MOVEO: Moving made easy

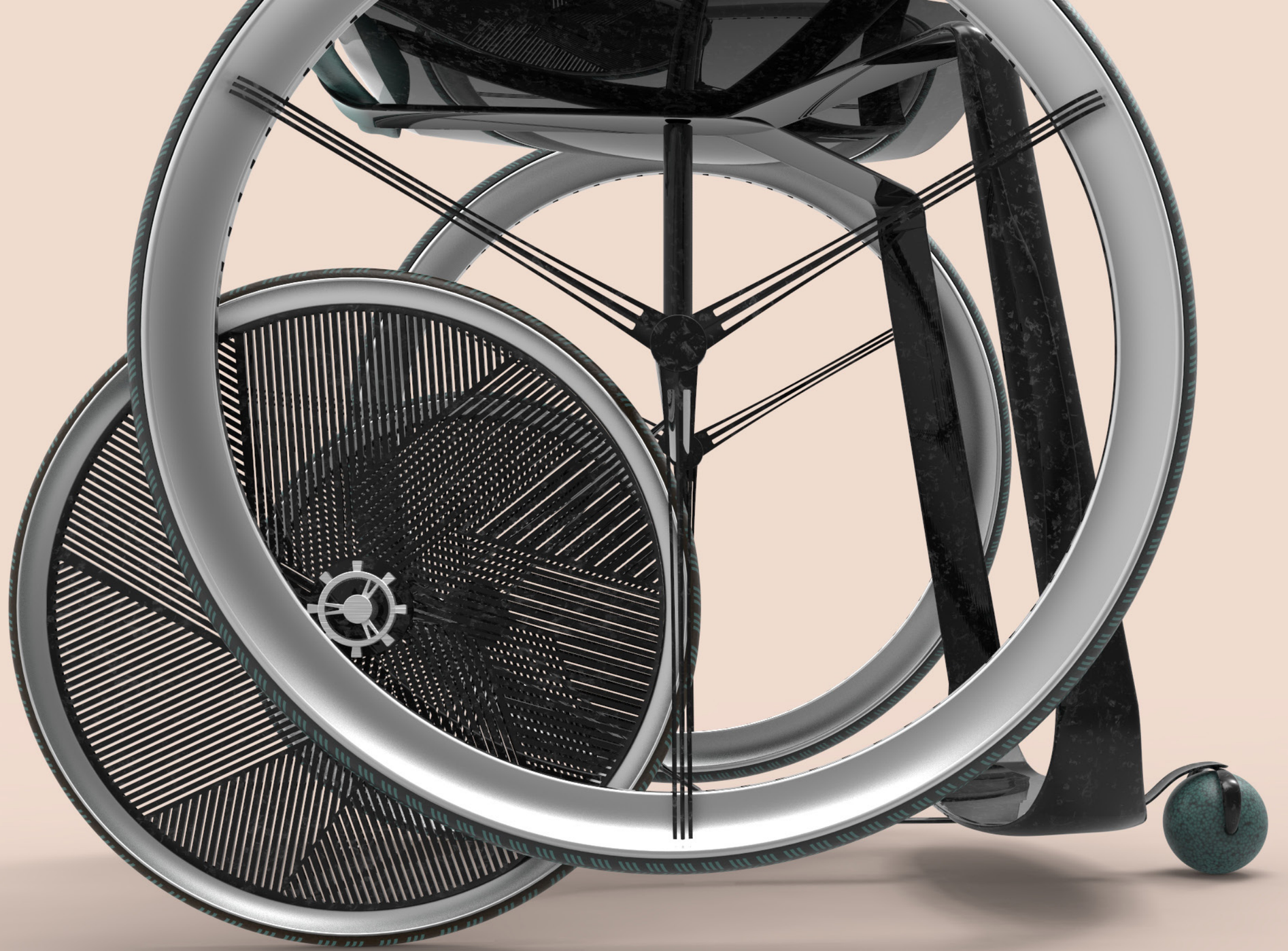
Designed by Kristen Tapping

Moveo is an innovative wheelchair that was designed specifically for people with spinal cord injuries. However, it can be used by any wheelchair user 8 years of age and older. I chose to create something for this particular disability as the concept was originally designed for the Bolt Burdon Kemp 2018 Design Challenge geared towards people with spinal cord injuries, of which I won 1st place. In addition, a close friend of mine has this disability and I have observed the hidden challenges this group of people face on a daily basis.

My idea initially came from the frustration of observing how unsanitary and non-functional the pushing mechanism is on traditional wheelchairs - the hand must touch the wheel when pushing, leading to contamination of whatever the wheel has picked up from the ground or the floor. In addition, this disability brings along poor dexterity meaning users have a very hard time pushing the rim - Moveo solves this by providing a wider pushing surface made of a rubber-like material that is easy to grip.

Moveo's main attribute is the defered pushing mechanism that runs through a spur gear allowing for a physical separation of the push rim and wheel. In addition to providing a more sanitary and effective pushing mechanism, the gear reduction process reduces the force needed to propel the wheelchair due leveraging of the applied force. Through prototyping, a set of spur gears could be developed to meet the needs of users with varied strength capabilities.

This concept is different from any other product, as this spur gear derived pushing mechanism (where users are still using a push rim) does not exist in the wheelchair market and answers a great need of separating the push rim from the wheel. Prototyping would have to begin with establishing whether this spur gear mechanism works in a wheelchair context, designing a spur gear that reduces force required without making it too fast, and fabricating the frame to be as functional as possible while keeping the design clean and minimal. Using plywood for the seat and armrests, 3D printing for the frame and spur gears, and existing bicycle wheels for the wheels and push rim, I would estimate a proof of principle rig could be constructed for approximately £1000. An improved iteration , which I hope would be a prototype capable of real world testing (carbon fibre frame, PCM packs in the seat, Infinergy E-TPU on the wheels and push rim, plastic/metal 3D printed rims, and formed plywood or carbon fibre for the seat and armrest) could be constructed with the remaining £4000.



Research

In a market abundant with wheelchairs, Moveo attempts to stand out from the rest not only by tailoring features to people with a spinal cord injury but also by countering common issues.

From primary and secondary research, I observed these issues to be: high cost, bulky weight, unaesthetic appearance, slippery rail, contact with dirty tire upon pushing rail, abundance of complex joints, perspiration prone fabric.

I also observed the challenges facing potential users of Moveo to be: inability to grab rail/low push power, necessity of wearing gloves to push rail, inability to regulate body temperature from injured vertebrae down, undetected high blood pressure, uncontrollable shaking legs and feet, poor posture due to inability to employ core strength.

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A functional, comfortable, and aesthetic wheelchair designed especially for people with a spinal cord injury. Moveo makes moving easy through gear reduction, lightweight yet high strength materials, and a pushing mechanism that seperates the push rim from the wheel for a cleaner, more efficient movement. Available in three trims, the wheels, rims and frame feature trending colours through intricate patterns and details.

MOVING MECHANISM

1 | Pull push rim backwards

Place hand on the rubberlike push rim and pull it backwards. The push rim does not touch the ground/floor allowing user to keep hands clean.

2 | Spur gear is triggered

The push rim moving backwards makes the spur gear move forward staying aligned to the rim's inner grooves.

3 | Wheel is propelled forward

The spur gear drives the wheel in the same forward direction creating movement.

Reduced Force Needed

The gear reduction mechanism reduces the force needed to propel the wheelchair due to leveraging of the applied force. Varied sized spur gears would be available to match the user's strength.

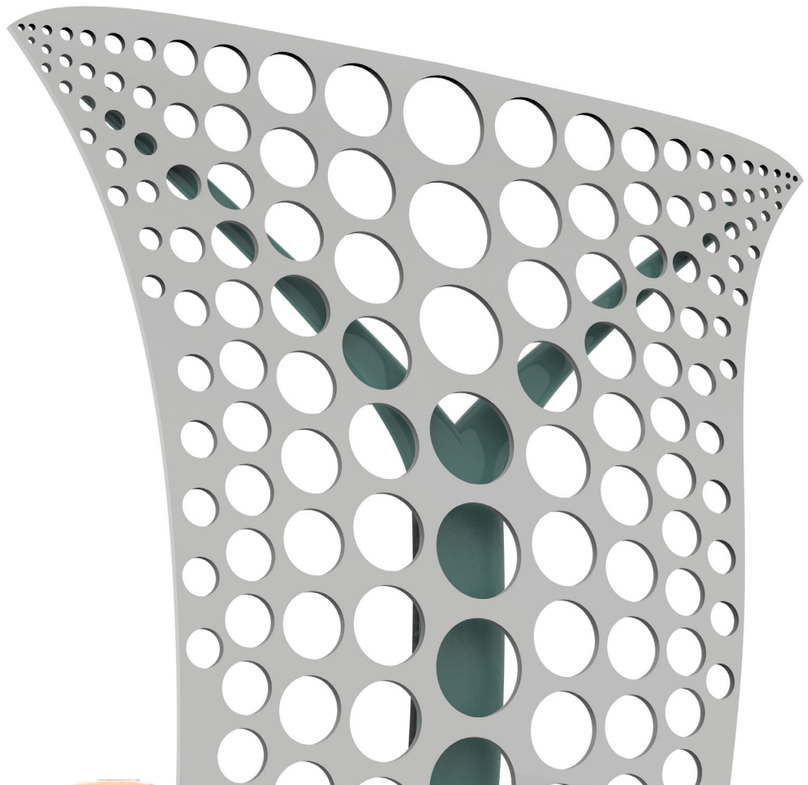
360 Movement

The front rubber-like sphere is attached to a mechanism that can move freeley forward and back and allows minimal tilting for easier maneuvering.

USER ENHANCING FEATURES

Ultra-Grip Push Rim

The push rim has an oval shape providing a flatter structure that perfectly complements the user's hand. The rubber-like surface enhances grip traction making pushing easier and preventing slippage when wet.

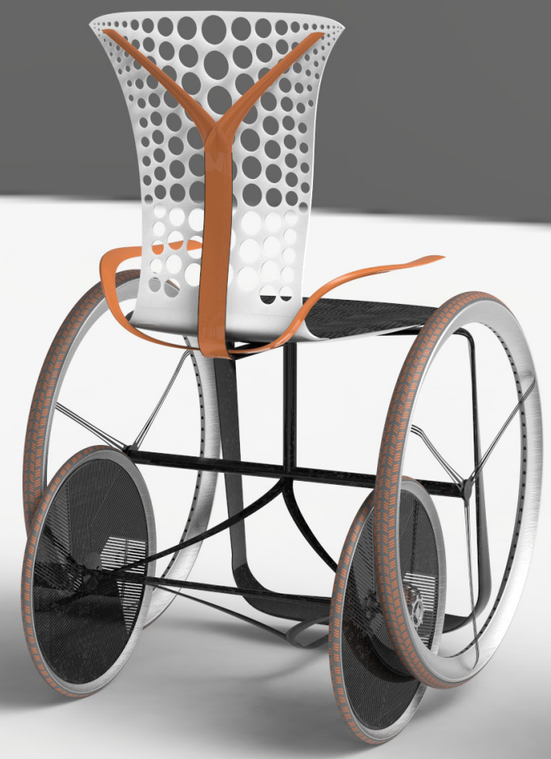


Temperature Control

To help alleviate the uncontrolable temperature changes users experience, Moveo's seat is lined with phase change materials which release hot or cold thermal energy depending on the user's state.
**If Moveo were to be prototyped, wax packs would be employed due to their larger energy storage capability.*

TRIMS & COLOURS

Sencha



Nemo

Dulche

MATERIAL SELECTION

The materials were selected to create a lightweight, resistant, and cost-effective wheelchair that provides smart inherent solutions to the end user. The use of recycled materials not only decreases cost and carbon footprint, it provides a unique look that stands out from the norm. All of these materials can be processed for low to high production, leaving the manufacturing process open to scalability.

Recycled Aluminium

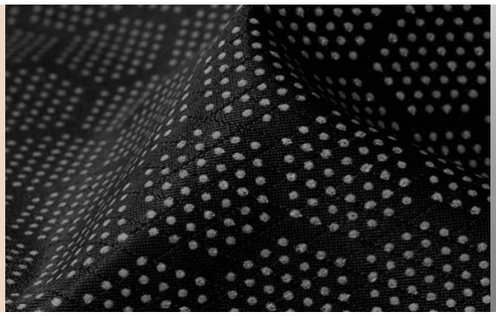
Performance
High strength to weight ratio
Easy machining
Corrosion resistant
Easy to clean
Sustainability
Only requires 5% of energy to recycle aluminum vs extract from new sources. Abundantly recyclable without degradation of performance.
Cost
£0.30 - £0.60 / kg
Usage
Spur gears, rims
Supplier
Alcoa

Recycled Carbon Fibre

Performance
Superior strength to weight ratio
Can create non-linear 3D shapes
Sustainability
Over 30% of CF ends up as waste during production.
Cost
30-40% cheaper than virgin carbon fibre
Usage
Base frame
Supplier
ELG Carbon Fibre

Hostaform POM

Performance
Excellent wear resistance
High strength and stiffness
Can be used for detailed structures
Sustainability
100% recyclable
Cost
In line with engineered plastics
Usage
Seat, backrest, armrests
Supplier
Celanese, Dupont



Schoeller PCM

Performance
Stores and releases thermal energy
Compatible with a range of textiles
Weatherproof & resistant to washing
Sustainability
Made of recycled carbon fibre scraps
Cost
TBD - depending on textile quality
Usage
Seat cusion cover
Supplier
Schoeller, Outlast

Infinergy E-TPU

Performance
Low bulk weight
Water and chemical resistant
High abrasion resistance
Sustainability
Made of recycled Adidas soles
Cost
TBD
Usage
Wheels, pushrims, inner seat cushion
Supplier
BASF