

Team 6: Ian and Shirley Rowe Award Application

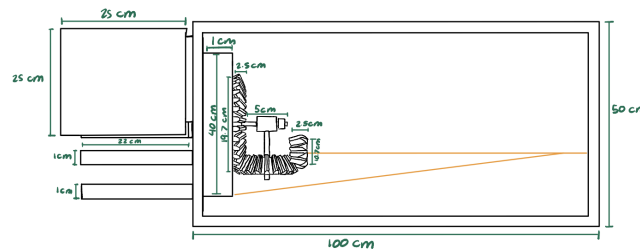


Figure 1: The blueprint for our final design, a gearbox that streamlines cordage-making for individuals with osteoarthritis. This design mirrors the process of cordage-making for basketry, which involves twisting one side of reed, and then plying the other side over it in the opposite direction. In this design, a handle is attached to a large wheel connected to a gear rack with a large initial gear, a perpendicular intermediary gear, and a small final gear. The small gear is attached to the first side of the reed and twists it when the handle is turned. The other side of the reed is attached to the large wheel which plies over the twisted reed. The twisting and plying motion is standardized, limiting the possibility of knots, and thus, effectively making cordage.

How has your design created value for your stakeholders? How has it done this differently than what is currently available on the market?

The gearbox design has significantly enhanced the twining experience for arthritic members in the Toronto Guild of Spinners and Weavers. By providing an alternative method for cordage making, we have enabled them to continue their enjoyment of basketry despite physical limitations. Specifically, our system effectively minimizes the force required, decreases the number of repetitive movements, diverts strains away from vulnerable joints, and promotes beneficial hand postures for osteoarthritis. According to the USA Spine Care and Orthopedics clinic, the main joints impacted are the thumb and finger joints; our design diverts these stresses to the deltoid, tricep, and elbow. Furthermore, our mechanism encourages optimal hand positions, such as the O-shape, highlighted by the Arthritis Foundation. Our gearbox design, differentiated by its ability to accommodate varying levels of arthritis due to its adjustability, makes cordage-making an enjoyable, inclusive, and fulfilling process for arthritic basket weavers.



Why should we believe you have done innovative design work? How does your process support this creation of value?

Our design process delivers a structured yet iterative approach to problem identification and solution ideation, demonstrating our value in innovation. The foundation of our design process focuses on the stakeholders' needs, ensuring that our designs align with their requirements according to established standards. Additionally, our team leverages a variety of divergent thinking tools such as Lotus Blossom, Brainwrite 635, and SCAMPER to explore different perspectives, minimize anchoring bias, and generate a diverse scope of creative ideas. These tools facilitate an innovative and inclusive brainstorming process, enabling us to explore beyond conventional ideas.

How have you included everyone in your design to ensure that it represents the values and work of your entire team?

During our framing process, our opportunity was re-scoped to diversify the design space. This enabled us to cater to the various ideas, values, and approaches proposed by different team members. Our opportunity is nuanced as

favoring one of the stakeholder needs could potentially undermine the others. For instance, stakeholders highly value authenticity in the cordage-making process, while also emphasizing efficiency and speed. In this case, opting for a design with increased automation may compromise authenticity but boost the speed. Within our re-scoped design space, our team members were able to model their interpretation of this complex challenge according to their personal values. As a result, we created three distinct prototypes that addressed the differing values and priorities within our team and among stakeholders.

How has your teamwork enabled you to create an innovative design? What processes enabled you to leverage the diversity of your team to create success?

Our collaborative efforts were fundamental in crafting an innovative design that effectively reconciled the diverse values and perspectives of our stakeholders and team members. Through differing personal iterations, we were able to include the unique ideas of many members into a single prototype that maintains the turning motion required for cordage making while simultaneously making it quicker and less strenuous on the joints.

Furthermore, the diversity of our team allowed us to capitalize off of our varied strengths; for example, the feasibility of our design was tested via the 3D modeling skills of one member, while other members optimized it through torsion calculations done and by applying a machine learning model. This resulted in our final gearbox design, which achieved a balance between competing priorities and team values. Leveraging our varied skills and interests, we involved the creative aspects of all team members and finalized a result that was made to the best of our abilities. Shaped from our individual and collective creativity and experiences, this was a novel and distinct mechanism that could not be replicated or found elsewhere.

How have you demonstrated to your community that you truly care about improving their lived experience?

When Miriam, the chair of the Toronto Guild of Spinners and Weavers, voiced her primary need for a cordage-maker, we did not just solve the immediate problem but delved deeper to understand the underlying challenges individuals with osteoarthritis faced in the Guild. This involved engaging with Miriam to understand how osteoarthritis affected the cordage-making process and consulting with medical articles (that we CRAAP tested) to gain insight into the pain associated with osteoarthritis. By understanding these challenges, we explored pain management strategies that encourage user's participation in the Guild. For example, we placed a strong emphasis on ergonomics in our prototype to mitigate discomfort. Additionally, learning about osteoarthritis attacks—a trigger that worsens the symptoms from overdoing an activity and through repetitive movement—and recognizing the importance of the diverse needs for different osteoarthritis patients motivated us to integrate an adjustability feature in our design.

How have you worked to engage your community in a participatory design process?

We engaged with our community by consistently seeking opportunities to request their insights and opinions on our design process. During the re-framing phase, we had both an in-person and virtual meeting with Miriam to learn about her specific challenges. This resulted in us re-scoping our opportunity to focus solely on cordage-making for people with osteoarthritis. Furthermore, during our converging phase, we reached out to her again for validation of whether our top prototypes aligned with her needs and desires. This was beneficial as we found that our constraint for one of our requirements, the maximum allowable level of automation, was not consistent with Miriam's desires. Overall, by repeatedly engaging with our community, we were able to gain extensive insight into the current needs of our stakeholders and how we should direct the focus of our design with due-diligence.