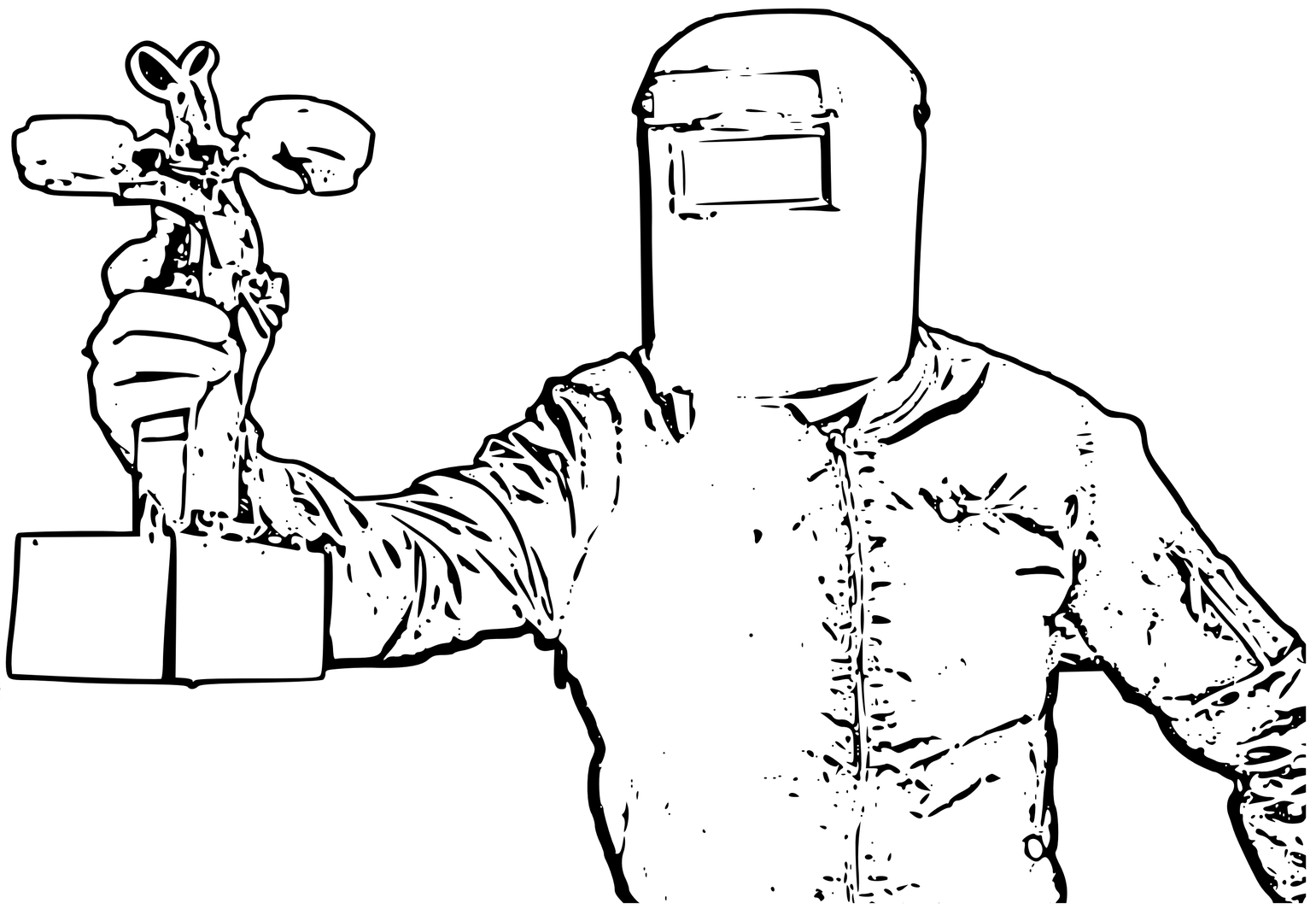
University of BRISTOL

BIG Bristol Interaction Group

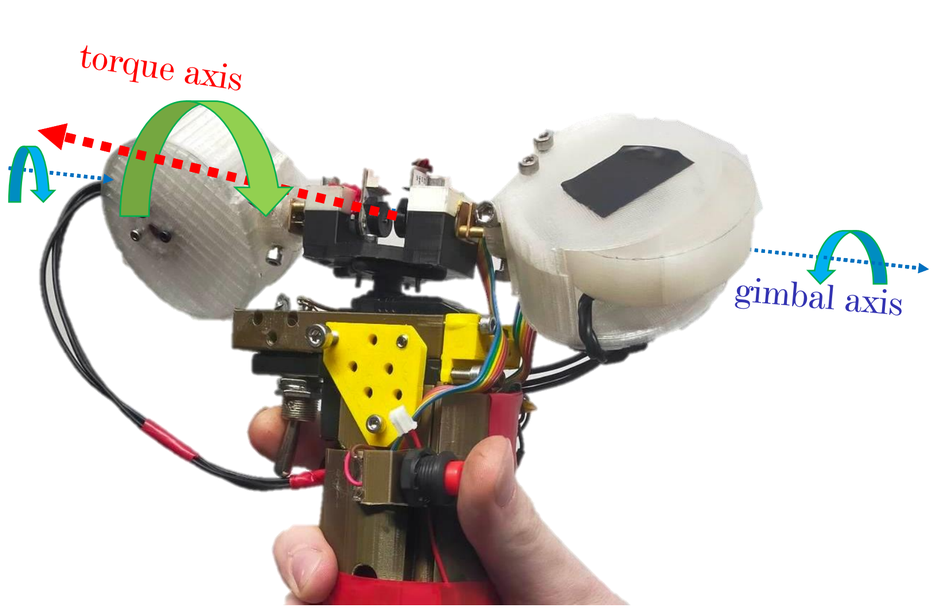
GIMBALSCOPE:

SPACECRAFT ATTITUDE CONTROL FOR HAPTIC FEEDBACK.

A Dual Parallel Gimbal Controlled Moment Gyroscope for Ungrounded Directional Force Feedback.



Jordan Taylor Supervisor: Anne Roudaut



Induction of a Backwards Torque

My work involves determining the suitability of such a system on the **human scale.**

The Gimbalscope allows total workspace freedom for the user, being untethered and battery powered. The dual controlled-moment-gyroscopes allow for six degrees of freedom haptic torque feedback.

A preliminary study of N = 8 participants show that users are able to correctly perceive the device's haptic cues.
Present research outcomes involve a study of N = 20 participants with the aim of determining the Gimbalscope's minimum human perception threshold as a function of gyroscope rotational velocity.

Planned further outcomes will make use of the device's onboard IMU to guide the aim of a cohort of users to a selection of targets.

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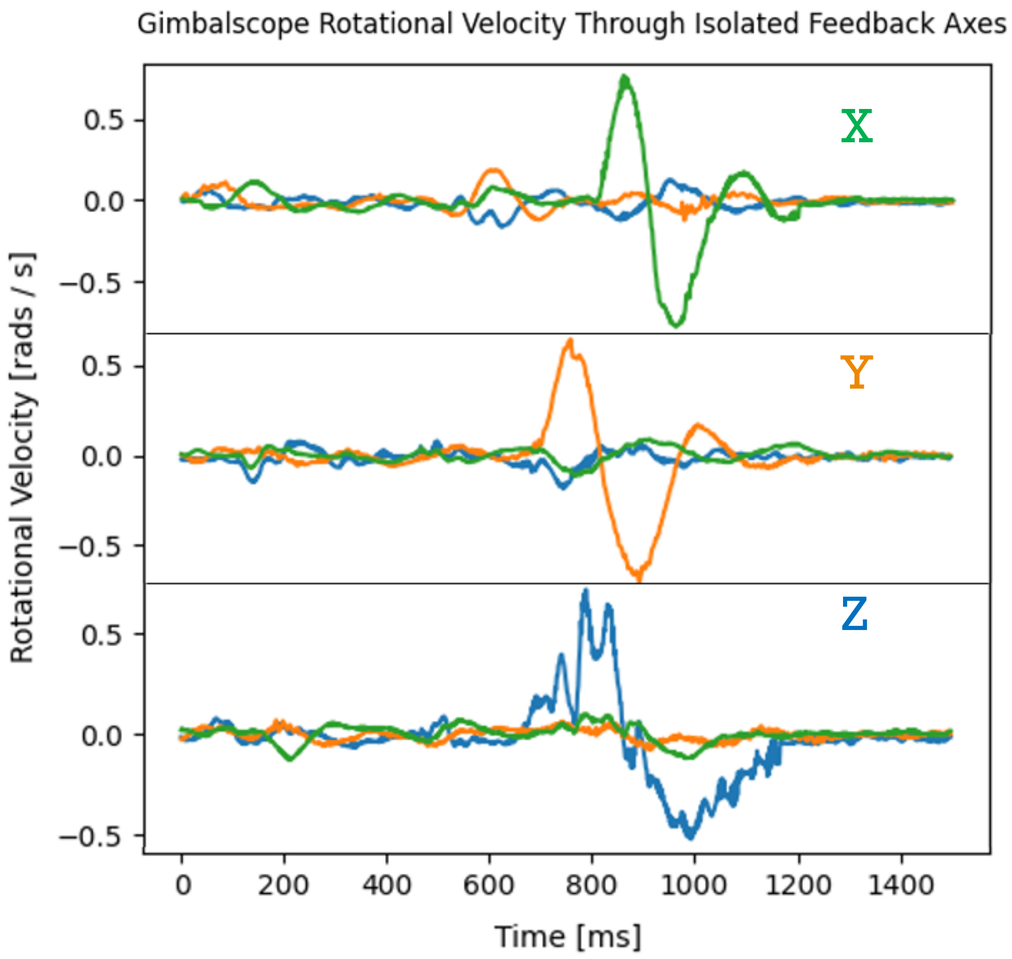
The key problem with current force feedback haptic devices is balancing the three-way trade-off between **form-factor**, the **workspace of interaction**, and **force fidelity**. The Gimbalscope attempts to maximise the **first two points** while not sacrificing the third.

We present the first remotely operated ungrounded general purpose directional haptic feedback device powered by gyroscopic precession.

Traditionally, **Controlled Moment Gyroscopes (CMGs)** are devices used for attitude control and stabilization in spacecraft and satellites. They work by using a spinning mass (gyroscope) that can be oriented in any direction, and by controlling the angular momentum of the spinning mass, it can create a torque to control the orientation of the spacecraft.



Isolated Torque Axes for clockwise cues