Enhancing the comfort of the Budy tandem bike

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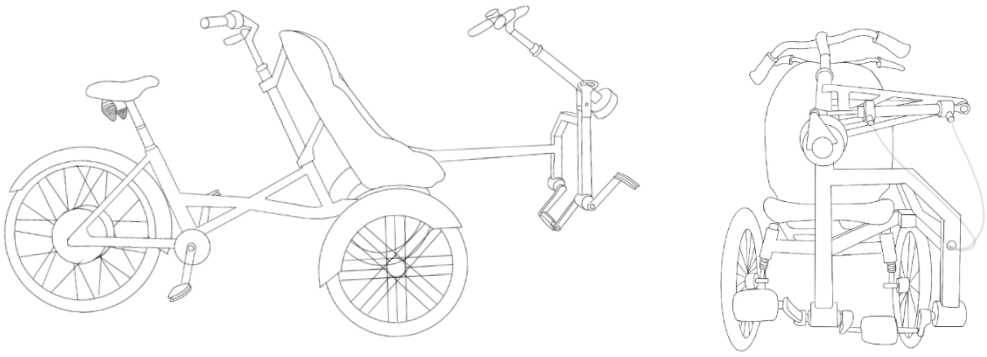
Introduction

Van Raam is currently experimenting with providing biking solutions for users who can be trusted to bike on their own but still need a 'caretaker' in case of any problems. They are tackling this through the 'Budy prototype', a two-person tricycle tandem with two steering and pedal mechanisms.

The main idea behind this prototype is to give the user (elderly, disabled person…) a sense of independence and control of the bike, which is achieved by positioning them at the front of the tricycle. And thanks to the dual steering and peddling, the front rider is able to have control of the bike's direction. However, if the steering movements aren't reciprocated or corrected by the caretaker, situated at the back of the bike, the bike steering will get overridden, and the bike will steer in the direction of the caretaker.

The last version of the prototype has been tested with end users and has proven to be a success. Nevertheless, there were some reported issues with the comfortability of entering and exiting the bike. Users were faced with an uncomfortable experience due to the positioning (and repositioning) of the handlebars, which are currently in the way of entry and exit. To improve this interaction, the project will enhance the front rider's comfort when entering and exiting the Budy, with a particular focus on the handlebar positioning mechanism.

Figure 1: Budy prototype drawing



Approach

The project started by defining the concept of 'comfort' through the lens of ergonomics, focusing on both cognitive and physical aspects. These principles were used to guide the overall design, aiming to create a comfortable cognitive by reducing processing time and increasing recognition as well as

a comfortable physical experience by designing for natural interactions and reducing strenuous movements.

After defining these concepts, the project focused on identifying the pain points and needs of end users through testing and feedback sessions. This research was translated into specific requirements that would be used to evaluate the final results. The next phase involved developing the handlebar position mechanism and its controls into tangible concepts. Once all directions were defined, low-fidelity prototypes were built to observe and gather feedback from user testing. This feedback would help determine which control concepts were most suitable for the handlebar positioning mechanism, while the mechanism prototype would help to convey to users and peers how this interaction would feel.

Figure 2: Control and handlebar position mechanism concepts

Figure 3: Prototyped control concepts

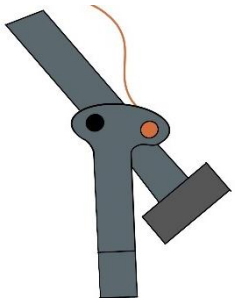
Results

Once all the prototypes were built and the tests were conducted, the project was then able to determine the best control to use and how the interaction between the front rider and Budy would be when entering, adjusting and exiting the bike. The following storyboard explains this interaction.

1

At the bike dealership, the bike is adjusted to the front rider. These adjustments include calibrating the riding position slot angle, making the bike have two positions.

2

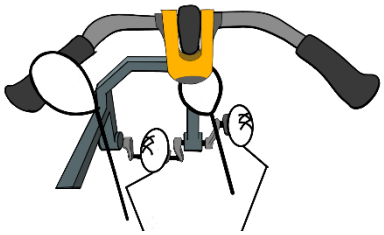


To ensure sufficient clearance for the user to enter the bike, the default position of the steering will be set to the highest position.

3

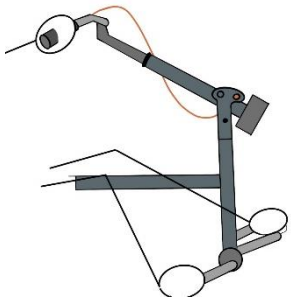
Once seated, the user positions their feet on the pedals, reclines against the chair and keep their extended arms grabbing the handlebars.

4



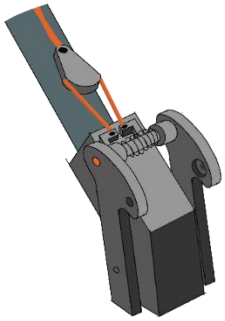
To adjust the steering to their riding position the user has to activate the controls on the handlebars.

5



The controls are connected to the clamping mechanism vie brake wire.

6

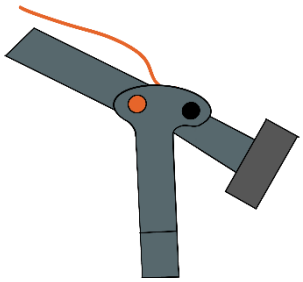


Once the control has been activated the outer cylinders compress the spring making the mechanism unclamp.

7

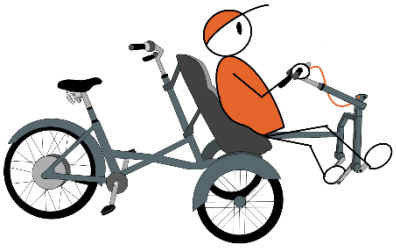
The user can then lower the steering until the mechanism clamps on to their riding position

8



Once the outer cylinders are clamped into the riding position the steering is fixed to the correct height and secured for riding.

9



The user now has the steering in their preferred riding position, enabling them to start with their ride.

Figure 4: Final result storyboard

Conclusion

Overall, this project has used the research to identify design principles that ensure an ergonomic interaction between the user and the Budy, as well as to address the discomfort users experienced while using the bike. This information served well in the ideation phase, where various solutions and iterations were considered and refined based on the projects requirements. Prototypes of these directions enabled end users and peers to test and experiment with the concepts. Finally, the project gathered information from these tests, comparing the results with the project's requirements to evaluate whether they were met and determining the final result.

The user's preference for control Concept 2 confirmed that the proposed handlebar positioning mechanism does indeed facilitate a comfortable entry, adjustment and exit from the Budy prototype. The centrally located control (Concept 2) was preferred due to its placement, larger surface area and intuitive design. These factors enabled users to easily recognize the control's location and function, enhancing cognitive interaction. Additionally, the size and position of the controls allow users to access it without muscle strain and with minimal effort adhering to the project's physical ergonomic requirements. Ultimately, the proposed design ensures adequate clearance for entry and exit while providing the front rider with the control and independence that the Budy aims to emulate.