Object Selection Techniques in 3D Interactions

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Four Basic Interactions in Virtual Reality

- **Object Selection**
- Navigation
- Manipulation
- Data Input
Introduction
Introduction

Problem:
Object Selection can be hard because the 3D environment may be dense or occlusion.
Related Work

- **Ray-casting Technique**
  - Casting ray from user’s hand and calculate intersection with objects

- **Hand Extension technique**
  - User controls a 3D cursor to select objects
Related Work

Hand Extension Technique
Related Work

Ray-casting Technique
Selection Techniques

Design Guidelines (1/2)

- Allow for fast selections
- Allow for accurate selections
- Be easy to understand and use
- Produce low levels of fatigue
Selection Techniques

Design Guidelines (2/2)

- Satisfy the above for sparse and dense target environments
- Support selections for both visible and occluded targets
Bubble Cursor (Hand Extension Technique)

- Resize dynamically
- Contain the closest target
- Render second bubble around the target when the cursor approaching or leaving
- Magic lens: objects in its vicinity become semi-transparent
  - overcome occlusion issue
Selection Techniques

(a) The 3D bubble is rendered as a gray semi-transparent sphere;
(b) The second bubble is rendered
Selection Techniques

(a) Objects become semi-transparent when close to the bubble cursor;
(b) Occluded objects become visible when near the bubble cursor.
Selection Techniques

Depth Ray (Ray-casting Technique)

- User controls depth marker to select objects in different depth along this ray
- Objects near the ray become transparency
Selection Techniques

(a) The object closest to depth marker is selected;
(b) Depth marker can be controlled by moving hand forward or backward
Selection Techniques

Problems those techniques before

- Occlusion is inevitable
- Need users have pre-understanding of the 3D environment (Cannot directly search!)
- Need global operations (switching viewpoint)

Apply some auxiliary techniques
Selection Techniques

Flow Visualization: visualize flow field shown as streamline

- Feature extraction
- Encoding
- Viewpoint selection
- Tour recommend
Selection Techniques

Flow String
- Resample streamlines and consider their shape similarity
- Encoding those streamlines for easy retrieval
Flow string case study of plume dataset. (a) to (h) show streamlines matched by different words
Selection Techniques

Flow Tour

● Feature extraction (eliminate unrelated objects to reduce occlusion)
● Viewpoint selection
● Recommend optimal tour for traversing the whole 3D environment
Selection Techniques

Flow tour for plume dataset. (a) is the whole tour generated by this approach; (b) to (g) show respective views from six viewpoints along the tour path as marked in (a)
Selection Techniques

My idea (1/3)

Step 1: Preprocessing

- Feature extraction
- Encoding objects
- Viewpoint Selection
Selection Techniques

My idea (2/3)

Step 2: Applying Selection Techniques

- Bubble Cursor
- Depth Ray
Selection Techniques

My Idea (3/3)

Step 3: Selection Recommendation

○ Recommend optimal path for users
○ Highlight following potential targets
Conclusion

● Augmented selection techniques such as bubble cursor and depth ray can overcome difficulties.
● Applying auxiliary techniques may achieve better performance.
