

PRODUCT DESIGN FOR SCIENTIFIC LITERACY

A multifunctional orrery for cognitive stimulation

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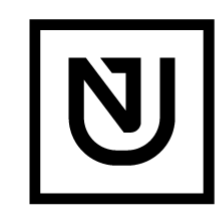
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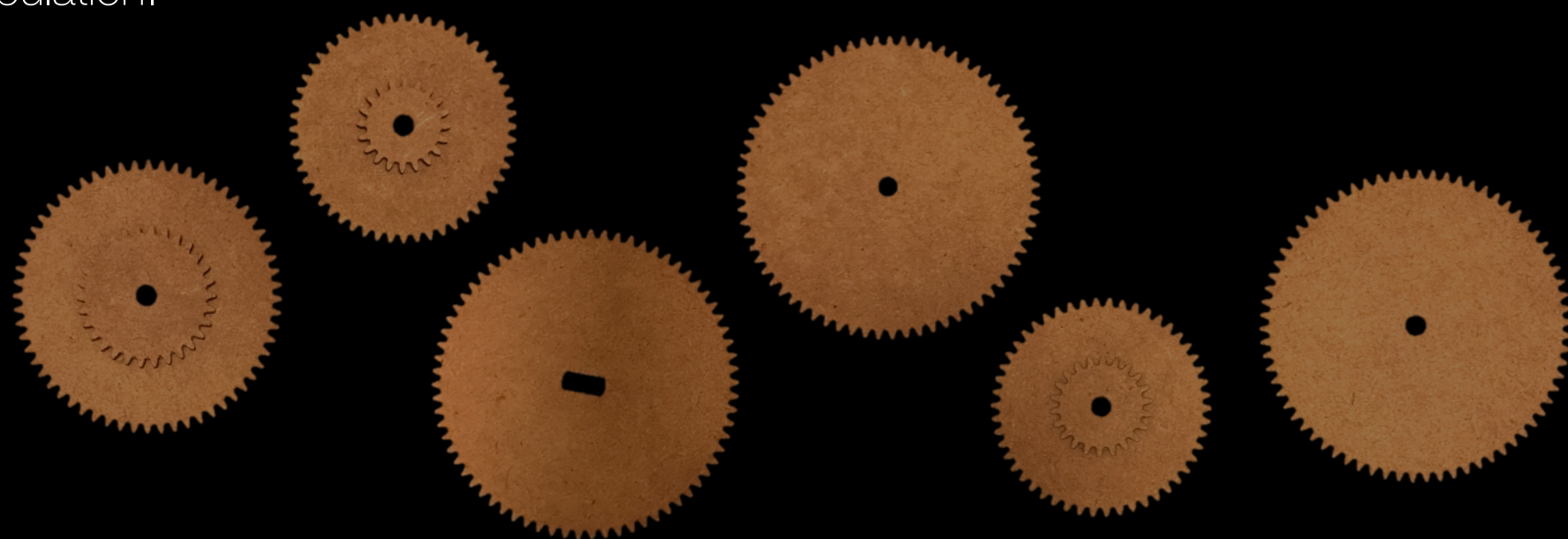


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Promoting scientific and technological literacy

The impact of scientific and technological advancements on society often depends not only on their inherent relevance but also on the public's trust in science and their ability to understand and apply the associated key concepts.

Individuals with Intellectual Disability are full citizens with equal rights in society. However, the importance of basic scientific and technological literacy is often overlooked in this population.



Living in an incomprehensible world

Adults with Intellectual Disability (ID) have significant challenges in understanding and predicting the physical world around them. The construction of mental models to interpret fundamental phenomena, such as the cycles of days, seasons, and phases of the moon, is typically underdeveloped in both children and adults with ID.

These difficulties are partly associated with a lack of adequate cognitive stimulation, and not solely a result of their impaired abstract reasoning abilities. In many cases, these individuals can understand and apply scientific and technological concepts if they are conveyed appropriately.

Putting the pieces together

We developed a simplified mechanical model of the sun-earth-moon system - an orrery - specifically designed for adults with mild to moderate intellectual disability.

The product consists of a wooden puzzle composed by a set of interlocking gears of different sizes. Additional components include a ruler that holds the axes supporting the gear mechanism and a circular base (500mm diameter) representing the four seasons of the year. The pieces' set fits in a 250x350x100mm box.

Once assembled, the orrery simulates the earth's rotation, as well as the orbits of the earth around the sun and the moon around the earth.



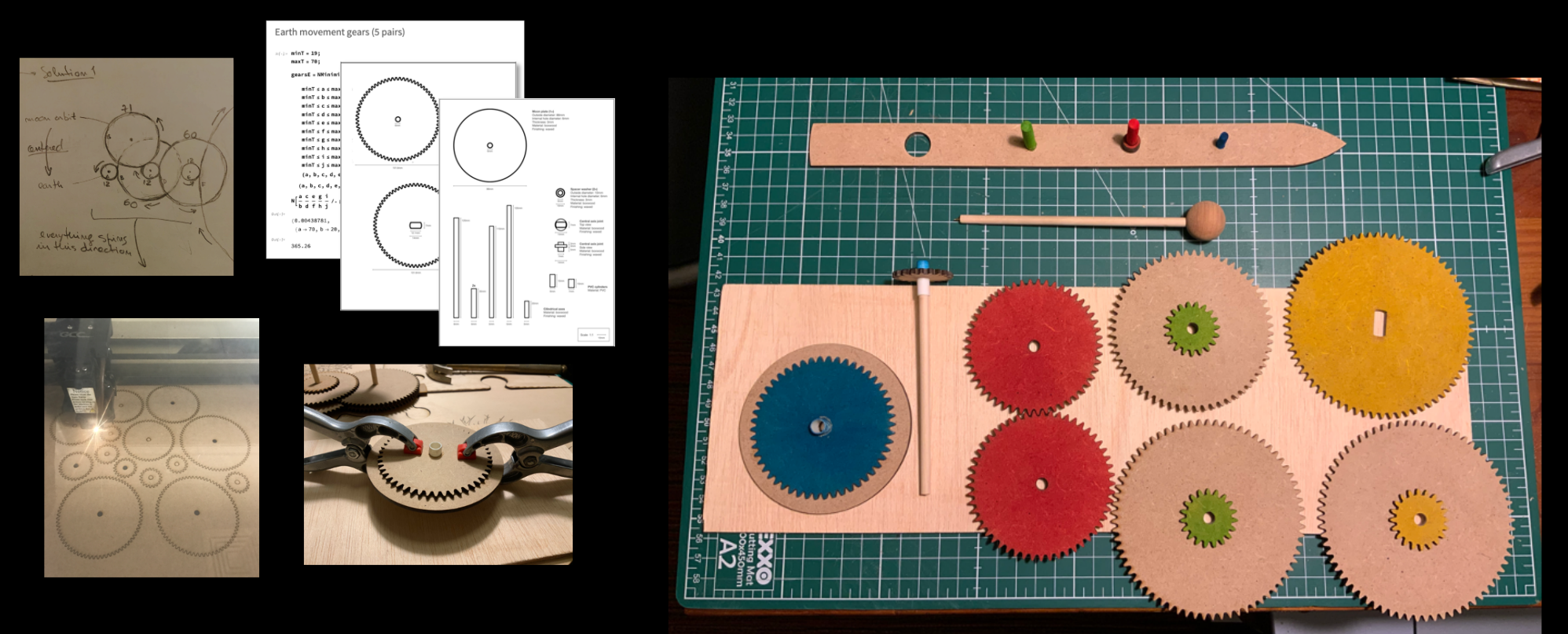
Focusing on people and their context

Most products currently available for cognitive and physical stimulation are either not designed for adults or are not tailored to the intellectual and motor limitations of this user group. Our approach aims to achieve two complementary objectives: a) to promote an intuitive understanding of fundamental astronomy and mechanical concepts; and b) to offer broader cognitive, motor, and sensory stimulation through a variety of activities and product configurations.

A work in progress

This project is currently in its initial design phase, with the manufacture of the first functional models. An optimization algorithm was developed to calculate appropriate gear ratios and axes distances under different design requirements and constraints, enabling efficient iteration of alternative configurations and complexity levels.

The presented prototype was calculated to simulate the movements of the earth and moon using fewer than 20 large pieces rotating on four axes. The main components were designed in AutoCAD and fabricated from plywood and MDF using a laser cutter. Manual post-processing steps, including sanding, painting, and waxing, were then applied. Additional pieces were crafted from pine wood and manually processed.



Solving a root problem

Living with Intellectual Disability poses many personal challenges, from significant limitations in performing intellectual activities to impaired conceptual, social or practical skills needed for everyday life. Our product addresses the supporting foundations of these skills, such as the ability to relate cause and effect, logical thinking, spatial reasoning, problem solving, and hand-eye coordination.



Impacting a broader complex reality

Most individuals with ID continue to develop their abilities, learning and improving skills throughout their lives. Access to tools that support this process contributes to a greater level of independence and social integration and an improved quality of life.

The fact that an intricate mechanism with non-intuitive behaviour can be assembled as a puzzle with fewer than 20 pieces inspires curiosity and a sense of accomplishment, and encourages a more confident approach to other seemingly complicated challenges.

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