Image and Force-Dynamic Schemas

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Neural Evidence for category structure

- Are there specific regions in the brain to recognize/reason with specific categories?
- No, but there are specific circuits distributed over relevant regions of the brain.
- What might the general characteristics of such circuits look like?

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Overview

- Types of Schemas:
  - Spatial relations schemas
  - Force-dynamic schemas
  - Complex schemas
- Language
- Embodied basis

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Container Schema

- Embodied Basis
  - Experience
  - Motor-control
  - Perception
- Schematic structural elements
- Language

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Language

Spatial relations descriptions

- Limited set of schematic spatial distinctions
- Cross-linguistic variation

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Spatial distinctions

- Focal distinctions within scene – figure, ground
- Figure and ground geometries, relative orientations
- Presence or absence of contact
- Force-dynamics – largely independent of other spatial distinctions

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Example -- “ON”

- The cup is on the table.
- The skier is on the mountain.
- She has a large green hat on her head.
- Jack is standing on the top step of the ladder.

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Cross-linguistic Variations

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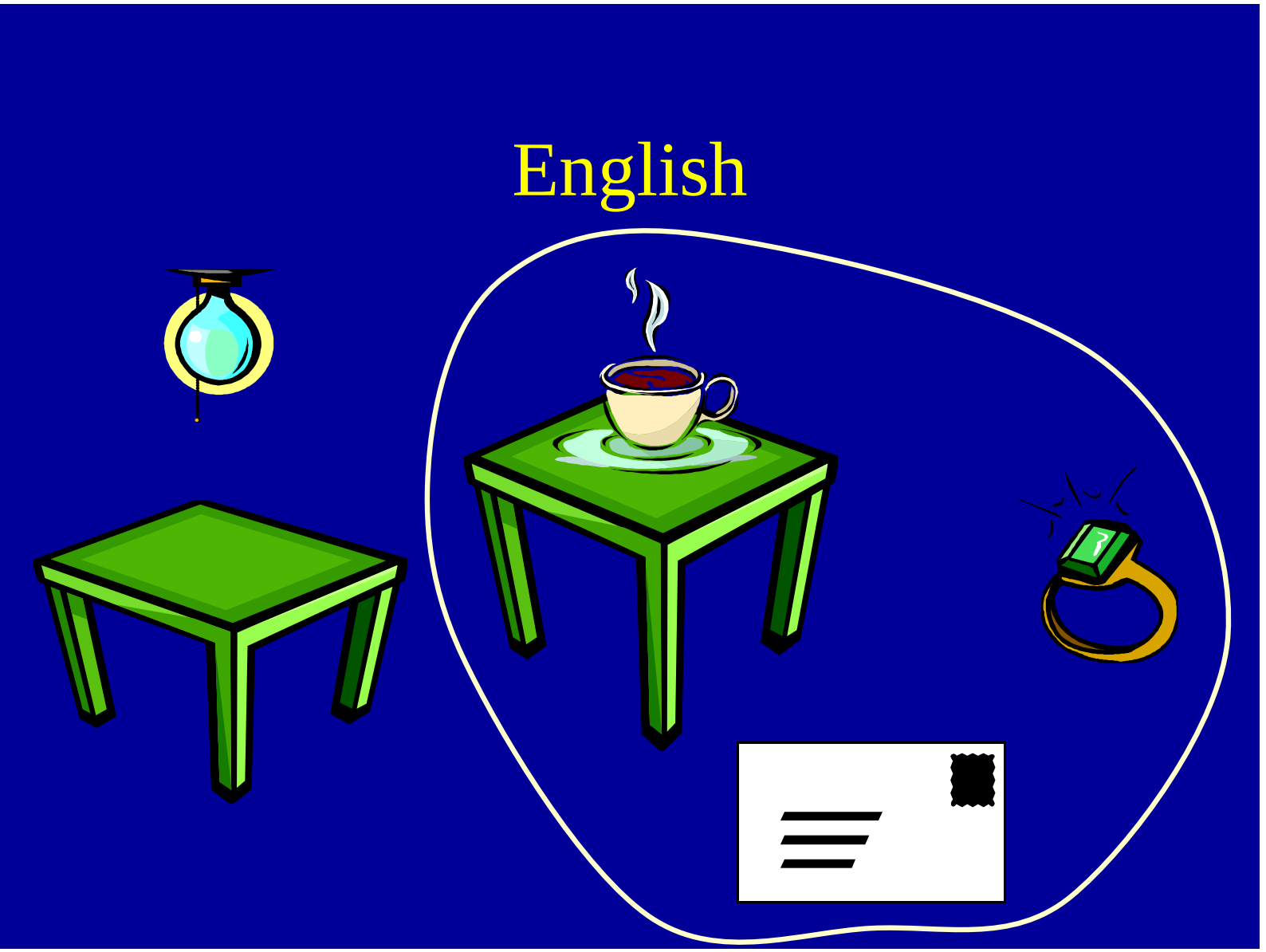
English



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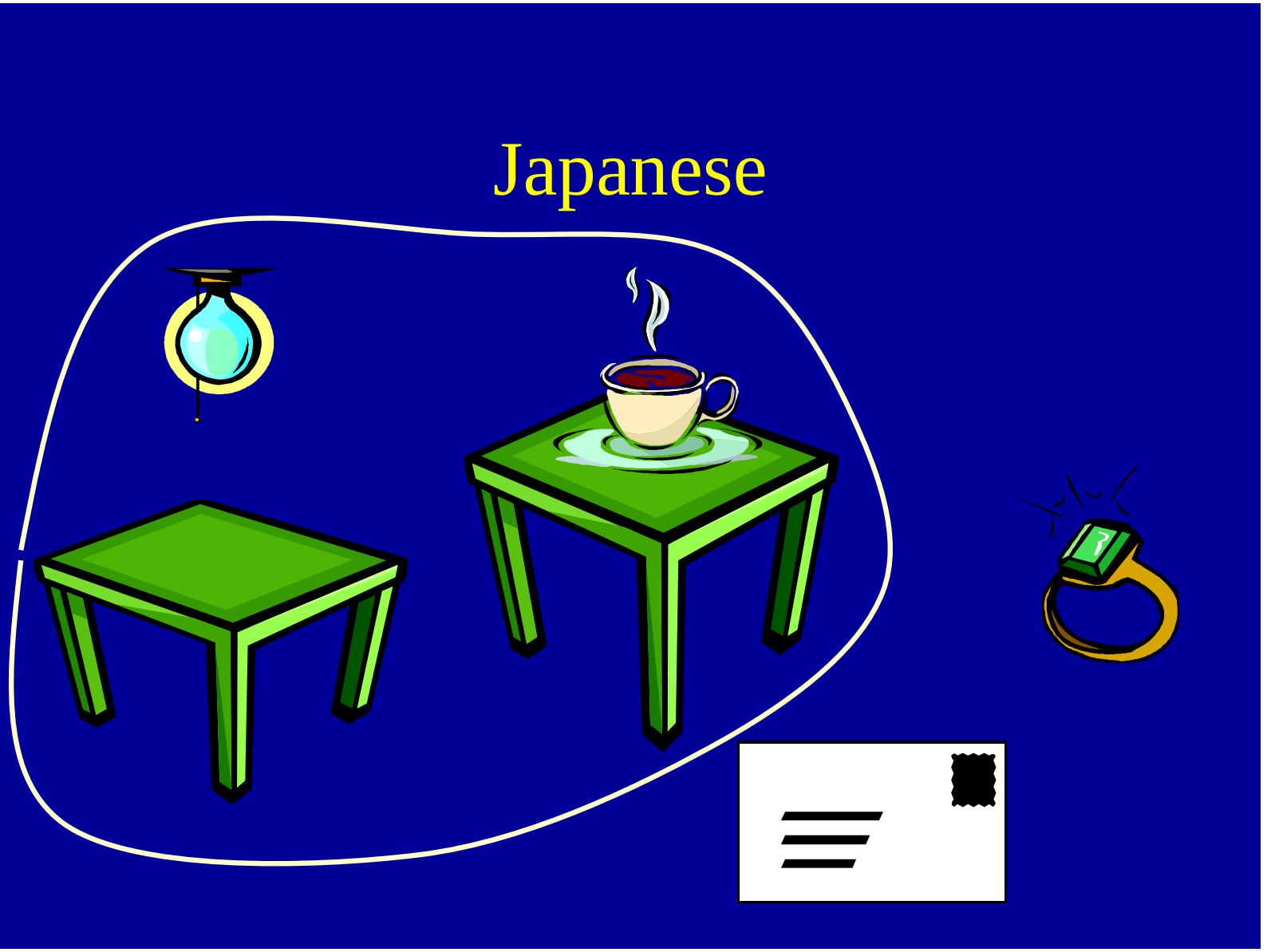
Japanese



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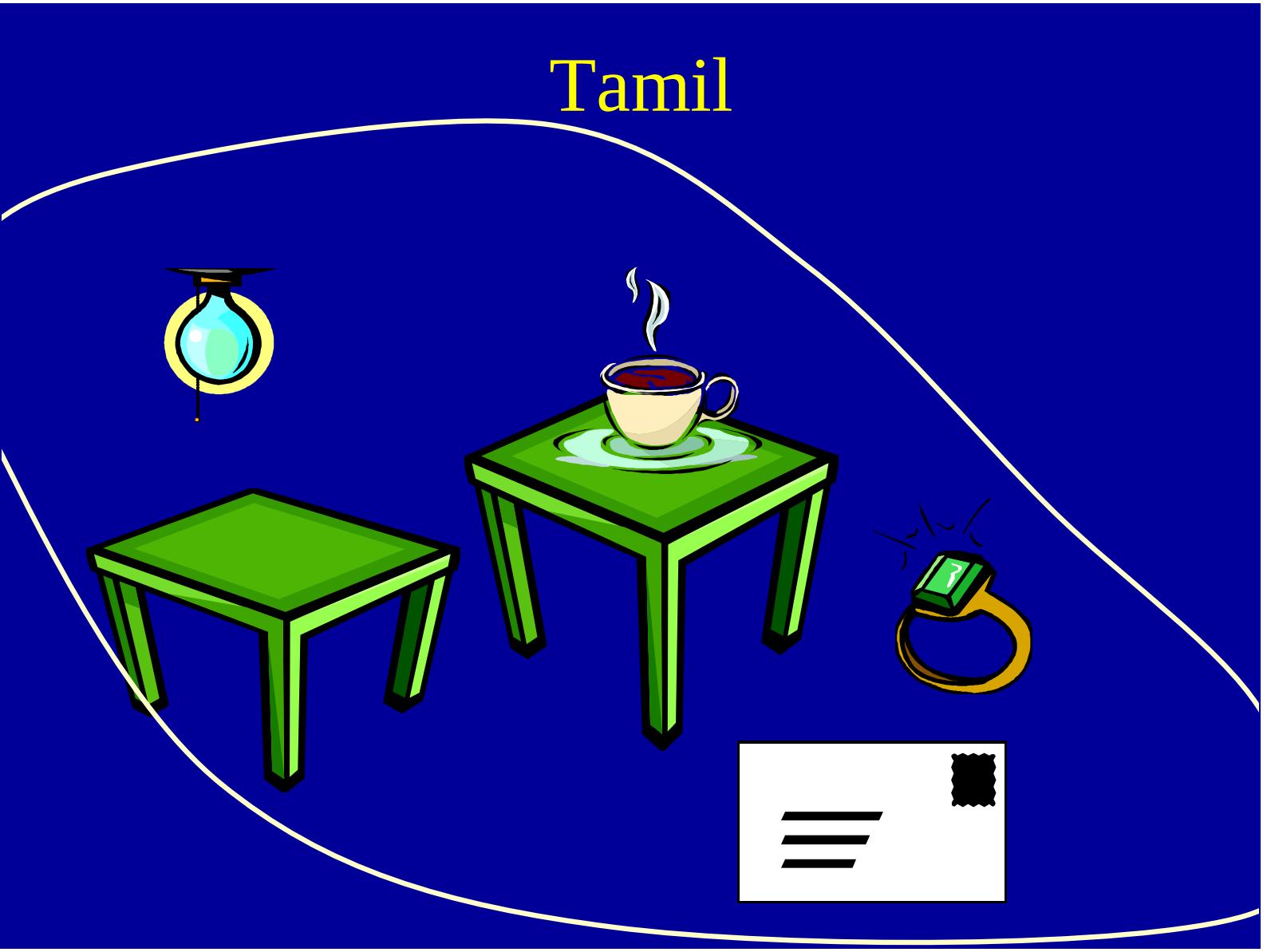
Tamil



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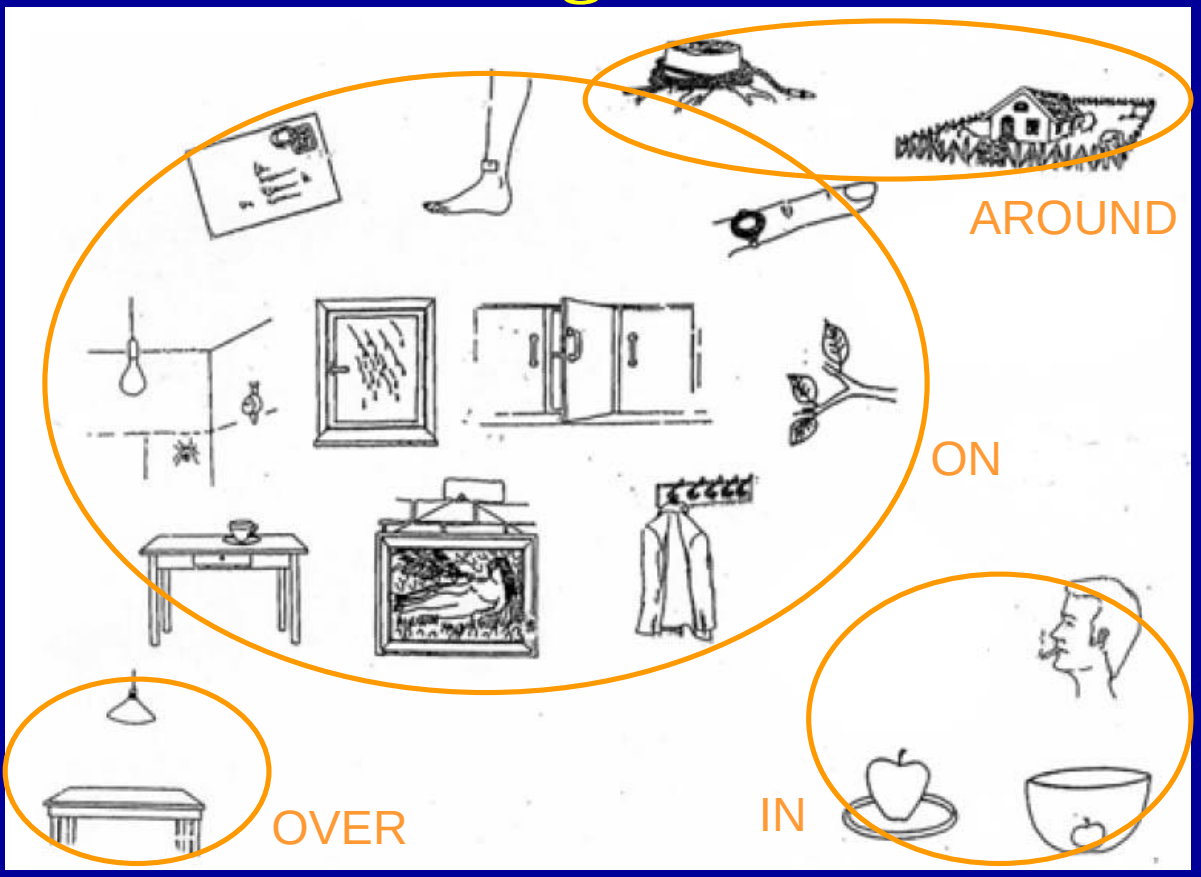
English



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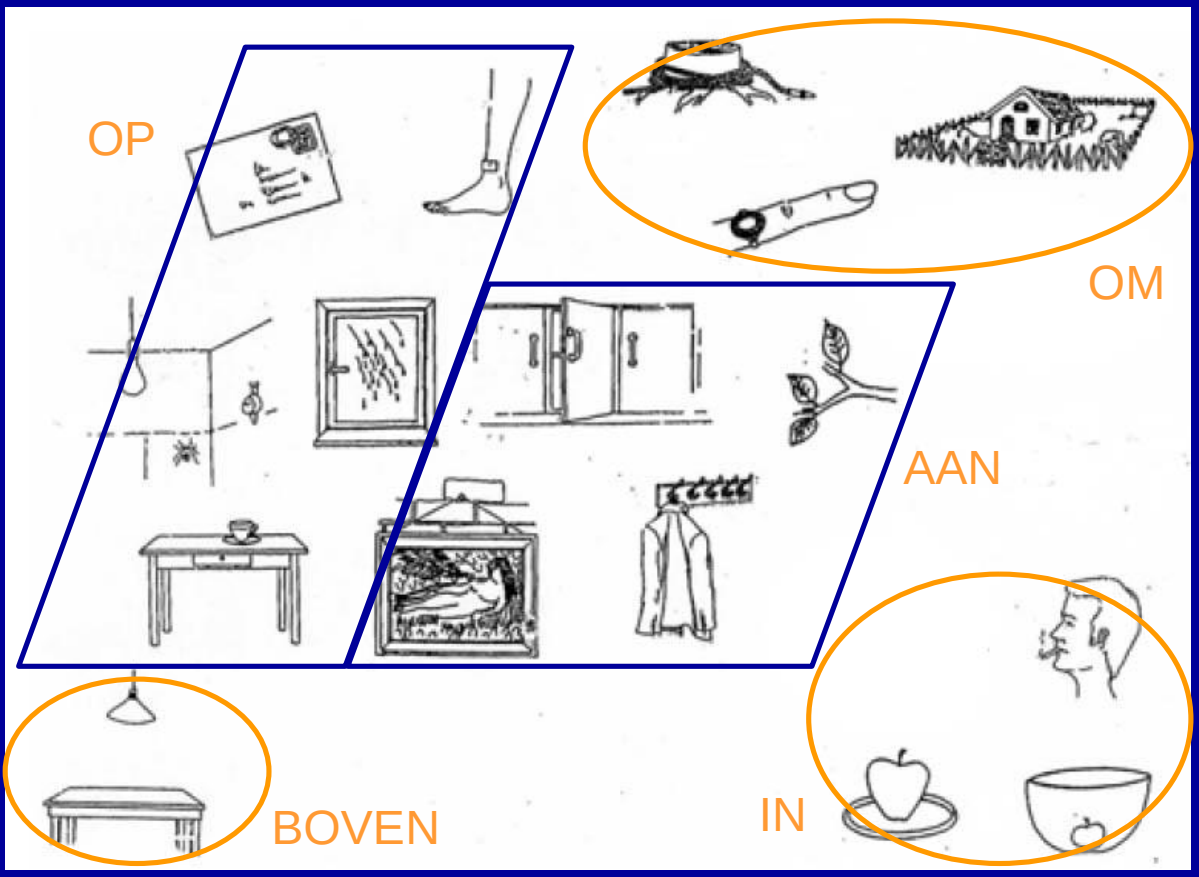
Dutch



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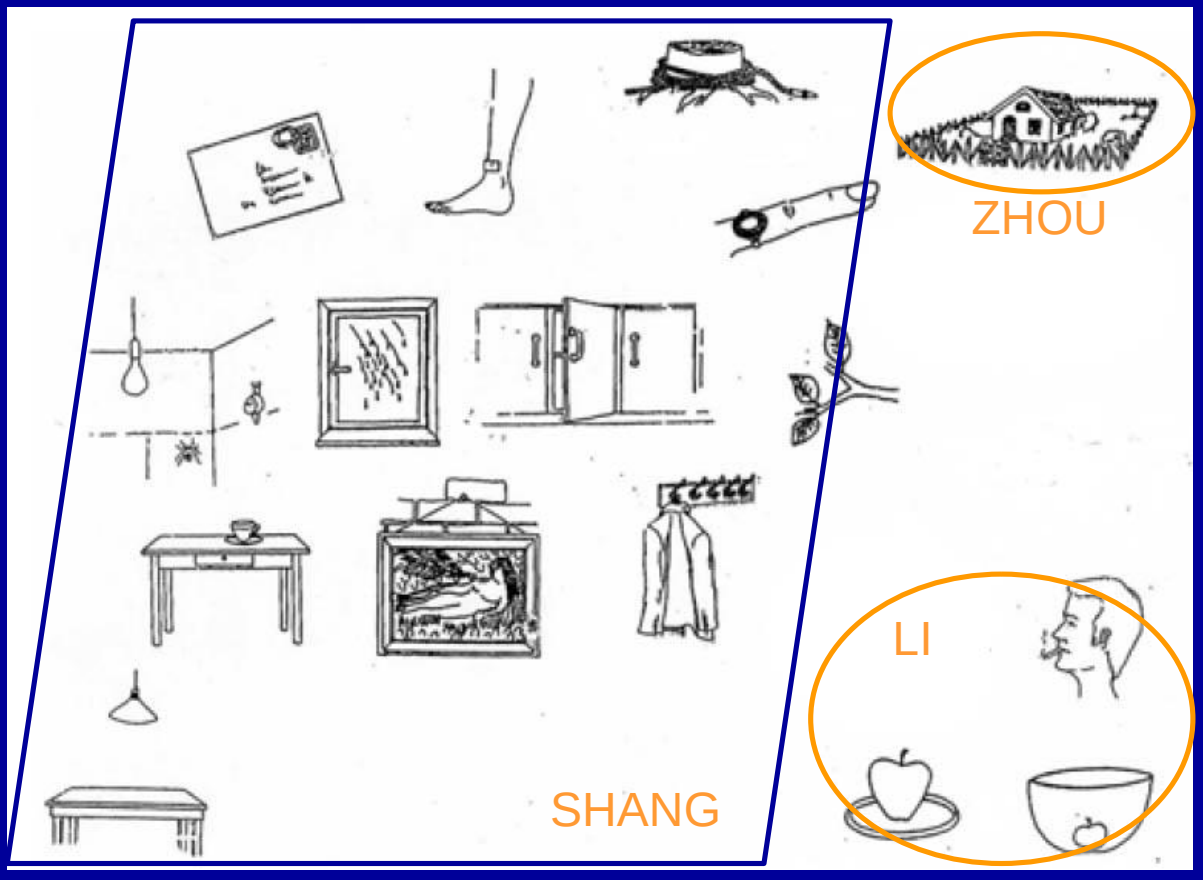
Chinese



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Language -- main points

- Cross-linguistic variation
- Limited number of image schemas

- Shouldn’t equate primitive image schemas with the spatial relations terms which express them.

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Embodied Basis of Image Schemas

- Regularities in our perceptual, motor and cognitive systems
- Structure our experiences and interactions with the world.

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Embodied Basis

- Perceptual systems
- Motor routines
- Experiential Correlations
- Image Schema properties depend on
  - Neural circuits
  - Interactions with the world

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Embodied Basis

Similarity:

- Perceptual and motor systems
- Basic functional interactions with the world
- Environment

Variation:

Cross-linguistic variation in how schemas are used.

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Schemas

- Spatial image schemas
- Source-Path-Goal schema
- Force-Dynamic schemas
- Combinations of schemas

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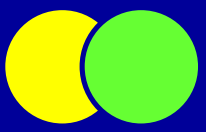
Spatial Image Schemas

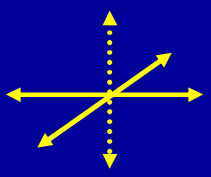
- Trajector/Landmark relation

- Boundaries, bounded region

- Topological relations



- Orientational Axes



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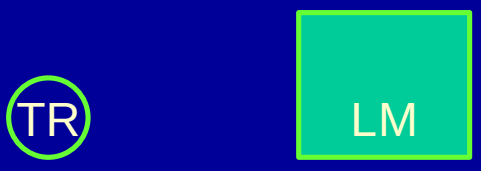
Trajector/Landmark Schema

- Roles:
  - Trajector (TR) – object being located
  - Landmark (LM) – reference object



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Trajector/Landmark Schema

Asymmetry

- *The cup is on the table*
- *?The table is under the cup.*

- *The skateboard is next to the post.*
- *?The post is next to the skateboard.*

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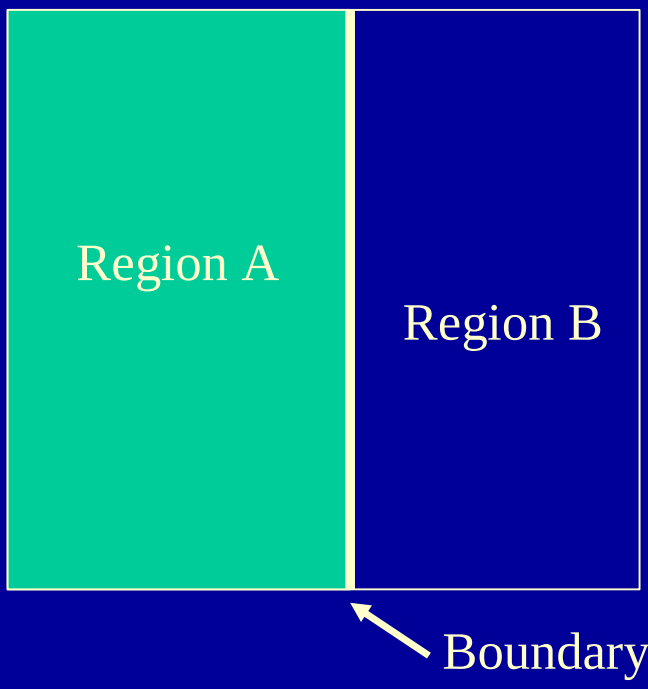
Boundary Schema



Roles:

- Boundary
- Region A
- Region B

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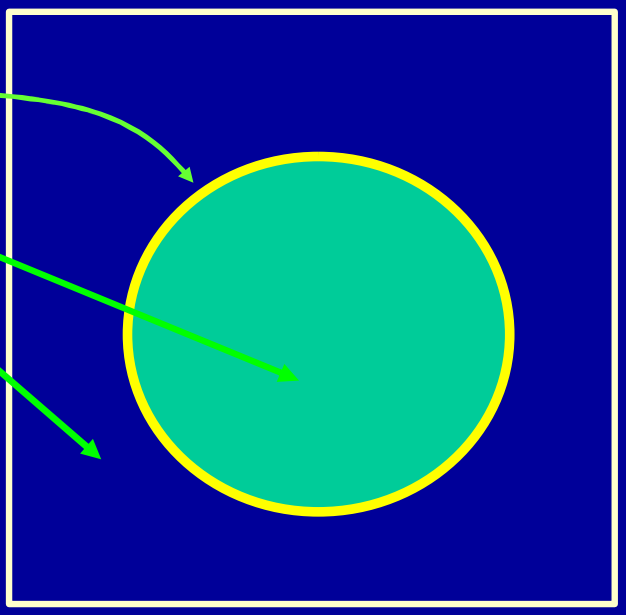
Bounded Region Schema

Roles:

- Boundary
- Bounded Region
- Background region



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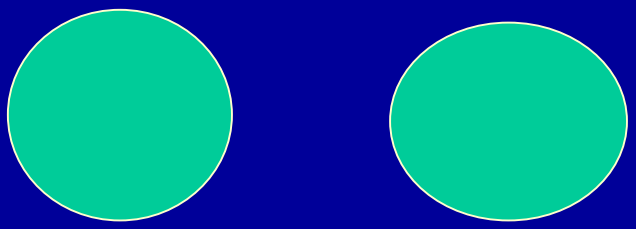
Topological Relations

- **Separation**



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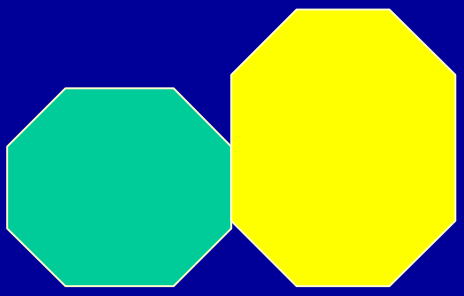
Topological Relations

- Separation
- **Contact**



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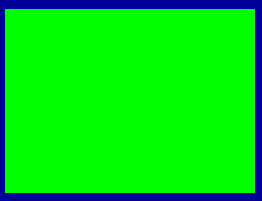
Topological Relations

- Separation
- Contact
- **Coincidence**:



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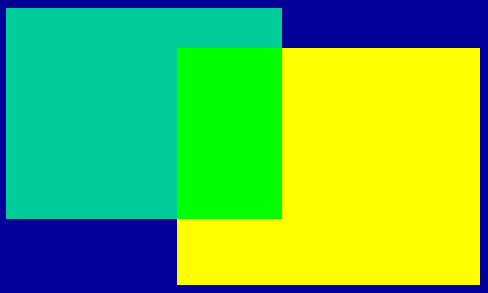
Topological Relations

- Separation
- Contact
- Coincidence:
  - **Overlap**



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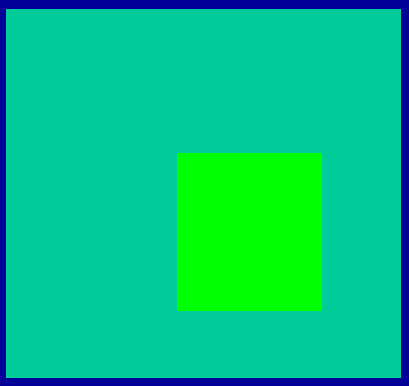
Topological Relations

- Separation
- Contact
- Coincidence:
  - Overlap
  - **Inclusion**



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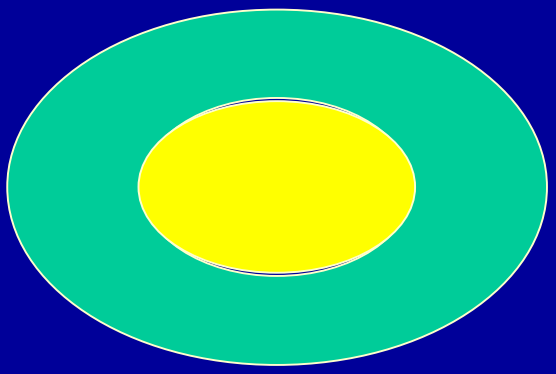
Topological Relations

- Separation
- Contact
- Coincidence:
  - Overlap
  - Inclusion
- Encircle/surround



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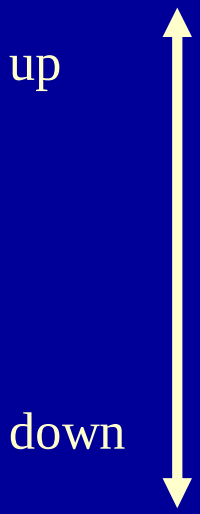
Orientation

- Vertical axis -- *up/down*



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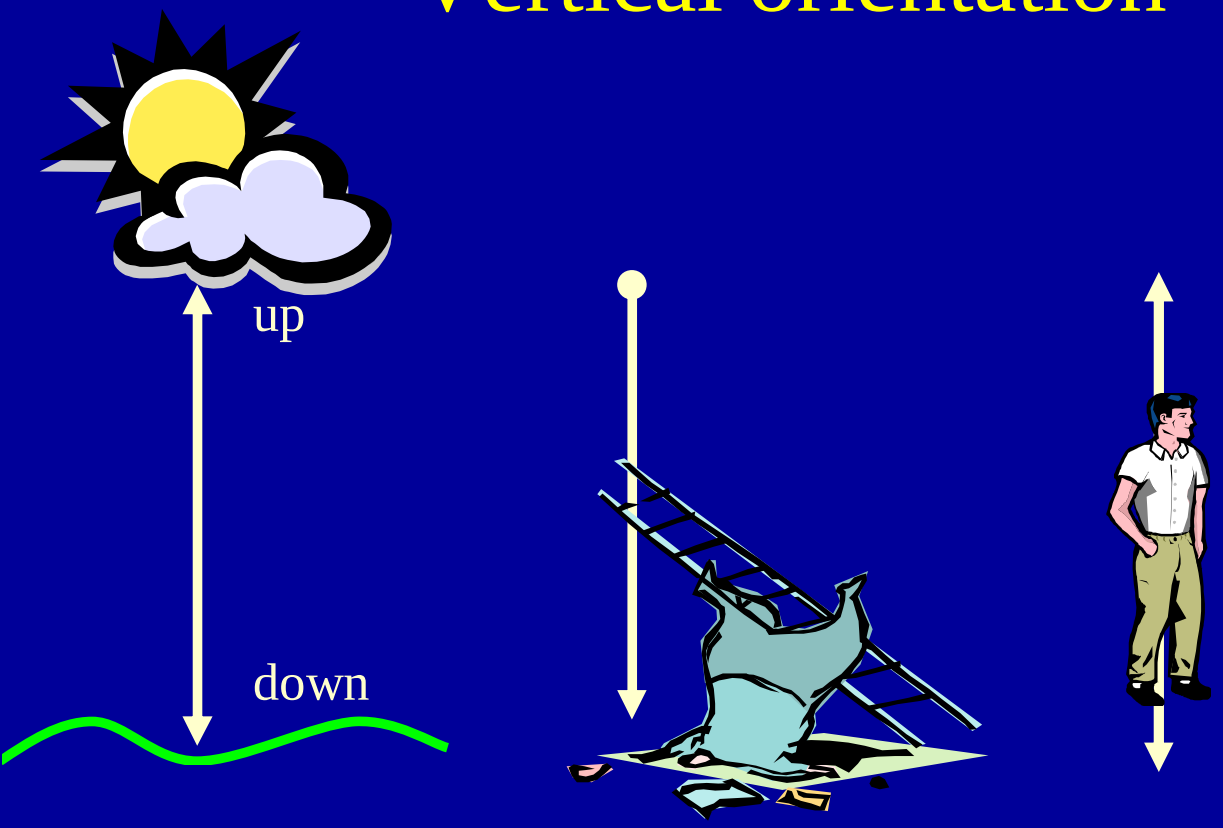
Vertical orientation



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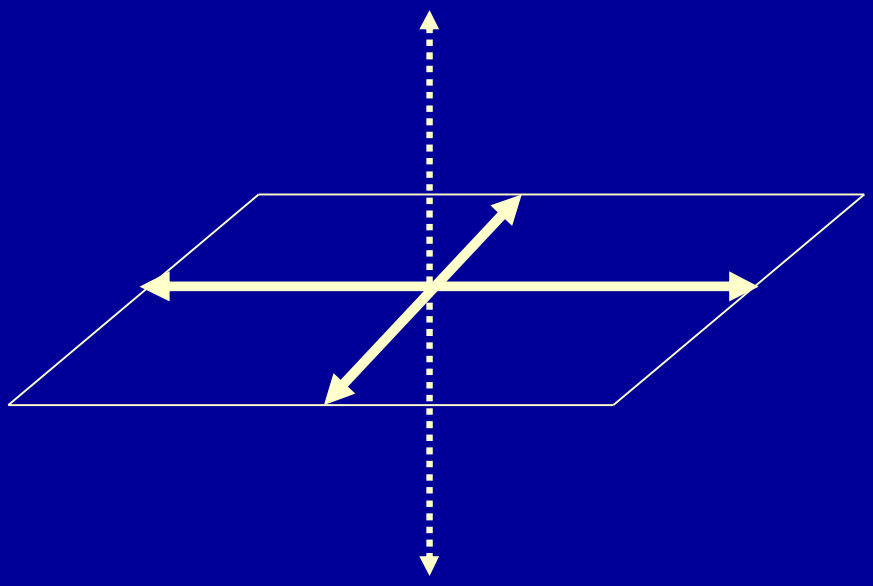
Orientation

Horizontal plane – *Two axes:*



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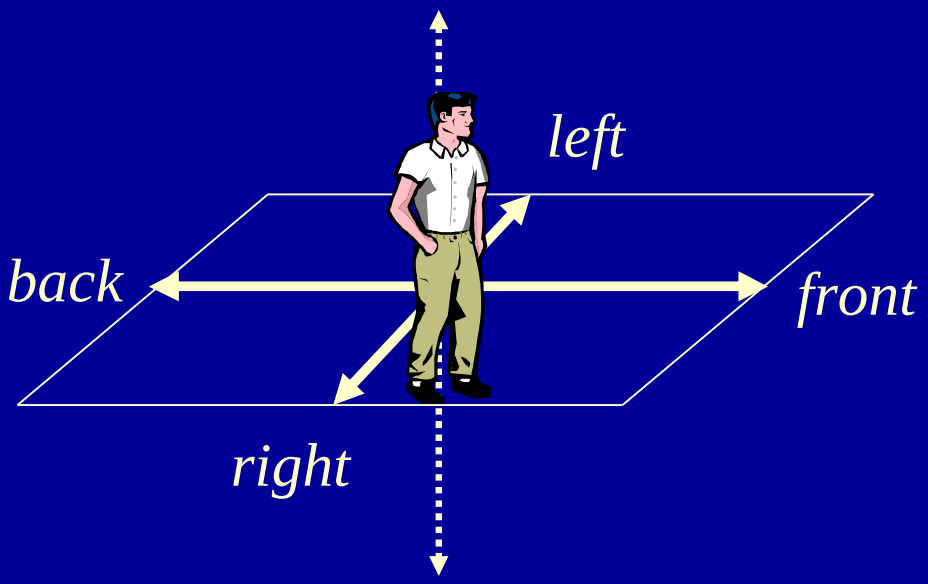
Orientation

Inherent features of the Landmark



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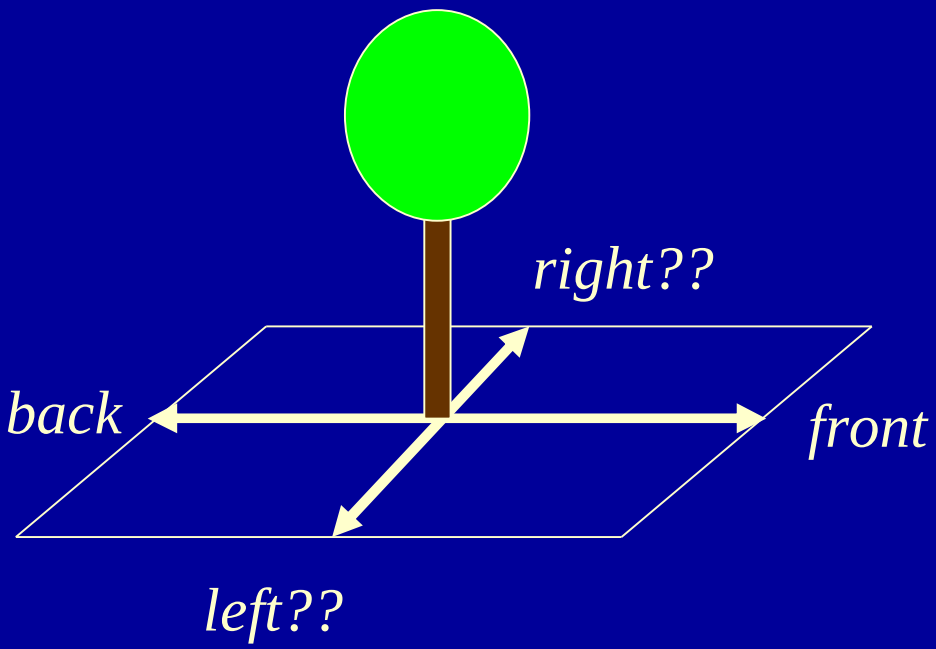
Orientation

Viewer perspective



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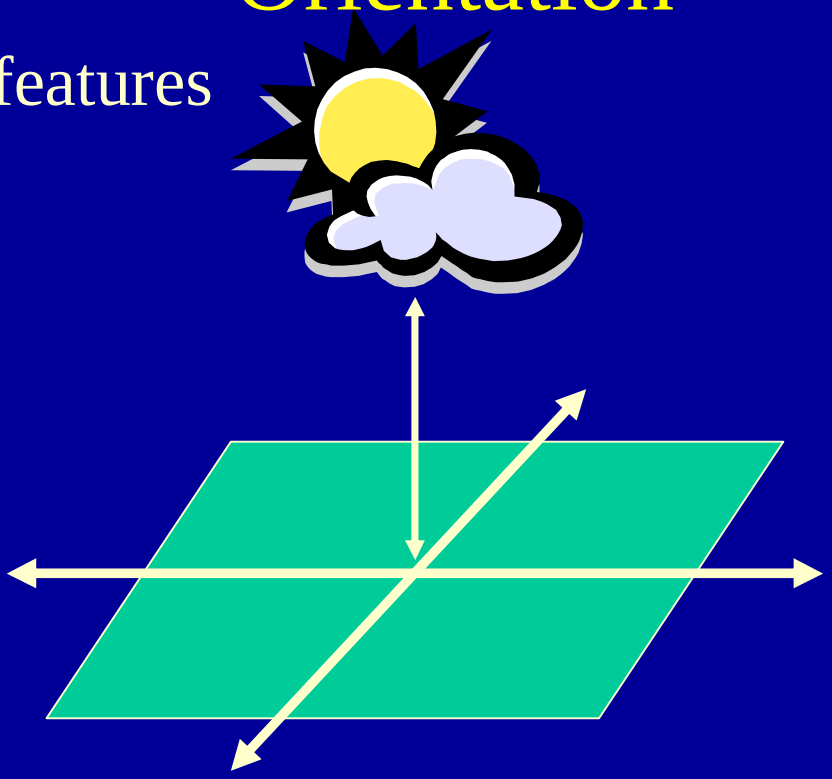
Orientation

External features



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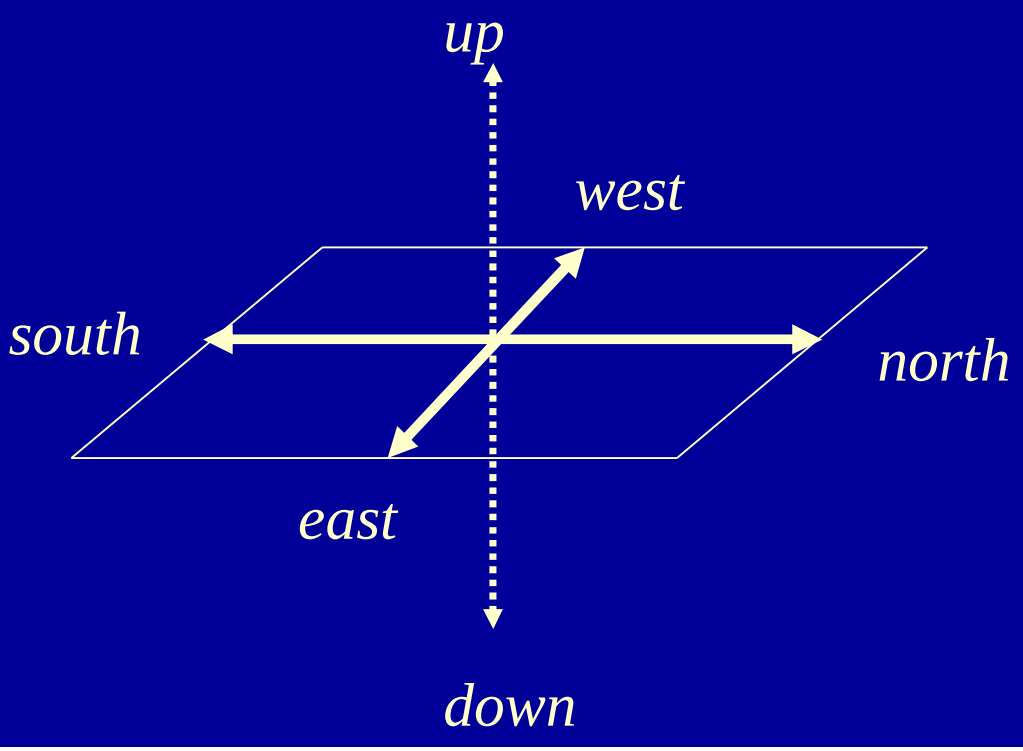
Orientation

Absolute frame of reference



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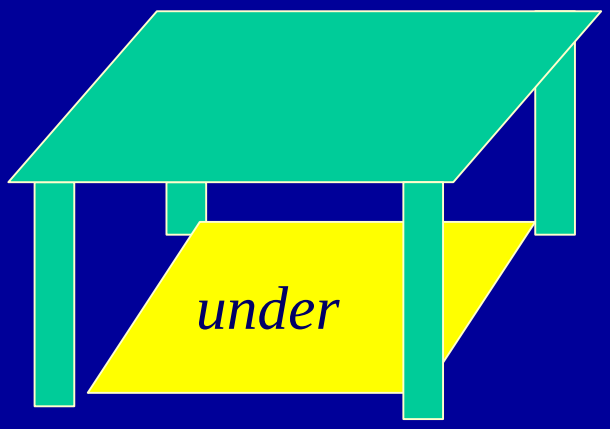
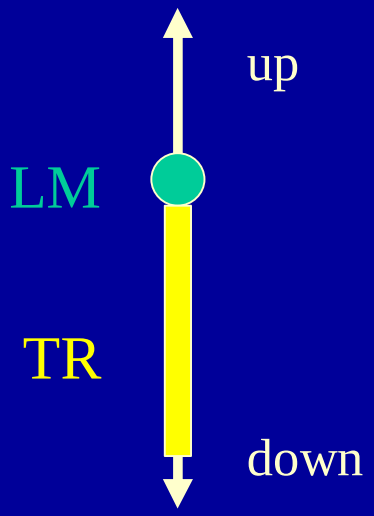
TR/LM and Verticality Schemas

- *The book is under the table.*





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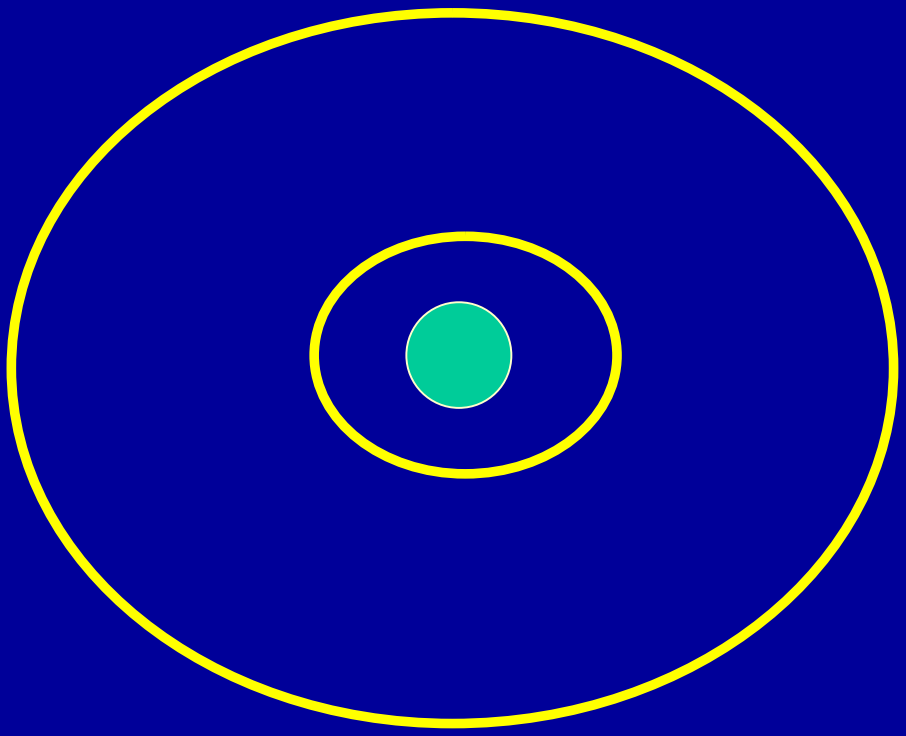
Proximal/Distal Schema



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Dynamic schemas

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Source-Path-Goal schema

Schematic Structure

- Mover
- Source
- Path
- Goal

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Source-Path-Goal schema

Embodied basis

- Motion detection
- Motor-control
- Spatial Relations

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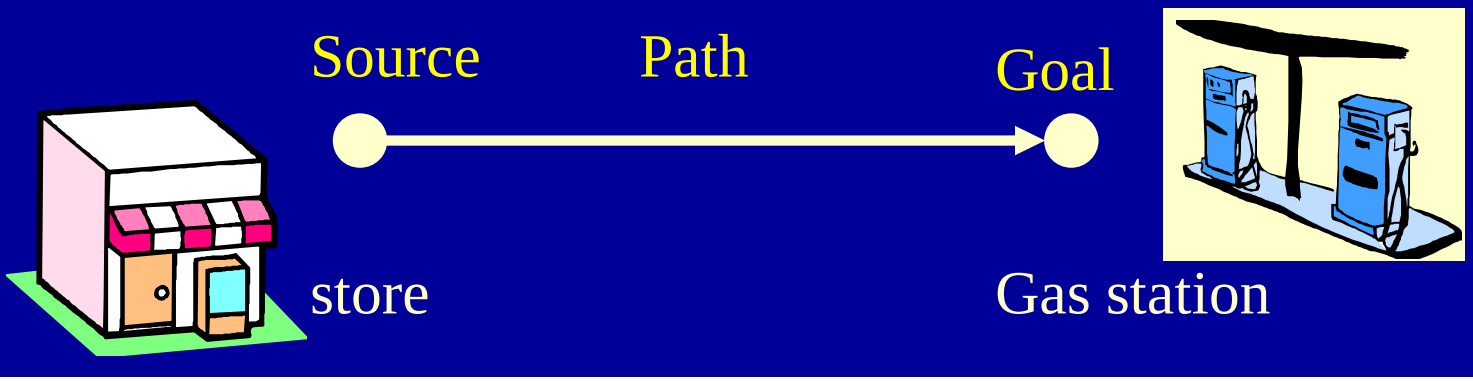
Source-Path-Goal schema

She drove from the store to the gas station.

Mover = *she*

Source = *at the store*

Goal = *at the gas station*



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Spatial relations

- *She put the cup on the table*
- *They ran out of the house*
- *He threw the ball over the fence*

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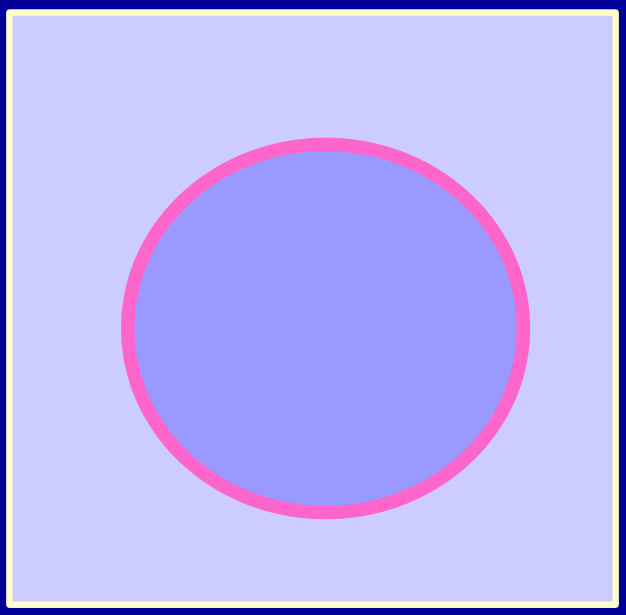
Container Schema

- Roles:
  - Container
  - Boundary
  - Interior
  - Exterior



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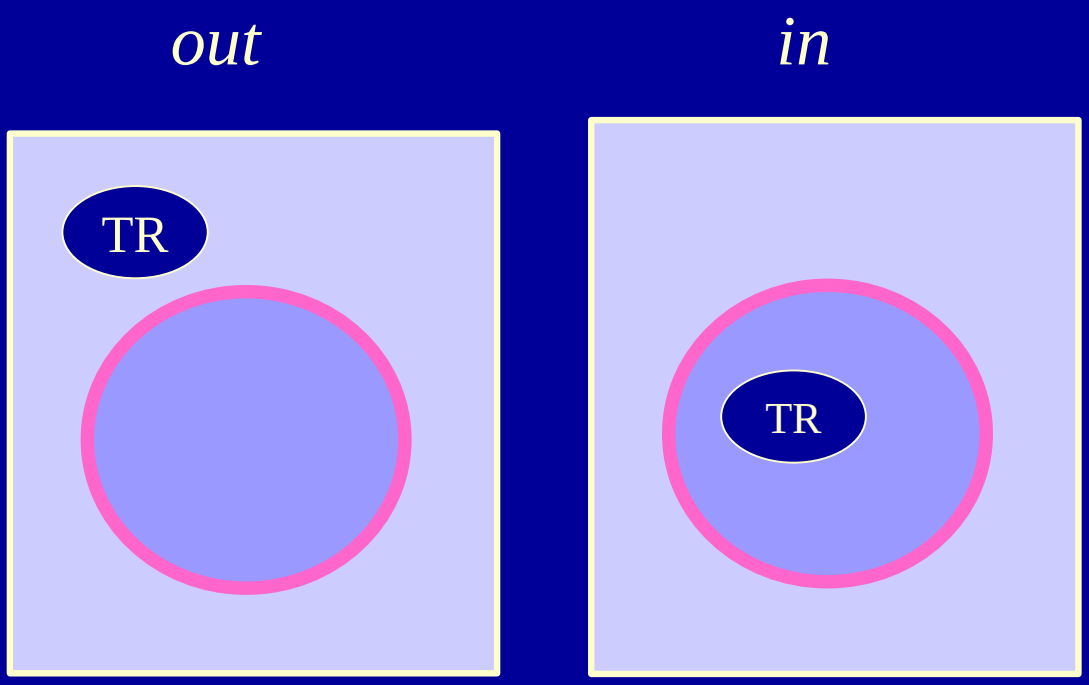
Container Schema



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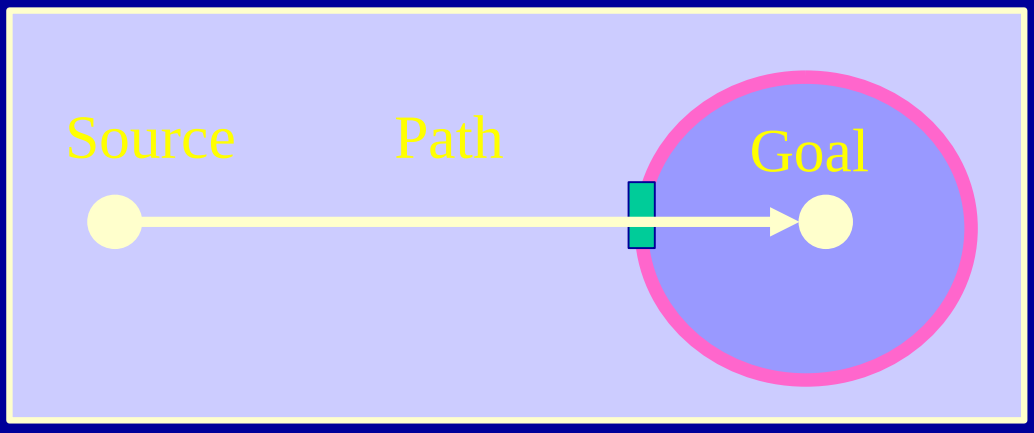
SPG and Container

She ran into the room.

SPG. Source Container.Exterior

SPG.Path Container.Portal

SPG. Goal Container.Interior



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Force-Dynamics

Prevent Motion

- Containment
- Support
- Blockage

Cause Motion

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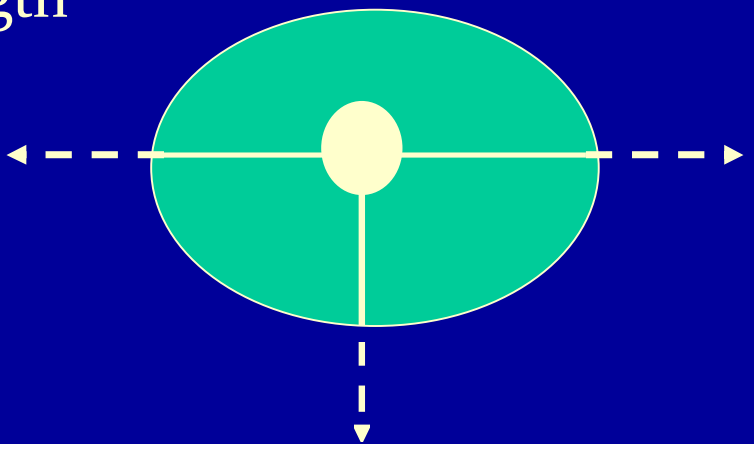
Force-Dynamics

Containment:

- Prevent motion across boundaries
- Additional Container properties
  - Boundary Strength
  - Portal role



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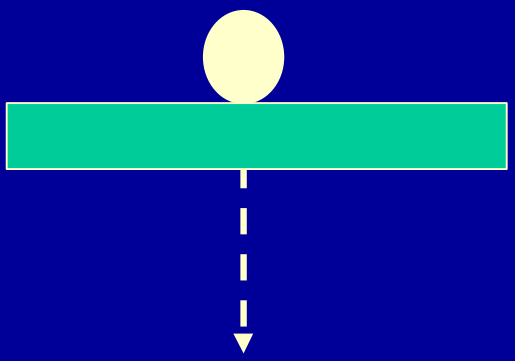
Force-Dynamics

Support:

–Prevent downwards (gravitic) motion



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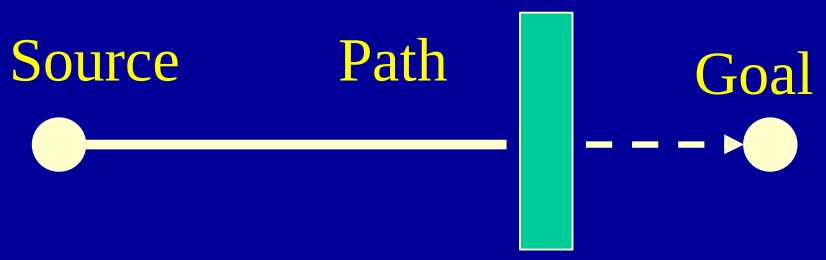
Force-Dynamics

Blockage

- Prevents motion along Path



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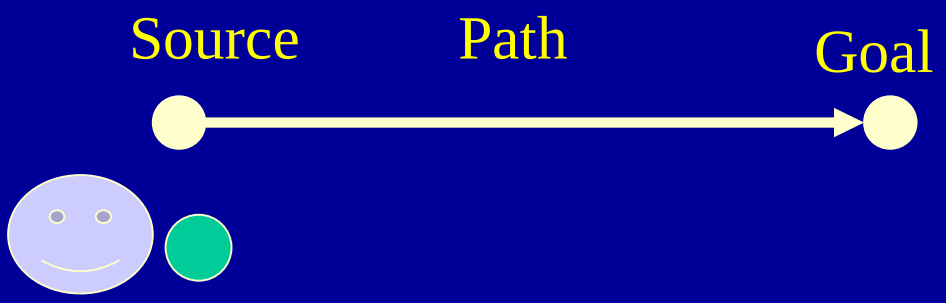
Force-Dynamics

- Cause Motion
- *He threw the ball over the fence*



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Summary

Image and Force-Dynamic schemas :

- Are embodied
- Properties depend on neural circuits and interactions with the world
- Structure language, but are not tied to the specific word forms which are used to express them.

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