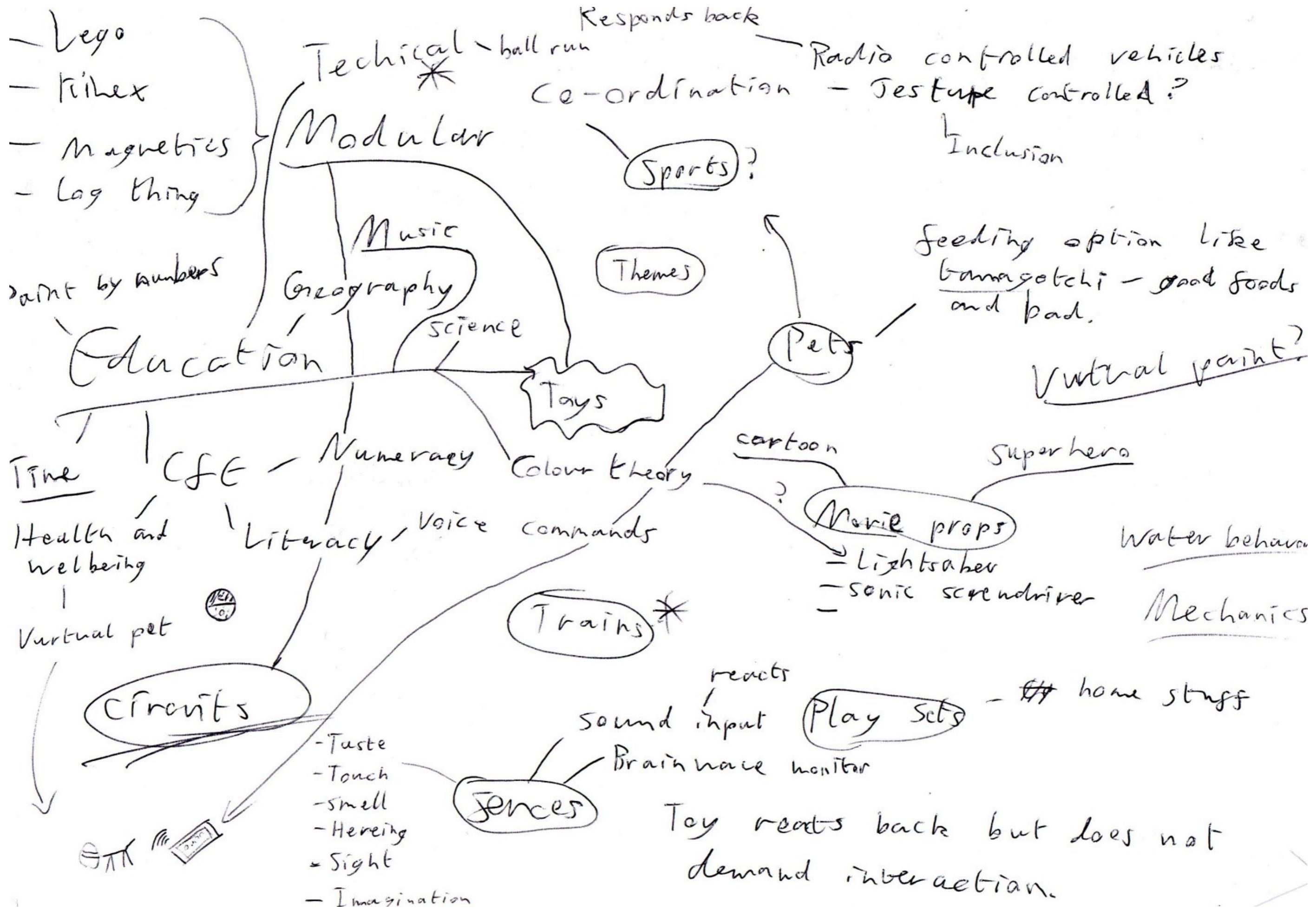
Design Zolea was initially score 36 out of a possible 50 prior to assessment, after it scored up to out of 50. The unit simulates certain aspects of a dog to a child, however it provides educational value. The child user is able to interact with the unit through it in a controlled manner as well as gain an understanding of safety, social animal interaction, and responsibility through interactive programs and behavioral input. Feedback from the unit. The simple, ergonomic design and foldable legs allow for ease of storage as the unit is compact. The unit's main body is manufactured in two halves allowing the user to disassemble it for complete maintenance and cleaning. The unit is manufactured mostly from ABS which is extremely durable and lightweight meaning there will be no ergonomic or durability related issues. ABS is non-toxic and there are no surface finishes used meaning the unit is safe for younger children. ABS is a thermosetting plastic meaning it can easily be injection molded allowing for complex shapes to be produced quickly, efficiently, and with relatively low cost. The unit is completely configurable through a computer API and has many features such as proximity sensors, facial recognition and touch interactivity making it suitable for its intended users. If a particular child does not like the toy or is disturbed by it, they can be selected to be 'ignored'. Additionally the unit can accommodate user-initiated play to allow for a range of play methods. The unit features an LED lit screen of light-diffusing polycarbonate to be coloured by the child through the interactive screen to make it appealing to the intended user group. The unit features the GPN logo moulded into the casing just under the head to brand the product.



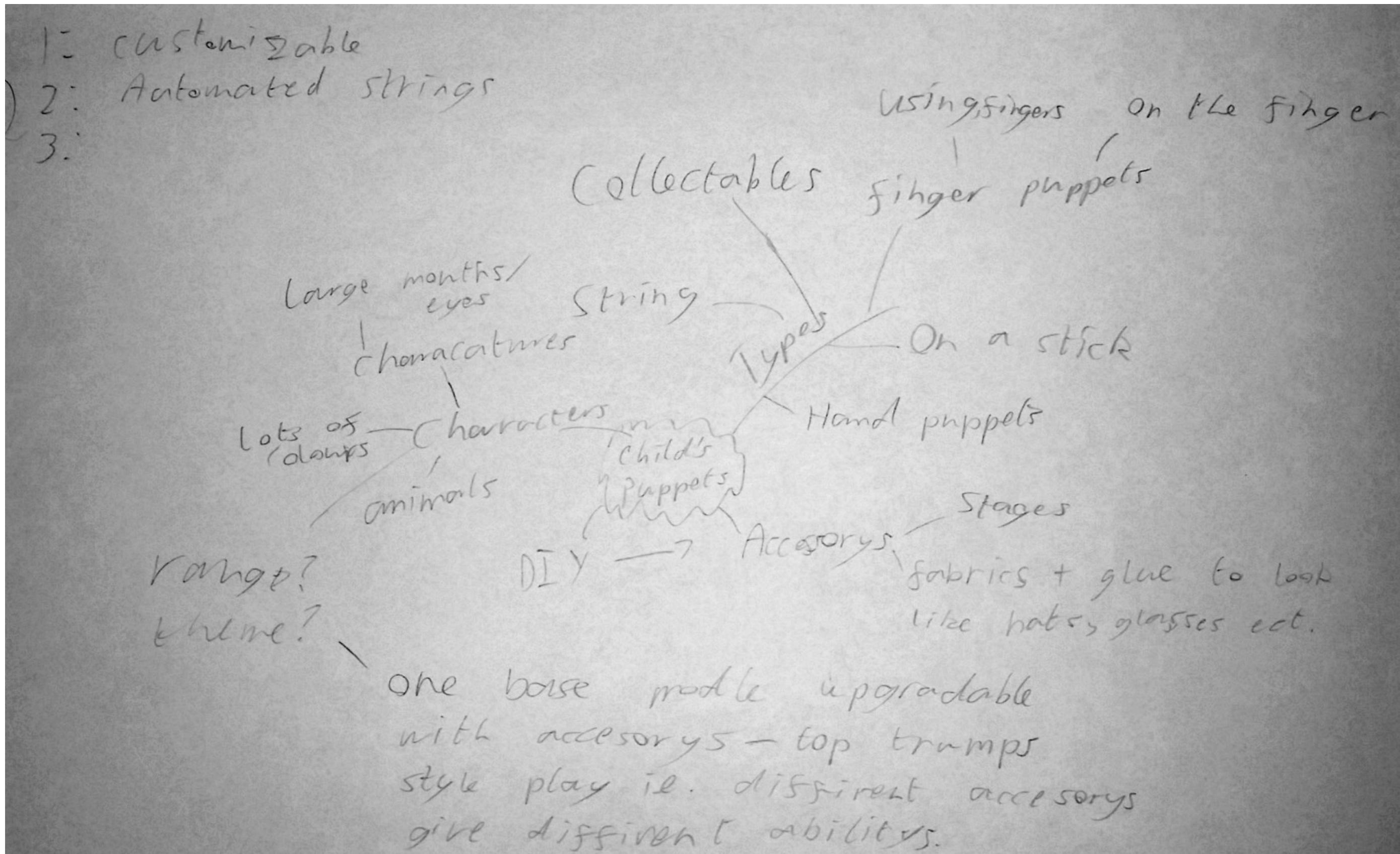
An early lifestyle board for the target market created for inspiration



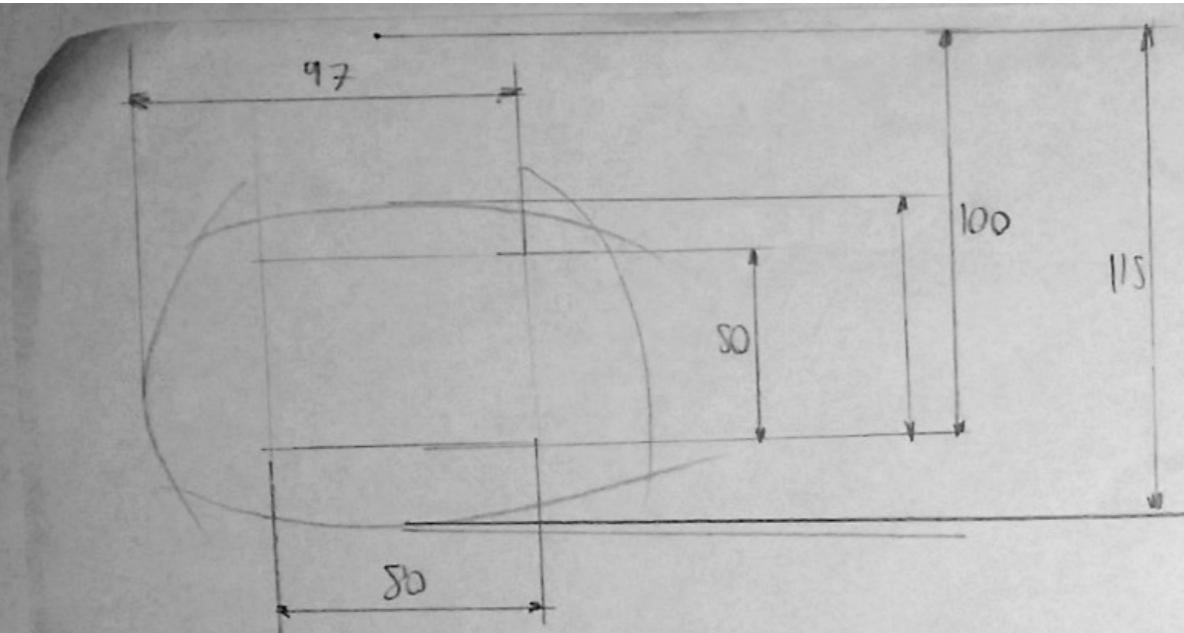
Early idea generation and analysis



Initial Idea generation for a rejected puppet idea



Mix of market research and early idea generation



Toy that changes function
based on outfit

Anger
Happy
Sad
curious
Tall
Calm
excited
nervous

toy represent emotional personality

Kimochis

American Girl dolls

B.Toyz Critter Clinic - teaches empathy
animal hatell.

Aearonax My First Career
inspiration / maturity pretend to be adults
simulated emotions

Expressions / emotion cards -
teaches to identify facial expressions

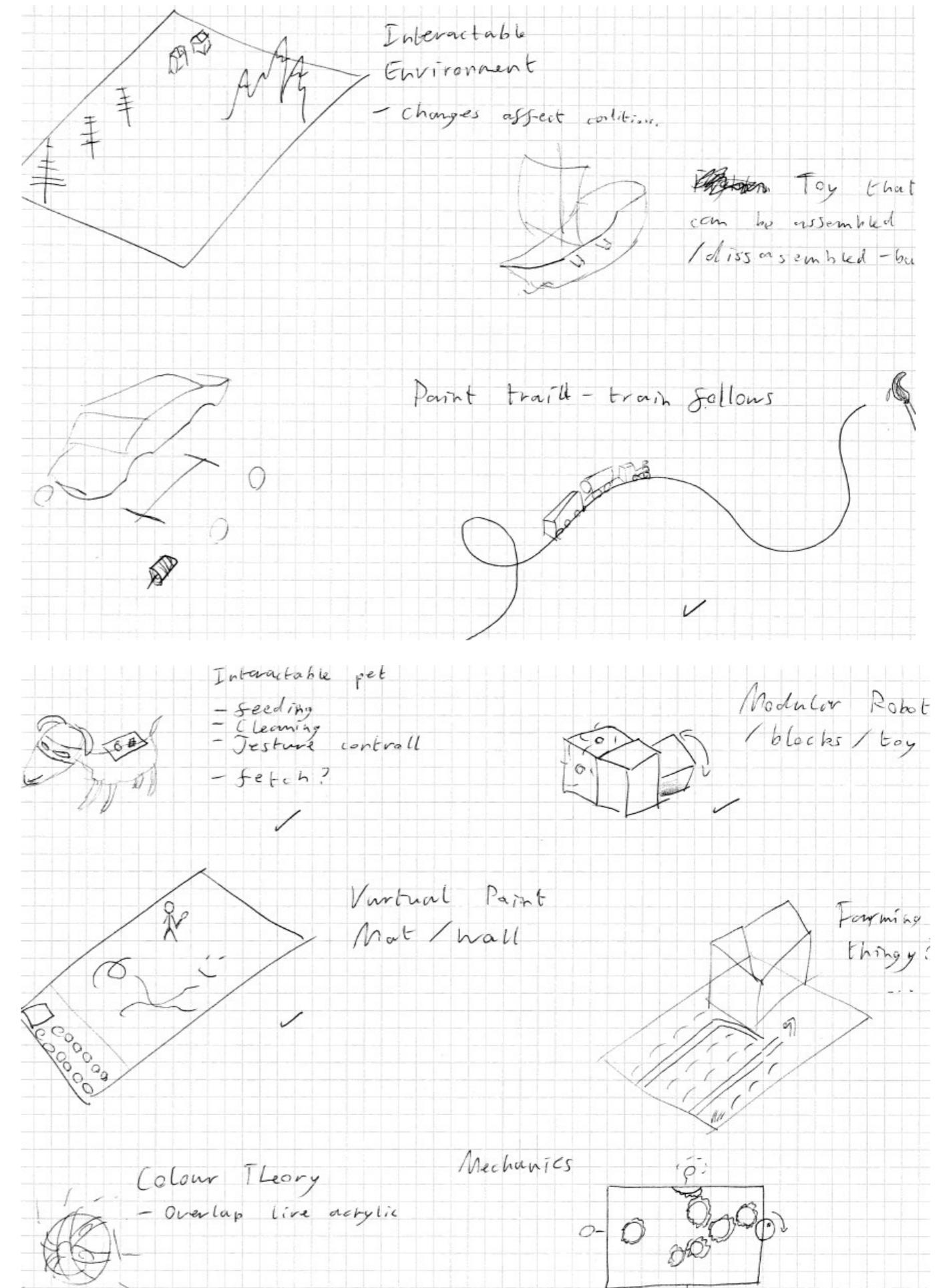
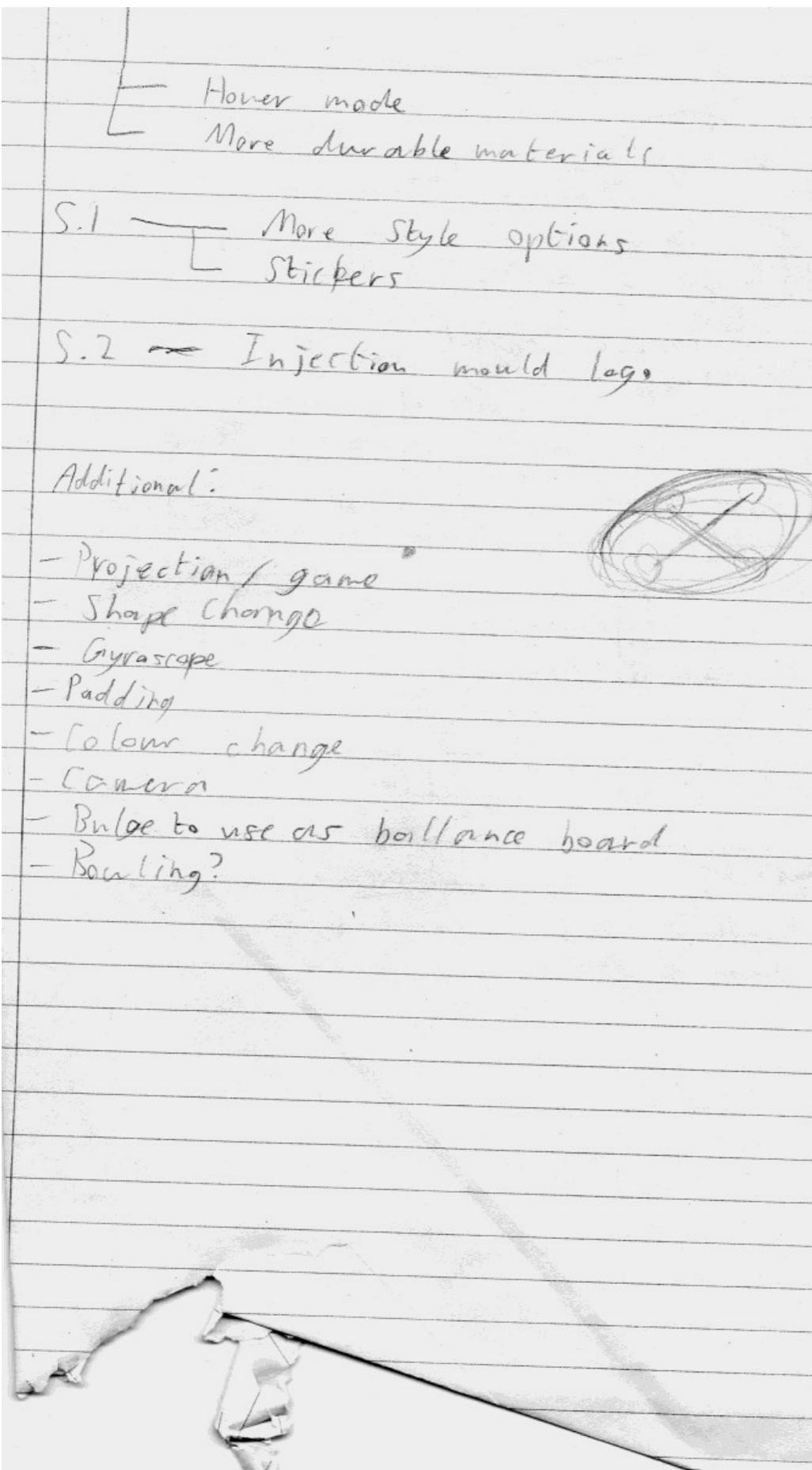
Horse Stable - name horses
/ match them
Come empathy?

Rolling planning and development (ticked sketches are ideas which were eventually used)

	Design Idea 1 Possible dev
1.1	- Educational value ✓
1.2	- Storage ✓
3.1	- Materials Durable + lightweight ✓
3.3	- Suitable for commercial production ✓
4.1	- Must be suitable for intended users ✓
5.1	- Patterns, shapes, colours appealing to children ✓
5.2	- G & D logo ✓
	Design Idea 4 Possible Dev
1.2	- Storage
2.1	- Clean + maintain
4.1	- Suitable for intended users
5.1	- Patterns, shapes, colours
5.2	- G & D logo
DI 1	1.1 - Food Bowls -
	- Games X
	- Interactive screen X
	- Digitalisation -
	- Moods ✓
1.2	- Uniform shape ✓
	- Fold in shapes / components ✓
	- Disassembly ✓
3.1	- Fiberglass? - Do research, new shell ✓
	- Lithium ion battery - AA ✓
	4.8 2.0

	3.3 - Standard components
	- Motors ✓
	- Sensors ✓
	- Camera ✓
	- Shape / material change ✓
4.2	- New interactability ✓
	- Whiteboard X
	- Tablet ✓
	- Projection X
	- Sonar + auto stop X
	- Limited movement ✓
	- Tamer movements -
S.1	- New colours *
	- LED colouring ✓
	- New shape ✓
	- Draw-on
	- Dress up
S.2	- Logo moulded on underside ✓
	- Sticker X
DI 4	1.2 - Stackable Shape
	- Storage locker - charge station
2.1	- Waterproof Components / materials
	- Simpler components
4.1	- Computer controlled per child
	- Multi user mode
	- Controller - RC

Rolling planning and development (ticked sketches are ideas which were eventually used)



Page planning and idea generation for the initial ideas

This design aims to educate children's understanding of health and wellbeing by simulating a dog's behaviour in a safe controlled manor.

Infra-red sensors will help it map environments in a similar way to robot vacuums. A camera with facial recognition software will ensure it 'pays attention'

to all children not just one. This will also allow it to respond to gestures.

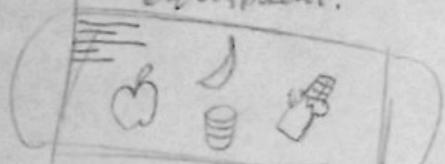
Tasks provided will educate children on healthy living and pet care, for example when the dog is hungry, they can choose what to feed it. Healthy foods will improve the dogs 'health' controlling its general interactability.

This design introduces children of any physical ability to active health with two settings. In one mode, the four quad-rotor fans give it slight uplift meaning that when thrown, its acceleration towards the ground is much slower than expected.

Children can use it as a frisbee or simply throw it in the air in a safe-controlled manor. In the other, it can be controlled as a helicopter by a simple remote to teach about motion.



The unit could be expanded with software updates or add-on equipment.



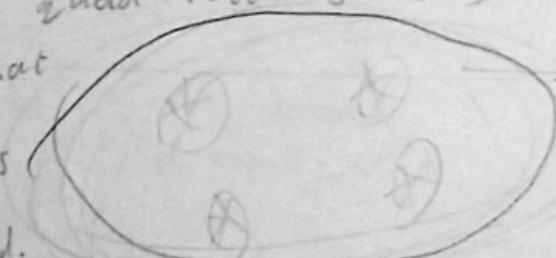
The dog is small enough to not intimidate children but large enough to be stable.

The top speed is slow and will stop if a child steps in front

The moving parts are small to avoid finger-traps

A hand held interactive interface allows the teacher to set perimeters at play and allows children to interact with the dog by completing tasks.

Tasks provided will educate children on healthy living and pet care, for example when the dog is hungry, they can choose what to feed it. Healthy foods will improve the dogs 'health' controlling its general interactability.



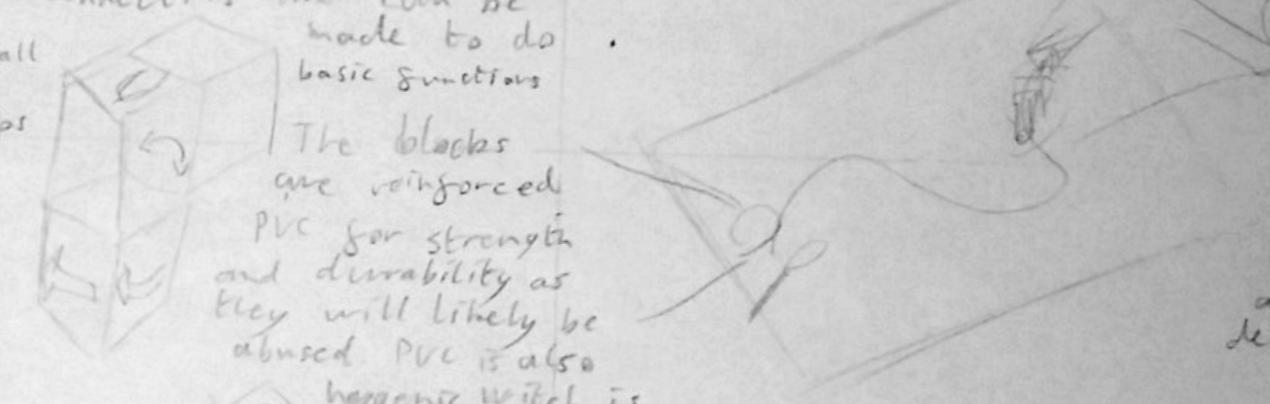
This design utilises modular blocks with different functions to give children a basic understanding of physics and mechanics as well as allowing them to exercise their imagination.

The blocks too can be

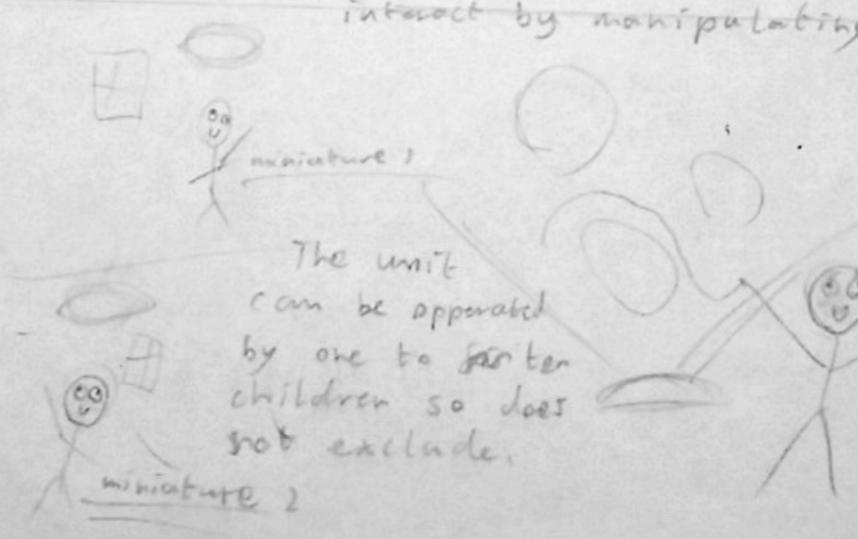
joined using ball and socket connections and can be made to do basic functions

The blocks are reinforced PVC for strength and durability as they will likely be abused. PVC is also

hygienic which is necessary as the children may try and eat it.



This design uses a wall or surface mounting to project interactive columns, images, words etc onto a wall. Dual cameras track children's hand gestures and allow them to interact by manipulating shapes on moving objects



The unit can be operated by one to four children so does not exclude.

Emotional Dev?

The programs can range from basic shape manipulation to sentence structuring and mathematics depending on the situation and specific user.

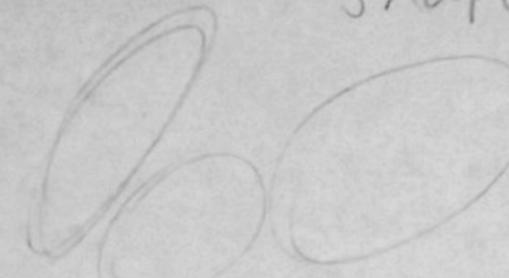
This toy teaches children about motion by allowing them to 'paint' on a mat with different colours. A train can then be placed on it and will follow the lines varying speed depending on colour.

The paint technology is similar to other drawing mats on the market while the train uses a camera to detect the line.

Rolling planning and development (ticked sketches are ideas which were eventually used)

New Motor movements + API
F, Er,
1.1, 4.1

New body shape



A, Er,

4.1, (1.1), 5.1

OH cut + LEDs

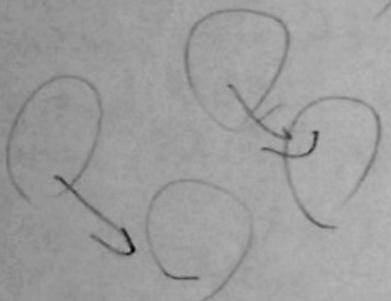


Assembly

F, Er,

4.1, 3.3, 5.1,
3.1

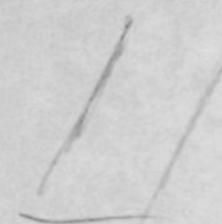
Body casing



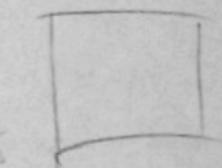
F, M, D

3.1, 3.3, 4.1

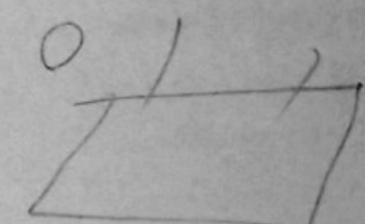
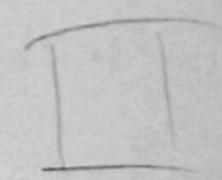
OT Nuts
+ Bolt
fixings



Materials



M.M



Battery

1.2, 3.3

New foot des

3.1, 3.3

En, M,

cam

-SC

Transmit
receive
circuit
- SC

Sonar

F, En, Ea, S, C

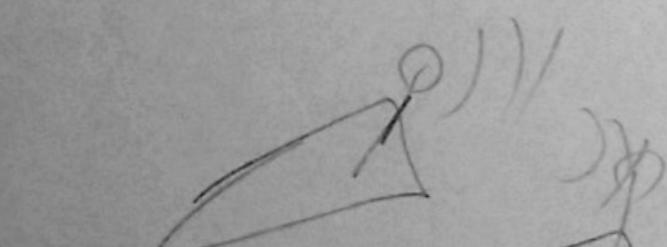
tb

3.3, 4.1

Limited movements

4.1, 3.3

F, En, Ea, S



F, C, MP, En

1.1, 3.3, 4.1

Rolling development: Planning sheets too far in advance meant that often dimensions, sizes and annotations were often miscalculated so I employed a method of taking a picture of a sheet, overlaying the next planning stage over it in DTP and using that as reference.

The old design's function centre's around its ability to glide allowing the user access to activities usually beyond their skill level. However the rotors were to near the centre of the design causing stability issues. One solution I devised would be to remove excess material and extend the rotors as shown. This would allow the design to incorporate a flying feature as the unit is now a quad-rotor configuration.

The new spindles greatly reduce the mass of the unit and space out the areas of up thrust resulting in overall better aerodynamic function.

It was necessary to keep a ring on the outside for the child to grab onto and throw with.

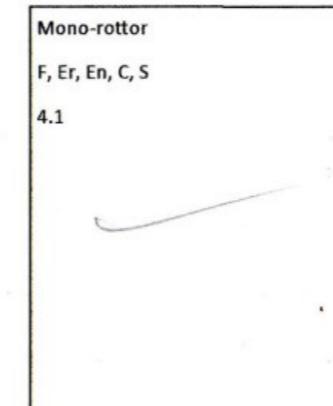
The shapes have been curved to avoid any shear edges that would look unappealing to children and collect dirt.

New shape and assembly
F, En, Er, C, S
4.1

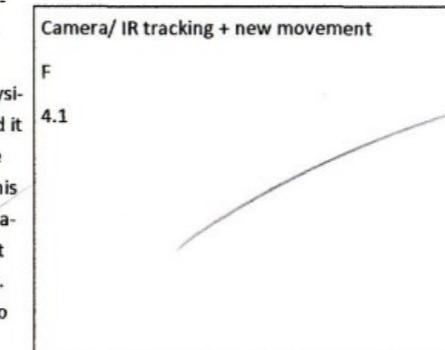
Alternatively the unit could be made an upright shape, employing the use of a single rotor. A slight weight at the bottom would mean the unit would be kept upright while a single rotor would spin around the body elevating it. While this would provide the necessary up thrust and stability, a radical redesign would be necessary and the ability to use its original function.

The body's casing has been changed to a high-impact polystyrene as the unit will be subjected to a lot of rough play and must resist against knocks and impacts. In addition, it will likely be used outside and so is required to be waterproof. Polystyrene is light and stiff so ideal for the frame of the unit as weight is a concern for ease of use.

The motor would angle very slightly to allow for directional control.



If the unit is to incorporate a flying functionality in tandem with its use as a physical activity, I decided it required an intuitive means of control. This solution uses an infrared sensor to detect movement below it. This could be used to either 'flee' from or 'follow' children by compensating the unit's position at a fixed altitude.



This method of user-detection is non-specific, meaning that the unit will not follow a single individual but respond to the greatest movement it detects and adjusts accordingly allowing for group play or individual use.

To keep weight low but retain the unit's durability, I made the casing thin (1.5mm) but added strengthening webs to the inside that will absorb the energy from impacts. This would remove the option for the unit to be compression moulded, a relatively cost effective and fast method of production as the complex web shapes can only be achieved through injection moulding.

In addition to the previously stated functional issues, the new body casing features new pins on the top of the body casing, at the end of each spindle, and holes of the same size underneath allowing the unit to be stacked easily.

In addition, the top and bottom of the unit is flat to allow for stability.

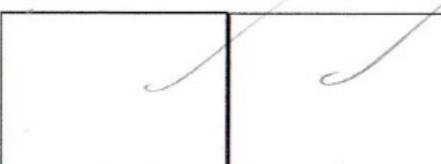
Any extraneous components have been flattened such as the rotor covers to achieve this.

This diagram shows a completed model which could be used for testing. The model successfully helped me to interpret the design and manufacture requirements of the unit.

Storage -New shape= easier stack
Er, En, D
1.2

In order to test the effectiveness of these changes, I decided to create a CAD model which could simulate the unit and allow me to duplicate it, hypothesising about a range of scenarios. This model told me that the rotor protective grills required flattening in order for the unit to stack.

The pin is rounded at the top and the hole is somewhat conical towards the bottom to allow the user to insert the unit more easily but still be secure when in place.



Shown here is the cross-section of an orthographic drawing I generated in order to demonstrate what the model helped me to understand. The drawing features two identical copies of the remodel aligned the way they would when being stacked.

Rotor assembly
2.1

"Idk wright about each component here, I'm running out of time" -Oddert
3.3.14

Remote controllers
F, Er, En, S
4.1

The unit does not need a specifically designed controller as the RC compatibility will allow standard RC controllers to be paired. This reduces cost substantially.

The child's controller features large buttons to clearly indicate the operations.

Polypropene would be used for the casing as it will be treated roughly and needs to be durable and impact resistant.

Rolling development: Planning sheets too far in advance meant that often dimensions, sizes and annotations were often miscalculated so I employed a method of taking a picture of a sheet, overlaying the next planning stage over it in DTP and using that as reference.

EHS Higher Design Assignment

While being better aero-dynamically and providing better up-thrust, the new design is difficult to grasp/throw. For this reason I decided some form or structural modification was necessary.

An outer layer of thin uPVC. Provides chemical and dirt resistance. PVC has been chosen for its hygienic qualities which will be safe should a child attempt to eat it.

A thin layer of foam provides comfort of grip as well as safety.

The frame is made of polypropene in order to be rigid but have some flexibility when impacting on a surface. As with the rest of the unit, it is thin with strengthening webs to reduce weight and material cost but retain strength.

It is common knowledge that children, especially the younger ones, rarely use toys in the manner they are intended to be used in. This ring not only provides better protection for the unit and objects it may come into contact with but allows for creative use of the toy.

One solution would be to add a thin sheet to the edge of each arm as shown to allow the user to grip and throw the unit. This is an aesthetically pleasing solution but less aero-dynamic and does not provide the safety of the next solution.

An alternative solution could be to add a foam ring to the edge of the unit. This would provide the necessary ability to grasp the unit as well as being safer to use and allow for additional functionality.

For this reason I deemed the handle option shown here to be too unsafe and will use the ring as my design decision.

Shown here is a diagram of one way a child may find intuitive to play with the toy, by throwing it like a loop and demonstrating the added versatility of the new design as well as safety.

2014

As the unit will likely be used outside a lot, I found it necessary to ensure it was water tight. The material used for the body and fans (material x) is already water-resistant but there is a risk of water getting in through the component gaps.

To solve this, I decided a thin rubber insulator could be used to seal the gaps. It would run along the edge of the two sections, aligned by small loops which would fit onto injection moulded pins. Rubber was chosen as it is waterproof and can be compressed to allow the user to tighten the two sections.

The cross-section of the rubber insulator would be consistent for symmetry and would look like this.

While the shape of the unit is somewhat appealing to children while functionally useful, the colour of the raw (material x) is dull.

One solution would be to paint the unit upon assembly but there would need to be a wide variety of colours to appeal to a wide user base.

A secondary solution I devised would be to use thermo chromatic pigments in the plastic which would make it change colour depending on surface temperature. This diagram shows how a child may create a handprint while using it.

To avoid the unit causing accidents when in hover mode, I decided to include a gyroscope-accelerometer sensor combination to cut out if the unit is tilted at an angle or is used incorrectly.

In order to incorporate the G&D logo, I decided that once again it could be injection moulded into the under section of the unit, on one of the arms, during assembly.

Design Task No _____ Page _____ Name _____ Candidate No _____