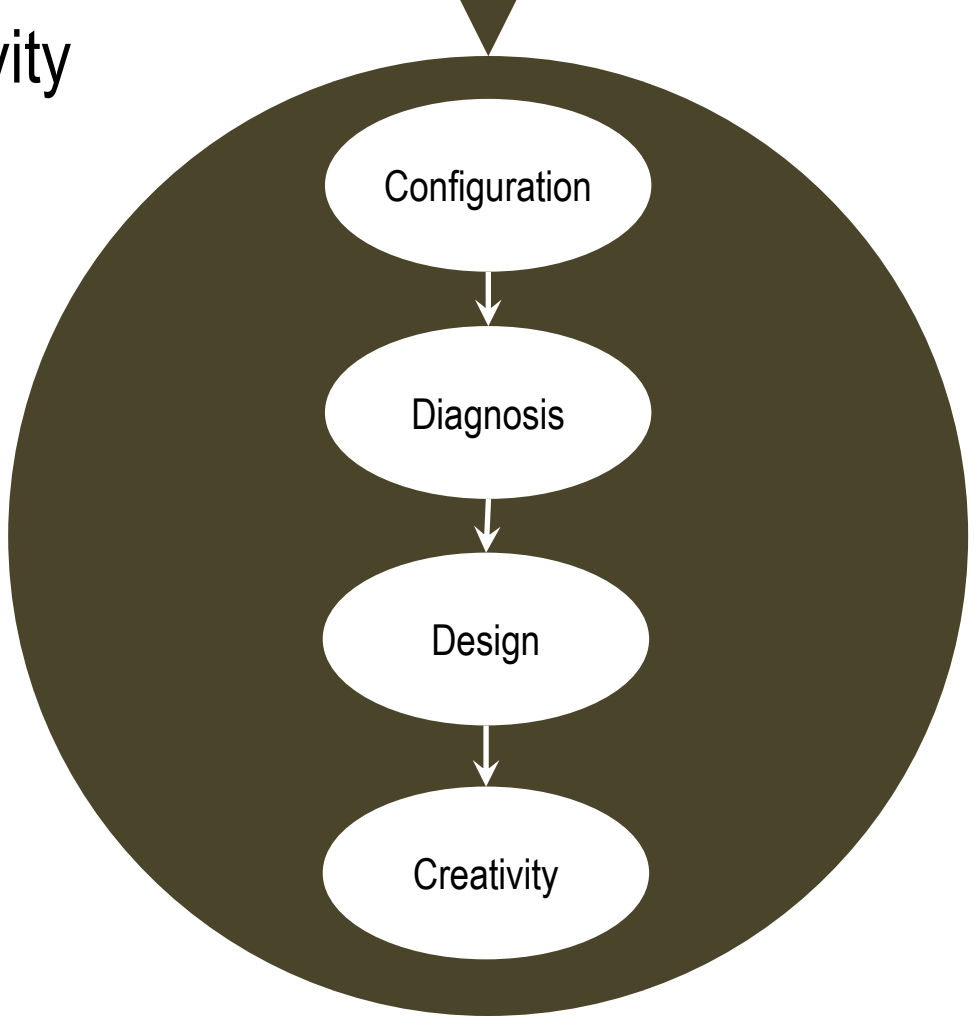
Diagnosis

Design & Creativity



Lesson Preview

- Defining diagnosis
- Data and hypothesis spaces
- Mapping data to hypotheses
- Two views of diagnosis

Patient:

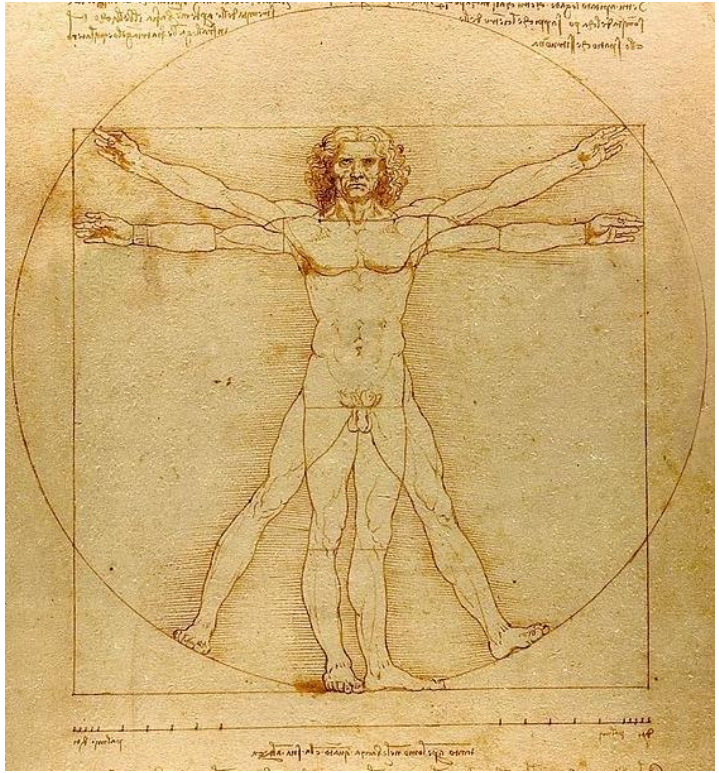
- A: Normal
- B: High
- C: Low
- D: Normal
- E: Normal
- F: Normal
- G: Normal
- H: Low

What illness (or set of illnesses) would you use to diagnose this patient?

Illnesses:

- Alphaitis: Elevated A, Reduced C, Elevated F
- Betatosis: Elevated B, Reduced C, Elevated E, Reduced H
- Gammanoma: Elevated D, Elevated E, Elevated F
- Deltacol: Elevated B, Reduced C
- Epsicusus: Reduced H
- Zetad: Elevated B, Reduced C, Reduced E, Reduced F
- Etaemia: Elevated A, Reduced D, Reduced H
- Thetadesis: Elevated B, Reduced C, Reduced H
- Iotalgia: Elevated A, Reduced E, Elevated F, Elevated G
- Kappacide: Reduced A, Reduced F, Reduced G
- Lambdacrite: Reduced A, Reduced E, Reduced F, Reduced G
- Mutension: Elevated A, Elevated G

Diagnosis: To determine what is wrong with a malfunctioning device.



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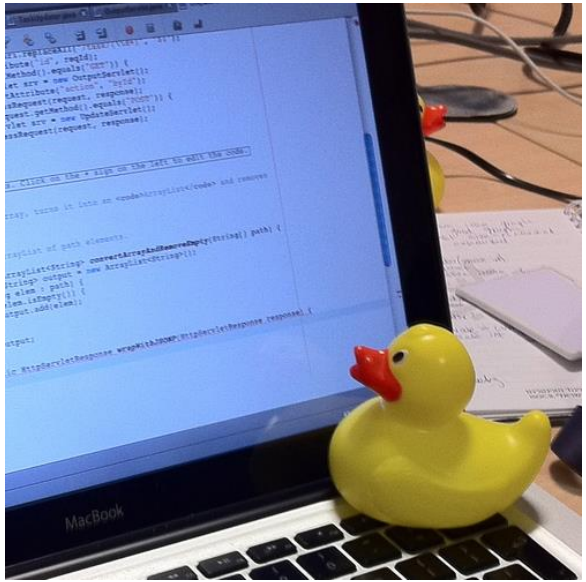
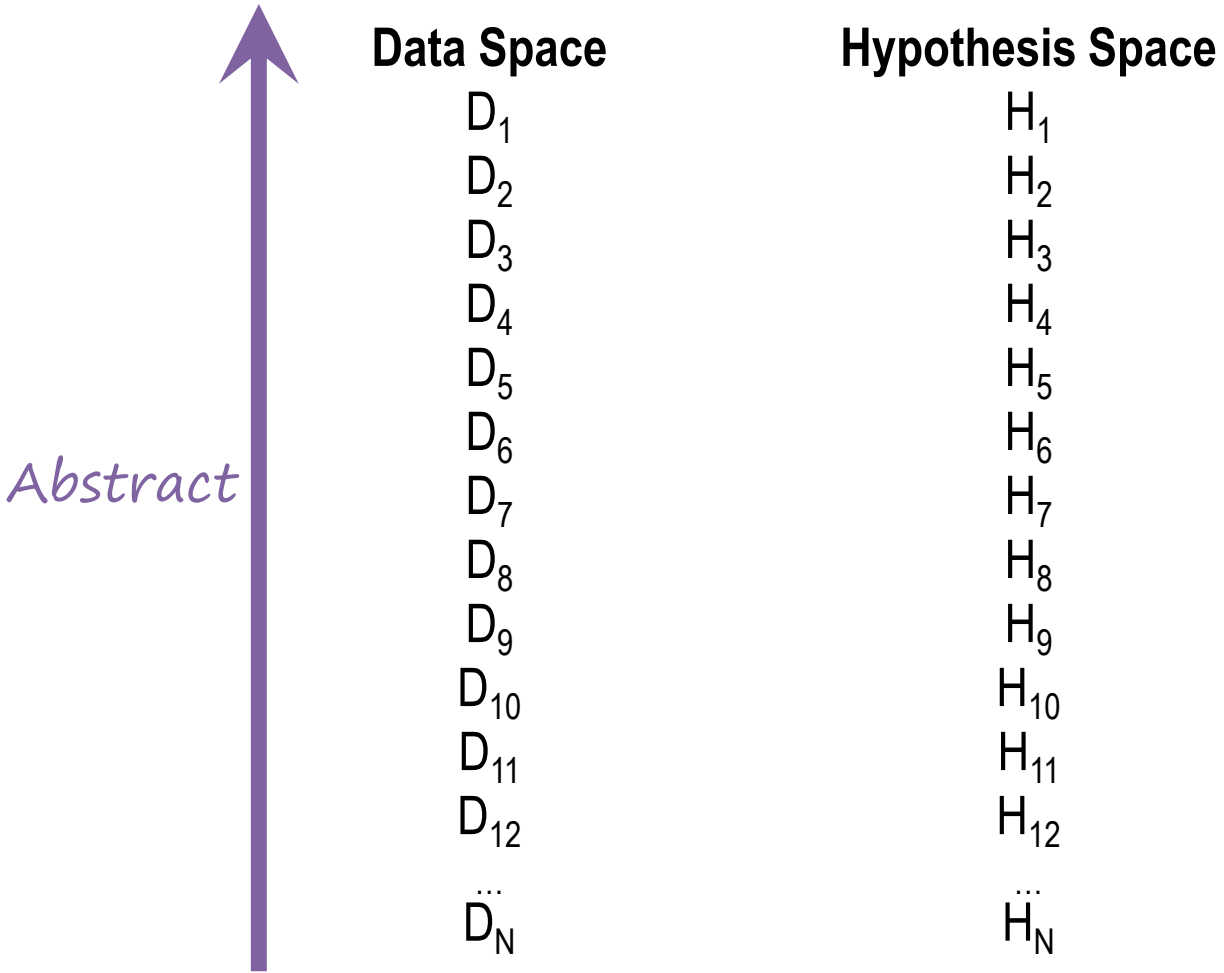


Data Space	Hypothesis Space
D_1	H_1
D_2	H_2
D_3	H_3
D_4	H_4
D_5	H_5
D_6	H_6
D_7	H_7
D_8	H_8
D_9	H_9
D_{10}	H_{10}
D_{11}	H_{11}
D_{12}	H_{12}
...	...
D_N	H_N


Abstract
Data Space
D_1
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D_7
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D_{10}
D_{11}
D_{12}
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D_N
Hypothesis Space
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H_3
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H_5
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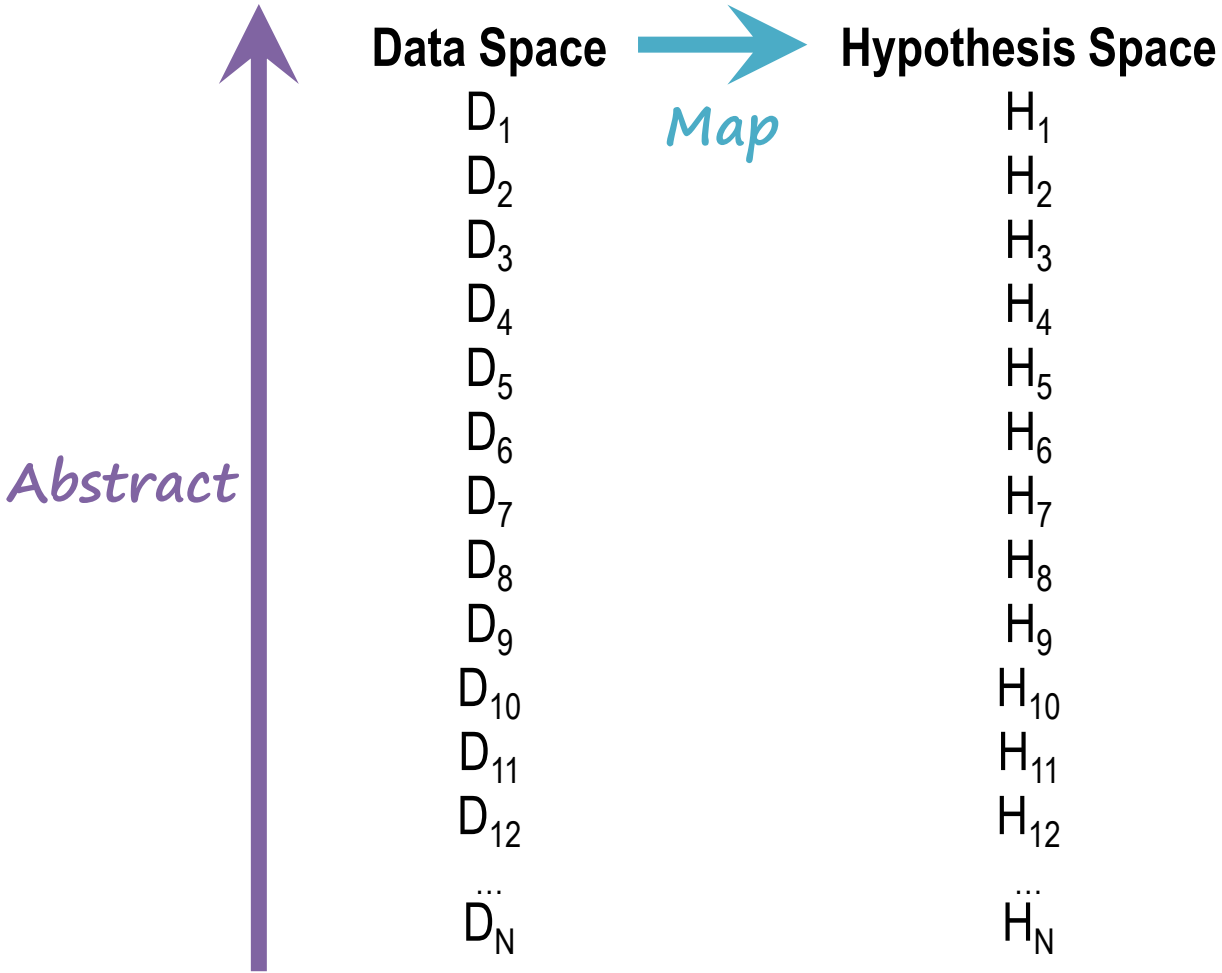
H_N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Data Space
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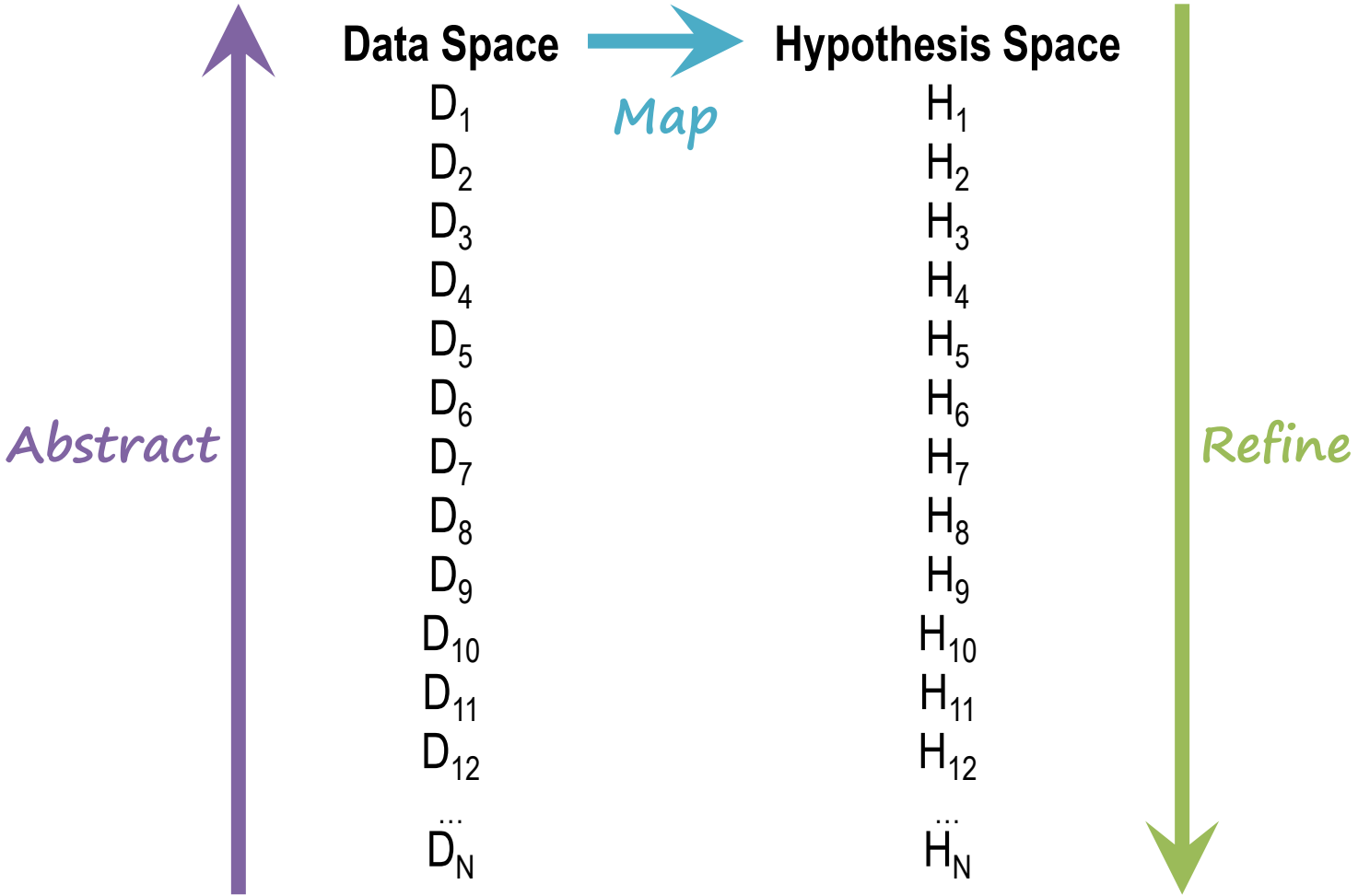
H_N


Data Space
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Hypothesis Space
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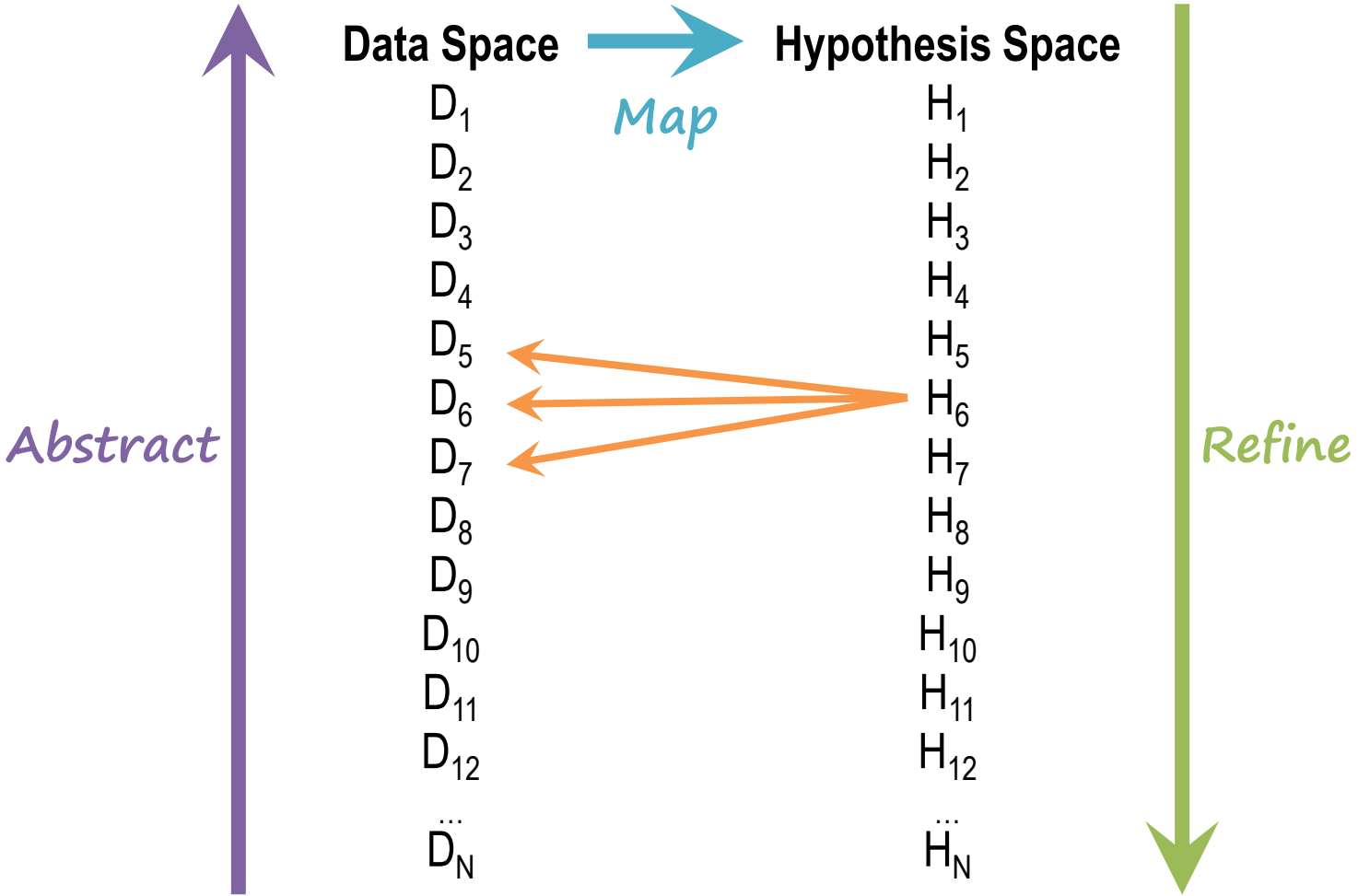
H12
...
HN
Abstract
Refine


Data Space
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H1
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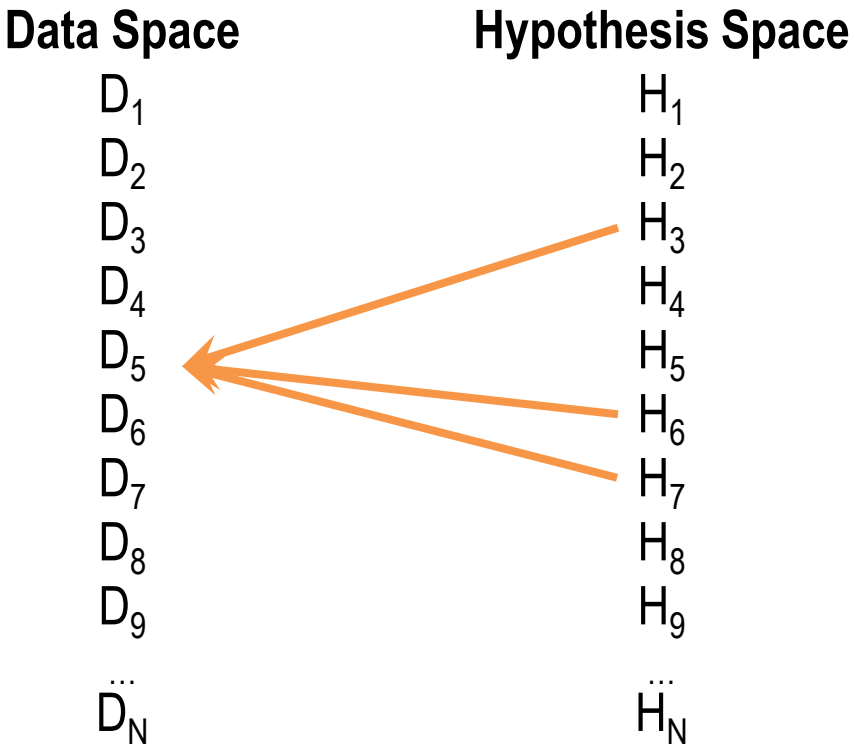
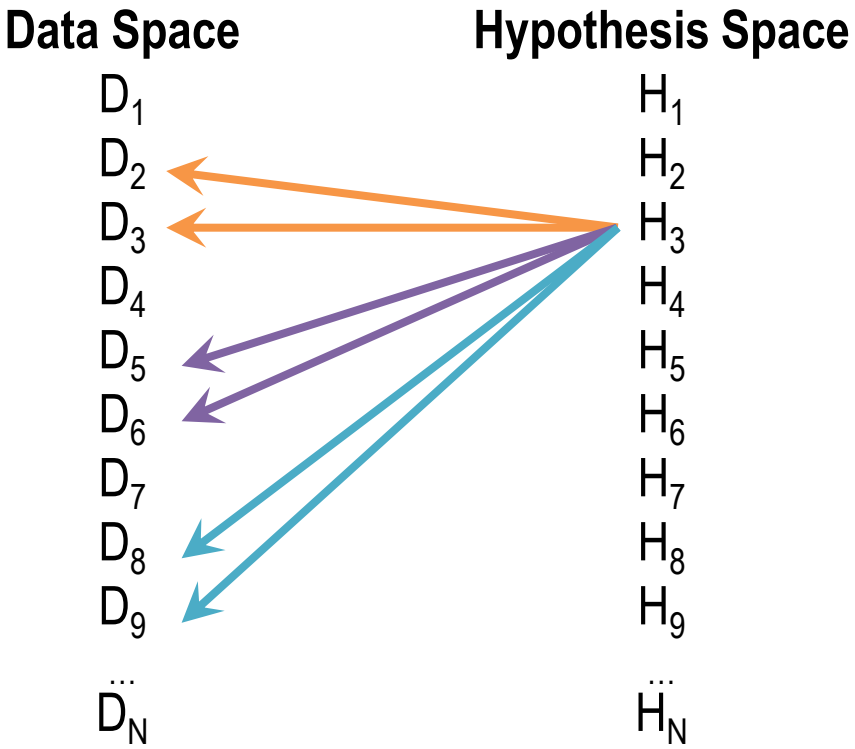
Abstract
Refine

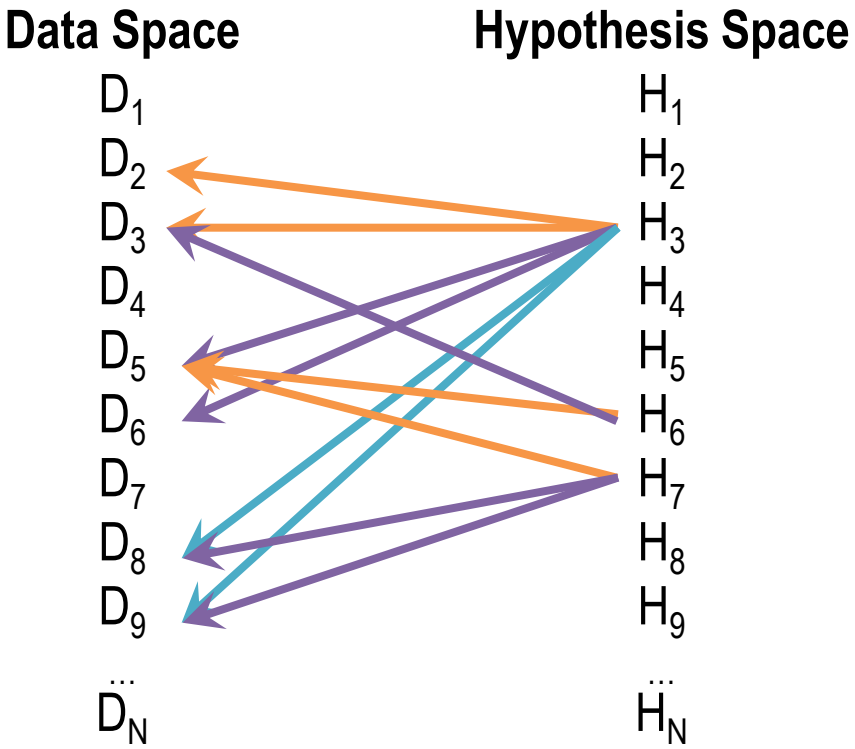
Problem #1: One data point, multiple hypotheses.



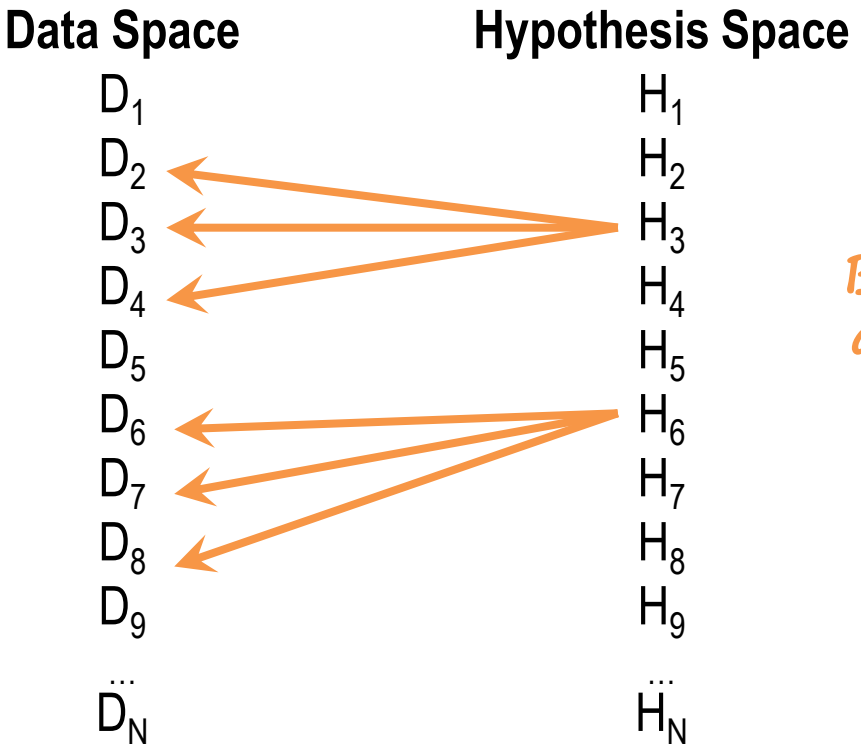
Problem #2: One hypothesis, multiple sets of data.



Problem #3: Multiple hypotheses, multiple sets of data.



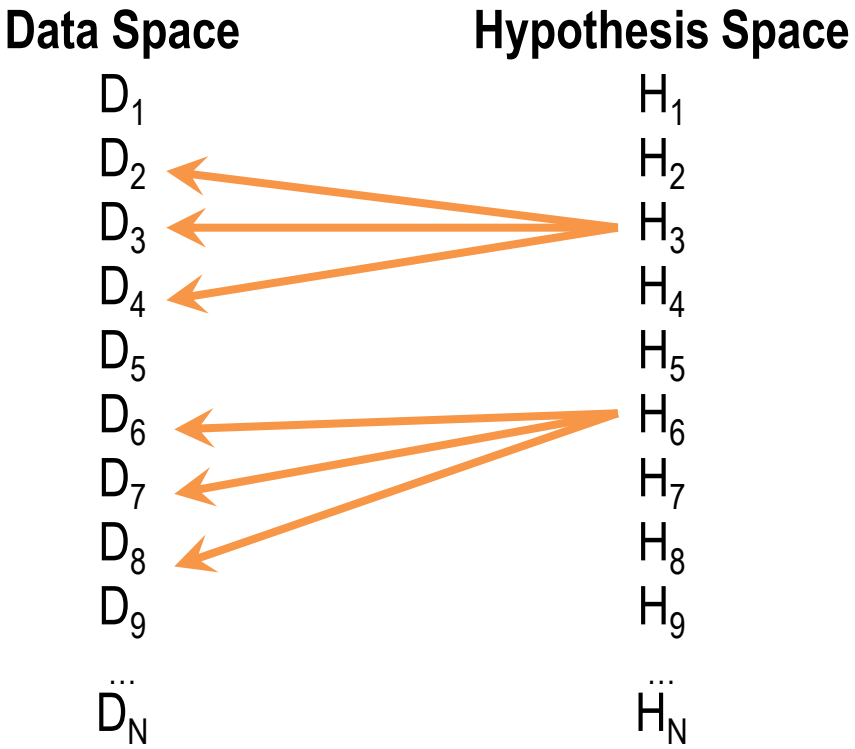
Problem #4: Mutually exclusive hypotheses.

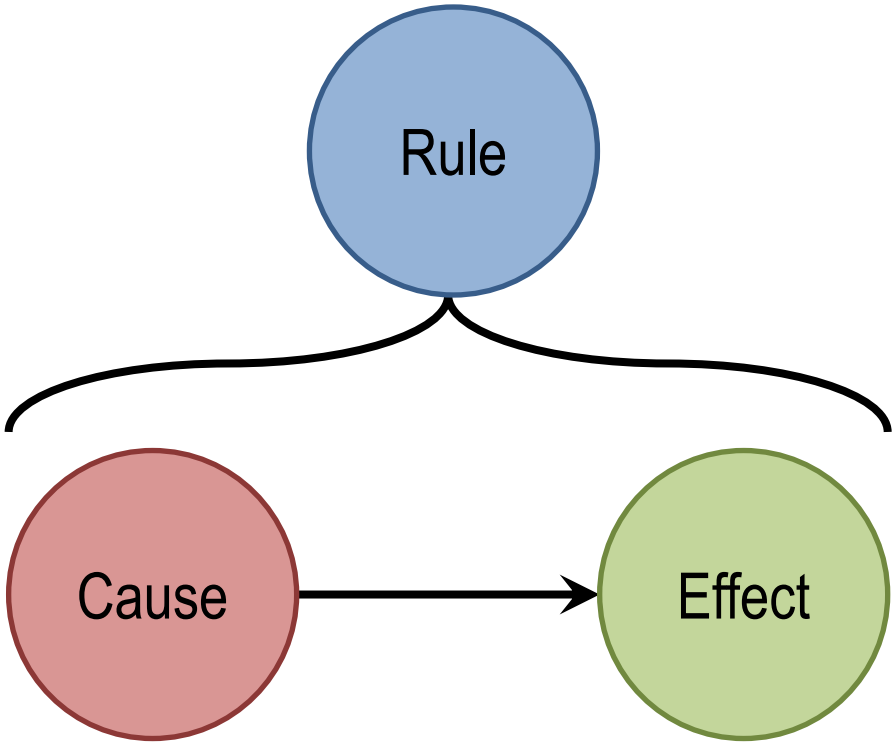


But H_3 and H_6 are mutually exclusive.

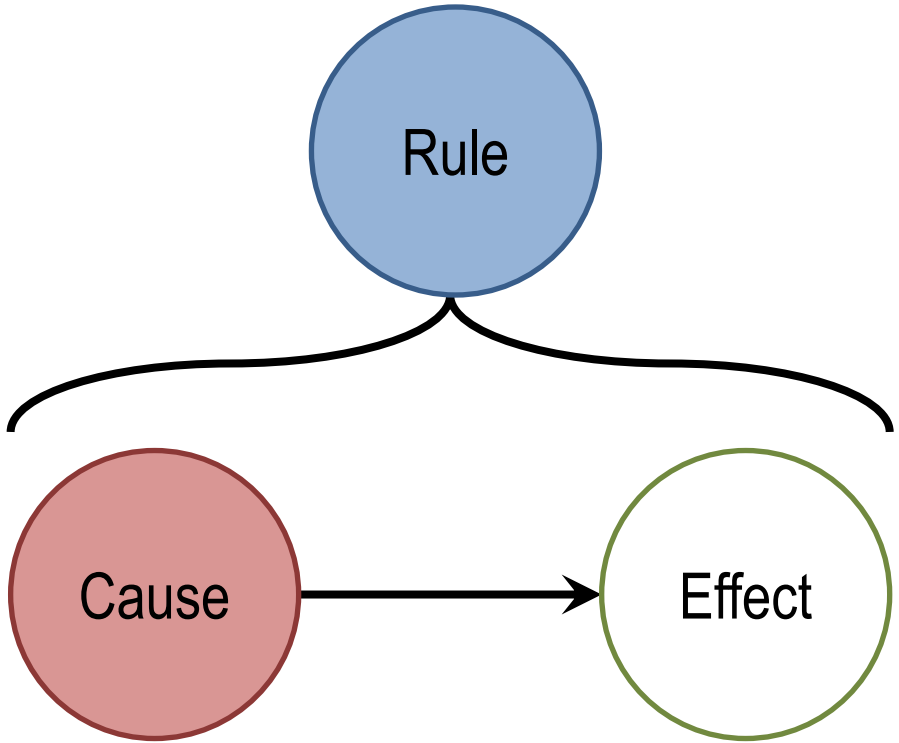
Problem #5: Interacting data points.

But D_5 and D_9 cancel each other out.

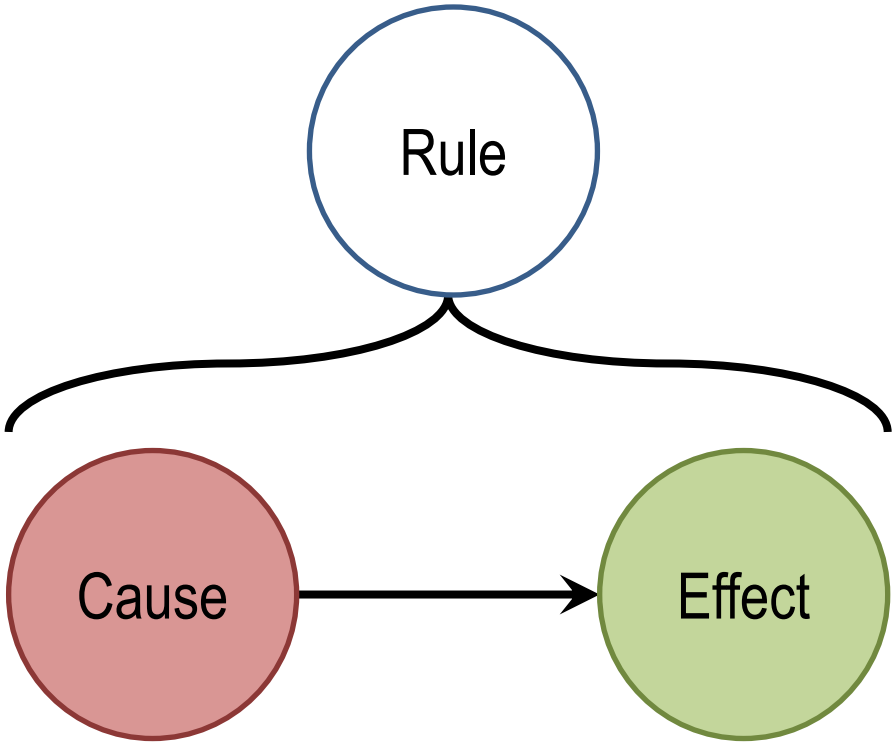



Rule
Cause
Effect

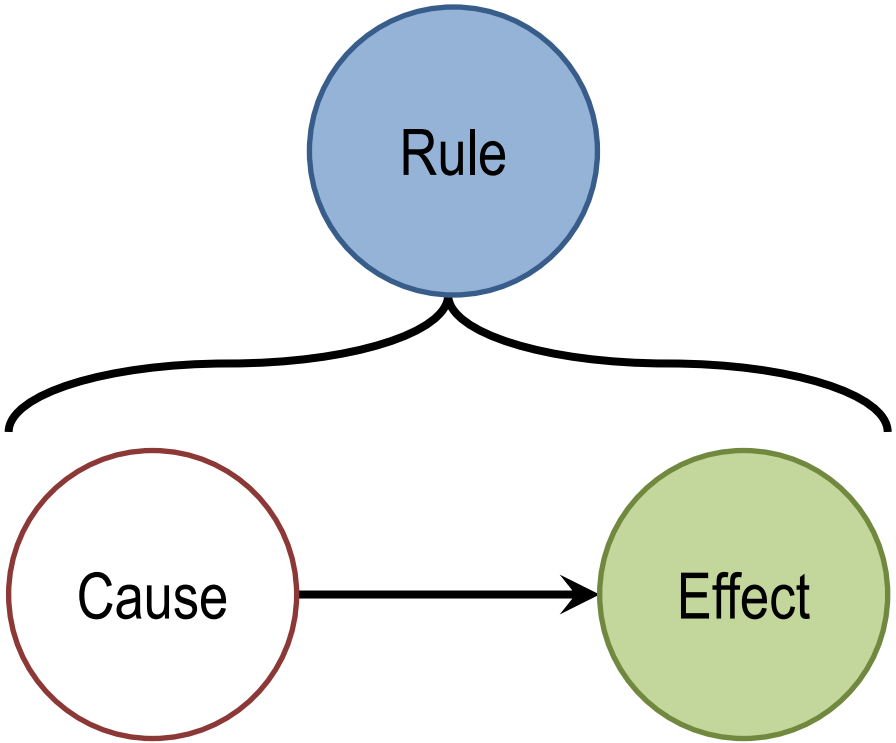
Deduction: Given the rule and the cause, deduce the effect.



Induction: Given a cause and an effect, induce a rule.



Abduction: Given a rule and an effect, abduce a cause.



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- Zetad: Elevated B, Reduced C, Reduced E, Reduced F
- Etaemia: Elevated A, Reduced D, Reduced H
- Thetadesis: Elevated B, Reduced C, Reduced H
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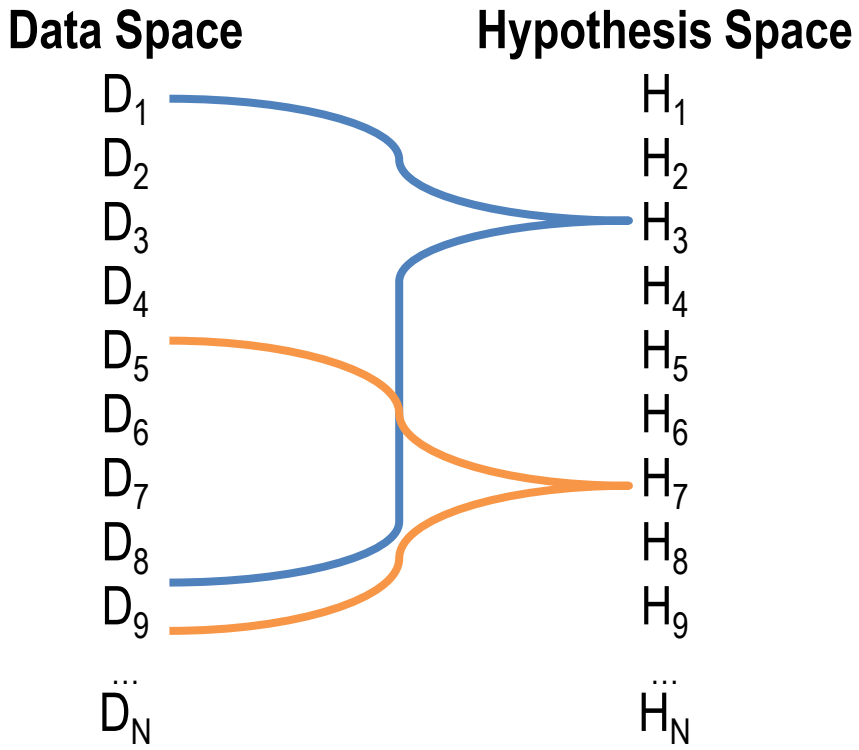
- Kappacide: Reduced A, Reduced F, Reduced G
- Lambdacrite: Reduced A, Reduced E, Reduced F, Reduced G

Criteria for Choosing Hypotheses

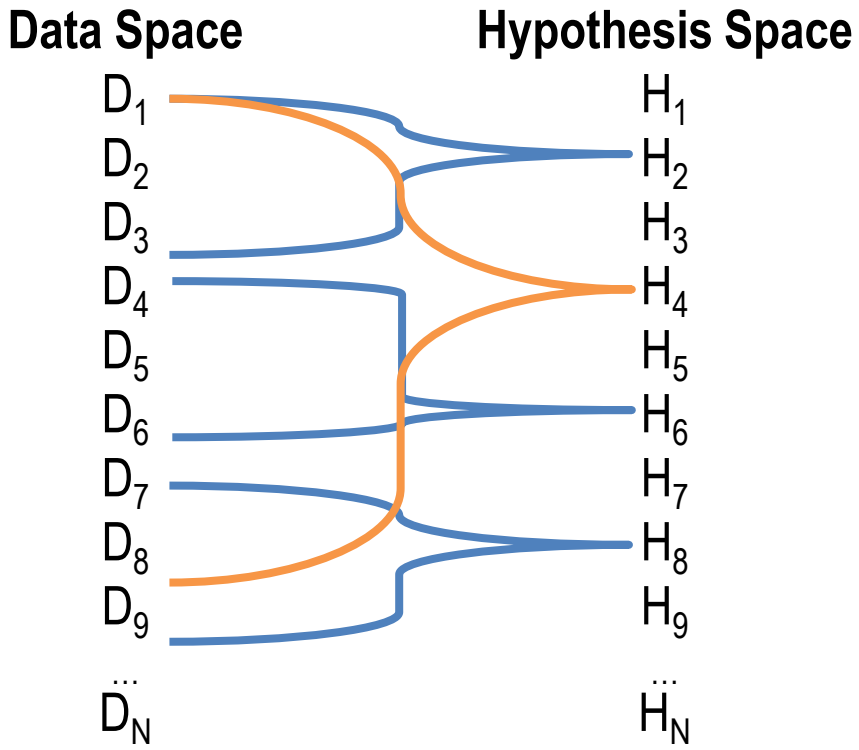
1. Hypotheses must cover as much of the data as possible.



Criteria for Choosing Hypotheses

1. Hypotheses must cover as much of the data as possible.

2. The smallest number of hypotheses ought to be used.



Criteria for Choosing Hypotheses

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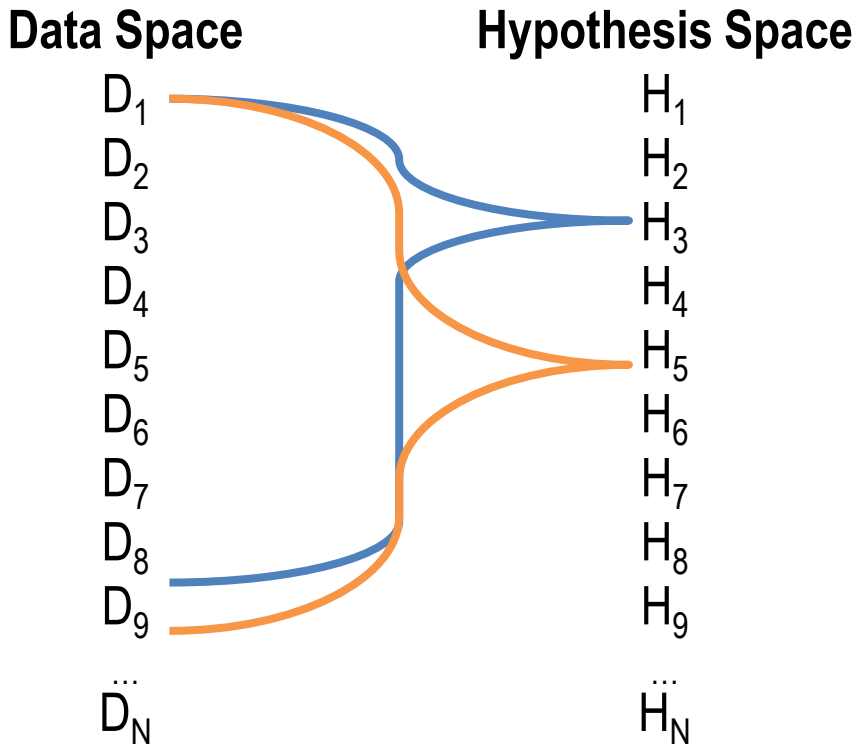
2. The smallest number of hypotheses ought to be used.

3. Some hypotheses may be more likely than others.



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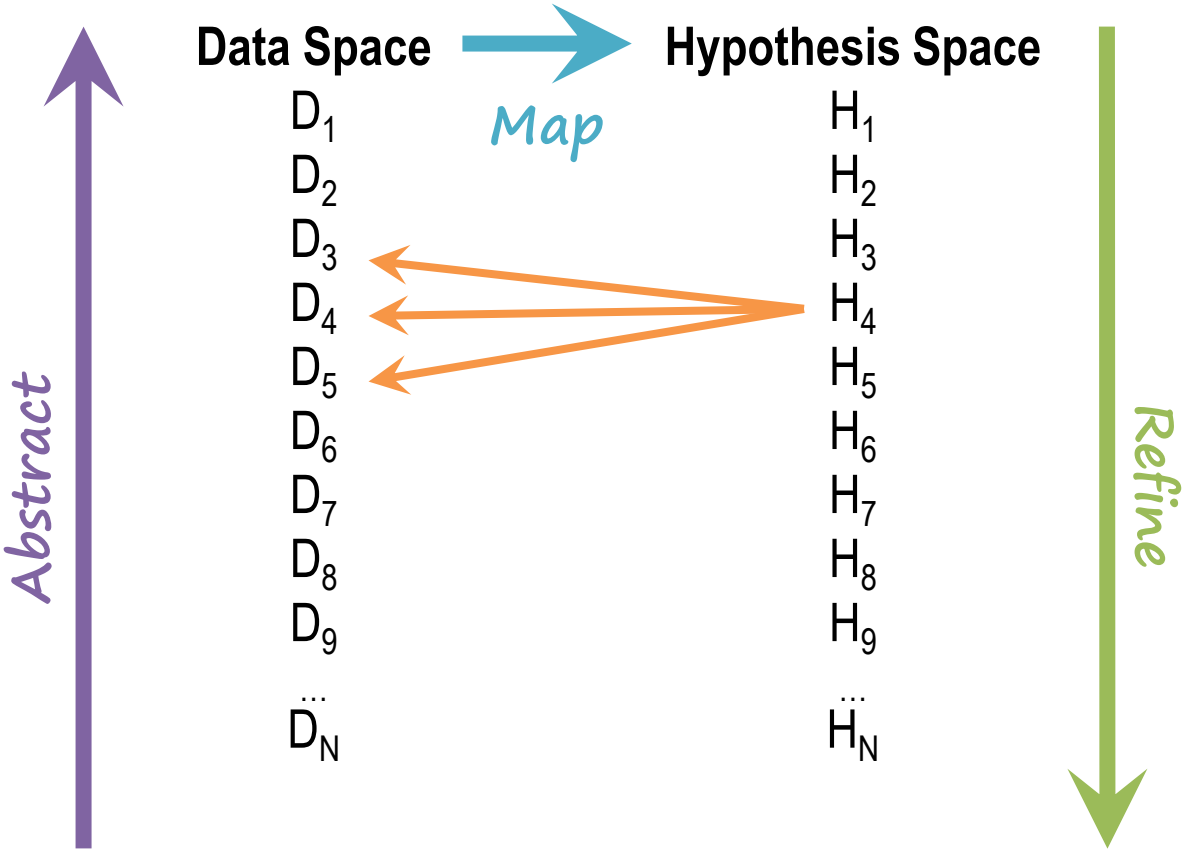
- Kappacide: Reduced A, Reduced F, Reduced G
- Lambdacrite: Reduced A, Reduced E, Reduced F, Reduced G
- Mutension: Elevated A, Elevated G


Data Space
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Hypothesis Space
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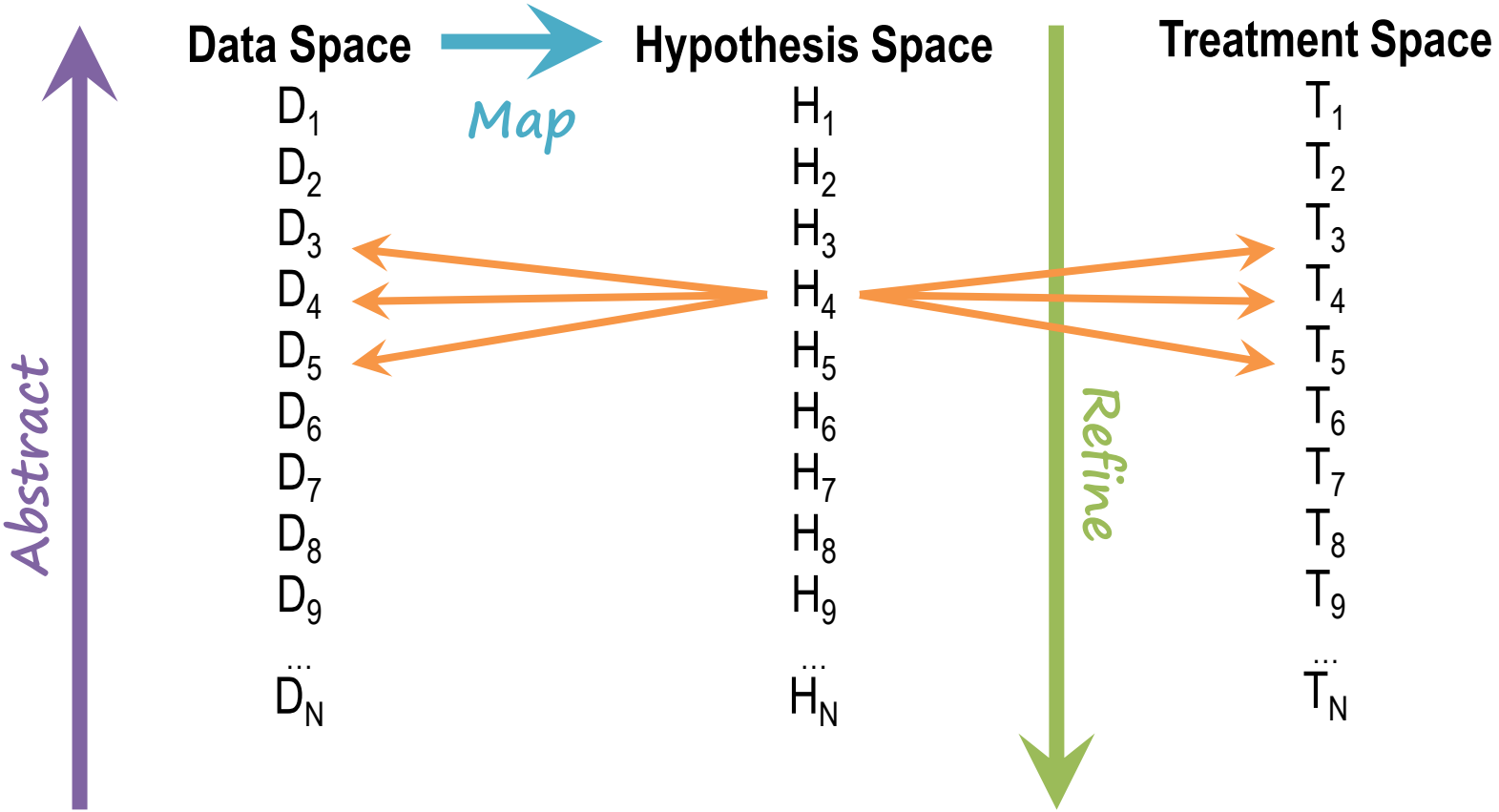
Abstract
Refine


Abstract
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Hypothesis Space
Refine
Treatment Space
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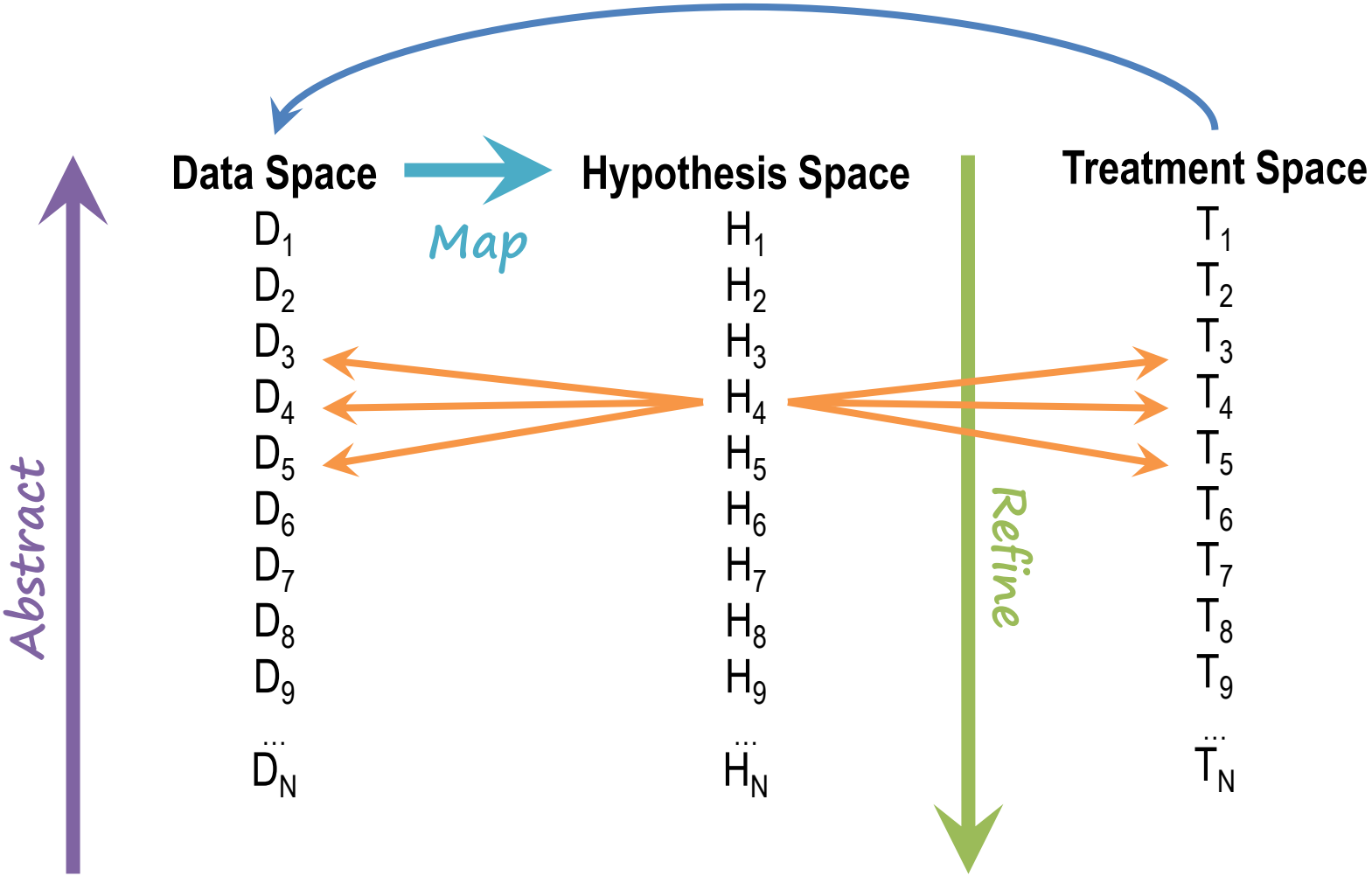
Data Space
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Hypothesis Space
Treatment Space
Abstract
Refine
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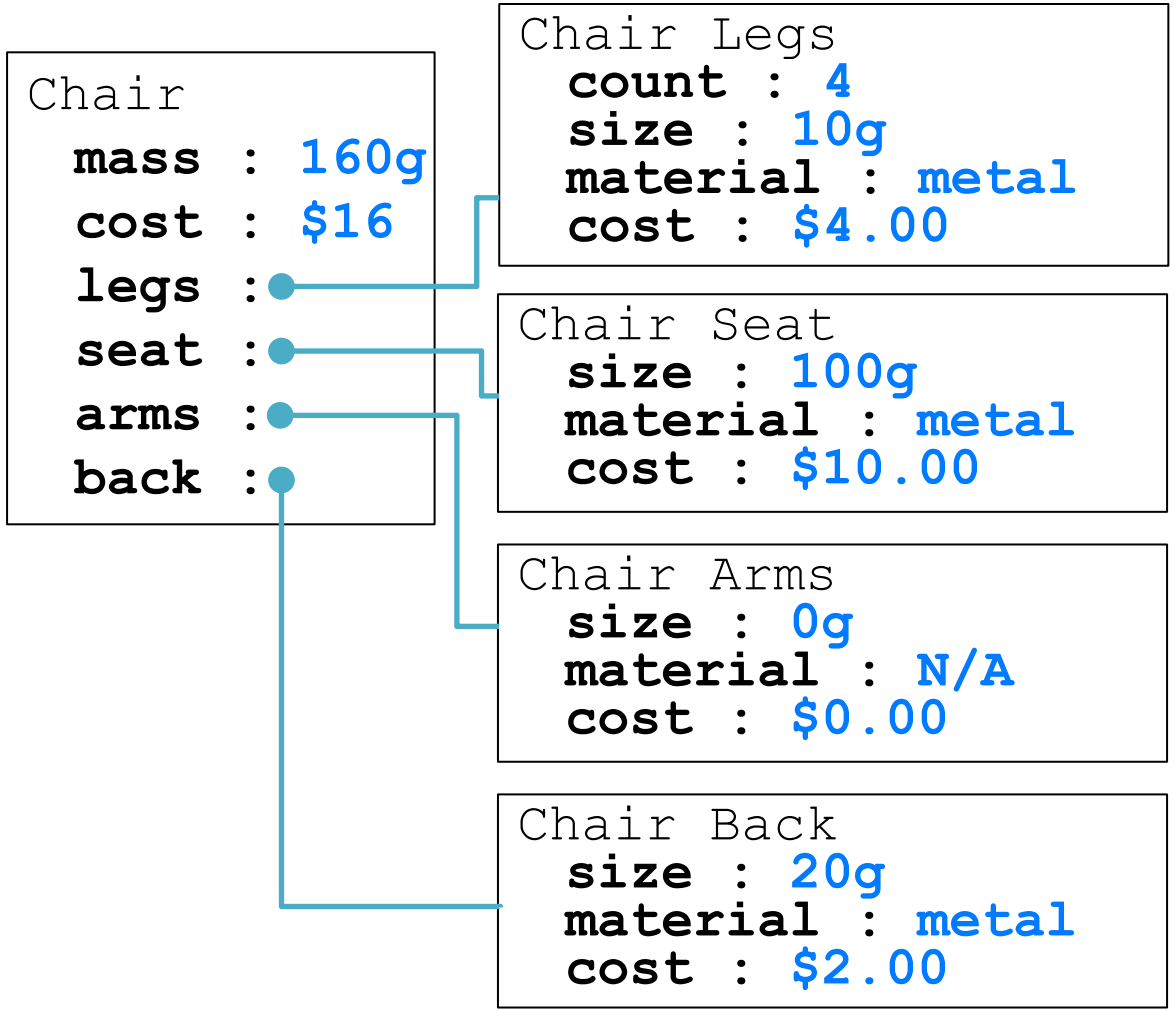
What constraints dictated the design of this chair?



Assignment

How would you use diagnosis to design an agent that could answer Raven's progressive matrices?

To recap…

- Defining diagnosis
- Process of diagnosis
- Diagnosis as classification
- Diagnosis as abduction