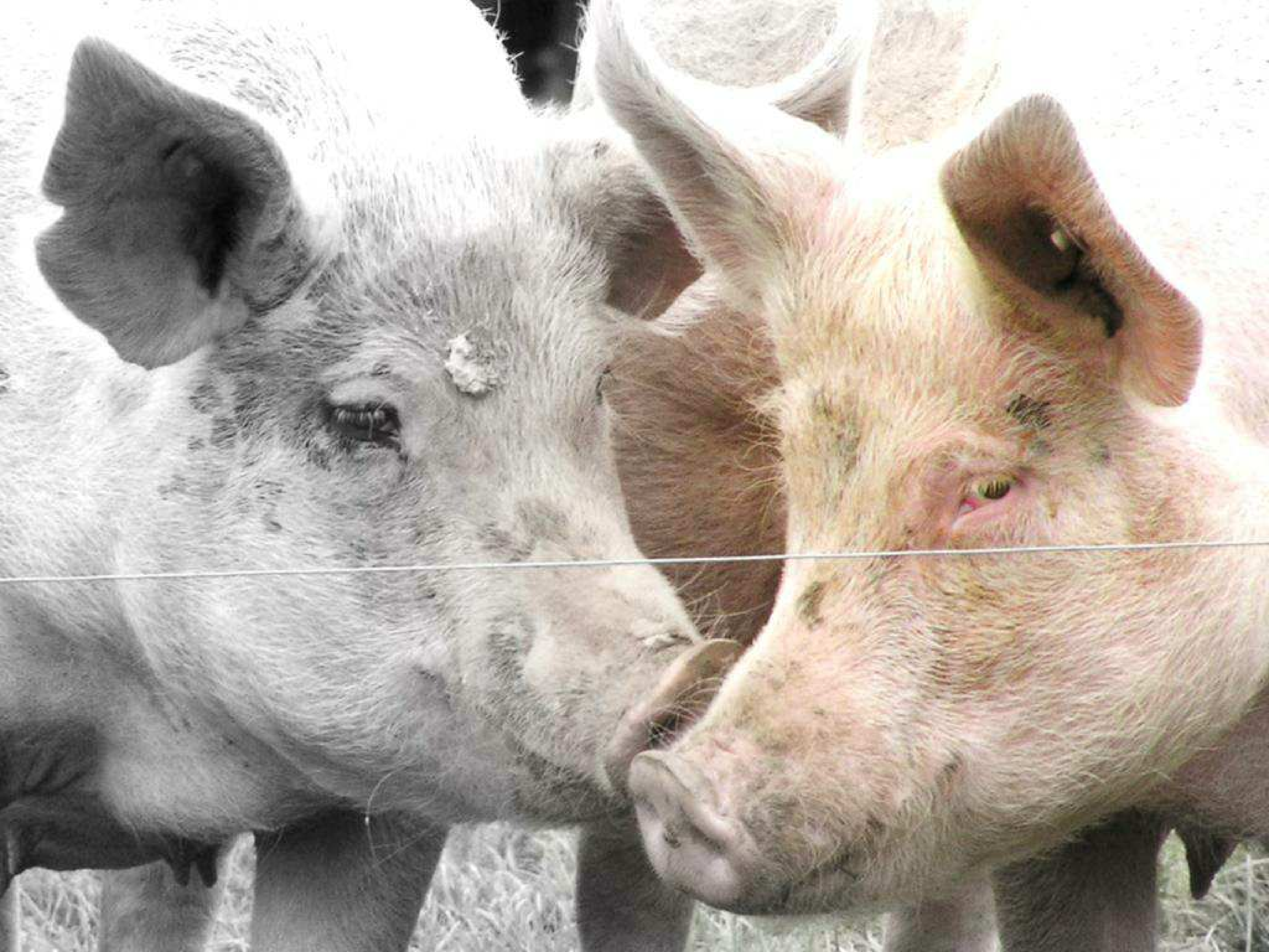
Logic I (PH126)
Lecture 01

s.butterfill@warwick.ac.uk

http://goo.gl/CYIgf



Either it went up the left fork or it went up the right fork

It didn't go up the left fork

therefore:

It went up the right fork

Either it went up the left fork or it went up the right fork — premise

It didn't go up the left fork — premise

therefore:

It went up the right fork

Either it went up the left fork or it went up the right fork	premise
It didn't go up the left fork	premise
therefore:	
It went up the right fork	conclusion

Either it went up the left fork or it went up the right fork — premise

It didn't go up the left fork — premise

therefore:

It went up the right fork — conclusion

argument

Either it went up the left fork or it went up the right fork

premise

It didn't go up the left fork

premise

therefore:

It went up the right fork

conclusion

argument

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

Either it went up the left fork or it went up the right fork } premise

It didn't go up the left fork } premise

therefore:

It went up the right fork } conclusion

argument

<u>Argument 2</u>

Either it went up the left fork or it went up the right fork

The left fork is unsuitable for pigs

therefore:

It went up the right fork

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

Either it went up the left fork or it went up the right fork — premise

It didn't go up the left fork — premise

therefore:

It went up the right fork — conclusion

argument

Argument 2

Either it went up the left fork or it went up the right fork

The left fork is unsuitable for pigs

therefore:

It went up the right fork

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

Either it went up the left fork or it went up the right fork — premise

It didn't go up the left fork — premise

therefore:

It went up the right fork — conclusion

argument

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

Either it went up the left fork or it went up the right fork — premise

It didn't go up the left fork — premise

therefore:

It went up the right fork — conclusion

argument

This or that

Not this

therefore:

That

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

Either it went up the left fork or it went up the right fork — premise

It didn't go up the left fork — premise

therefore:

It went up the right fork — conclusion

argument

This or that

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therefore:

It went up the right fork — conclusion

argument

This or that

Not this

therefore:

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Either it went up the left fork $\boxed{\text{or}}$ it went up the right fork } premise

It did$\boxed{\text{n't}}$ go up the left fork } premise

therefore:

It went up the right fork } conclusion

argument

This $\boxed{\text{or}}$ that

$\boxed{\text{Not}}$ this

therefore:

That

Logical constant

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

Either it went up the left fork or it went up the right fork — premise

It didn't go up the left fork — premise

therefore:

It went up the right fork — conclusion

argument

This or that

Not this

therefore:

That

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

Either it went up the left fork or it went up the right fork — premise

It didn't go up the left fork — premise

therefore:

It went up the right fork — conclusion

argument

This or that

Not this

therefore:

That

$$\begin{array}{|l} \text{this} \vee \text{that} \\ \neg\text{this} \\ \hline \text{that} \end{array}$$

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

Either it went up the left fork or it went up the right fork — premise

It didn't go up the left fork — premise

therefore:

It went up the right fork — conclusion

argument

This or that

Not this

therefore:

That

$P \vee Q$

$\neg P$

Q

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

Why Logic?

‘Logic pervades the world: the limits of the world are also its limits.’

(Wittgenstein, *Tractatus* 5.61)

‘Logic pervades the world: the limits of the world are also its limits.’

(Wittgenstein, *Tractatus* 5.61)

‘don’t obey no laws, not even gravity’

(Tariq Trotter)

precise expression

‘If a card has a vowel on one side, then it has an even number on the other side.’

(Waison & Johnson-Laird 1972)

‘If a card has a vowel on one side, then it has an even number on the other side.’

(Waison & Johnson-Laird 1972)

E	K	4	7

‘If a card has a vowel on one side, then it has an even number on the other side.’

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E K 4 7

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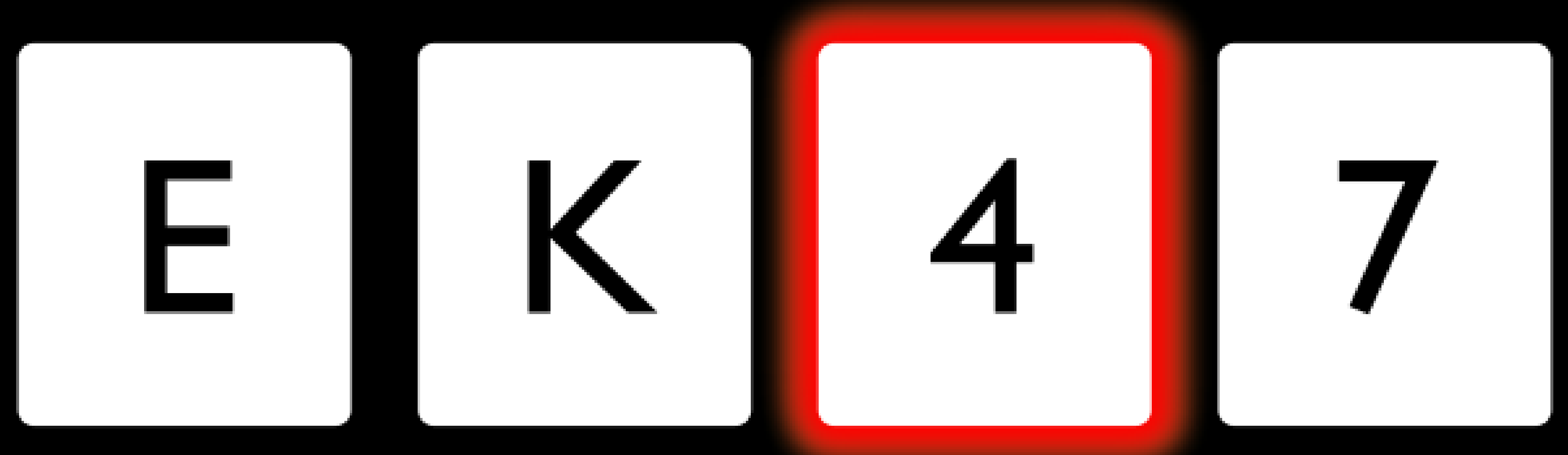

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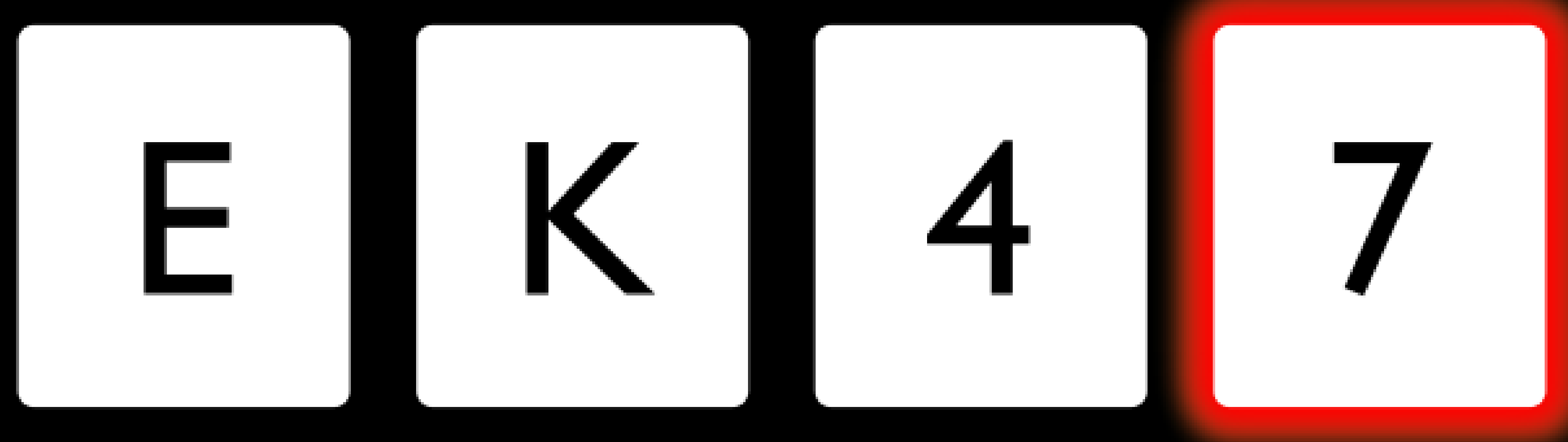

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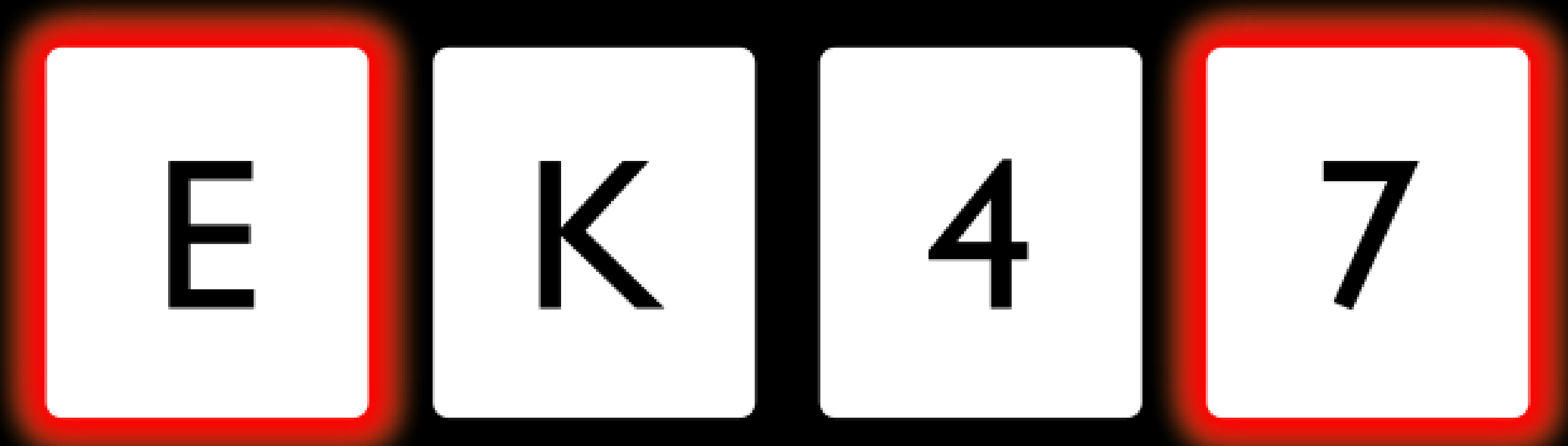


‘Philosophy is thinking in slow motion.’ (John Cam

Admin

Admin

- Seminar groups (check email or see module web page)

Admin

- Seminar groups (check email or see module web page)
- Exercises

Admin

- Seminar groups (check email or see module web page)
- Exercises
- Fast-track lectures

Admin

- Seminar groups (check email or see module web page)
- Exercises
- Fast-track lectures and seminars

Admin

- Seminar groups (check email or see module web page)
- Exercises
- Fast-track lectures and seminars
- Support

Subject	From	Date
York Causation Workshops		26/08/2008
FW: Coming to England!		26/08/2008
Re: Logic teaching		26/08/2008
ToM workshop - information		26/08/2008
		27/08/2008
Re: "when is a grasp a grasp"		27/08/2008
[Phil-staff] Postgraduate Dissertatio...		28/08/2008
PHILOS-L Index - 27 Aug 2008 to 2...		01:00
		03:55
[Phil-staff] 1st year Resit Board		10:46
Greetings from Sunny? Bournemouth		10:55

Subject:
From:
Date: 03:55
To: s.a.butterfill@warwick.ac.uk

Dear Stephen,

I am re-taking starting logic on tuesday, and was wondering if you could explain to me the difference between contingent, tatologous and inconsistent in terms of truth table results, as I cannot find this information anywhere else?

Many Thanks,


PYXIS
Shades of Deep Purple
Parlophone 1968
Deep Purple
Harvest 1969
Neil Diamond
Graham Bonnet
(See details)

Quick Intro to Logiya (‘FOL’)

John is square

John is to the left of Ayesha

John is square

John is to the left of Ayesha

name

$\boxed{\text{John}}$ is square

$\boxed{\text{John}}$ is to the left of $\boxed{\text{Ayesha}}$

$\boxed{\text{name}}$ (refers to an object)

John is square

John is to the left of Ayesha

name (refers to an object)

predicate

John is square

John is to the left of Ayesha

name (refers to an object)

(refers to a property) predicate

John is square

John is to the left of Ayesha

name (refers to an object)

predicate (refers to a property)

relation

John is square

John is to the left of Ayesha

name (refers to an object)

(refers to a property) predicate

relation

John is square or Ayesha is triangular

John is square

John is to the left of Ayesha

John is square or Ayesha is triangular

name (refers to an object)

predicate (refers to a property)

relation

connective

atomic sentences

John is square

John is to the left of Ayesha

name (refers to an object)

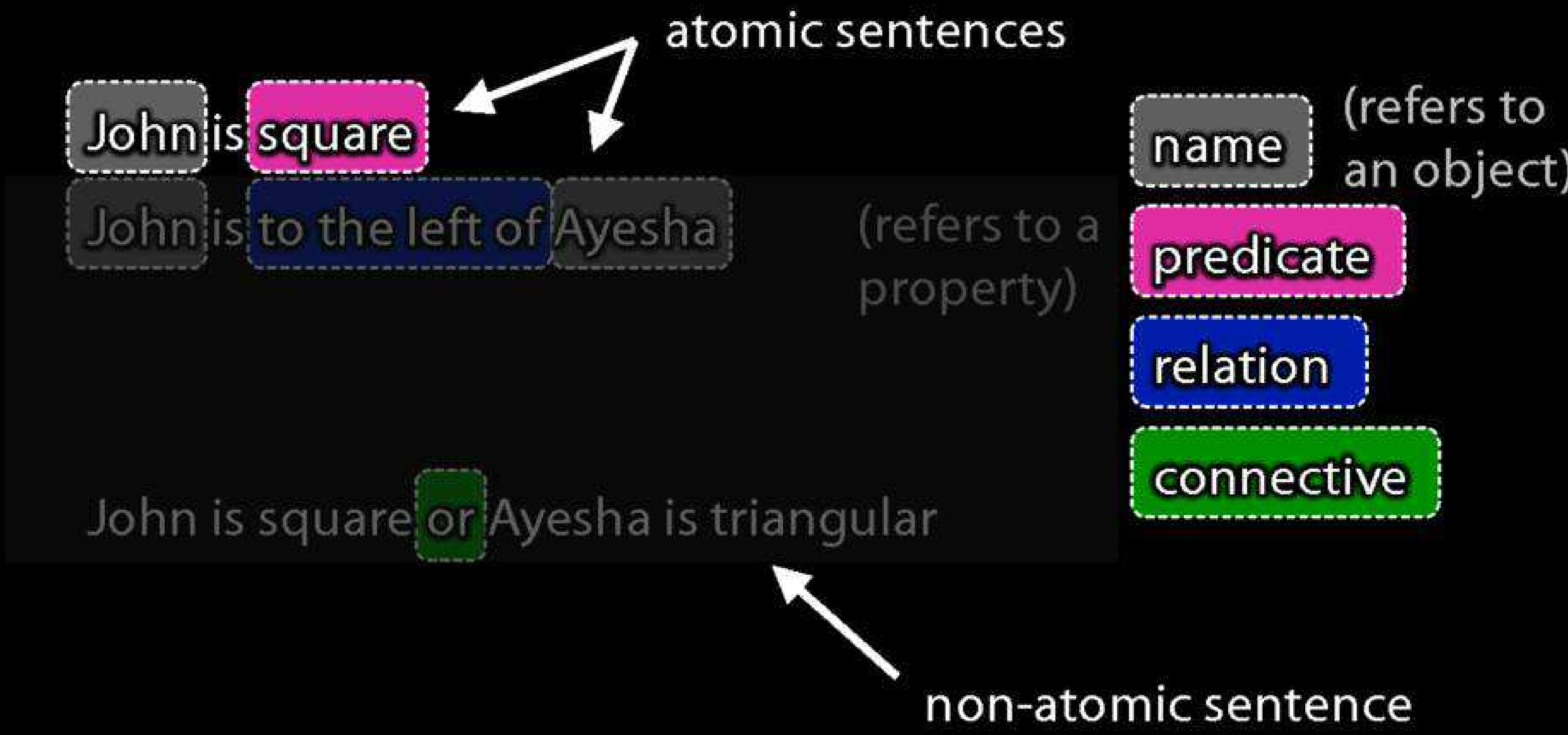
predicate (refers to a property)

relation

connective

John is square or Ayesha is triangular

non-atomic sentence


atomic sentences
John is square
John is to the left of Ayesha
(refers to a property)
John is square or Ayesha is triangular
non-atomic sentence
name
(refers to an object)
predicate
relation
connective

atomic sentences

John is square

John is to the left of Ayesha

(refers to a property)

name (refers to an object)

predicate

relation

connective

John is square or Ayesha is triangular

non-atomic sentence

Square(a)

LeftOf(a,b)

Square(a) $\vee$ Triangular(b)

atomic sentences

John is square

John is to the left of Ayesha

(refers to a property)

John is square or Ayesha is triangular

non-atomic sentence

name (refers to an object)

predicate

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non-atomic sentence

Square(a)

LeftOf(a,b)

Square(a) ∨ Triangular(b)

name (refers to an object)

predicate

relation

connective

atomic sentences

John is square

John is to the left of Ayesha

name (refers to an object)

(refers to a property) predicate

relation

connective

John is square or Ayesha is triangular

non-atomic sentence

Square(a)

LeftOf(a,b)

Square(a) $\vee$ Triangular(b)

atomic sentences

John is square

John is to the left of Ayesha

(refers to a property)

name (refers to an object)

predicate

relation

connective

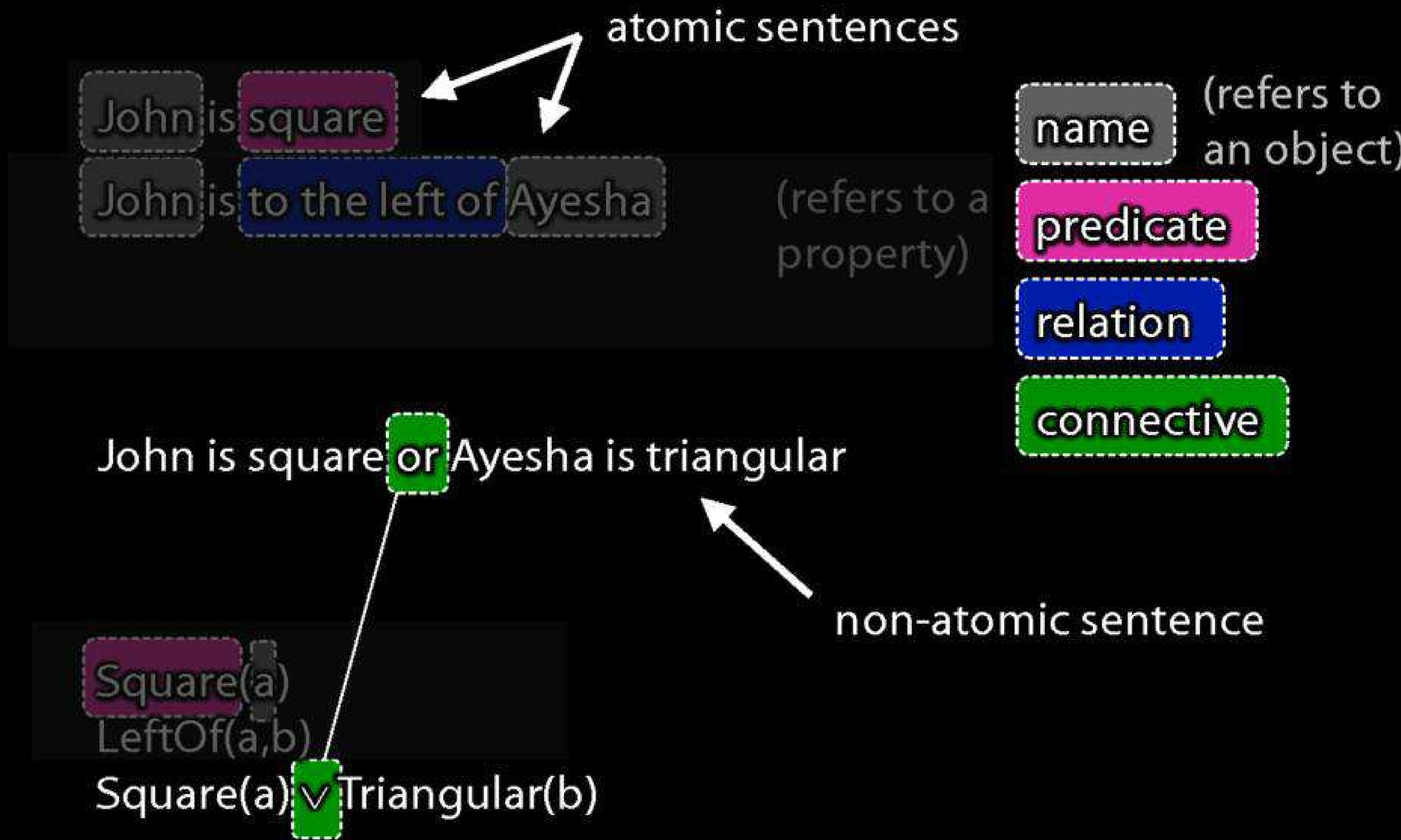
John is square or Ayesha is triangular

non-atomic sentence

Square(a)

LeftOf(a,b)

Square(a) $\vee$ Triangular(b)


atomic sentences
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(refers to a property)
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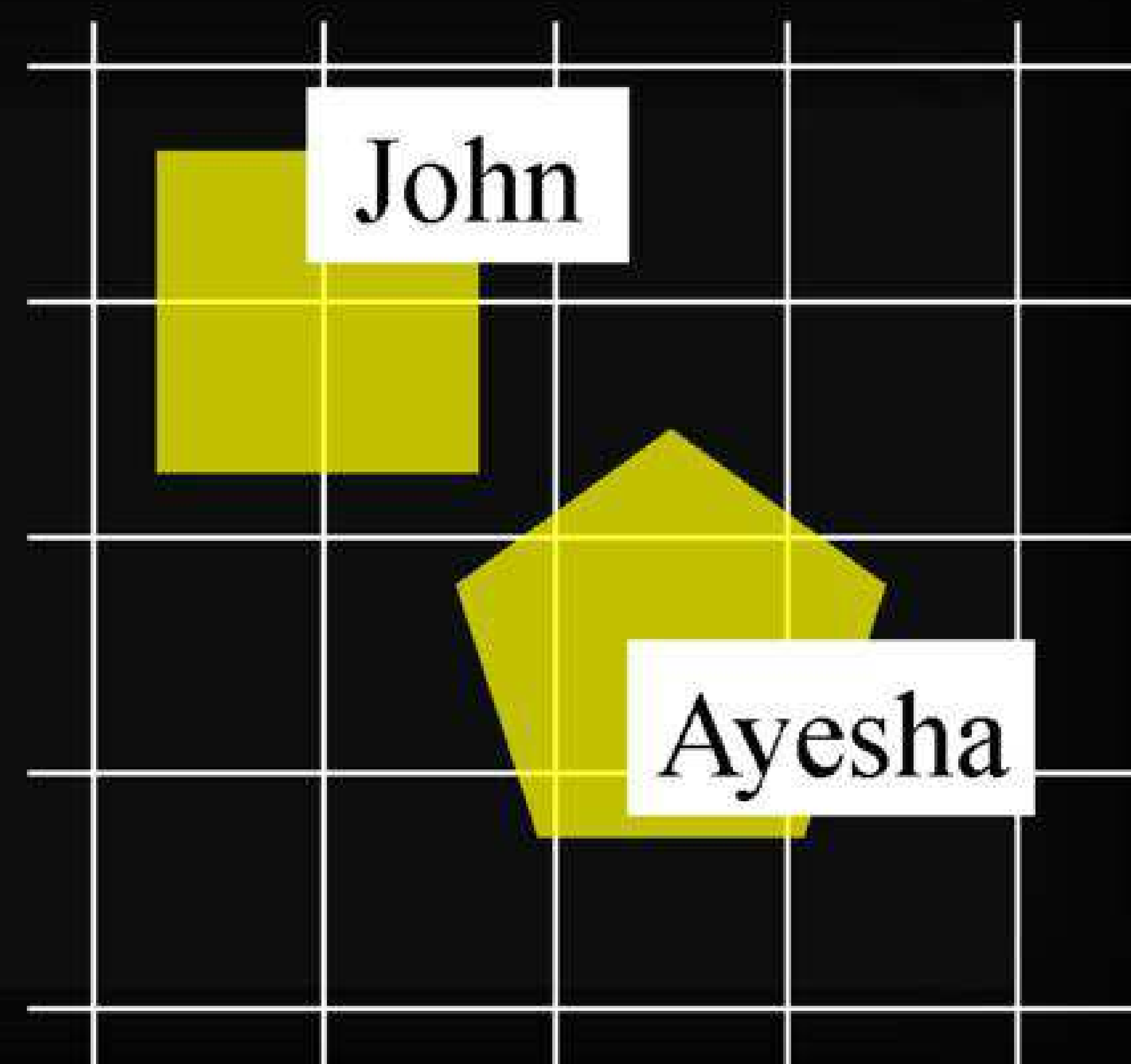

Square(a)

LeftOf(a,b)

Square(a) $\vee$ Triangular(b)

atomic sentences

John is square

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predicate

relation

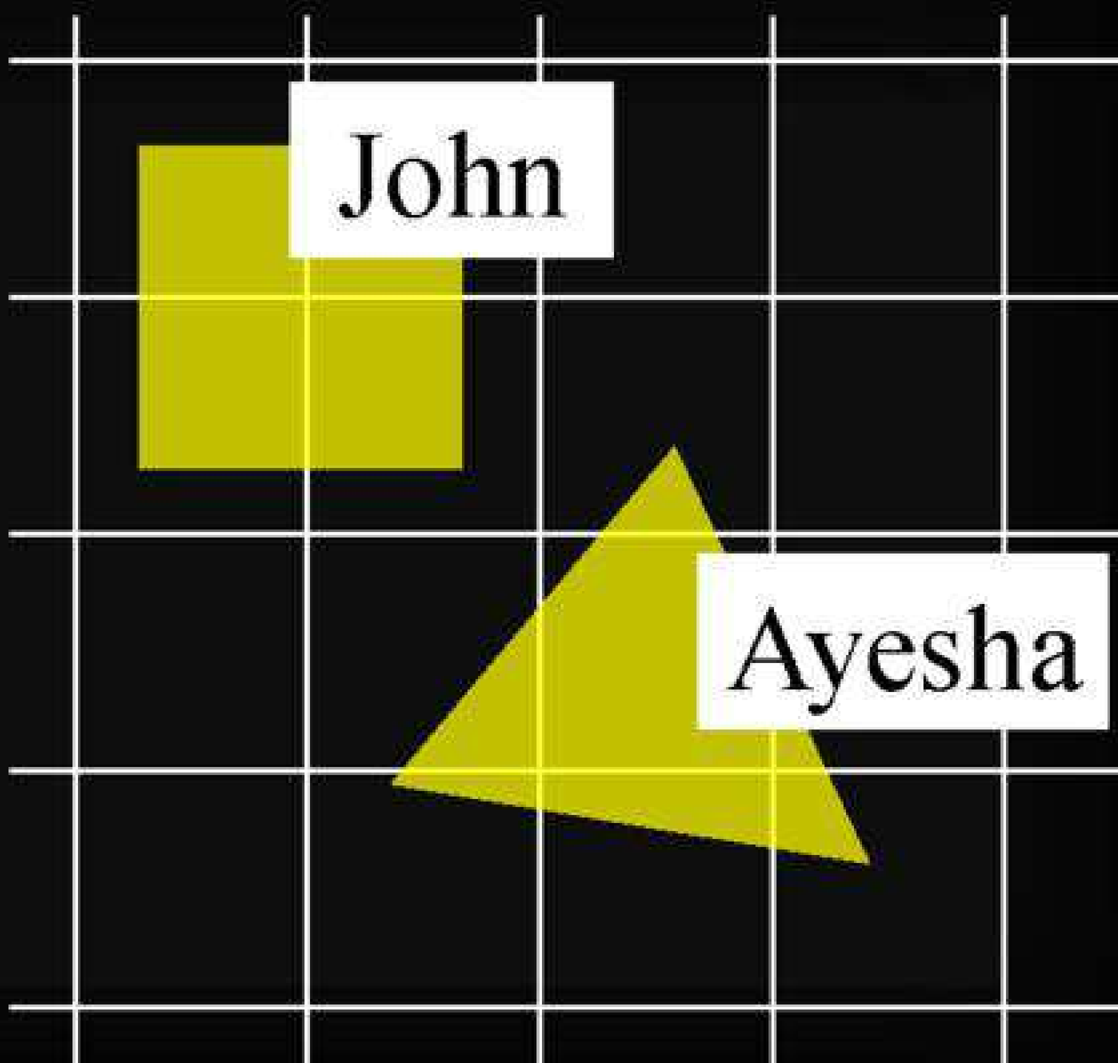
connective

John is square or Ayesha is triangular

Square(a)

LeftOf(a,b)

Square(a) $\vee$ Triangular(b)



This is a hospital where doctors are trained.

Many more people have been to Paris than I have.

Logically Valid Arguments

$\mathrm{Square}(a) \vee \mathrm{Square}(b)$
$\neg\mathrm{Square}(a)$
$\mathrm{Square}(b)$

or

$\mathrm{Square}(a) \lor \mathrm{Square}(b)$

$\neg \mathrm{Square}(a)$

$\mathrm{Square}(b)$

or

not

Square(a) ∨ Square(b)

¬Square(a)

Square(b)

$Square(a) \lor Square(b)$
$\neg Square(a)$
$Square(b)$

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

$\text{Square}(a) \lor \text{Square}(b)$
$\neg\text{Square}(a)$
$\text{Square}(b)$

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

$\mathrm{Square}(a) \lor \mathrm{Square}(b)$	//premise
$\neg \mathrm{Square}(a)$	//premise
$\mathrm{Square}(b)$	//conclusion

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

$\text{Square}(a) \vee \text{Square}(b)$	//premise
$\neg\text{Square}(a)$	//premise
$\text{Square}(b)$	//conclusion

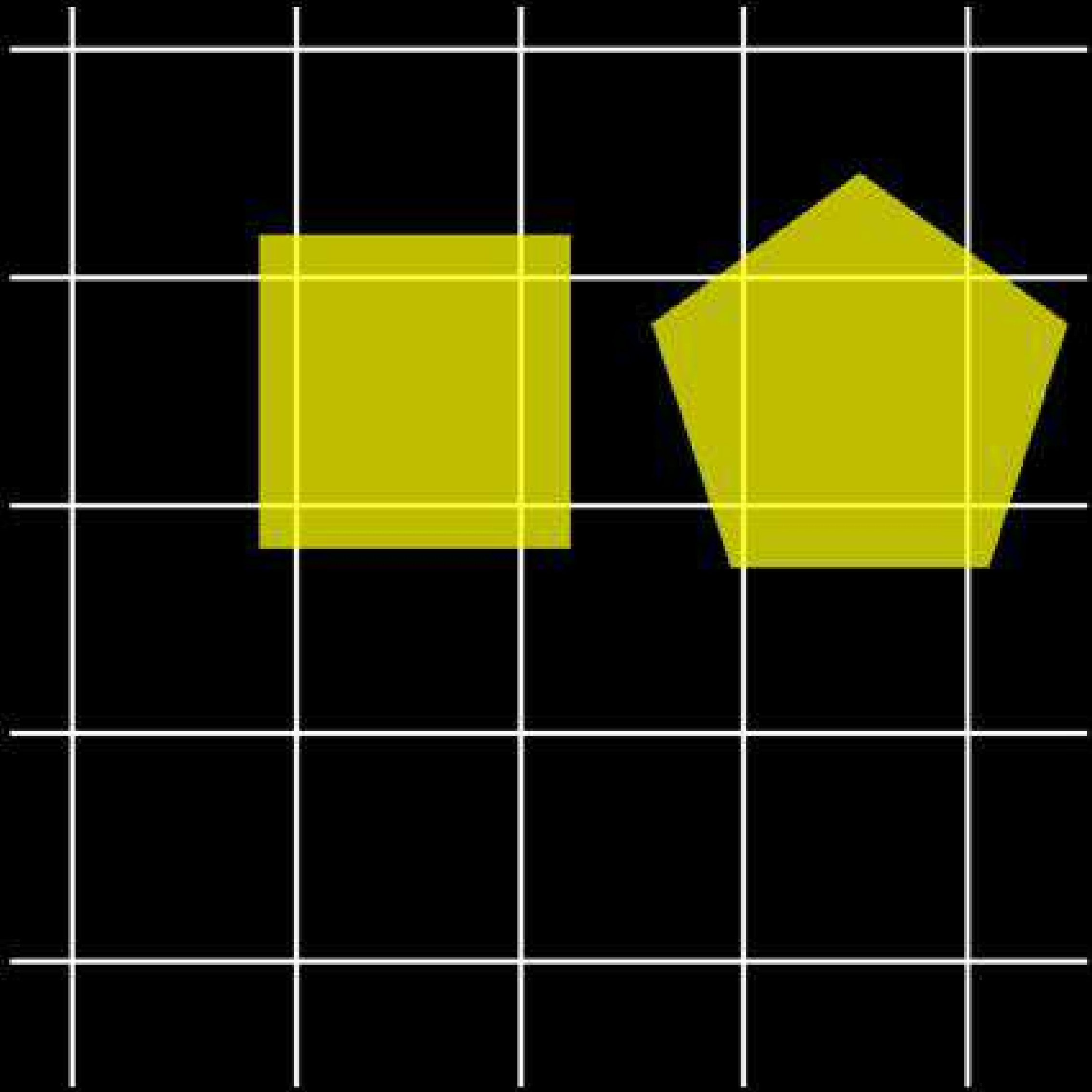
An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

Square(a) ∨ Square(b) //premise
¬Square(a) //premise
Square(b) //conclusion

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

$$\begin{array}{|l} \text{Square}(a) \lor \text{Square}(b) \\ \neg\text{Square}(a) \\ \hline \text{Square}(b) \end{array}$$

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false



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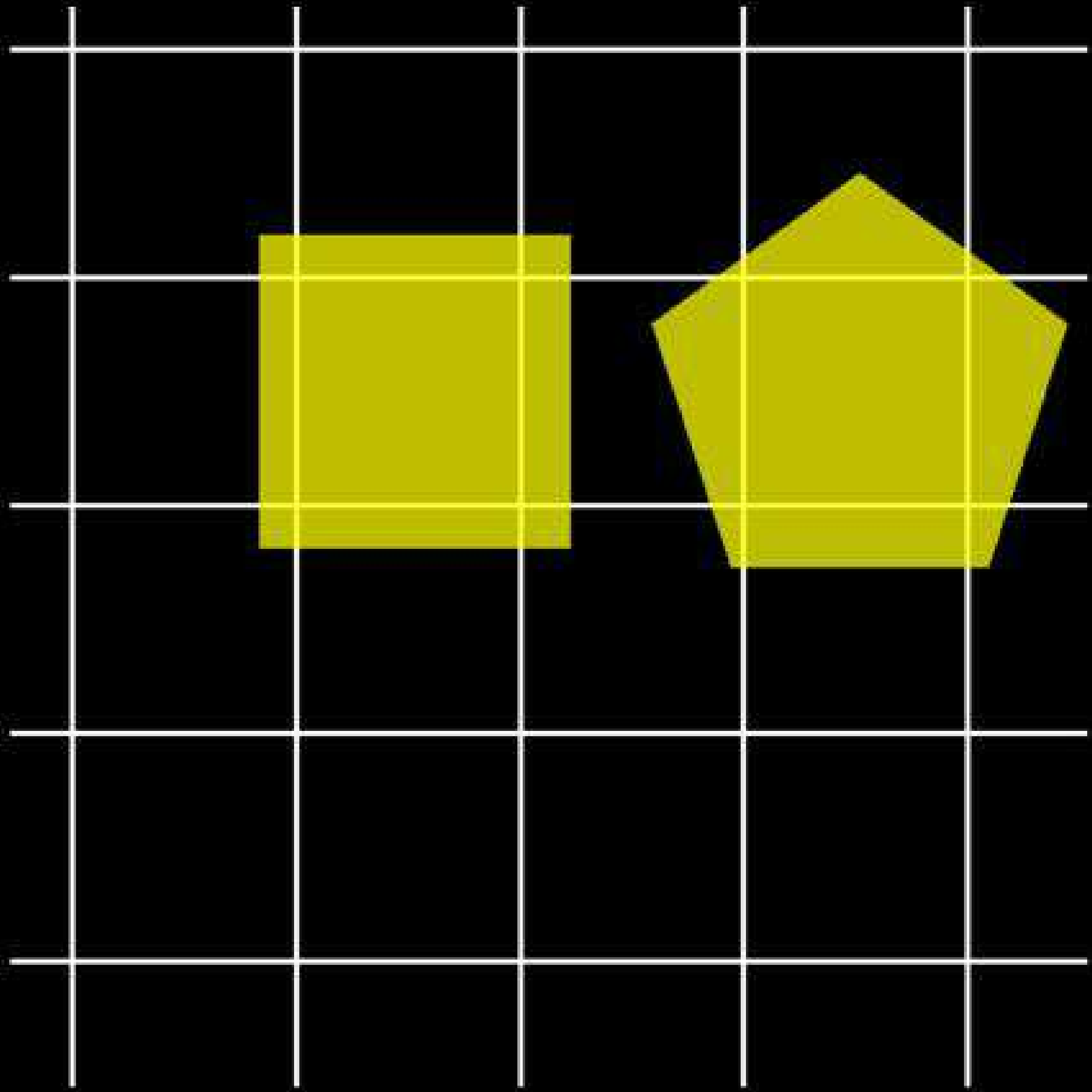
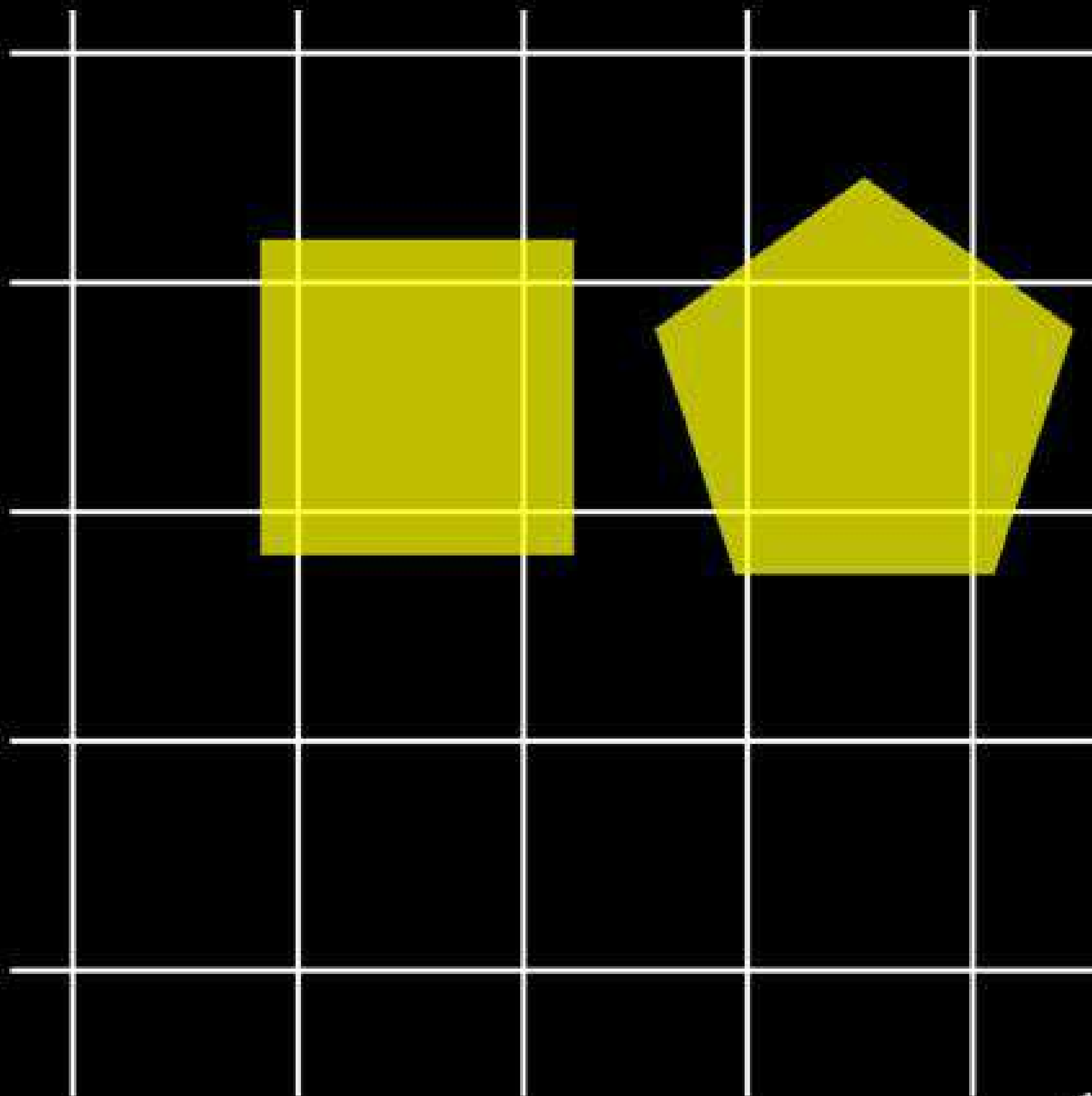


Square(a) $\lor$ Square(b)
$\neg$Square(a)

Square(b)

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

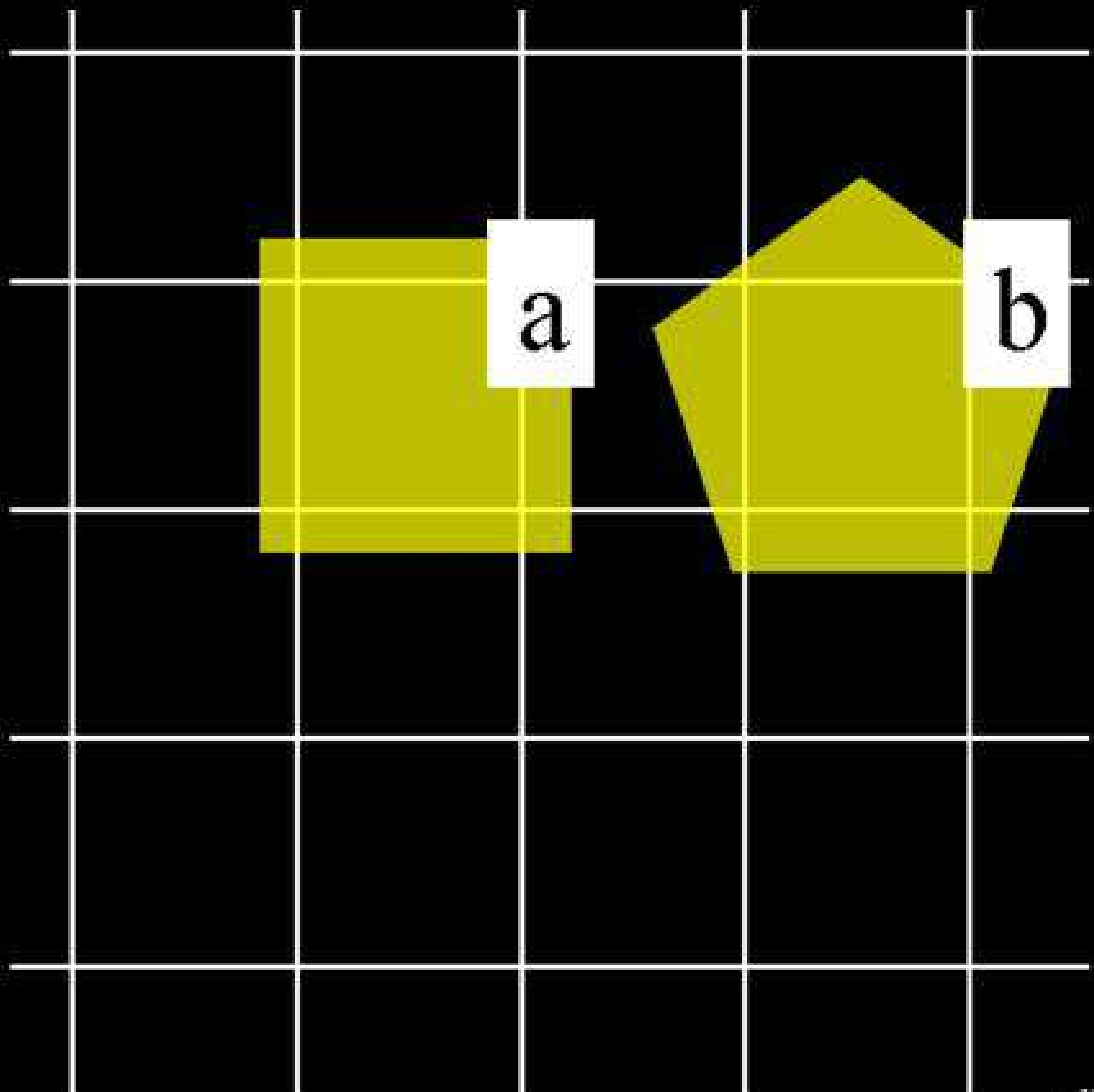


name

Square(a) ∨ Square(b)
¬Square(a)

Square(b)

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false



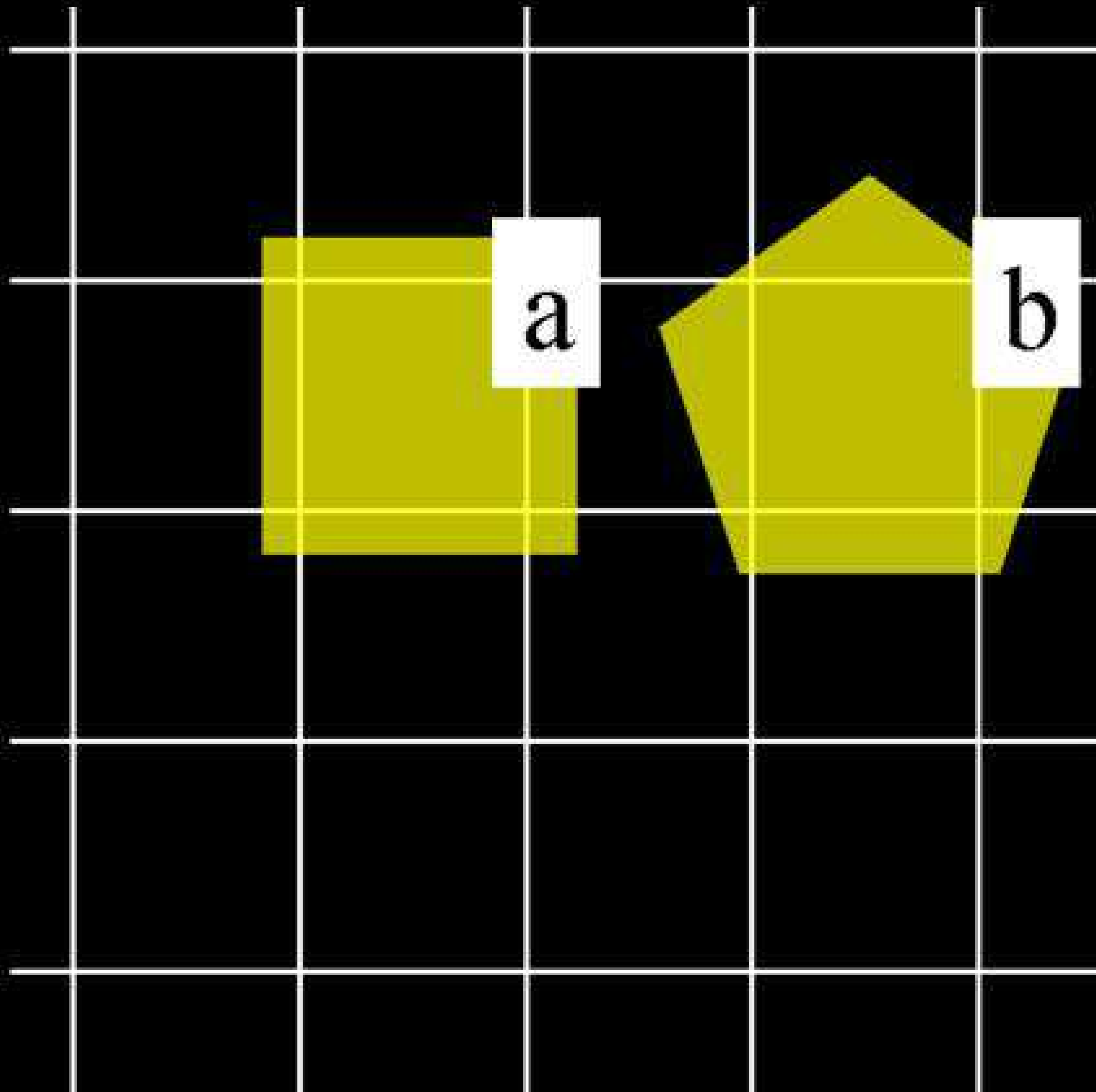
name

Square(a) $\vee$ Square(b)

$\neg$Square(a)

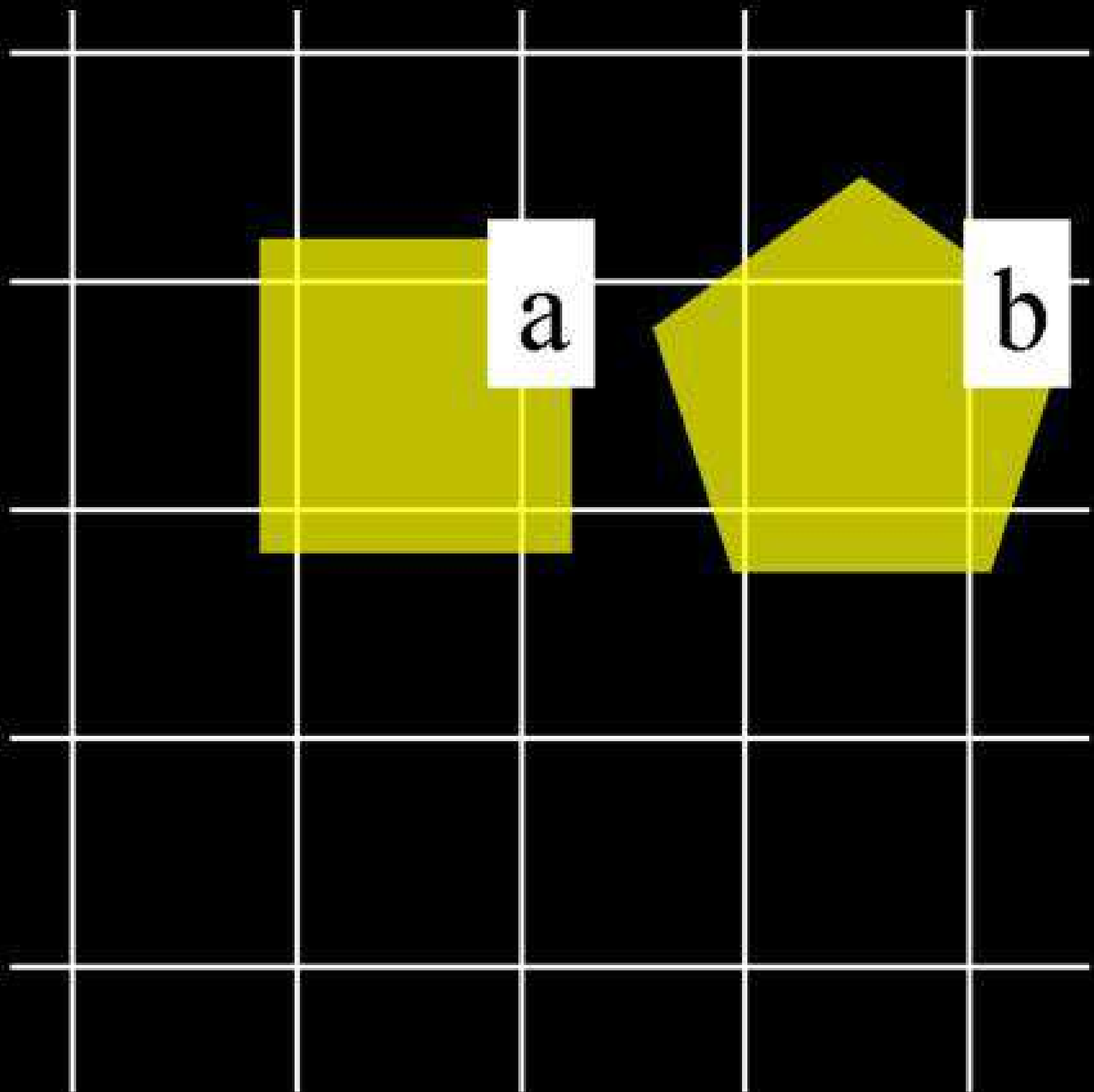
Square(b)

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false



T | Square(a) ∨ Square(b)
  | ¬Square(a)
  |—
  | Square(b)

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

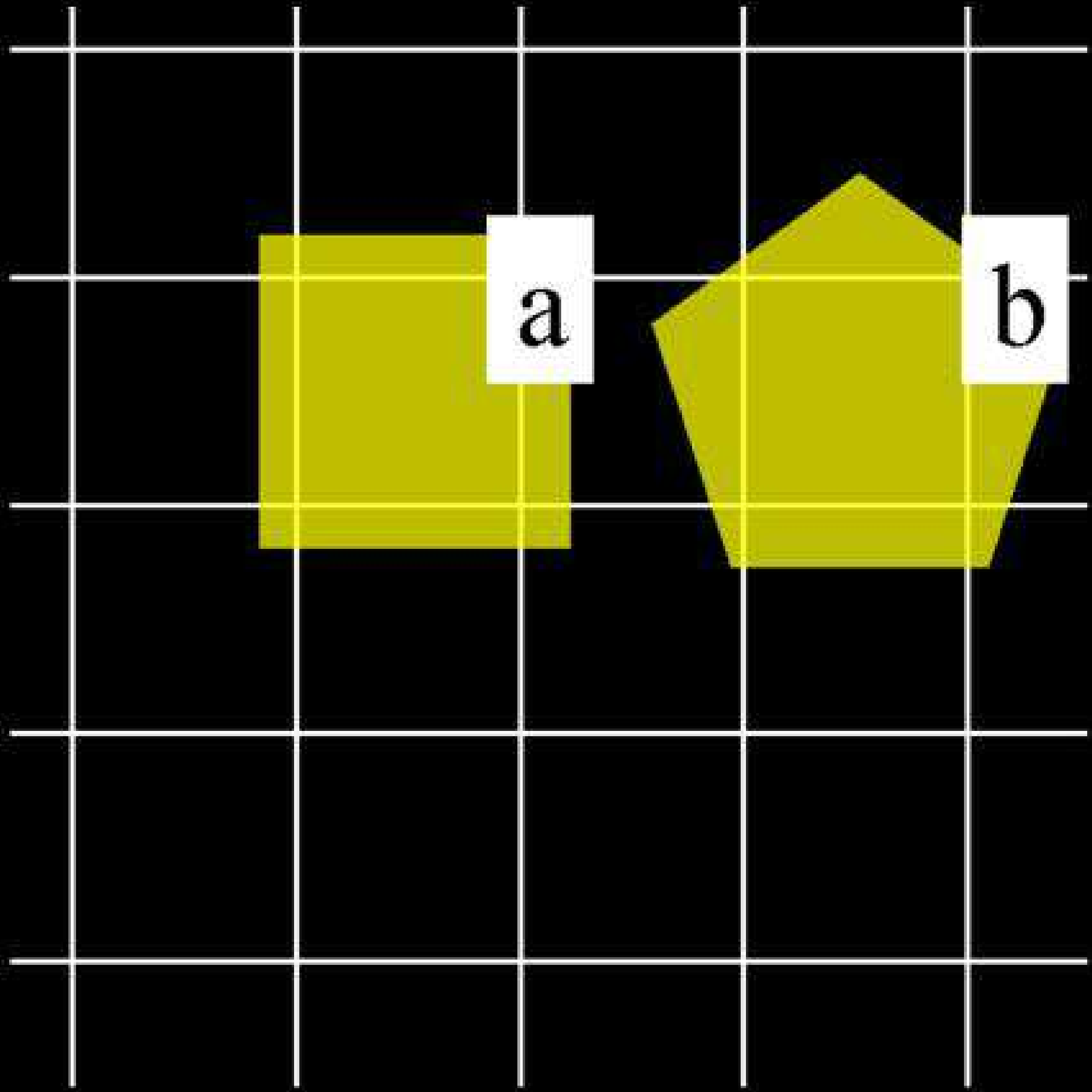


T $\quad \text{Square}(a) \lor \text{Square}(b)$

F $\quad \neg\text{Square}(a)$

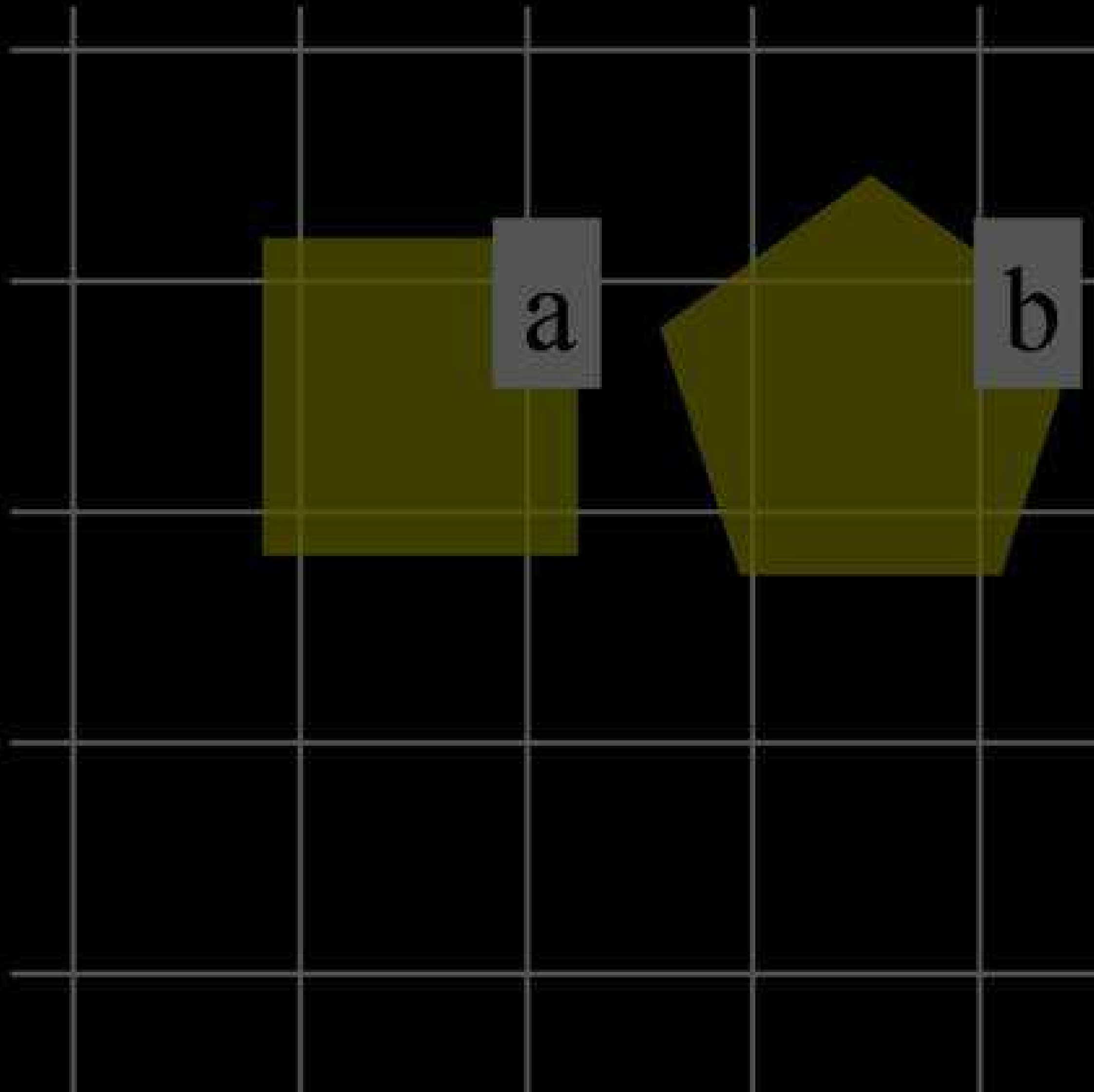
$\quad \text{Square}(b)$

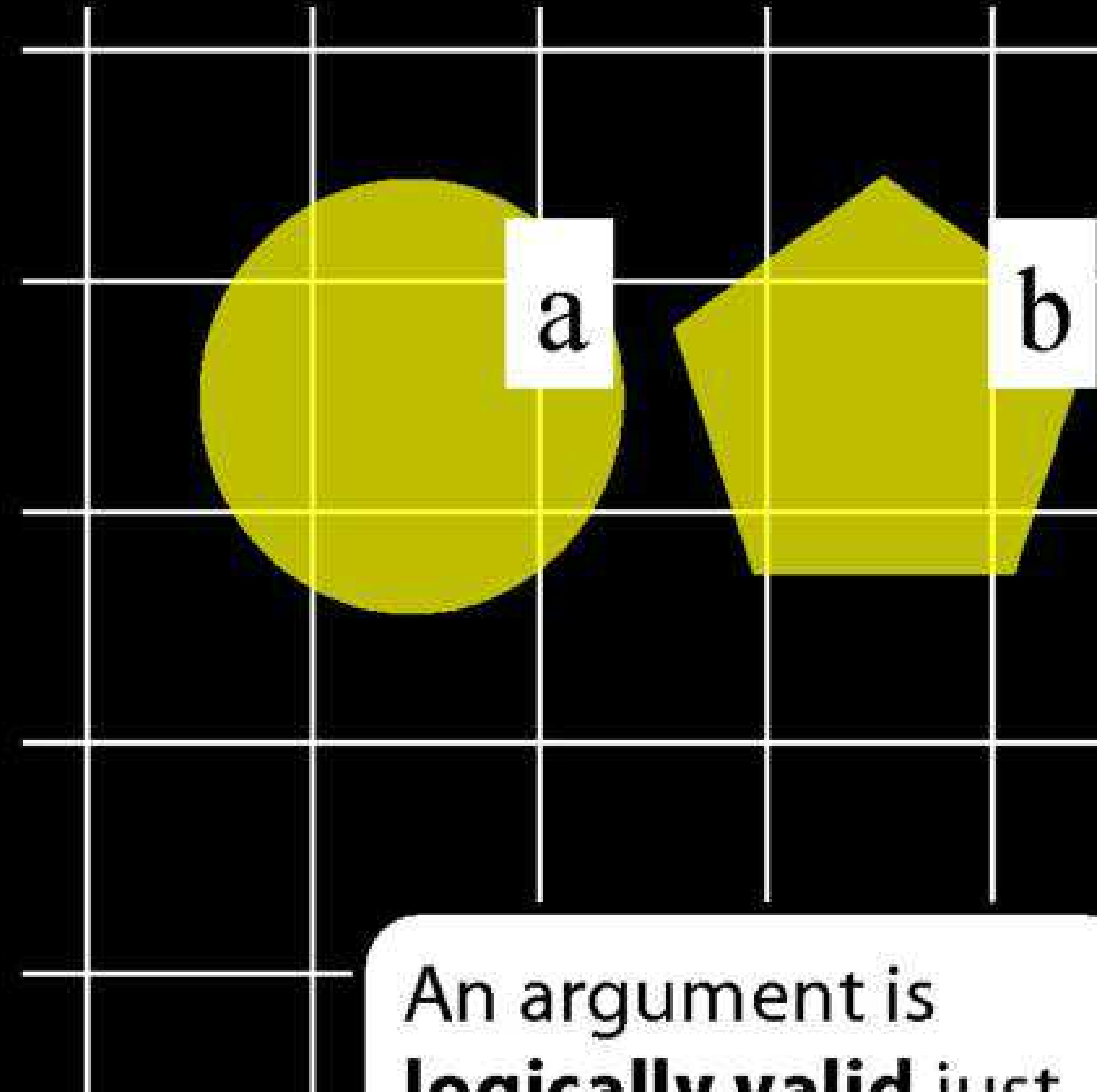
An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false



T | Square(a) ∨ Square(b)
F | ¬Square(a)
F | Square(b)

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false



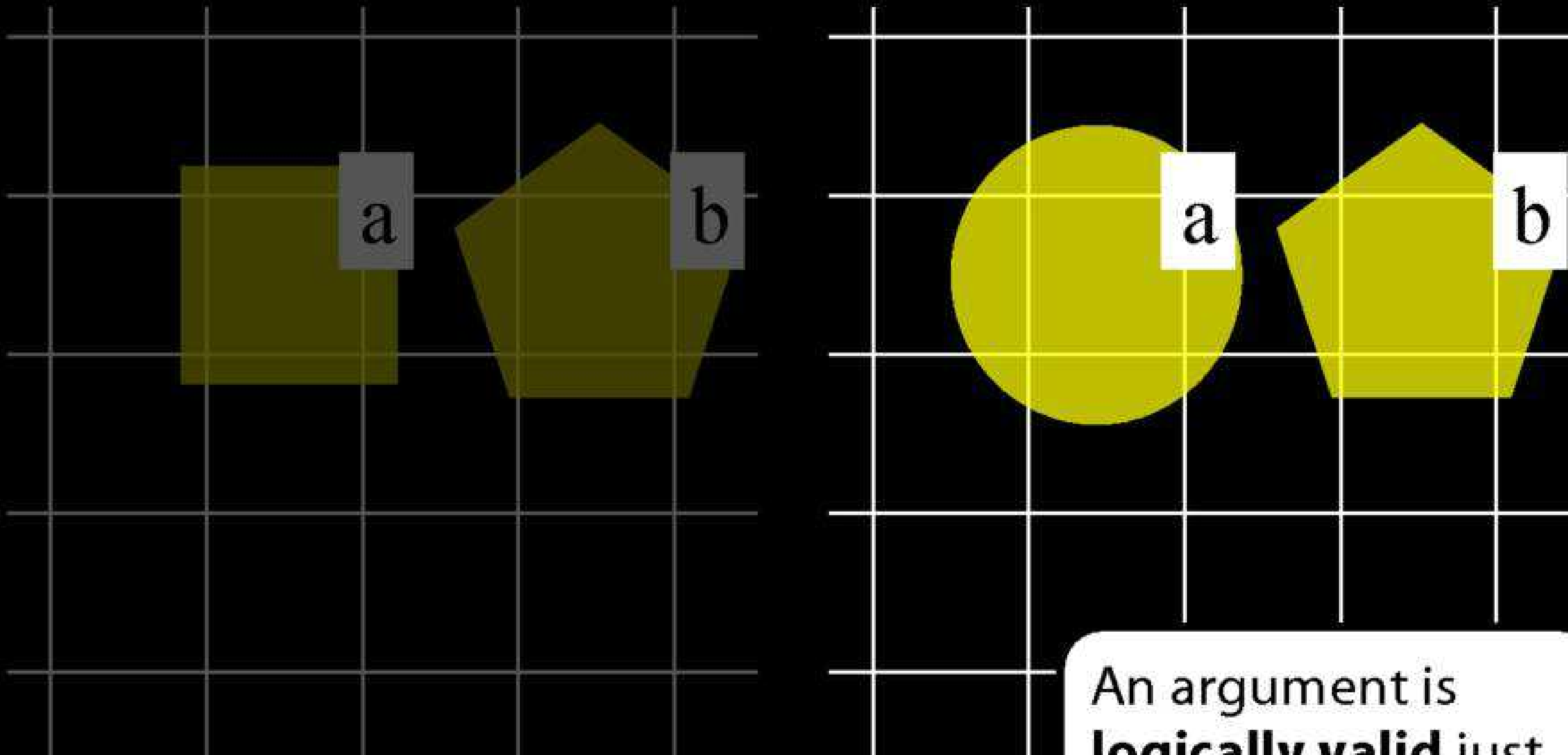


$\mathrm{Square}(a) \vee \mathrm{Square}(b)$

$\neg\mathrm{Square}(a)$

$\mathrm{Square}(b)$

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false



$\mathrm{Square}(a) \lor \mathrm{Square}(b)$

$\neg \mathrm{Square}(a)$

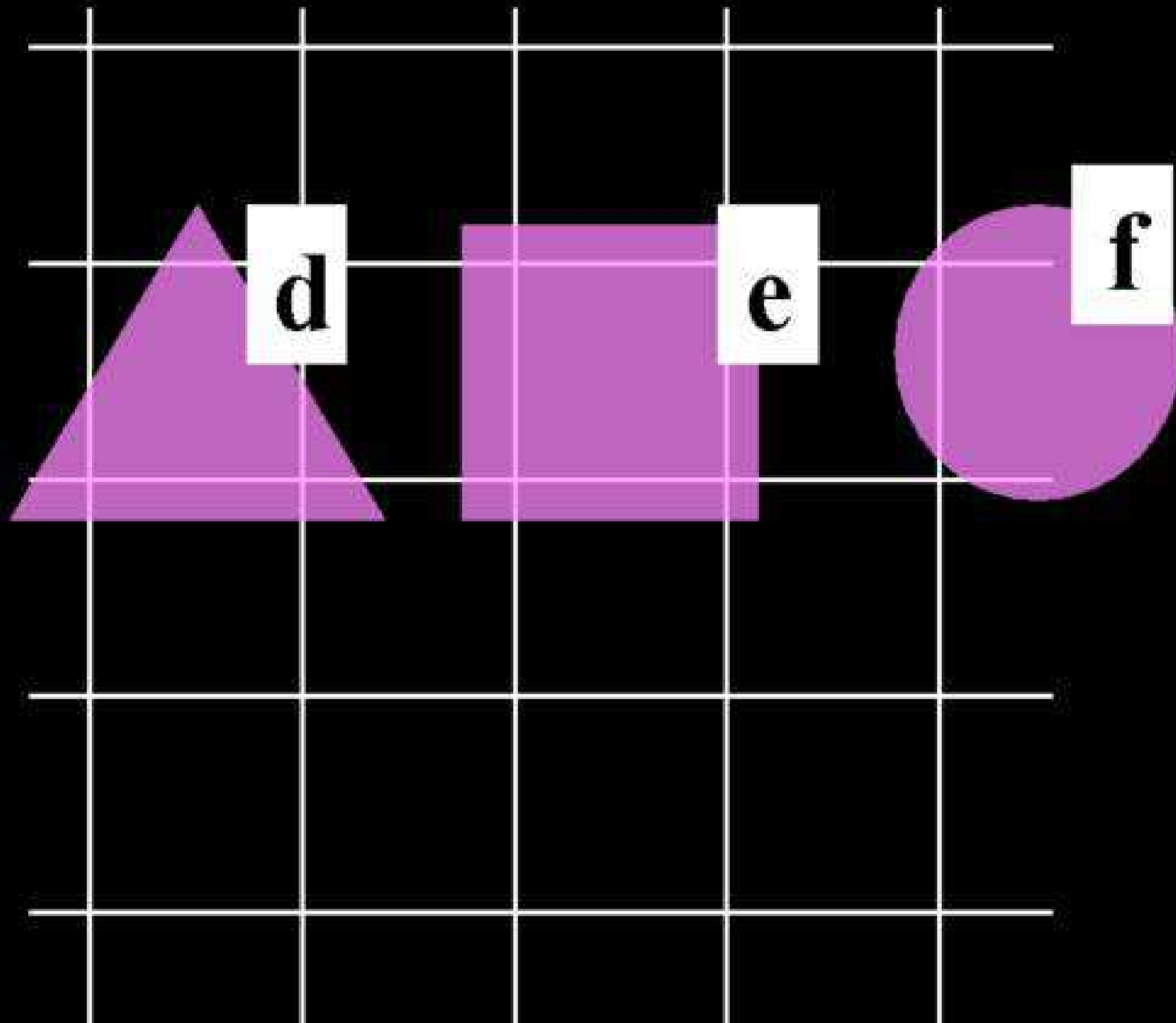
$\mathrm{Square}(b)$

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

Counterexamples

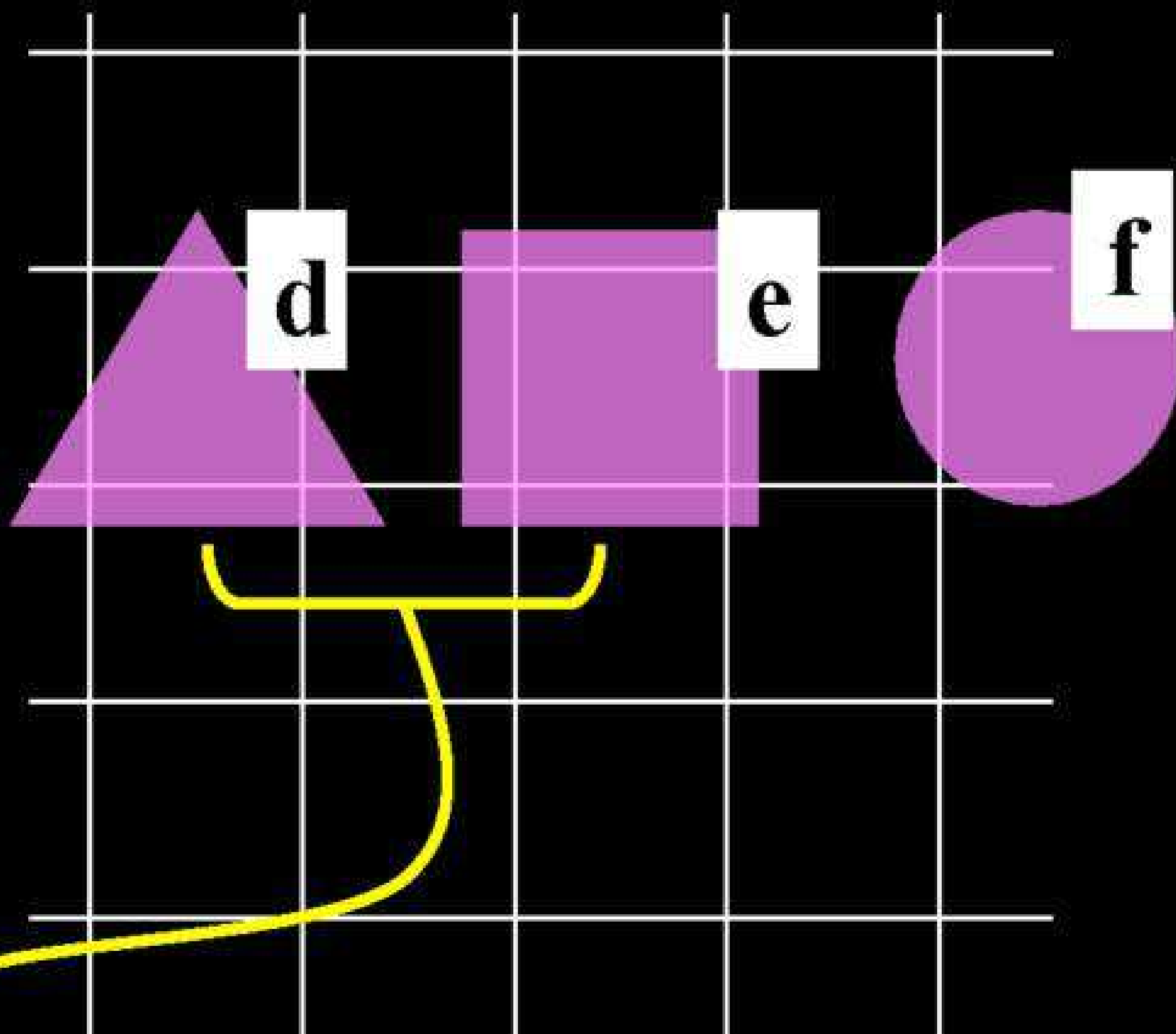
An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

Adjoins(d,e) //premise 1
Adjoins(e,f) //premise 2
Adjoins(d,f) //conclusion



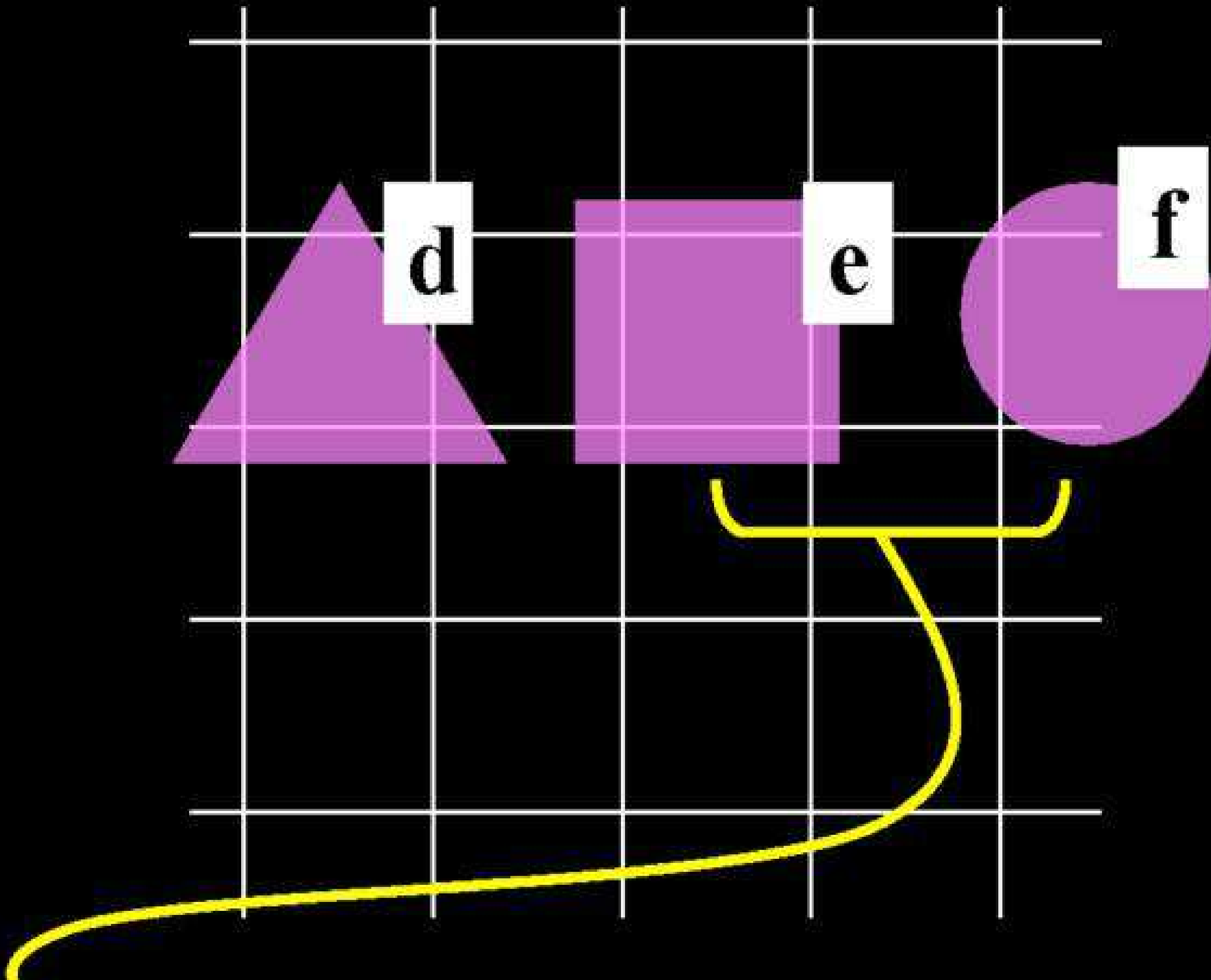
An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

Adjoins(d,e)   //premise 1
Adjoins(e,f)   //premise 2
Adjoins(d,f)   //conclusion



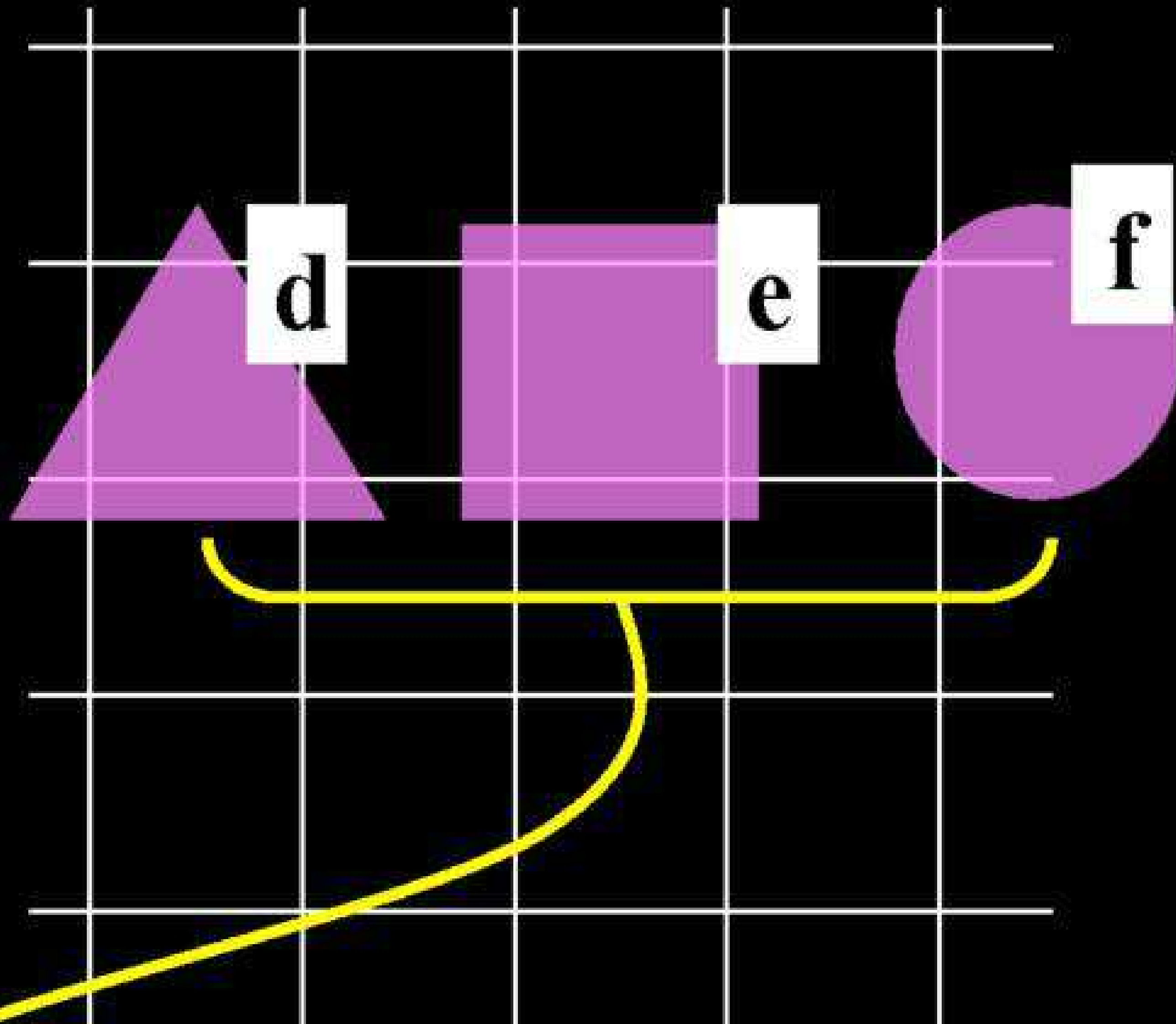
T | Adjoins(d,e) //premise 1
Adjoins(e,f) //premise 2
Adjoins(d,f) //conclusion

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false



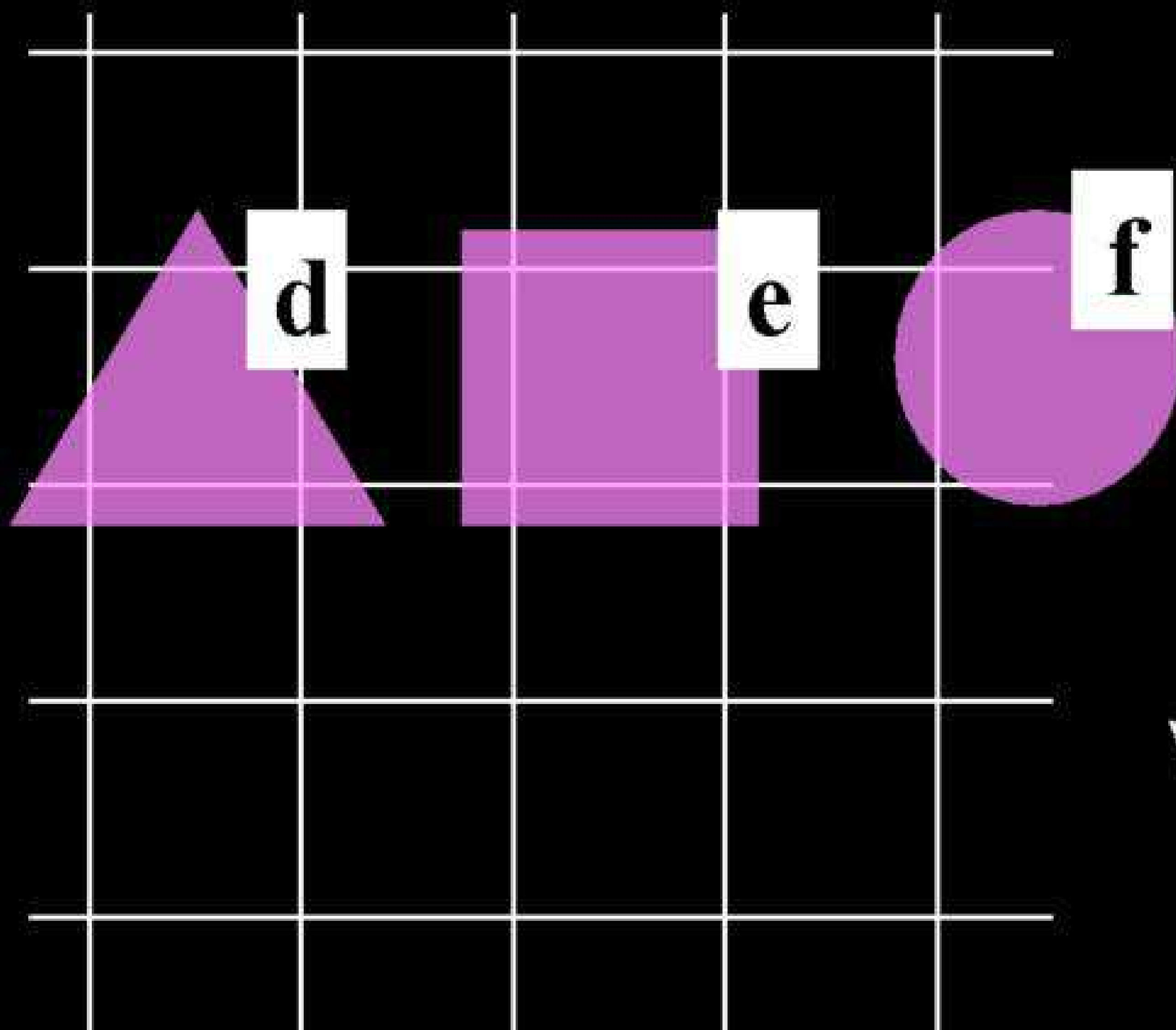
An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

T | Adjoins(d,e) //premise 1
T | Adjoins(e,f) //premise 2
| Adjoins(d,f) //conclusion



An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

T | Adjoins(d,e) //premise 1
T | Adjoins(e,f) //premise 2
F | Adjoins(d,f) //conclusion



An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

A **counterexample** to an argument is a possible situation in which its premises are T and its conclusion F

T | Adjoins(d,e) //premise 1
T | Adjoins(e,f) //premise 2
F | Adjoins(d,f) //conclusion

There are no counterexamples to a logically valid argument.

If an argument is not valid, then there is at least one counterexample to it.

To show that an argument is *not* logically valid, we specify a counterexample to it.

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

A **counterexample** to an argument is a possible situation in which its premises are T and its conclusion F

An argument is **sound** just if it is logically valid and its premises are all true

An argument is **sound** just if it is logically valid and its premises are all true

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

An argument is **sound** just if it is logically valid and its premises are all true

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

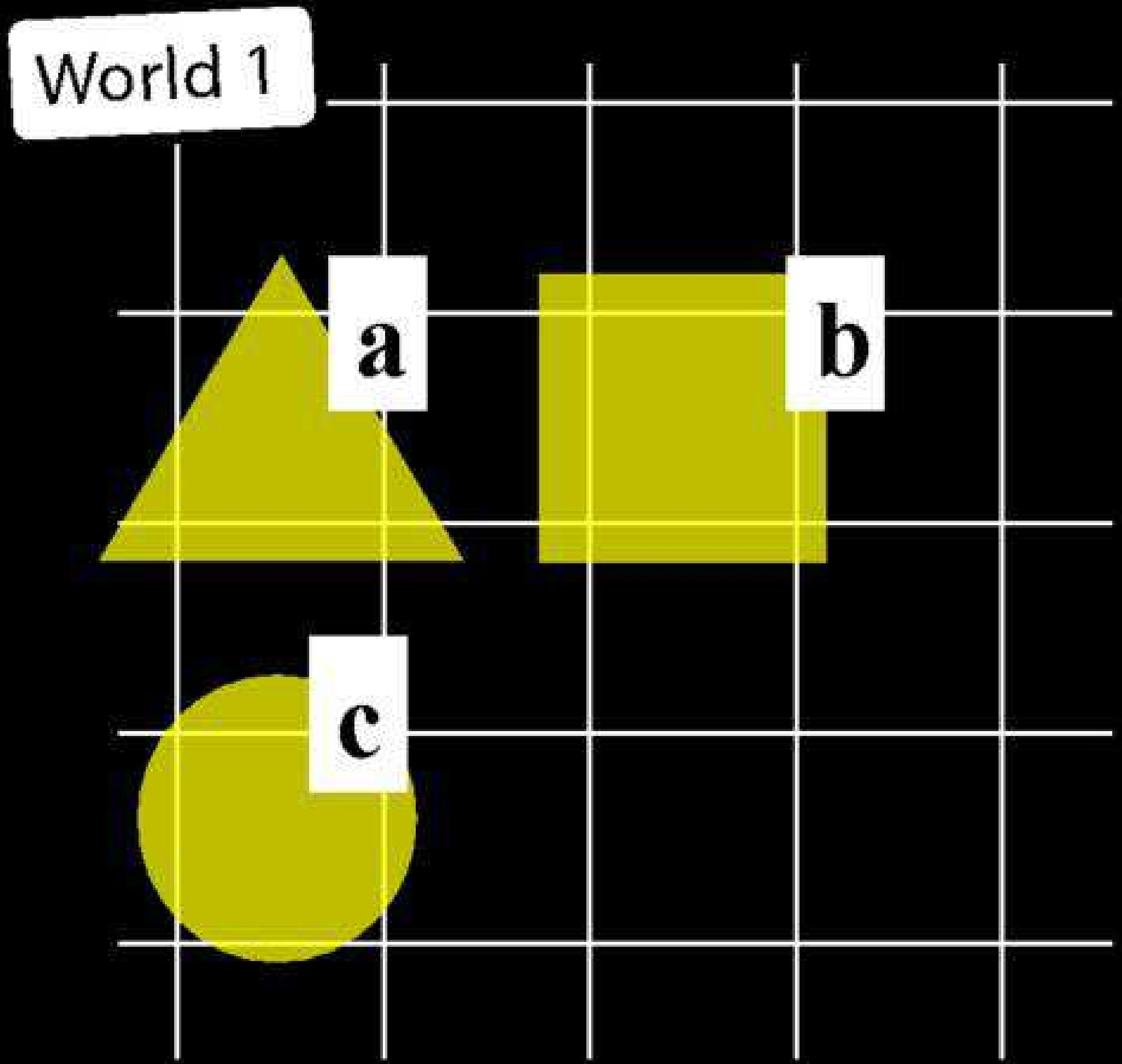
An argument is **sound** just if it is logically valid and its premises are all true

LeftOf(a,b) //premise 1
LeftOf(b,c) //premise 2
LeftOf(a,c) //conclusion

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

An argument is **sound** just if it is logically valid and its premises are all true

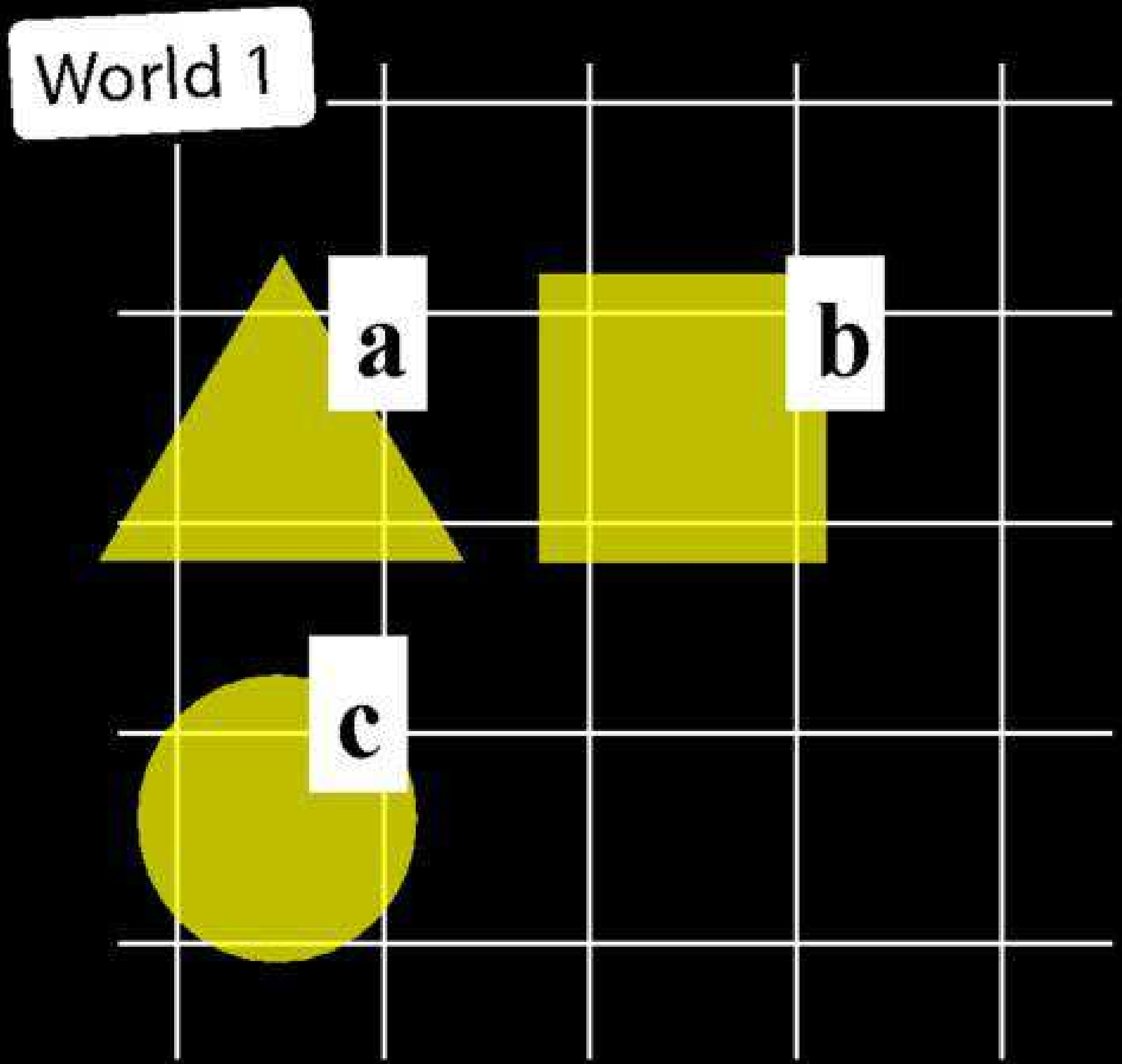
? LeftOf(a,b) //premise 1
? LeftOf(b,c) //premise 2
? LeftOf(a,c) //conclusion



? LeftOf(a,b) //premise 1
? LeftOf(b,c) //premise 2
? LeftOf(a,c) //conclusion

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

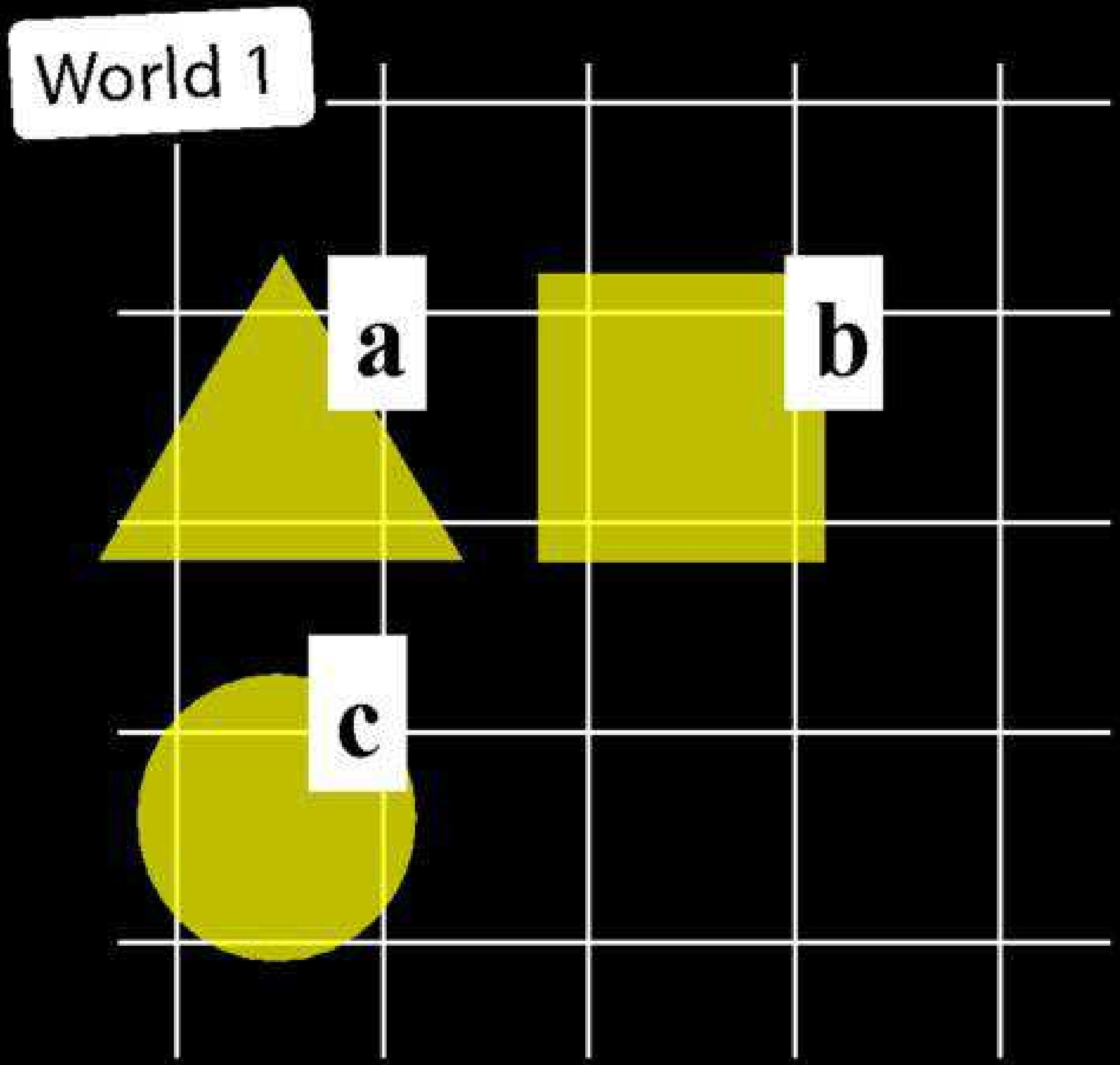
An argument is **sound** just if it is logically valid and its premises are all true



T | LeftOf(a,b) //premise 1
F | LeftOf(b,c) //premise 2
F | LeftOf(a,c) //conclusion

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

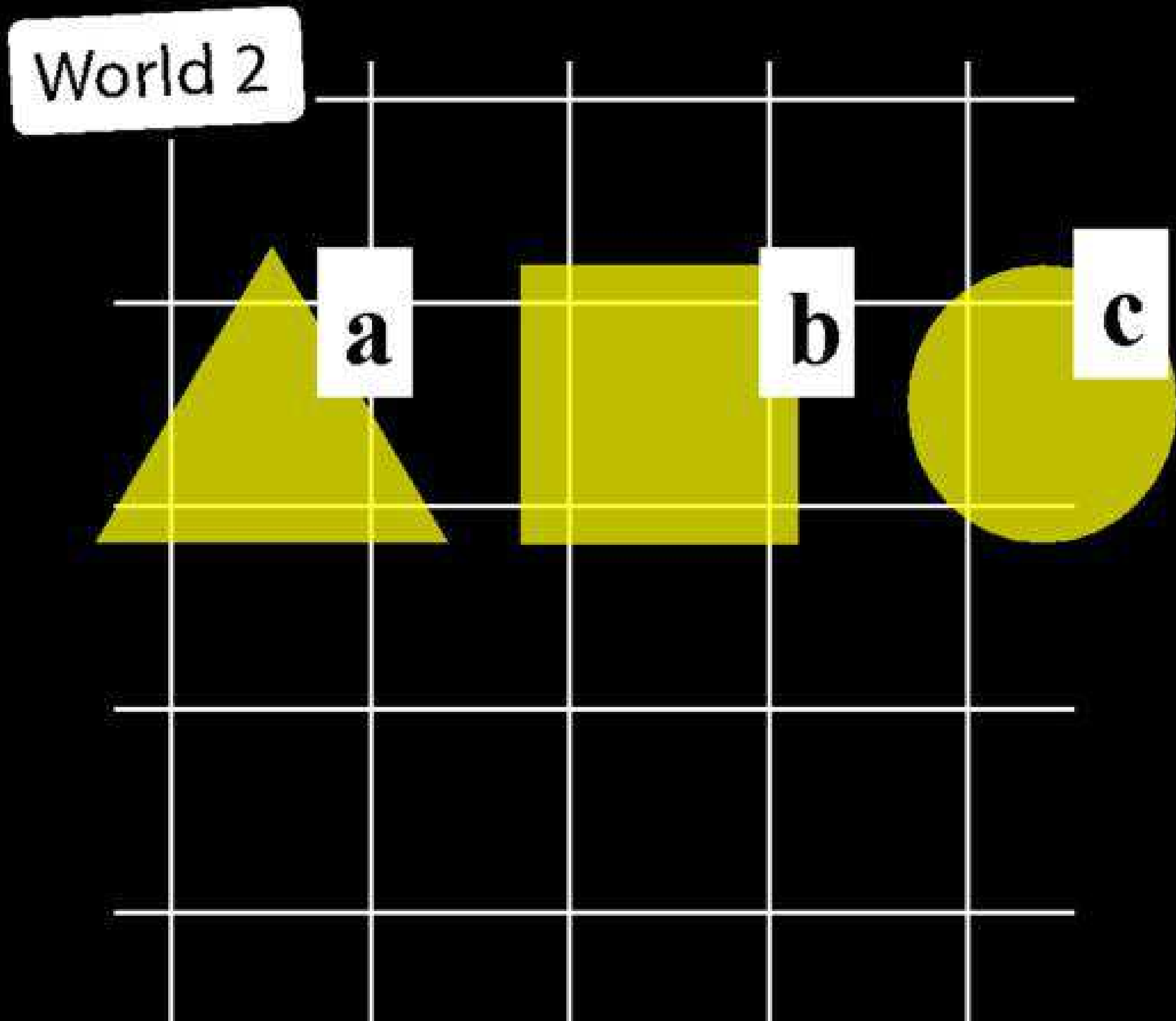
An argument is **sound** just if it is logically valid and its premises are all true



T | LeftOf(a,b) //premise 1
F | LeftOf(b,c) //premise 2
F | LeftOf(a,c) //conclusion

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

An argument is **sound** in a possible situation just if it is logically valid and its premises are all true in the situation



T | LeftOf(a,b) //premise 1
T | LeftOf(b,c) //premise 2
T | LeftOf(a,c) //conclusion

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

An argument is **sound** in a possible situation just if it is logically valid and its premises are all true in the situation

Whether a sentence is **true** may depend on which possible situation is actual.

The same applies to whether an argument is **sound**.

But whether an argument is **logically valid** does not depend on which possible situation is actual.*
(*There may be exceptions but we can ignore these.)

An argument is **logically valid** just if there's no possible situation in which the premises are true and the conclusion false

An argument is **sound** just if it is logically valid and its premises are all true