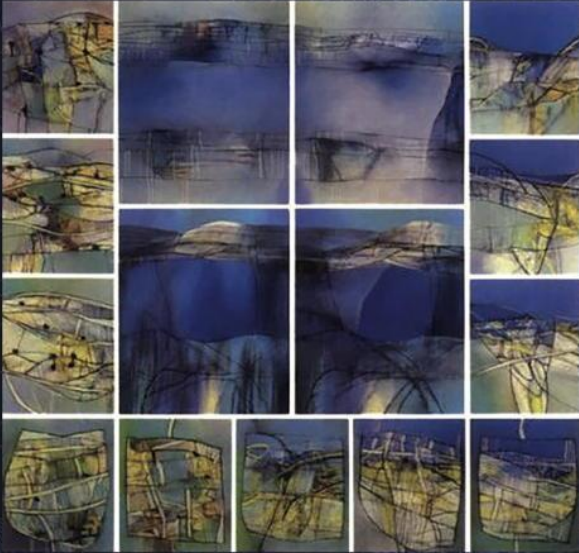


ARTIFICIAL INTELLIGENCE

Humans at the Heart of Algorithms

Second Edition



Alan Dix

A Chapman & Hall Book

 CRC Press
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Chapter 5

Machine learning

The knowledge elicitation bottleneck

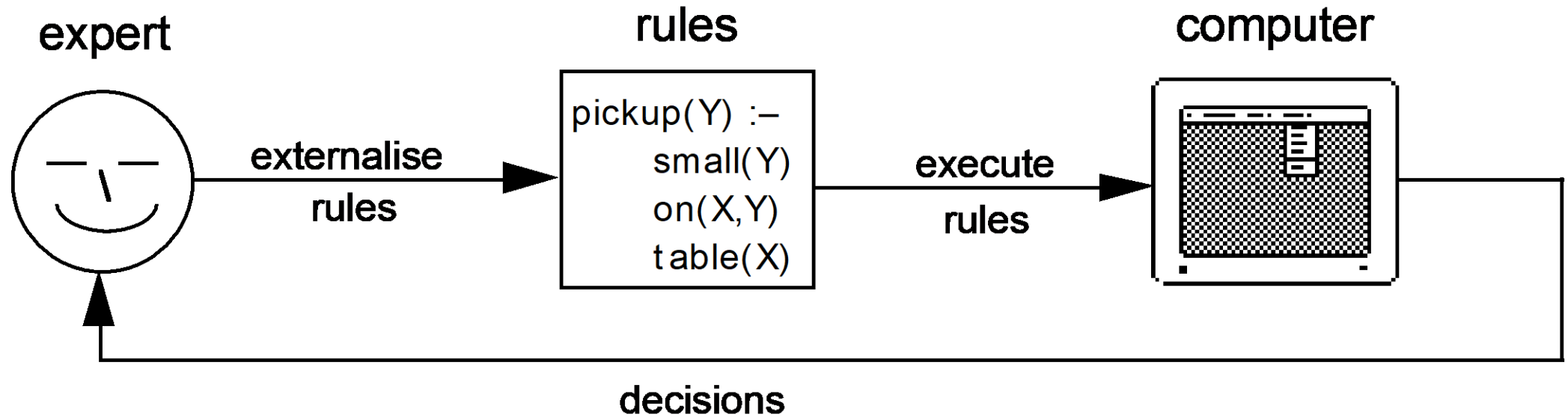


Fig. 5.1

Machine learning avoids the bottleneck

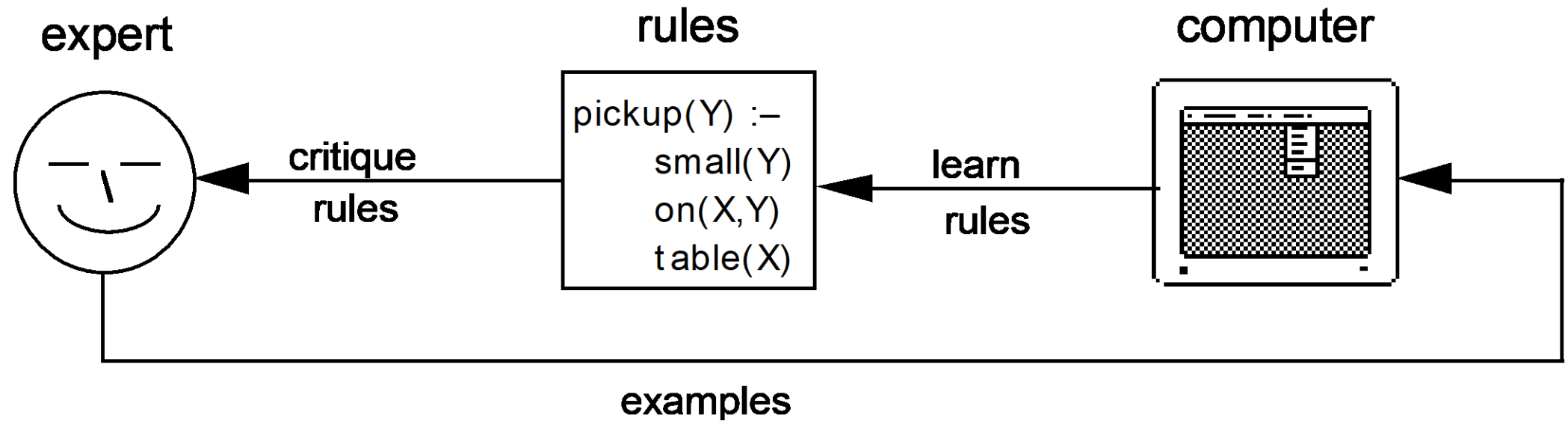


Fig. 5.2

Phases of machine learning

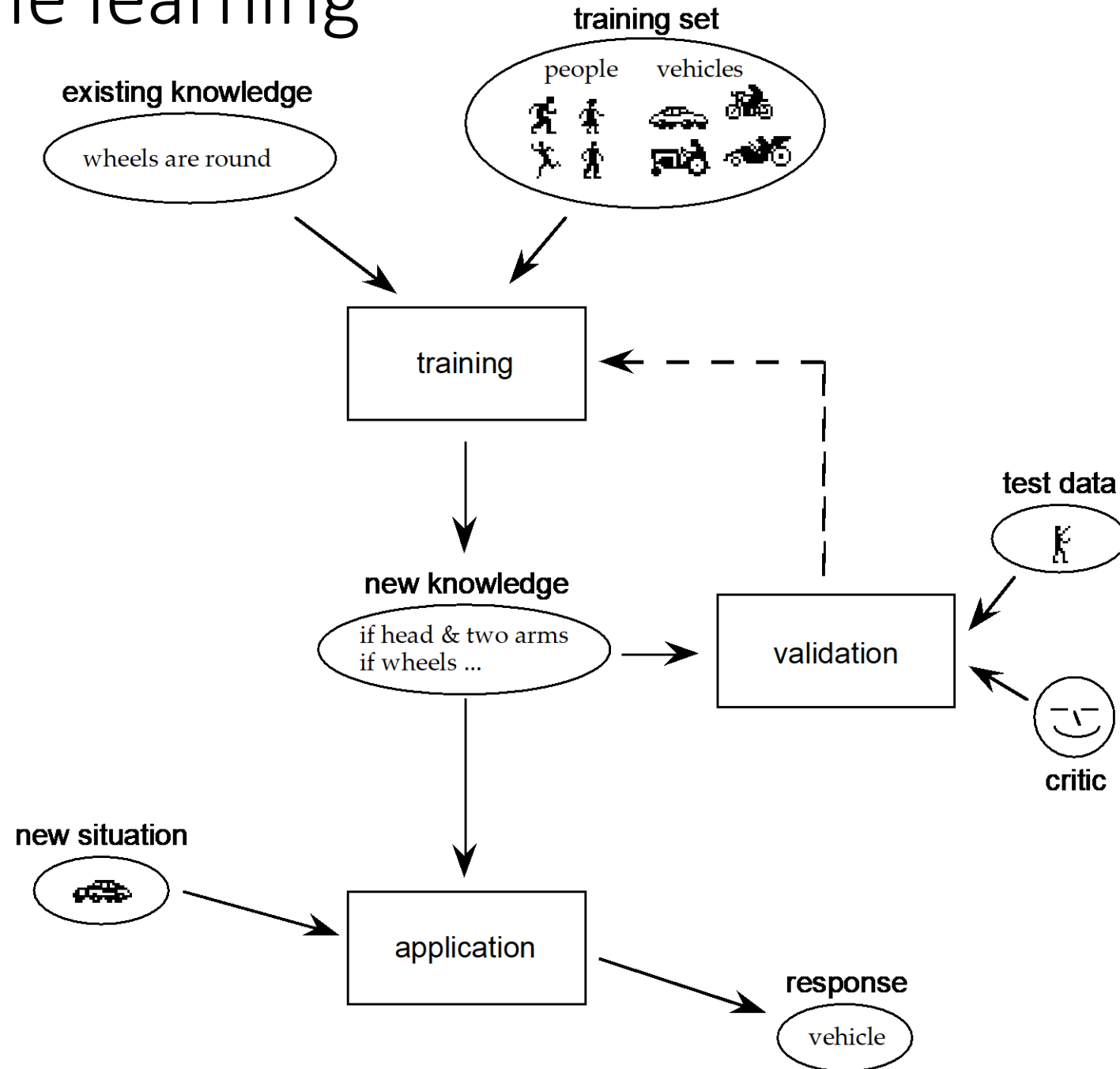


Fig. 5.3

Knowledge continuum

knowledge-rich

deductive learning

explanation-based learning

case-based reasoning

inductive learning

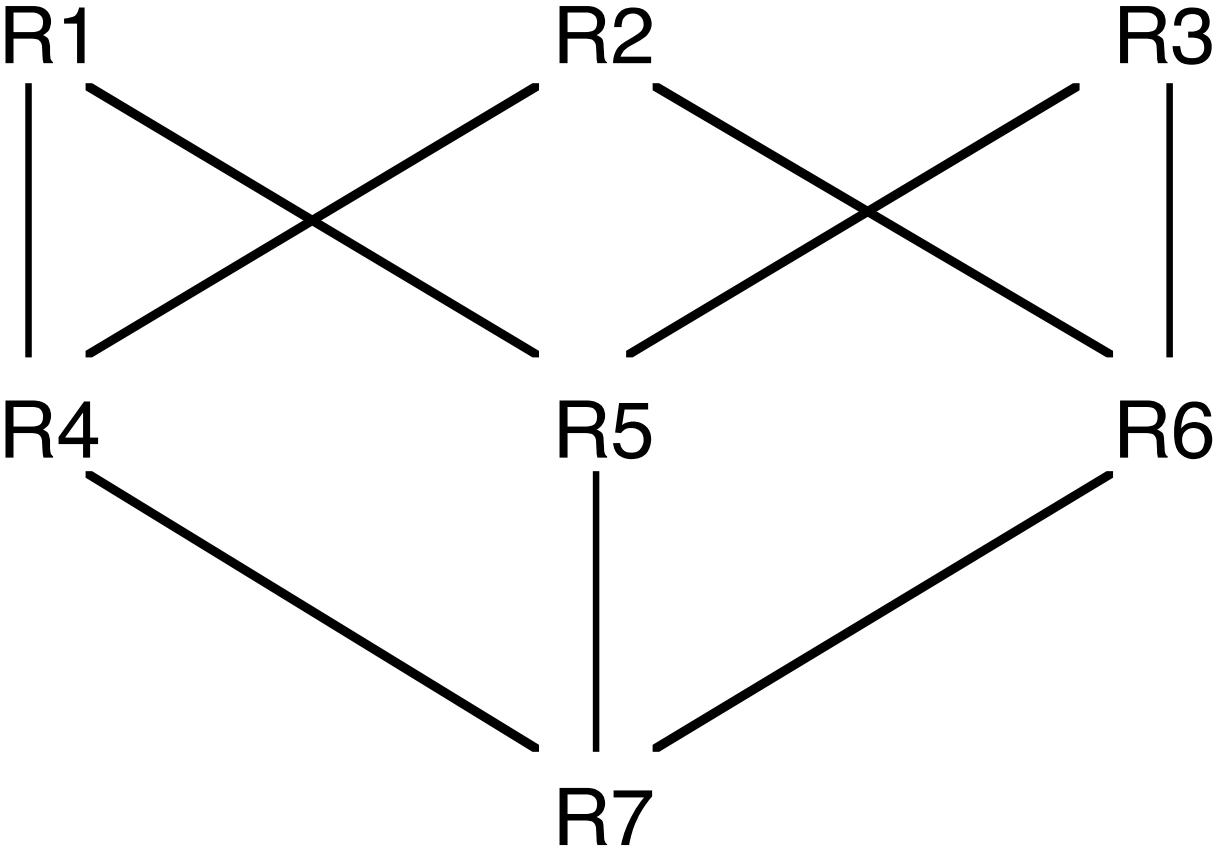
knowledge-poor

neural networks



Fig. 5.4

Rule lattice



most general rules

most specific rule

Fig. 5.5

Shape taxonomy.

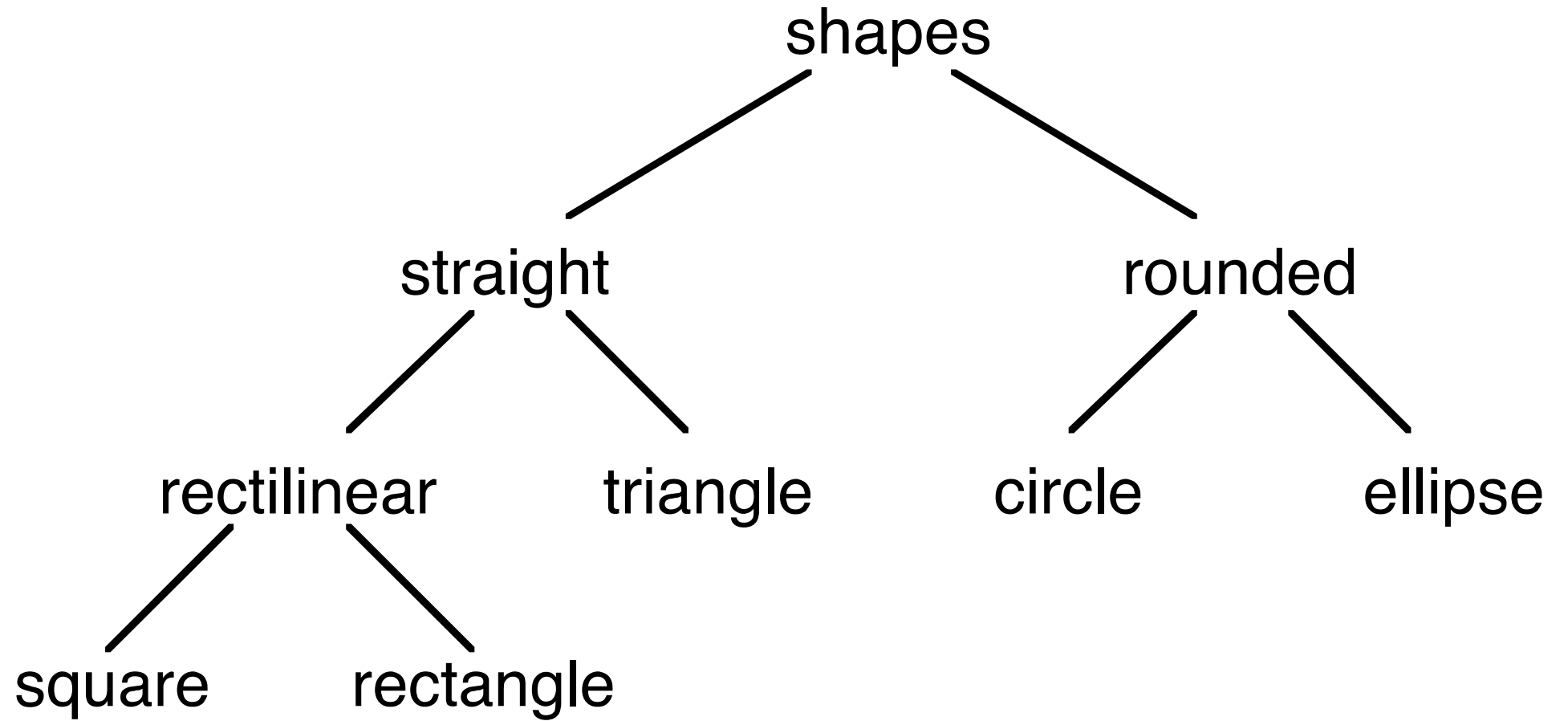


Fig. 5.6

Decision tree

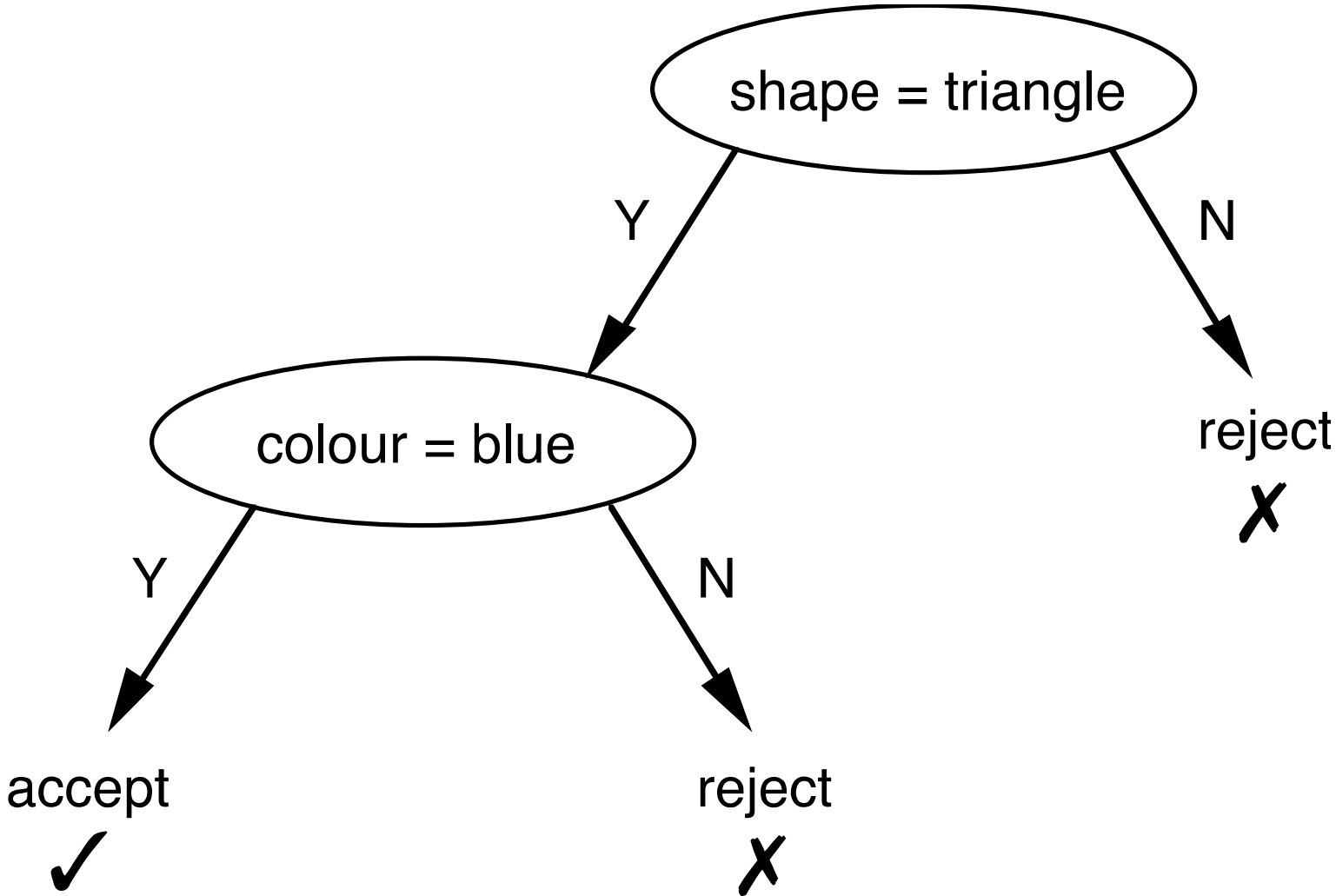


Fig. 5.7

Starting to build a decision tree.

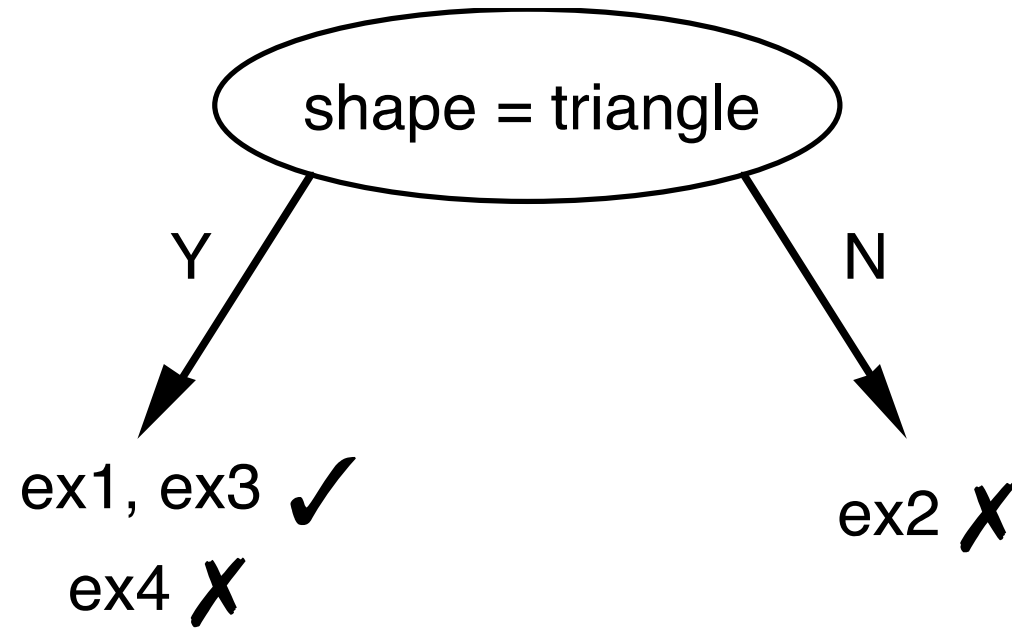


Fig. 5.8

Completed tree

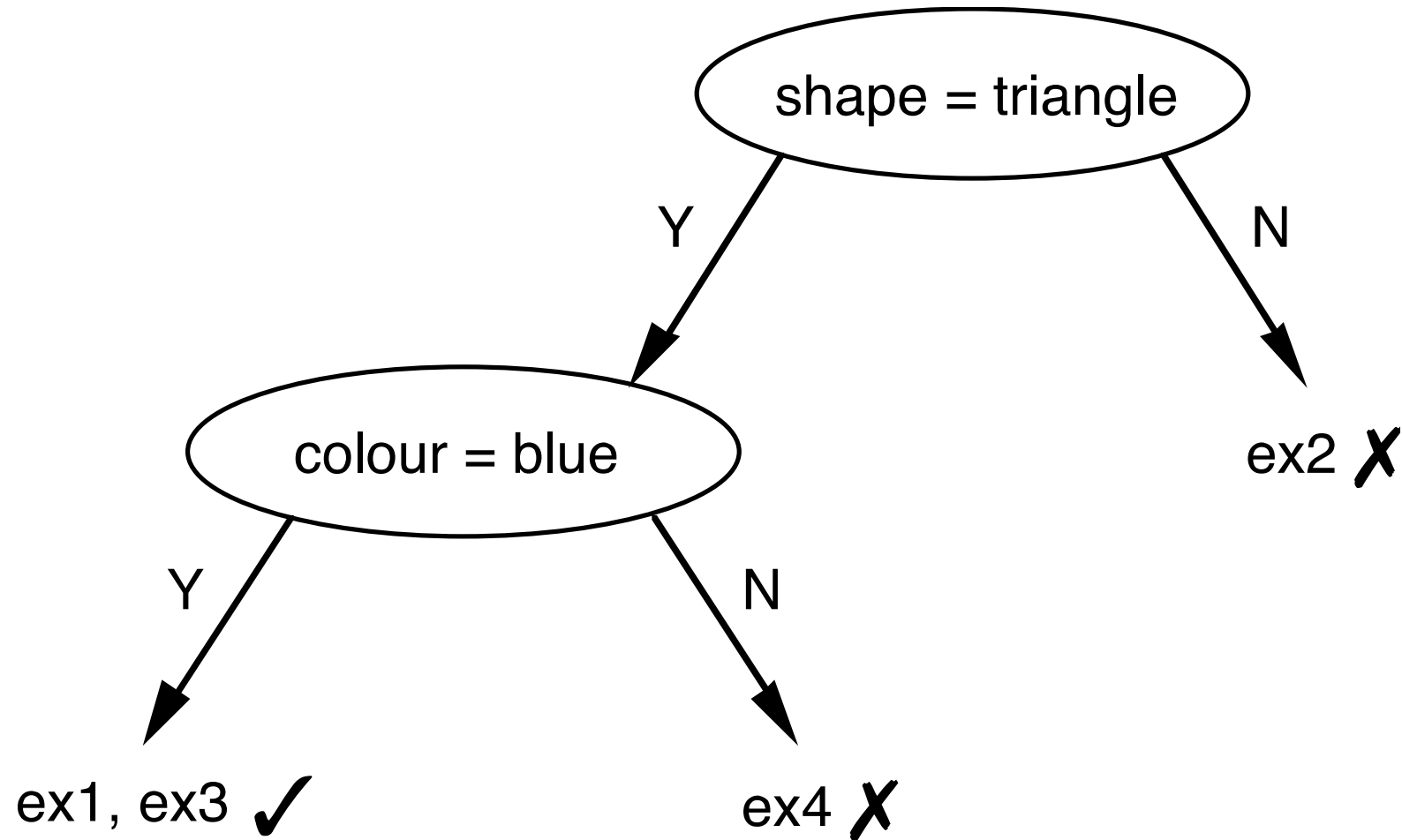


Fig. 5.9

Starting a different tree

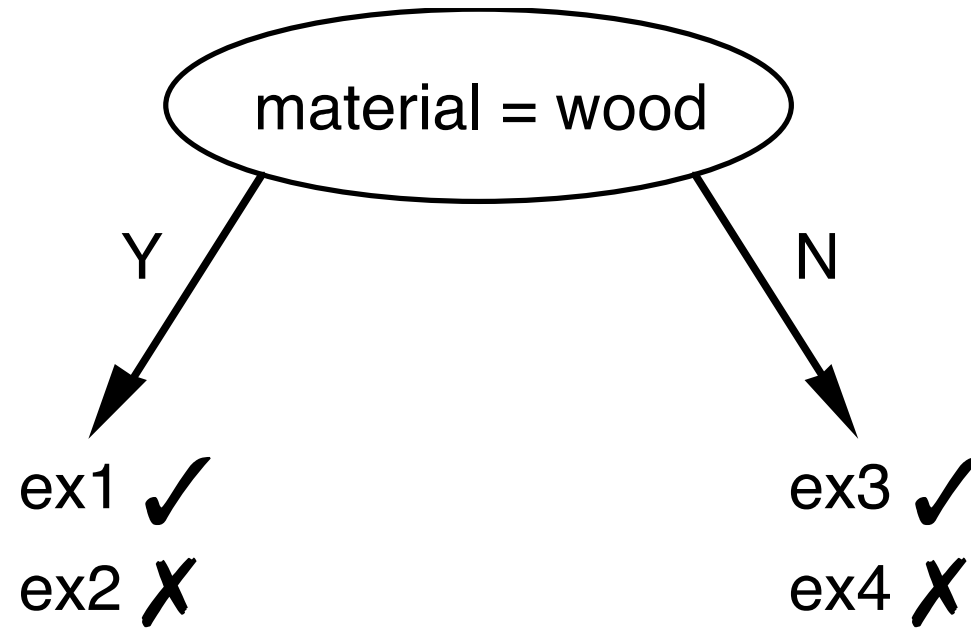


Fig. 5.10

A different decision tree

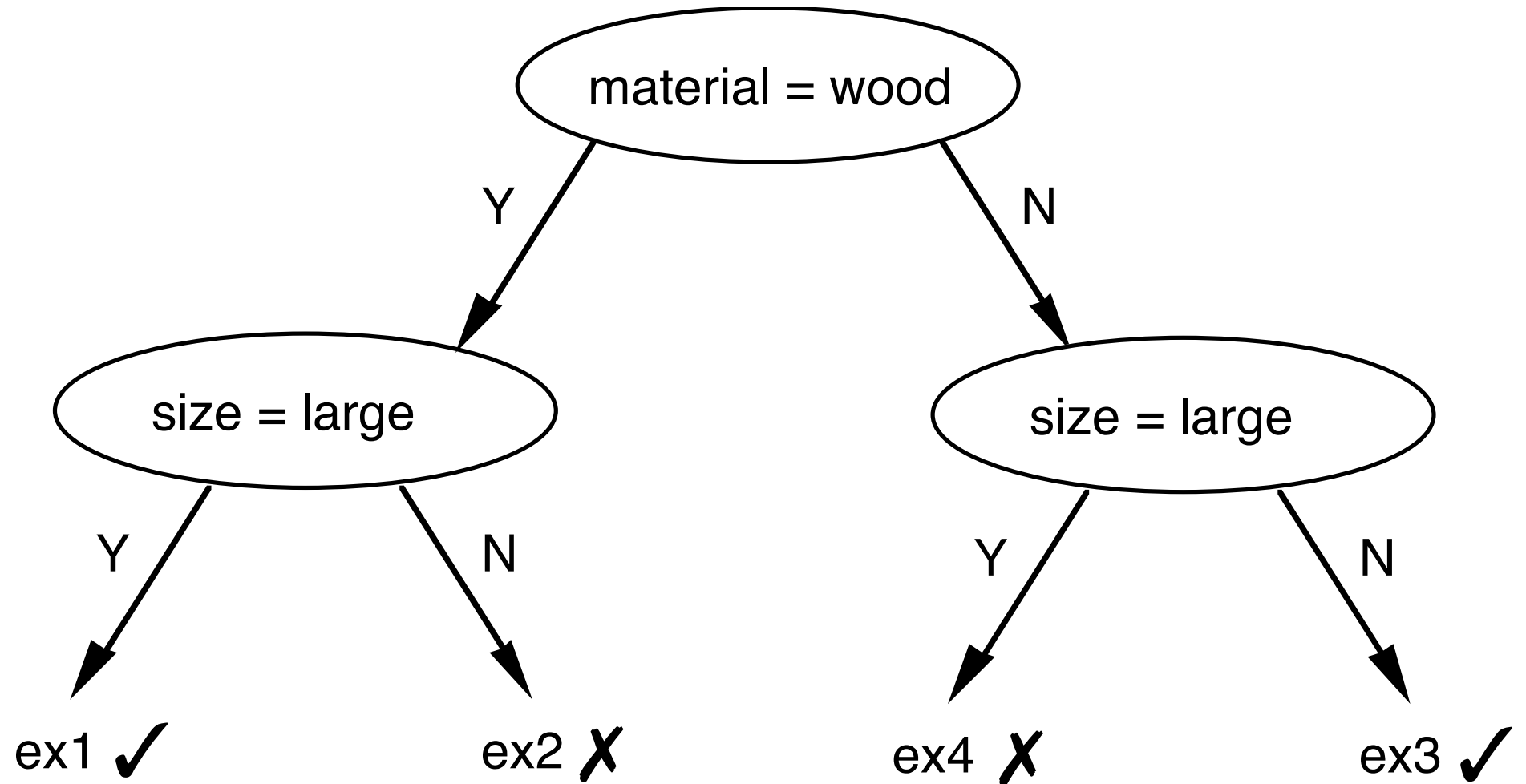


Fig. 5.11

Contingency tables for different choices

shape = triangle

	Y	N	
✓	2	0	2
✗	1	1	2
	3	1	

material = wood

	Y	N	
✓	1	1	2
✗	1	1	2
	2	2	

Fig. 5.12

Pole balancing.

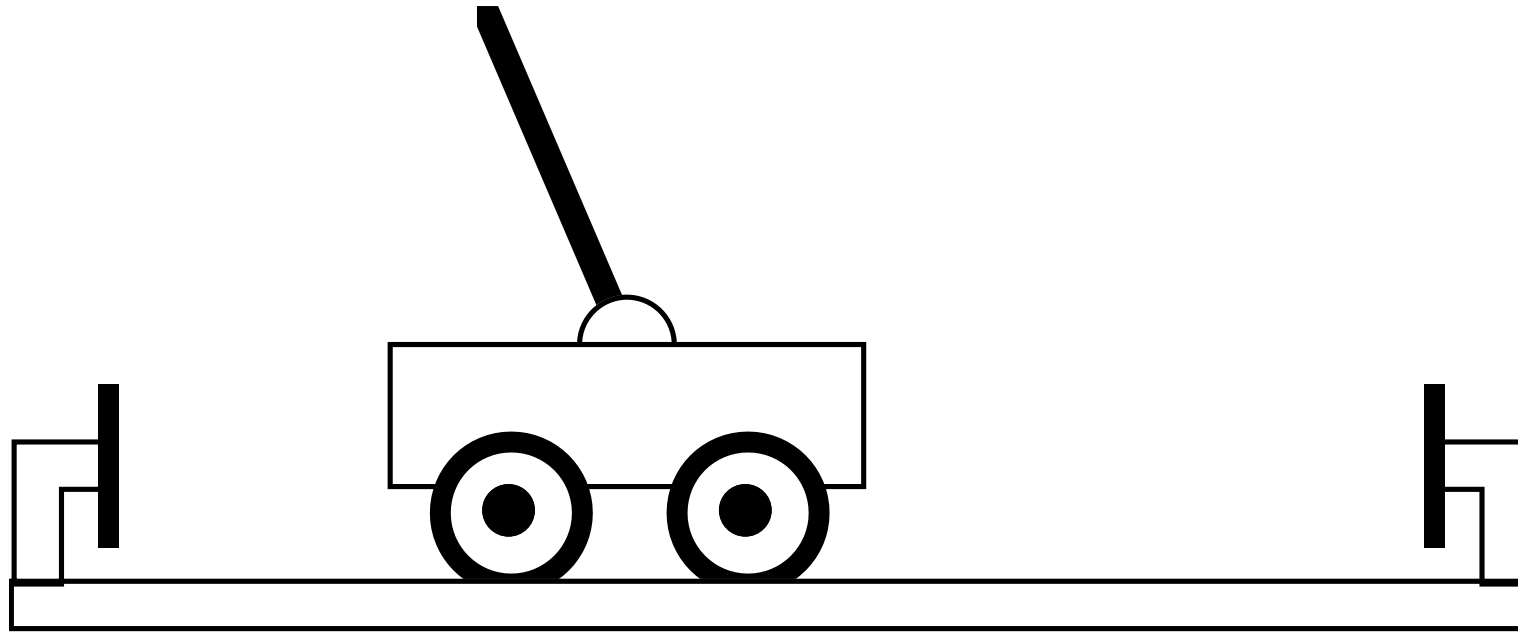


Fig. 5.13

Query-by-Browsing – user ticks interesting records.

Listing			
Name	Department	Salary	
William Brown	Accounts	21,750	X
Margery Chen	Accounts	27,000	X
Thomas Herbert	Accounts	14,500	√
Janet Davies	Accounts	16,000	X
Eugene Warbuck-Smyth	Accounts	17,500	
Fredrick Blogia	Cleaning	7,500	
Mary O'Hara	Cleaning	5,670	

Fig. 5.14

Query-by-Browsing – system highlights inferred selection

Query

```
SELECT name, department, salary
WHERE department = "accounts"
and salary > 15000
```

Yes No

Yes but..

Listing

Name	Department	Salary	
William Brown	Accounts	21,750	X
Margery Chen	Accounts	27,000	X
Thomas Herbert	Accounts	14,500	√
Janet Davies	Accounts	16,000	X
Eugene Warbuck-Smyth	Accounts	17,500	
Fredrick Blogia	Cleaning	7,500	
Mary O'Hara	Cleaning	5,670	

Fig. 5.15

Table 5.1 Fish and Non-fish

	swims	has fins	flies	has lungs	is fish
herring	yes	yes	no	no	✓
cat	no	no	no	yes	✗
pigeon	no	no	yes	yes	✗
flying fish	yes	yes	yes	no	✓
otter	yes	no	no	yes	✗
cod	yes	yes	no	no	✓
whale	yes	yes	no	yes	✗

Table 5.2 Example Tiles

	shape	colour	size	material	
ex1	triangle	blue	large	wood	✓
ex2	square	blue	small	wood	✗
ex3	triangle	blue	small	plastic	✓
ex4	triangle	green	large	plastic	✗