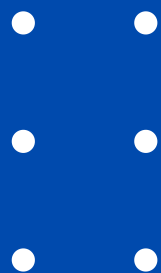


ALEXANDRA NOMIKOS' DESIGN DEVELOPMENT RECORD



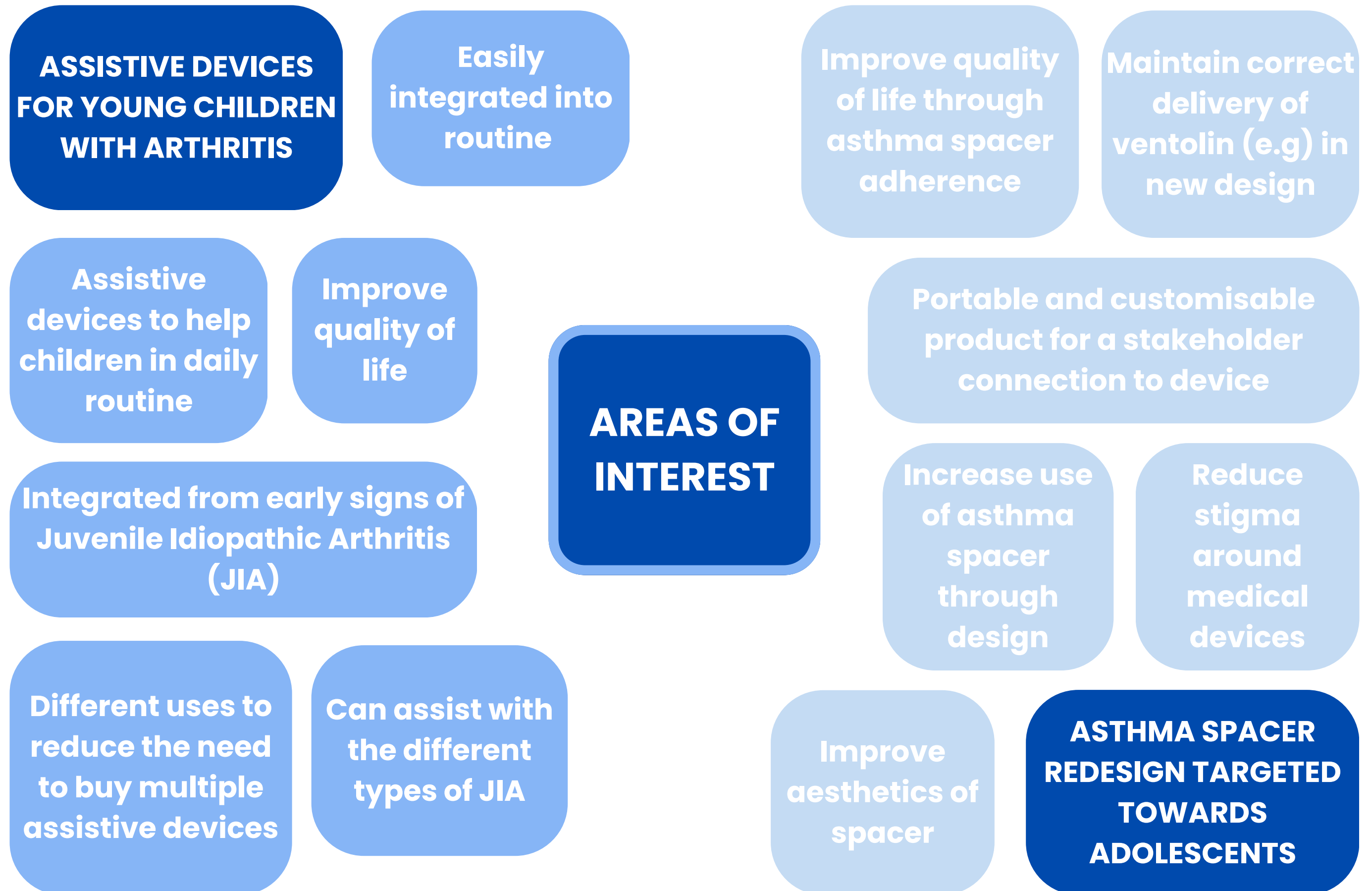
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01

EXPLORATION





EXPLORING AREAS - ASTHMA

ID7: Capstone | DNB311

Explored the topic of asthma and stigma surrounding use of asthma spacers in public. Initial benchmarking to identify what is currently offered and if there is a gap in the market for a redesigned solution. **POTENTIAL CONTACTS:** i know someone in the hospital industry – they have more contacts with specialists, my own personal doctor, nurse graduates, coworkers/friends/family/peers who have asthma or experienced when they were younger

TWO TOPICS:

1. STIGMA AROUND USE OF ASTHMA SPACERS IN TEENS
2. ARTHRITIS IN YOUNGER CHILDREN

ASTHMA:

1. PEOPLE:

- a. primary and high school children
- b. young adults
- i. secondary users - adults:
 - i. general practice doctors or doctors in hospitals (can find more connections through my dad who works at the mater hospital)
 - ii. teachers - to help encourage the use of the spacer for children
 - iii. specialists
 - iv. health hygienists
 - v. physiotherapists - exercises to reduce pain or discomfort in the lungs

2. ACTIVITIES:

- a. school sports - over exertion - needing their inhaler
- b. seasonal asthma (effects of asthma that are more prominent with sudden weather changes)
- c. casual walking
- d. excursions
- e. running
- f. going to the gym

3. CONTEXTS:

- a. at school
- b. on an excursion
- c. at home
- d. a birthday party
- e. at work (secondary users)
- f. on holidays (less access to chemists or prescriptions for their inhalers)

help combat this stigma of the spacer or embarrassment for children to use it around other people

improving the spacer design or creating a new one that reduces this embarrassment of using it - make it look cool or something that's more trendy/adaptable to the user's personal taste

the less use of the spacer will in turn affect the user's asthma negatively, the spacer is there to help the medicine get into the lungs easier, whereas using the nozzle from the inhaler itself isn't as efficient as using the spacer

spacer has an additional attachment (a face mask) for users who may struggle to close their lips around the mouthpiece of the spacer

the face mask is more commonly used for younger children but can also be used for anyone who struggles with the mouth piece or even just prefer the face mask

Bullying and/or teasing on children with asthma shows that the child's asthma is more likely to report worse control as well as restrictions on daily activities.



"I literally turn away or hide" - Stigma surrounding puffer use is a barrier to better treatment
 (This 30-second speech, written by a young person with asthma, was part of a campaign to raise awareness of the stigma surrounding asthma. It was filmed in a school playground in London, UK. The young person is a member of the National Asthma Campaign's Young Ambassadors.)

So not only does the bullying of the child with asthma hurt their mental health, but it also impacts their control and wellbeing of their asthma. It will then reduce the use of the child's inhaler and especially the use of the spacer - a chamber used to help control the medicine so that it is easier for the user to inhale.

- stigma around the use of the spacer - a child feels embarrassed to use the spacer as not only are they being bullied for simply having asthma but they are also less likely to use their spacer as a result of this



EXPLORING AREAS - ARTHRITIS

ID7: Capstone | DNB311

explored the topic of juvenile idiopathic arthritis (JIA) in children under 17 years old and assistive devices for every day tasks. BENCHMARKING was INITIALLY conducted to see what is in the market currently and where i can see myself DESIGNING IN. POTENTIAL CONTACTS: three contacts in the education system – two in primary and one in high school, peers/family/friends who have it??

- ARTHRITIS:**
1. PEOPLE:
 - a. children - from six months to 16 years old
 - b. teenagers - from 13 to 16
 - c. secondary - parents to assist their children
 - d. teachers
 - e. doctors
 - f. physiotherapists
 - g. specialists for braces
 2. ACTIVITIES:
 - a. writing in school
 - b. drawing
 - c. painting
 - d. playing sports
 - e. everyday walking
 - f. tying their shoelaces
 - g. putting on clothes
 3. CONTEXTS:
 - a. at school
 - b. home
 - c. at a friend's house for a sleepover
 - d. the doctor's office
 - e.

JIA is harder to diagnose right away as it has lots of different symptoms and infections like Lyme disease have similar symptoms to JIA - the doctor needs to rule out all possibilities before diagnosing the child with JIA

Juvenile Idiopathic Arthritis (JIA) is prevalent in children under the age of 17 years old.

Would be experiencing pain or stiffness, even flare ups if it gets too bad. Can be in a variety of areas, from hands, arms, legs and can even in turn affect other organs

7 different types of JIA:

1. **Systemic JIA:** affects the whole body. Experiencing fluctuating fevers or rashes. Lymph nodes might become enlarged and eventually the body's joints are affected by swelling, pain and stiffness
2. **Oligoarthritis:** affects four or fewer joints, often pain, stiffness or swelling in the knee and ankle joints. Can also give someone inflammation of the iris
3. **Polyarticular arthritis, rheumatoid factor negative:** affects more guys than girls. Swelling will occur in five or more joints - small joints of the hands usually affected as well as weight bearing joints like knees, ankles, feet and neck
4. **Polyarticular arthritis, rheumatoid factor positive:** similar to adult arthritis. Least common but carries higher risk
5. **Psoriatic arthritis:** having psoriasis and arthritis together
6. **Enthesitis related arthritis:** affects lower joints like ankle and the spine. May also have juvenile ankylosing spondylitis if joints of the low back are inflamed
7. **Undifferentiated arthritis:** when someone's arthritis doesn't fit into any of the above categories

stiffness can be hard in the morning as the inactivity will make it harder to get out of bed.

eventually the discomfort lessens after the person is up and moving

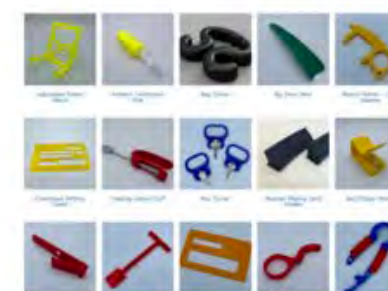
an assistive device to help the child wake up better or function properly in the morning

like: brushing their teeth, putting clothes on, brushing their hair, tying their shoelaces

- factor positive:** similar to adult arthritis. Least common but carries higher risk
5. **Psoriatic arthritis:** having psoriasis and arthritis together
 6. **Enthesitis related arthritis:** affects lower joints like ankle and the spine. May also have juvenile ankylosing spondylitis if joints of the low back are inflamed
 7. **Undifferentiated arthritis:** when someone's arthritis doesn't fit into any of the above categories

properly in the morning

putting clothes on, brushing their hair, tying their shoelaces



Chose the asthma spacer redesign topic as it is something I am more passionate about and interested in developing a design in this area.

INITIAL NOTES:

- redesign of the asthma spacer - make it more aesthetic (reduce the psychological stuff against it / not wanting to be seen to use it), portable, compact
- talk about the psychological effects on it
 - how no one really wants to use it in public as it's so big, clunky and also just really ugly. not wanting to be judged by other people
- spacers are used to increase the amount of ventolin into the lungs but not many people use it because of how big and ugly (bad word) it is, so a redesign to reduce the prejudice against it to help ensure users are getting the proper care they need from the ventolin

AREAS OF INTEREST

Improve quality of life through asthma spacer adherence

Maintain correct delivery of ventolin (e.g) in new design

Portable and customisable product for a stakeholder connection to device

Increase use of asthma spacer through design

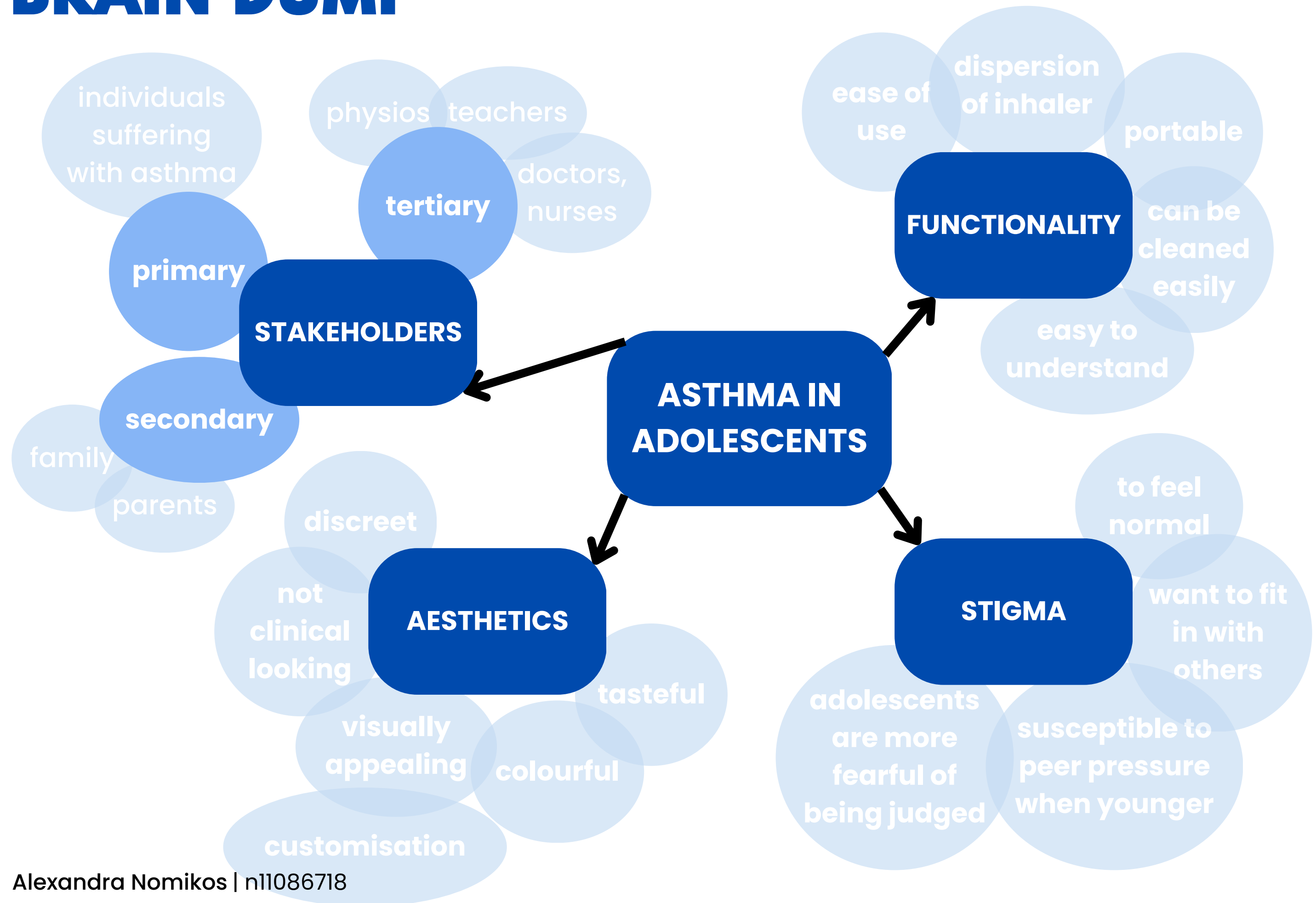
Reduce stigma around medical devices

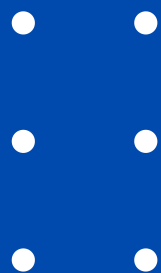
Improve aesthetics of spacer

**ASTHMA SPACER
REDESIGN TARGETED
TOWARDS
ADOLESCENTS**

BRAIN DUMP

ID7: Capstone | DNB311





02

RESEARCH



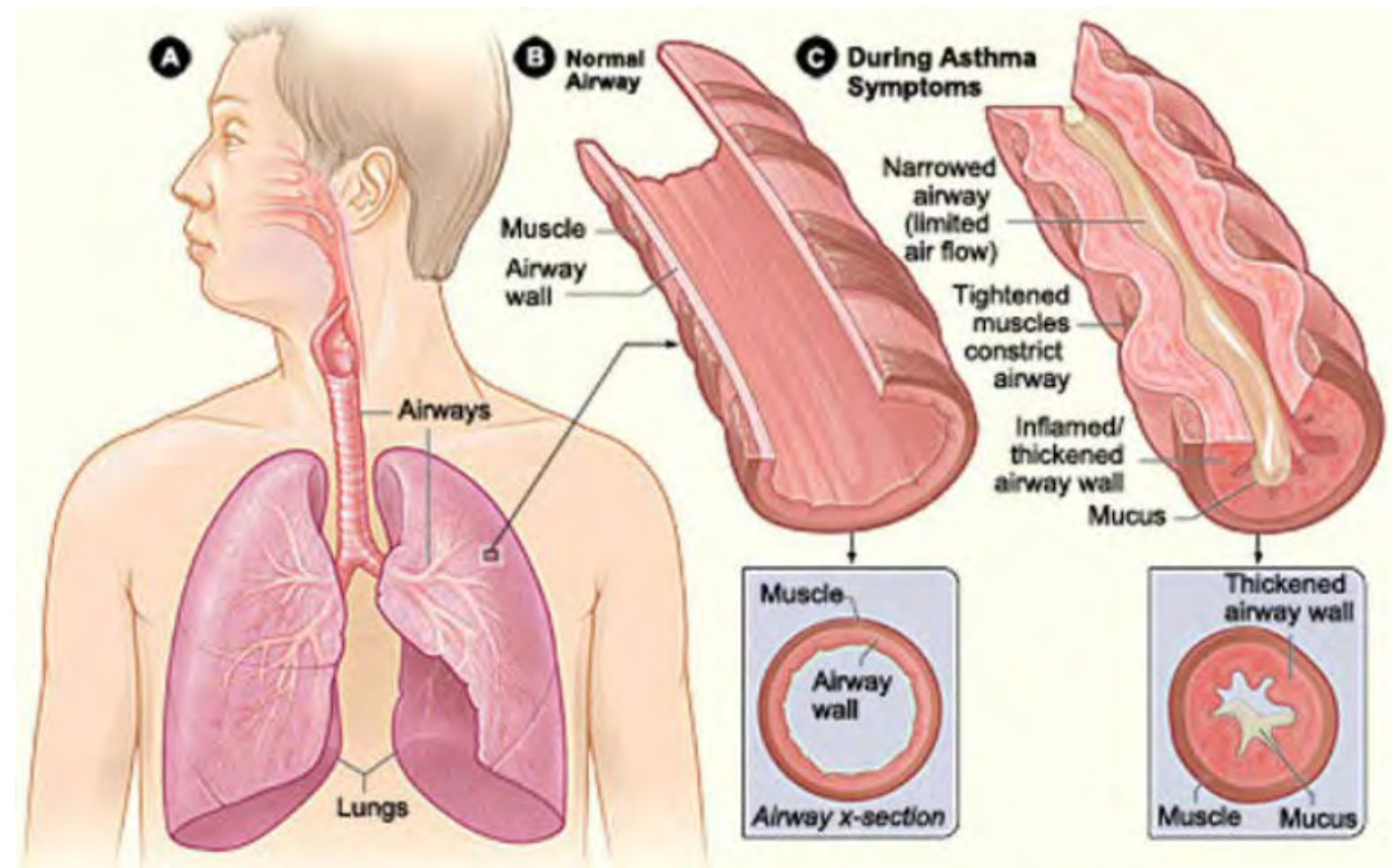
WHAT IS ASTHMA?

Asthma is a chronic inflammatory lung condition affecting the airways, it is caused by inflammation and tightening of the thin muscle around the airways making it harder to breathe (National Asthma Council, 2024).

Sometimes for those with asthma, they find it harder to breathe in and out, as the airways in their lungs are more narrow – other times their breathing can be normal.

Symptoms include:

- wheezing
- coughing
- tightness in the chest
- feeling of not getting enough air



So what is happening when someone has asthma symptoms?

Inside the lungs:

Airways tighten up due to contracting muscles.

Airways thicken up with the lining of the tubes getting swollen and inflamed.

Airways fill up by mucus blocking the inside of the tubes.

ASTHMA TREATMENT

Medicine for asthma management is essential. The main aims of asthma treatment are:

- to keep the lungs as healthy as possible
- to keep symptoms under control
- to prevent asthma from interfering with school, work or play
- to prevent flare-ups or asthma attacks

There are two main categories for asthma medicines: **relievers** and **preventers**.

The former is used when symptoms occur and the latter is meant to be taken daily to reduce airway inflammation to lower the risk of flare-ups

And prednisolone tablets are used for more severe asthma flare-ups.

(National Asthma Council, 2024)

Asthma requires medication for safe management, as severe flare-ups can be life-threatening. The **best treatment depends on the user's age, symptoms, and preferred inhaler type**. Correct inhaler technique is essential for effective medication delivery, with healthcare professionals providing training when needed.

Some inhalers require a spacer for improved delivery, though certain plastic spacers must be pre-conditioned to prevent medicine from sticking to the chamber walls. Non-static spacers do not need preparation.

In Australia, most asthma medications are partially subsidised through the healthcare system, helping make ongoing treatment more affordable.

WHAT IS AN INHALER?



Asthma inhalers are hand-held portable devices that deliver medicine to one's lungs. There are a range of different types that can be provided by a healthcare professional.

Most common inhalers provided:

- **Metered dose inhalers (MDI)**
- Dry powder inhaler
- Soft mist inhaler
- Other: nebulisers

(Mayo Clinic, 2024).

Consist of a pressurised canister containing medicine. It is released by pushing the canister down into the boot

Inhaler doesn't use a chemical propellant but the users releases medicine by breathing a deep breath

Propellant-free inhaler that releases a slow mist for easier, controlled breathing. Slightly larger than standard inhalers

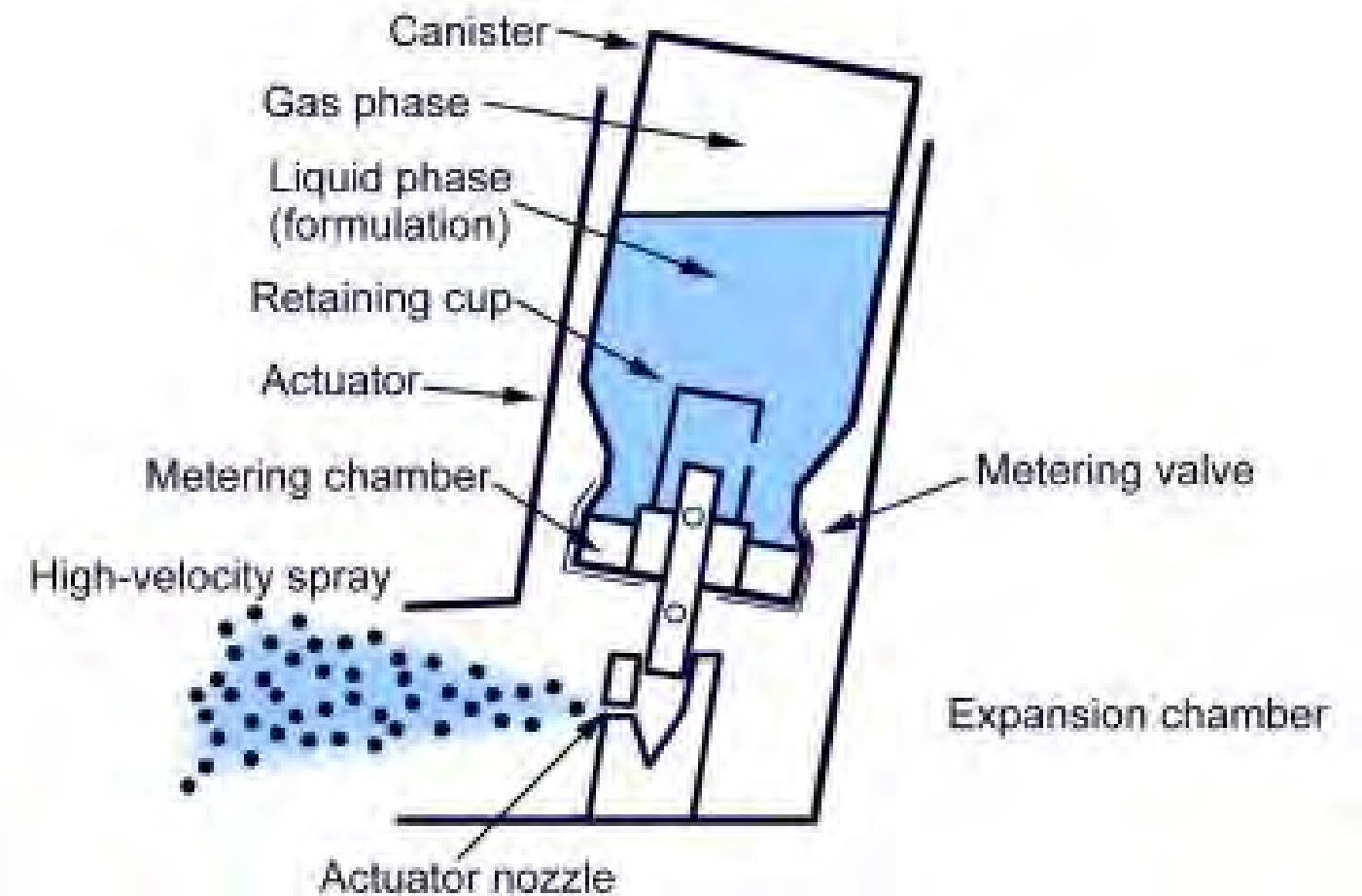
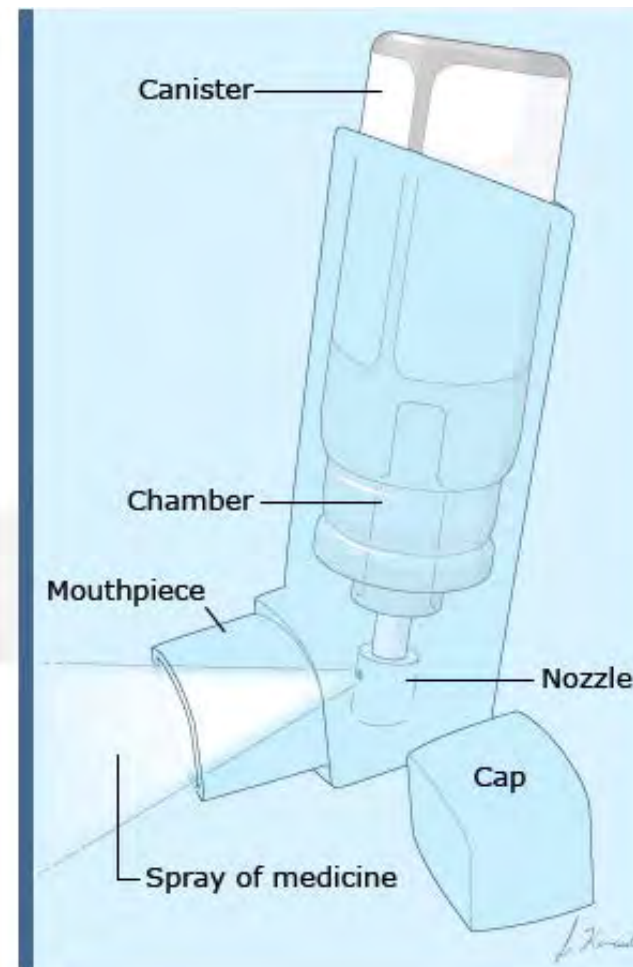
Turns medicine into a fine mist that is breathed in through a mouthpiece or mask. Better for large doses of medicine.



METERED DOSE INHALER



Metered dose inhaler

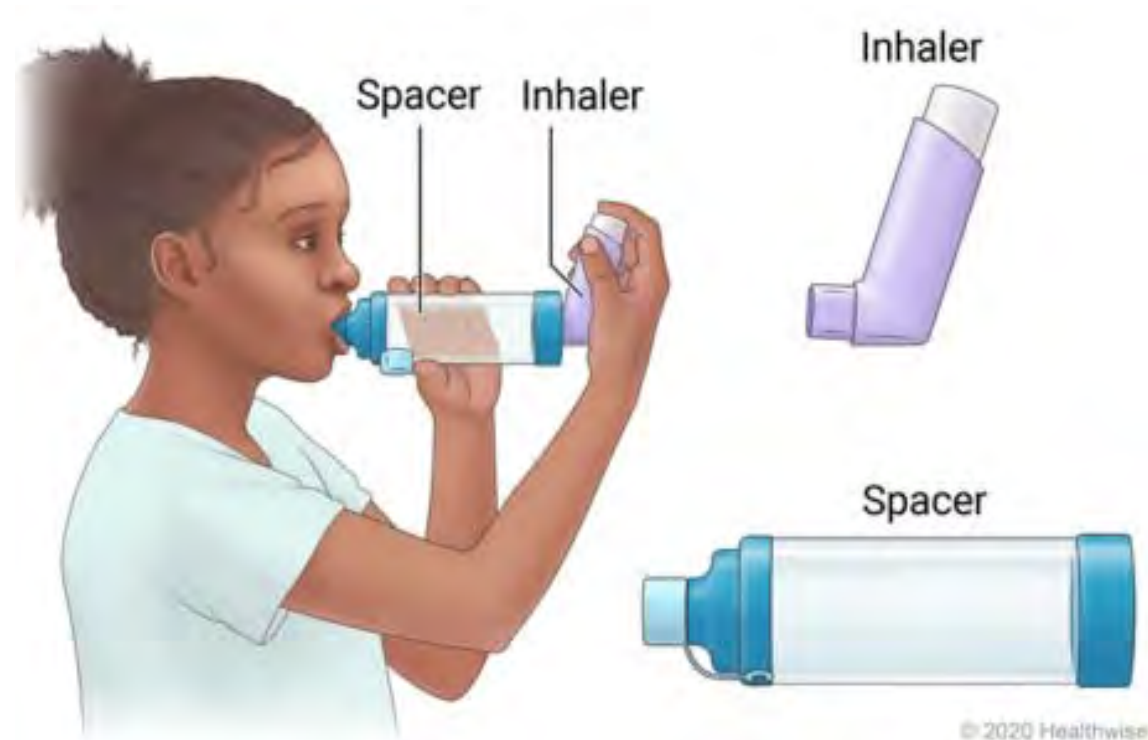


A MDI consists of a small, pressurised canister containing medication and a propellant. When the user depresses the canister into its actuator (or “boot”), it releases a metered dose of aerosol that the user inhales. ([Lung Foundation Australia, 2024](#))

How it works

- The user shakes the inhaler to mix contents before use.
- With the mouthpiece or spacer in place, they press the canister, releasing the medication into the chamber or mouth
- Inhale slowly and deeply so the aerosol reaches the lungs rather than being lost in the mouth. Spacers improve delivery by reducing speed of the spray and allowing easier inhalation.

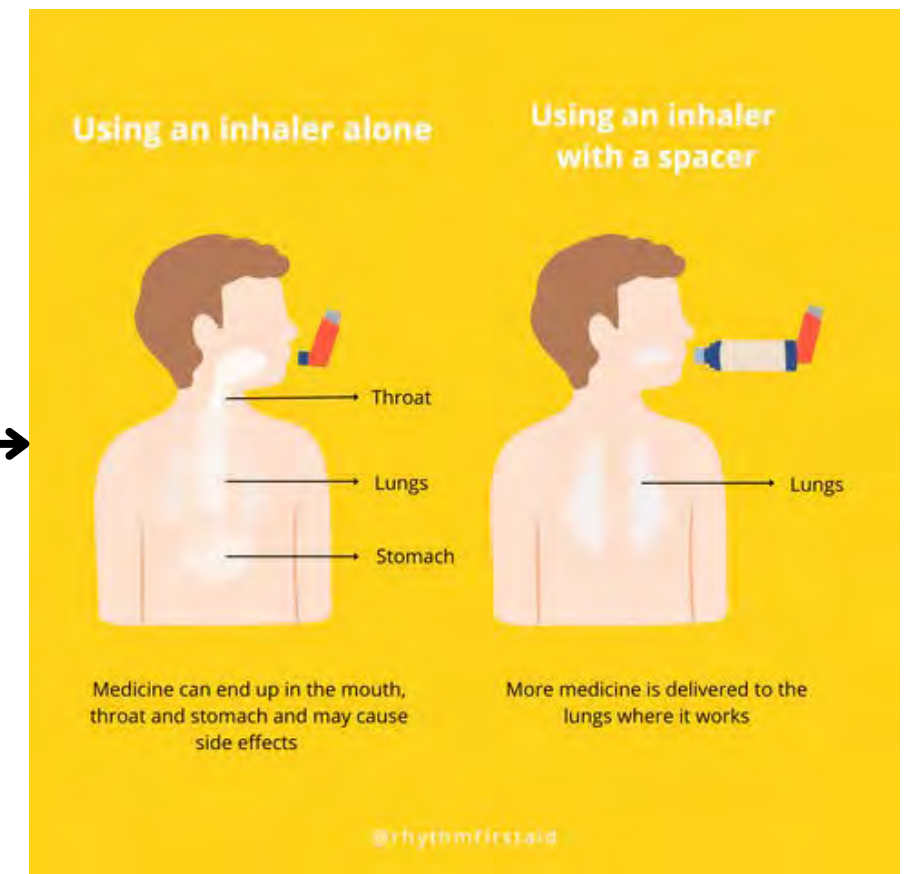
WHAT DOES A SPACER DO?



The spacer is a tube/chamber that attaches to the MDI (or commonly known as a puffer), to help make breathing in asthma medication easier and more effective in reaching your lungs. It essentially gives the medication 'space' to slow down for the user to breathe it in slowly and deeply and holds it within the tube/chamber.

(National Asthma Council, 2025).

Without the spacer, the medication from the inhaler can end up in your mouth and throat.



This can lead to irritation, hoarseness and infections

WHY USE A SPACER?

This review discusses the use of a spacer (or a valved holding chamber (VHC) to deliver medication from an MDI and how the properties may vary across devices according to physical characteristics, materials of manufacture, risks and benefits of valves and the evidence that they contribute to the delivery of therapy.

- Spacers and MDIs **reduce need** for precise hand-breath coordination by allowing the patient to inhale medication from the chamber rather than right after canister actuation
- Spacers decrease oropharyngeal drug deposition (less drug stuck in the mouth/throat) and **increase lung-deposited dose**, which can **improve effectiveness** and **reduce side-effects**
- Different types of spacers vary in **volume, antistatic coatings, valve design, and shape**, these design features affect performance and suitability for different patient groups
- While effective, the article emphasises that not all spacers are used or selected optimally: issues include **incorrect technique, device cleaning, and matching the spacer to the inhaler**
- Better patient education, improved design of spacer devices (especially for children or those with coordination difficulties), and stronger evidence can help guide spacer selection and use in clinical practice

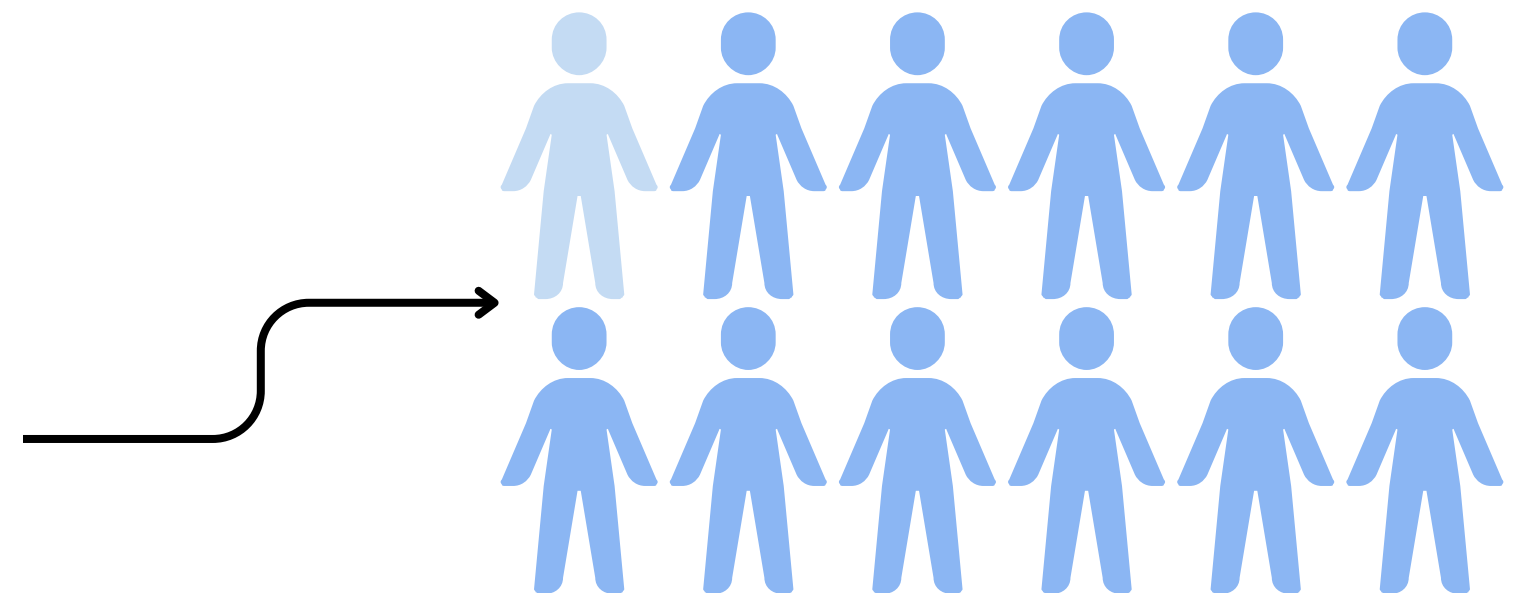
KEY TAKEAWAYS:

- Design of spacer device matters in real world use and not just medication or inhaler itself
- Volume, valve, finish impact usability and effectiveness
- Designing spacers to reduce coordination and improve lung delivery

ASTHMA IN AUSTRALIA

- Asthma affects nearly 2.8 million Australians, representing about 11% of the population
- 1 in 9 Australians report having asthma
- Among children under 15 years, around 1 in 10 boys and 1 in 16 girls have asthma
- In 2022–23, there were over 31,000 hospitalisations where asthma was the main diagnosis – nearly 43% of those were children aged 14 or under
- Asthma is the leading cause of disease burden for children under 14 and the fourth leading cause for adolescents and young adults (15–24 years)
- Only 1 in 3 people with asthma use regular daily medication and have an asthma action plan
- Only 1 in 2 children (49%) used asthma medication in the last two weeks [of the research] in 2022

(Asthma Australia, 2024).



Looks pretty isolating doesn't it?

More importantly this data:

- Highlights asthma's widespread impact in Australia – especially among children and adolescents
 - reinforces importance of accessible and user friendly devices

ASTHMA IN AUSTRALIA

The Australian Institute of Health and Welfare (2022) provided a report on Asthma prevalence among children.

Key findings from the report:

- In 2017–18, around 10% (approximately 460,000) of Australian children aged 0–14 were reported to have asthma as a long-term condition.
- The prevalence was higher among children with a disability (18 %) compared to children without (8.9 %).
- While child asthma prevalence rose in earlier decades, between 2007–08 and 2017–18 it remained relatively steady at 9.3 %–11 % in children aged 0–14.
- Children aged 5–9 had the highest prevalence (boys 15 %, girls 10 %).
- Asthma rates vary by demographic factors: higher among Indigenous children (15 % vs ~9 % non-Indigenous), children in low socioeconomic areas, and children in one-parent families.
- While severe outcomes are relatively rare in children, asthma can significantly restrict physical, social, and emotional activities.

Alexandra Nomikos | n11086718

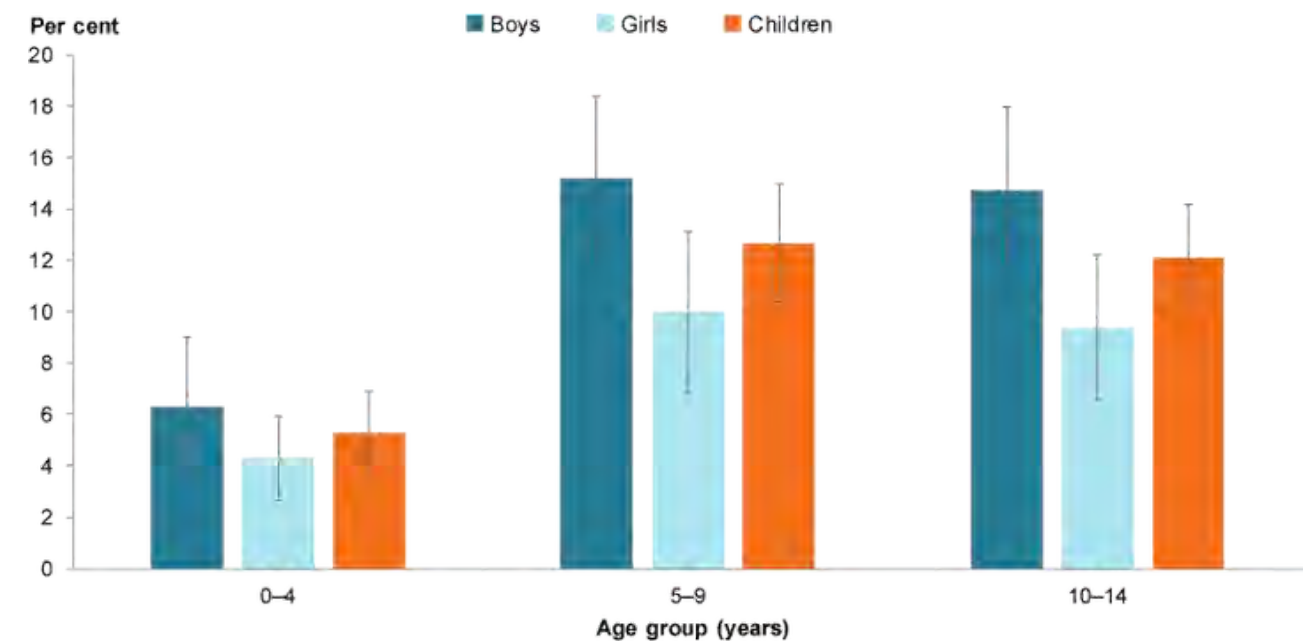


Figure 1: Prevalence of asthma among children aged 0–14, 2017–18

Shows that asthma is prevalent amongst children and adolescents in Australia (and in crucial developmental years). This underscores the importance of effective treatment devices being **confidence-promoting** and also widely **available** and **accessible** to all users to ensure that it has the best impact it can for younger users who struggle with asthma.

ADOLESCENTS W/ ASTHMA

Young people with asthma face physical impacts of their children like everyone, but as well as social, psychological and functional impacts which are heightened by developmental challenges that are faced in adolescence.

Asthma Australia did a survey on youth and asthma and these were their findings/concerns:

- **63%** of young people had **poor asthma control** with 90% of the participants reporting experiencing shortness of breath at least once a week in the last four weeks [since the survey was conducted]
- **quality of life** was **impacted** with **56%** of participants reporting **asthma hinders enjoyment of life in some way**
- 42% had to **miss** some education, or work **due to their asthma**
- only 60% of respondents said they took their preventer medication every day and only half had an asthma action plan
- and 12% reported they currently smoked

'10.2% of people aged 15–24 have asthma – more than 315,000 Australians'
(Asthma Australia, 2025).

Note: **'adolescents'** are defined by World Health Organisation as people aged **10–19** and **'youths'** are defined as young people aged **15–24** years old

(World Health Organisation, N.A).

STIGMA AROUND ASTHMA

Asthma Australia also conducted another survey into how people felt about taking their medication in front of other people and here are some quotes and facts they provided:

- “I literally turn away or hide – with my head almost in my bag – to use my puffer with a spacer,” said one person.
- While 95% people said they were supportive of someone using a puffer in public, at least 1 in 4 people said that if they had asthma, they would be uncomfortable using one themselves.
- Nearly 1 in 2 people (48%) who have asthma or care for someone with asthma say they would feel uncomfortable to use an asthma puffer in public.

As a result of this stigma, users are more susceptible to their asthma worsening if they're not taking enough medication and inherently damaging their quality of life.

(Asthma Australia, 2022).

Specifically for adolescents and youths, stigma around asthma may seem heightened. Especially in adolescence as it is peak time where emotions are heightened and they're easily influenced.

Pop culture references stigmatise asthma by portraying characters with asthma as nerdy, weak and overemotional.

Dealing with the stigmas around asthma can lead to a higher risk of anxiety and depression. The fear of social judgement can result in a reduced use of inhaler and avoidance in using medication – especially using the asthma spacer – which can have serious outcomes and places the user at risk of asthma flare ups and attacks.

(Asthma Australia, 2022).

ASSISTIVE DEVICE STIGMA

To get a better understanding of stigma surrounding asthma, I conducted research into assistive devices and the stigma surrounding the use of it.

Assistive Technology (AT) Use and Stigma (Parette & Scherer (2004) article highlights that even though assistive technology has the potential to improve the independence of users, many avoid it or stop using them because of the social stigma associated with visibly different or 'medical looking' devices.

Factors contributing to stigma in AT use:

- If the device is **visibly bulky or conspicuous**, it can increase the users feelings of being different
- Many ATs prioritise being super functional and then **forgetting about aesthetic and social acceptance** of the product – may look clinical as a result and attracted unwanted attention
- Young users can be **sensitive** to how AT devices affect their **social image** and **perception** from their peers

- They also introduce 'social validity' as whether the device is perceived as acceptable, useful and dignified by users and peers – arguing that it affects long term adherence (totally agree with).
- Design implications they mentioned: ATs should be more unobtrusive, allow for user choice (personalisation/customisation) to match user identity and design them with social context in mind as even though the device works, they may not be used
- Article also points out that AT research focuses on functional outcomes about whether it works effectively rather than addressing the emotional, social and psychological consequences of device use
 - **PRESENTING A HUGE GAP in how design and stigma interact in everyday experience of device users**

ASSISTIVE DEVICE STIGMA

Additionally, this study, *'Overcoming the Stigma Associated with Assistive Devices,'* (Jacobson, 2010) explores the ways stigma related to assistive devices could be challenged from the viewpoint of design.

Why???

- Many devices are engineer designed – which means it prioritises function over aesthetics, making it look medical or institutional
- Association with disabilities make users feel different or pitied, especially in public
- Hospital designed devices appear out of place when used in every day settings
- As a result, users abandon devices that meet medical needs but harm their self esteem or social identity

Identity and perception:

- Modern days, appearance is closely tied to identity – how one presents themselves define the person they are
- Unlike eyeglasses (which were once stigmatised and are now fashionable) most devices remain clinical and denying users the opportunity for personalisation

Personalisation as a design solution:

- Customisation is proposed as solutions to reduce stigma
- Being able to select colours, materials or add ons help create a connection to the device
- Modularity to allow for modification for users to match their preferences

This paper urges designers, not just engineers, to be involved in assistive design technology development. These devices should be treated like every other consumer product, to be designed for identity, style and emotion just as much as function (like kitchen appliances or utensil). This customisation will help to empower users through aesthetic choice and personalisation, this will help shift devices from status of a disability to symbols of empowerment and individuality.

ADOLESCENCE BEHAVIOUR

Adolescents find 'belonging' important, they don't want to stand out for the 'wrong' reasons or to be seen as different from others. To help understand this ideology better, I looked into adolescent behaviour and how this would eventually affect their views on using an asthma spacer.

The importance of belonging and the avoidance of social risk taking in adolescence (Tomova, Andrews and Blakemore, 2020) explores how adolescents often avoid social risk taking, the risk being socially excluded by their peers and the negative affects associated.

- Socially belonging is especially important during adolescence as social exclusion and loneliness are high during this stage – can have negative effect on immediate and long term well being
- Devices or behaviours can highlight the difference or draw attention to themselves and may increase the perceived social risk which can harm their confidence or adherence
- Social context, peer dynamics and emotional safety is critical to explain why some adolescents avoid devices
- Achieving a sense of belonging requires reducing the visible difference and designing for social comfort – not just functional

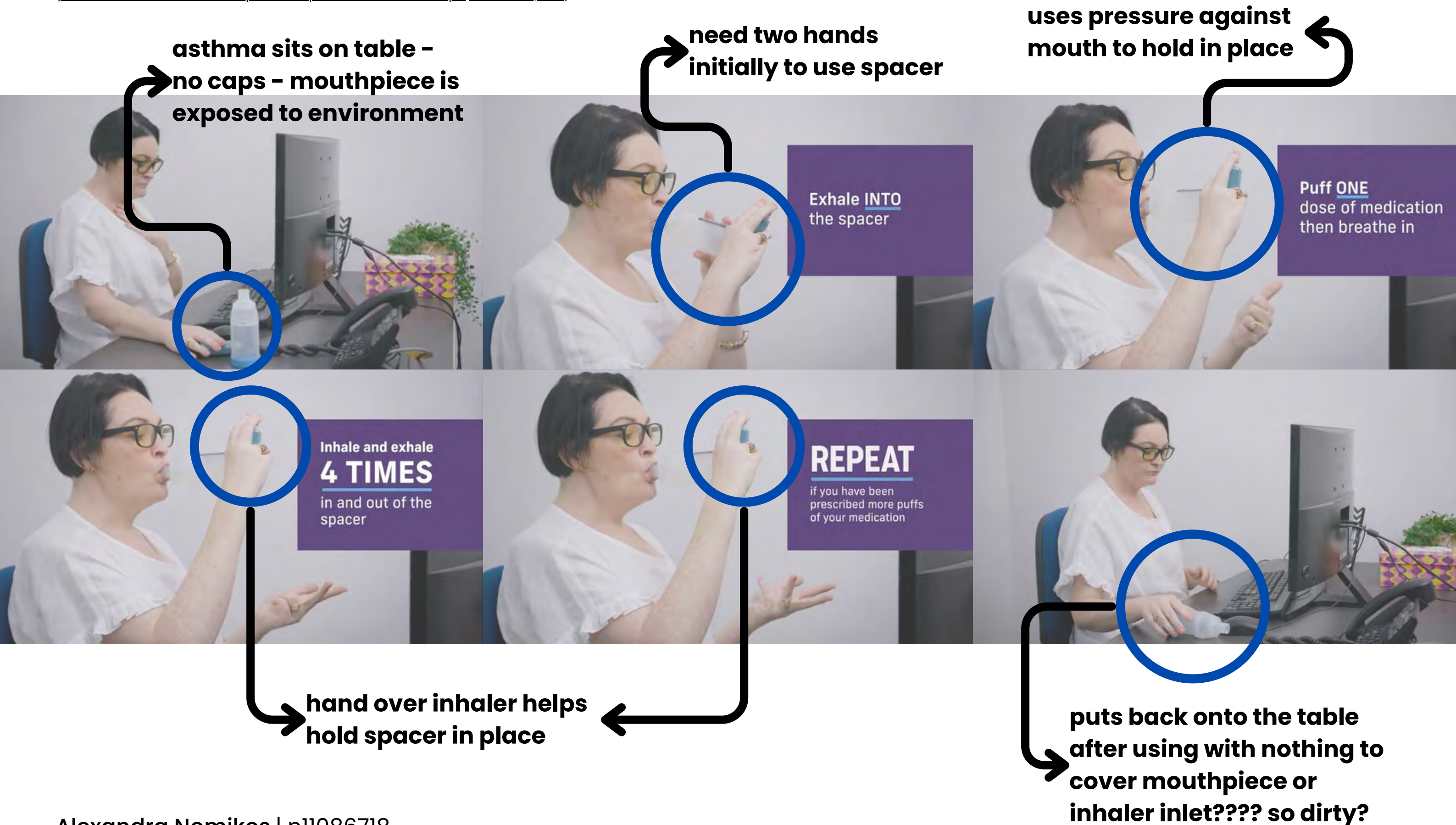
GAP REMAINS FROM PREVIOUS SLIDE:

This research reinforces why adolescents may avoid using devices that look clinical or draw unwanted attention.

It also shows why reducing stigma and increasing social comfort in design/assistive devices is just as important as the medical functionality in the design of a product as it will encourage users to not be afraid to use it and help their health.

USING A SPACER

(Asthma Australia How to use a spacer and puffer - 4 breath technique on Youtube, 2021)



SPACER MAINTENANCE

(How to clean an inhaler and spacer | Boston Children's Hospital on Youtube, 2015)



inhaler to be cleaned by removing cap and canister and using water and soap to clean

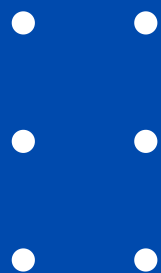
same process for asthma spacer but is more important to let air dry – as small soap residue acts as a way to ensure the spacer is anti-static to prevent medication sticking to the chamber

According to National Asthma Council Australia, cleaning a spacer should be **weekly** and especially **after recovering from a cold or respiratory infection**. The spacer should be **replaced** after **12 months** of use or as per the manufacturers instructions.

To clean:

1. Dismantle your spacer, if necessary.
2. Wash all the parts in clean warm water with liquid dishwashing detergent.
3. **Allow the parts to air dry without rinsing – drying with a cloth or paper towel can result in static building up on the inside of the spacer, which makes the medication stick to the sides.**
4. Wipe the mouthpiece clean of detergent, if needed.
5. When completely dry, reassemble if necessary

Additionally, the spacer should be checked every 6–12 months by a professional to check the structure and the valve is working correctly.



PRODUCT RESEARCH



CURRENT SPACERS

These are just everyday spacers that are more popular from what I could see – reviews, availability and also cost.



A simple, widely used spacer with an anti-static chamber to improve medication delivery. Made from plastic with a soft silicone end-cap that fits most inhalers. Easy to clean and affordable.



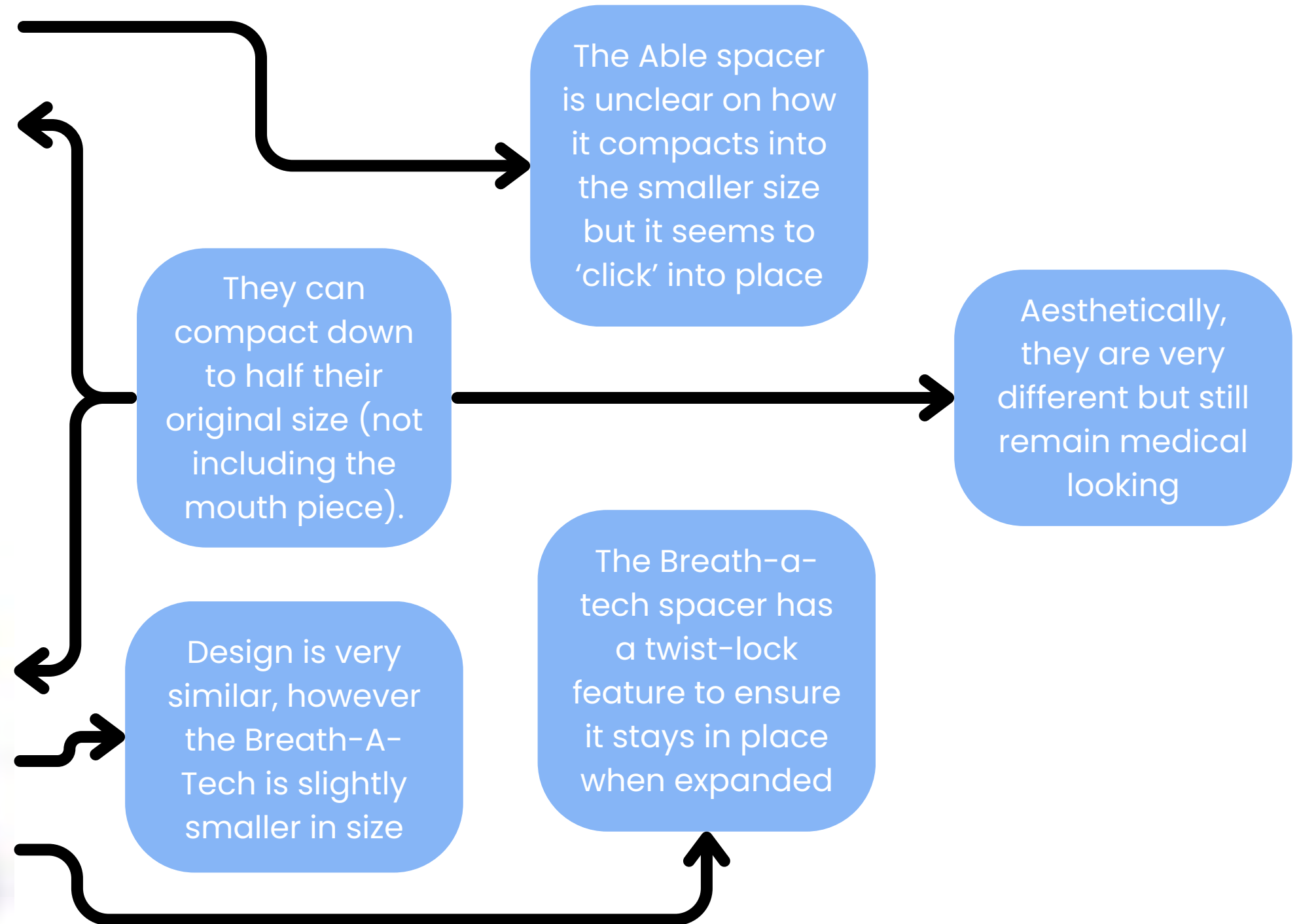
A more compact spacer with low resistance valves and a visible expiratory valve to confirm correct inhalation. It's a slightly more advanced spacer than the previous one.



Similar to Philips, it features a Flow-Vu inhalation indicator and FlowSignal whistle for visual and audible feedback. Includes low-resistance valves, compatible with pMDIs and soft mist inhalers.

COLLAPSIBLE SPACERS

With the same functions as a basic asthma spacer, these two are different as they are collapsible.



DISPOSABLE SPACERS



Disposable spacers are ideal for travel, hospitals and emergencies as they eliminate the need for cleaning and reduce the risk of cross contamination due to their disposable nature.

HOWEVER, they are much less durable than reusable spacers, one time use design, they can become more expensive over time and generate more waste.

Some of the disposable spacers lack features like one way valves or inhalation whistles like the first spacers explored.



Due to the nature of my project, these will not be explored further as they are essentially obsolete from a (my) design perspective. But the size of them is a good source of inspiration

OTHER SPACERS



Another concept but is more of a redesign of the shape of the inhaler itself to assist children in administering the medication themselves



Funhaler is a child-focussed spacer that uses toy-like incentives to improve adherence. While encouraging management it also maintains effective drug delivery - a concept however that was not brought to market



Volumatic is a large holding chamber that improves lung delivery and reduces throat deposition. Though less portable, it is clinically reliable, especially for corticosteroids.

SPACERS FOR INHALERS

Alongside all these spacers mentioned, the National Asthma Council also provides users with specific spacers for different needs in a chart – includes spacers that have masks and are also compatible with them.

(National Asthma Council, N.D),

National Asthma Council AUSTRALIA

Spacers for pressurised metered-dose inhalers

MOUTHPIECE SPACERS

- AeroChamber Plus® Flow-Vu® Spacer Youth Mouthpiece (5+ years)*
- AeroChamber Plus® Flow-Vu® Spacer Adult Mouthpiece*
- AeroChamber 2go® Spacer
- e-chamber La Petite
- Resomax Aero Spacer - Valve Holding Chamber Adult (5+ years)*
- e-chamber La Grande
- Able Spacer™ Antibacterial
- e-chamber Mini
- e-chamber Turbu
- Breath-A-Tech Anti-Static Spacer
- Allersearch Compact Space Chamber Plus
- Breath-A-Tech Anti-Static Collapsible Spacer
- Able Spacer™ Collapsible Antibacterial

CARDBOARD SPACERS

- Breath-A-Tech Cardboard Spacer
- Able Disposable™ Cardboard Spacer
- Able LiteAire® Disposable Cardboard Spacer
- e-chamber eco

MASK SPACERS

- AeroChamber Plus® Flow-Vu® Spacer Small Mask (0-18 months)*
- AeroChamber Plus® Flow-Vu® Spacer Medium Mask (1-5 years)*
- AeroChamber Plus® Flow-Vu® Spacer Adult Small Mask*
- AeroChamber Plus® Flow-Vu® Spacer Adult Large Mask*
- Breath-A-Tech Anti-Static Spacer & Anti-Static Silicone Face Mask Small (0-1 years)*
- e-chamber La Petite Asthma Spacer with Small Mask (0-6 years)*
- Breath-A-Tech Anti-Static Spacer & Anti-Static Silicone Face Mask Medium (1-5 years)*
- Breath-A-Tech Anti-Static Silicone Face Mask Large (5+ years)*
- Able Spacer™ with Whistle Mask Small/Medium
- Resomax Aero Spacer Valve Holding Chamber - Small Mask Infant (0-1.5 years)*
- Resomax Aero Spacer Valve Holding Chamber Child (1-5 years)*
- Resomax Aero Spacer Valve Holding Chamber Adult (5+ years)*
- Wellcare Breatheasy Spacer Includes Child and Adult Detachable Masks*
- Allersearch - Compact Spacer Chamber and Mask

MASKS

- e-chamber Small Mask Infants and Children*
- e-chamber Large Mask Older Children and Adults*
- Able Spacer™ Mask with Coaching Whistle Small/Medium
- Able Spacer™ Large Mask

RESOURCES

TREATMENT GUIDELINES

Australian Asthma Handbook: asthmahandbook.org.au

AeroChamber Plus® Flow-Vu® Spacers for pressurised metered-dose inhalers information sheet: nationalasthma.org.au/living-with-asthma/resources/healthprofessionals/information-paper/aerochamber-plus-flow-vu-spacer.pdf

HOW-TO VIDEO

SCAN ME

SPACER TECHNIQUE

Using a spacer with your inhaler fact sheet: nationalasthma.org.au/living-with-asthma/resources/patientcarers/factheets/using-a-spacer-with-your-inhaler

Spacer use and care fact sheet: nationalasthma.org.au/living-with-asthma/resources/patientcarers/factheets/spacer-use-and-care

Other resources for patients and health professionals: nationalasthma.org.au

* Age suitability as specified by the manufacturer

A pMDI plus a spacer should be considered the preferred mode of aerosol inhaler delivery, particularly with young children, older people, and those with cognitive and physical impairments. Children younger than 3 years may require a face mask with a spacer.

This chart was developed independently by the National Asthma Council Australia with support from Trudell Medical International, trudellmed.com.au 2025 © National Asthma Council Australia

BENCHMARKING

To begin the analysis of these products, I have created a benchmarking criteria to mark them against.

It is as follows:

1. **Quality and Durability**

- a. Spacers must be reliable, safe, and built from durable, medical-grade materials that withstand repeated use and cleaning.

2. **Accessibility and Affordability**

- a. Spacers should be reasonably priced, widely available through pharmacies, hospitals, and community health providers, and ideally reusable to reduce long-term costs for individuals and families.

3. **Design and Aesthetics**

- a. Design should balance function with aesthetics to encourage consistent use. For children, fun and engaging designs support confidence, while adolescents and adults benefit from discreet, less clinical forms that reduce stigma and social discomfort.

4. **Functionality and Features**

- a. Covers compatibility with different inhaler types, portability, detachable or modular parts, and ease of cleaning for hygiene and maintenance.

5. **Ergonomics and Comfort**

- a. Comfort in handling, ease of forming a seal, mask or mouthpiece fit, and suitability across age groups and physical abilities.



BENCHMARKING ANALYSIS

Scoring Methodology

Each design was rated on a scale of 1-10 for each category with the following benchmarks:

- **1-3: Below average** (limited features, bad reviews or outdated design)
- **4-6: Average** (adequate but not exceptional)
- **7-8: Above average** (strong features, good reviews, some aspects are innovative)
- **9-10: Excellent** (leading in the category, exceptional feedback, cutting edge design)

Final Evaluation

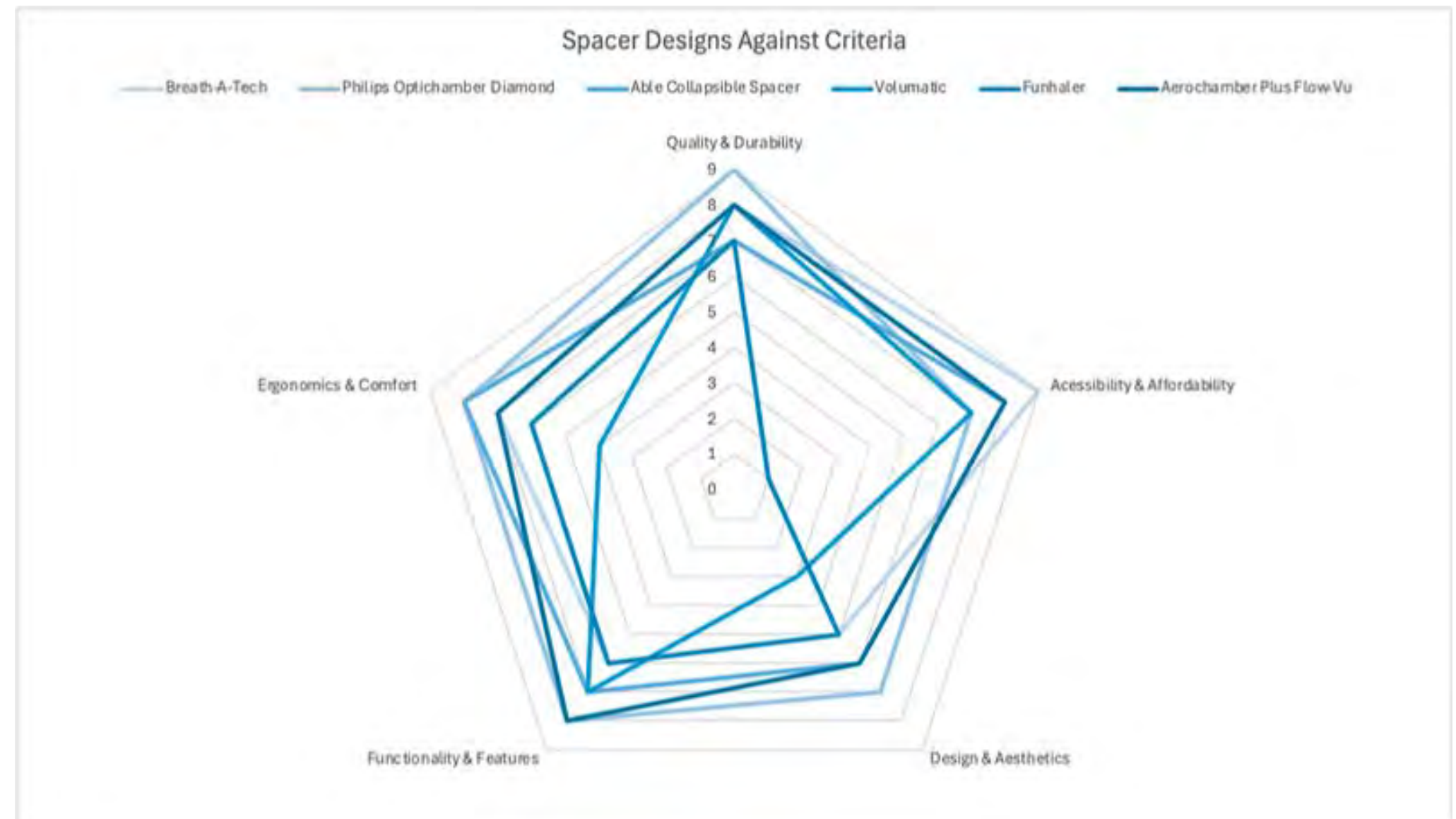
Spacer	Quality & Durability	Acessibility & Affordability	Design & Aesthetics	Functionality & Features	Ergonomics & Comfort
Breath-A-Tech	8	9	5	6	7
Philips Optichamber Diamond	9	7	7	8	8
Able Collapsible Spacer	7	8	6	7	8
Volumatic	8	7	3	7	4
Funhaler	7	1	5	6	6
Aerochamber Plus Flow-Vu	8	8	6	8	7

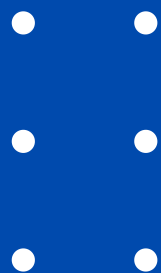
BENCHMARKING ANALYSIS

In excel, I was able to put my evaluation table into a radar graph to better identify each competitors strengths and weaknesses against each other as well as the commonalities and gaps in each category I created.

While several spacers excel in different criteria, most of them are limited by their clinical/medical appearance, negatively effecting their score in the Design and Aesthetic category. Many of the spacers are suboptimal in Ergonomics and Comfort and Functionality and Features, highlighting a gap in the market for a spacer that can integrate usability, discreet design, and user-centred features more efficiently.

Radar Graph





PRIMARY RESEARCH



TO NOTE:

Due to my project focussing on adolescents, due to ethical procedures my survey question and observational study will be using retrospective sampling.

I will be asking the participants a mix of questions – some will be relevant at their older [than adolescent] age as well as retrospective questions asking them to reflect on their experiences during their adolescence. Very few participants will be in the adolescent age gap but I am framing the questions in a way that will suit both younger and older participants.

I tried my best to ensure my questions weren't directive, and only relevant to the subject at hand (like leading them to their answer through the way I phrased my question) or would provide them with a range of ways to answer (multiple choice, short or long description answers).

SURVEY CREATION

I wanted this survey to help me gain a better understanding of a range of users experience with asthma spacers currently, or when they were younger. The questions were created in a way to identify if stigma played a role in the lack of use of the asthma spacer and whether that was from inconvenience of the size of the spacer or a result of the way the spacer looks.

My intro to the survey was:

"This research project is being undertaken as part of an Industrial Design Capstone project at the Queensland University of Technology by Industrial Design student, Alexandra Nomikos.

The purpose of this project is to investigate the social stigma surrounding the use of asthma spacers in teens. While spacers are a recommended tool that improves the delivery of medication like Ventolin, many users choose not to use them due to embarrassment, fear of being judged, or bullied. It focusses on the connection between health-related stigma and product appearance, and how current spacer designs often feel clinical, outdated or childish, making users feel even more alienated.

You are invited to participate in this research project because you have felt embarrassed to use a spacer and your prior experiences are valuable in understanding how young people perceive and interact with these medical devices."

Alexandra Nomikos | n11086718

Questions Responses Settings

Do you currently have asthma?

☐ Yes, I currently have asthma

☐ No, but I had asthma as a child/teen

Do you currently use a spacer, inhaler only, or nebuliser?

Multiple choice

☐ Spacer and inhaler

☐ Inhaler only (without spacer)

☒ Nebuliser

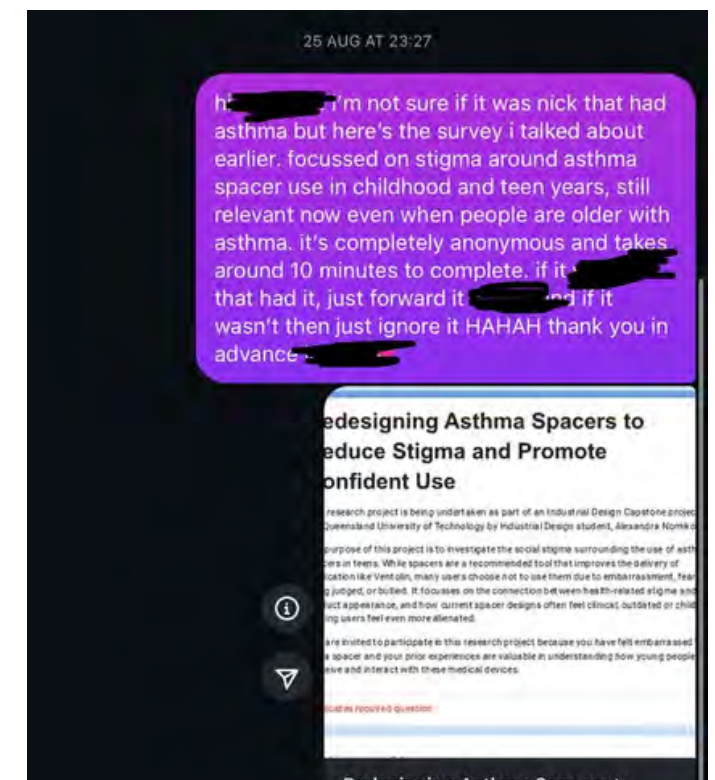
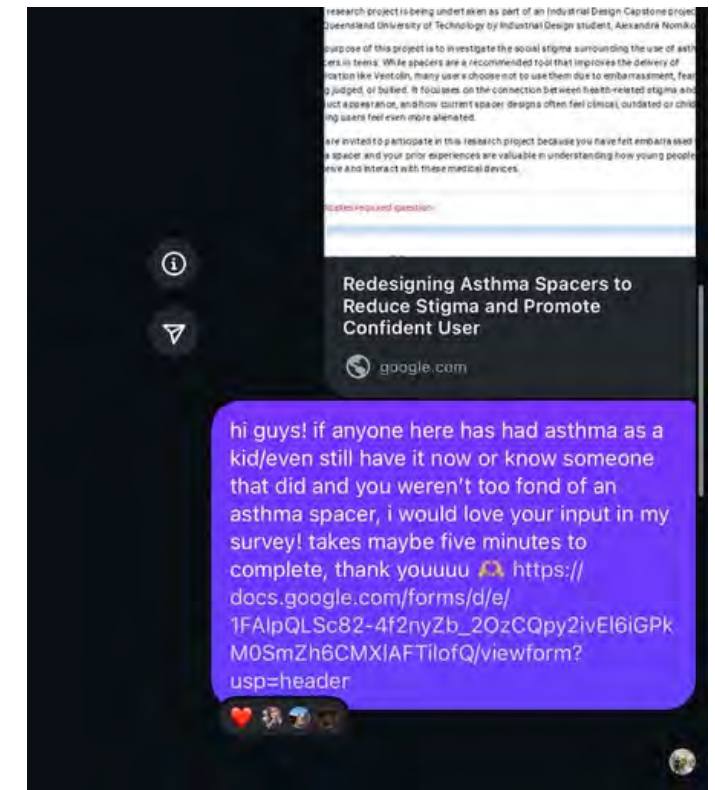
☐ None

☐ Add option or [add "Other"](#)

SURVEY DISTRIBUTION

To receive as many responses as I could get, I connected with people I personally knew – through work, university or personal connections – as well as posting to my social media, posting in the ID7 group chat as well as privately messaging others I knew and their relation to asthma.

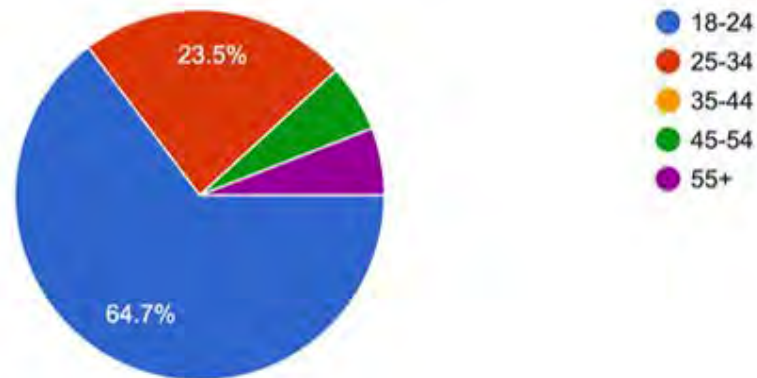
Unfortunately my survey did not yield the amount of responses I desired, but the answers that the participants provided were more than enough to help aid my research.



SURVEY ANALYSIS

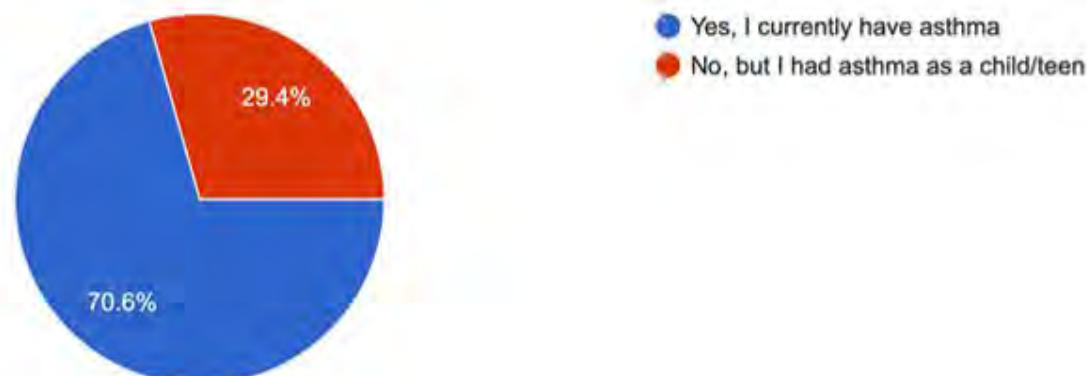
1. What is your age?

17 responses



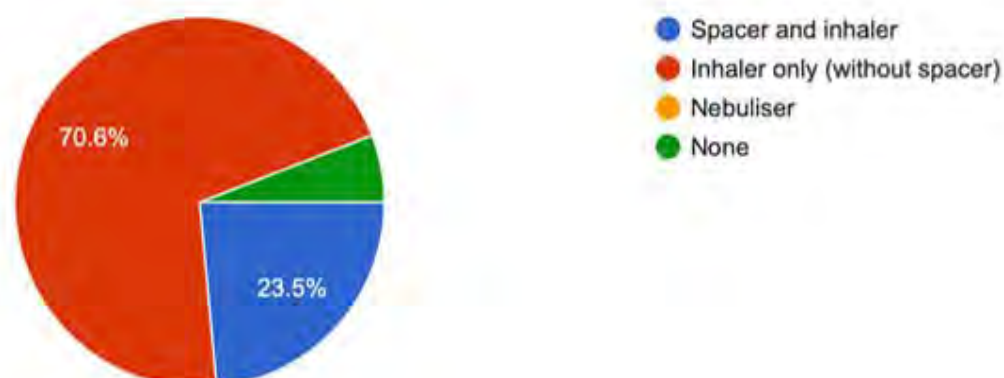
2. Do you currently have asthma?

17 responses



3. Do you currently use a spacer, inhaler only, or nebuliser?

17 responses



4.

If you selected 'none' or 'inhaler only' for the previous question, please describe why?

12 responses

I find that the spacer takes up too much space for me to carry it around everywhere like to work, uni or even going out

I tend to keep an inhaler in a sports bag as a precaution when exercising. I found spacers take up too much space and draw attention. It is important to me that it is discreet, as I've found people may doubt my ability to participate in sport if they discover that I'm experiencing asthmatic symptoms.

Easier to use and carry on its own once I got the hang of it.

It's easier as I don't have to carry a spacer around with me

I used to use a spacer with the inhaler as a kid but only at home (i do not remember the exact reason why it was only at home, maybe parents were afraid i would loose it or break it when in was in my bag?). And only an inhaler now for multiple reasons. Firstly, for convenience. I find that also carrying a spacer around just takes up unnecessary room, is clunky and large in my bag. Additionally I find myself unconsciously thinking why do I need a spacer if the inhaler by itself works just fine (lack of knowledge on a spacers purpose? potentially). Also, having to take out a long tube, attach it to the inhaler and then use it is kind of awkward and "attention grabbing," where I feel as if people are staring at the long tube protruding from my face, making me a little self conscious, so just using the inhaler was quick and easy. BOOM BAM BACK IN BAG DONE.

Inhaler is too bulky to travel with but also embarrassing use in public

Just ease of use, much easier to carry just an inhaler around then a massive spacer too

Asthma not that severe

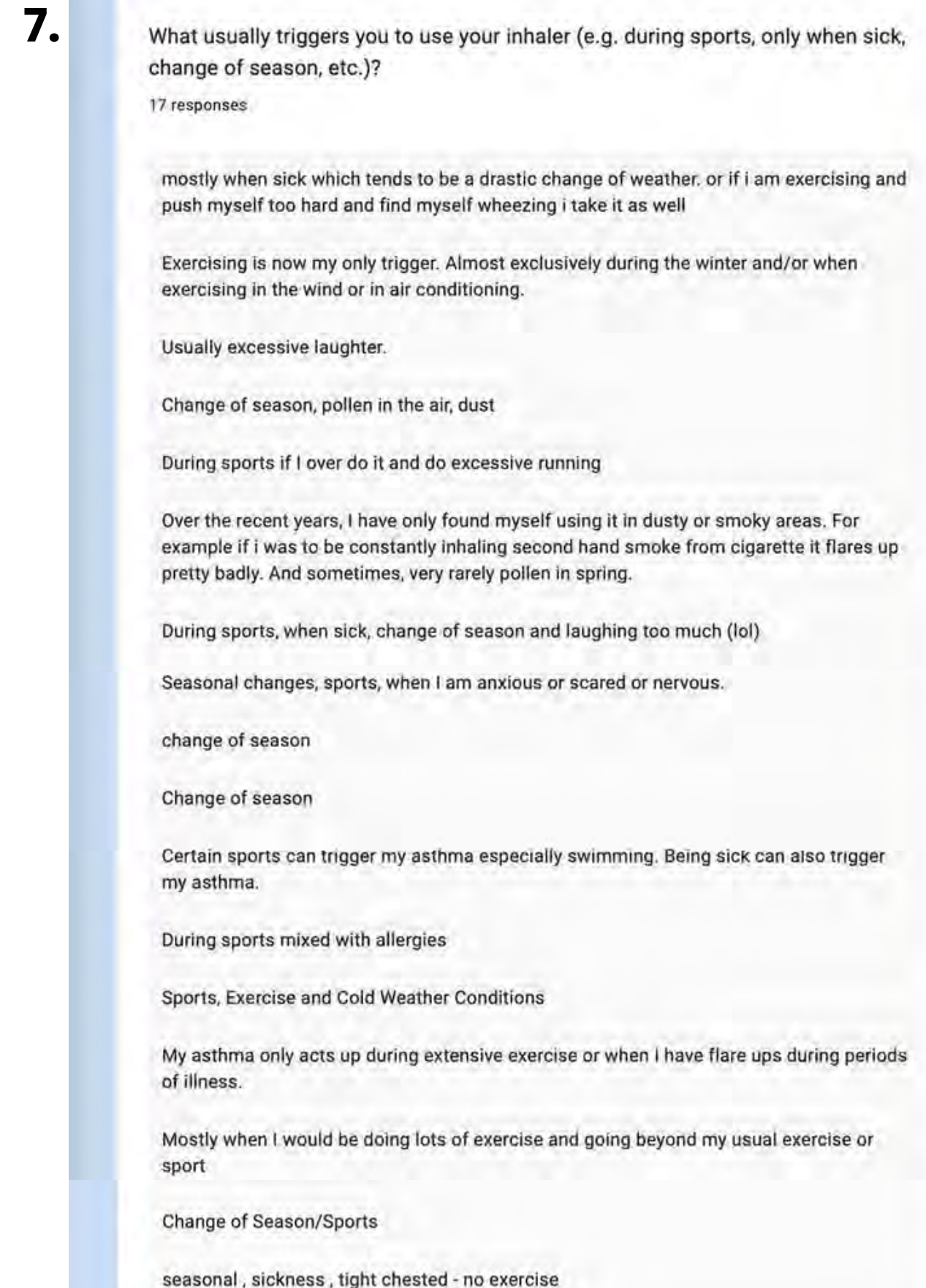
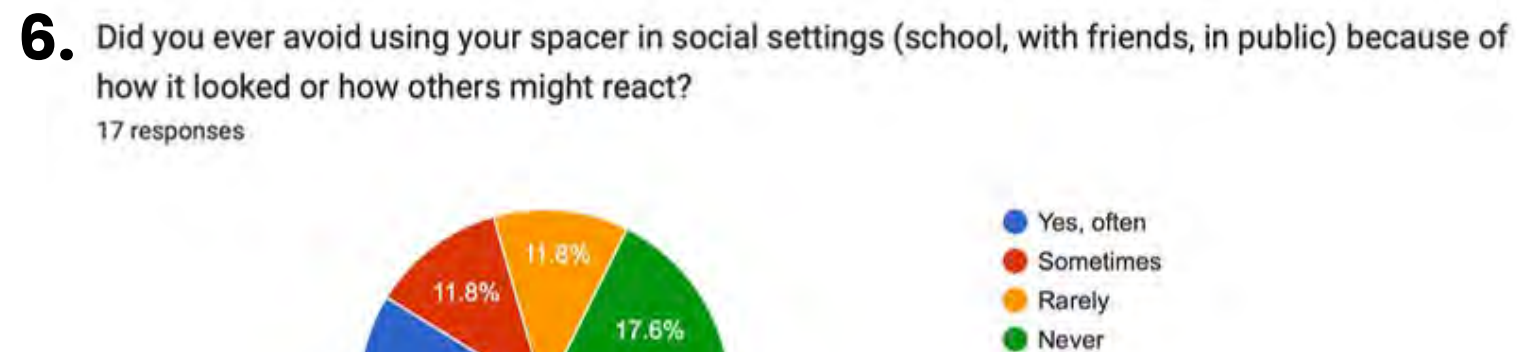
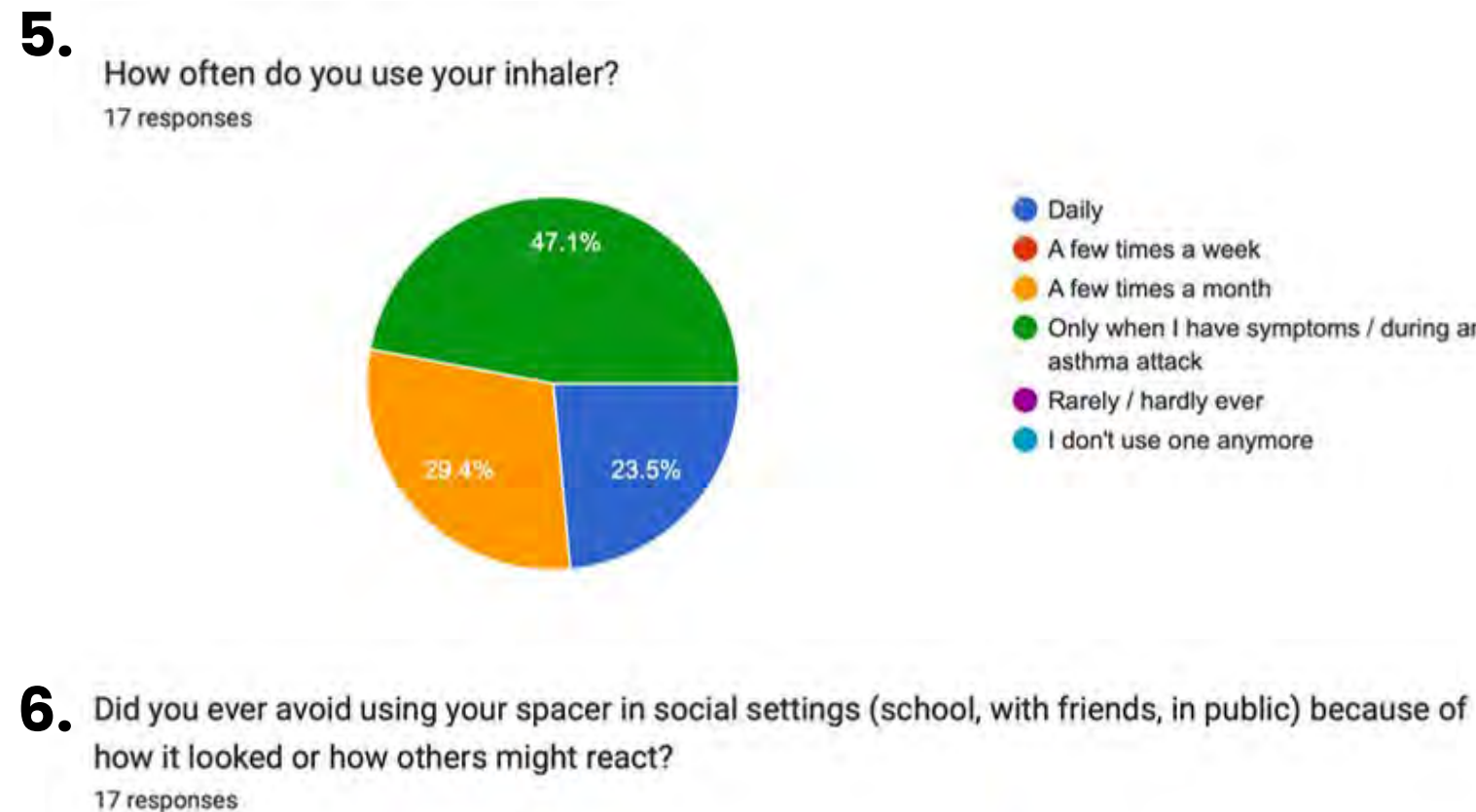
I grew up only using a spacer and never knew the need for it

The Spacer is too much to carry around in my sports bag. Plus it looks a bit goofy

Since I no longer have asthma I no longer use one. But I used a spacer as a child.

My asthma is relatively mild

SURVEY ANALYSIS

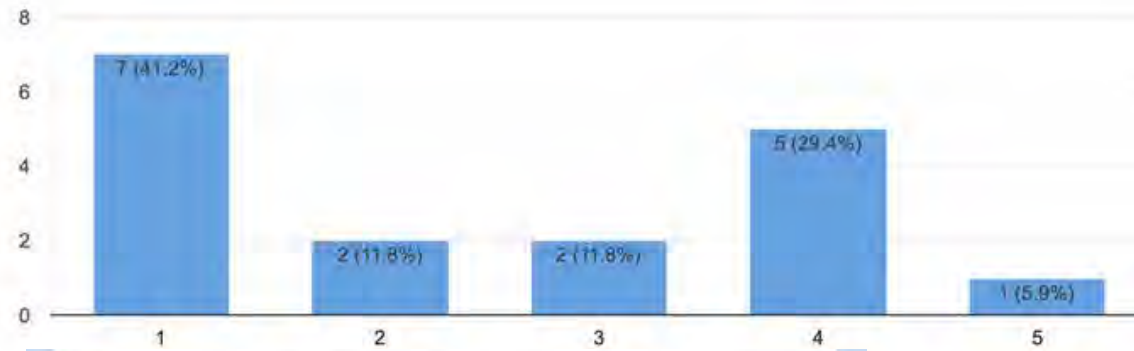


SURVEY ANALYSIS

8.

When you were younger, did you ever feel embarrassed or uncomfortable using a spacer around others?

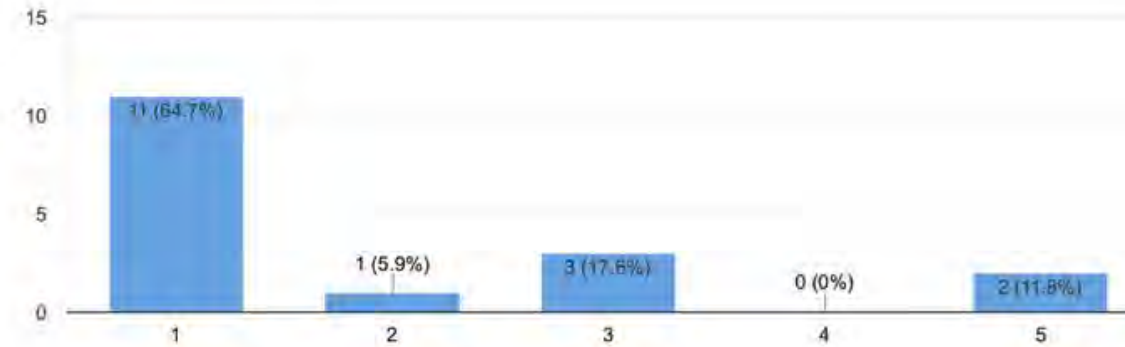
17 responses



9.

I felt more comfortable using my inhaler without the spacer, even though I knew it worked better with one.

17 responses



10.

Can you describe a time when you chose not to use your spacer around others? What influenced that decision?

17 responses

when i was in primary school. i was afraid that the kids around me would judge me for having asthma, especially since i wouldn't see anyone else using one

When I would be playing sport, I'd make the choice to leave my bag with my inhaler in a private area. So that during the game I could leave and access it without my team members noticing. I did this out of fear that my coach or teammates would identify that I was having asthmatic symptoms, and I'd be forced to stop participating. Or that they'd 'baby' me because of my condition.

I've never considered using a spacer as something to be embarrassed about, and I'm not up-to-date on the science behind its effectiveness. I stopped using the spacer because I found it slightly too cumbersome to have to carry around everywhere.

At the airport. Too many people around

It was after a sports carnival in school, I did one of the running events and needed ventolin but didn't use a spacer cause I thought it would be embarrassing to use around others

One time, I didn't use my spacer on the bus because I felt awkward pulling it out in front of everyone and making it seem like a "oh look at me" situation. So instead, I just whipped out my inhaler turned to the window in the corner and used it quickly.

During sports at school, people may see me as nerdy or disabled. It's also very obvious when you're using it

When I was around my relatives, they will judge and consider me as weaker person and will give unnecessary advice and sympathy.

I keep a spacer at home for bad asthma attacks but that is about it just due to how considerable the size is

Not wanting to get it out

I didn't use a spacer because I didn't own one and didn't think it changed

anything so I got into a habit of using it without one

I kind of thought of the Spacer as training wheels for the puffer when I started primary school. Once I got older and more used to it, it was just easier to carry the puffer

When I was at athletics training, I got an asthma attack which was already embarrassing enough as it was, with a group of 20 people my age I didn't want to cause a scene. We were running and I didn't want to seem unfit either, so I grabbed my inhaler and went somewhere else to use it.

I have never owned a spacer

At a sports carnival in school, I was doing some running event and after it ended I was wheezing a lot and need Ventolin. I was afraid to get my spacer from my bag so my peers wouldn't see me as I was afraid of what they would think

The spacer is too bulky to carry around so I just take the inhaler out when I'm feeling tight chested

Surrounded by immature people who often would refer to the spacer as a penis pump

11.

What did you like about using a spacer (if anything)?

17 responses

I liked that it would help administer the ventolin correctly, as sometimes I would find that if I used the inhaler only the medication would come out from the top of it as I guess when I would breathe it would push it back out?

It was easier to use and more effective, especially when I am physically tired from exercising and out of breath.

It was simple to use.

Knowing I'm taking in most or all of the ventolin

It was efficient and delivered the Ventolin correctly

HMM to be honest nothing really? As a kid maybe I liked the fact that I could see the air I was breathing in from the clear tube? If that makes sense? Like see the white puff on the plastic from the inhaler and then me breathing it in? Was fun to watch.

Ease of breathing or having to really suck in the Ventolin once sprayed, tasting the spray at the back of your throat and not having to do extra puffs because most of it evaporates if you don't use a spacer and I need to repuff

I don't use one.

how effectively it mitigates symptoms

Nothing

It did seem to have more of an effect of the inhaler

Seeing the vapour appear in the tube

It was easy to fit the inhaler into, quick and efficient when you can't breathe properly.

N/A

I liked how well it delivered the medication and help to breathe it in better

It gives me better inhalation of the puffer and goes deeper into my lungs

It is effective even though it is poorly designed

SURVEY ANALYSIS

12.

What did you dislike about using a spacer?

17 responses

i disliked how big it was and that it wasn't very discreet. sometimes i found the rubber mouth piece that would go over my nose and mouth would be uncomfortable as well so i would end up just not using it

Too large and would often draw attention. The size also made it difficult to store in my everyday bag.

Having to carry it around everywhere.

It's bulky

It was big and would get dirty easily, especially if i would take it with me or keep it in my backpack

Large. Obnoxious. Ugly. Hard to carry around. Easy to loose. Flimsy.

It's bulky looking and a plastic monstrosity, hard to travel with (I have a folding out one that collapses on itself but still 'solid' because of its material, kind of sound like Darth Vader when using it kind of feels like how it feels to open a pad packaging in the bathrooms on your period and the sound is a little too loudly obvious lol, it also feels extra nerdy to use one thanks to asthma's depreciation in movies too!

It's embarrassing.

the size of the actual device, it's about 7 times the size of the inhaler

Difficult to carry around

It was big and required an extra step to use the inhaler

How bulky it was

It was big, obvious to others around me and when kept in my bag it got dirty easily.

N/A

How big and medical looking it was. It would get dirty easily and made me not want to use it

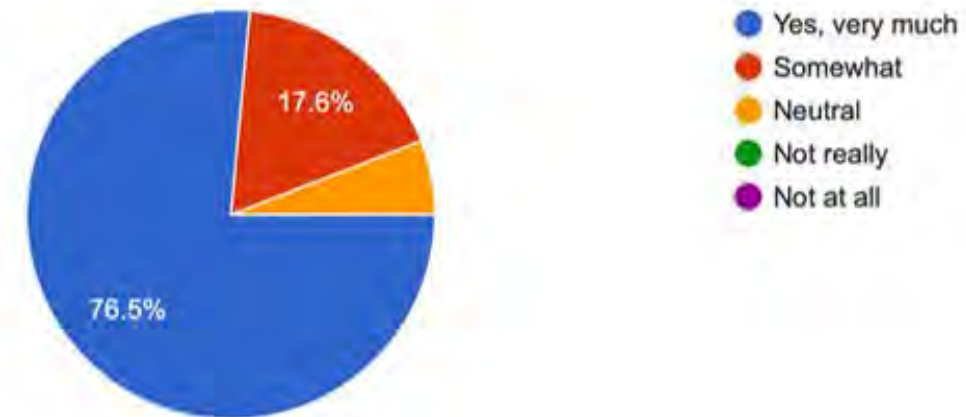
I have to keep cleaning it every week

everything , its poorly designed, who said it has to resemble the male anatomy ?

13.

Did you feel the spacer was too big, too medical-looking, or otherwise uncomfortable to use?

17 responses



14.

If you could change something about the spacer design or your experience using it, what would it be?

17 responses

definitely the size and how it looks. made me feel like a medical patient when all i needed was it to help me breathe better. otherwise the experience was fine as it always helped me a lot more than the inhaler

Smaller and more discreet.

I would make it smaller, though I recognise that may impact the effectiveness of it.

The size

It's looks and size. Looks very clinical and feels bigger than it is when I bring it out to use it

Def's the colour. Less bulky so it was easier to take with me to places. Fun design.

Making it out of silicon or a soft material that's squishy or can almost fold up

(like a period cup?), definitely something more discrete and smaller in size, not see-through!!! I know my life might depend on it but it's so loudly saying 'I can't breath' like getting oxygen in a hospital but in public.

I would change its size if I can.

reduce size and make it more inconspicuous without removing too much effectiveness

Smaller?

Make it smaller and if possible attached to the design of the inhaler

Somehow make it more compact or expandable.

Designing for a more discrete and smaller in size would reduce attention brought to you when having an asthma attack. I think if it could close as well, to prevent sand and dust from getting in that would make it so much easier to keep it clean and ready to use.

The size and look of it, maybe something that's more customisable or better looking than a clinical looking tube?

Maybe the length of the spacer if thats able to change

Mmmm - Think seashell design or large snail, the neck of the snail is the Ventolin connecting to the body of the shell, the Ventolin is dragged through the cyclonic chamber

SURVEY ANALYSIS

15.

Did the appearance of the spacer ever affect how you felt about having asthma?

17 responses

Yes

No

yeah it did, felt like an outcast sometimes? like i was different than other people and in a bad way cause i needed a spacer to help me breathe better when others didn't

Yes. Especially as a child, I felt in stigmatised my condition. It would draw attention from other people, and I would feel alienated from my peers. As it limited my ability to participate.

No.

Some what

I felt somewhat ashamed that I had to use it, like everyone would be looking at me if I would take it out to use it

No, more towards me actually having to use it. I did not mind having asthma.

Yes, I felt like a stereotypical nerd from a movie or something, I honestly wouldn't use it around people unless I was in dire need or could get to a bathroom cubical.

yeah it does

It was very big and bulky. I think that was the main thing that I found, I think it was more about how other people perceived it, I didn't want to cause a scene, but when I was already wheezing loudly and then the pacer is brought out I felt like everyone was looking at me.

N/A

Yeah it did, I felt embarrassed that I had asthma sometimes when I needed to use it

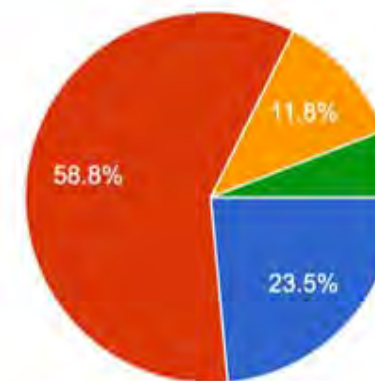
No not really mostly about taking it into public settings

Yes, its quite large , and not really travel worthy if you like to pack lite

16.

Which device do/did you prefer using?

17 responses



- Spacer + inhaler
- Inhaler only (without spacer)
- Nebuliser
- No preference

17.

Why did you prefer that device?

17 responses

i definitely liked the spacer and inhaler as it helped a lot, i wish i used it more but i haven't bought one since primary school.

When dealing with asthma symptoms, it can be difficult to calm myself enough to effectively administer with an inhaler alone. Spacers reduced this problem and allowed me to administer far more effectively.

I only use the inhaler on its own out of convenience.

Because you can use it in the privacy of your own home

Was smaller and just easy to use

Weirdly it felt more effective? Like closer to mouth = stronger in my eyes. Additionally, close to the mouth, hand hides it, quick and easy to pull in and out of bag.

Because it actually works better but hard to have handy unless I'm at home and it's stored away. In public I find it hard to travel with still

So I don't have a carry an another piece with me. Only inhaler fits perfectly in my pocket.

portability

No spacer

It doesn't look as bad as having a medical tube near my face for people to look at

For a long time I just used the inhaler and didn't make a difference until I spoke with my GP who said to use the inhaler to make it more effective

Beurer has marketed a very small compact rechargeable unit like a vape pump

Using a inhaler without a spacer made it a lot more portable a lot more accessible if needed

Easier to carry around and quicker to use. I could just run to my bag, have some water and a quick puff and keep playing.

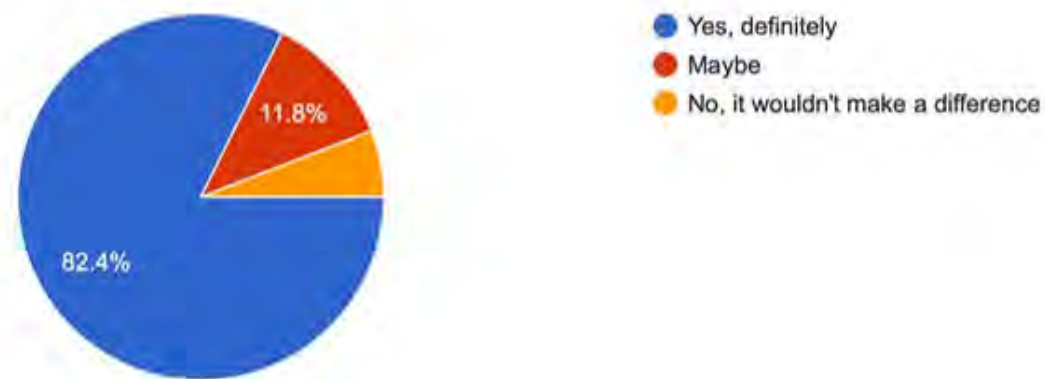
It was quicker, and not as obvious to people around me.

it's easy, and the inhalers i buy don't come with them anyway

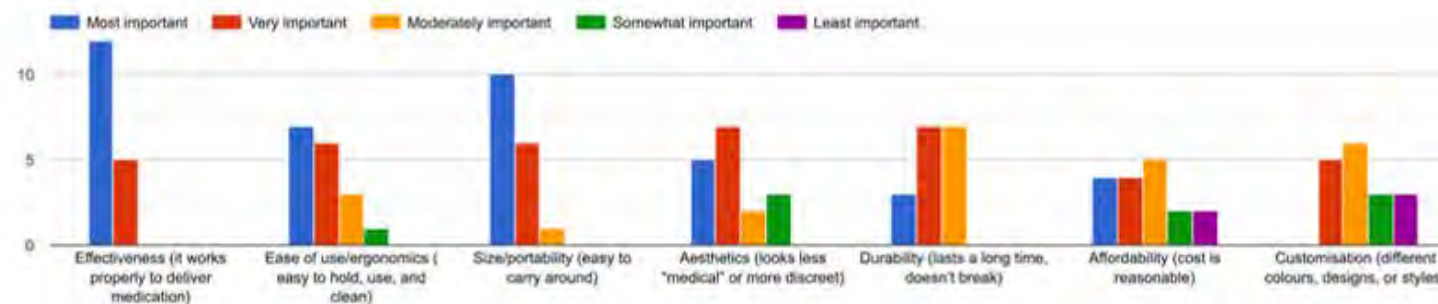
SURVEY ANALYSIS

18. If spacers were redesigned to look smaller, less medical, or more customisable, would that make you feel more comfortable using them?

17 responses



19. When using (or imagining using) a spacer, what aspects are most important to you?



21. Would you be comfortable taking part in a short observation session where you use your spacer and inhaler? If yes, please provide your email below so we can send you more details and the consent form. If no, simply leave this blank and proceed.

7 responses

REDACTED

20.

Any other comments about your experience using asthma spacers as a child/teen that you would like to share?

17 responses

No

N/A

maybe that it was just weird to bring out a big tube to put some medicine in to help me feel better was strange. idk maybe it could just look better so i don't feel so embarrassed to bring it out, even now that im over 18

When I had to use a spacer, I was well past being self-conscious about medical requirements.

Not really, besides that I would feel embarrassed to use it since it was so big and medical looking, which would make me use the inhaler

Weirdly I did not mind using it at a kid but now as an adult and throughout my teenage years I became more self conscious about it. I also noticed lots of other kids around who also did not use spacers (primary school and high school) and would just quickly pull the inhaler out of their bag take two puffs and then shove it back in. On a very rare occasion would someone not mind at all and use the spacer.

It felt extra, nerdy, obvious, lame, embarrassing and I would have rather not been able to breathe right or have a wheeze than to use it in public

I honestly don't like using spacer.

I only have used spacers when having severe asthma attacks, just because of how impractical it is to carry around

Nil

It felt kind of cool as a kid to have this magical puffer I could use when breathing became difficult. I didnt really consciously stop using the Spacer, I kind of just went "i can probably do this without like a big boy" and never looked back.

I would definitely say the most important aspect is the size of the device, as I always felt that was what drew most attention from my peers and made the asthma attack more obvious.

-

Not really, besides that I sometimes would feel alienated and really embarrassed to use it. One time in primary school I remember getting bullied about it cause they said it wasn't 'cool' which I guess is where this embarrassment of the spacer began

OBSERVATIONAL STUDY

I chose to do a Think-Aloud protocol to best observe my participants using an asthma spacer but it ended up also merging itself into a semi-structured interview.

To keep myself and the participant on track, these were some things I made sure I looked out for:

- Ease of use
 - are they struggling to attach the inhaler to the spacer?
 - is there any fumbling?
- Comfort
 - did they say anything about how it feels in their hand or against their mouth?
 - too big or small, sharp edges, slippery even?
 - does the size affect handling?
- Aesthetic
 - do they make any comments about its appearance?
 - do they say they're embarrassed?

- Quality of Materials
 - any comments on material (does it feel cheap)?
 - how does the material feel?
- Features
 - do they know how to use a mask alongside the spacer?
- Maintenance
 - do they know how to clean it?
- General Emotions
 - are they frustrated, hesitant, relaxed or confident when using it?

Knowing me, the observation may not be heading in the exact direction I want it to so to help steer it in the right direction, I've written some prompts to assist me:

- "Talk me through what you're thinking as you use this."
- "What do you expect to happen when you attach this?"
- "How does this feel compared to what you normally use?"
- "Is there anything that feels uncomfortable or awkward?"
- "Would you be happy carrying this around or using it in public?"

DOVETAIL ANALYSIS

Dovetail categorised the transcription from observation 1 into different topics based on what was said throughout the observation and was then able to provide a summary of the conversation.

Ergonomics and usability

The spacer device presents significant ergonomic challenges, requiring two hands to operate which creates difficulties in public settings or while holding other items. The current design is described as "physically awkward" with uncertainty around proper hand positioning. 1 2

Storage and portability

The rigid, bulky construction poses storage and transportation challenges, with users expressing reluctance to carry it in public. The device's size and inflexibility make it difficult to fit in bags, unlike more adaptable items. 3 4

Hygiene and maintenance

Cleanliness is a major concern, with users worried about contamination when carrying the device in bags or touching various surfaces. The clear material shows decay over time and cleaning challenges exist, particularly with multiple components. 5 6

Aesthetic and social considerations

The clinical appearance creates discomfort around public use, with users preferring to wait until they're home. There's interest in more aesthetically pleasing designs, including color options and artistic elements that could make the device feel more like an accessory than medical equipment. 7 8

Recap

The research focused on understanding user experience with inhaler spacers. Key findings revealed significant concerns around portability, hygiene, and social stigma. Users prefer compact, one-handed operation but find current devices bulky and clinically appearing. The spacer's two-handed operation poses challenges in public settings. 1 2

Actions

- Redesign for one-handed use: Develop a collapsible, compact design that enables single-hand operation. Evidence shows current two-handed requirement limits usage in common situations like public transport. 3
- Improve portability: Create a foldable or telescopic design with protective storage pouch to address hygiene concerns and bulkiness issues. 4

- Enhance aesthetics: Develop non-clinical color options and designs to reduce stigma and increase user comfort. Consider artist collaborations for customizable appearances. 5
- Optimize cleaning features: Implement easily detachable parts and cleanable surfaces to address hygiene concerns. Users express strong preferences for thorough cleaning ability. 6

1.

Main Theme	Sub-Themes	Examples / Descriptions from Transcript
Comfort & Usability	Mouthpiece vs. Mask	Mask feels "comfier," easier to use, more ergonomic; mouthpiece touches tongue, causes taste issues, requires awkward mouth positioning.
	Grip & Handling	Spacer feels long and cylindrical, unclear how to hold ("Do I double hand it?"); requires two hands, awkward in public or when carrying bags.
	Size & Bulkiness	Spacer described as "too long," "bulky," and "hard to travel with"; compared to a hard lunchbox that doesn't fit well in bags.
	One-Handed Use	Difficulty using while holding other items (e.g., bus pole, bags); user suggests thumb-operated inhaler design for easier handling.
	Cleaning & Hygiene	Concerns about bacteria buildup (compared to water bottles), inability to clean thoroughly, device picking up dirt when loose in a bag.
Design & Aesthetics	Weight	Spacer felt light overall, but inhaler adds heaviness; not a major issue compared to size/bulk.
	Clinical Appearance	Described as "clinical," "daunting," and like "something you'd find in a hospital"; clear plastic seen as making it "more obvious" rather than discreet.
	Colors & Customisation	Preference for black or solid colors over clear/white; comparisons to accessories like bandanas; suggestion that artists could design patterns to make them expressive.
	Durability & Portability	Clear parts turn "cloudy and nasty" over time; collapsible versions suggested for easier storage; pouch for hygiene mentioned.
Stigma & Social Use	Comparisons to Other Products	Compared to baby bottles (too many parts that can be lost), lunchboxes (hard vs soft), water bottles (cleaning challenges).
	Public Use	User wouldn't carry or use it in public due to bulkiness and appearance; would wait until home to use spacer.
	Embarrassment / Social Perception	Concern that others would think "she can't breathe, she needs help"; described as "super obvious" and "a big contraption."
	Desire for Normalisation	Suggestion that if it looked more like an accessory (colorful, customised), it could feel less medical and more acceptable in social settings.
Functionality	Effectiveness	Knows spacer improves delivery but avoids it due to convenience and design; prefers inhaler alone when rushing.
	Ease of Use	Spacer requires timing and coordination ("two hand job"); feels less practical in urgent or outdoor situations.
	Confidence in Use	Confident in correct use as an adult, but recalls needing guidance as a child; relies on sensory cues (taste, smell) to know if used incorrectly.

2.

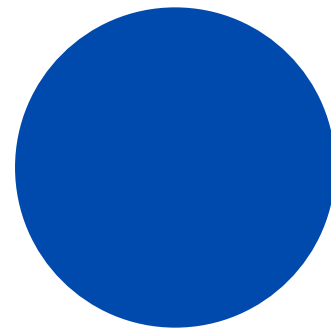
Main Theme	Sub-Theme	Description from Transcript
Comfort & Ergonomics	Mouthpiece fit	Found the mouthpiece "a bit awkward on the teeth" and preferred when it sat higher in the mouth.
	Handling & grip	Struggled to keep a steady hold while pressing the inhaler. "I've got bigger hands but it still feels fiddly."
	Mask option	Mentioned that a soft mask would be easier on days when breathing feels "tight" and avoids awkward lip positioning.
	Portability	Said the spacer "doesn't fit in a pocket" and usually leaves it at home, relying on just the inhaler when outside.
Usability & Practicality	One-handed use	Noted it was "tricky on the go" since both hands are needed, especially when carrying shopping bags or opening doors.
	Cleaning & maintenance	Frustrated by cleaning process: "You've gotta take it apart properly, otherwise it smells plasticky."
	Appearance	Felt the spacer looked "medical and clunky," compared it to "something you'd expect in hospital."
Design & Aesthetics	Size & bulk	Commented on how "big and obvious" it looked when carried in public, preferring something flatter or foldable.
	Colour/design appeal	Suggested darker colours would make it "blend in better" compared to the current transparent plastic.
	Reliance on inhaler alone	Admitted he "mostly just uses the puffer" when out, despite knowing the spacer gives better results.
	Long-term habits	Explained he has "gotten used to doing it wrong sometimes" because the spacer feels inconvenient.
User Behaviour & Adaptation	Experience & confidence	Confident in his technique after decades of use but still noticed errors like tasting the medicine when rushing.

STYLE GUIDE

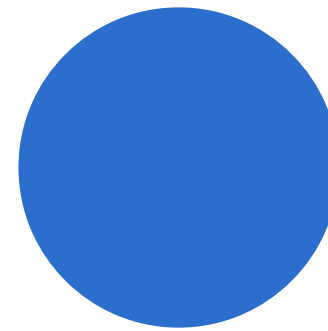
Graphics



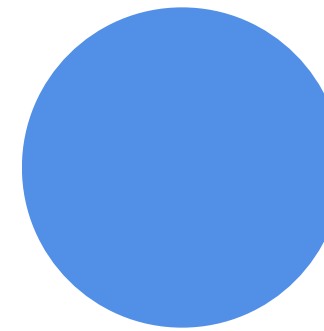
Colour Palette



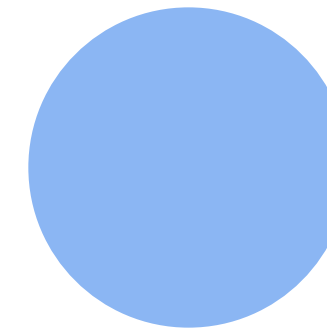
#004AAD



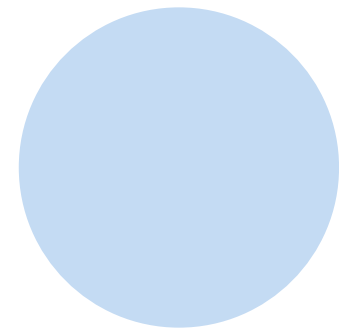
#2B6ECB



#528FE6



#8BB6F3



#C4DBF3

Font Family

Headings
Glacial Indifference
Regular + **Bold**
21pt - 28pt

Body Text
Poppins
Regular + Medium + **Bold**
12pt

Graphics

Smooth, rounded edges,
bold line work



DESIGN IMPLICATIONS

01

**Reduce clinical
aesthetic and stigma**

03

**Enhance ergonomics
and ease of use**

02

**Improve portability
and compactness**

04

**Promote hygiene,
maintenance and
adaptability**

KEY THEMES



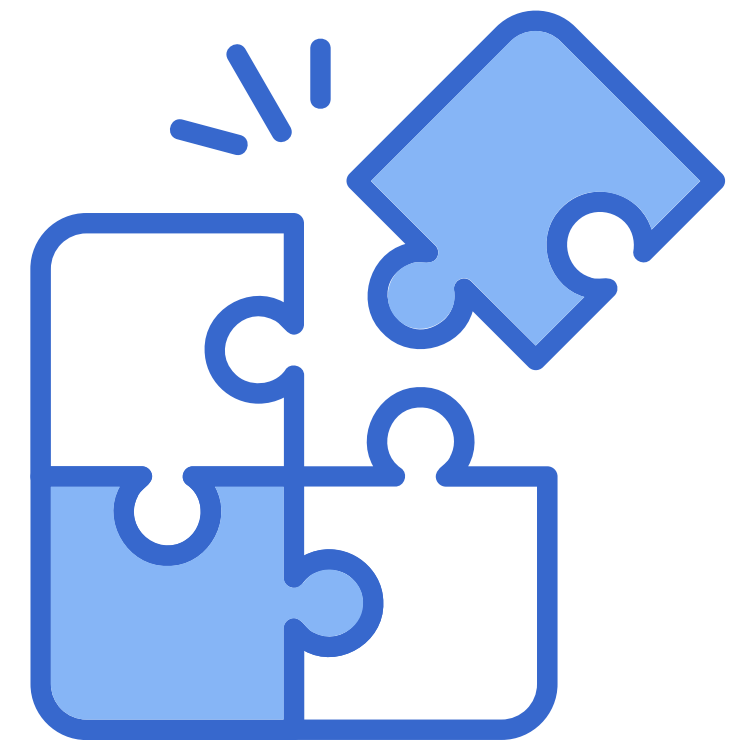
Theme One: Design and Appearance

The design and appearance of the spacer were consistently raised throughout my primary research. Participants mentioned their dissatisfaction with the spacers clinical aesthetic. Additional to appearance, the physical design contributed to discomfort, as participants described the mouthpiece and the long tube as awkward and weird to use.



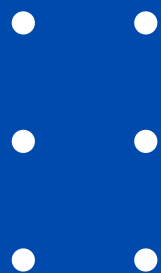
Theme Two: Social and Emotional Factors

Social stigma and embarrassment strongly influenced participants' ability to use the spacer in public comfortably. These feelings were tied to the device's large and medical appearance, forcing participants to rely only on the inhaler, even when knew it could compromise effective medication delivery.



Theme Three: Usability and Practicality

Participants identified problems with the spacer's size, portability, and hygiene. The device was considered inconvenient to carry. Its bulk and exposed components raised concerns about the cleanliness and practicality of using it daily.



04 IDEATION



IDEATION

Three themes:

1. Design and appearance

2. Social and emotional factors

3. Usability & practicality

Ideas:

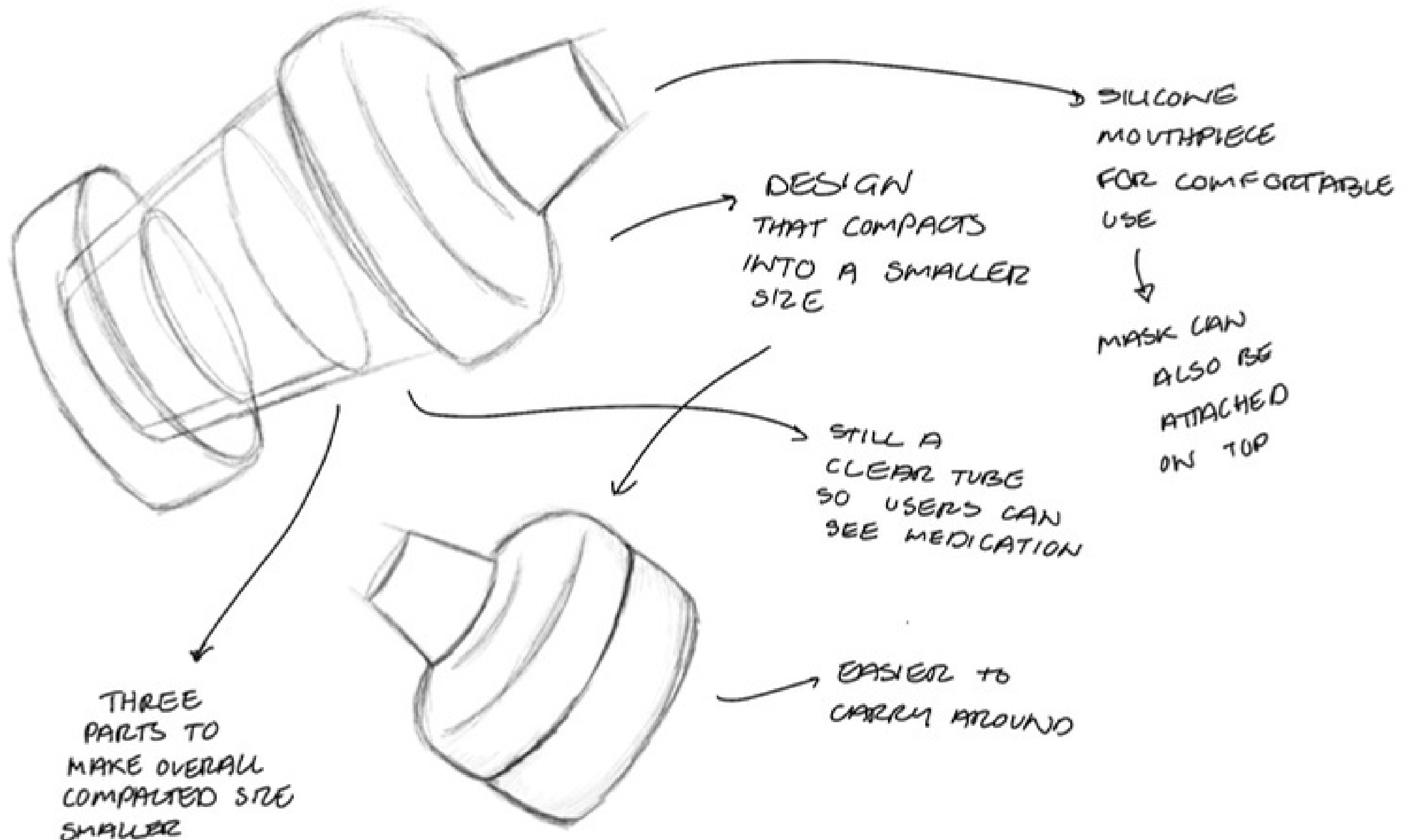


highlight to show connection

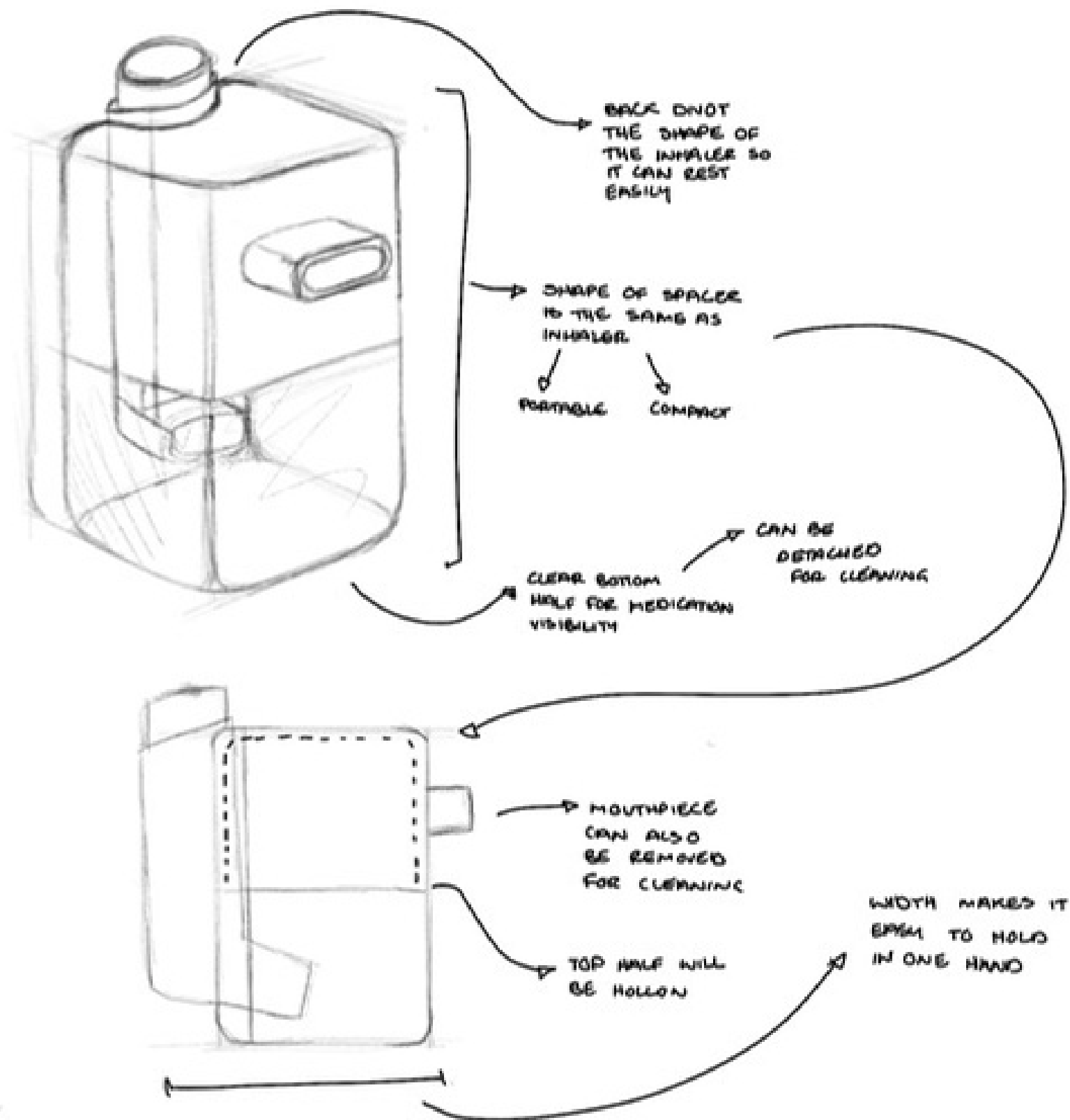
A my audience what they're afraid
A design for emotional attachment

IDEATION

ID7: Capstone | DNB311

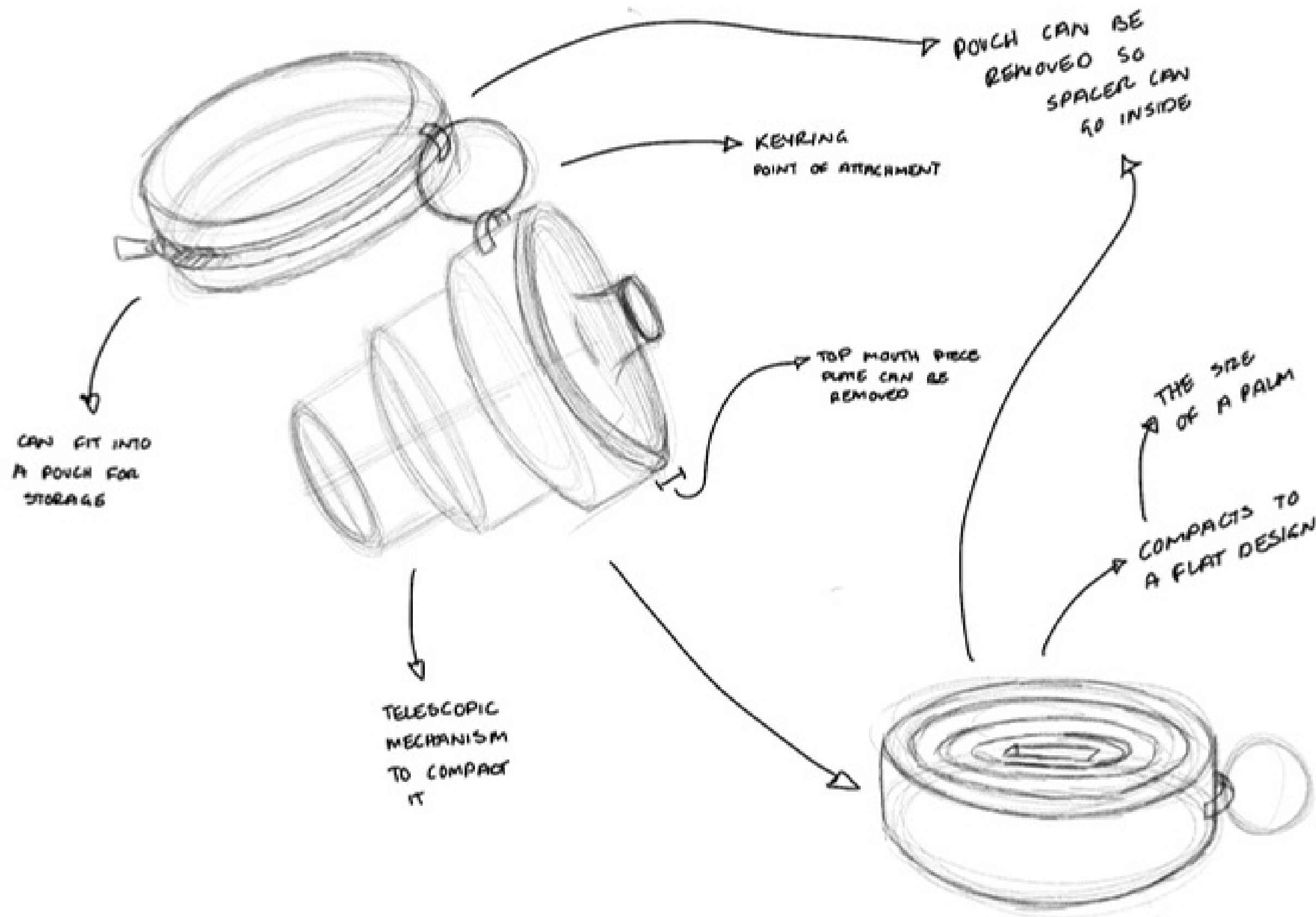


IDEATION



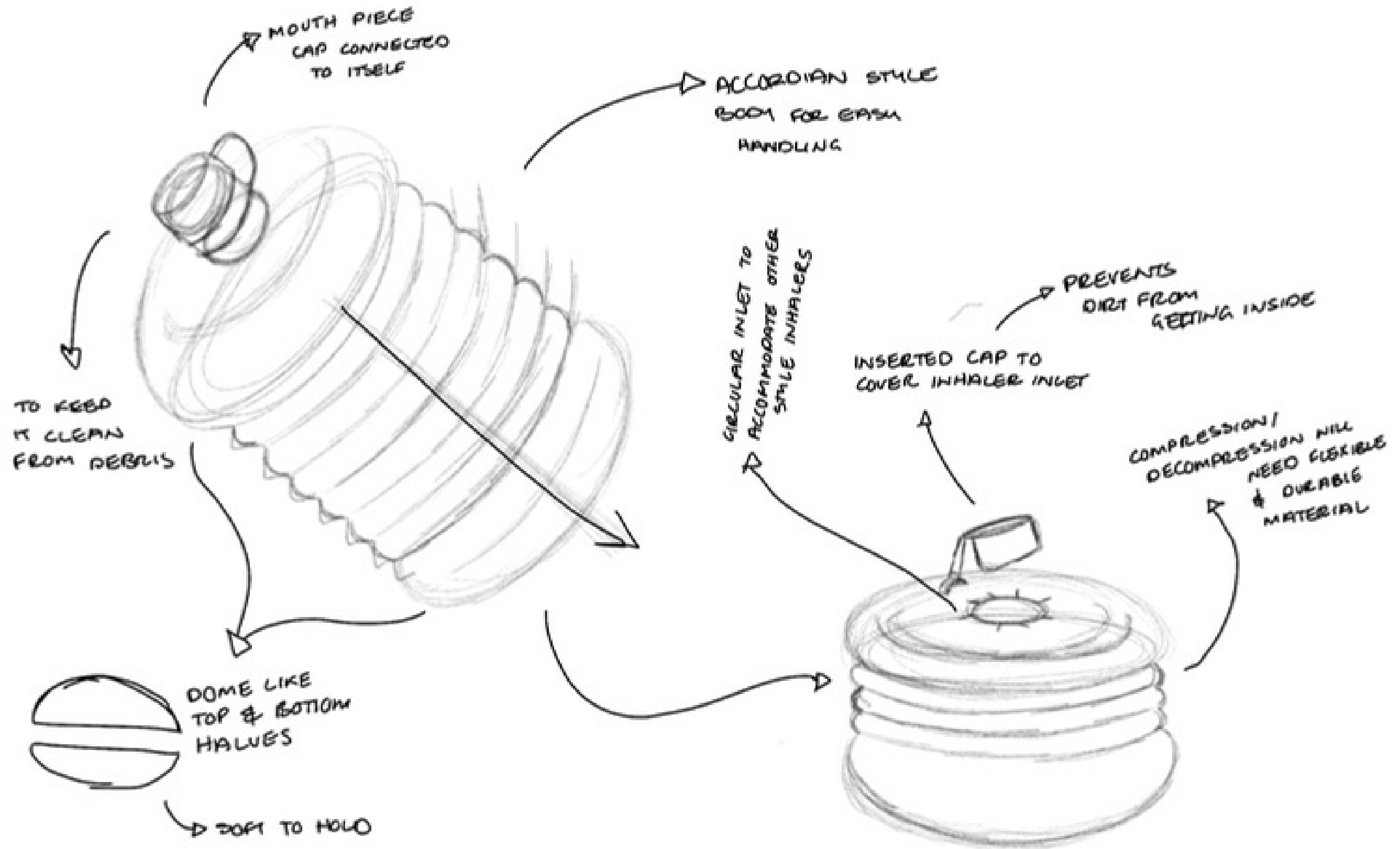
IDEATION

ID7: Capstone | DNB311



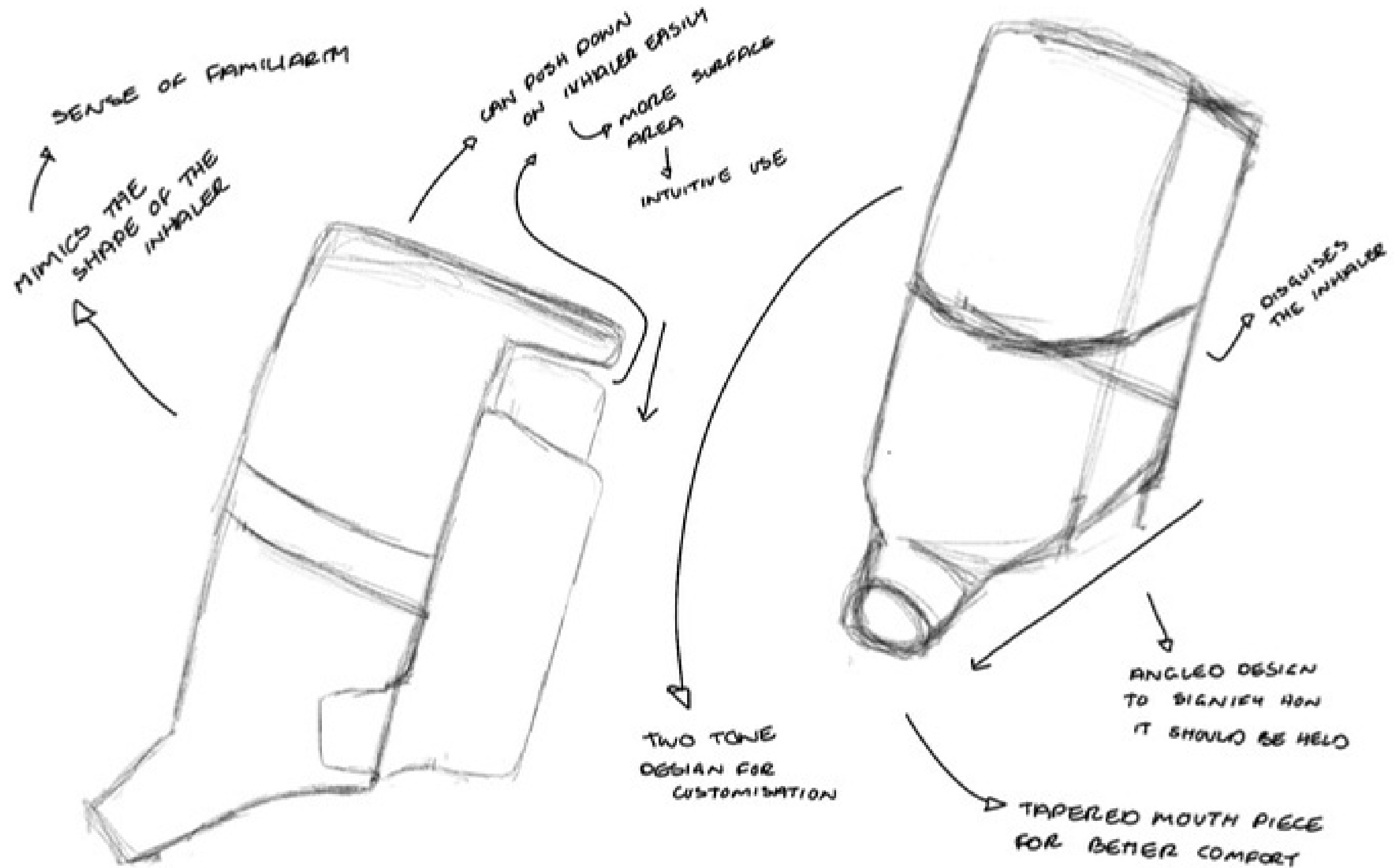
IDEATION

ID7: Capstone | DNB311



IDEATION

ID7: Capstone | DNB311



INITIAL PRESENTATION SLIDES

Research

Research was conducted through anonymous surveys and observational studies with individuals who have asthma or experienced it in childhood/adolescence. This approach provided insights into how spacer design impacts confidence, social comfort, and adherence, while also highlighting the emotional and practical challenges users face.

Key Themes:

1. Design and Appearance
2. Usability and Portability
3. Usability and Practicality

Design Implications:

- Portability:** Spacers need to be more compact and easy to carry on the move.
- Discreet Aesthetics:** A less clinical, more appealing appearance.
- Adaptability:** Adjustable sizing and customisable elements.
- Ergonomics:** Improved handling and comfort to increase usability and consistency of use.
- User acceptance:** Balancing function with emotional needs to help reduce embarrassment and promote adherence.

Not only does asthma affect users physically, but also mentally. Survey results revealed that 58.8% of participants often used their inhaler on its own rather than with a spacer. Additionally, 76.5% of respondents agreed that the spacer felt too large, overly medical in appearance, and uncomfortable to use.

ALEXANDRA NOMIKOS n11086718

Concept 1:

Features:

- Retractable clear tube that compacts into itself for easy portability.
- Outer shells (top and bottom) fully enclose the spacer when not in use, hiding the tube.
- Removable clear tube for easy cleaning and simple replacement when required.

Research:

- Aligns with findings that 76% of users wanted a smaller, more manageable device.
- Concealing the clinical-looking tube responds to the embarrassment participants described when using spacers in public.
- Telescopic mechanism makes it easier to carry without compromising function.
- More discreet form encourages use in public without feeling judged or stared at.

ALEXANDRA NOMIKOS n11086718

Concept 2:

Features:

- Similar in size to a Ventolin inhaler, making it highly portable.
- Upper shell available in colours/patterns chosen by the user, increasing personal expression.
- Clear lower half maintains visibility of aerosol plume.
- Back divot allows inhaler to rest securely and smoothly into place.
- Both the mouthpiece and lower clear section can be detached for easy cleaning or replacement.

Research:

- Compact shape mirrors the inhaler itself, meeting user requests for a more manageable device.
- Customisable top half aligns with findings that appearance influences embarrassment, encouraging public use.
- Clear bottom half allows visibility of the dose delivery, reassuring users of correct technique.
- Removable mouthpiece and base support cleaning and replacement, responding to concerns about buildup and long-term hygiene.
- By resembling the size of the inhaler, the device blends in, reducing the perception of "medical equipment" and increasing confidence in use.

ALEXANDRA NOMIKOS n11086718

Concept 3:

Features:

- Fully telescopic design: Three parts snap-fit into each other, collapsing down into a compact size.
- Integrated key ring allows the spacer to be carried like a personal item, attached to bags or keys.
- Discreet storage pouch keeps the device clean, concealed, and easy to transport.
- Snap-fit mechanism for a secure connection when extended, while enabling quick assembly/disassembly.

Research:

- Addresses size concerns for users wanting a smaller, more manageable device.
- Snap-fit mechanism makes it quick and easy to assemble while maintaining reliable function.
- Key ring and pouch conceal the medical appearance of the spacer, helping adolescents feel less embarrassed.
- Portable and discreet form makes it easier to carry and use consistently, supporting daily management of asthma.
- Framing the spacer as an accessory (bag/key item) instead of medical equipment empowers users and reduces resistance.

ALEXANDRA NOMIKOS n11086718

Concept 4:

Features:

- Accordion-style body allows the spacer to be compacted into a smaller size for portability.
- Rounded, compact form for easy holding.
- Mouthpiece and inhaler slot cap covers for cleanliness.
- Opaque material with customisable colours.
- Durable and flexible material allows repeated compression/expansion without compromising function.

Research:

- Accordion body fill gap for users wanting a smaller and more manageable device.
- Rounded, non-transparent design combats traditional "medical" appearance and helps users feel more comfortable in public with a colour of their choosing.
- Caps protect hygiene and allow users to carry the spacer more confidently without risk of dirtying it.
- By reducing the burden of carrying a bulky spacer, the design improves the likelihood of regular use.
- Compact, approachable form language supports discreet use and reduces self-consciousness.

ALEXANDRA NOMIKOS n11086718

Concept 5:

Features:

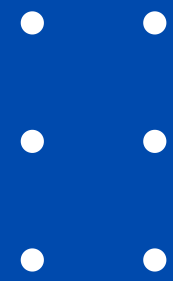
- Familiar compact inhaler form for seamless blend with inhaler.
- Press-down mechanism to mimic intuitive operation of inhaler.
- Slim mouthpiece to reduce discomfort.
- Soft rounded edges make spacer comfortable to hold.
- Two tone colour options for personalisation and increased aesthetic.

Research:

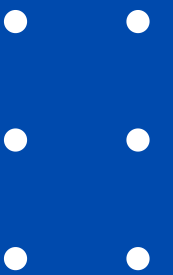
- Compact form tackles findings that bulkiness prevents users from carrying spacers on-the-go.
- Two-tone colour ways allows for personalisation to combat the feelings of embarrassment when using a clinical looking device in public.
- The intuitive press-down design supports usability by mirroring the way inhalers are used, making it easy for users to adopt.
- Softer design and slim mouthpiece to help reduce feelings of being "stared at" and to encourage adherence by a less intimidating design.

ALEXANDRA NOMIKOS n11086718

Needed to add additional information for my audience to get a better understanding of my project aim



FINAL CONCEPT PRESENTATION





Reducing Stigma Through Spacer
Design for Adolescents with Asthma

Concept Presentation

Prepared by: Alexandra Nomikos
12th September 2025



AI Use Statement

For the purpose of this presentation, I have utilised the Generative AI program, ChatGPT to assist in reducing word count of features by providing the program with a description and key features of each device.

Alexandra Nomikos

N11086718

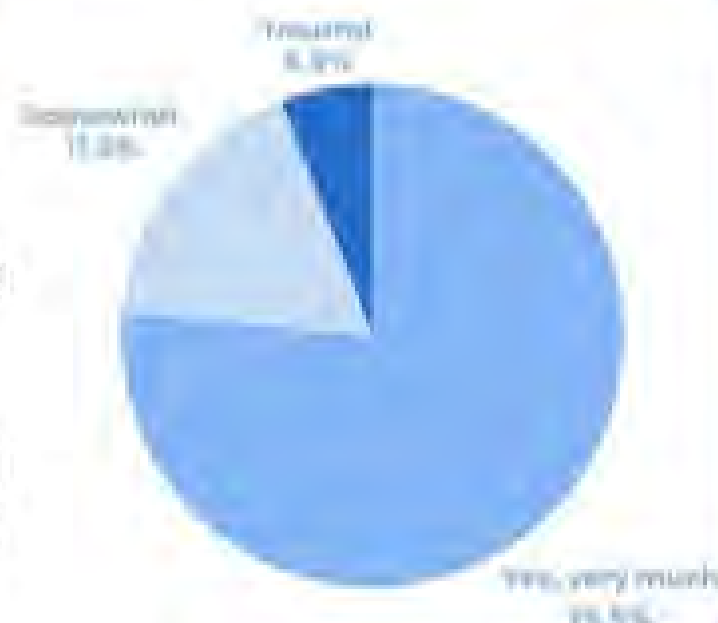
12th September, 2025

RESEARCH



Research was conducted through anonymous surveys and observational studies with individuals who have asthma or experienced it in childhood/adolescence. This approach provided insights into how spacer design impacts confidence, social comfort, and adherence, while also highlighting the emotional and practical challenges users face.

Not only does asthma affect users physically, but also mentally. Survey results revealed that 58.8% of participants often used their inhaler on its own rather than with a spacer. Additionally, 76.5% of respondents agreed that the spacer felt too large, overly medical in appearance, and uncomfortable to use.



Key Themes:

1. Design and Appearance
2. Social and Emotional Factors
3. Usability and Practicality

Design Implications:

- **Portability:** Spacers need to be more compact and easy to carry on the move.
- **Discreet Aesthetics:** A less clinical, more appealing appearance.
- **Adaptability:** Adjustable sizing and customisable elements.
- **Ergonomics:** Improved handling and comfort to increase usability and consistency of use.
- **User acceptance:** Balancing function with emotional needs to help reduce embarrassment and promote adherence.

AREAS OF OPPORTUNITY

The research highlights an opportunity to reimagine the design of the asthma spacer to support both practical and emotional needs.

Three key opportunities were identified:

****All concepts can be used in conjunction with spacer face masks, masks are not pictured. ****



STIGMA REDUCING DESIGN

Opportunity to create a spacer with a discreet, contemporary aesthetic that reduces embarrassment and promotes confident public use.



CUSTOMISATION AND PORTABILITY

Development of a compact, collapsible, or modular spacer with options for personalisation to suit adolescent lifestyles.



ERGONOMICS AND USABILITY

Designing for improved comfort, secure fit, and ease of cleaning to enhance adherence and long-term satisfaction.

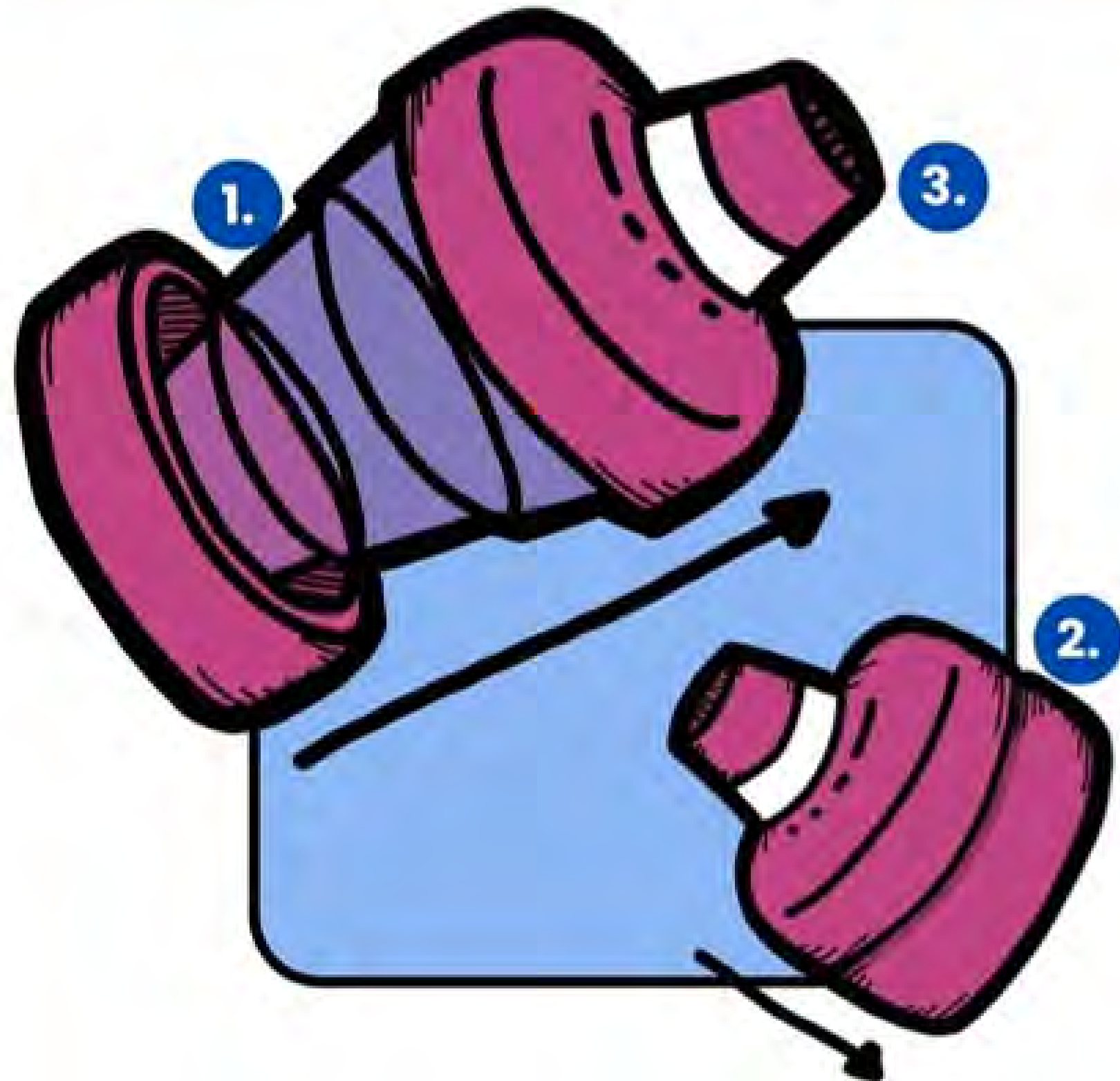
CONCEPT 1

FEATURES

1. Retractable and removable clear tube that compacts into itself for easy portability and clearing.
2. Outer shells (top and bottom) fully enclose the spacer when not in use, hiding the tube.
3. Silicone mouth piece for comfortable use without the mask attachment.

THE CONCEPT LINKS TO RESEARCH BY...

- Aligning with findings that 76% of users wanted a smaller, more manageable device.
- Concealing the clinical-looking tube responds to the embarrassment participants described when using spacers in public.
- Telescopic mechanism makes it easier to carry without compromising function.
- More discreet form encourages use in public without feeling judged or stared at.



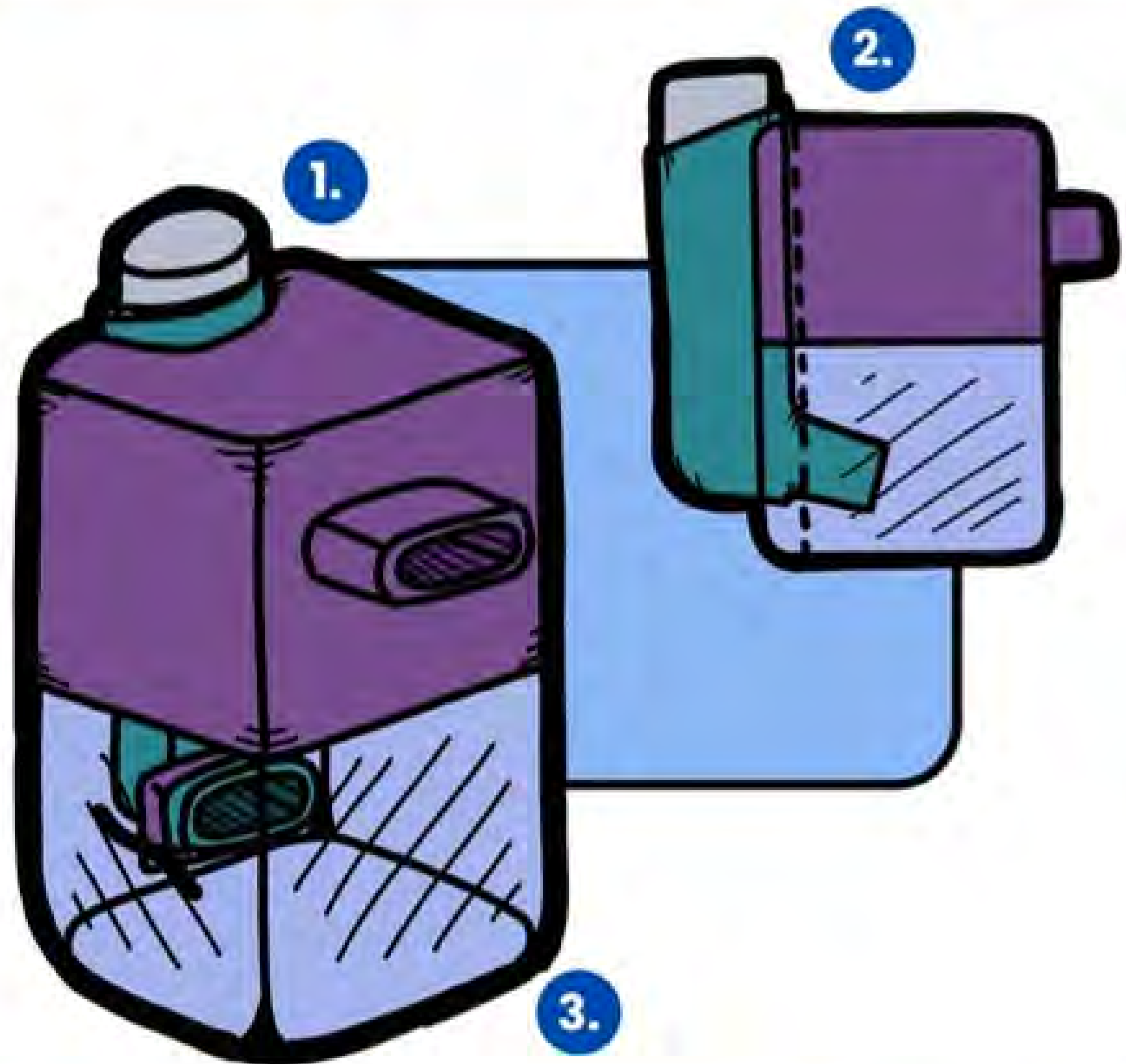
CONCEPT 2

FEATURES

1. Back divot allows inhaler to rest securely and smoothly into place.
2. Similar size in comparison to inhaler makes it highly portable.
3. Mouthpiece and lower clear component can be detached for easy cleaning or replacement.

THE CONCEPT LINKS TO RESEARCH BY...

- The compact shape mirrors the inhaler, meeting requests for a manageable device.
- Resembling the size of the inhaler, the device blends in, reducing the perception of "medical equipment" and increasing confidence in use.
- Removable components responding to concerns about buildup and hygiene.
- Reassuring users of correct technique with clear bottom half allowing visibility of the dose delivery.
- Custom colours aligning with findings that appearance influences embarrassment, encouraging public use.



CONCEPT 3

FEATURES

1. Telescopic design with three parts snap-fit into each other, collapsing down into a compact size.
2. Integrated key ring and pouch for discreet storage and transportation, allowing the spacer to be carried like a personal item.
3. Snap-fit mechanism for a secure connection when extended, while enabling quick assembly/disassembly.

THE CONCEPT LINKS TO RESEARCH BY...

- Addressing size concerns for users wanting a smaller, more manageable device.
- Ease of use with snap-fit telescopic mechanism maintains reliable function.
- Conceal the medical appearance of the spacer with pouch, helping adolescents feel less embarrassed.
- It's portable and discreet form making it easier to carry and use consistently, supporting daily management of asthma.
- Framing the spacer as an accessory (bag/key item) instead of medical equipment empowers users and reduces resistance.



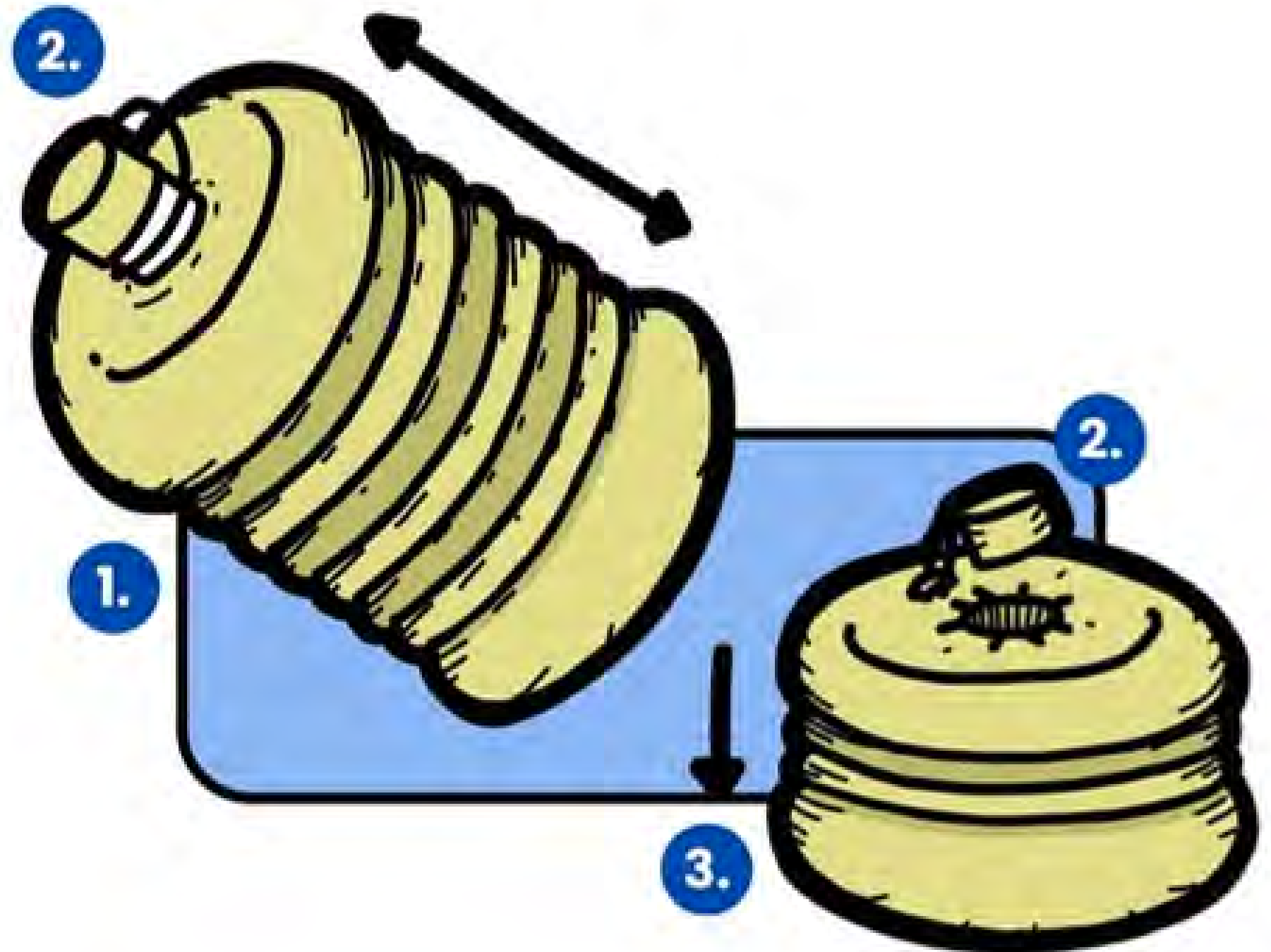
CONCEPT 4

FEATURES

1. Accordion-style body and round form allows the spacer to be compacted into a smaller size for portability and easy holding.
2. Mouthpiece and inhaled slot cap covers for cleanliness
3. Durable and flexible material allows repeated compression/expansion without compromising function.

THE CONCEPT LINKS TO RESEARCH BY...

- The accordion style body filling gap for users wanting a smaller and manageable device. Ease of use with snap-fit telescopic mechanism maintains reliable function.
- The rounded, opaque design reducing the clinical look and bulk of traditional spacers, making it easier to carry and encouraging confident, regular use.
- Caps protecting hygiene, allowing users to carry the spacer confidently without risk of dirtying it.
- Compact, approachable form language supports discreet use and reduces self-consciousness.



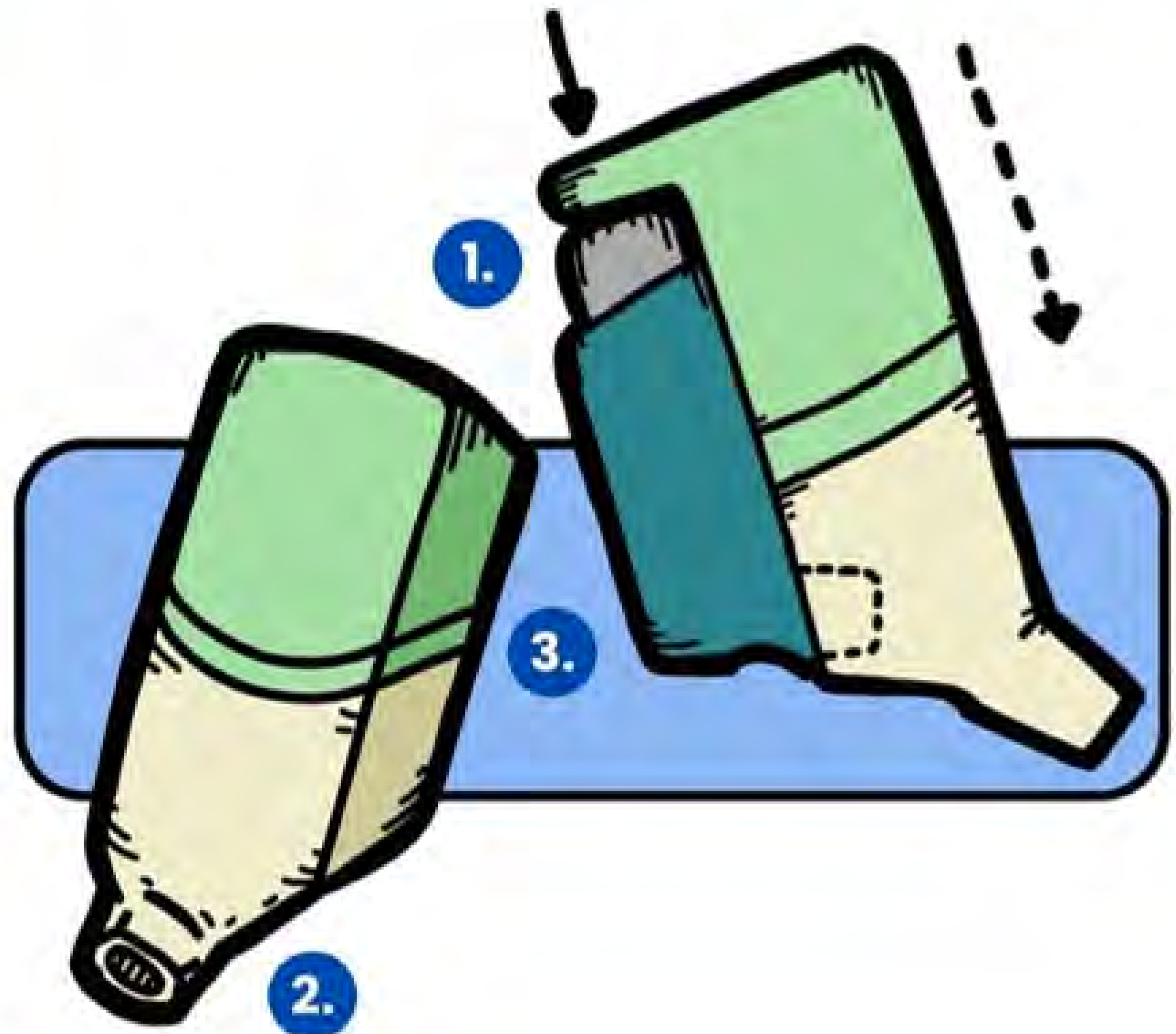
CONCEPT 5

FEATURES

1. Familiar compact inhaler-like form with a press-down mechanism that mimics intuitive inhaler use.
2. Slim mouthpiece and soft rounded edges for comfort in use and handling.
3. Two tone colour options for customisation and increased aesthetic.

THE CONCEPT LINKS TO RESEARCH BY...

- Its compact form tackles findings that bulkiness prevents users from carrying spacers on-the-go.
- The two-tone colour way allows for personalisation to combat the feelings of embarrassment when using a clinical looking device in public.
- The intuitive press-down design supports usability by mirroring the way inhalers are used, making it easy for users to adopt.
- Softer design and slim mouthpiece to help reduce feelings of being 'stared at' and to encourage adherence by a less intimidating design.



SUMMARY OF CONCEPTS

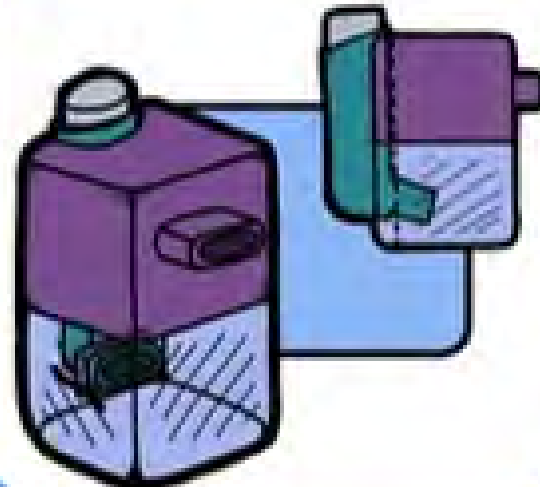
01

- Retractable clear tube that compacts into itself
- Outer shells (top and bottom) fully enclose
- Silicone mouth piece for comfortable use



02

- Back divot for secure resting position for inhaler
- Similar size to inhaler makes it highly portable
- Mouthpiece and lower clear are detachable



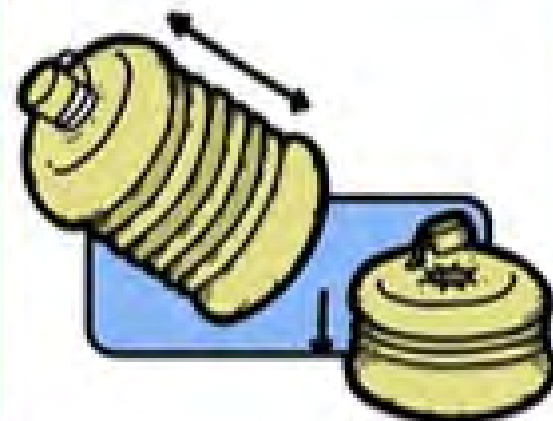
03

- Telescopic design with three snap-fit parts
- Key ring and pouch for discreet storage
- Snap-fit mechanism for a secure connection



04

- Accordion-style body and round form for portability and easy holding
- Mouthpiece and inhaler slot cap covers for cleanliness
- Durable and flexible material



05

- Form and intuitive press-down design mimics inhalers
- Slim mouthpiece and soft rounded edges for comfort in use and handling
- Two tone colour options for customisation and increased aesthetic



FEEDBACK FROM PEERS:

- concept 1 and 3 - likes portability, colours and how fun and playful - positive colours - for kids to help reduce stigma
 - 3 makes it seem like an accessory
- likes key ring concept to make it portable and carry around
- like the case to keep it clean and store it easier
- concept 2 - top could be smaller to fit inside bottom plastic part for portability - like stackable bowls - can have it's own little pouch thing as well
- concept 4 is hard to clean - BIG NO NO

concept 1 more favourable - small and compact - maybe a cap for the mouth piece - need to figure out how to cover the inhaler hole

FEEDBACK FROM SPECIFIC PEER

CONCEPT 1

considerations for cleaning

- + does the silicone piece come off for easy access to the tube ?
- + for the part that it cajoins for it to expand, the crevices ?

colouration is key !!

i rilly like this one !
a simple solution that considers things users may not have thought that they needed.

finding a way to combine this concept with others ? like getting some rilly good features like the lid cap or keychain attachment and adding it on !

CONCEPT 2

not a spacer connoisseur so use ur research to back it up but is it still effective if the inhaler shoots at the bottom ? whereas the mouth piece is at the top ?

her suggestion about making the spacer as a container or case for the inhaler was great too !!

just need to consider germs and if users would be inhaling bacteria eg. touching the inhaler > putting it back into the container ? using it later on when it has time to fester expecially in hot sweaty enviroments

CONCEPT 3

pouch is good ! easy to wash too

again with concept 4
how can we make this not flimsy when in user ?
are there locks to keep the modular element in place ?

CONCEPT 4

great portability !

but i think if it was to expand out it would still be the same as a regular spacer in use

structure challenges as well ! depending on type of material it could end up being flimsy or too easily collapsible

is the cap attached to the spacer too ??
thats pretty cool and pretty funnnnn

love the mouthpiece cover !
keeps everything clean and sterile when being carried around ... i dont think mine ever had a mouth piece.

CONCEPT 4

this one is cool too ! could rilly mess around with design for disassembly.

again with the whole spacer effeciveness too as it shoots rilly close to the mouthpeice but again, i dont know how spacers work hehehe.

mouth piece angle ? angle of user heads or angle of spacer and how that effects the push down motion

CHOSEN CONCEPT

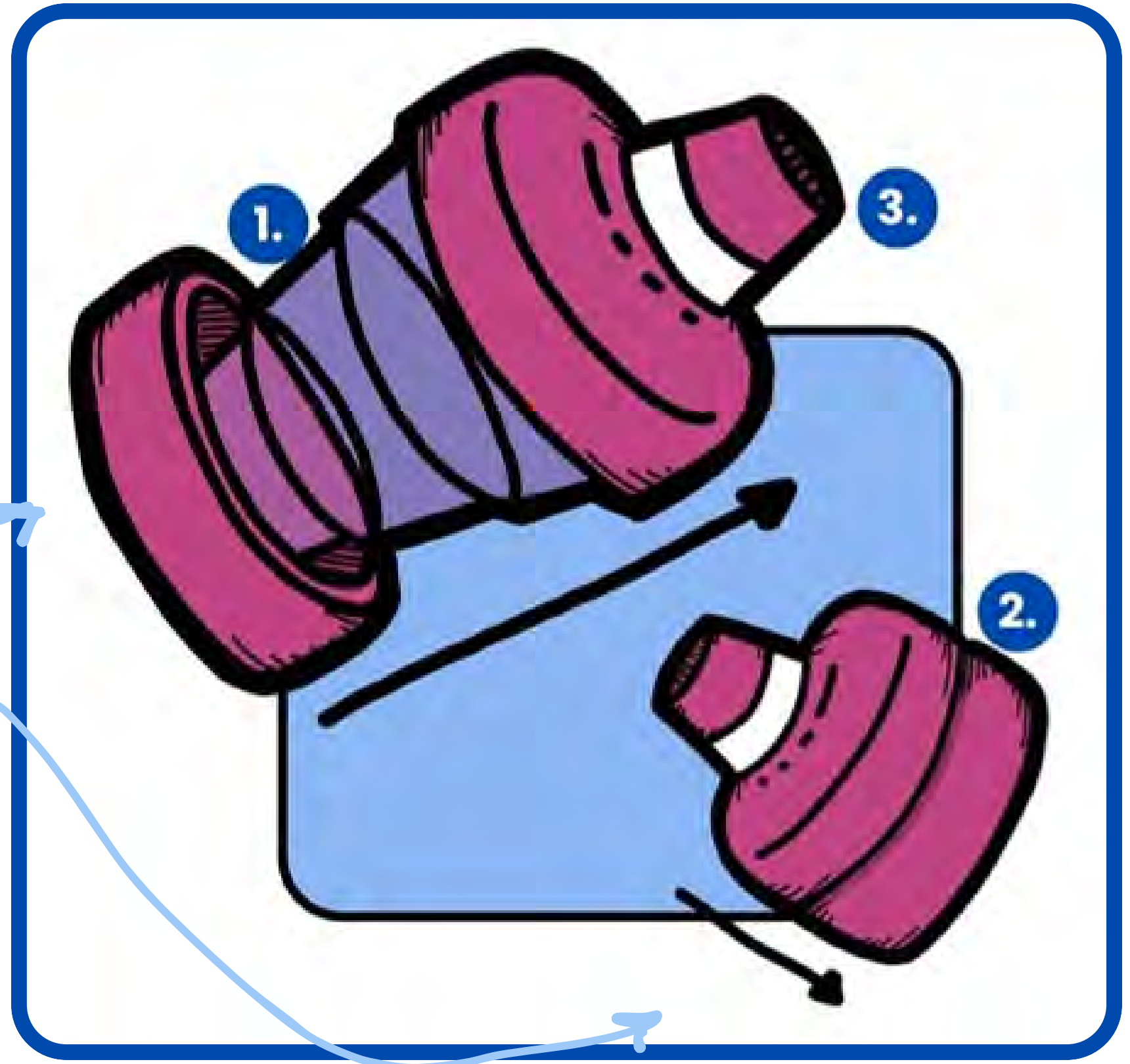
Concept 1 was chosen to further improve based on the feedback provided by my peers. I also went with this concept as I felt it suited my aim the most.

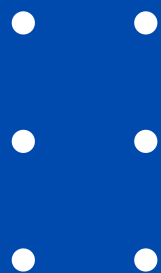
Liked the ability to be able to customise the colours

How it compacted to a smaller size



I look forward to incorporating their feedback as I was more drawn to this design the most





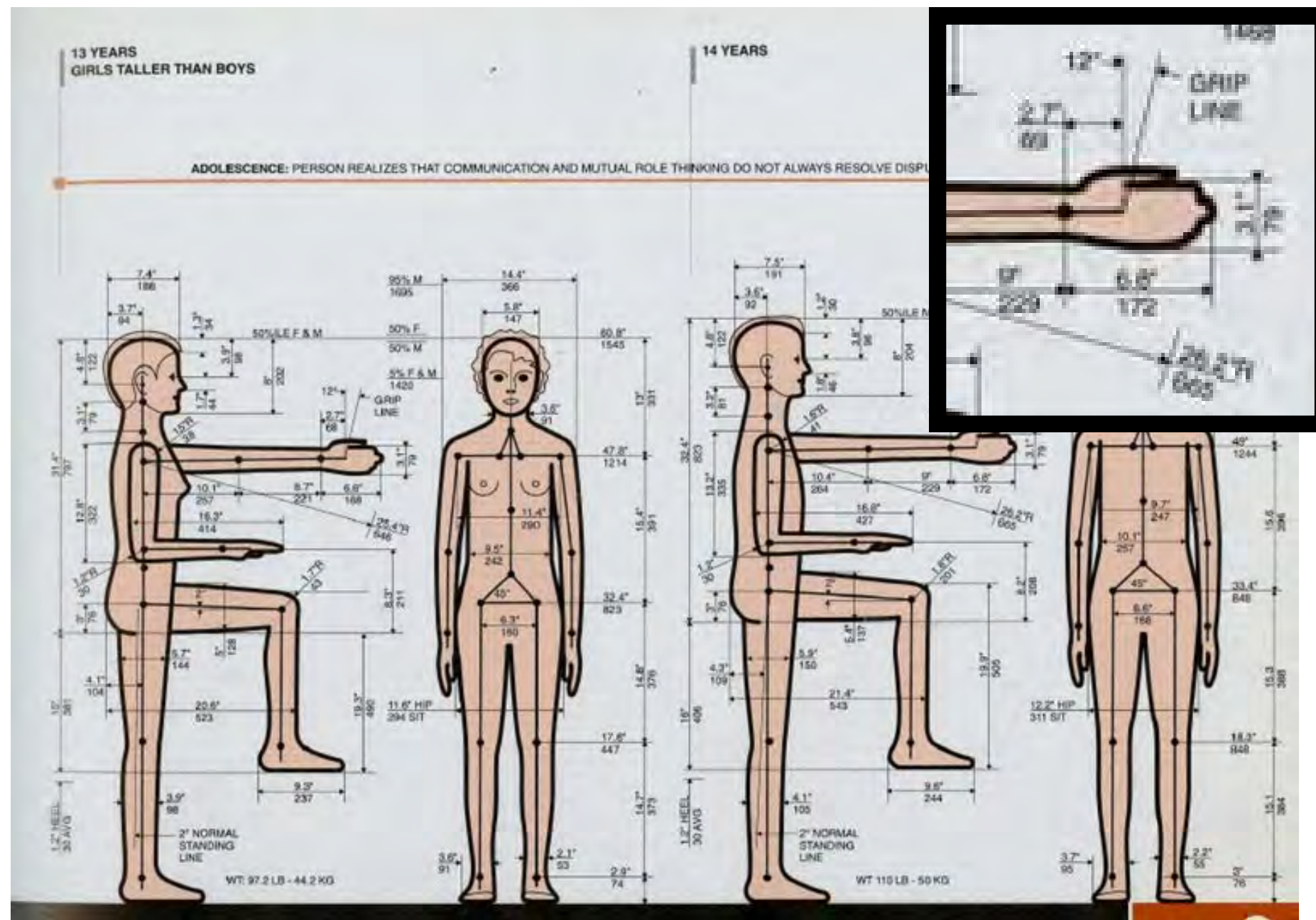
05

REFINEMENTS



ANTHROPOMETRIC DATA

Using the measure of man and woman, it will help guide my process into the size of my design and how it will best accomodate for the adolescent age group.



14 year old boy dimensions will be what I will roughly base my dimensions off of. But very loosely, as this spacer will not only just be for adolescents but also for age groups much beyond that.

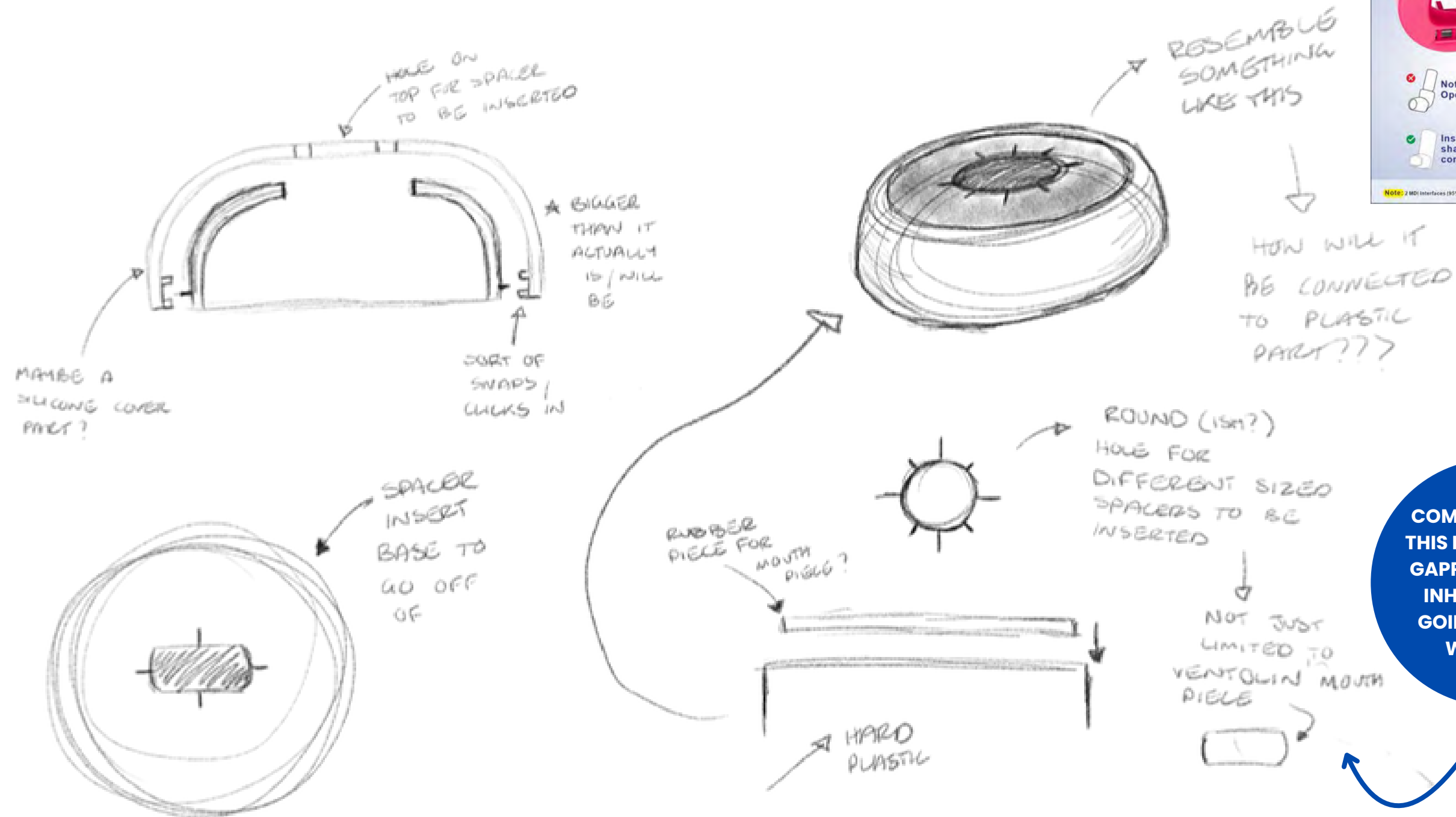
Can use my own hand as part of the limiting users to help with my dimensioning.

14 year old boy dimensions:

- Length: 172mm
- Width: 79mm
- Base of hand to base of thumb: 69mm

REFINEMENT

ID7: Capstone | DNB311



COME TO REALISE THIS MAY PRESENT GAPPING FOR THE INHALER... NOT GOING FURTHER WITH THIS

AESTHETICS

Kept these design principles in mind when heading into the next stage of this assignment.

My aim:

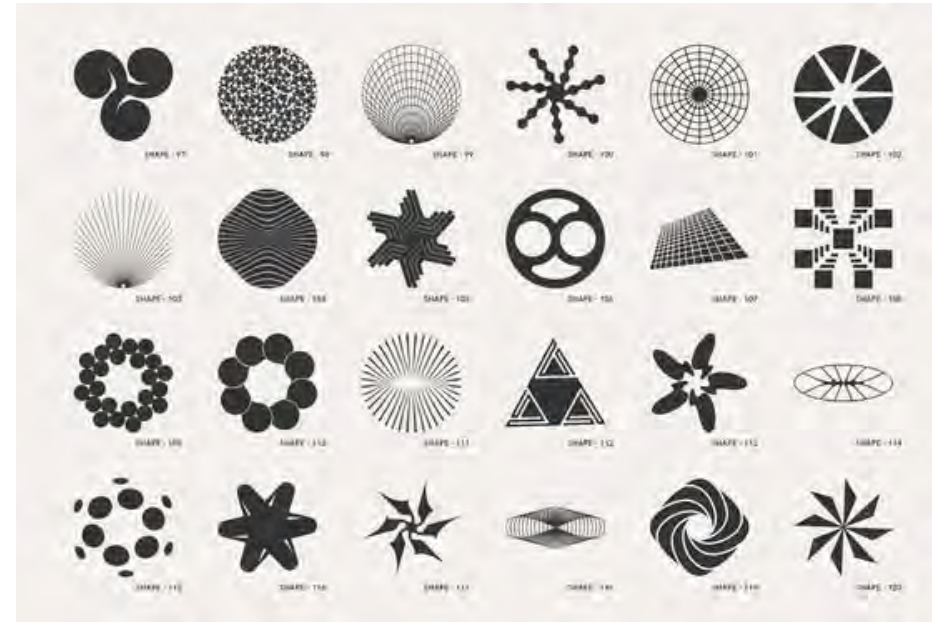
- craft a cohesive form language
- design with balance (symmetrical design)
- playing with light and shadow
- balance simplicity and character
- speak the product's function visually
- refine edge details and transitions

(Johnathan Thai, 2025)

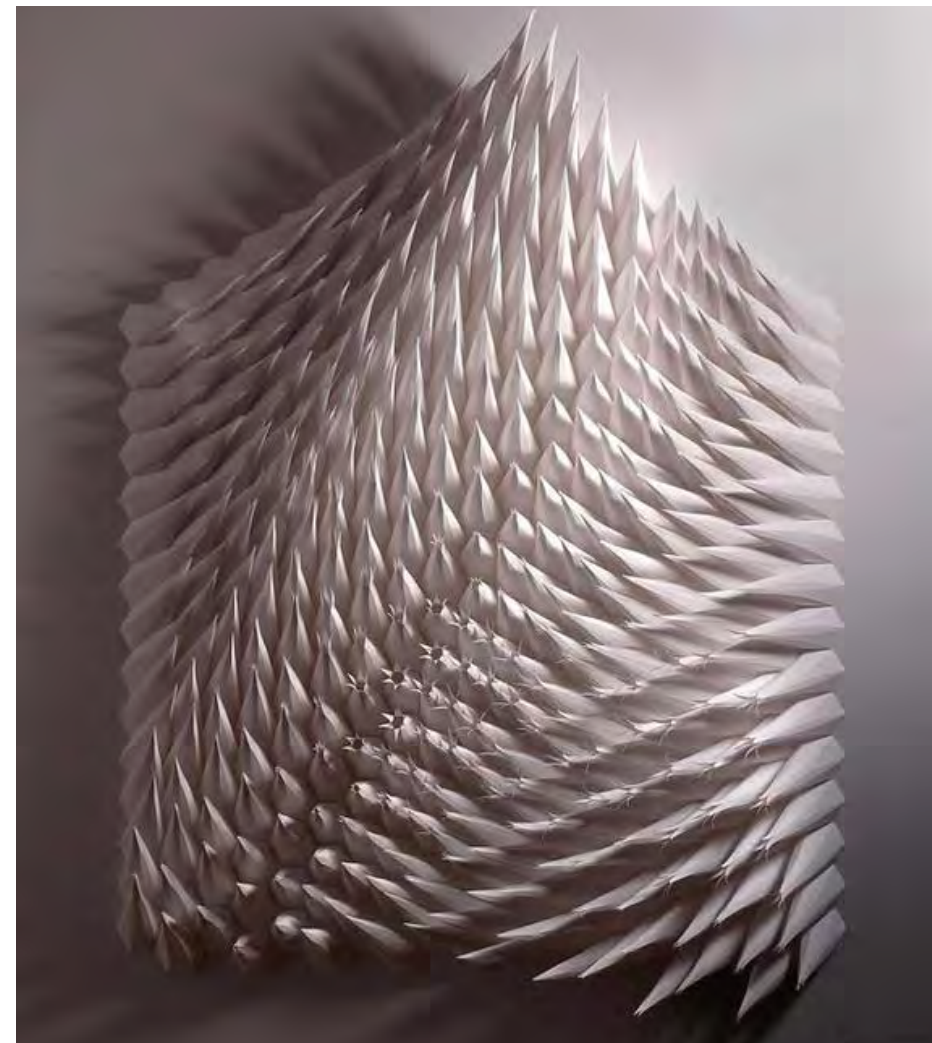


FORM INSPO

ID7: Capstone | DNB311



Looked at organic forms, art sculptures and connecting shapes to help give me some inspo for how I want the outer shell to connect to each other.



Alexandra Nomikos | n11086718

REFINEMENT

OVERALL FORM
INSPIRATION

VERY ROUGH
DIMENSIONING AS
FINAL DIMENSIONS
WERE COMPLETED
OFF TO THE SIDE
DURING CAD

LOST THE
PAPER I
DREW IT ON
SOMEHOW??

DESIRED WAY
FOR THE
TELESCOPIC
MECHANISM TO
SIT IN THE SHELL

UPPER
TUBE
COLLAPSED

★ DRAWING
NOT ACCURATE
KIT ALL ★

TO ALLOW FOR
ADDITIONAL
ROOM

40mm 40mm 40mm
120mm

50mm

MOUTHPIECE



Looked into potentially having the mouth piece be made from silicone rubber?

Could be useful for those who tend to chew on things and then eventually ruin the mouth piece of the product.

If I do continue with this, needs to be replaceable for easy maintenance and hygiene concerns.

Either medical or food grade silicone??

MOODBOARD

ID7: Capstone | DNB311



CUSTOMISATION



INTERCONNECTION



TEXTURES



FORMS

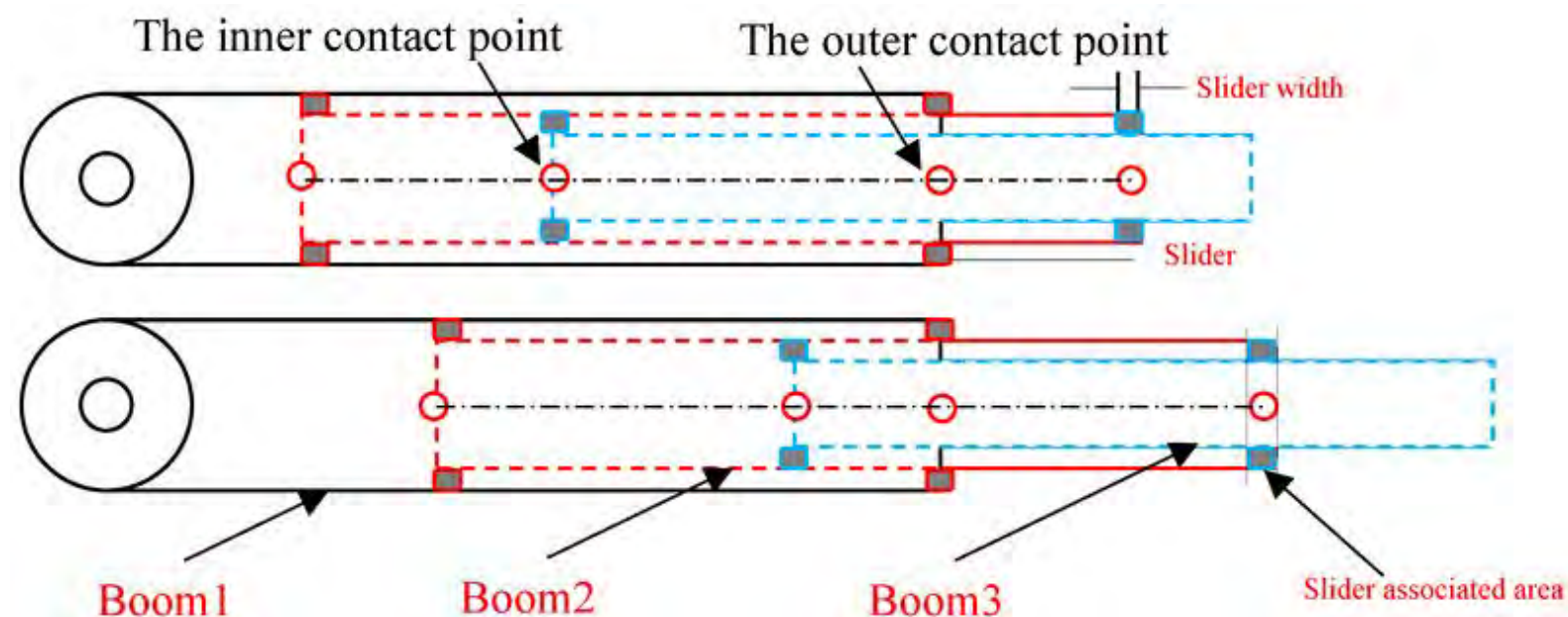
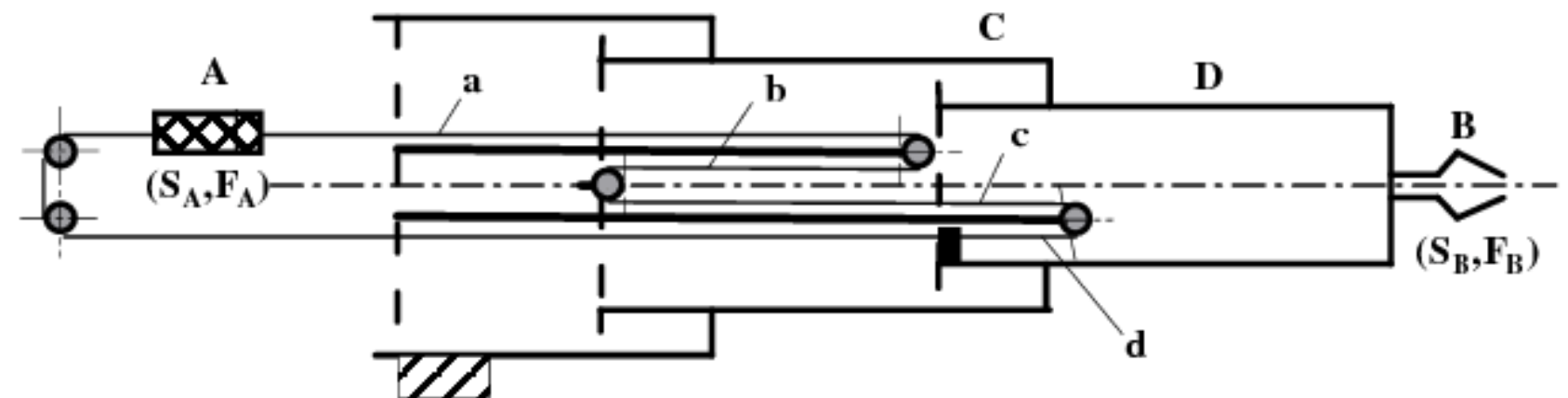


YOUTH APPEAL

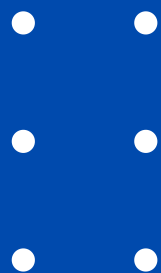


TELESCOPIC MECHANISM

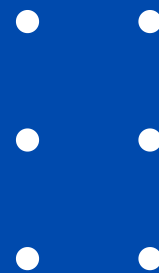
To gain a better understanding of how the mechanism would *actually* work, I referred to diagrams of how telescopic mechanisms actually worked and how I could apply it to my design.



I referred to these diagrams a lot throughout my cad prototyping to ensure that I stayed on track and the mechanism would work correctly



INITIAL PROTOTYPING



FOAM AND PLASTICINE

Turning 2d sketches into 3d models was super helpful in understanding the scale of my product more. I used foam and plasticine to model my design, foam was used for the chamber and plasticine as the outer shells



Using the dimensions I sketched out previously, I realised the the chamber was longer than I wanted it, especially with the addition of the outer shells' depth

As it progressively got smaller the more I took a part out it showed me how it would feel from the biggest size to the smallest

FOAM AND PLASTICINE



A small gap was left of the chamber - probably incorrect dimensioning

The organic lines would match up when closed all the way for a seamless look and then would be pulled apart but stay in the same position

Felt too bulky in my hand, kinda defeated the purpose of the spacer (and this model didn't even have the mouthpiece) so needed to adjust dimensions further

FOAM AND PLASTICINE



Second prototype I adjusted the chamber components to be smaller by about 12mm or so? but instead of it having three 'chains' I made it four

Which meant it would be able to compact to a smaller size and also extend to a similar length as my original spacer

So with the width changed of the individual chamber component, the outer shell fit much better over it

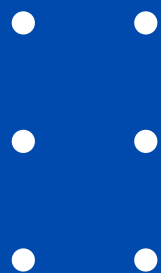
FOAM AND PLASTICINE



The components were able to retract in on itself easily and fit snugly into the biggest chamber component

Outer shell fit a lot better over the whole chamber

Tested against a bag to see a size comparison - still seemed bulky but may be a result of the plasticine being too big



CAD PROTOTYPING



TO NOTE:

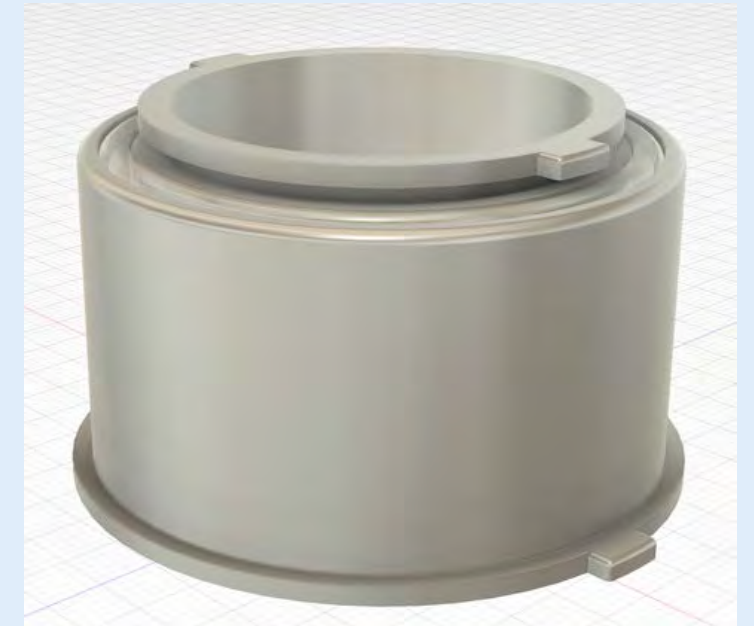
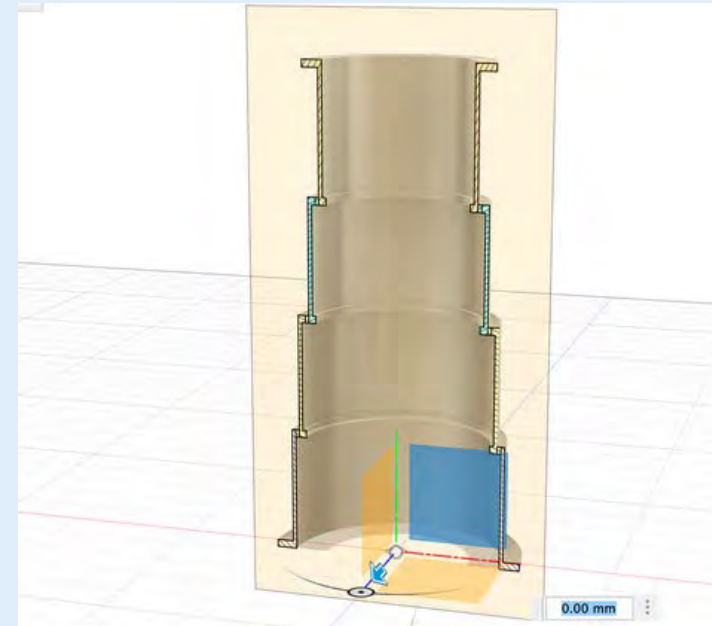
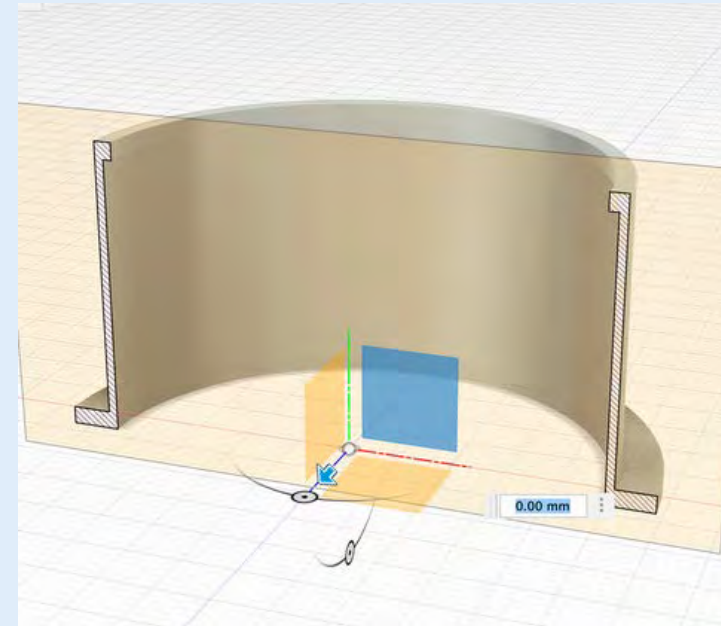
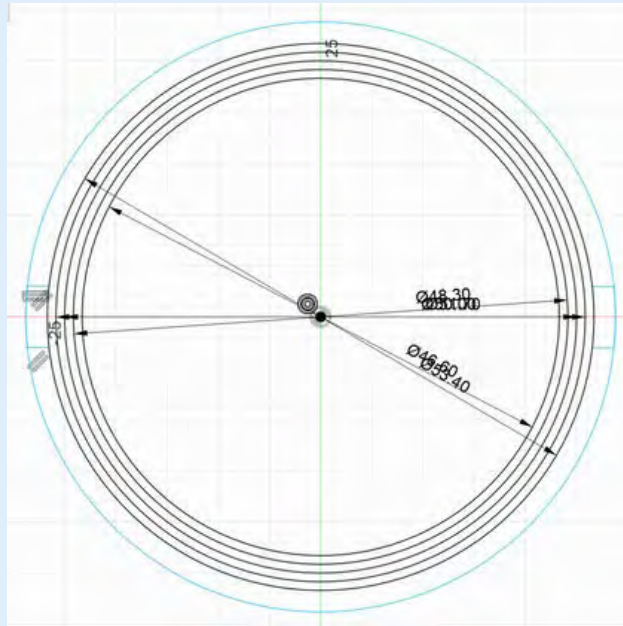
Unfortunately with my amazing luck, Fusion decided that in the week leading up to final presentation that it should crash and lose my files... this was definitely not on my agenda, so I had to act quick in re-creating my design. Which meant that I may have missed some key components that I wanted to include but didn't have the time for so I had to move on and keep going!

Also will be simplifying the cad process as there was a lot of steps, so I will only be showing the most important parts.

CAD PROTOTYPING

Telescopic Chamber

ID7: Capstone | DNB311



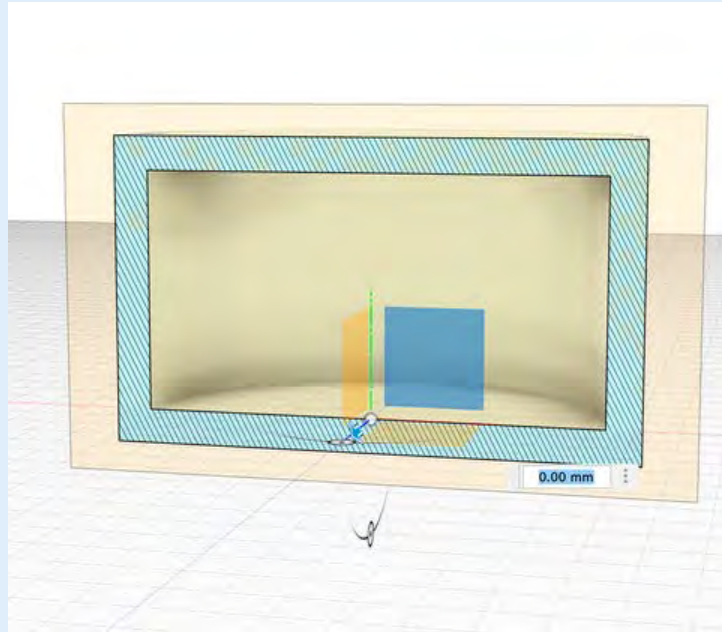
I began by sketching the overall dimensions of the first (biggest) chamber

I extruded each part to the necessary dimensions so that the mechanism could work and the bottom I would later extrude for the tabs after cutting into the outer shell

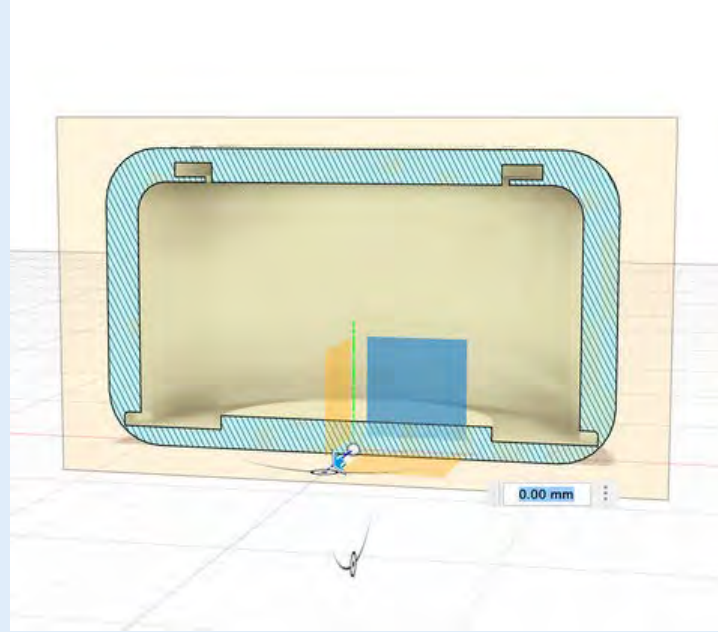
I repeated the previous steps to the other parts, creating sketches on top of one another and extruding to a new component

After necessary adjustments were made to the chamber parts, I filleted to create a softer edge and also extrude the tabs and filleted for the same reason

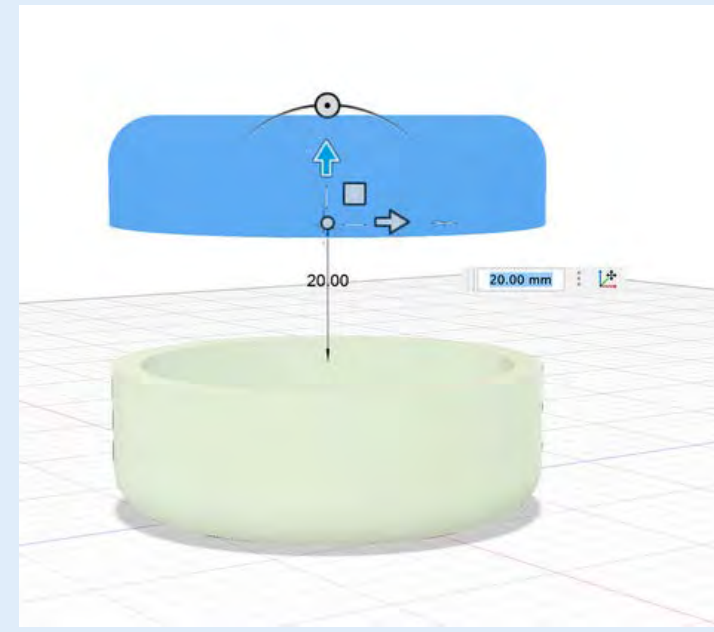
CAD PROTOTYPING



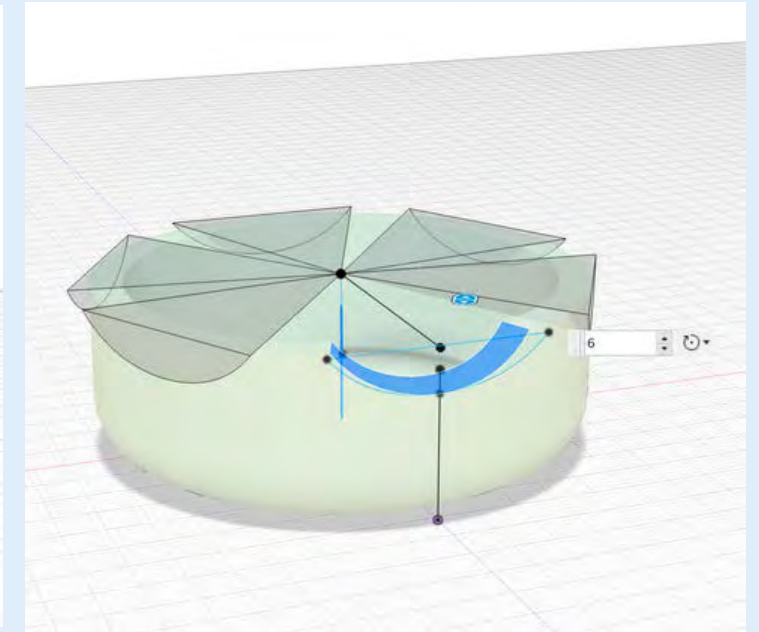
After the chamber components were complete, I then sketched the outer shell and extruded it and ensured that there was a hole on the inside and even wall thickness around it



Using the combine tool, the outer shell was the target body and I used the chamber as the tool to ensure I got the correct cut into the body. Unfortunately I dimensioned the outer shell incorrectly but I rectified this later so that the shape wasn't compromised



After all adjustments were made, I split the main body but off centre, as the wave pattern would distribute enough material for both halves and it would also look like it is split evenly after the pattern has been executed



Using offset planes, I sketched my desired curve and angles then with the loft tool I was able to cut into the body. In order to get the repeating wave around the edges, I tried using the emboss tool which failed so I decided to use the circular pattern to get what I wanted

CAD PROTOTYPING

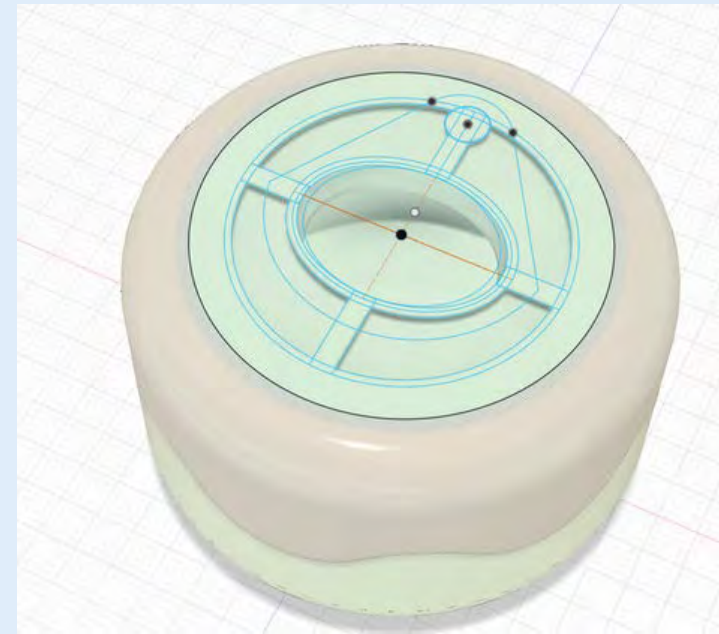
ID7: Capstone | DNB311



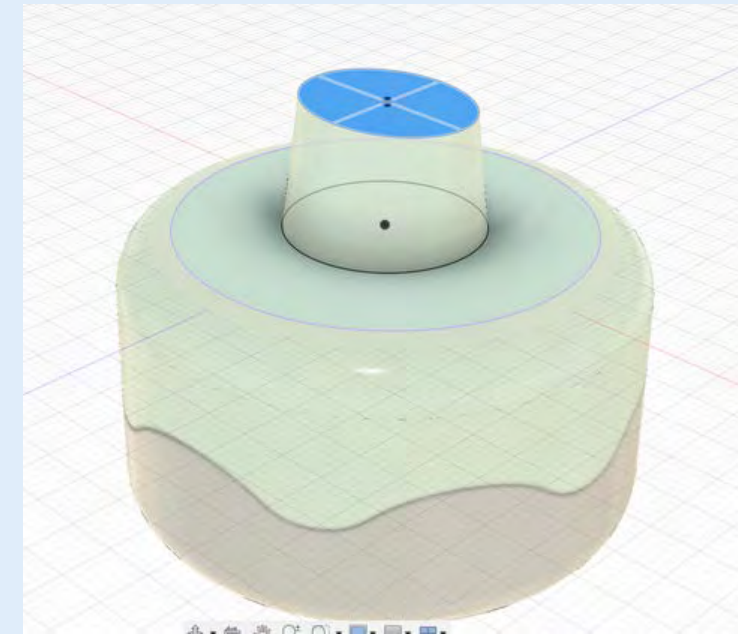
After the chamber components were complete, I then sketched the outer shell and extruded it and ensured that there was a hole on the inside and even wall thickness around it. I then used a fillet to curve the top of the pattern so it wasn't so harsh



For the top shell to have the same pattern, I was able to extrude it downwards so it would go beyond the pattern. Using the combine tool, I used the bottom half to cut into the top to create the same pattern. To make the exterior edges softer, I used a small fillet which made the pattern stand out more.



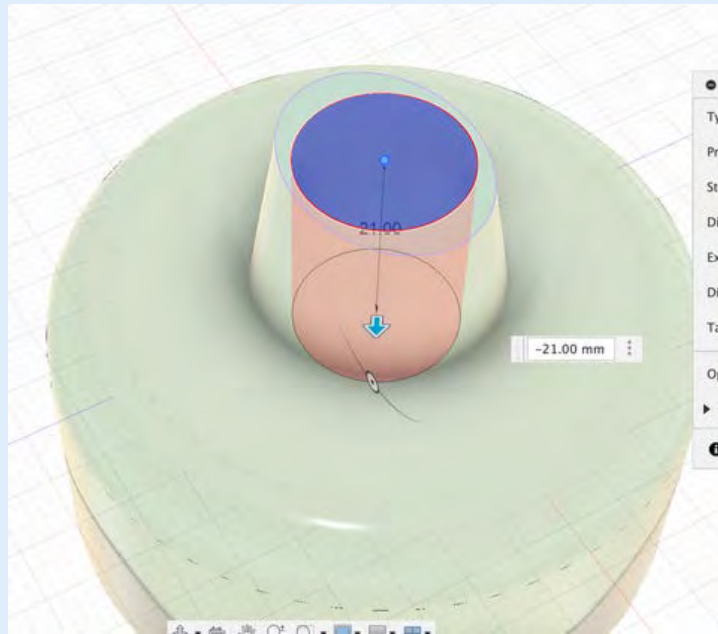
To create the inhaled inlet, I sketched on the underside of the bottom half. I then extruded to the depth necessary and used the fillet tool to get more rounded edges. Reason for this pattern is to draw attention to where the inhaler should be inserted



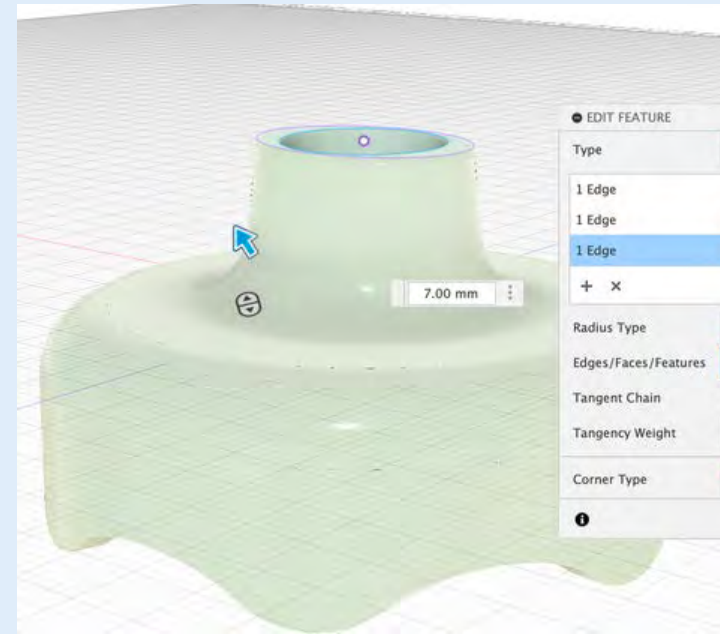
Starting on the mouth piece, I sketched on two different planes with my desired measurements and then used the loft tool in order to get my desired tapered shape

CAD PROTOTYPING

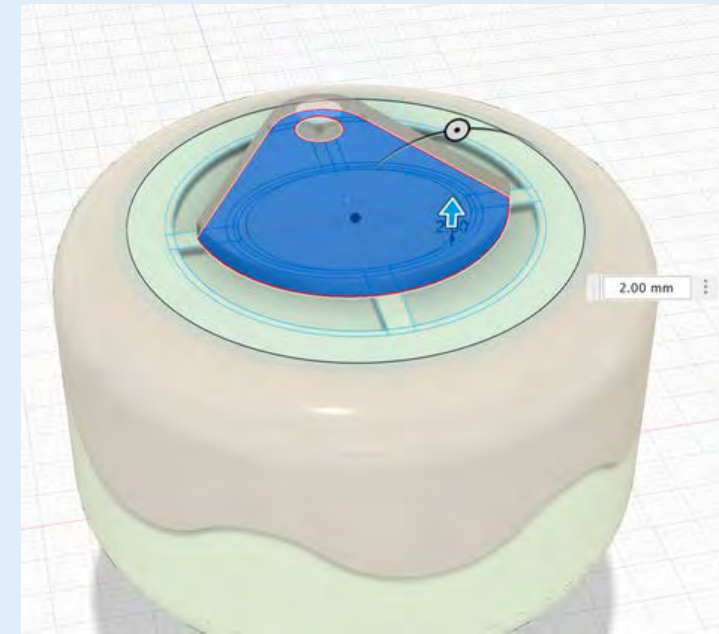
ID7: Capstone | DNB311



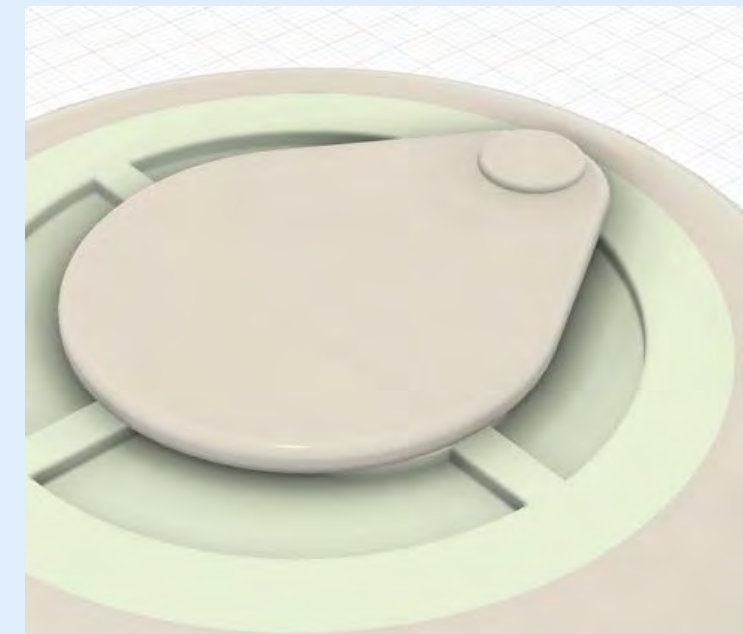
I then sketched onto the top of the mouthpiece the hole for the user to breathe through. Then I extruded it down to cut through all the way to the shell, making adjustments to the interior of the shell using the extrude tool again (not pictured)



To create a seamless blend between the mouth piece and the body, I used the fillet to pull outwards from the bottom edge of the mouthpiece and created the curve as seen above. I also used the fillet tool to give small soft edges to the top of the mouth piece - the internal hole and the exterior edge

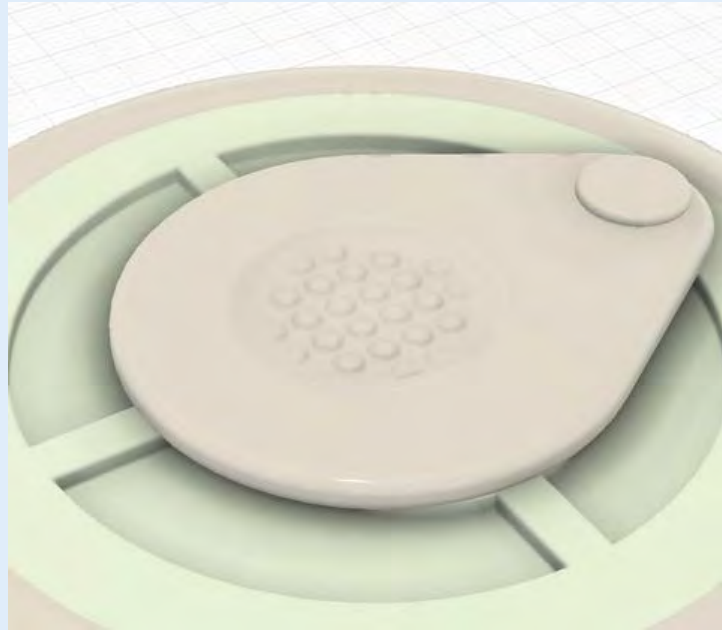


Using the same sketch I made when I created the inhaler design, I extruded the shape I drew for the slider as well as extruding the pin that would hold the slider in place and allow for it to move around.



After the slider was extruded, I needed to make a cap for the pin so I sketched ontop of the pin and made a small extrusion that would attach to the top of the pin. Then to round out the shape of the slider, I used the fillet tool to achieve my desired effect and same with the edges and the pin cap

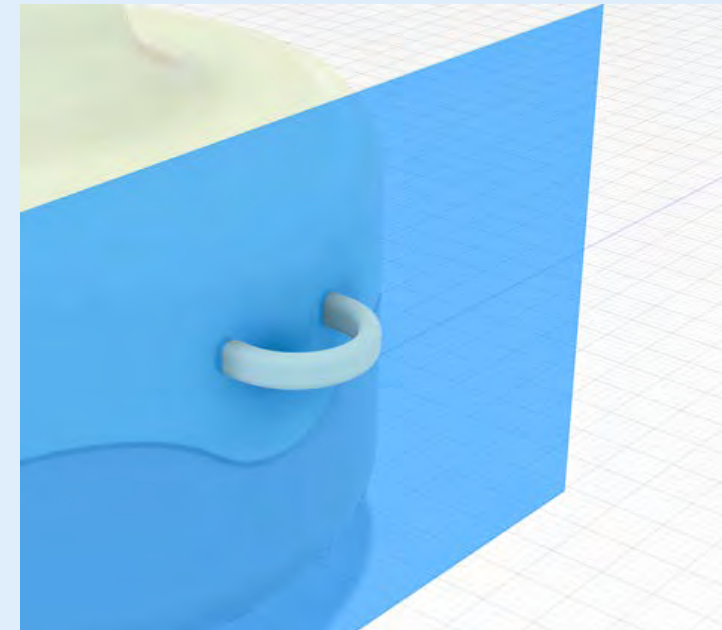
CAD PROTOTYPING



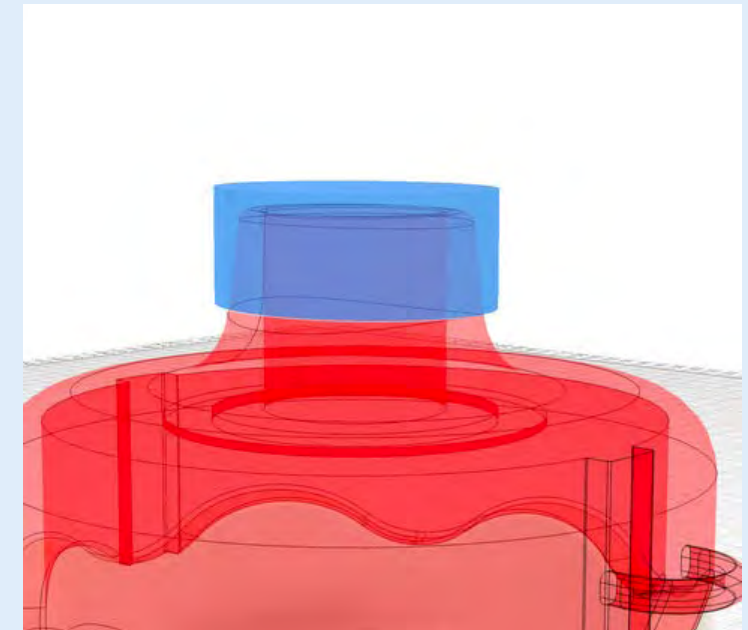
To create a thumb grip/signifier, I sketched on top of the slider, extruded down to cut, used the fillet tool to give the cut a smoother feel on the thumb and repeated similar steps for the bumps on top of it but extruded upwards



Then underneath the slider to create a 'seal' for the inhaled inlet, I sketched my desired shape, extruded and filleted so that it would fit into the inhaler at the right size



To create the hook for the connector loop, I created an offset plane, sketched the shape I wanted, extruded outwards, sketched on top of the extrusion to ensure the right gap and then used the fillet tool for rounded and soft edges



For the cap of the mouth piece, I create a similar sized ellipse shape and then extruded down to my desired height. Then I used the combine tool to ensure an accurate cut into the mouth piece to accomodate for the curves and taper of the mouthpiece

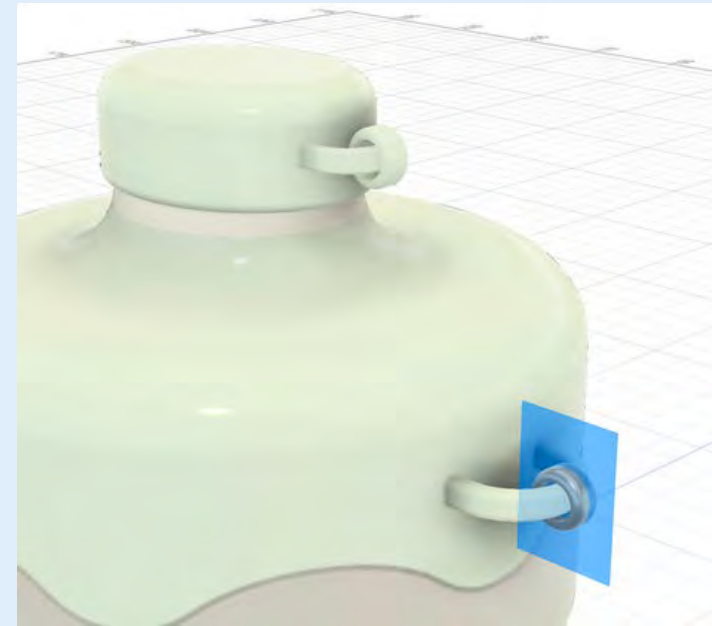
CAD PROTOTYPING



After the previous step, I used the fillet tool to create soft edges around the cap and the inside where the seal was. For the mouthpiece to be removable, I split it from the top shell and created tabs to be able to insert into the main body after replacing/cleaning. I used the combine tool again for accurate cuts



As per my other step for the hook on the main body, I created a smaller one on the cap so the loop can be attached to both hooks. The hook on the main body is larger so that a keyring can also be hooked onto it for portability



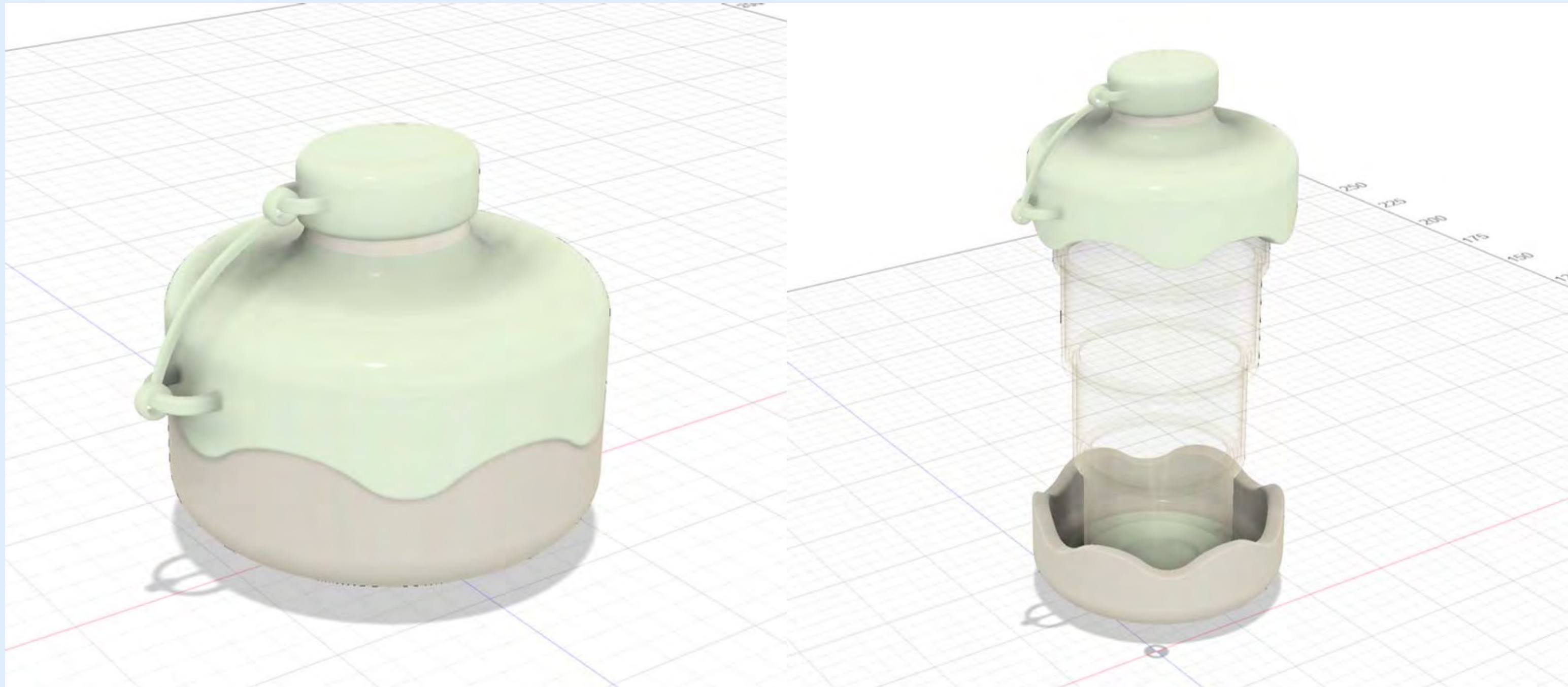
Using an offset plane to cut into the hooks of the body, I sketched the size of the circles, extruded on both sides and then used the fillet tool to make the circle more rounder and softer



I then sketched the connecting piece on the same plane, extruded similarly to the previous step but thinner, and then filleted for softer edges

CAD PROTOTYPING

ID7: Capstone | DNB311



And then, finally the spacer was complete. I will definitely be making adjustments before the exhibition as it didn't turn out the exact way I wanted it to but overall I was really happy with how it came to fruition from the sketches. I applied my materials onto it and it was ready to be rendered!

Alexandra Nomikos | n11086718

MATERIAL EXPLORATION

Outer Shell Components

Acrylonitrile Butadiene Styrene (ABS)

For all other plastic components, ABS felt the best suited when compared to polypropylene or polycarbonate.

Here's why:

- It offers a strong, lightweight structure which is perfect for handheld medical devices
 - Will ensure there is no hand fatigue by keeping the body durable but not heavy
- It holds its shape extremely well, especially when fitted with moving parts
 - Will maintain a consistent fit between the chamber and other components for reliability and smooth operation
- It takes colours and finishes evenly, and can be painted or printed easily
 - Perfect for the aesthetic customisation my spacer offers to reduce stigma and help to make the device feel more like an accessory
- It is highly suited for injection moulding with its low cost, fast production and tight tolerances
 - Perfect for mass manufacturing and where consistency and cost efficiency is important

([Protolabs](#), N.D)



MATERIAL EXPLORATION

Chamber component

Polycarbonate

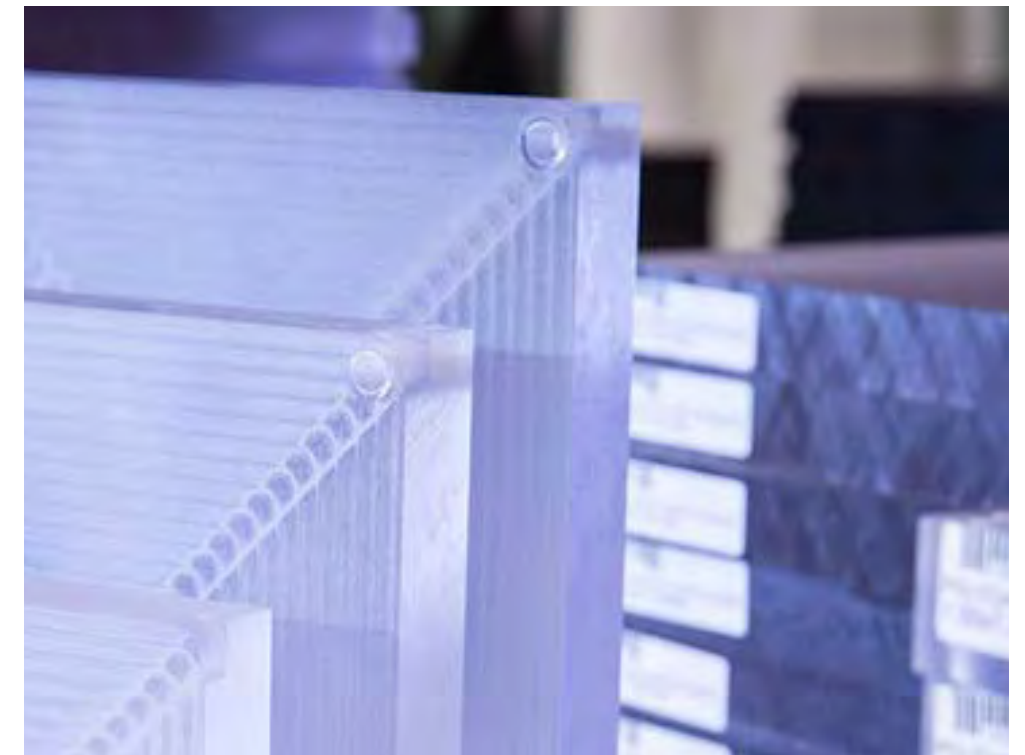
For the chamber component, I was initially going between acrylic and polycarbonate (PC) but ended up deciding on PC.

Here's why:

- It is impact resistant and virtually shatterproof (250x stronger than acrylic)
 - This is important as it will be safer for when children, teens and many users drop it during daily use
- It can withstand movement and flex which is ideal because of my telescopic mechanism
 - This is also important as the telescoping parts will need resilience and a small degree of flexibility for the lock-twist function
- It has a higher heat tolerance and resists cleaning, disinfectants and boiling water
 - This will allow for regular cleaning and sterilisation which is essential for maintaining hygiene
- It is ideal for injection moulding for parts that have fine tolerances and moving components
 - Important as it allows for precision parts like the interlocking features with consistent wall thickness and smooth finishes
- Although acrylic is more ideal for clarity, PC maintains better over time as it is resistant to cracking



([Protolabs, 2023](#))



MATERIAL EXPLORATION

Cap connector/loop part

Thermoplastic Elastomer (TPE)

Choosing TPE over rubber for this part, was because of it's manufacturing compatibility, durability and recyclability.

Here's why:

- Can be injection moulded in the same process as ABS and PC
 - Will allow for the mould of the connector to be made in the same production line as the other components
- It combines the elasticity of rubber with the strength and process-ability from that of plastic - it stretches and bends without tearing but is firm enough to hold shape
 - Allows for the connector loop to bend and flex
- TPE is recyclable as it can be melted and reprocessed
 - As it is a small part, breakage may occur which if possible it can be offered to take the part back to be recycled and reused
- Providing a soft touch and non slip feel, will help improve grip and usability
 - This ensures that it remains smooth, flexible and durable even with the daily use of taking the cap on and off

([Kinsoe, 2025](#))



MATERIAL EXPLORATION

Smaller components: mouthpiece, inhaler inlet

Medical-Grade Silicone Rubber

I decided on medical grade silicone rubber for the mouthpiece and inhaler inlet as they interact with the user's mouth and medication pathway.

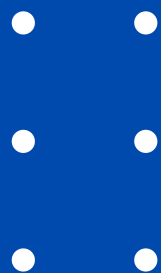
Here's why:

- It is biocompatible and hypoallergenic, which will make it safe for skin and oral contact. It is non-toxic, odourless and resistant to microbial growth
 - Ensures comfort and safe inhalation for repeated use
- It is soft and flexible whilst maintaining shape memory, creates a comfortable seal between the mouth and the inhaler to prevent leaks from the medication
 - It improves comfort for the users so they can press their lips around it without any discomfort
- After sterilisation, boiling and alcohol based cleaning, it won't degrade or warp or release harmful residues
 - Allows for easy cleaning to maintain hygiene and longevity
- It can be liquid injection moulded due to it's material makeup as it is resistant to high and low temperatures
 - Important as the parts are smaller and detailed, and using liquid silicone rubber will help to achieve that detail, the flexibility and finish

([Protolabs](#), N.D)

Alexandra Nomikos | n11086718



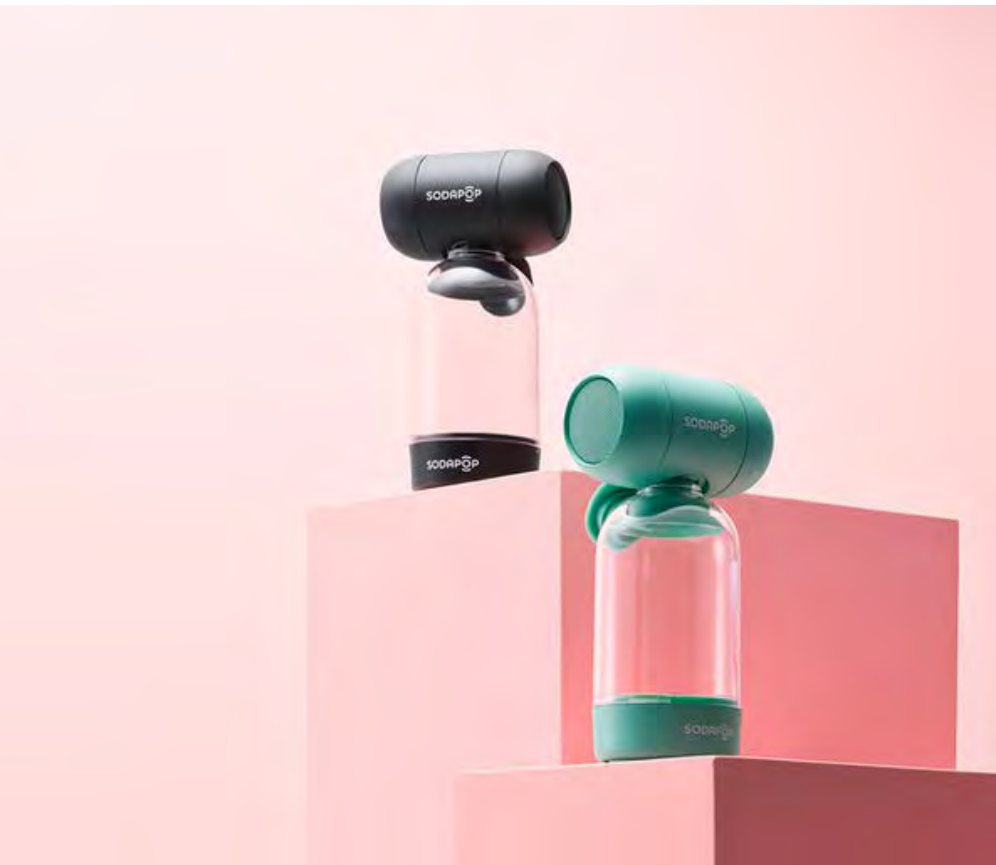


BRAND IDENTITY



BRAND INSPO: PERMAFROST

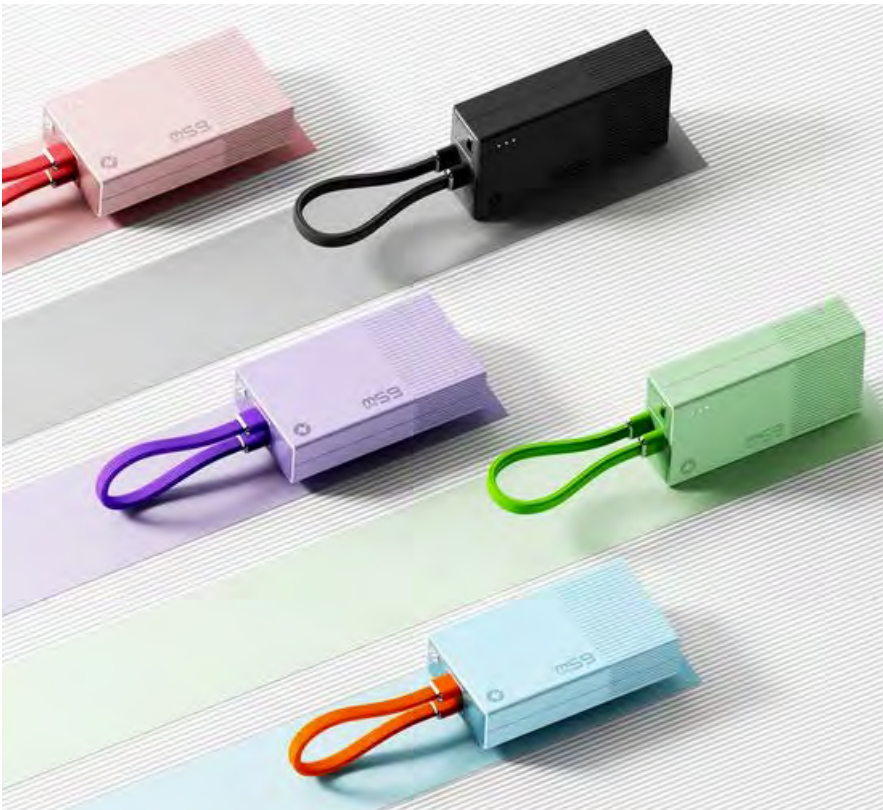
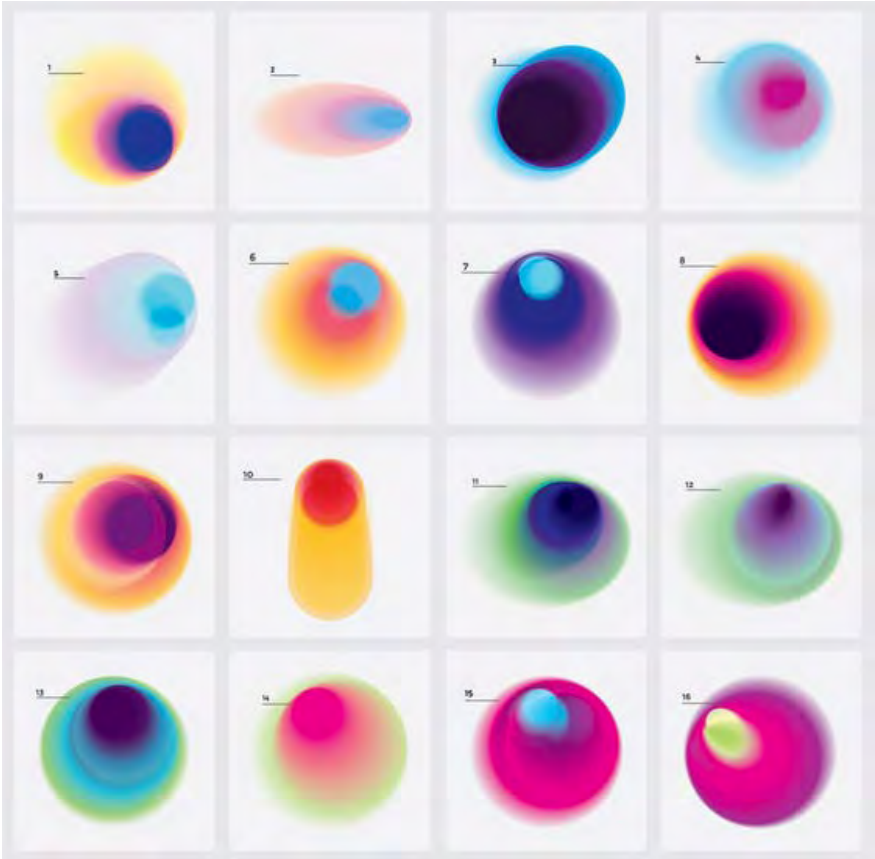
An industrial design studio based in Norway has some amazing designs that have been a source of inspiration for me. I found them organically as I was looking for inspiration for my first moodboard and found them deep in my pinterest search.



The **rounded edges** make for a **softer** look. **Bright** and **vast** range of colours in their products make it **fun**. **Contrasts** of **material finishes** create **interest** within the product. All of these in which I aim to portray in my own design to bring fun and interest into my design and to also make it more **personable** for people and like they ***want*** to use the spacer as it actually looks good and well designed for the targeted user group.

MOODBOARD - CMF

ID7: Capstone | DNB311



BRAND IDENTITY

To create something that is **fun, colourful and interesting** in the area of sad, blue and white medical devices.

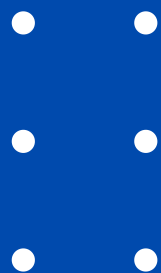


Use **soft lines, edges and corners** to create an inviting feeling - comfort the user that using an asthma spacer is okay

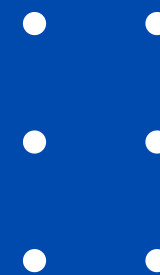
A playful yet sophisticated design that not only will appeal to adolescents but age groups beyond them.



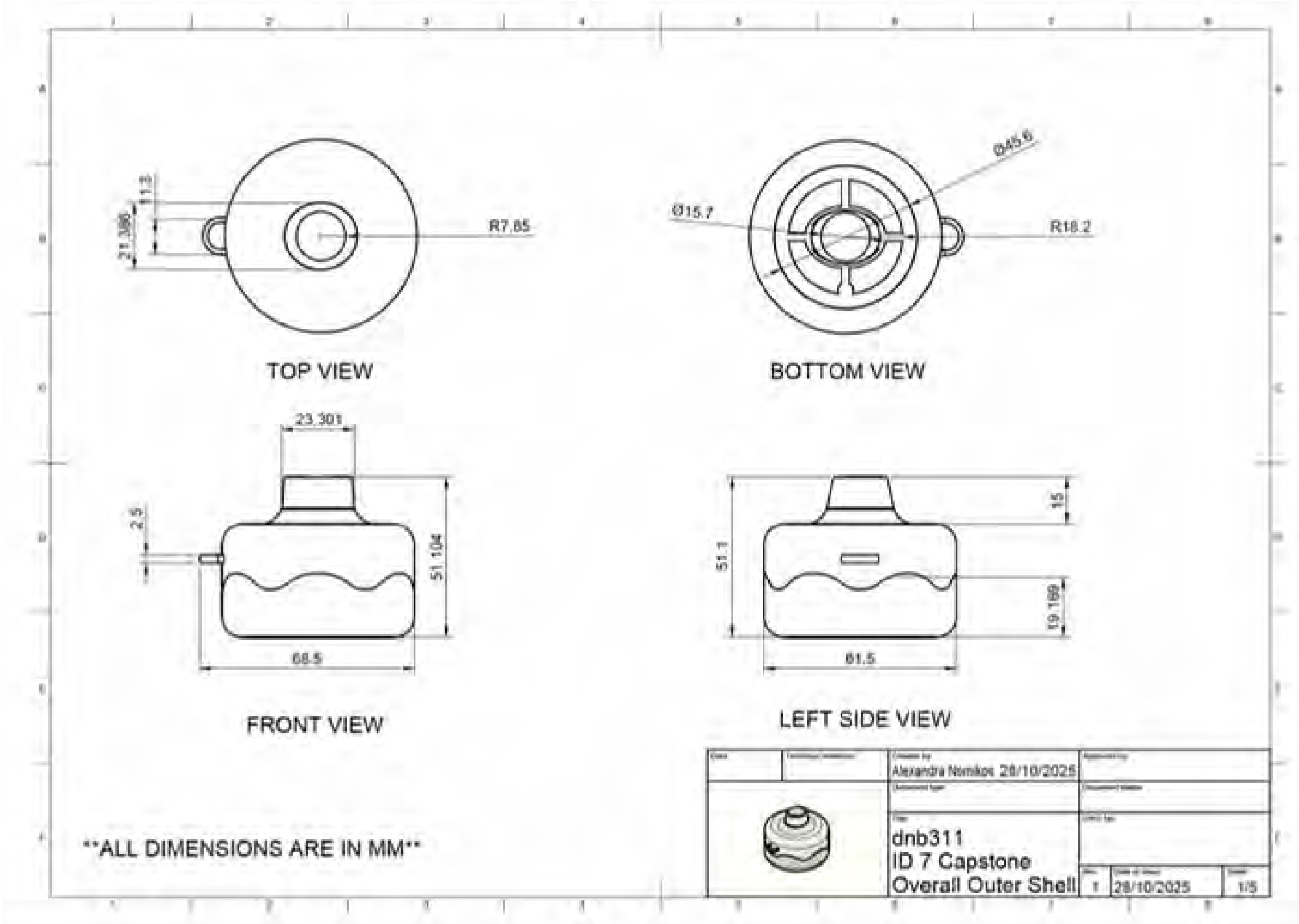
Play with **material finishes** to create interest within the product



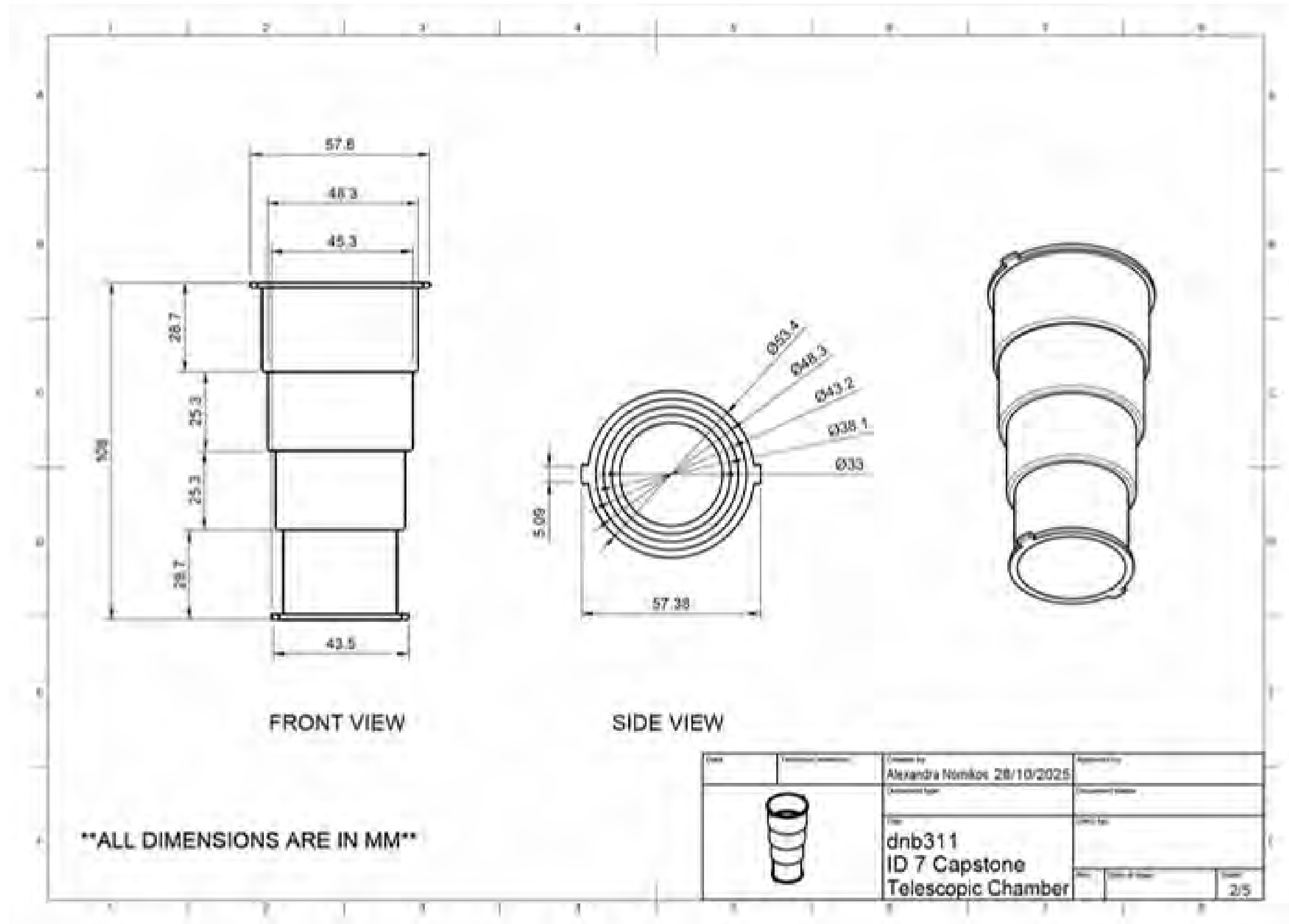
FINAL PROTOTYPING



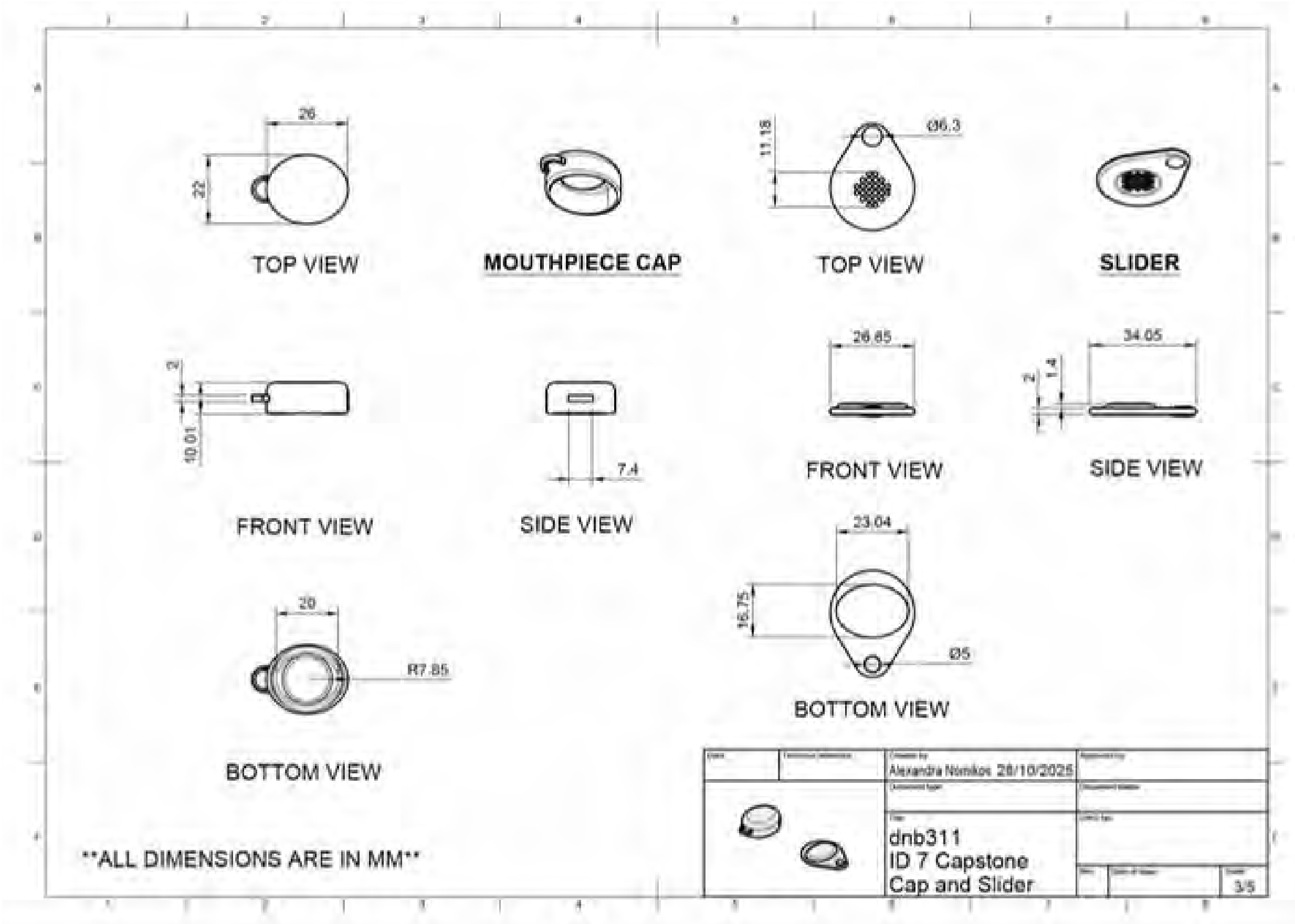
TECHNICAL DOCUMENTATION



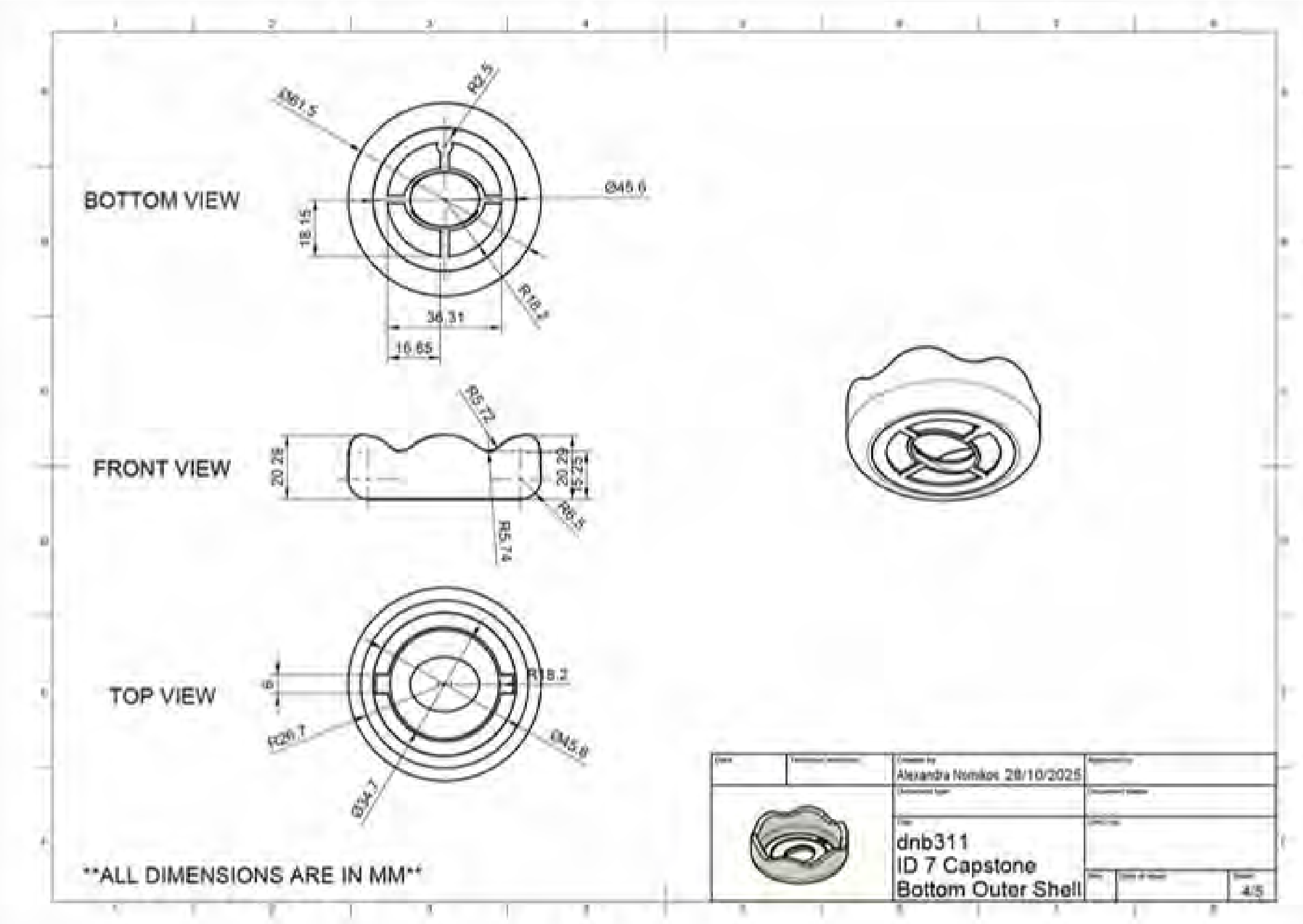
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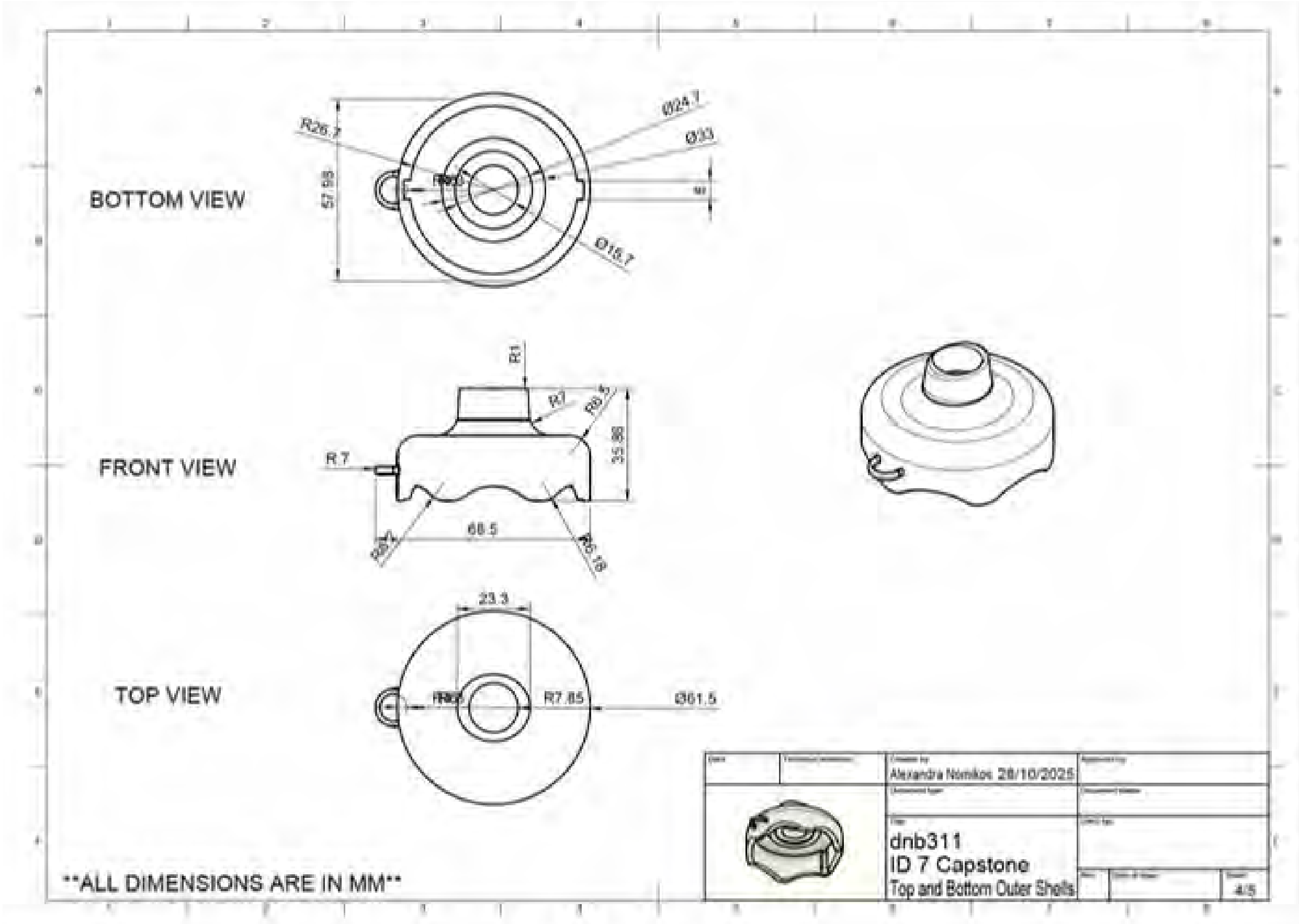
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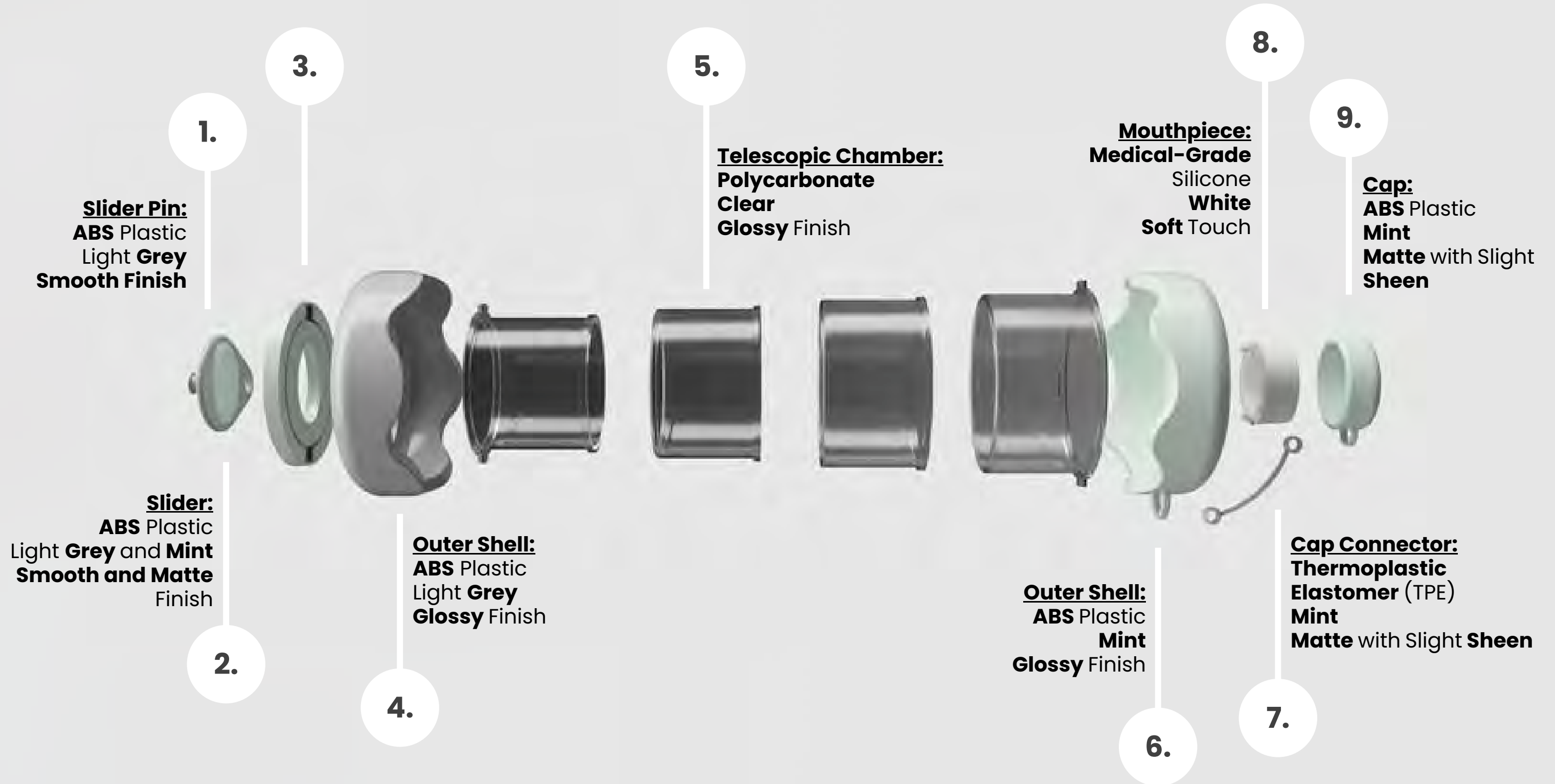
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TECHNICAL DOCUMENTATION



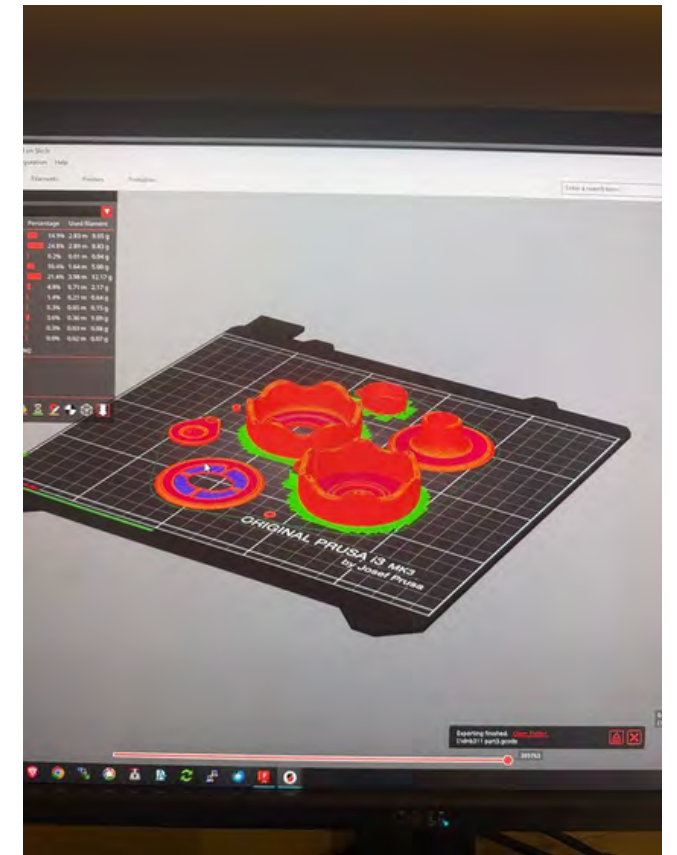
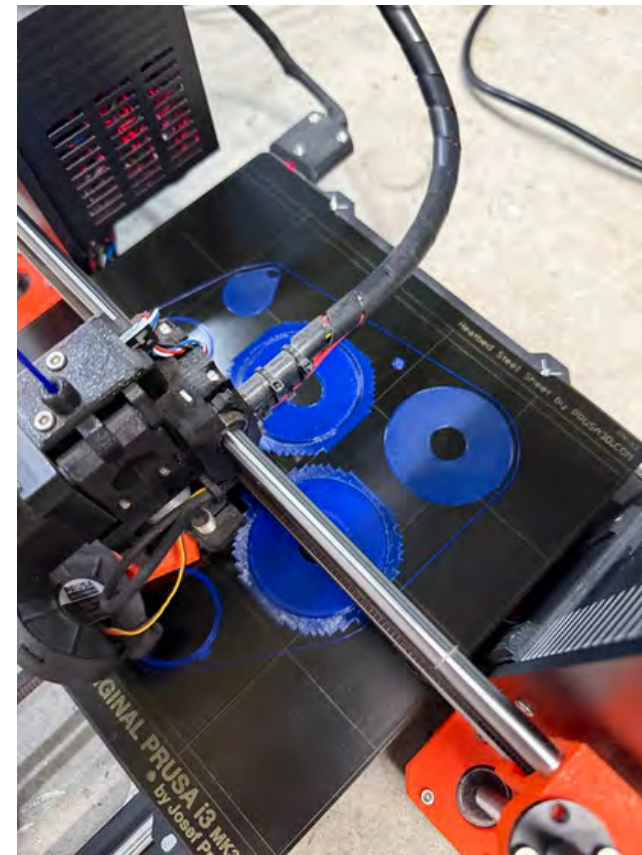
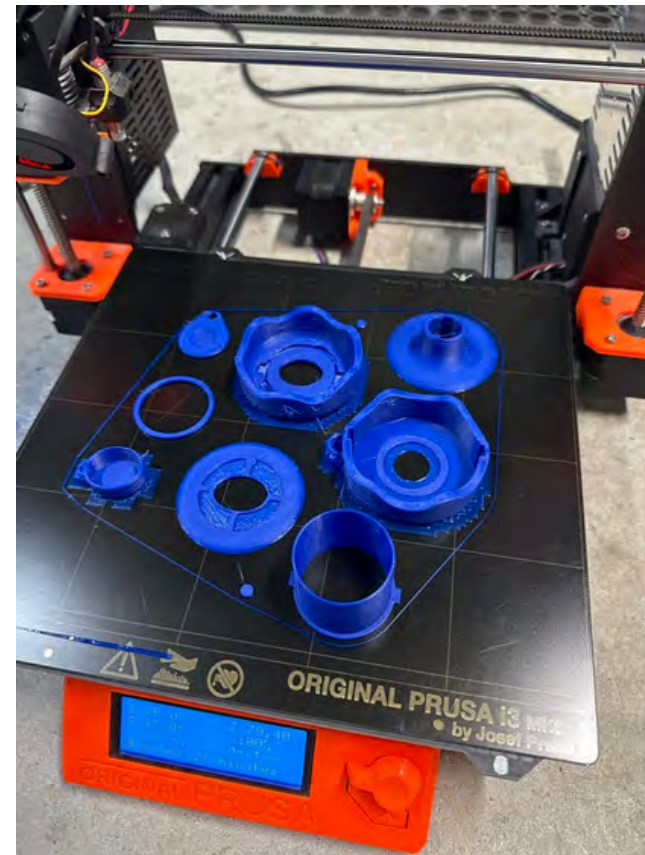
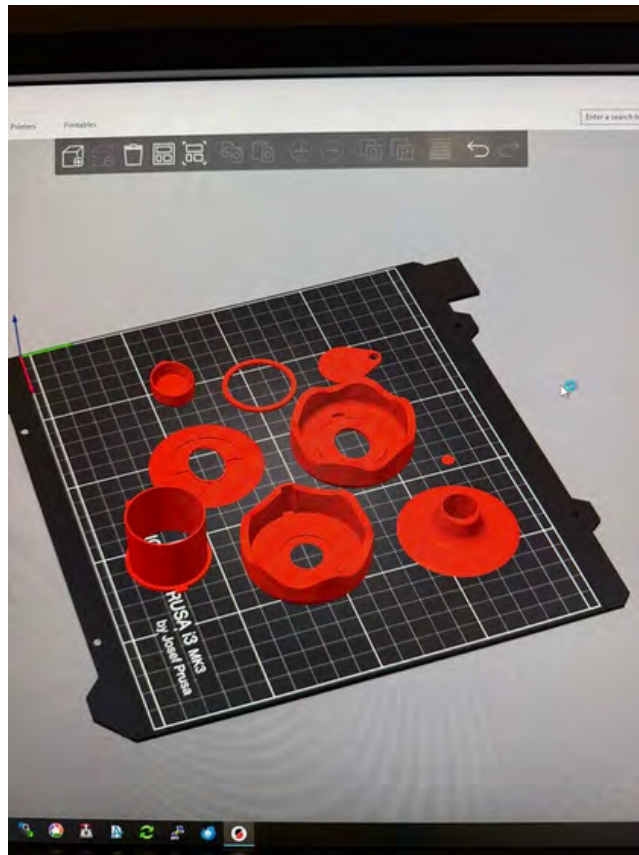
EXPLODED VIEW



BILL OF MATERIALS

Part No.	Part Name	QTY	Manufacturing Method	Finish	Material	Colour	Comments	Weight	Cost
1	Slider Pin	1	Injection Moulded	Smooth	ABS Plastic	Light Grey	Customisable Colour	1g	\$0.10
2	Slider body with seal	1	Injection Moulded	Matte	ABS Plastic + Silicone Rubber	Light Grey + Sage	Customisable Colour	6g	\$0.80
3	Silicone Inhaler Inlet	1	Compression Moulded	Soft Touch	Silicone Rubber	Sage	Customisable Colour	7g	\$0.80
4	Bottom Outer Shell	1	Injection Moulded	Gloss	ABS Plastic	Light Grey	Customisable Colour	18g	\$1.80
5	Telescopic Clear Chambers	4	Injection Moulded	Gloss	Polycarbonate	Clear	Not Customisable	36g (9g each)	\$2
6	Top Outer Shell	1	Injection Moulded	Gloss	ABS Plastic	Sage	Customisable Colour	19g	\$1.85
7	Removable Mouthpiece	1	Compression Moulded	Soft Touch	Medical-Grade Silicone	White	Not Customisable	5g	\$0.70
8	Cap Connector Loop	1	Injection Moulded	Matte with Slight Sheen	Thermoplastic Elastomer	Sage	Customisable Colour	2g	\$0.25
9	Mouthpiece Cap	1	Injection Moulded	Matte with Slight Sheen	ABS Plastic	Sage	Customisable Colour	5g	\$0.30

3D PRINTING



As mentioned previously in my unfortunate circumstance with my CAD, I used my dad's 3D printer at home due to the time crunch I was in. Using Prusa Slicer, I was able to identify whether my parts could be printed the way I wanted them to and adjusted some settings. For some, due to the curved edges, I had to cut onto a flat plane so I could glue it later and other parts needed support for those edges as well as the hook on the top shell and the cap. I printed in three sessions - 1st one was for my first prototype with one chamber selected, the 2nd was the rest of the chamber components and the 3rd was a print of just the outer shell components to show what the spacer looked like closed (had to do this and make my model a visual model and have two of them).

PREPARATION



After the print had completed, I had to clean up a couple parts as it didn't print the best. I then had to assemble the chamber which proved to be difficult as I could've left a 0.4mm gap (same size as the nozzle) and the chamber would've been able to print how I had it on CAD. Thankfully preempting this, I cut the tops off of each chamber so I could manually glue them back on once I have each chamber component in the place it needs to be.

PREPARATION



I repeated the process of stacking and gluing until the chamber was complete. By the end of it, the mechanism did work and was able to compact but I ended up deciding to add more glue to it so that it stayed in place in fear of it breaking during presentation.

I glued all other necessary parts together and then all the parts were ready for sanding and painting!

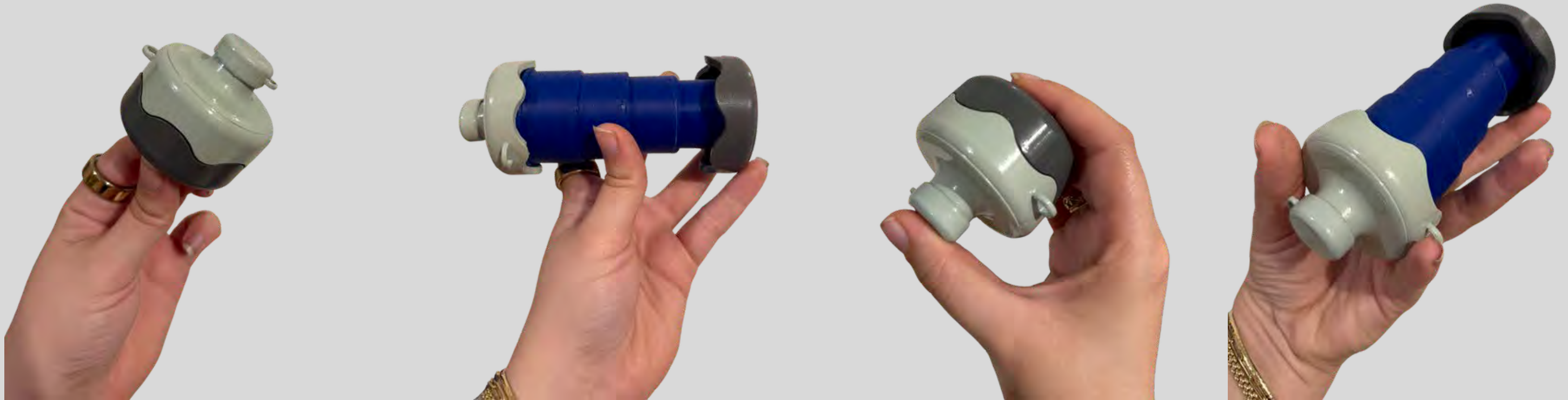
PREPARATION



With my sanding, I ended up using a 180 grit sandpaper as I didn't want to overscuff the model and create unnecessary gaps or marks. During the 3d print, there were a couple extra bits of material left on the side which I was able to sand off quite easily. I also focussed on trying to make it as smooth as I could with just the sandpaper and layers of paint as I didn't have any putty on hand. So I would paint, let it dry (would sometimes leave a drip mark but thats okay), sand it lightly remove any bumps, spray it again and continue this process until I was satisfied. Finish definitely could have been resolved had I not have so many complications throughout this process.

FINAL PROTOTYPE

ID7: Capstone | DNB311



Overall was happy with my end result for presentation as it was able to communicate the design's intention. This prototype will definitely be more resolved by exhibition, so I will need to re-do this process again and hopefully with better materials.

FINAL PROTOTYPE

ID7: Capstone | DNB311



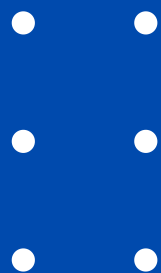
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FINAL PROTOTYPE

ID7: Capstone | DNB311



Alexandra Nomikos | n11086718



10

RENDERS



FINAL RENDERS

ID7: Capstone | DNB311



FINAL RENDERS

ID7: Capstone | DNB311



FINAL RENDERS

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FINAL RENDERS

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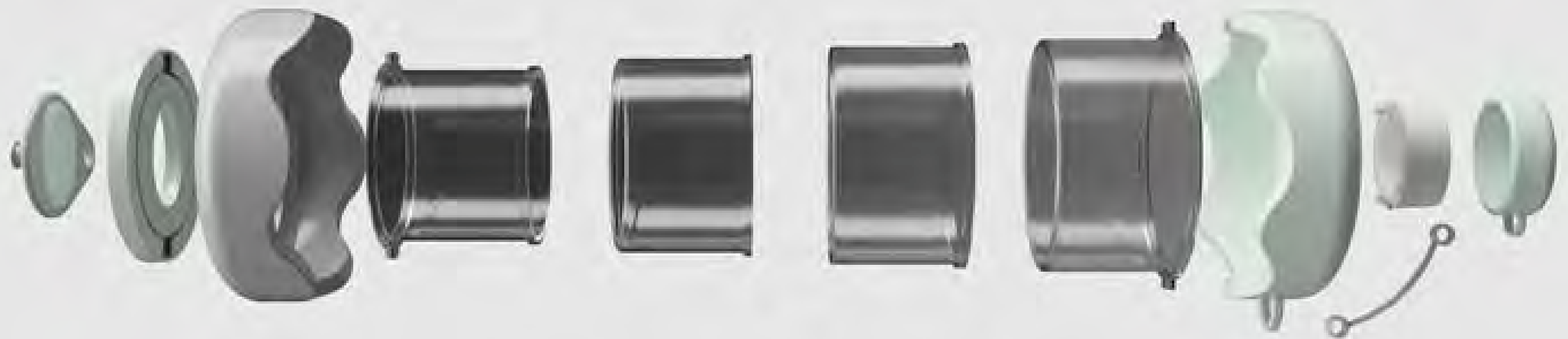
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