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Introduction

FitIt is a toy that enables children to build whatever they desire out of cardboard with a sustainable product. It does so by making use of ‘fitters’, round wooden discs in which pieces of cardboard can be pressed together to make all kinds of shapes and structures. The power of cardboard for our product is that it is a cheap, accessible and sustainable material.

This product is an outcome of us, four students of Industrial Design at the TU/e, working on our first half-year project.

Our project theme was called Smart to Touch. This theme revolved around the idea of finding inspiration from experimenting with a certain material and its properties and trying to develop a product from there.

Project goal

The goal of our project is to create a sustainable product that stimulates children to express their creativity by building their own toys with accessible materials. We want to accomplish this by producing building kits with which children can build premade structures with the help of instruction booklet. This serves as an introduction and explanation to our product and spark their own creativity. As an extension to these building kits, electrical components are to be provided separately to introduce children to the concept of working with electronics at a young age, and to keep our product interesting to a wider target group. By setting up a website where children can share their projects and see those of others, further stimulating each other’s creativity.

As industrial design students we aim to develop ourselves during this project in the following competencies;
Creativity and Aesthetics
By making a house style and brand for our design in order to stimulate attractiveness and a clean communication of the concept.
Math Data and Computing
By programming a mockup of our website ourselves.
Business and Entrepreneurship
By making a business model and talking to experts.
User and Society
By usertesting with our target group to create a user-centered product.
Technology and Realization
By making the electronics ourselves and as easy as possible for children to use.

Met opmerkingen [1]: ik weet dat jullie dit bullshit vinden maar ik denk dat ze dit wel even kort willen horen. Zeker als ik naar de rubric kijk. Verander maar als je het er niet mee eens bent

Met opmerkingen [2]: Vind dit top

Exploring

Exploration

Within the theme Smart to Touch we started our design process with a material. The material we chose to do explorations with was cardboard. We chose cardboard because it is: accessible, light, cheap, isolating, easy to shape, biodegradable, can be recycled and can be very strong when used in the right way. We all made things from cardboard within 3 categories;

• 1. Packaging

Paper is biodegradable so we thought it could be a sustainable alternative for packaging. We found out that paper on its own isn't ideal for packaging because it lets air through.
We packaged some sort of plastic hay we found in paper to see what it would feel like reference. We found out that it behaved a lot like a pillow but with a very unusual outer texture. We found the bounce effect really interesting so we further explored that property.

1. packaging exploration

• 2. Physical sense

Cardboard is generally seen as a stiff material that does not bend easily. We tried a few methods to change this. We placed a thinner piece of cardboard into foam to get a chair that deforms when you sit on it and bounces back to its original shape when you do not reference.We made a button out of cardboard with a looped piece of cardboard inside of it to act as a spring. We also tried out a few different cutting and folding lines patterns to see how we could deform cardboard.

2. chair exploration

• 3. Foldability
By interlocking pieces of cardboard in a diamond pattern, we created a something that can withstand a strong force and is foldable. This inspired us to think about foldable structures of furniture. We also experimented with weight applied to different shapes of paper to see which shape could take on the most weight reference. Additionally, we looked at a form that could only let a shape through in one direction reference.

3. foldability explorations

Ideating

After around two to three weeks of exploring with cardboard, we ended up with a wide range of explorations. Because of this, we found it hard to combine our explorations into one concrete idea. Additionally, using the material and its properties as inspiration to come up with an idea was something all of us had not ever done before. As a result, we tried coming up with different product ideas with each exploration individually.

Our paper packaging explorations were pretty quickly put aside since we could not really think of anything with this to further develop in. With explorations based on folding structures, our mind quickly went to using this to make furniture or portable structures out of. We also experimented with foldable cardboard and pleated paper. We thought about making interesting types of fabric with this because of the different properties they had from more conventional fabrics. The cardboard button we made, in combination with the pleaded pieces of paper, made us think of using paper and cardboard towards creating interesting types of interactions and haptic experiences with products.

Reference papiertjes met ideeën

Wrapping up the ideation process, we tried coming up with ideas, not from the perspective of our explorations this time, but from a more conceptual perspective instead. The concepts we wanted to ideate around were: interactions and haptics, furniture, structures, and lastly toys. Though the last category might not seem to be based on any explorations we made, the category ended up on our list because of the relative ease with which we could make different objects out of our chosen material. We figured that this property of our material could be put to use in making toys with which children could easily create a variety of objects to play with. When we realized all four of

us were quite interested in using the building properties of cardboard towards developing toys, we quickly decided to focus our project on this.

Iterating and prototyping

Fitters

After ideation, we agreed we wanted to make a toy for children that stimulates them to be more creative. Cardboard is a good material to use for a toy since it is really accessible and easy to use for children. The first problem we needed to tackle was; how to easily connect and assemble loose pieces of cardboard? We thought of 2 things;

• Beams and blocks with velcro on it:

We designed beams and blocks where you could build a frame with for what you wanted to build reference. The space between these beams could then be filled with cardboard plates that also had velcro on them. The velcro wasn't very sturdy when making big structures and also is not a very durable material. It would also be a lot of work to put velcro on all the blocks.

4. beam with velcro

5. unfolded beam with velcro

• Fitters:

We looked into clothespin or K'Nex like reference connection pieces that cardboard could be stuck into by it being pressed tight. Taking inspiration from the K'Nex pieces, we decided that round pieces in which cardboard can be pressed would give the most angles and dimensions to build with. By making round wooden discs with small grooves in them that

slowly become tighter as they move inwards, the cardboard can be squeezed into a groove and then stays tight. Reference

6. first iteration fitter

7. second iteration fitter

8. third iteration fitter

9. fourth iteration fitter

To make sure the cardboard stays into the fitter we first thought of grooves with hooks. In the first batch, we tried different types of grooves with hooks and barbs and a smoother groove reference. We noticed the smooth groove worked a lot better since the hooked and barbed grooves damaged the cardboard too much making the cardboard not easily reusable. Next to the grooves we put a big gap in the wooden disk, the size of its thickness, so two disks could be interlocked into each other reference. With this pieces of cardboard could be put in in different orientations. This gap gave the other grooves more room to bend making it easier to fit cardboard in them. Because of the bending, though, pieces easily broke off so we decided to eventually leave the gap out.

While making a small car with the fitters we thought it would be fun to be able to make wheels from our fitters. That is why we decided to make small holes in the fitters to use as axis for wheels. Two additional holes were added on the side, letting the fitters to be used as hinges as well. The holes are so small that it does not decrease the structure strength of the fitters.

We made the difference in width between the beginning and the end of the grooves pretty large to enable cardboard plates of different thicknesses to fit in. We chose to lasercut the fitters out of MDF because it is a very strong and cheap material. We also 3D-printed a fitter out of plastic, but this material had a too smooth surface, making it so that the cardboard could not stick in the disk as well as the wooden disks. We made the wooden disks, which we ended up calling ‘fitters’ at this point, have a diameter of six centimetres. This size makes it small enough for children to handle but big enough that it could not become a choking

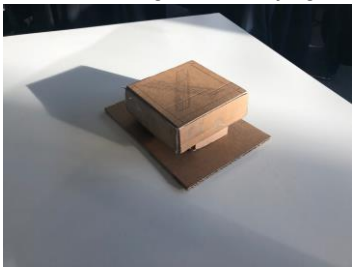
hazard. It also makes the fitter big enough to have a lot of grooves without losing strength. reference

10. tenth iteration fitter

With the fitters we had at this moment, the thoughts and ideas got more focussed on applications with them, like building kits, making users learn how to play with FitIt. We decided on building a few of the same building kits, so we could user test them. With this test we could know if the fitters functioned well and were fun to use and if the building kits served the purpose we wanted it to have.

Electronics

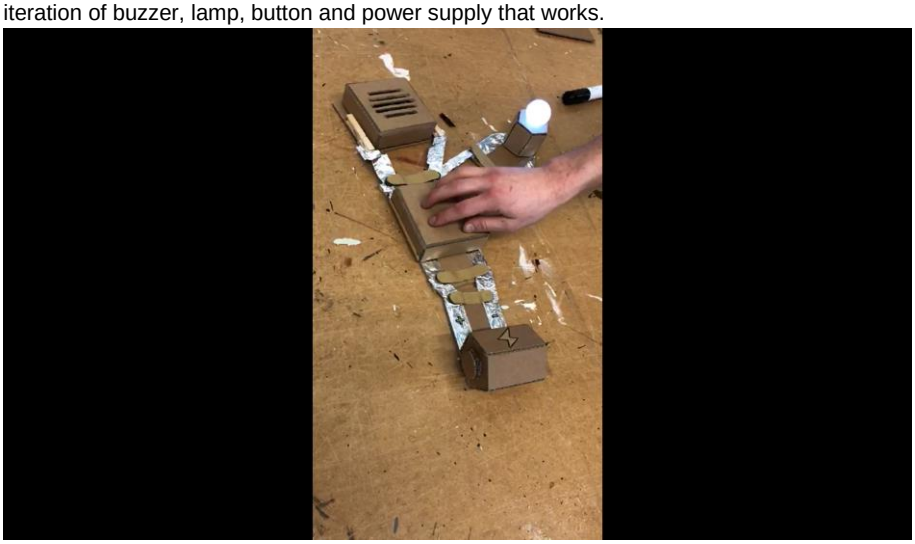
The idea of including some electronics to our project was something we were interested by from the start. However, we mostly wanted to focus on developing our fitters and the building kits before we added electronics. In the exploration phase we made a big button out of cardboard that gave a satisfying feeling when pressed reference.



11. ideation button

We took the concept and aesthetic of the button make large and easy to use electronic components. After thinking about which kinds of electronic components we wanted to make, we started making a light, a sound buzzer, a button and a power supply reference?.12. first

iteration of buzzer, lamp, button and power supply that works.

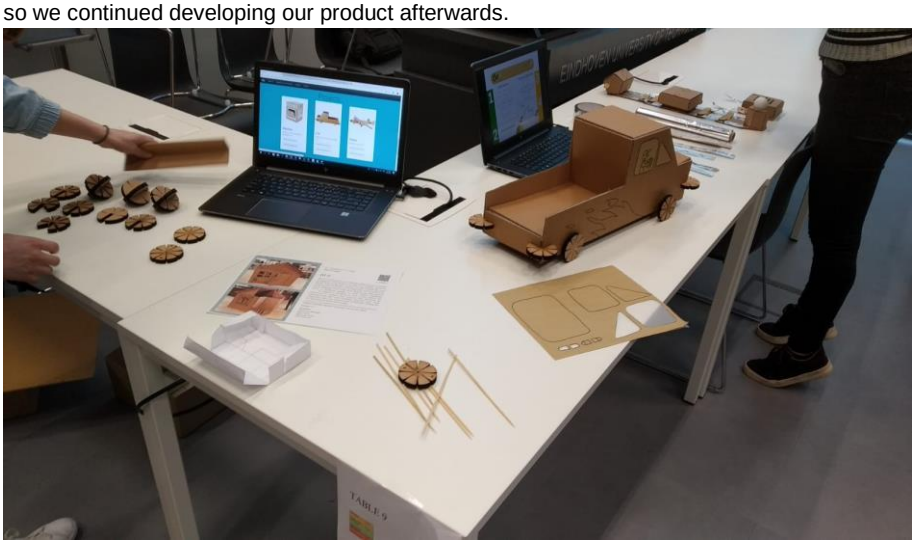


We wanted the electronics to be able to attach to the cardboard to make the creations more interactive. To join the electronic components and make a circuit. At first, we thought of doing this with a marker containing a conductive ink. We stepped away from this idea because it could become too expensive and too unreliable. We wanted to use aluminum foil as a cable because it is something everyone has lying around the house and it conducts

electricity well. We made a small circuit with a buzzer, a battery and aluminium foil as cable to test if the foil would work as cable. And it did. This was a good step forward because it was hard to get cables that were cheap, easy to get, easy to get the right size of and also easy to use. We also needed to connect the strips to the electronics in a certain way. For this we considered clothespins, velcro and magnets. We ended up using magnets because they were the most user friendly. reference. After some more considering we bought aluminum tape to try out but it ended up not conducting electricity because of a plastic coating.

Midterm demo day

To prepare for midterm demo day, we made two building kits, one of a house and one of a car. We also showed the prototypes of the electronics and a mockup of a website for children to share their projects.
The demo day went well, but we hardly got any useful or critical feedback. We did struggle a bit with not getting a lot of feedback, but we knew where our product still had to be improved, so we continued developing our product afterwards.

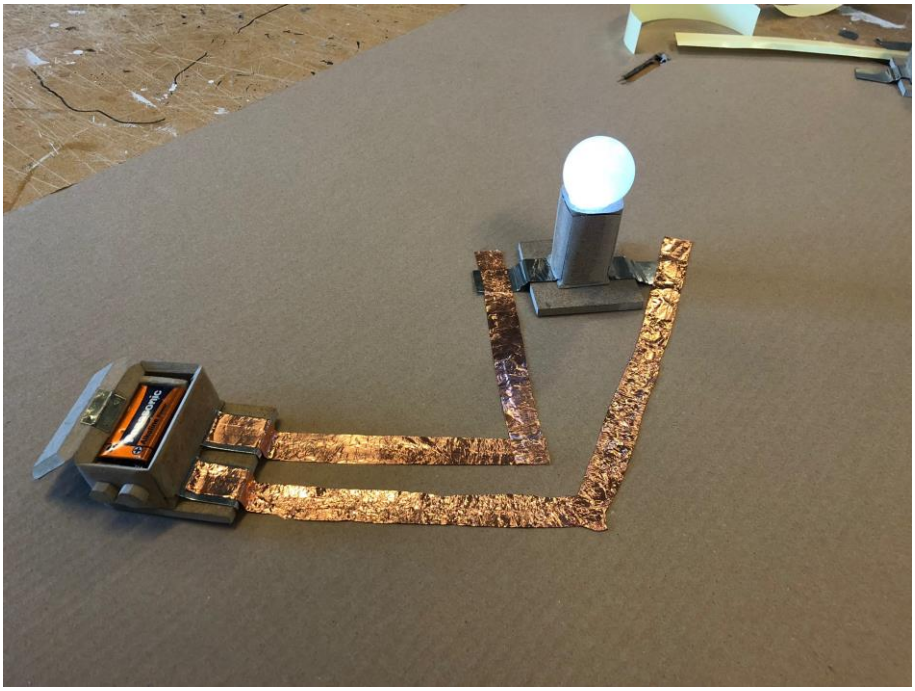



Projects
Kitchen
Car
Plane
FIT IT

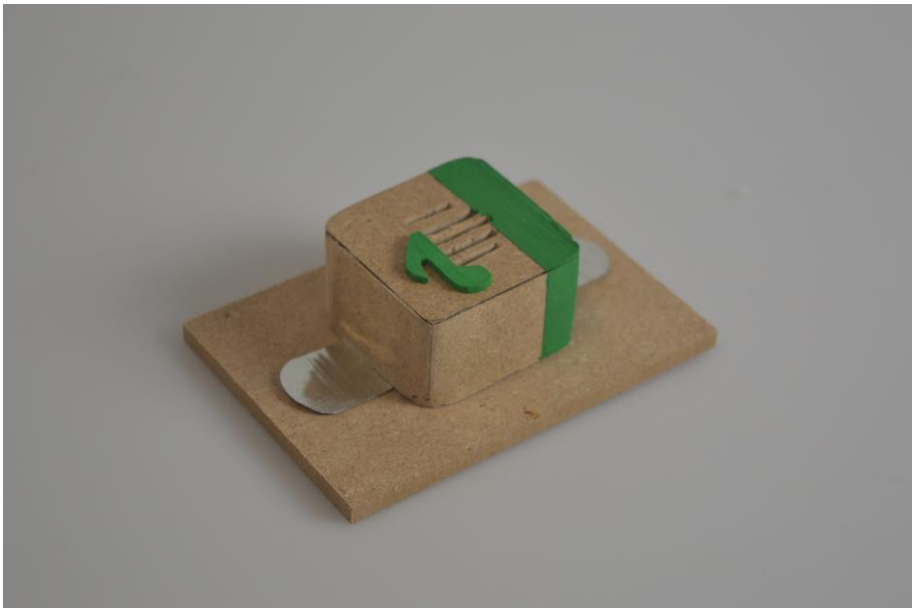

TABLE 9

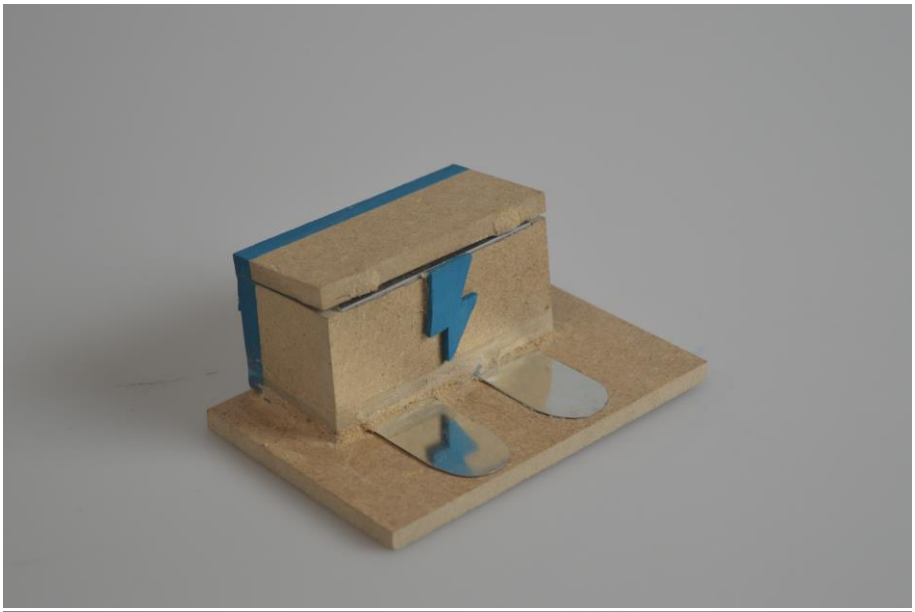
Electronics

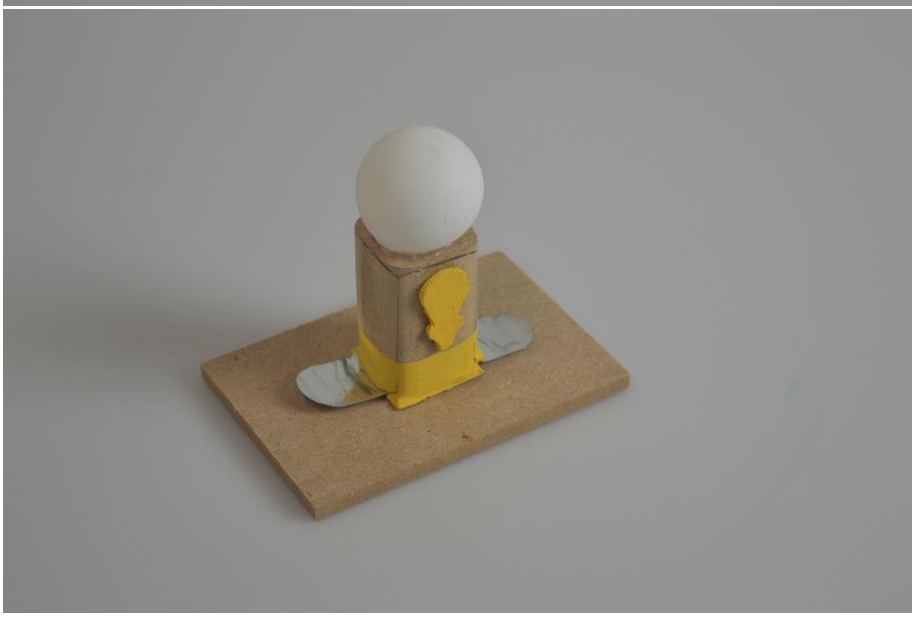
In the second quartile we have worked on improving the aesthetics and physical properties of the electrical components. We ended up using MDF instead of cardboard, because we wanted these components to be more durable than if they were made out of cardboard. MDF is still fairly sustainable, as it is made out of compressed pieces of wood. At last we made some changes to their appearance to make them look more like an end product instead of a prototype reference. We also improved the way the electronics can be connected. We used copper tape because it is more convenient to use and conducts electricity very well reference. We have folded over the edges so that even two pieces of tape are glued over each other at an angle. As a result, the sides of the tape were conductive and there was an adhesive layer in the middle of the strip reference, making the tape easy for children to apply.

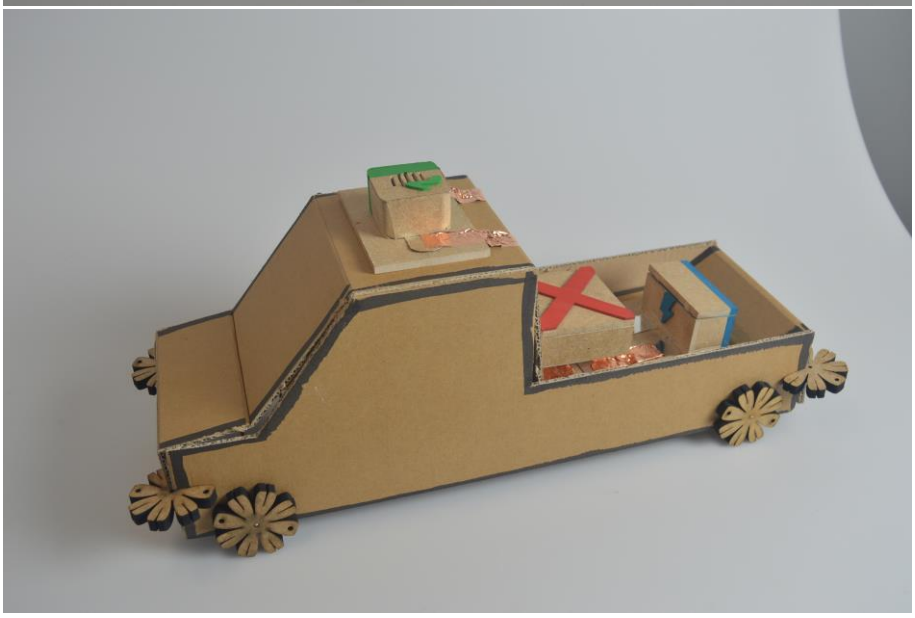


after this we have again made improvements to the electronics. We changed the size and ringing of the connection points so that they are easier to connect. Finally, we have also added color to the electronics so that the components look more attractive for children to play with.









Collecting and analyzing data

While developing the electronics, we wanted to further develop our fitters by conducting user tests and seeing experiencing first hand how usable our fitters are.

User testing

First user test

Before we could begin with a user test, we needed to have enough building kits made that were fully complete. Each kit consisted of a box with outlines drawn on it from which the children could cut out a car, an instruction booklet, seven fitters of version 10, and two skewers. We also bought markers with which the children could decorate the car.

After finishing these preparations, we conducted our first user test at a daycare in Son en Breugel. In addition to the car kit, we brought loose pieces of cardboard of various sizes for the kids to further build with. We wanted to see if:
1. The kids could apply enough force to properly fit the cardboard in the fitters,
2. The kids were able to follow the instructions, cut out the car and build it themselves,
3. The kids enjoyed playing with our product.
4. The kids would be motivated to decorate the car with the supplied markers.

The whole user test was video-recorded and we were present during the user test to make note of everything we saw. The user test was conducted with seven children aged six through eight. They worked in groups of two. We noticed that the kids seemed interested in our product. After shortly explaining what they had to do and how the fitters could be used, they started opening up the box and tried following the instructions. Almost every child had difficulty with cutting the cardboard with scissors. With some of our help they eventually managed to get the right shape out of the box. Understanding how the car needed to be folded was for some a problem and for others not, while understanding where the fitters and skewers needed to be placed was something more children had problems with. All in all, building the car took longer than expected but eventually all building kits were made. While most kids directly took off to play outside, there were two girls that worked together really well and started decorating the car. Two out of the four cars were left at the daycare since some kids mentioned wanting to play with it more. We did not have enough time and kids to play with the other pieces of cardboard.

From this test we stated the following things as points for improvement:

- The booklet was too difficult for the children to understand. They did not understand the schematic drawings in particular.
- The children had trouble getting the cardboard in the fitter because their motor skills were not as developed as assumed.
- Children had too much difficulty in cutting out the car out of the box.
- Children have short attention spans so individual tasks should not take too long.
- The skewers were to sharp and dangerous for the children to play with.

Things that were already good:

- The children were immediately interested and enthusiastic.
- They wanted to finish it even if it brought up frustration
- Some were motivated to decorate it with the supplied markers.

Second user test

After processing all points for improvement of the first user test, we made a new building kit of a train. This kit consisted of four pre-cut plates with the outline of the train, an booklet with more detailed instructions, four times seven fitters of our newer version 12 (see fitter iterations) and four times sticks with a rounded head for the wheel construction and connecting part of the train. On the backside of the instruction booklet, we placed a short questionnaire for the children about their experience using our product.

The second user test was again done in a daycare, but another one then used before. We had two groups of children: one group with four children of the ages eight to ten worked with

the train kit and the other group with seven children of the ages five to seven had loose pieces of cardboard of various sizes and fitters to play with. The most important thing for us to test with the train kit was whether the improvements we made were good enough and if any other problems would arise. With the younger group we wanted to find out if our product motivated the children to get creative with cardboard.

From the test with the train kit we observed that:

- The children could apply enough force and had the motor skills to use the fitters.
- They quickly picked up how to work with the fitters.
- They like building but also decorating their creation afterwards.
- The booklet was understandable and the children were able to build the train themselves.
- The children responded mostly positive about our product in the questionnaire.

With the younger group we observed that:

- In the beginning, the children had a hard time with using the fitters on their own. After we gave them some demonstrations on how they could be used, they started working on their own.
- They were inspiring each other to build different things.
- They started playing with their creations after building with it.
- They started building and playing with each other.

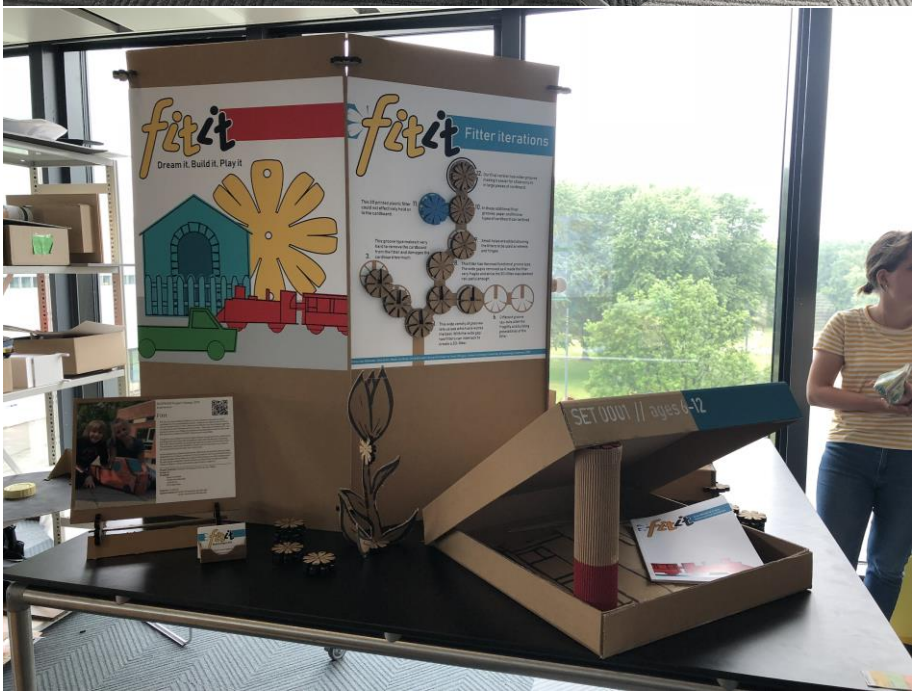
From our meeting with the daycare supervisors it became clear that the product had to be cheap in order for daycares to buy it. We also found out that the kits were definitely not finished. The booklets needed improvement, the packaging was totally not finished and a business plan was needed.

Finalizing

After finishing this second user test, we were content with the state of our fitters for now and building kits, so we started working on finalizing our project. We finished the booklet, reference made packaging for the train building kit reference and a business plan which you can see below.
We also started preparing for demo day, which consisted of thinking about how we wanted to present our product, writing a pitch and making interactive posters.

Final demo day reference

During demo day we got a lot of very positive feedback. Most people showed excitement about the concept of our product and of the product itself. A lot of people showed interest by asking questions which we answered for them.


fitit
Dream it. Build it. Play it
fitit
Fitter iterations
SET 0001 // ages 4-12


fitit
Electronics
Battery
Button
Buzzer
Lamp
fitit
Building kits and website


Electronics
fit it
Building kits and website
Our website contains a webshop from which our products can be bought.
The instruction booklets, next to them being supplied in the kits, can be downloaded from here as well.
On our website, children can post pictures of their own creations.
They can also take inspiration from other children's projects.
Build it
Children can build anything they want with cardboard and our product. With the kits and instruction booklets, we show children how they can use the fitters and how to make strong building structures.
Finish it
Children can decorate their projects with for example paint, markers, stickers or our electronics. This way, children are stimulated to think beyond structures and also be creative with electronics and colours.
Play it
We want to let children express their creativity and play in a sustainable way.
Let's start playing!


fitit
Dream it. Build it. Play it
fitit
Fitter iterations
SET 0001 // ages 6-12


Fitter iterations
fitit
Electronics


fitit
Electronics
Battery
Button
Buzzer
Lamp

Regarding feedback concerning our product, someone said that there are parents that do not want their children to use digital devices and that because of that, we should look into ways of stimulating the children's creativity without having them to visit a website. Though we believe that our product is sufficiently usable without the website, we should look into

ways of stimulating a child's creativity like our website intends to do, without having them to use a digital device.

A second point of feedback was that, though we did want to focus more on educating children about electronics at a young age, we did not deliver the tools with which children could actually get do this with our product. Educating children about electronics is still something we think our product could be very useful for and definitely something we should spend more time on developing in the future.

Business plan

Introduction business model
As a startup named FitIt, run by 4 students, we want to start the company off on a small scale. You can imagine the small scale like us 4 going to toy shops and daycares ourselves and pitching/testing our product. With this the word will spread and some sales will come through. After we have evidence that the product will sell, the bigger scale will come in the picture. Distributors will be contacted and partnered up with after showing the sale evidence. The distributors will help with getting our products to a bigger audience.
For this we first need to complete some steps before the business plan comes in. These steps in chronological order are:

1. Claiming the rights on the product from the university.
2. Finalize to make the product marked ready.
3. Finalize the website (primarily making a functional web shop)
4. Buy a domain name for our website
5. Get a KVK number.
6. European quality mark.
7. Consider possible investors.
8. Contacting transport and production companies.
9. Streamline the production and transport with the involved companies.
10. Contacting toy distributors.
11. Selecting a marked strategies and apply this.

When these steps are completed, the company can get kicked off. The company is solely focused on the sales of the FitIt products, with aims on expanding the product line within the FitIt concept. The plan is to deliver packages of 20 fitters or 50 fitters, building kits of a car, a train and a house, extension kits like a battery, a lamp, a buzzer, a button, a motor and a switch, and a free to use community on the website.

Business model

We want to start a company named FitIt.

Kiezen soort bedrijf en beschrijven wat voor type studenten startup
Maak onderscheid tussen groot en kleinschalig

s.i.v.huiden@tue.nl start up / Eindhoven

Building kits: Car, Train, House

Extension kits: Battery, Lamp, Buzzer, Motor, Button, Switch

Starter kits: 20 fitters, 50 fitters

Website with the possibility to share projects and order kits

Key partners

Small scale

1. The Technical university of Eindhoven is a key partner because they own the rights to our concept at the moment

2. Production companies are needed to be selected and partnered up with to establish a streamlined production.

Big scale

3. A distributor is next to the web shop a key partner to expand the market.

4.Transport companies are of course key partners to get the products where they need to go in order to sell them.

Key activities

1. Providing a well working and clear web shop

2. Make sure we get supplied by the producers

3. Making the kit ready with the supplied products

3. Creating a delivery inventory to deliver the products in a small amount of time

4. Accounting of all inventory and orders

5. Delivery of the sold products via an external company.

Key resources

1.A well-structured patent to make sure the concept will not be imitated

2. Entrepreneurship

Value propositions

FitIt is a gender neutral toy for kits and is fun for both girls and boys.

Build from sustainable materials and involves users in the direct recycling of cardboard

Stimulates children to use their creativity, technical thinking and spatial awareness in the building process.

Projects can be done in a group op children which helps the social skills.

The website provides a community to share projects.

Mach the supply can match the demand because of fast and flexible production

Customer relations

Online community on the website that is free to use.

Next to the online community, all of the relationships will be transaction driven.

Channels

1.Online web shop

2. Toy shops

3. Toy distributors

Customer segments

1. Private consumers mostly parents of children at the age of 4-12.

2. Daycares because it can be a way of reaching a lot of children at one place. It offers also a way for children to work together and inspire each other in projects.

3. For schools the same applies. It can be a way of reaching a lot of children at one place. It offers also a way for children to work together and inspire each other in projects.

		Building instructions are easy to understand for children because it consist of pictures and text.		

Cost structure	Income streams
1. Materials 2. Production: Laser cutting, printing and packaging 4. Website maintenance and updating 3. Transport: toy stores and private customers (Distributor on big scale) 5. Operating expenses 6. Innovation in new products and kits (7.Distributor, on large scale)	Sales from the online webshop Sales from the distributor Sales from toy stores Free website for a user community

Overall result

At the end of this semester, we presented our final product consisting of our finalized fitters; three building kits: a train, a car and a house, of which the train kit was fully developed with packaging and instruction manual; four electronic components: a battery, a lamp, a button and a buzzer; and finally a website with a mockup of a sharing platform and a webshop. We also looked into the business side of this product by setting up a business plan.

Conclusion

This design process was one that was very interesting and new to us since we had to start designing from a material choice and not from a concept or problem statement, like we have done before. We noticed that this approach to designing worked well for us and we found enough inspiration from it to develop a solid product.

At the start of this project, the weekly tutor sessions motivated us to consistently work on the project, set weekly goals and come up with new deliverables each week. At a point where our product concept became more clear, we found ourselves reaching a tipping point where, instead of being driven by the tutor sessions, we became intrinsically motivated by the project itself.

This was, among other things, a result of how we as a group communicated clearly, were both motivated and motivating, were very critical on each other and made good use of each others' complementing skill sets.

As stated in the project goal: "The goal of our project is to create a sustainable product that stimulates children to express their creativity by building their own toys with accessible materials." We can say that we are satisfied with the outcome of our project in relation to our project goal. Especially regarding the fact that we were able to present a complete product line consisting of a base product, extensions, packaging and a website.

Future

Currently, we are heavily considering to elevate this project into a startup. We have already made a roadmap of steps we need to take to start a business from this project and how the business would work. We all would love for this to work and run the company ourselves. To keep expanding we would create new building kits and put more time into developing the electrical devices.

Before this all can happen, we still find we need to finalize our fitters. Currently the fitters are easy to press onto cardboard but do tend to sometimes lose grip after some time. We are working on finding a solution for the fitters giving off charcoal and possibly for providing more grip. We are now spraying the fitters with hairspray so they do not give off charcoal but this is not ideal concerning the toxicity of this product. We would need to spend time finding a substitute for this.

Though there is still a lot to be done, we are motivated to put in the work and we see a bright ahead of us and FitIt.

We, as a group, believe we all had a great contribution to this project. Because we made everything of this project with the four of us being present we cannot say what every person did individually.

Reflections

blablabla

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hoeveel energie er nodig is voor mdf

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benefits of play, onderzoek van lego

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