Query by Attention: Visually Searchable Information Maps

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Automobiles

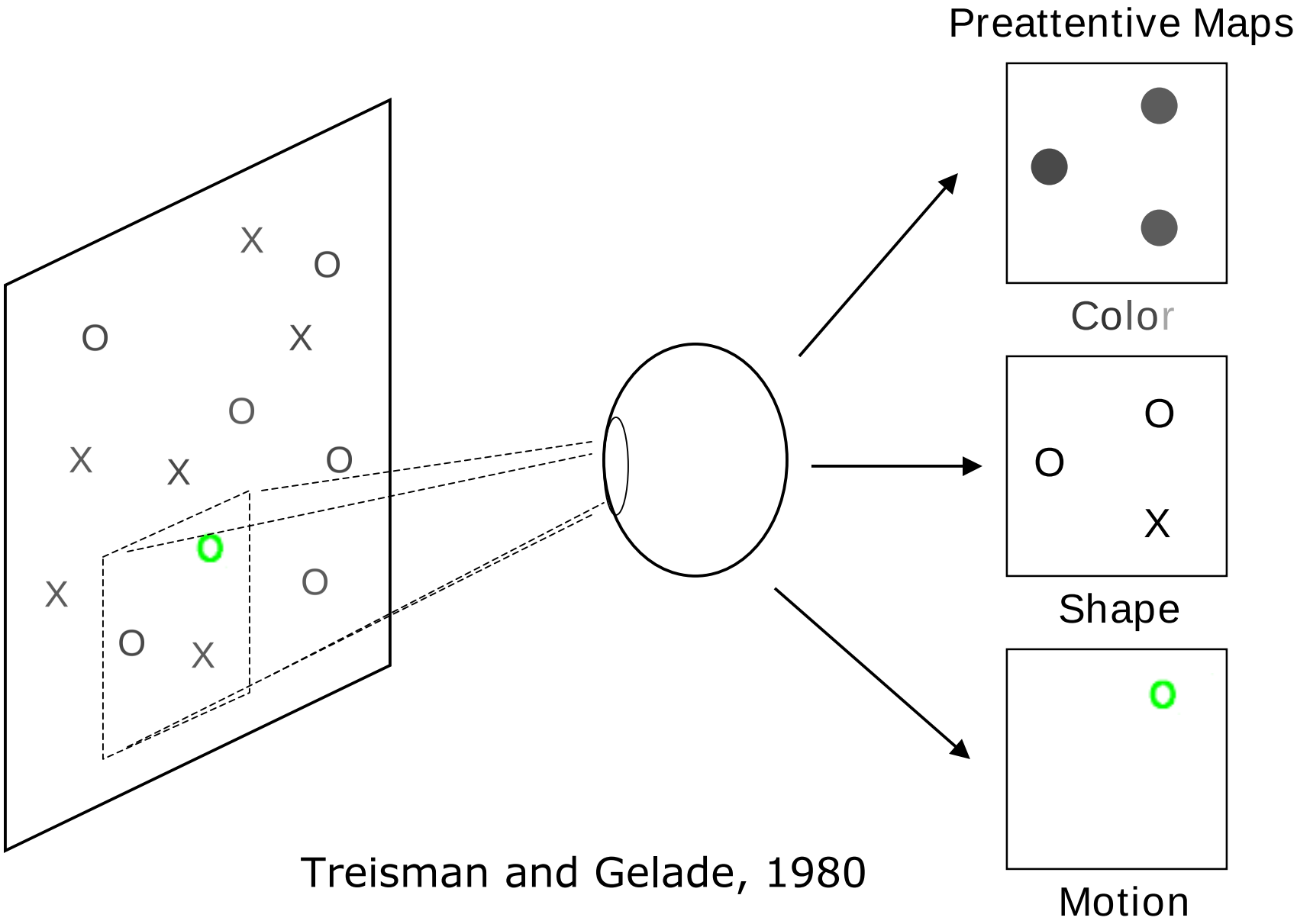
Price	Kilometers/Liter	Antilock brakes?
$18,000	6	No
$24,000	10	No
$20,000	8	No
$15,000	7	No
$12,000	6	No
$17,000	11	No
$13,000	10	Yes
$15,000	9	No
$18,000	6	No
$16,000	7	No
$19,000	9	No
$20,000	8	No
$32,000	4	No
$22,000	9	Yes
$26,000	7	No
$17,000	5	No
$10,000	11	No

Automobiles

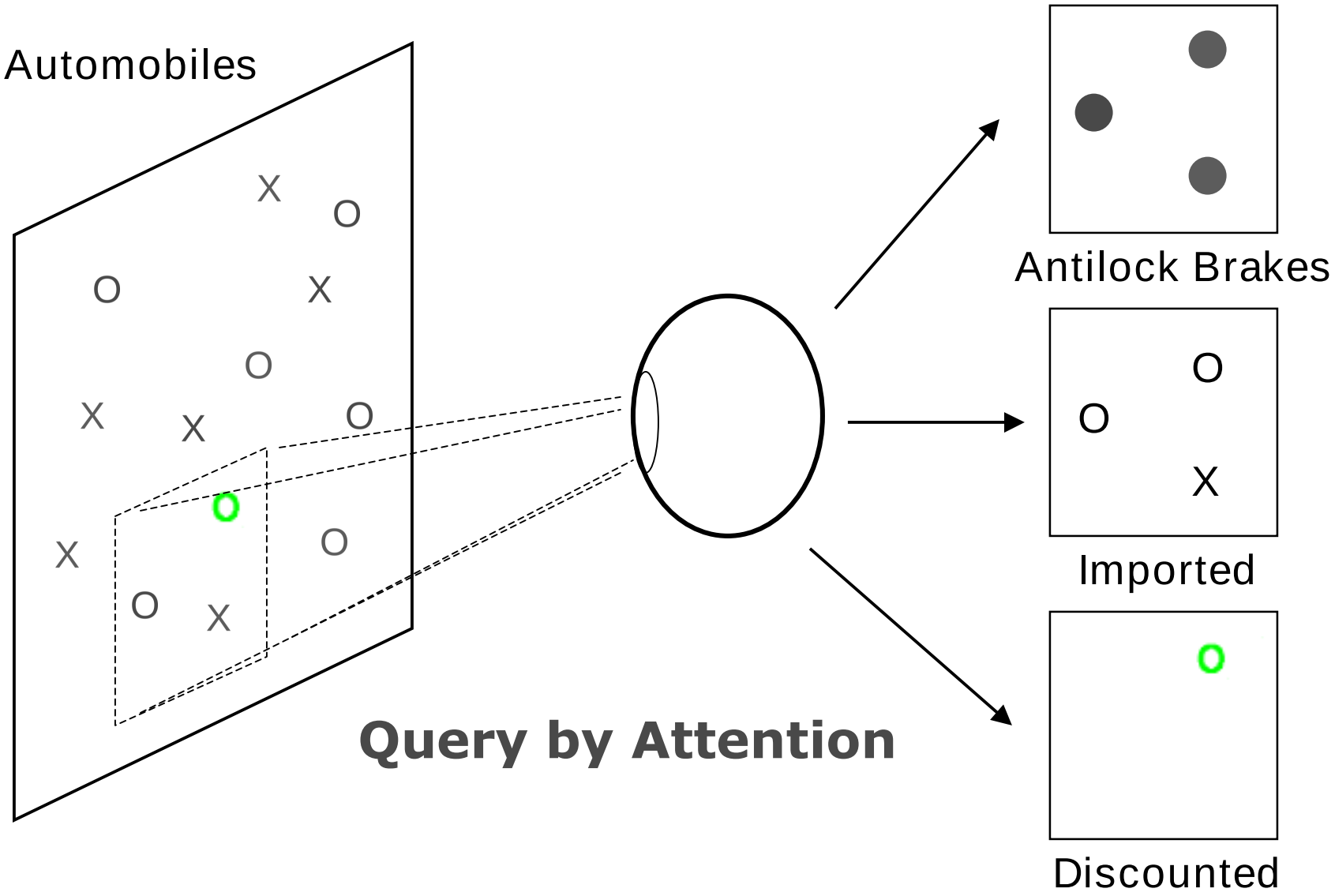
Outline

- **Query by Attention**
- **Review of Spatial Selection and Visual Search**
- **Mapping Info Dimensions onto Perceptual Dimensions**
- **Examples**
- **Related Work, Conclusion**

Perceptual Filtering



Information Filtering



Why Query by Attention?

- **User controls attention, instead of manipulating an interface**
- **Rapid adjustment of query parameters**
- **Immediate feedback**
- **Can lead to more complete exploration of info space**

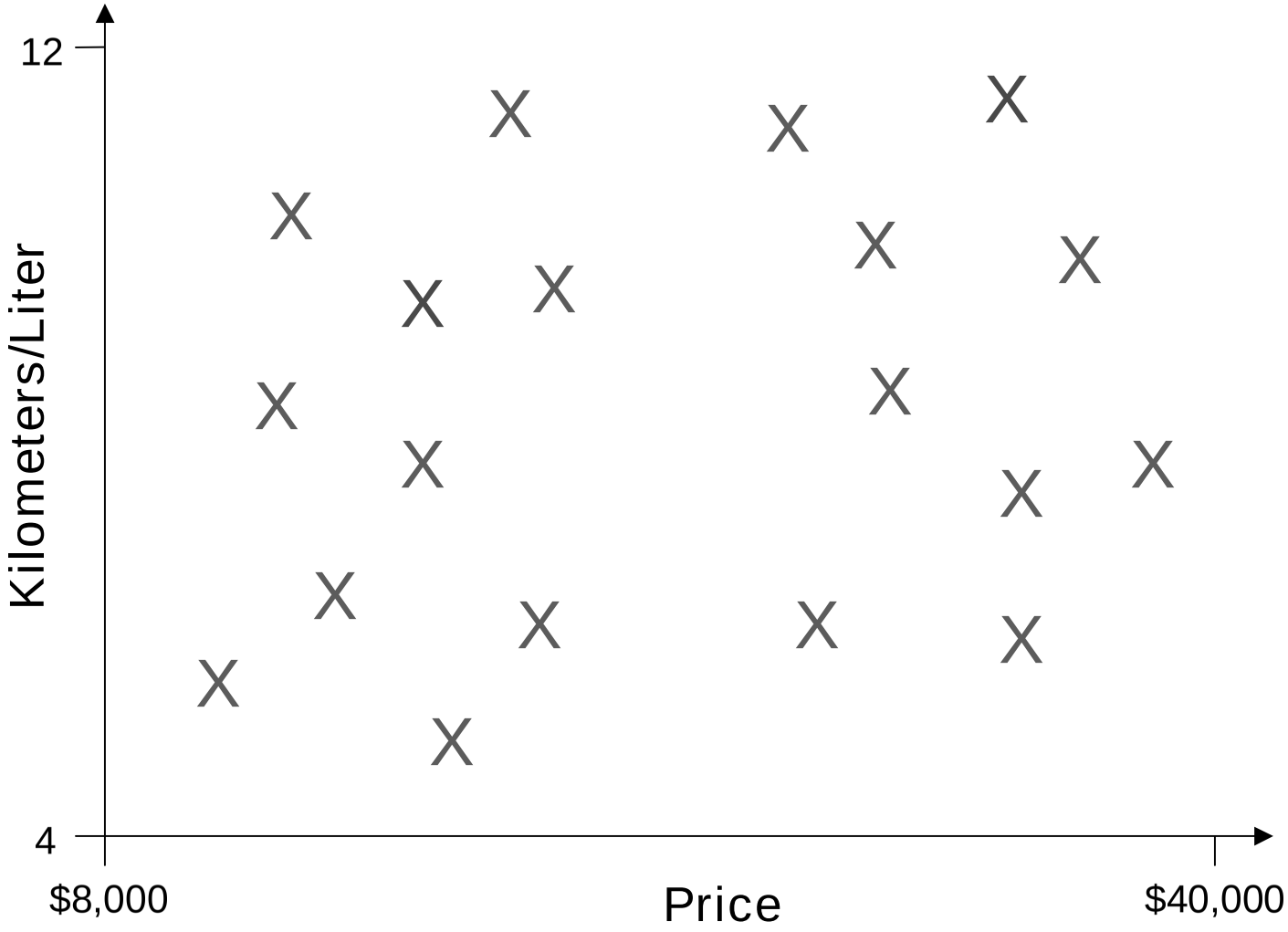
Good Perceptual Dimensions

- **Preattentive map**
  - **Attended items are immediately available**
- **Symmetric**
  - **Can filter for each kind of item equally well**
- **Many values**
  - **Can code information precisely**

Good Perceptual Dimensions

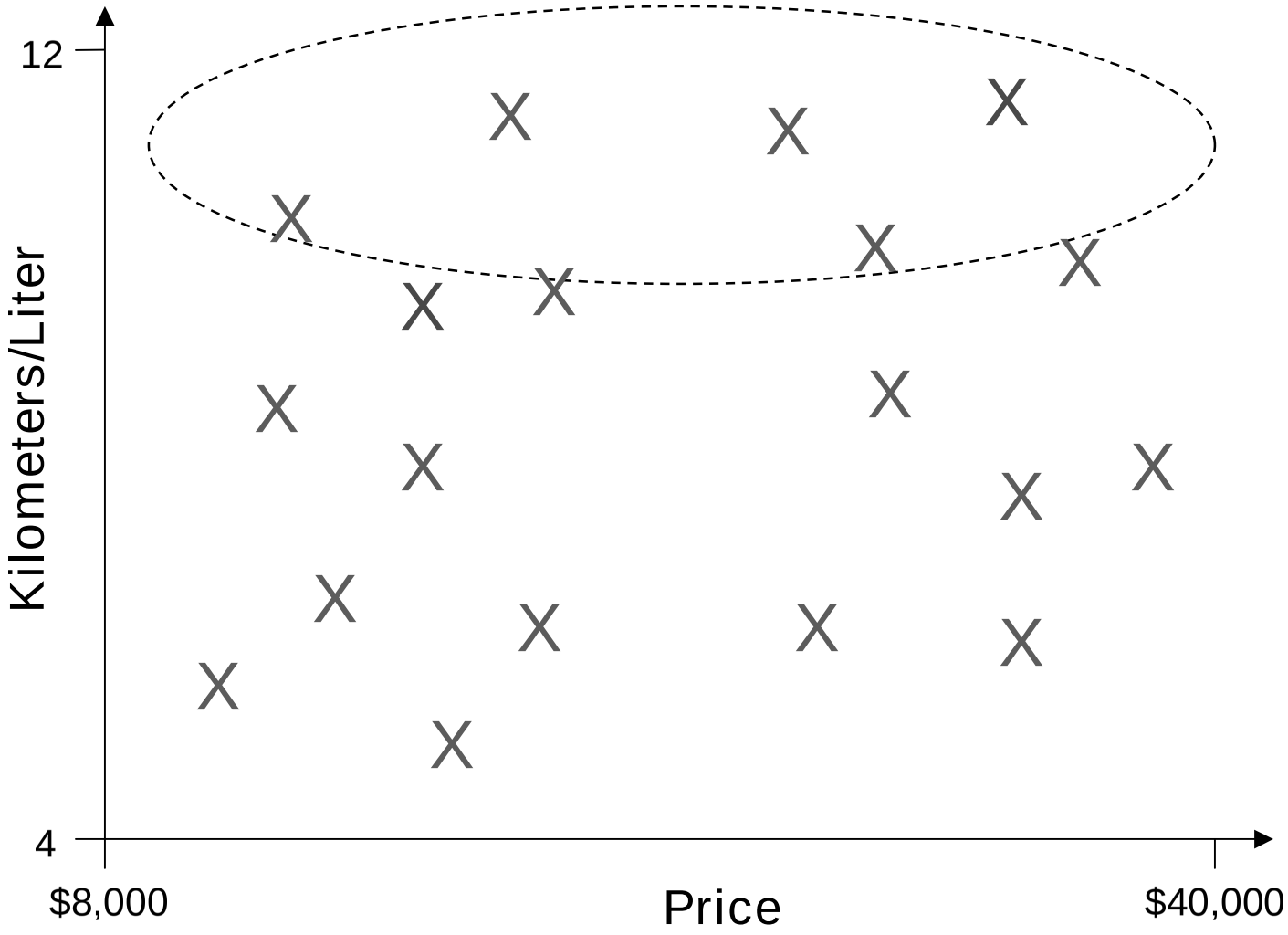
- **Spatial selection**
  - **Attention directed to contiguous regions**
- **Color**
- **Shape**
- **Depth**
- **Motion (not always symmetric)**
- **Size**

Spatial Selection



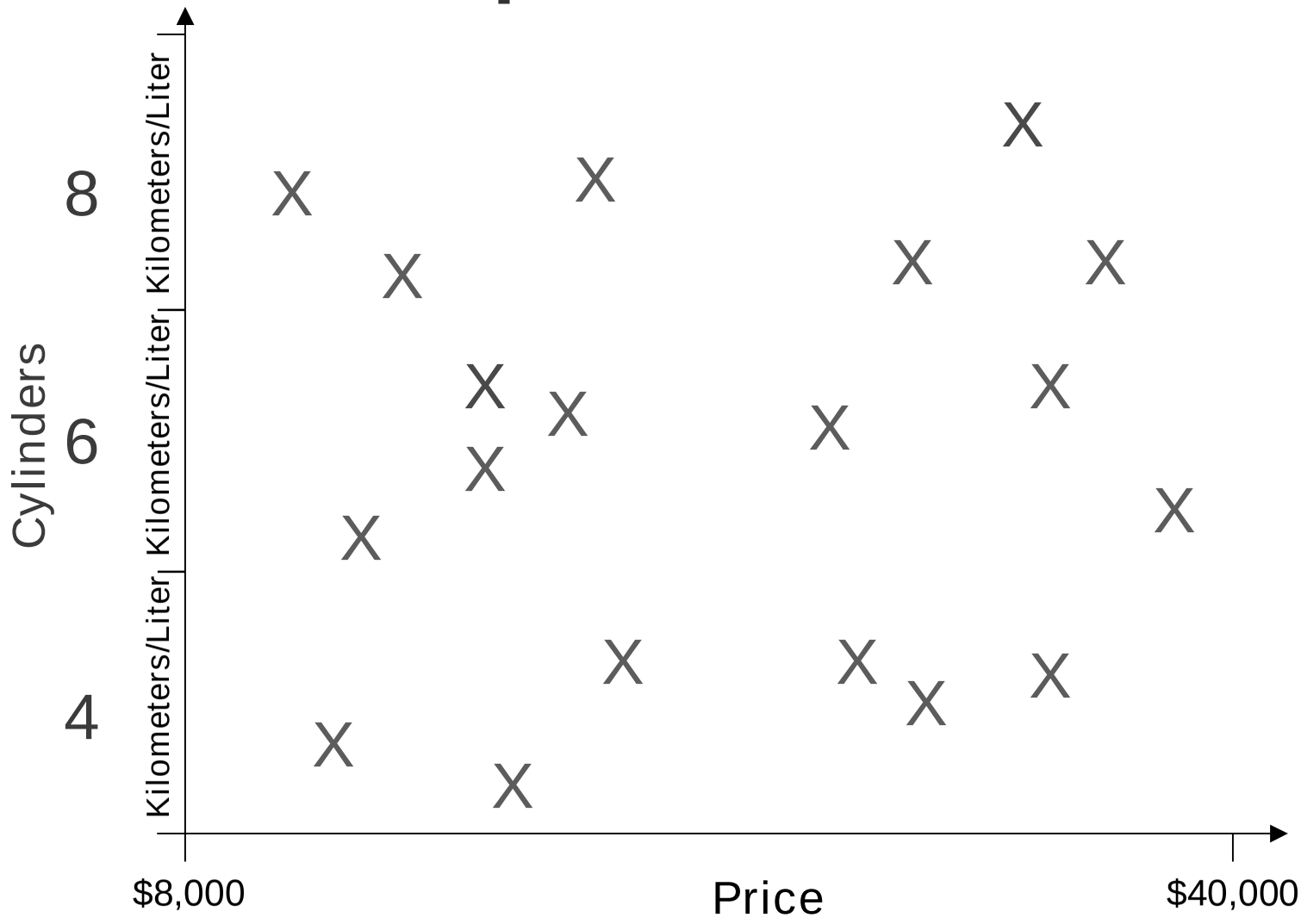
Zoom Lens Metaphor: Eriksen and St. James, 1986

Spatial Selection



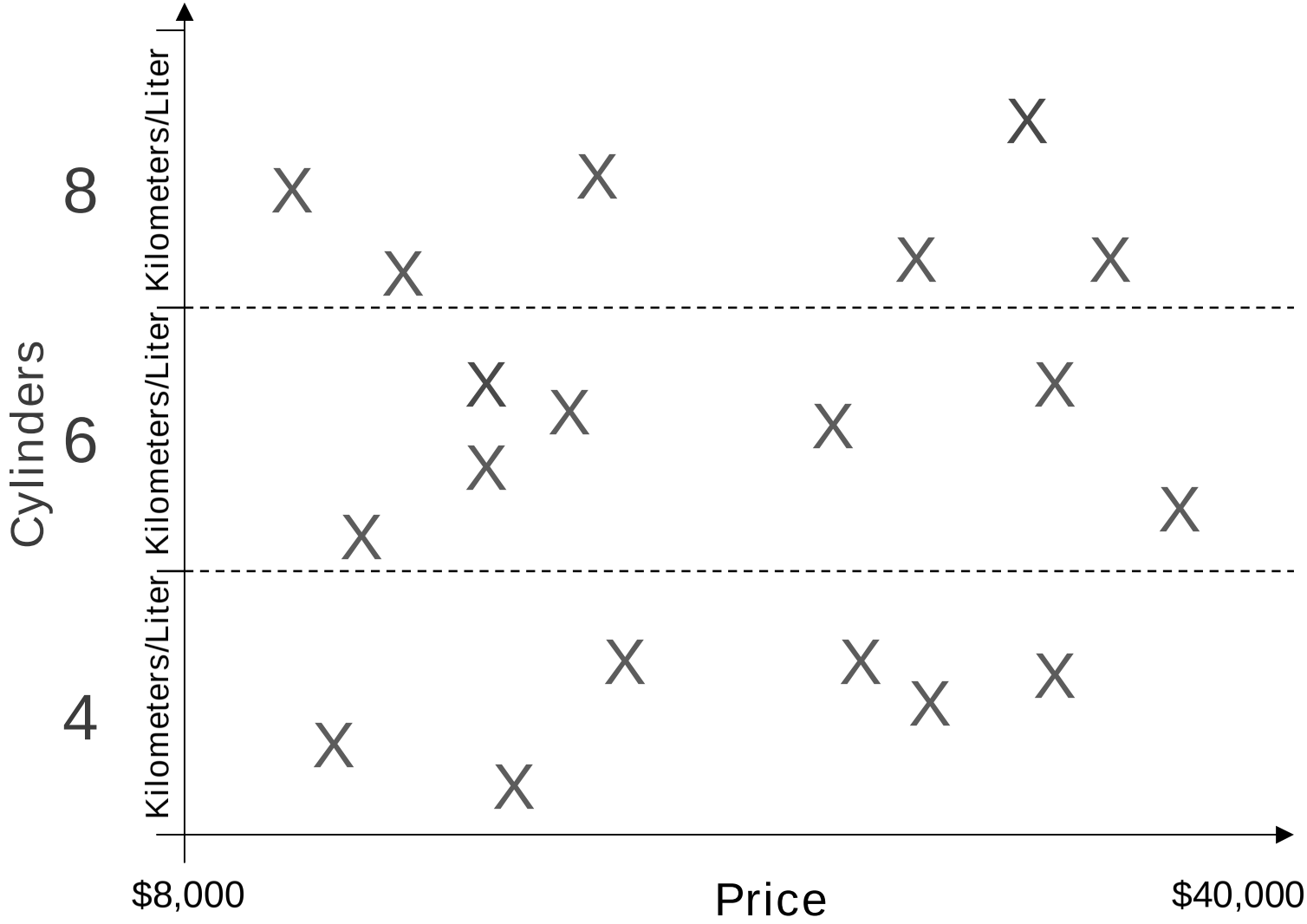
Zoom Lens Metaphor: Eriksen and St. James, 1986

Spatial Selection



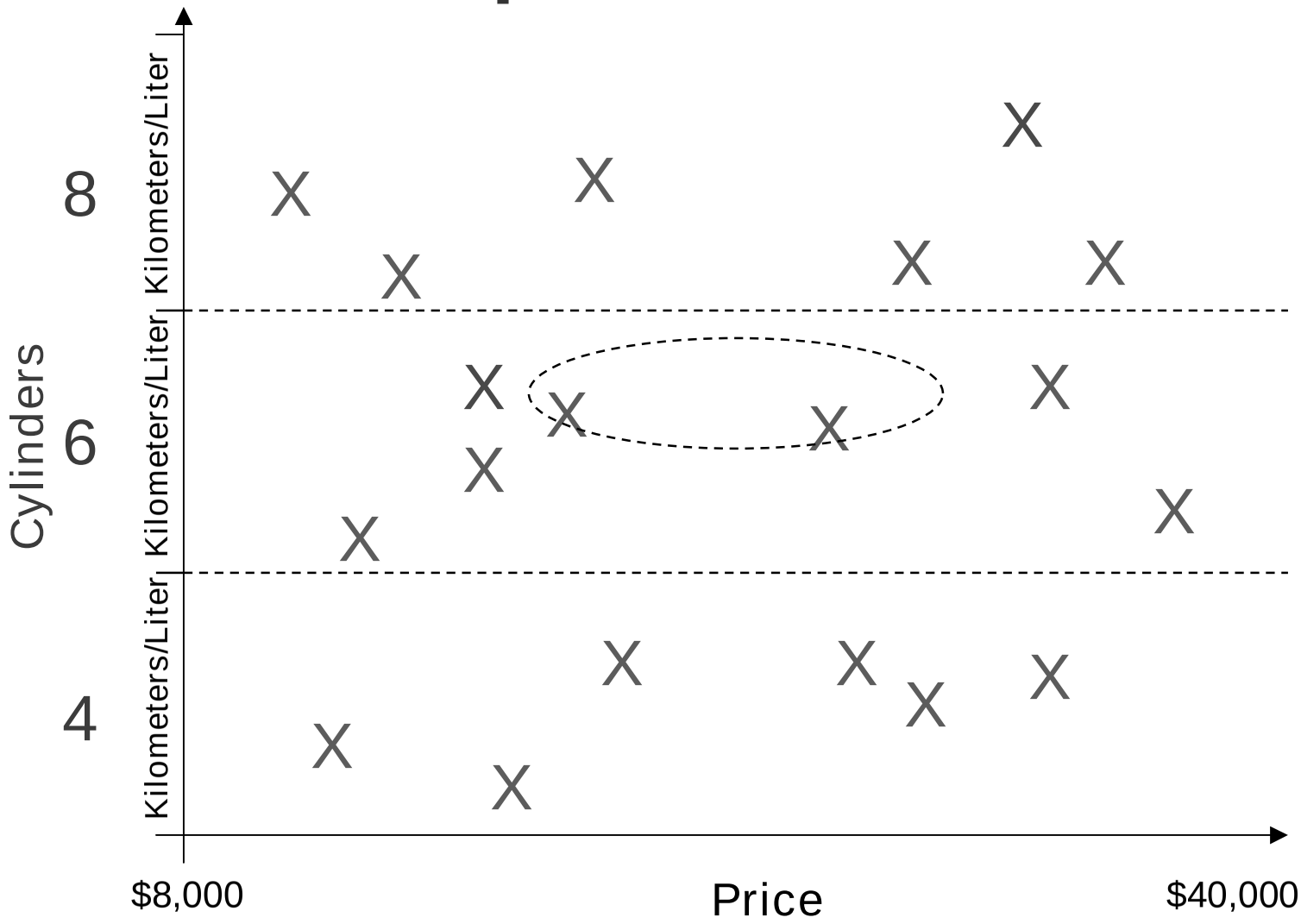
Hierarchical: One axis can code multiple attributes (Milhalisin et al., 1991)

Spatial Selection



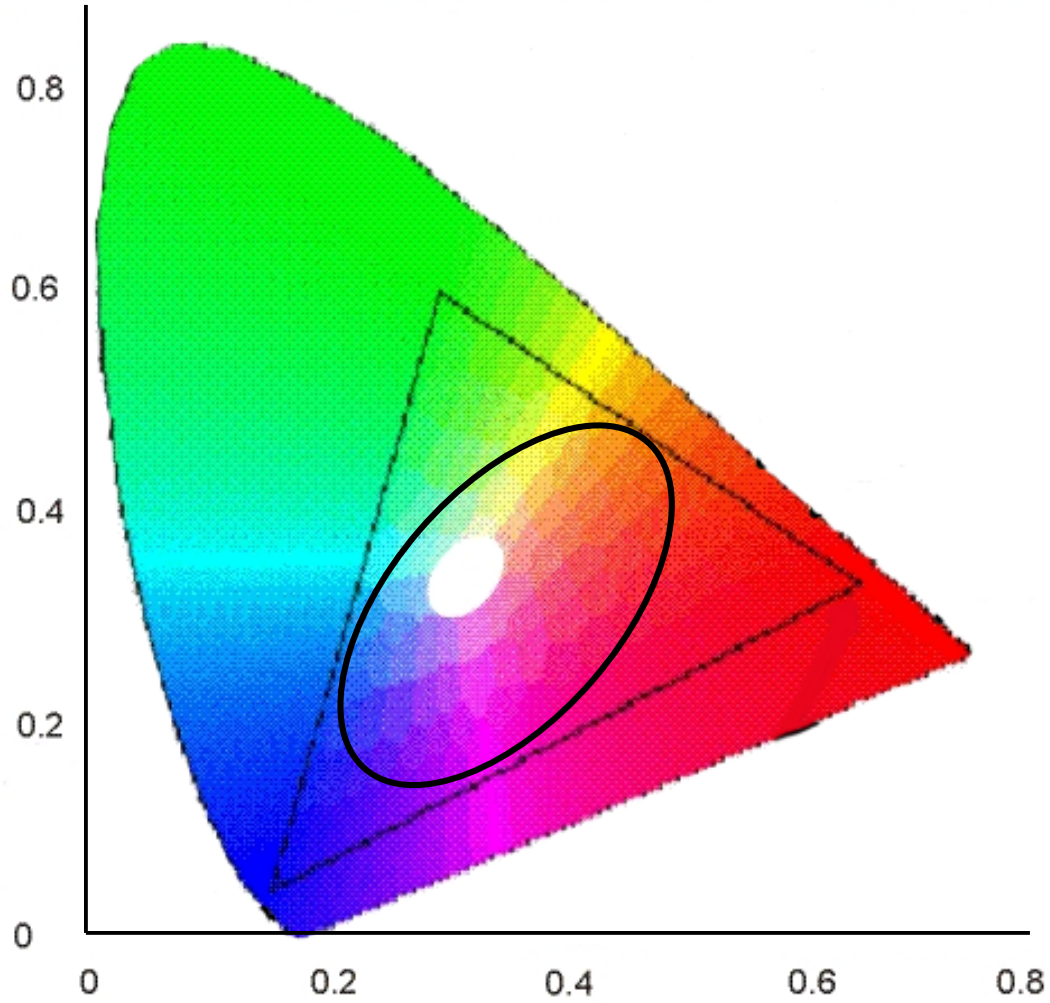
Hierarchical: One axis can code multiple attributes (Milhalisin et al., 1991)

Spatial Selection



Hierarchical: One axis can code multiple attributes (Milhalisin et al., 1991)

Color



Up to nine colors can be searched for efficiently (Zmura 1990, Smallman and Boynton 1990)

Shape

- **Many factors influence the efficiency of search**
  - **line terminations, closure, holes, intersections**
- **A conservative list**

- **A less conservative list**

Efficient Conjunctive Searches

- **Color and Shape**
  - **Egeth et al. 1984**
- **Motion and Shape**
  - **McLeod et al. 1988, McLeod et al. 1991**
- **Motion and Orientation**
  - **Driver and McLeod 1992**
- **Motion and Depth**
  - **Nakayama and Silverman, 1986**

Good Perceptual Dimensions

- **Spatial selection**
  - **Precise**
  - **Can query by range**
  - **Hierarchical**
- **Color**
  - **Nine values**
  - **Used discretely here**
- **Shape**
  - **Structure of this dimension poorly understood**

Mapping Information to Perception

Step 1: List likely queries and the info they need

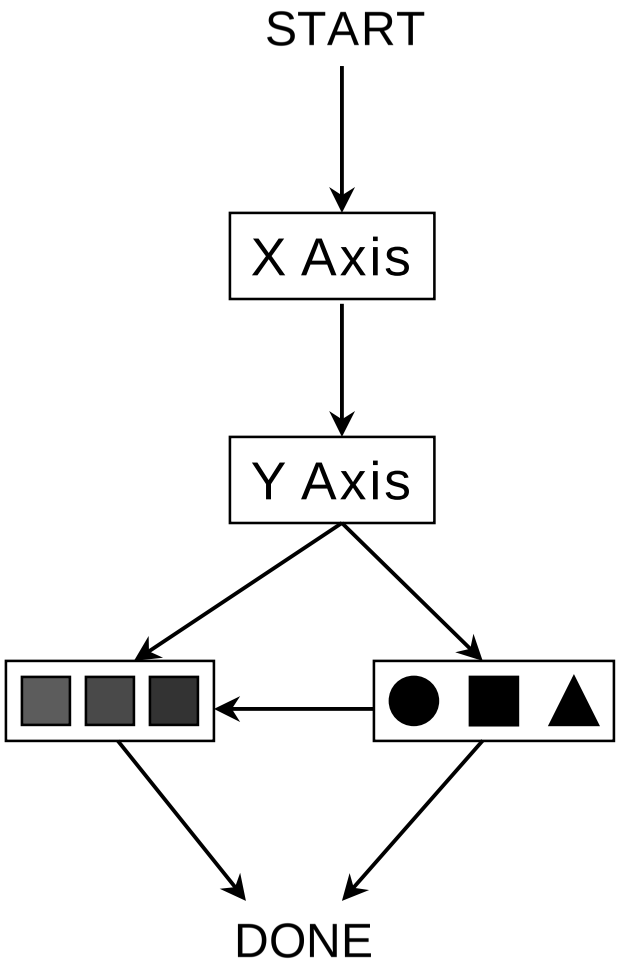
What recent comedies were good?	Year, Genre, Review
What were the 1980's Oscar-winners?	Year, Oscar
Has any horror film won an Oscar?	Genre, Oscar

Attribute set: Review, Year, Oscar, Genre, Title

Data modeling is hard! (PeopleFinder, Ellis et. Al. 1997)

Mapping Information to Perception

Step 2: Match info attributes to visual properties



Review

Year

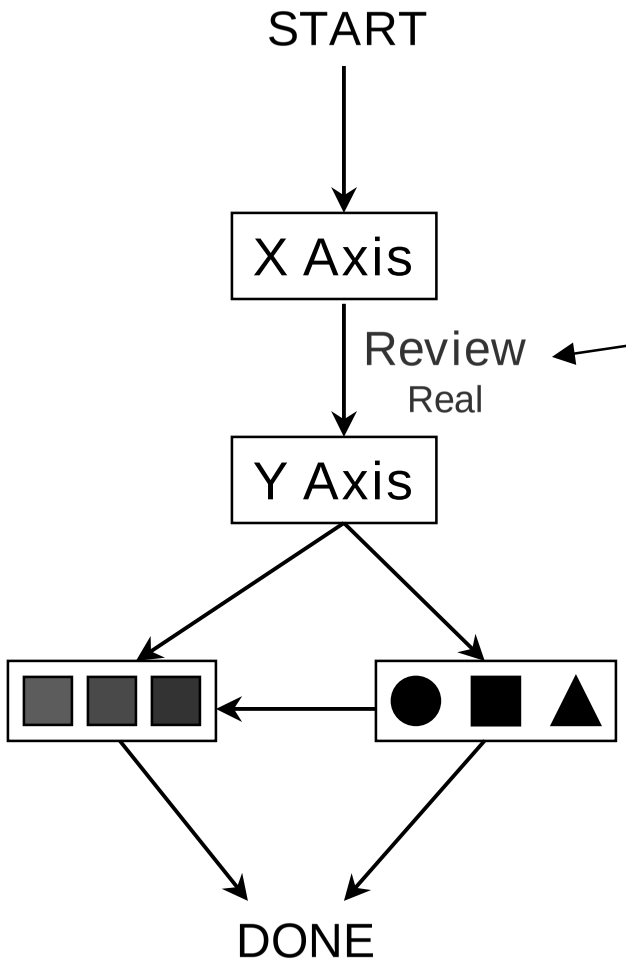
Oscar

Genre

Title

Mapping Information to Perception

Step 2: Match info attributes to visual properties



Review

Year

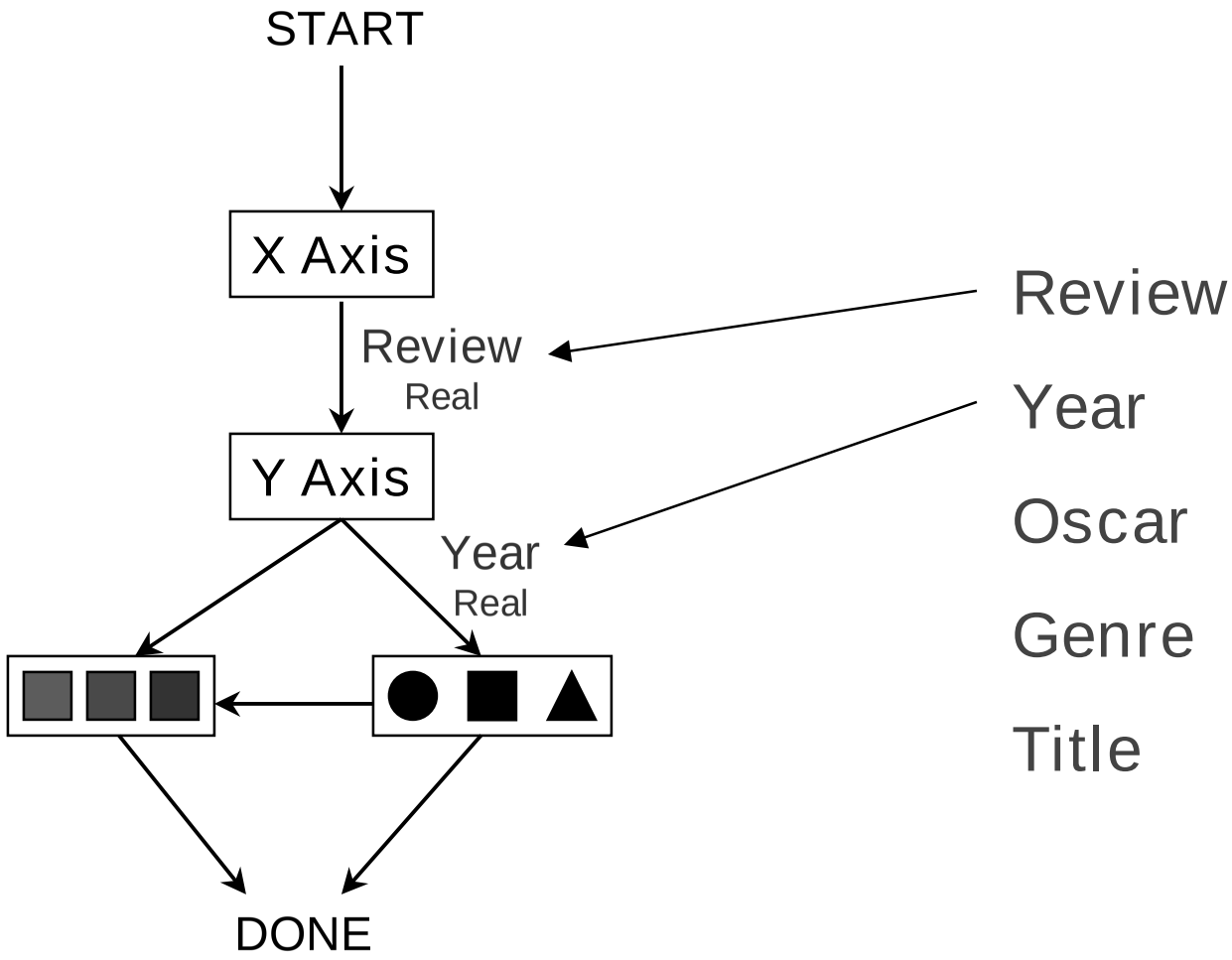
Oscar

Genre

Title

Mapping Information to Perception

Step 2: Match info attributes to visual properties



Mapping Information to Perception

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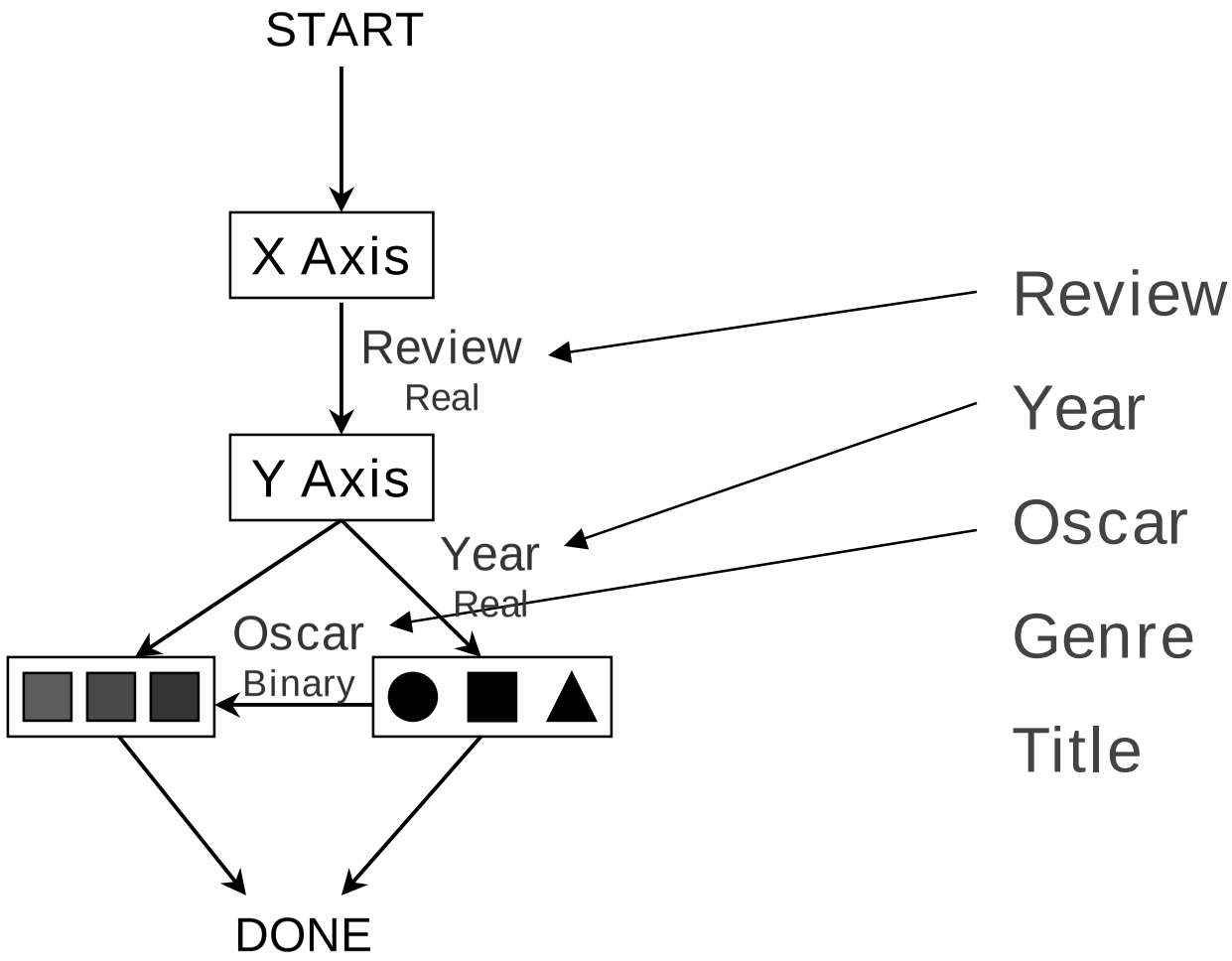
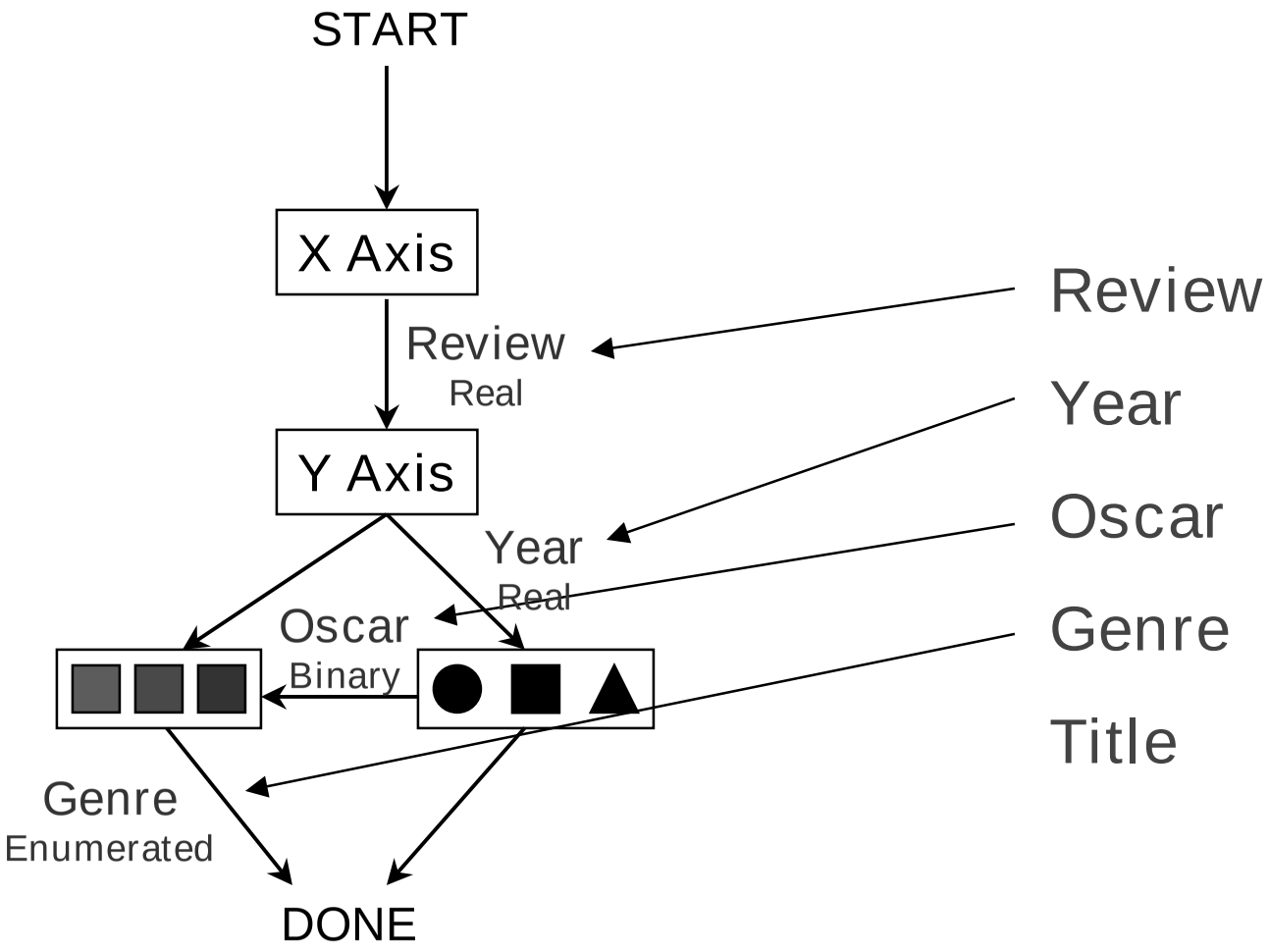


Mapping Information to Perception

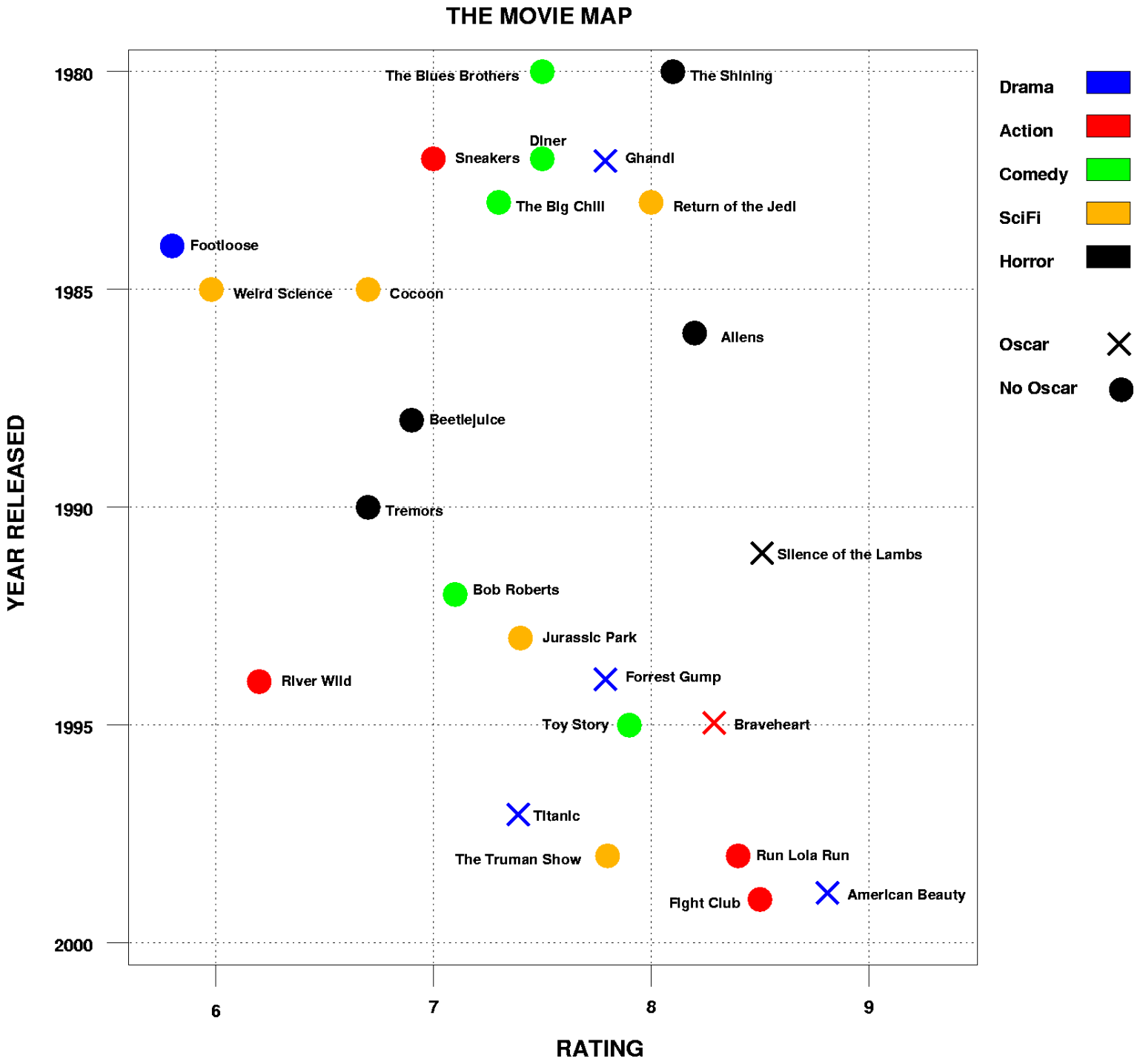
Step 2: Match info attributes to visual properties



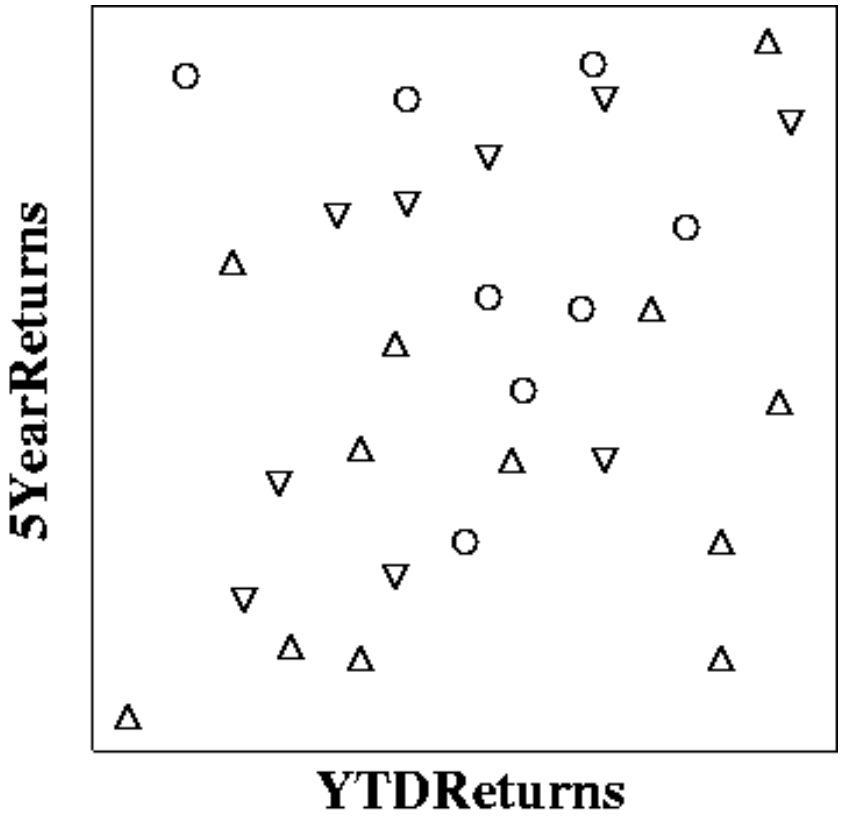
Mapping Information to Perception

Are perceptual dimensions used effectively?

What recent comedies were good?	Review Year Genre	X Position + Y Position + Color
What were the 1980's Oscar-winners?	Year Oscar	Y Position + Shape
Has any horror film won an Oscar?	Genre Oscar	Color + Shape

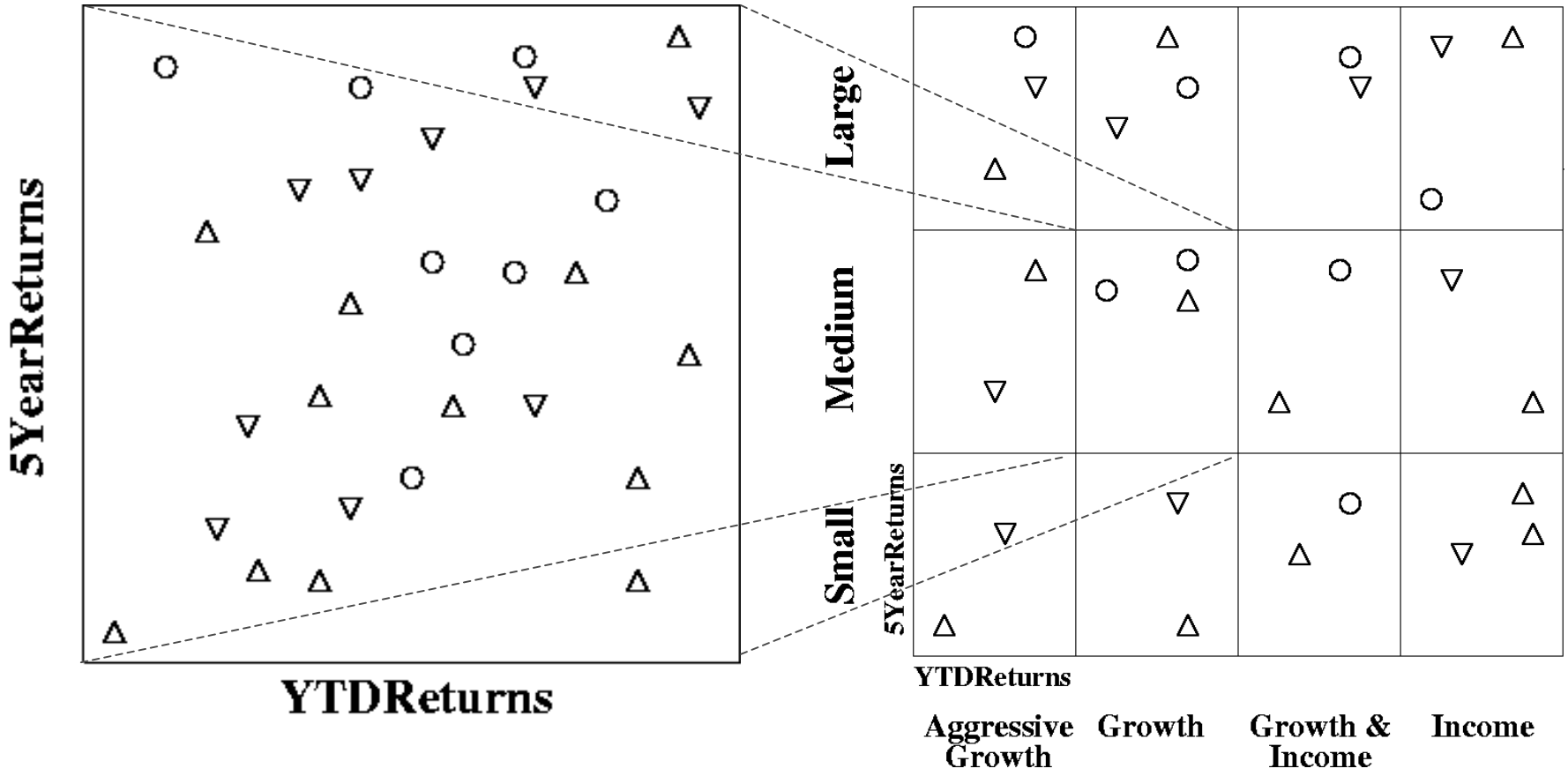

THE MOVIE MAP
YEAR RELEASED
1980
1985
1990
1995
2000
RATING
6
7
8
9
The Blues Brothers
The Shining
Diner
Sneakers
Ghandi
The Big Chill
Return of the Jedi
Footloose
Weird Science
Cocoon
Aliens
Beetlejuice
Tremors
Silence of the Lambs
Bob Roberts
Jurassic Park
River Wild
Forrest Gump
Toy Story
Braveheart
Titanic
The Truman Show
Run Lola Run
Fight Club
American Beauty
Drama
Action
Comedy
SciFi
Horror
Oscar
No Oscar

Mutual Funds



Volatility: △ High ○ Average ▽ Low

Mutual Funds



Volatility: △ High ○ Average ▽ Low

Related Work

- **Interactive information filtering**
  - **Ahlberg and Shneiderman, CHI 1994**
  - **Spotfire www.spotfire.com**
- **Studies of user attention**
  - **Pirolli et al., CHI 2001**
- **Presentation design systems**
  - **VQE (Derthick et al. UIST 1997)**

Future Work

- **Handling large numbers of items**
  - **IMDB: 12,511 films 1980-2001**
  - **Let user filter first**
- **Handling many information attributes**
  - **Multiple views, dimension reduction**
- **Making it easy to create these kinds of maps**
  - **Assisting or automating info design**

Conclusion

- **People perceptually filter.**
- **Take advantage to filter abstract information.**
- **A method to map information dimensions to perceptual dimensions.**