ACT-R Gaze Tracker

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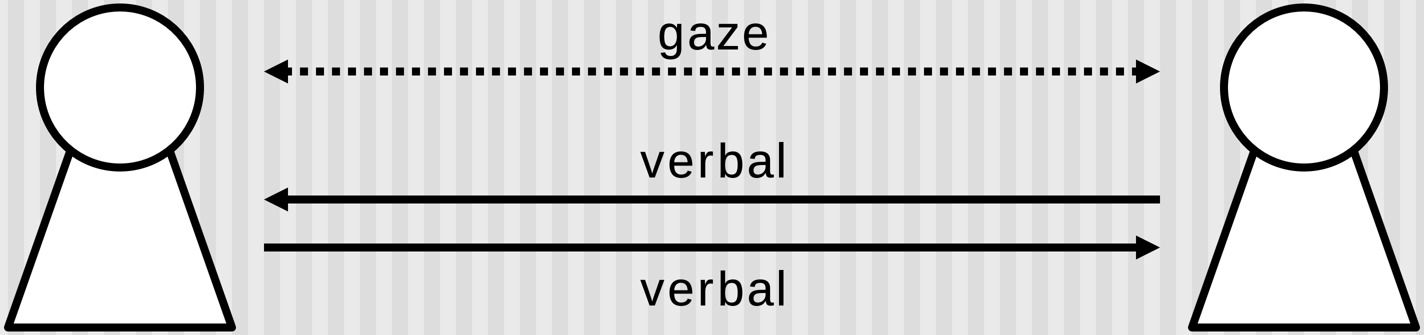
Overview

- Motivation
- Approach
- Experiment
- Model
- Future Works

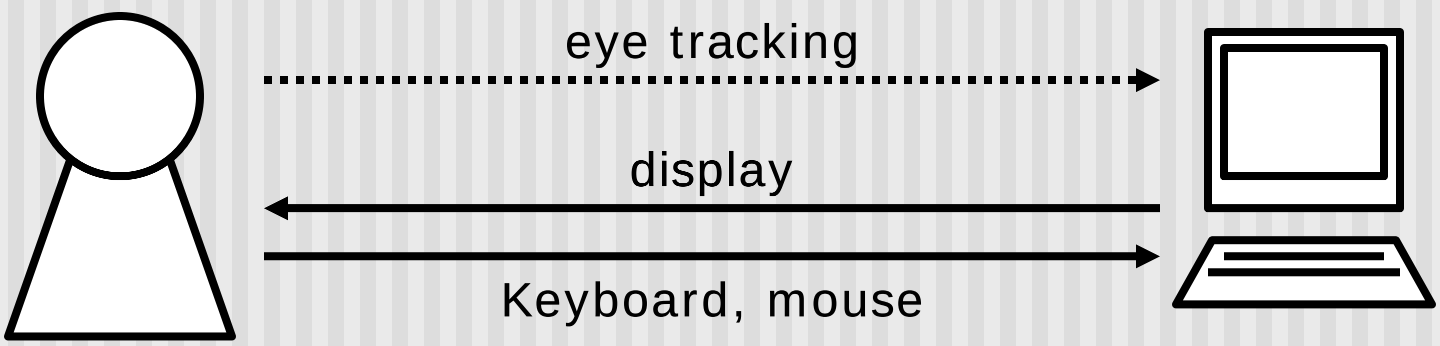
Motivation

- Gaze awareness in human-human interaction



Motivation

- Gaze awareness in human-computer interaction



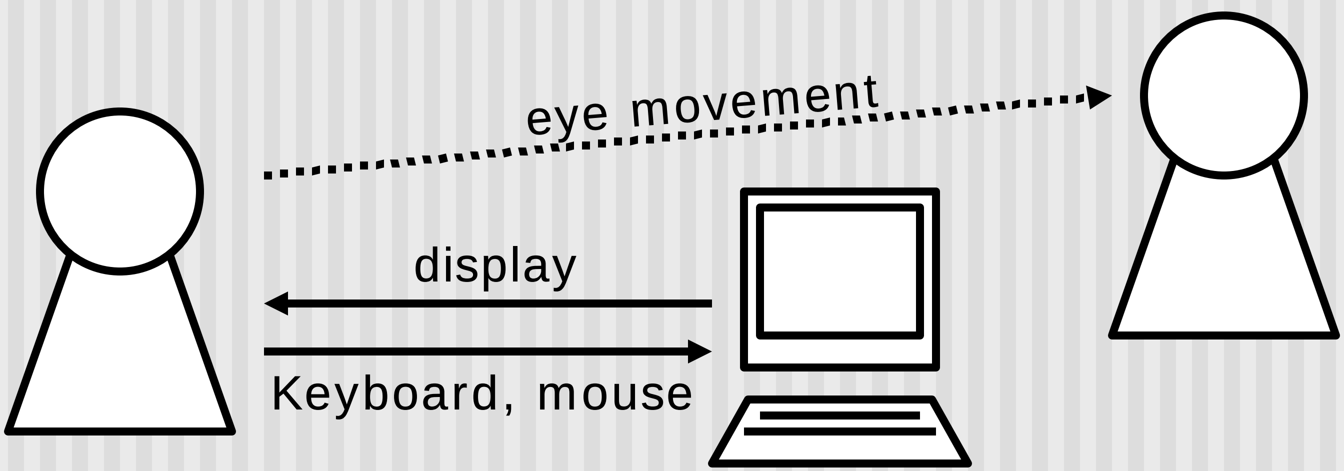
Motivation

- To search for a cheaper alternative to the eye-tracker equipped tutor system

- Model matching
  - track a student's reasoning process
  - track a student's eye movement?

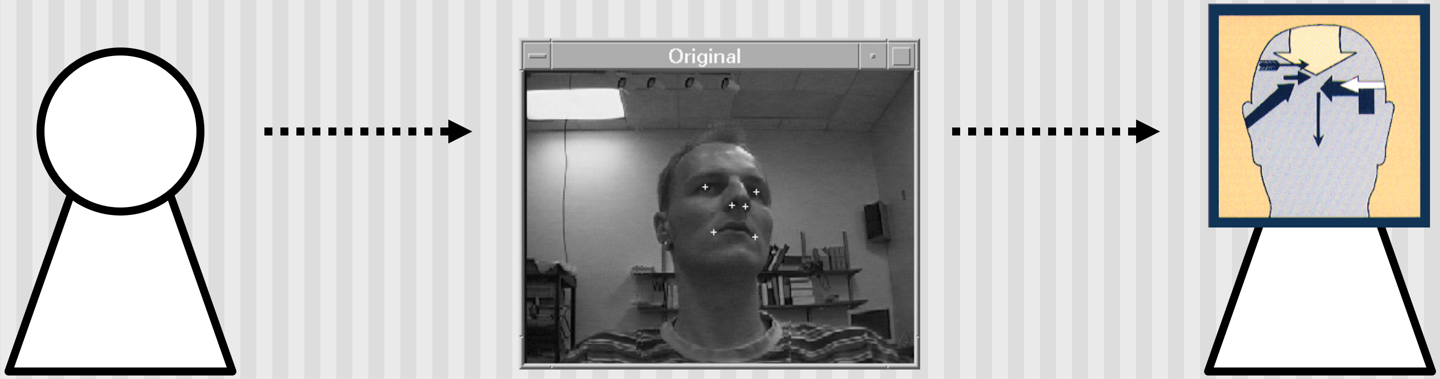
Approach

- Model a person tracking the other's gaze



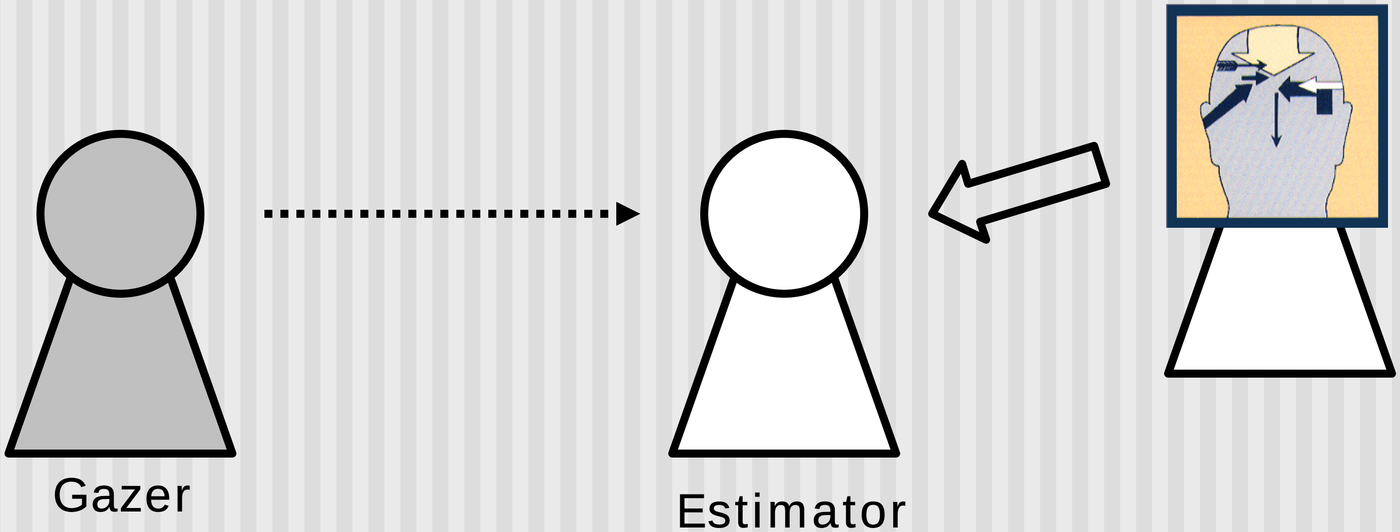
Approach

- Web camera with feature tracking algorithm



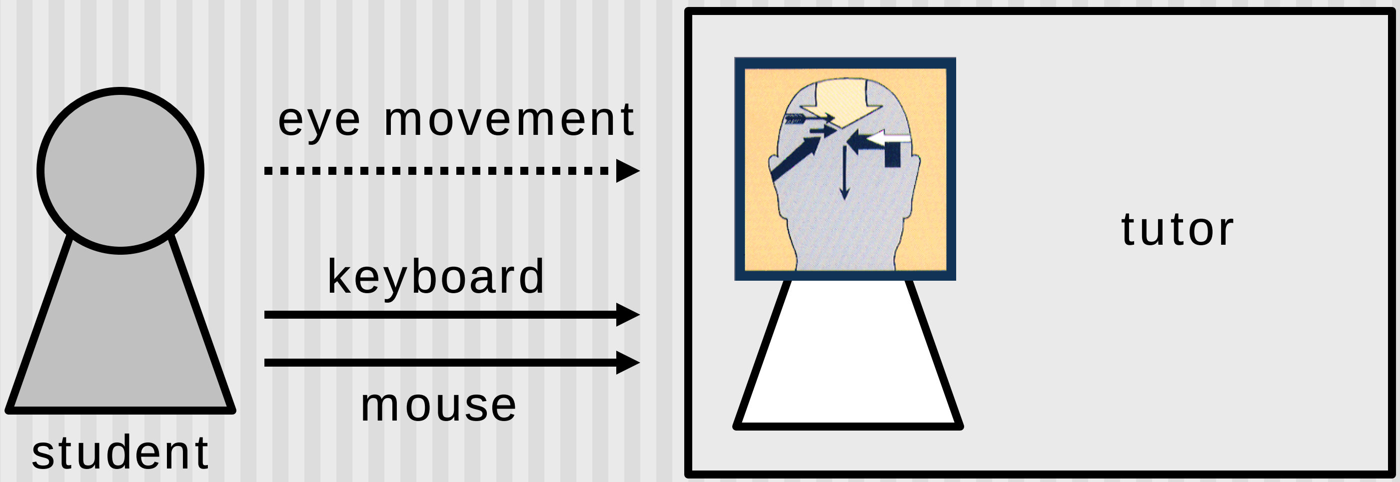
Approach

- Subjects estimate the gaze of the Gazer
- ACT-R modes the Estimator



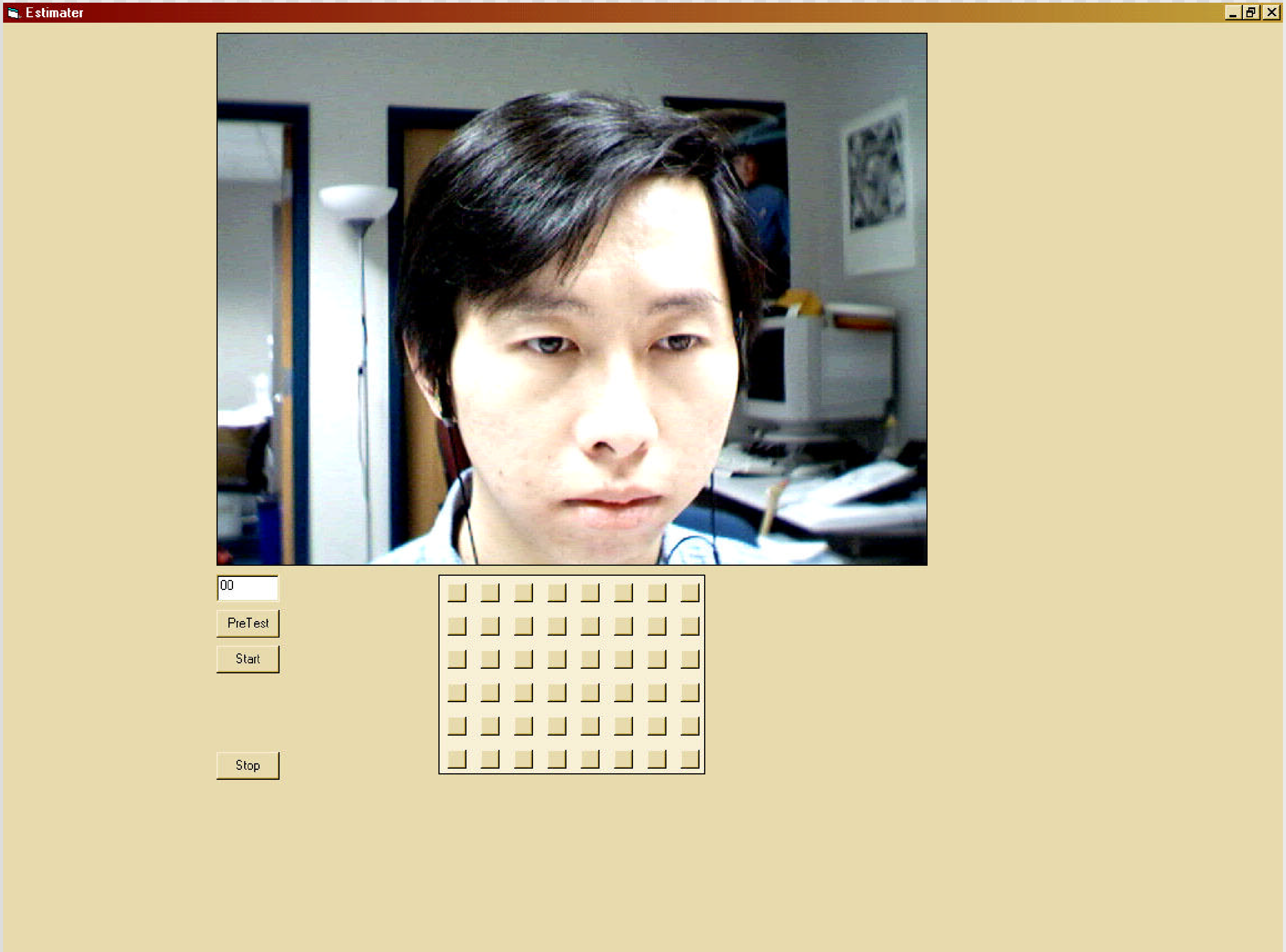
Approach

- Combination of tutor and ACT-R gazer tracker



Experiment

- Pre-taken photos of Gazer looking at 48 locations on a computer monitor
- Head-moving condition only
- 48 trials X 9 sessions
- No feedback in the first session
- Feedback frequency (1, 2, 8)


Estimater
00
PreTest
Start
Stop

Stimuli

Experiment: Result

Model

- Key components
  - Knowledge representation
  - Compensation mechanism
  - Estimation mechanism

Model: Knowledge representation

- Positions of facial features

```
(chunk-type headeye hx hy ex ey)
```

- Association between facial features and gaze position

```
(chunk-type gaze he tx ty state)
```

- Deviation of two *Gaze* chunks

```
(chunk-type comp dhx dex dhy dey dtx dty state)
```

- Task knowledge keeping track the whole process

```
(chunk-type task state che chx chy cex cey dhx
  dhy dex dey tx ty rhe rtx rty dtx dty
  max_dhex min_dhex max_dhey min_dhey feedback)
```

Model: Strategies

- Compensation Mechanism
  - Required when retrieved *gaze* chuck doesn’t match the perceived facial features
  - Calculate the offset of two *headeye* chunks
  - Retrieve *comp* chunk

    ```
    (chunk-type comp dhx dhy dex dey dtx dty
      state)
    ```
  - Calculate the offset of the target

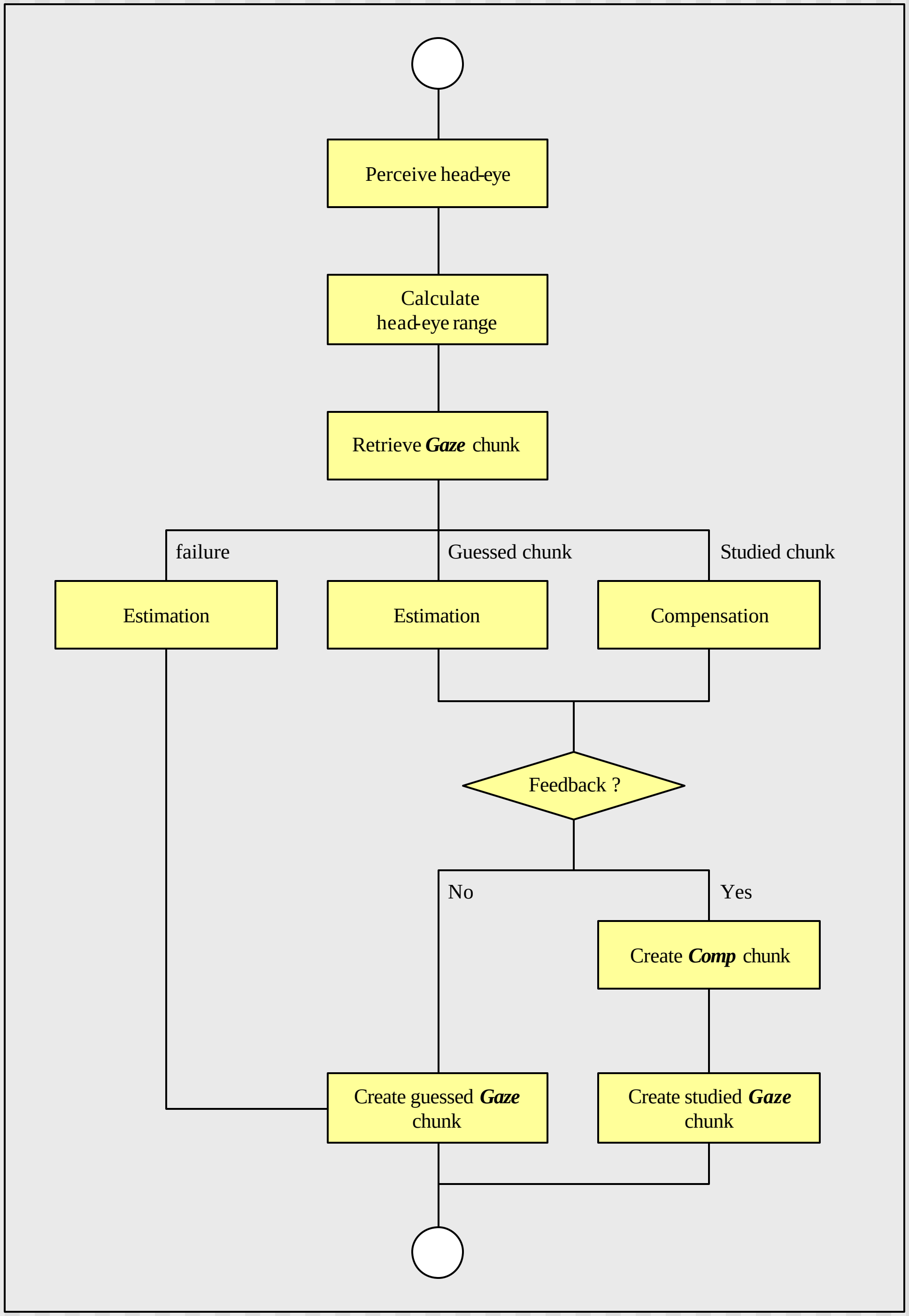
Model Strategies

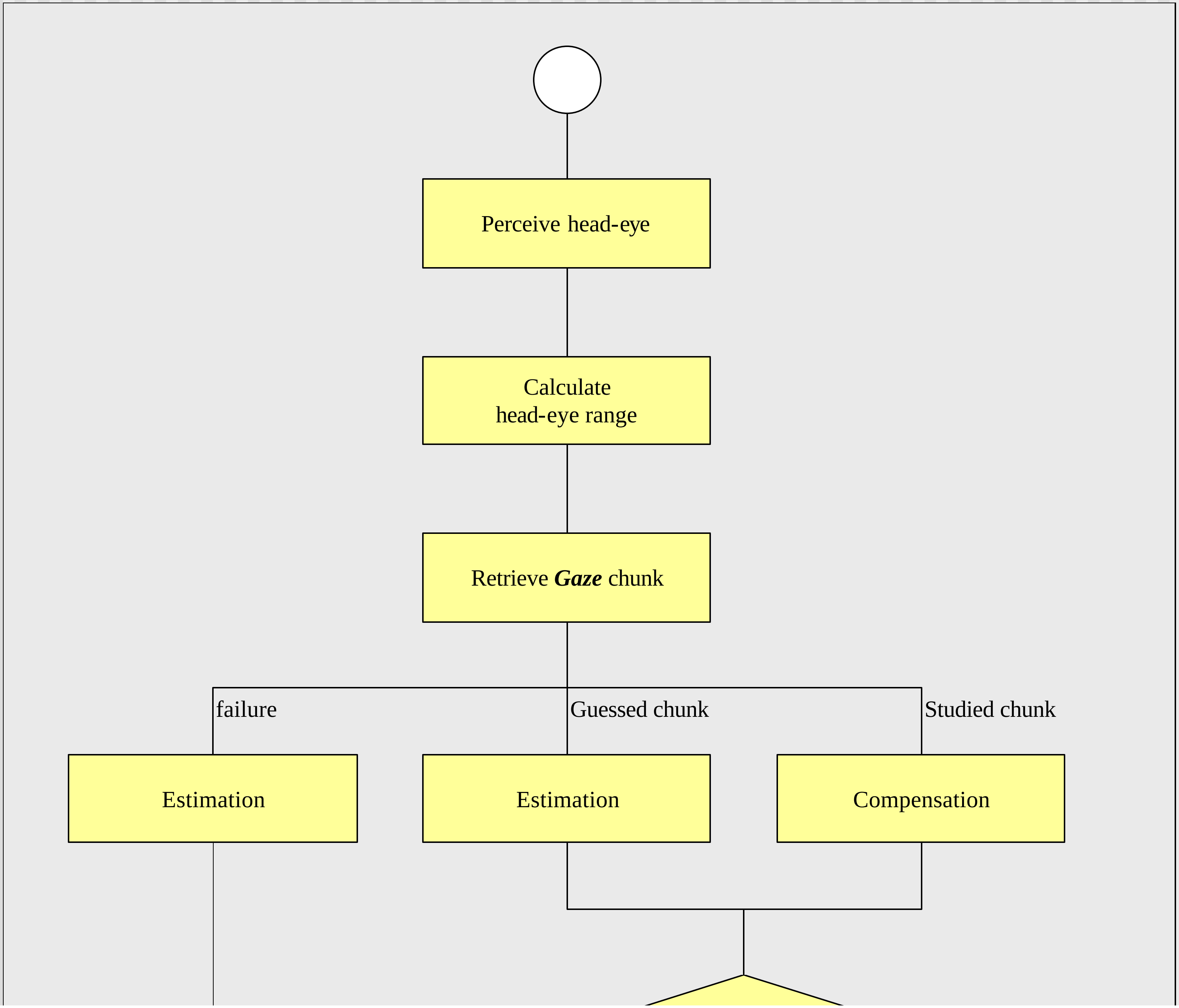
- Estimation Mechanism
  - Required when no feedback available and no prior knowledge
  - Range of *headeye* chunk

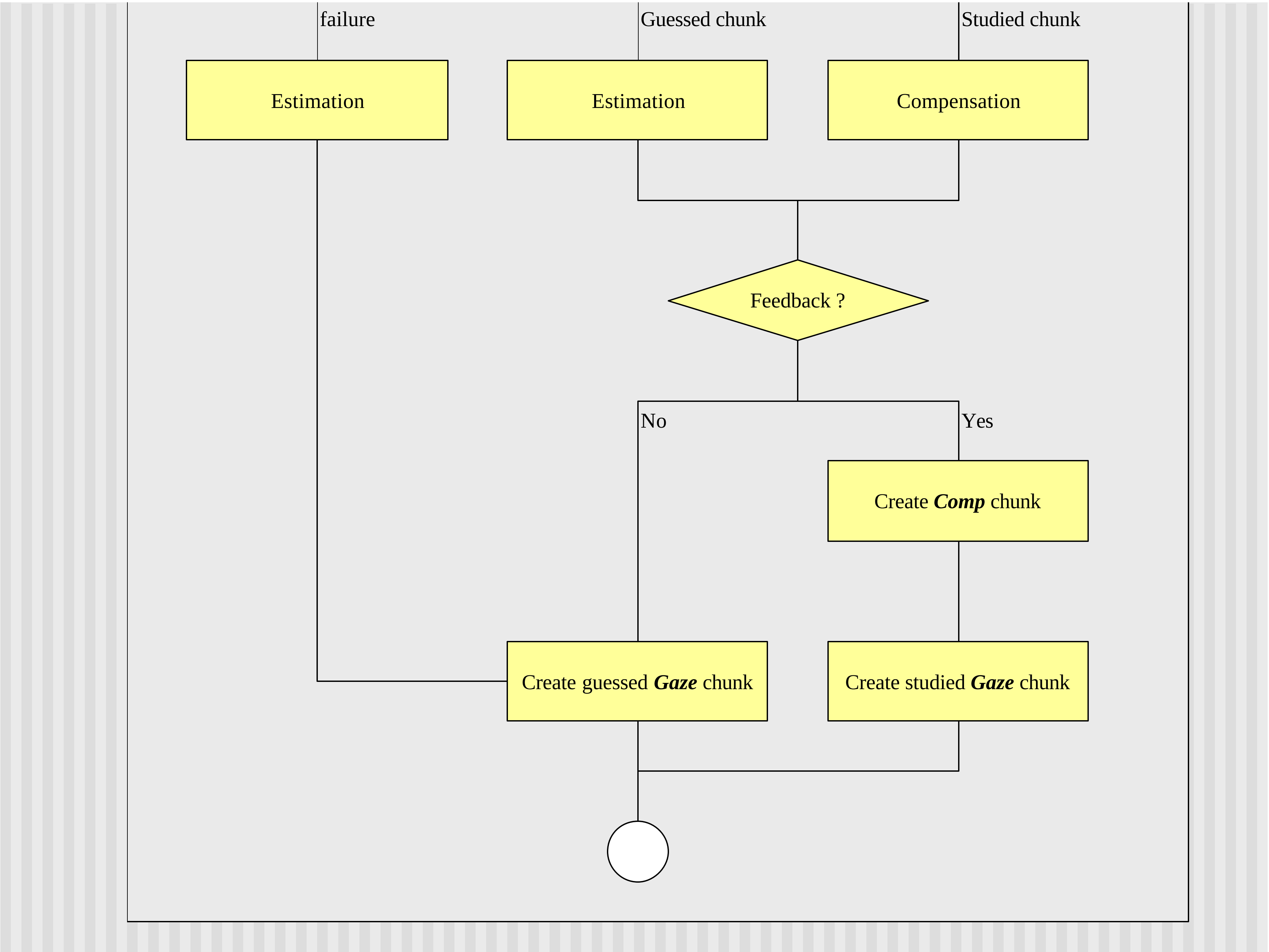
    ```
    (chunk-type he_dev_range maxx minx maxy
      miny)
    ```
  - Calculate target using interpolation

Model algorithm

- algorithm




Perceive head-eye
Calculate head-eye range
Retrieve ***Gaze*** chunk
failure
Guessed chunk
Studied chunk
Estimation
Estimation
Compensation

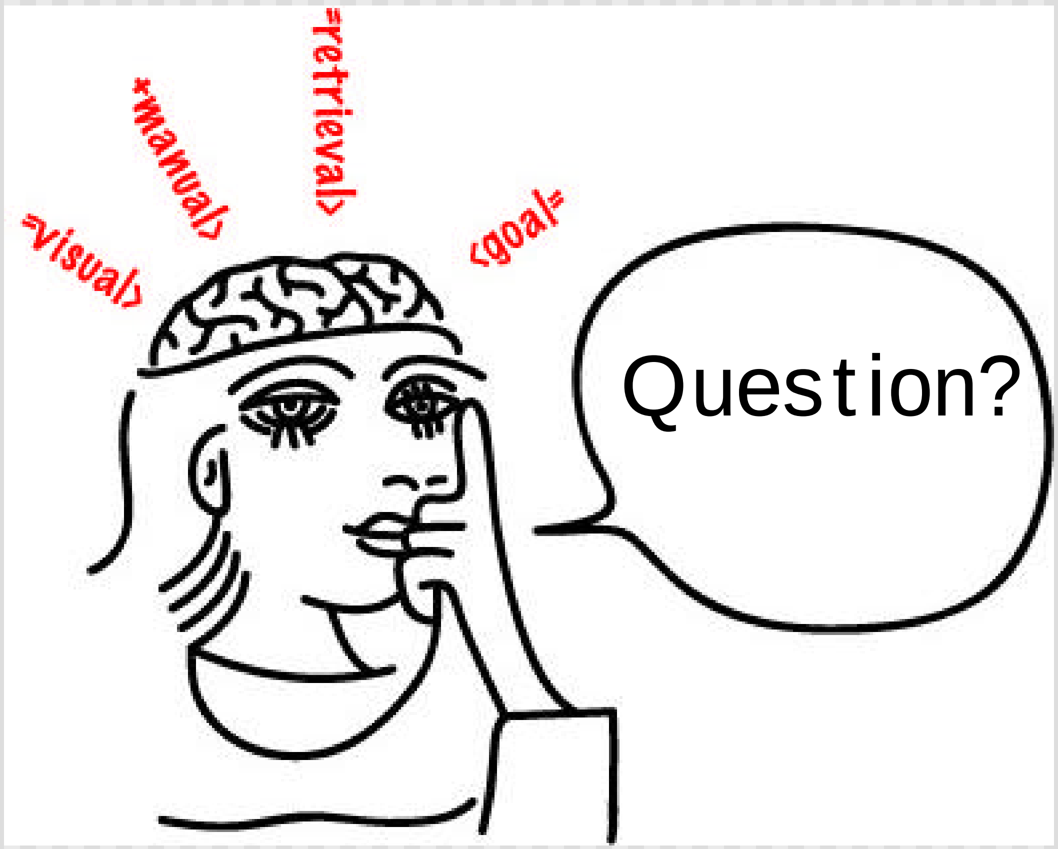

failure
Guessed chunk
Studied chunk
Estimation
Estimation
Compensation
Feedback ?
No
Yes
Create *Comp* chunk
Create guessed *Gaze* chunk
Create studied *Gaze* chunk

Model Result

Model Comparison

Future works

- Streaming inputs
- Continuous stimuli
- Contextual sensitive gaze prediction
- Changing of the gazer’s position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=retrieval>
<goal=
Question?