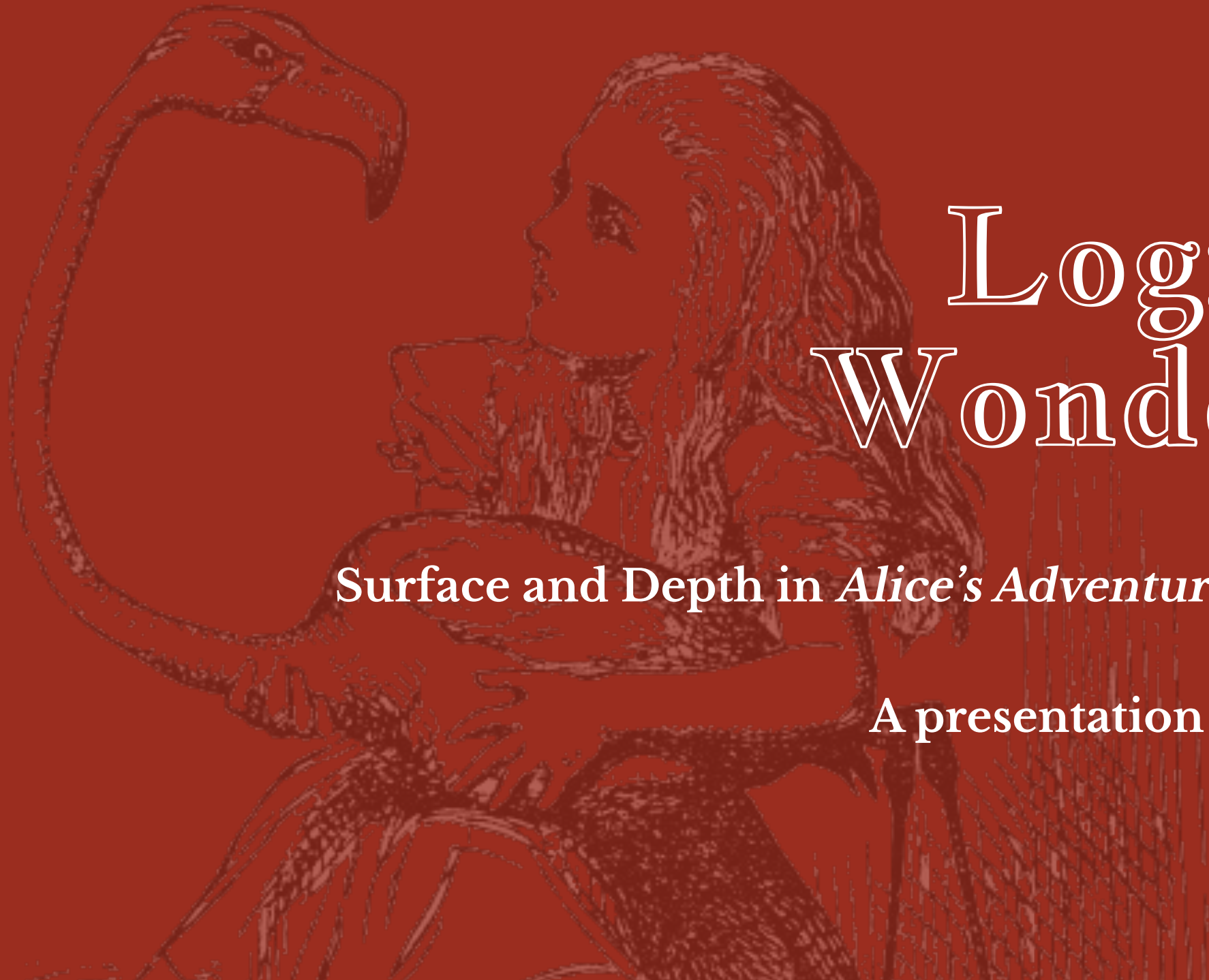


# Logic in Wonderland

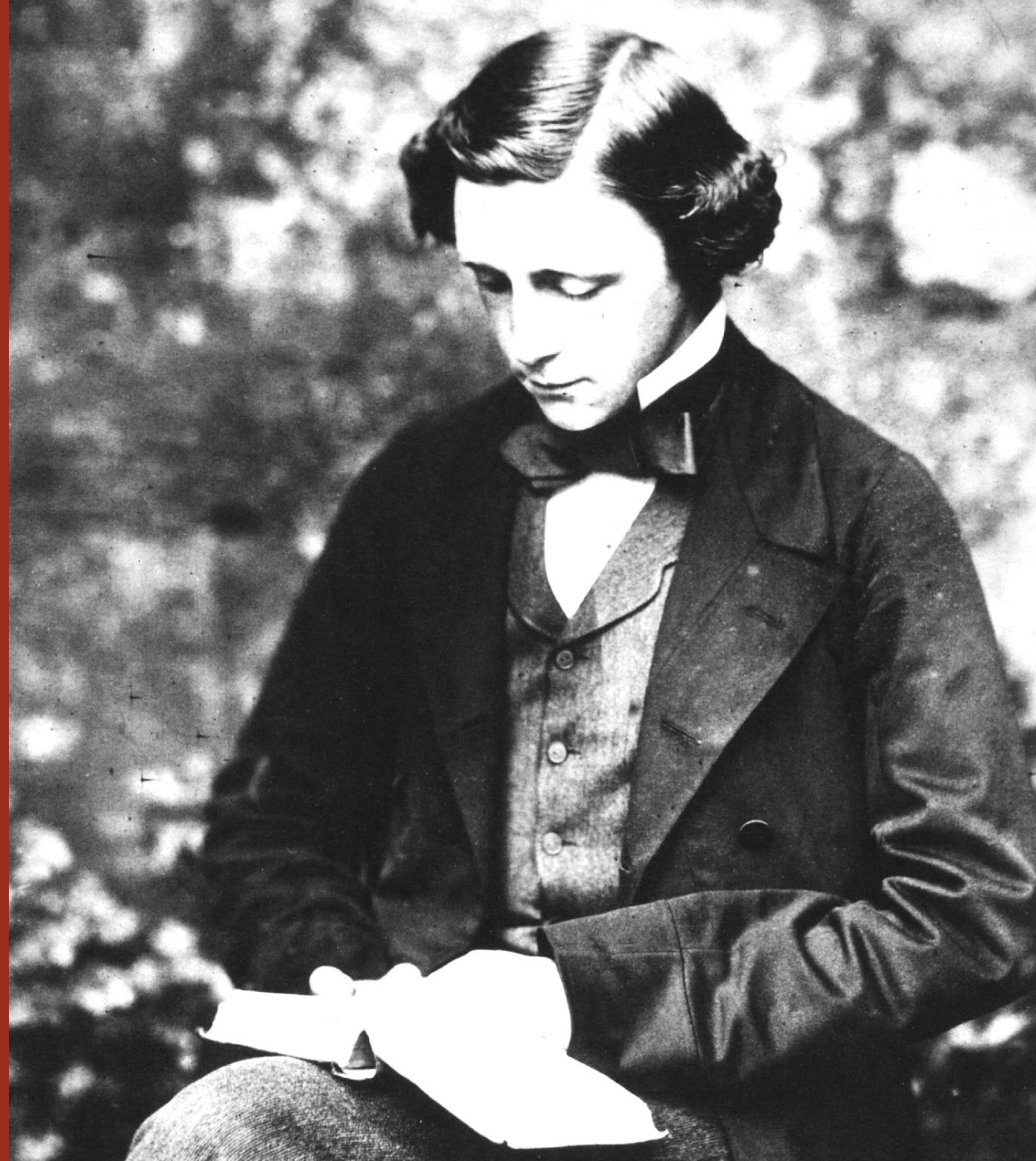
## Surface and Depth in *Alice's Adventures in Wonderland*

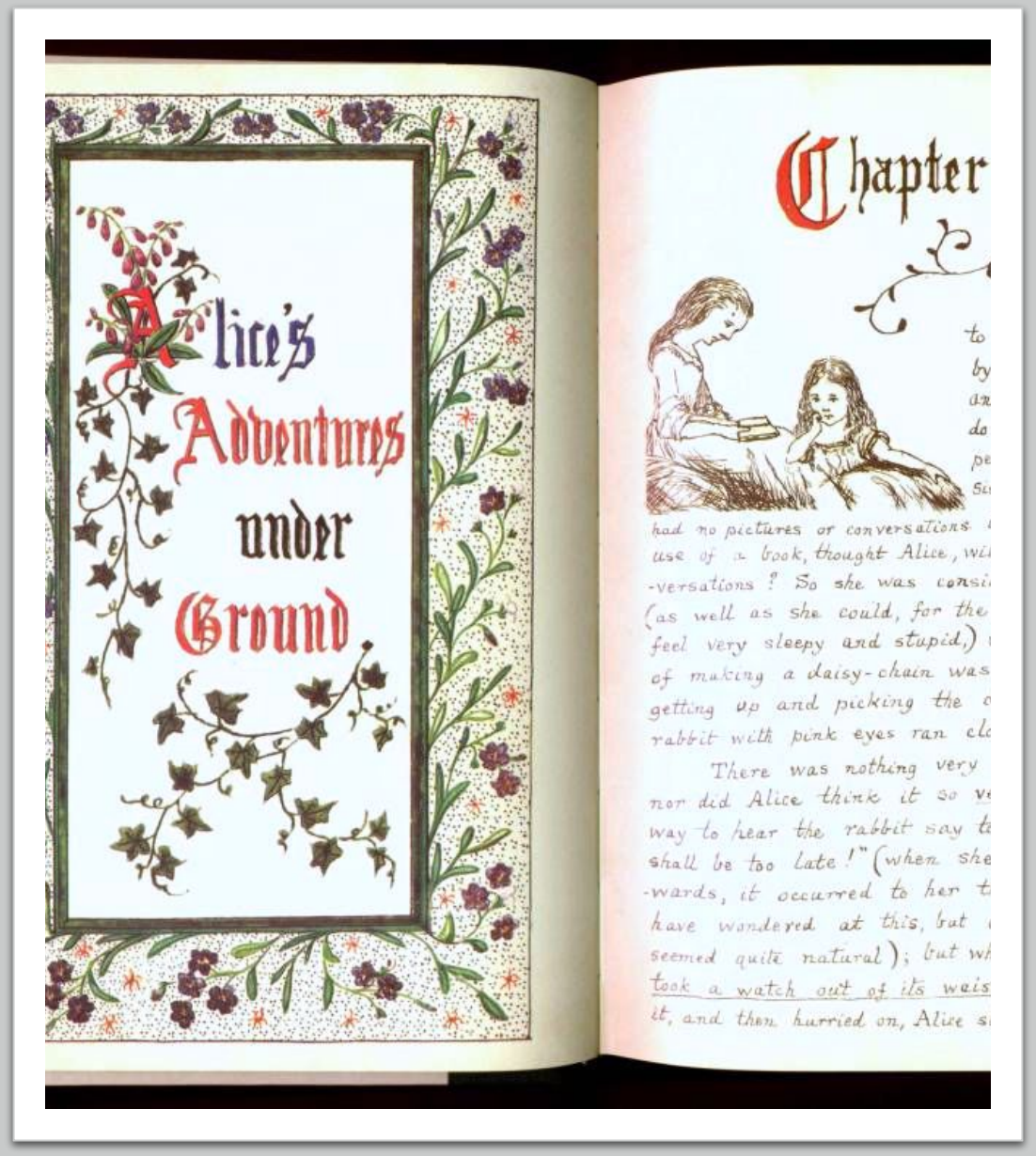
A presentation by Alanna Cronk

# Who I am

- My name is Alanna Cronk
- Sophomore at Georgetown University
  - Philosophy, English
- Aspiring academic
- Check out my personal website: alannacronk.com

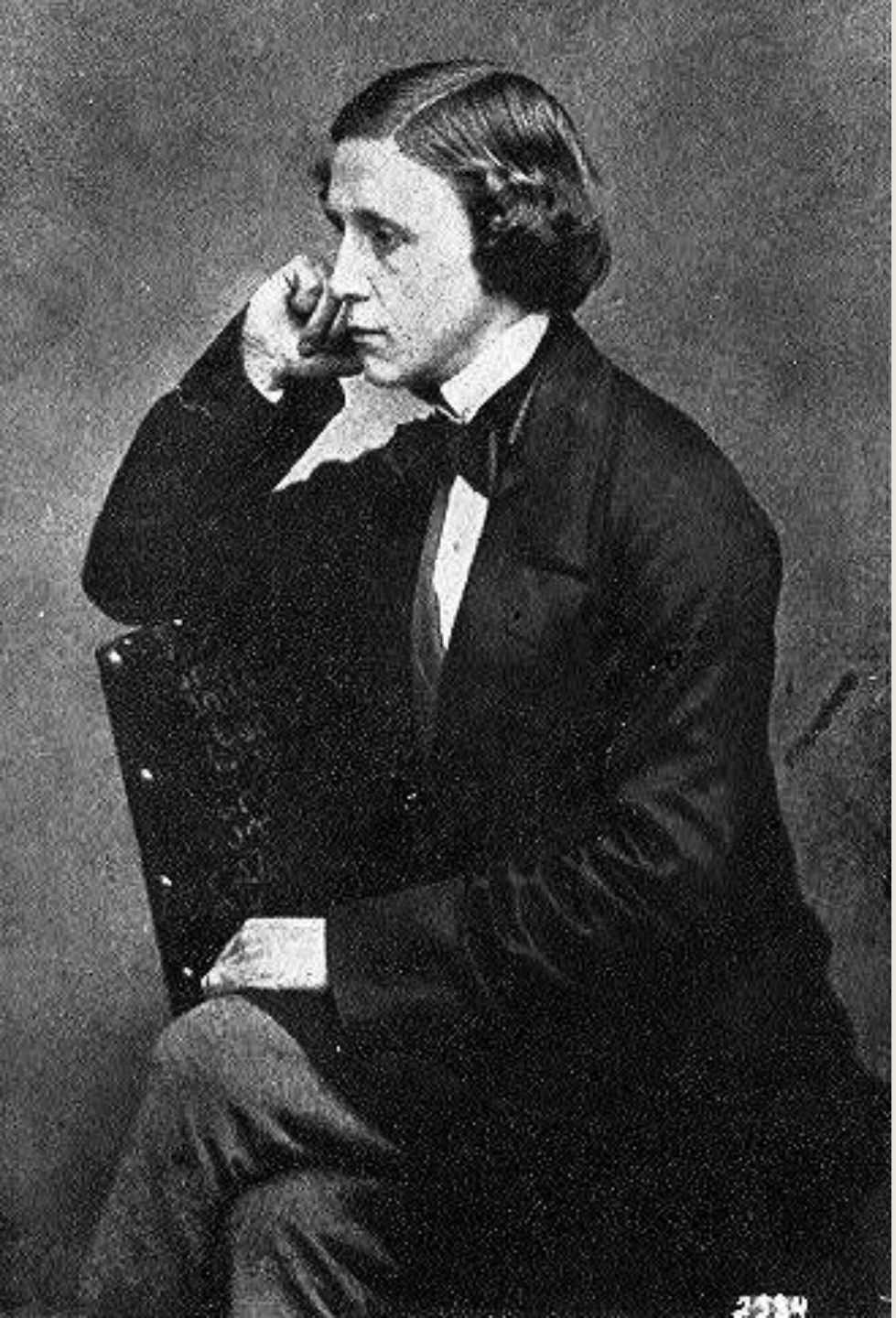
# Background Information





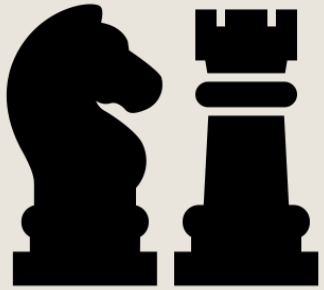

# the Book, the Author

- *Alice's Adventures in Wonderland*
- Written by Lewis Carroll (Charles Dodgson)
- Published in 1865
- Handwritten manuscript
- Originally titled *Alice's Adventures Underground*



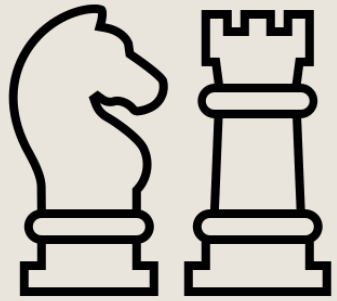
# Carroll's History as a Logician

- Experienced logician and mathematician
- *The Game of Logic* (1886)
- *Symbolic Logic* (1897)

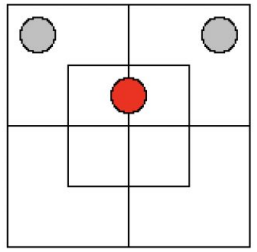


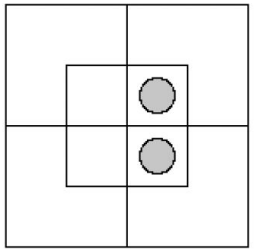
“Once you master the machinery of Symbolic Logic, and you have a mental occupation always at hand, of absorbing interest, and one that will be of real use to you in any subject you may take up, it will give you clearness of thought—the ability to see your way through a puzzle—the habit of arranging your ideas in an orderly and get-at-able form…”

(Symbolic Logic)

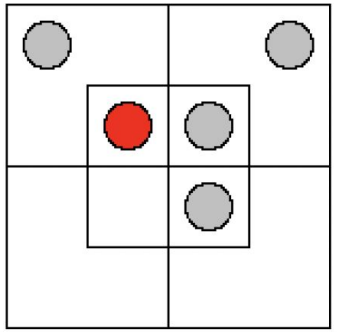


The Premisses, separately.

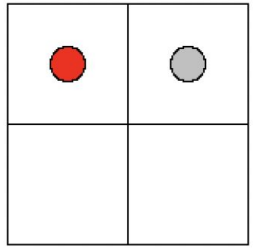




The Premisses, combined.

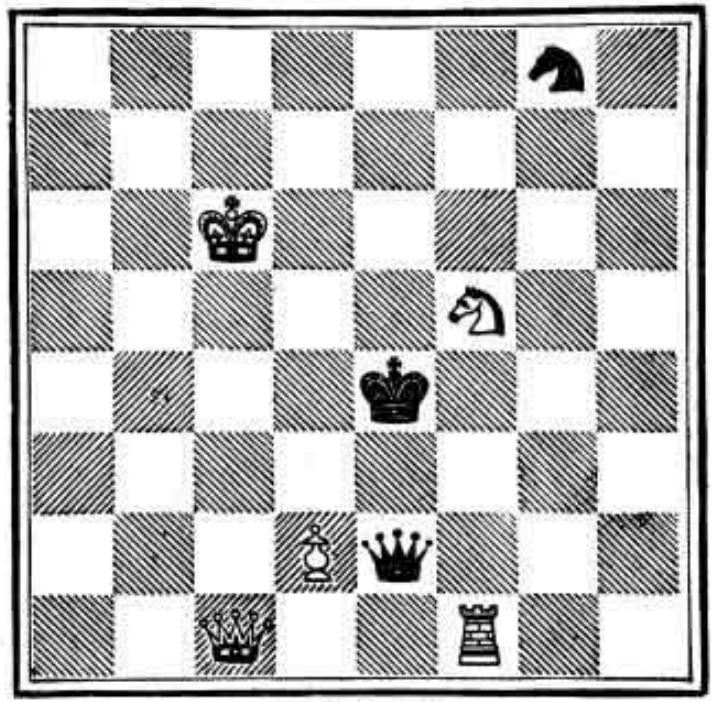


The Conclusion.



That story of yours, about your once meeting the sea-serpent, is totally devoid of interest.

RED

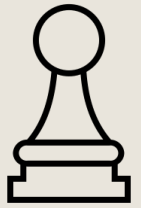


WHITE.

*White Pawn (Alice) to play, and win in eleven moves.*

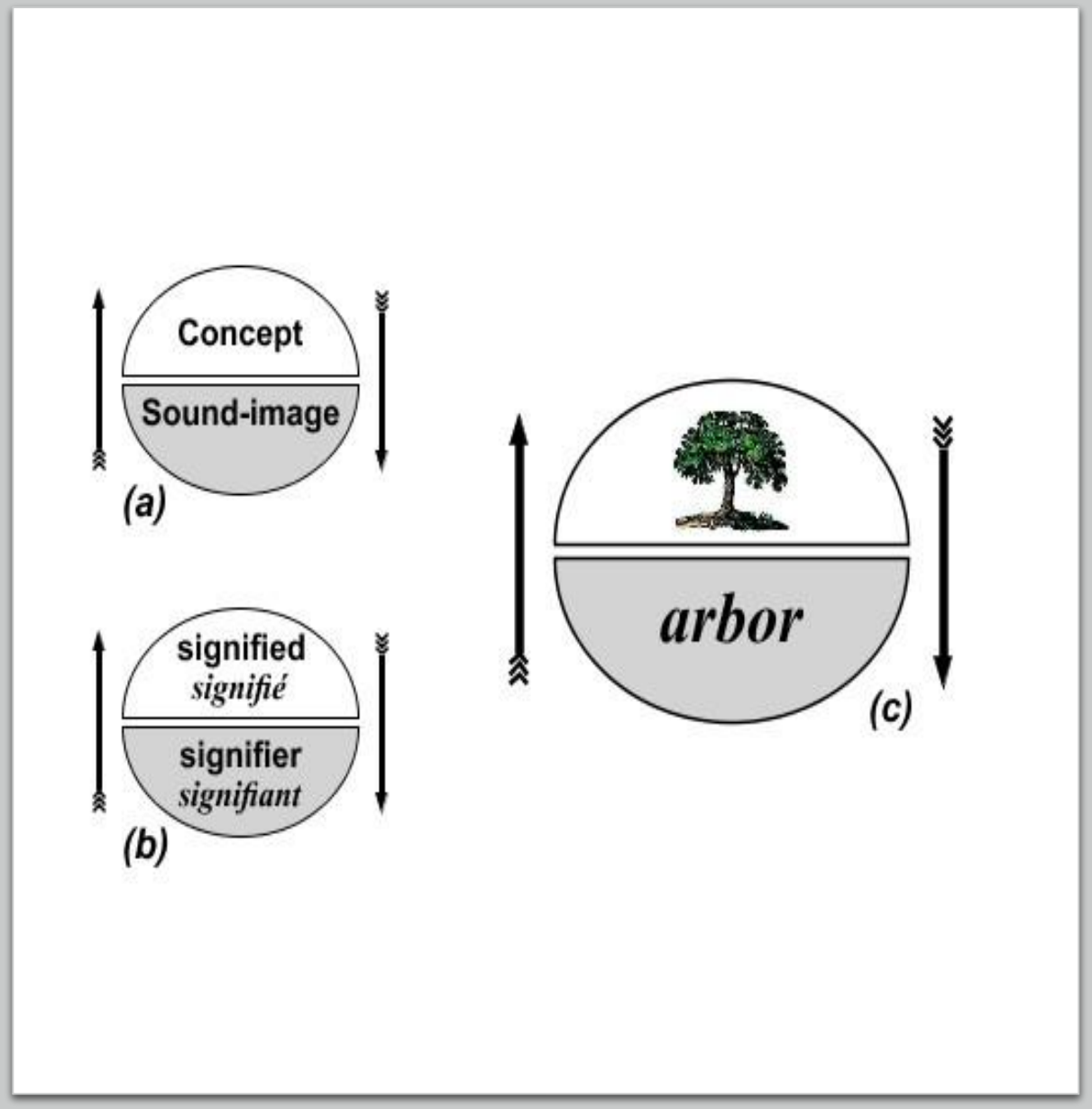
# Logica Utens vs. Logica Docens

- **Logica Utens**-the logic we use everyday, we understand intuitively (Pietarinen 358)
  - "In all reasoning, therefore, there is a more or less conscious reference to a general method" (Pierce 20-23)
- **Logical Docens**-a more formal, theoretical logic (Pietarinen 358)
  - "Antecedent to any systematic study of the subject, is called the reasoner's *logica utens*, in contradistinction to the result of the scientific study, which is called *logica docens*" (Pierce 20-23)



# Ferdinand de Saussure and Semiotics

- Signifier- sound image, a word, combination of letters
- Signified-the mental concept a signifier (word) refers to
- Sign-the union of signifier and signified
- (Saussure 649)



# Roadmap

- Surface
  - Waking up scene
  - logica utens + completeness of signs
- Wonderland
  - Cheshire cat scene
    - structural similarity
  - Croquet scene
    - Alice really thinks this is illogical
  - logica docens + incompleteness of signs

# The Surface

# Waking Up Scene

Scene One

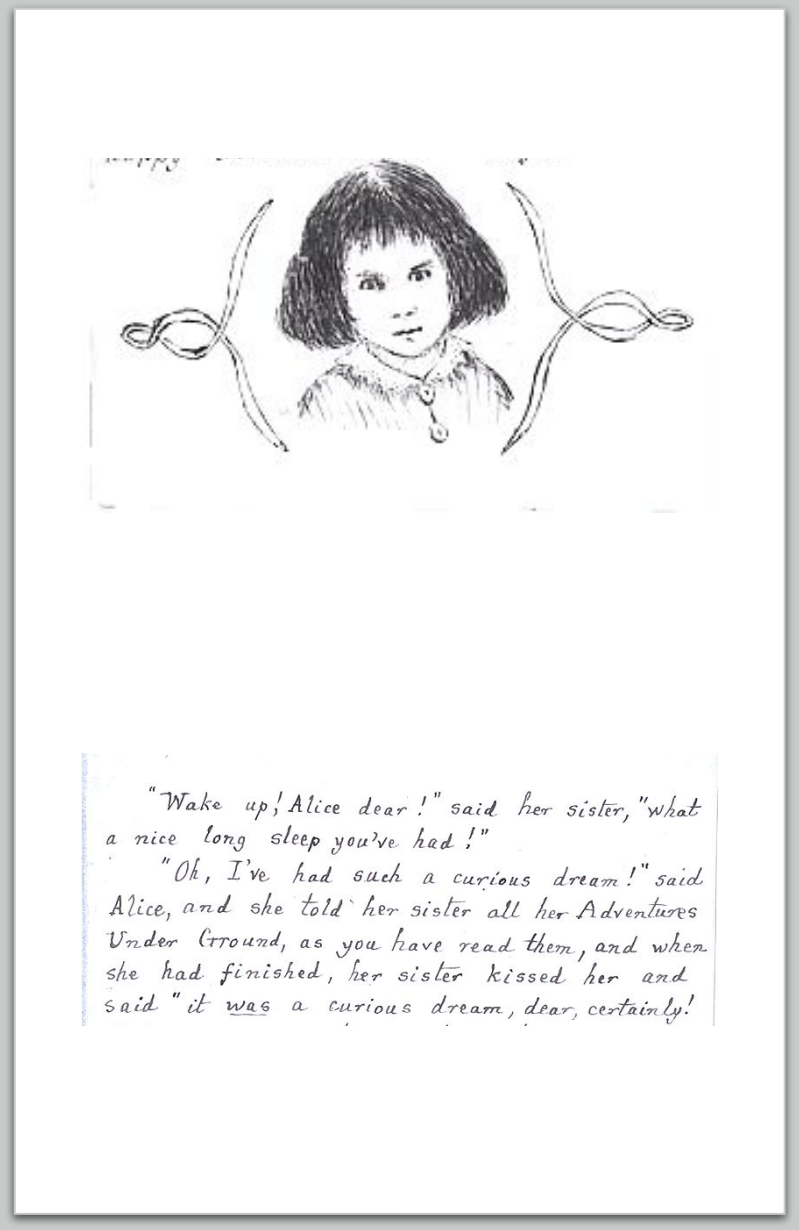



Image from The British Library

# The Surface and Logica Utens

- Literally on the surface, (original title)
- End of book, Alice and Alice's sister
  - Alice is gone for a long time sleeping, while having the Wonderland adventure
  - Alice's sister shouts, "Wake up!"
  - Alice responds, "I've had such a curious dream"
  - (Carroll 108)

# Modeled in First Order Logic

$$\forall x \forall y \left( \left( Gone\ For\ A\ Long\ Time\ Sleeping\ (x) \wedge Cares\ for\ (y, x) \right) \rightarrow Wakes\ Up\ (y, x) \right)$$

$$Gone\ For\ A\ Long\ Time\ Sleeping\ (alice)$$

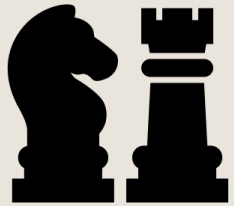
$$Cares\ For\ (sister(alice), (alice))$$

$$\therefore Wakeup\ (sister(alice), alice)$$

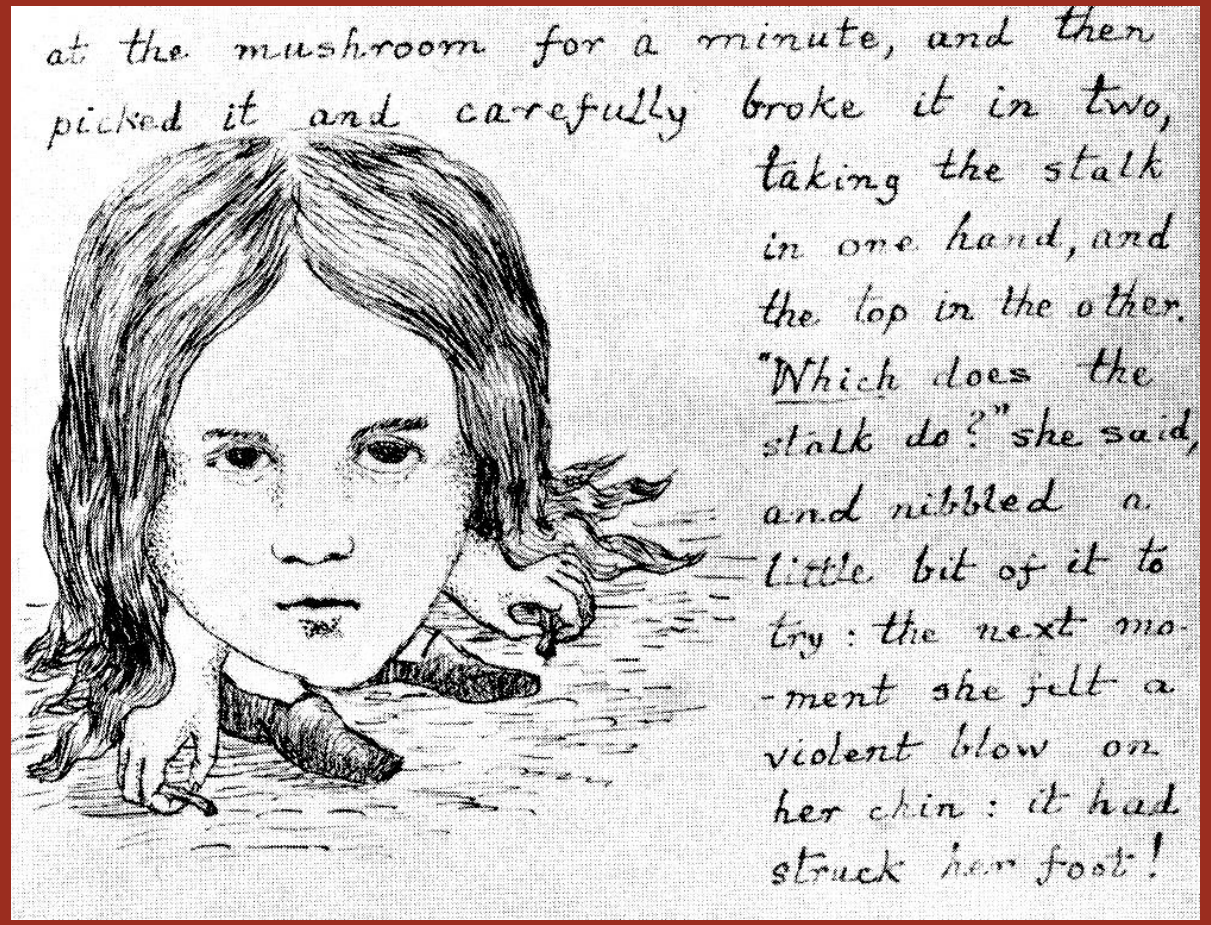
*In loglish (mix of English and logic), this reads: for all x and some y, if x is gone for a long time sleeping and y cares for x, then y will wake x up. Alice was gone for a long time sleeping. Alice's sister cares for Alice. Therefore, Alice's sister will wake Alice up.*

# Surface and Signs

- All signifiers map to known objects here
- No new words or concepts
- Does not require an understanding of the material conditional, or predicate logic
- No confusion



# Wonderland

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# Generally Considered Illogical or Confusing

- "Curious" appears 19 times
- "Opening up like the largest telescope that ever was"
  - New, no signifier, difficult to process, logica utens is not accessible
- Oxford English Dictionary makes an entry for curious in this book to mean "increasingly strange"
- OED defines strange as "difficult to account for"

Image from The British Library

# Cheshire Cat Scene

Scene Two

# Cheshire Cat Scene

- “We’re all mad here. I’m mad. You’re mad… You must be… or you wouldn’t have come here”
- “Alice didn’t think that proved it at all”
- Same structure as before, but now, it isn’t sufficient
- (Carroll 56)

# Modeled in First Order Logic

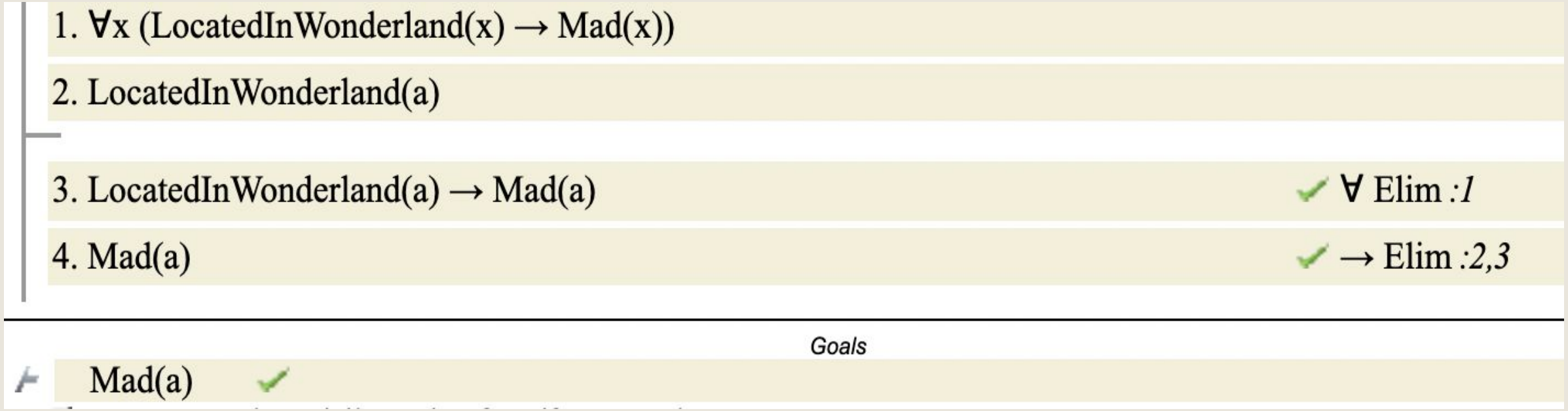
$$\forall x\,(Located\ in\ Wonderland(x) \rightarrow Mad(x))$$

$$Located\ in\ Wonderland\ (a)$$

$$\therefore\ Mad(a)$$

*In loglish, this reads: for all x, if x is located in wonderland, then x is mad. There is some a located in Wonderland. Therefore, a is mad.*

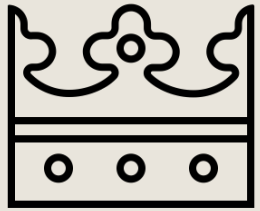
# Fitch Proof




*This is a Fitch proof proving the conclusion follows from the premises in the model I provided. Line three uses the rule of universal elimination, citing line one, to derive a conditional. Line four uses conditional elimination to derive an atomic sentence, citing lines two and three.*

# Depth Similar to Surface

- Conditional
- Instance of antecedent
- Conditional elimination
- Derive the consequent
- But this time, Alice is skeptical
- The words are different, signs incomplete
- Tension between logica utens and logica docens



# Croquet Scene

Scene Three

# Croquet Scene

- “Can you play croquet?” (Queen to Alice)
- “‘Yes!’ shouted Alice.”
- “‘Come on then!’ roared the Queen”
- “Alice thought she had never seen such a curious croquet-ground in her life: it was all ridges and furrows: the croquet balls were live hedgehogs, and the mallets live flamingoes…”
- (Carroll 71).

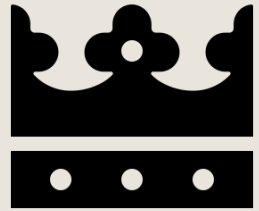
"I don't think they play at all fairly... and they don't seem to have any rules in particular: at least if there are, nobody attends to them— and you've no idea how confusing it is all the things being alive." (Carroll 73)

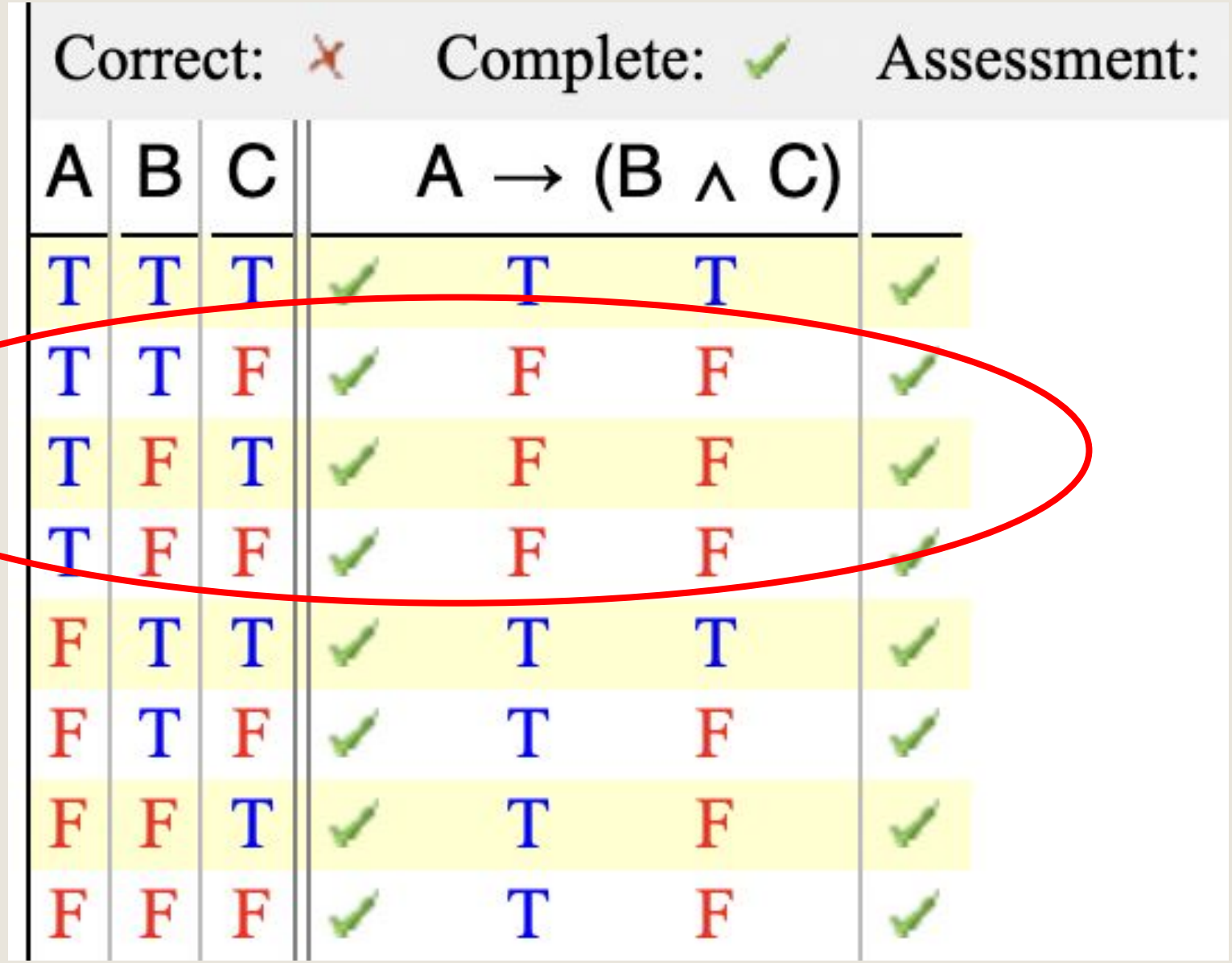
Image from The British Library

# What Is at Stake

Playing Croquet → (Mallet ∧ Ball)

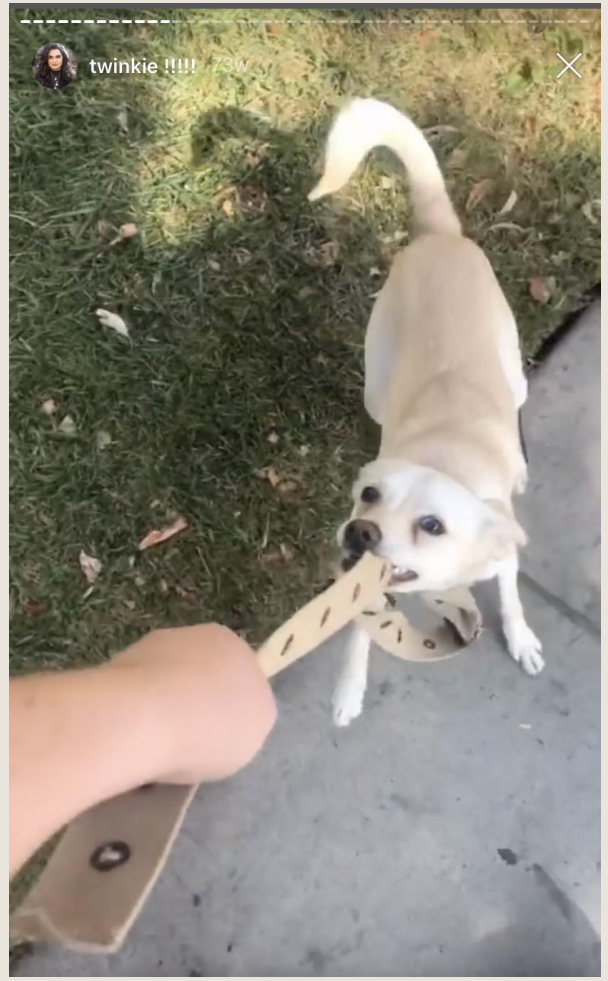
- Queen says they are playing croquet, so that's true
- If we don't have a mallet and a ball, then it's invalid
- We'll be focusing on the mallet, since that seems less probable




Correct:
Complete:
Assessment:
A B C A → (B ∧ C)
T T T T T
T T F F F
T F T F F
T F F F F
F T T T T
F T F T F
F F T T F
F F F T F

# Is a Flamingo a Mallet?

- Maybe, maybe not
- We use things as “other” things all the time
  - Keys as boxcutters
  - Jackets as pillows
  - Belts as leashes

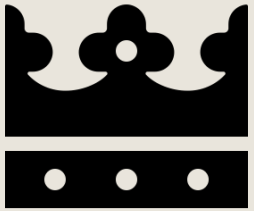


# Definitions

- OED defines mallet used for the game croquet as “The long-handled wooden hammer used for striking the balls in croquet, (formerly) pall-mall, or polo (*obsolete*)” (“mallet”)

- OED defines the tool mallet “A kind of hammer, usually of wood, but sometimes of other materials, smaller than a maul or beetle and usually with a relatively large head” (“mallet”)

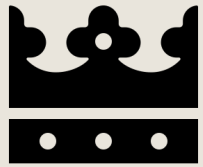
- Let’s make sure non-wooden mallets are okay...



# Metal Mallet

# The Croquet Association on Other Materials

- "For most beginners, a wooden shafted mallet will be perfectly adequate... More experienced players may want to try to keep the weight of the handle down, so that more of the weight is in the head, and the mallet has a better pendulum action. **This is one of the main advantages of going for a fibre-glass, carbon-fibre or aluminium shaft**. The flexibility of the shaft is also affected by the type of wood or **other material used** - **this is very much a matter of personal taste**, and you **should try a range of different types** before taking a decision on this."
- So... *why not* a flamingo?



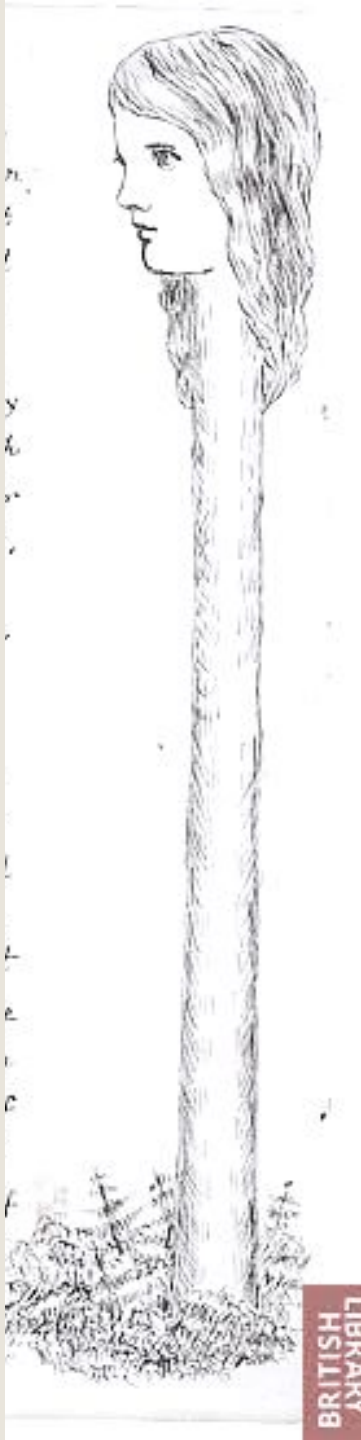
# Validity

Playing Croquet → (Mallet ∧ Ball)

- Same kind of argument for the ball
  - OED defines ball as “ A solid or hollow spherical or egg-shaped object which is thrown, kicked, hit, or otherwise propelled in a game”
- True premise, true conclusion
- Sound (valid+true)

# Signifier, Depth, Logica Docens

- Signifiers signifying multiple signifieds
- Validity modeled with logica docens
  - Understanding what makes something invalid
- This place of depth is unique
  - Logical structures become more important to recognize
  - Signs function differently than usual

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# Conclusion

# Structure Versus Content

## Language Proof and Logic

“If we can recognize that a sentence is logically true without knowing the meanings of the names or predicates it contains (other than identity), then we'll say the sentence is a first-order validity. One way to see this is to replace the familiar blocks language predicates with nonsensical predicates, like those using nonsense predicates to test for FO validity used in Lewis Carroll's famous poem Jabberwocky” (Baker-Plummer 269-270).

# Jabberwocky Poem

'Twas brillig, and the slithy toves
Did gyre and gimble in the wabe:
All mimsy were the borogoves,
And the mome raths outgrabe.

"Beware the Jabberwock, my son!
The jaws that bite, the claws that catch!
Beware the Jubjub bird, and shun
The frumious Bandersnatch!"

He took his vorpal sword in hand;
Long time the manxome foe he sought—
So rested he by the Tumtum tree
And stood awhile in thought.

And, as in uffish thought he stood,
The Jabberwock, with eyes of flame,
Came whiffling through the tulgey wood,
And burbled as it came!

One, two! One, two! And through and through
The vorpal blade went snicker-snack!
He left it dead, and with its head
He went galumphing back.

"And hast thou slain the Jabberwock?
Come to my arms, my beamish boy!
O frabjous day! Callooh! Callay!"
He chortled in his joy.

'Twas brillig, and the slithy toves
Did gyre and gimble in the wabe:
All mimsy were the borogoves,
And the mome raths outgrabe.

# Nonsense Test and First Order Validity

## Familiar Signifiers

$\forall x\ \text{SameSize}(x, x)$
$\forall x\ \text{Cube}(x) \rightarrow \text{Cube}(b)$
$(\text{Cube}(b) \wedge b = c) \rightarrow \text{Cube}(c)$
$(\text{Small}(b) \wedge \text{SameSize}(b, c)) \rightarrow \text{Small}(c)$

## Carroll's Nonsense Predicates

$\forall x\ \text{Outgrabe}(x, x)$
$\forall x\ \text{Tove}(x) \rightarrow \text{Tove}(b)$
$(\text{Tove}(b) \wedge b = c) \rightarrow \text{Tove}(c)$
$(\text{Slithy}(b) \wedge \text{Outgrabe}(b, c)) \rightarrow \text{Slithy}(c)$

Example from *Language, Proof and Logic*

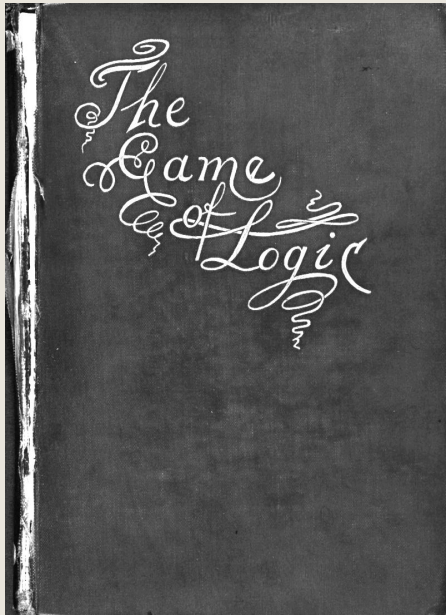
# Summary

- Surface→complete signs → access to logica utens
- Wonderland (Depth, Underground) → incomplete signs → logica docens becomes necessary
- There is nothing illogical about Wonderland, it's the same "rules"
- All that differs is our ability to understand it

Image from The British Library

# Implications

- There is no escaping the rules of logic
- Even if you did write a technically illogical sentence, it wouldn't make for good world building
- Playing with logic like this **enhances** fictional landscapes
- Gives our brain a challenge as we struggle to comprehend it
- Like a game or a puzzle... the game of logic
- This is why Wonderland continues to captivate us 15 years later



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