Physics Notes #3: Collisions

CSCI 321

WWU

February 5, 2013

Advanced collision techniques

Reading:

- `http://www.gamasutra.com/view/feature/3429/crashing_into_the_new_year_.php`

- `http://www.gamasutra.com/view/feature/3426/when_two_hearts_collide_.php`

- `http://www.gamasutra.com/view/feature/3427/collision_response_bouncy_.php`

- `http://www.gamasutra.com/view/feature/3190/advanced_collision_detection_.php`
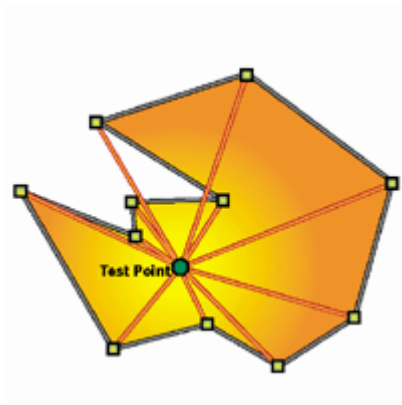
Dot vector to point with inward pointing normal
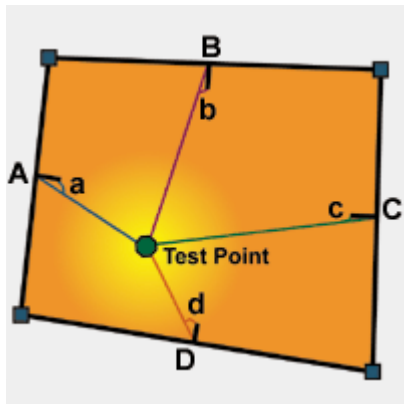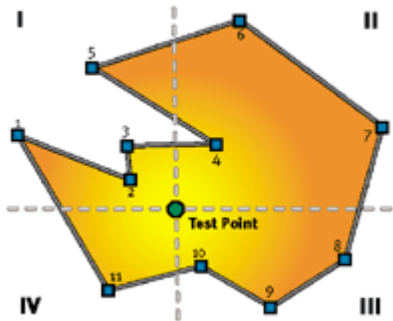
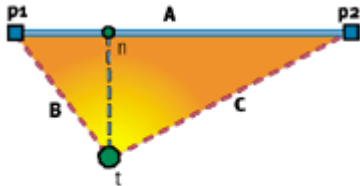# Does not work with concave polygons
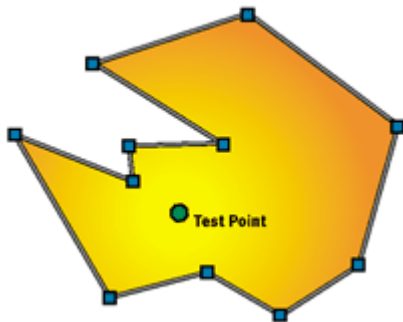
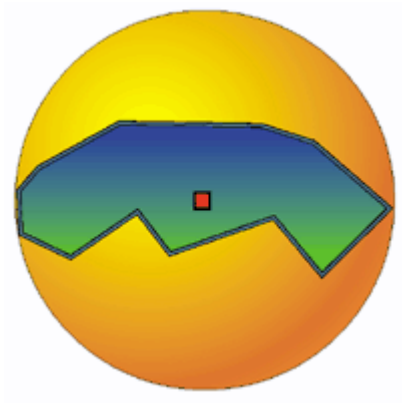# Sum of all the angles = 360?

Quadrant crossing = 4?

Or check even/odd intercepts.

Keeping at arm's length
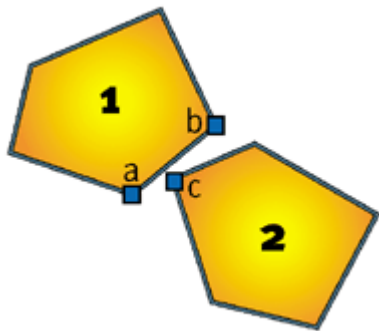

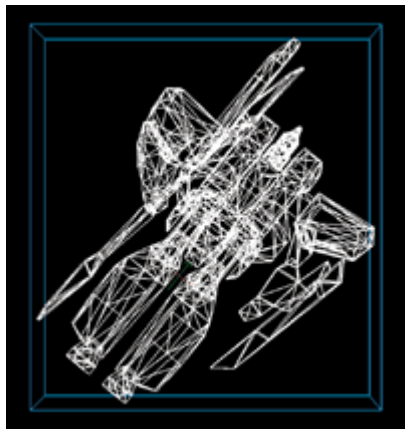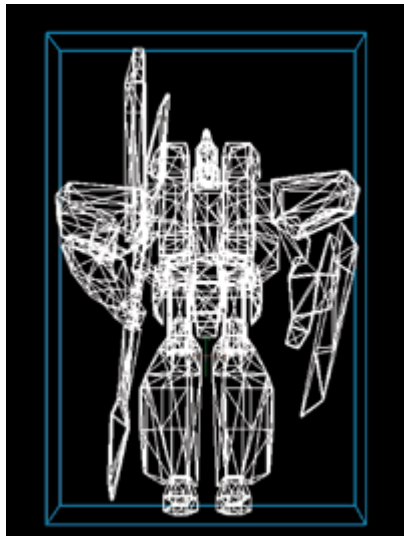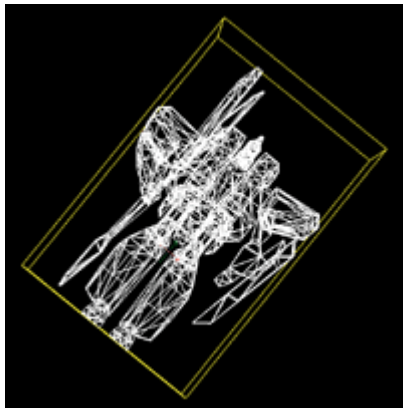$$n = p_1 + (p_2 - p_1)\frac{B \cdot A}{(B \cdot A) + (C \cdot A)}$$
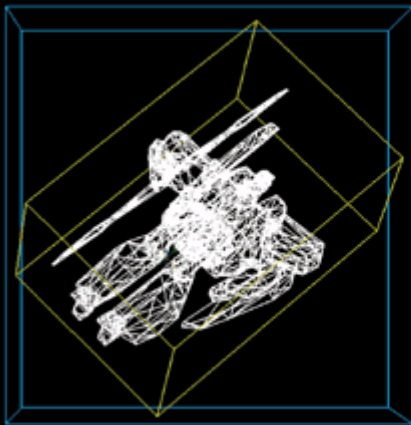
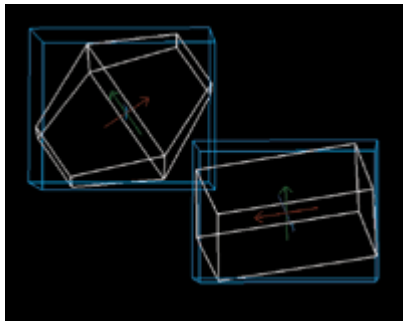# Bounding spheres

Find a separating plane

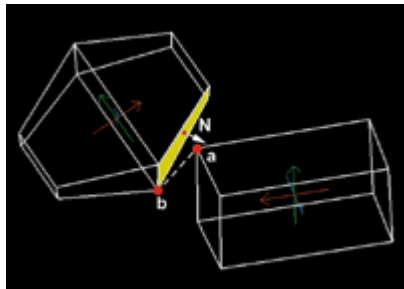# Axis-aligned bounding box (AABB)

Oriented bounding box (OBB)

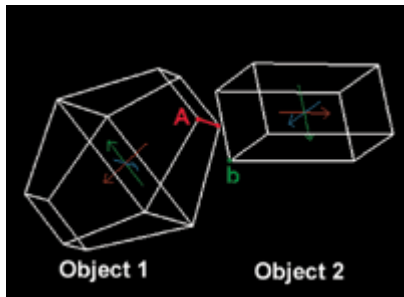# Fast and slow AABB calculation

Two objects that might be colliding

Find a separating plane: first try faces
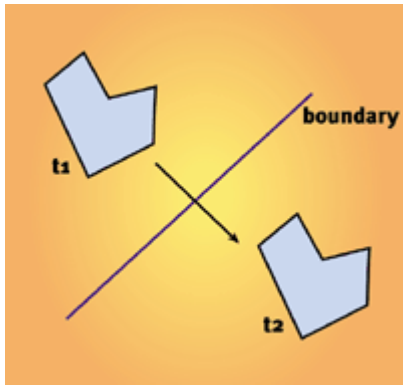
In 3D may not be a separating face

Need to check point-edge combinations as well.

Other points

- Cache separating planes.
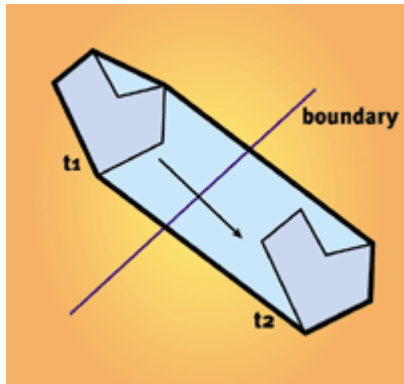- Separating plane only works for convex objects.
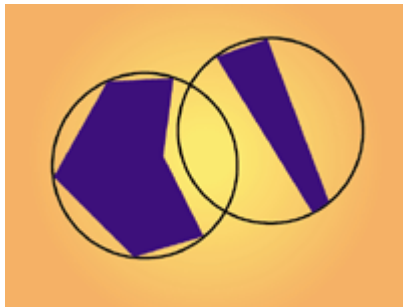
Collision may happen between frames

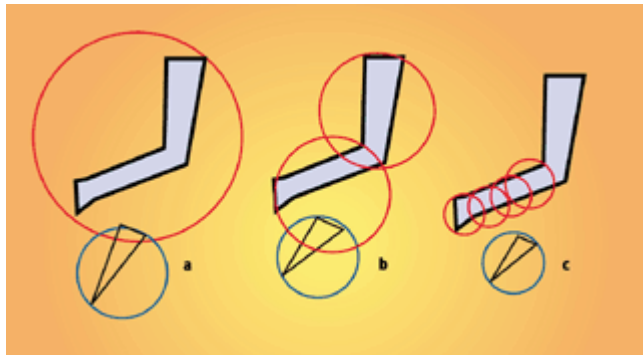- Smaller Δt in the physics.
- Don't make really thin walls.

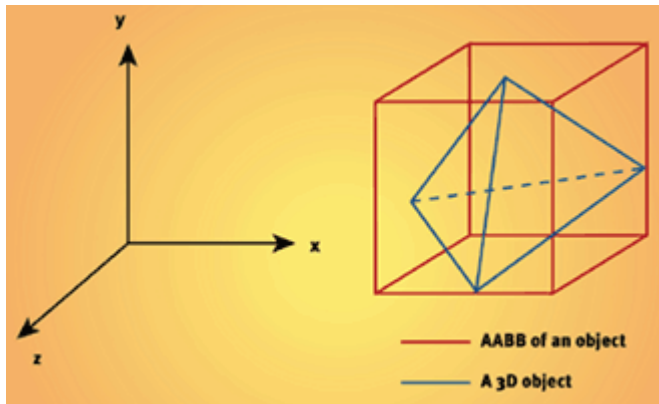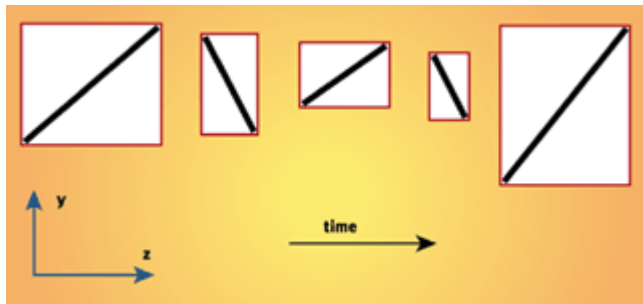# Create convex hull from object in two different frames

Bounding spheres

Create tree of bounding spheres
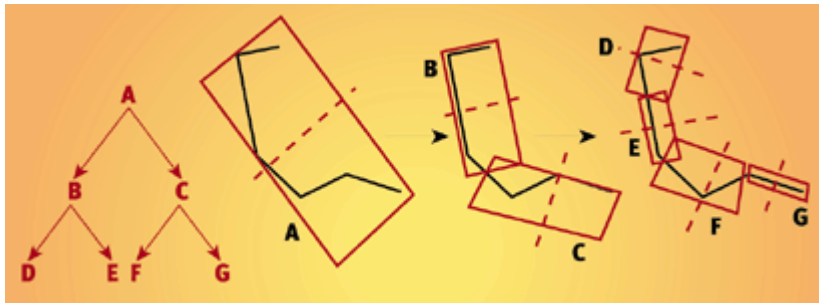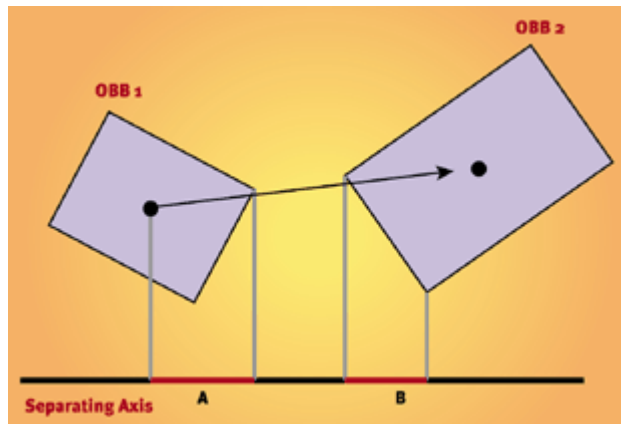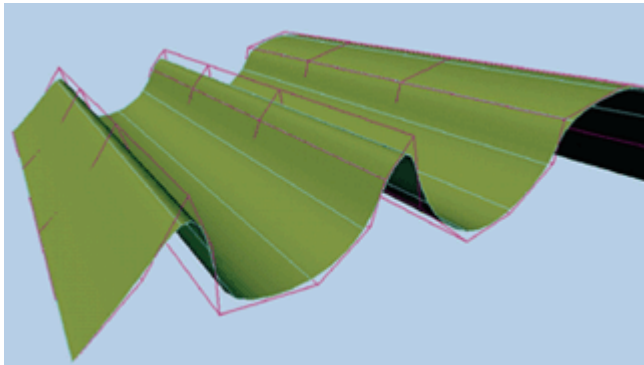
AABB

AABBs for rotating objects

Recursive OBB

- Check for collision at top level, if exists, recurse on both.
- Note: Require artists to specify OBBs, convex hulls, *etc.* in advance.
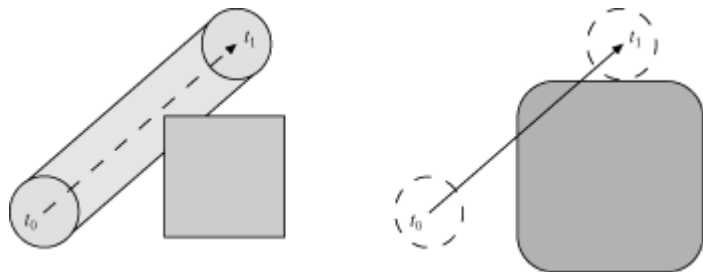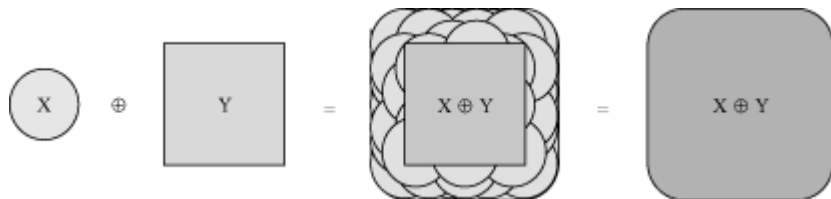
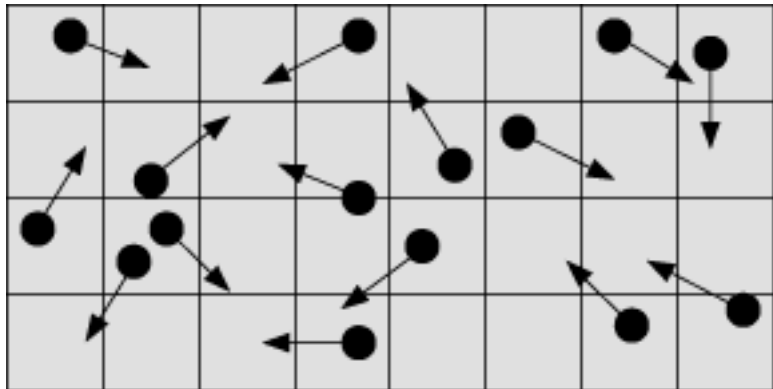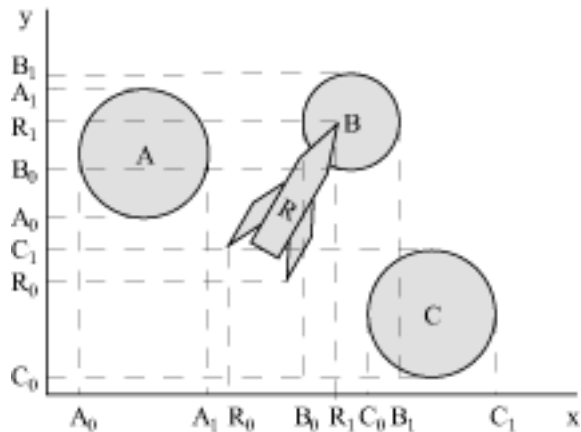# Check boxes for separating planes

Curved objects

Minkowski sums

Complexity with many objects

$$\left(\begin{array}{c} N \\ 2 \end{array}\right) = O(N^2)$$

Partitioning: $O(N)$

Sweep and prune: $O(N \log N)$

Use a Library

- `http://code.google.com/p/pymunk/`
- `http://bulletphysics.org/`