**Personal Space:**
User Defined Gesture Space for GUI Interaction

1. **Overview**

**Motivation**
Gesture based interaction allows users to relay information to a computer through body movement without physical contact with additional hardware. However, some of these interaction styles require the users to tailor their interaction for the system to recognize, which is not necessarily natural or ergonomic for the user. We introduce a technique for users to interact in a manner that is more natural and ergonomic by first defining their own Personal Space for interaction.

**Problem: De facto gestural interaction**

The *de facto* gestural interaction method refers to techniques currently used by commodity hardware, where users are required to hold their arms out. This leads to shoulder and arm fatigue quite quickly; a classic problem with gestural interaction, generally known as the “Gorilla Arm Syndrome.”

**Solution: Personal Space**

Our solution allows users to rest their elbow on a surface, thus significantly reducing discomfort. In this position, the user’s range of motion is not naturally a rectangle and therefore does not directly map to the screen. We use a non-linear mapping through a transformation matrix.

2. **Method**

**User performs calibration**

User defines gesture space by specifying his 4 corners. The system connects these points, building a quadrilateral flat plane.

**System builds user’s space**

- Front view
- Side view

There’s a difference between the quadrilateral flat plane of Personal Space and the natural motion of the arms. Good performance was achievable in spite of this difference.

**User’s space mapped to display device**

There’s a difference between the quadrilateral flat plane of Personal Space and the natural range of the arm – slightly curved. The system connects these points, building a quadrilateral flat plane.

3. **Results**

We benchmarked Gestural Navigation by asking users to perform a task similar to Whac-A-Mole with 3 different inputs: 1. the mouse, 2. the *de facto* input method, and 3. Personal Space. Metrics collected for analysis include:

- Total time to completion,
- Total cursor distance travelled,
- Target distance against completion time
- Target distance against distance travelled
- Self-reported fatigue and ergonomics rating

Our report shows:

- Personal Space performance is as good as the *de facto* method in terms of performance.
- No statistical significance between the 3 input devices for total distance travelled.
- Lower reported fatigue related to the Gorilla Arm Syndrome

**Conclusion**

Our research provides these contributions:

- Reduces the Gorilla Arm Syndrome.
- Non-linear mapping between hand and display.
- An approach which is usable with any new or existing gestural input.

**Our plans for the future:**

- User’s space currently modeled with a flat plane. Find a better model, or a better fit.
- Investigate accuracy and throughput.
- Investigate the use of Personal Space for Gestural Selection and Gestural Manipulation

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