

PD 20

Engineering Workplace Skills: Developing Reasoned Conclusions

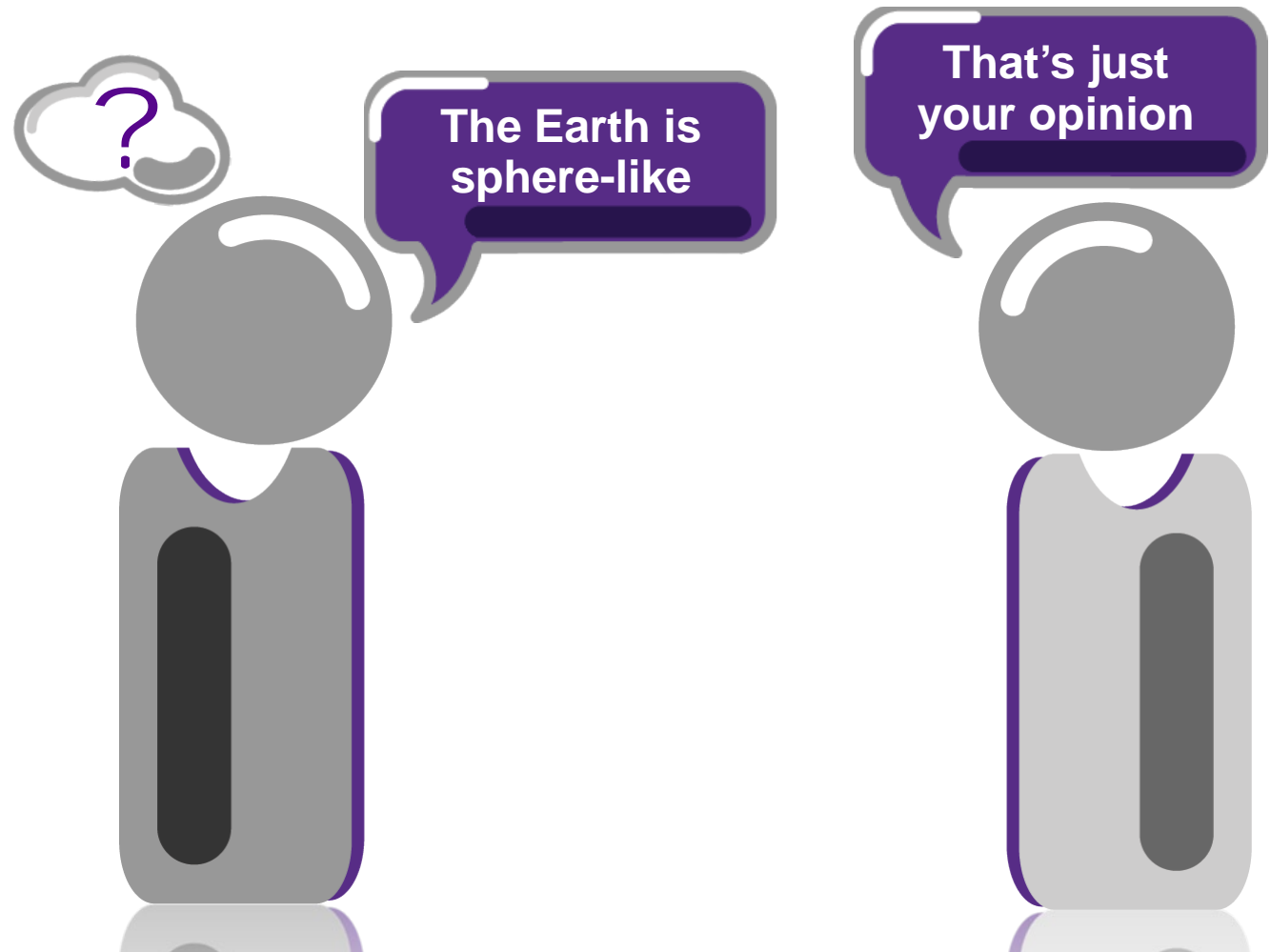
Unit 04

Understanding Arguments

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“That's just your opinion”



Aren't all opinions equally good?

Politically, maybe...

...but not from a logical point of view

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Aren't all opinions equally good?

Assume that nobody's opinion is wrong in a debate.

All opinions
are correct

Your opinion
is wrong

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Smith



Jones

Aren't all opinions equally good?

No! Not all opinions are equally good.

Assume that nobody's opinion is wrong in a debate.
If **Smith** is right, then **Smith** must concede that **Jones** is right...

Which is to say that **Smith** is wrong.

All opinions
are correct

Your opinion
is wrong



Smith



Jones

Aren't all opinions equally good?

Global warming...

Claim: Humans are contributing to global warming

Only a science-hating capitalist would disagree



Numerous scientific studies suggest that humans are causing an increase in greenhouse gasses



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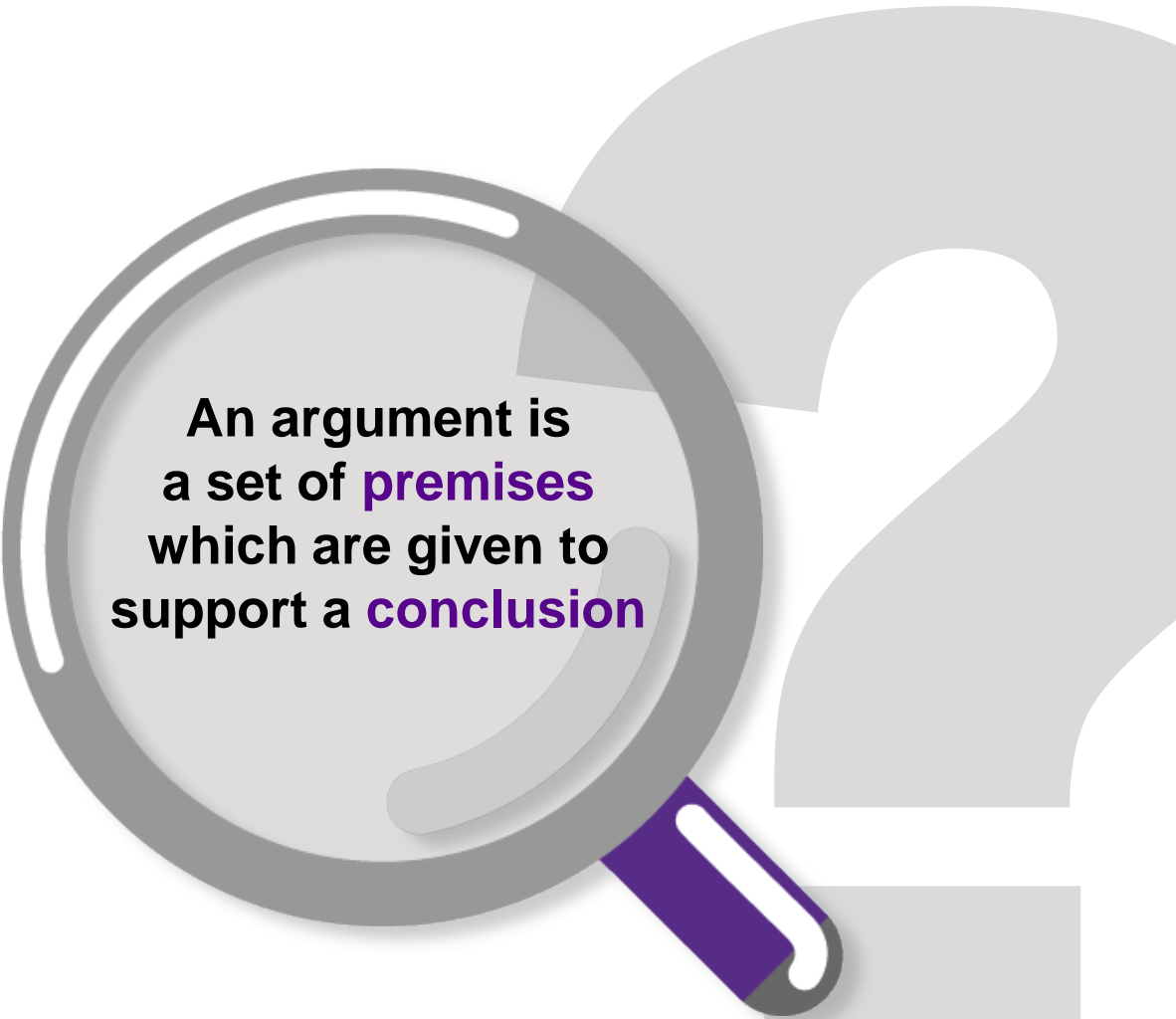


Smith



Jones

What is an Argument?

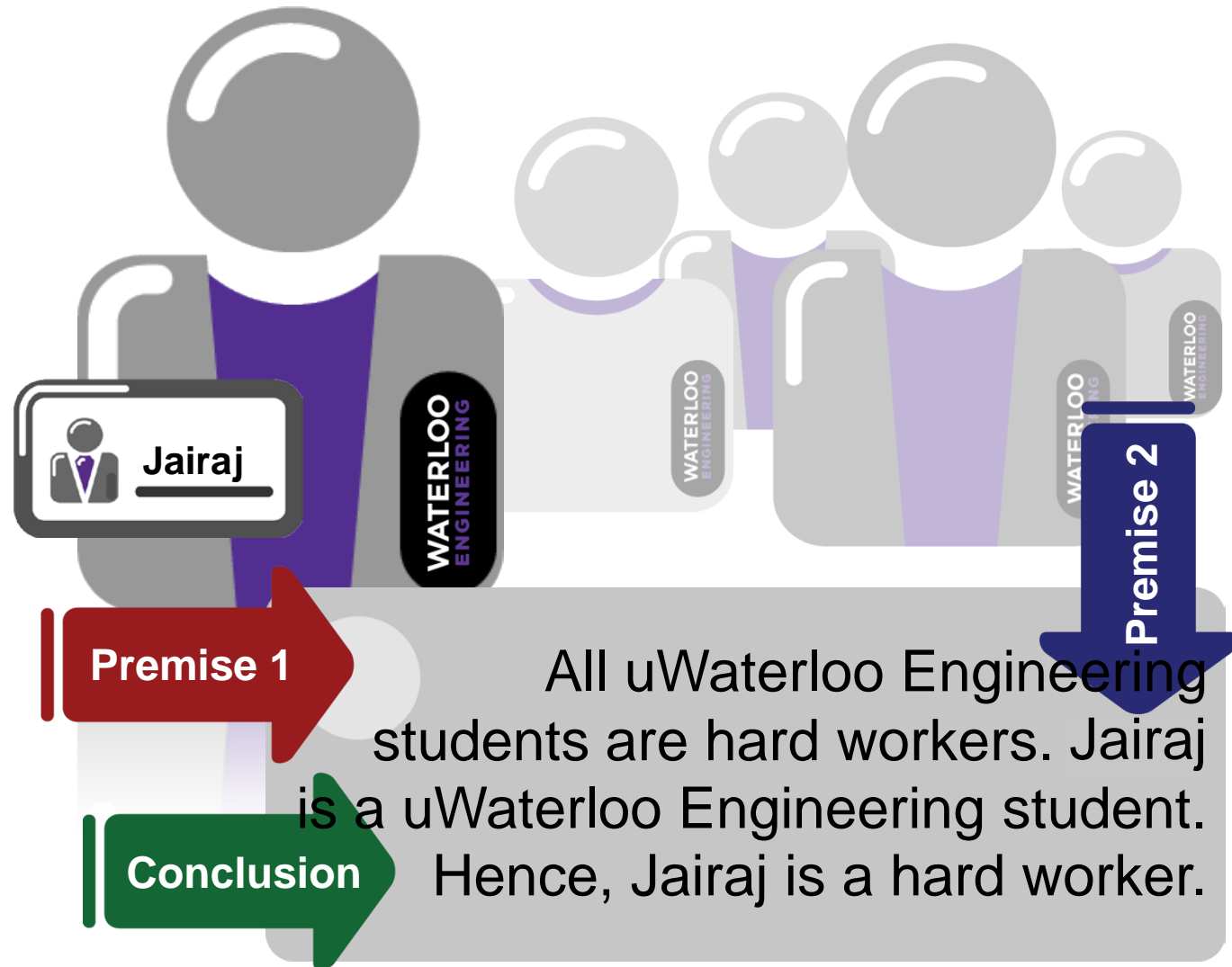


An argument is
a set of **premises**
which are given to
support a **conclusion**

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Example



Example



All uWaterloo Engineering students are hard workers.



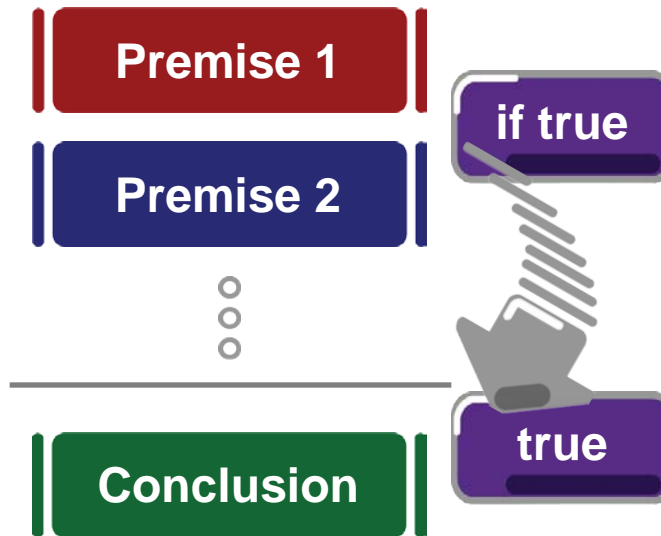
Jairaj is a uWaterloo Engineering student.



Hence, Jairaj is a hard worker.

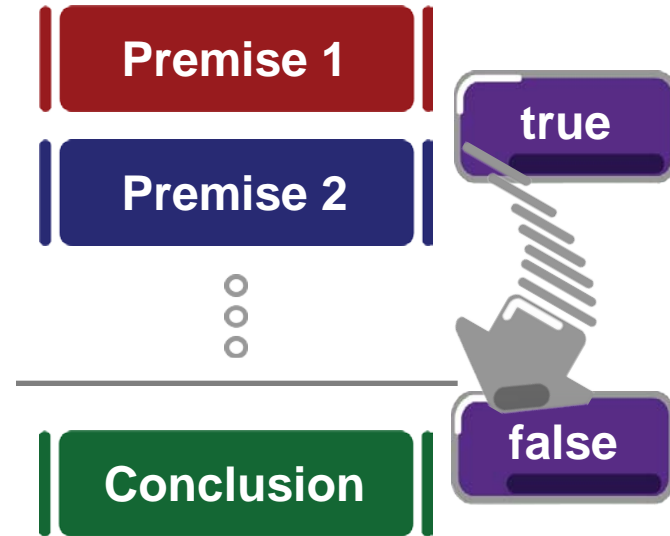
Types of arguments

Deductive Arguments



- Truth is guaranteed

Ampliative Arguments



- Defeasible

- Premises lend credence

Evaluating Deductive Arguments

Deductive Arguments

Premise 1

Premise 2



Conclusion

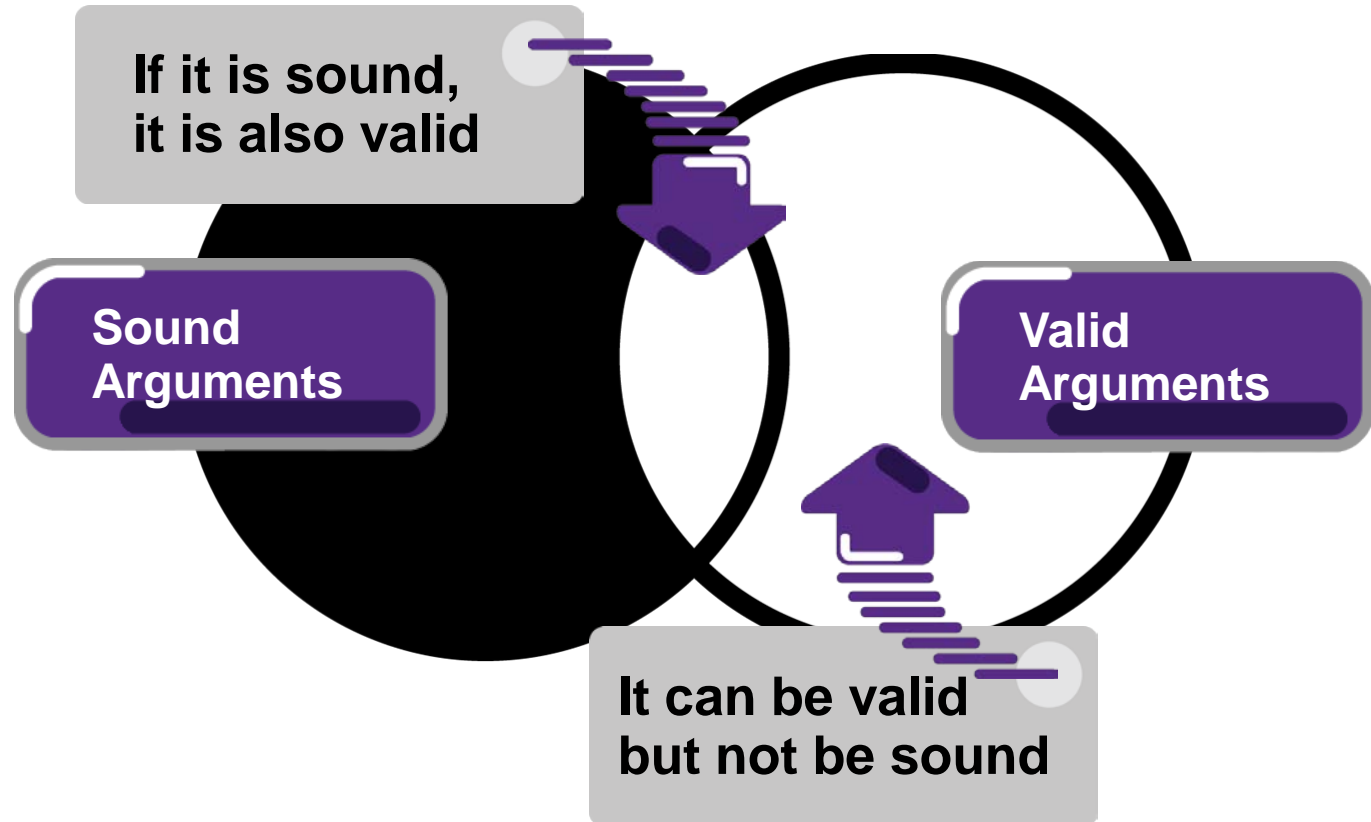
Validity:

If the premises are true,
then the conclusion must
also be true

Soundness:

An argument is sound if
(1) It is a valid argument, and
(2) Its premises are true

All sound arguments are valid arguments



But not all valid arguments are sound arguments

Examples

Example 1

P1 All cats are animals

true

P2 Boots is a cat

true

C Hence, Boots is an animal

true

Example 2

P1 All cats are dogs

false

P2 Boots is a cat

true

C Hence, Boots is a dog

false

Valid and Sound

Valid but not Sound

- Start with true premises

- Distinguish between form and content

Examples

Let S, P, and B be variables

Example 1

P1 All S are P

P2 B is a S

C Hence, B is a P

Example 2

P1 All S are P

P2 B is a S

C Hence, B is a P

How do we evaluate a deductive argument?

1) Analyze the argument form

Internal

2) Evaluate the truth of the premises and conclusion

External

Analyzing Argument Forms

Logical Vocabulary

The logical form of an argument depends on the logical vocabulary used in the premises and conclusion

Logical Vocabulary

Alice is in Toronto **and** Hamish is in Ottawa.

Either I got the job **or** Bob got the job.

If Anish is in Montreal **then** he is in Quebec.

*It is **not** the case* that chlorine is a garnish.

Analyzing Argument Forms

Once we understand the logical structure of the argument, we can look for counter examples

Counter Example

Try and come up with an argument where:

(1) The logical form is the same

(2) The premises are obviously true

(3) The conclusion is obviously false

Example of a Counter Example

Argument

(P1) If the bear patrol is working, then there won't be any bears around.

(P2) There aren't any bears around.

(C) Hence, the bear patrol is working.

Counter Example

(P1) If I'm the richest man in the world, then there won't be any bears around me.

true

(P2) There aren't any bears around me.

true

(C) Hence, I'm the richest man in the world.

false

Summary

✓ Not all opinions, beliefs, or claims are equal

✓ Claims need to be backed up with good arguments

✓ There are different types of arguments

✓ Evaluating deductive arguments is a two-part process:

1. Analyze logical form

✓ Check the logical vocabulary

✓ A good deductive argument is truth-preserving

2. Evaluate truth

✓ Evaluating truth is an external process

Logic Courses at uWaterloo

PHIL 240 Introduction to Formal Logic

PHIL 342 Non-Classical Logics

PMATH 330 Introduction to Mathematical Logic

PMATH 432 First Order Logic and Computability