



# PIQA: Reasoning about Physical Commonsense in Natural Language

**Yonatan Bisk**, Rowan Zellers, Ronan Le Bras, Jianfeng Gao and Yejin Choi



What's the meaning of a word?



$$p(w_t | w_0 \dots t-1)$$



$$p(w_i | w_0 \dots i-1, w_{i+1} \dots N)$$



# UV-Fluorescence Steampunk Lamp

By Junophor in Workshop > Lighting  43,224  648  92  Featured

 CC BY-NC-SA



# Stylish Duct Tape Backpack

By LanceMakes in Craft > Duct Tape

5,085

51

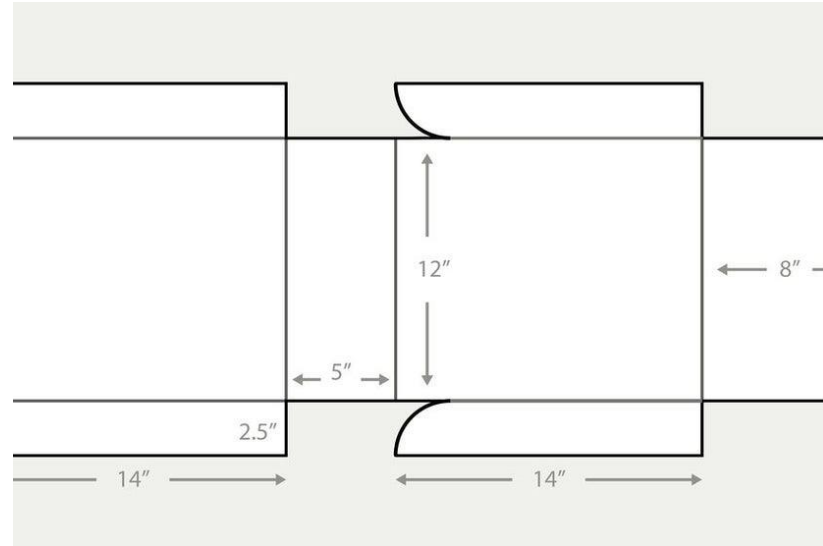
12

★ Featured

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<https://www.instructables.com/id/Stylish-Duct-Tape-Backpack/>



# Context



**Desire:** Something smushed

**Core tool:** Heavy flat object

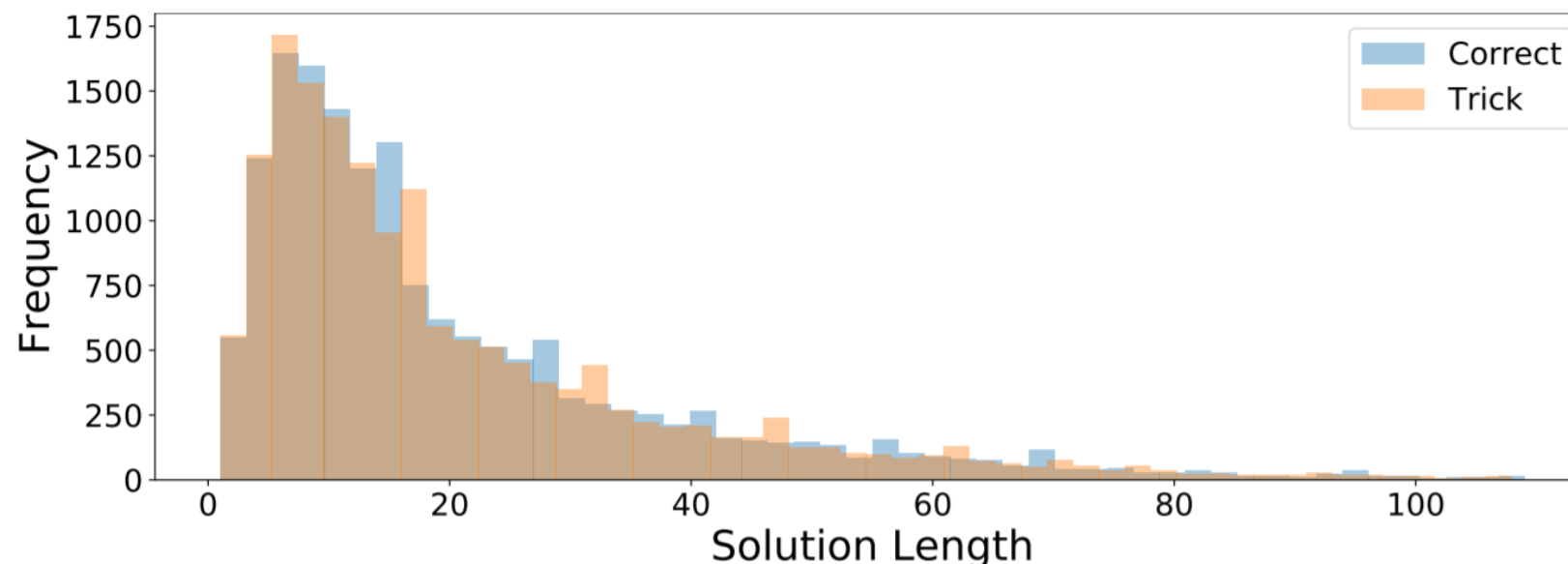
**Required component:** Time

To press a \_\_\_\_\_ you should place  
\_\_\_\_\_ on it for \_\_\_\_\_ hours.

Place a cutting board or another flat object over the top half of the backpack. Place about 10 lbs. (4.5 kg) of heavy objects on top. Leave the weights in place for at least 2 hours. (You can accelerate the process by using heavier objects, or by sitting on the cutting board as you read through the rest of this Instructable!)

# Annotation

1. **Visit** an Instructables.com page to collect inspiration
2. **Goal**: What is a related sub-task?
3. **Solution**: How would you go about achieving this?
4. **Trick**: What similar answer would fail to achieve the goal?



# Physical Commonsense

To separate egg whites from the yolk using a water bottle, you should ...

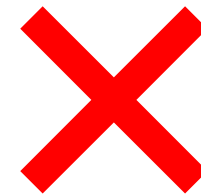
**A**

Squeeze the water bottle and press it against the yolk. Release, which creates suction and lifts the yolk.



**B**

Place the water bottle and press it against the yolk. Keep pushing, which creates suction and lifts the yolk.





# Physical Commonsense

To separate egg whites from the yolk using a water bottle, you should ...

**A** **Squeeze** the water bottle and press it against the yolk.  
**Release**, which creates suction and lifts the yolk.



**B** **Place** the water bottle and press it against the yolk.  
**Keep pushing**, which creates suction and lifts the yolk.



# Tools and Dataset Bias

*Bad idea: Asking humans questions*

- What can I use whisk eggs? Fork
- What can I use to pop a balloon? Fork
- What can I use to close an electrical circuit? Fork
- What can I use to dig a small hole in the garden? Fork
- What can I use to spread butter? Fork
- What can I use to open a paint can? Fork
- What can I use to let air out a tire? Fork

# Annotation Artifacts

What about...

Gururangan, Suchin, et al. "Annotation artifacts in natural language inference data." (2018)

Poliak, Adam, et al. "Hypothesis only baselines in natural language inference." (2018)

Solution:

Adversarial (2018) → specifically AFLite (Sakaguchi 2020)



Next Talk!



Gratuitous  
Popups!



Don't go  
anywhere!

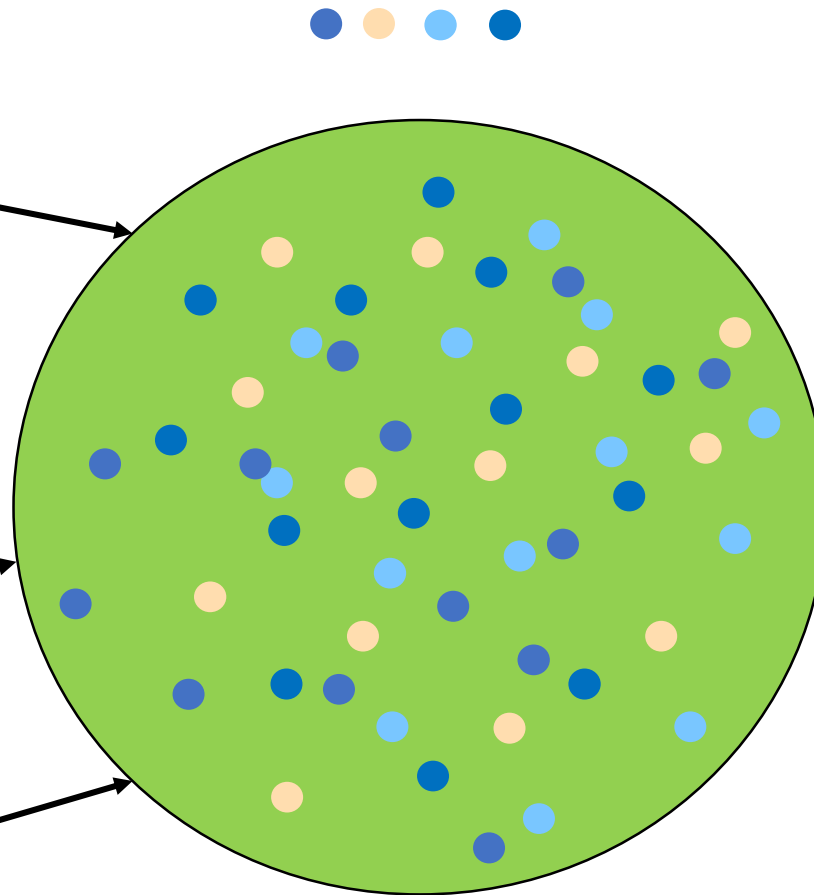
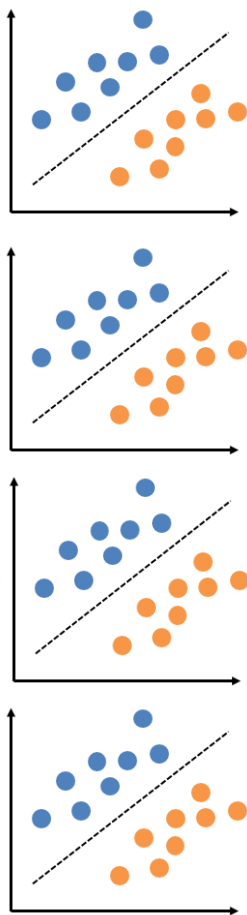
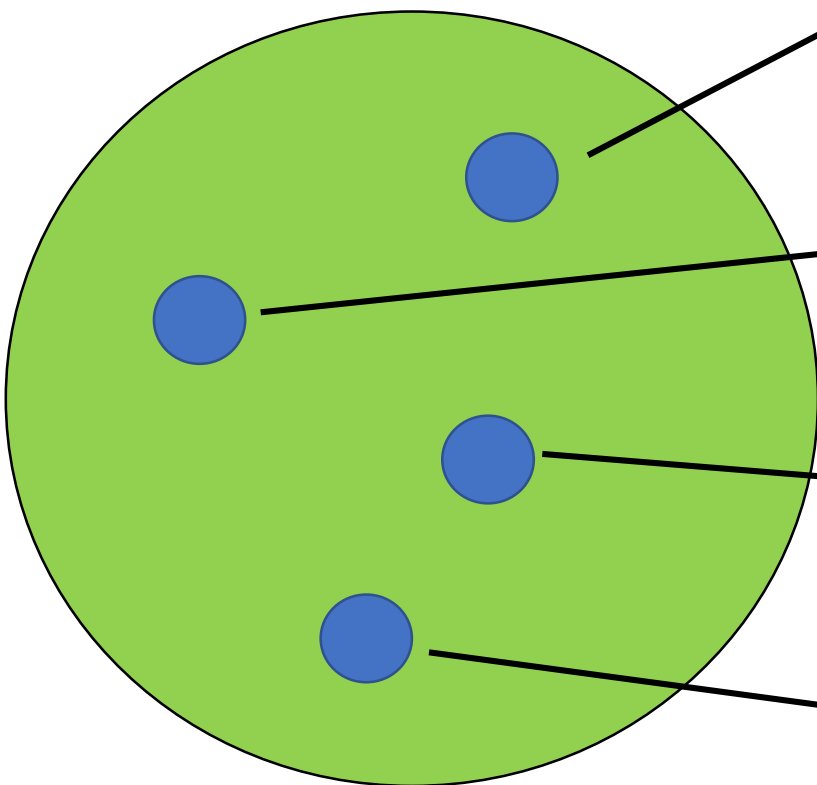
# AFLite

All data

Classifiers

Classify everything

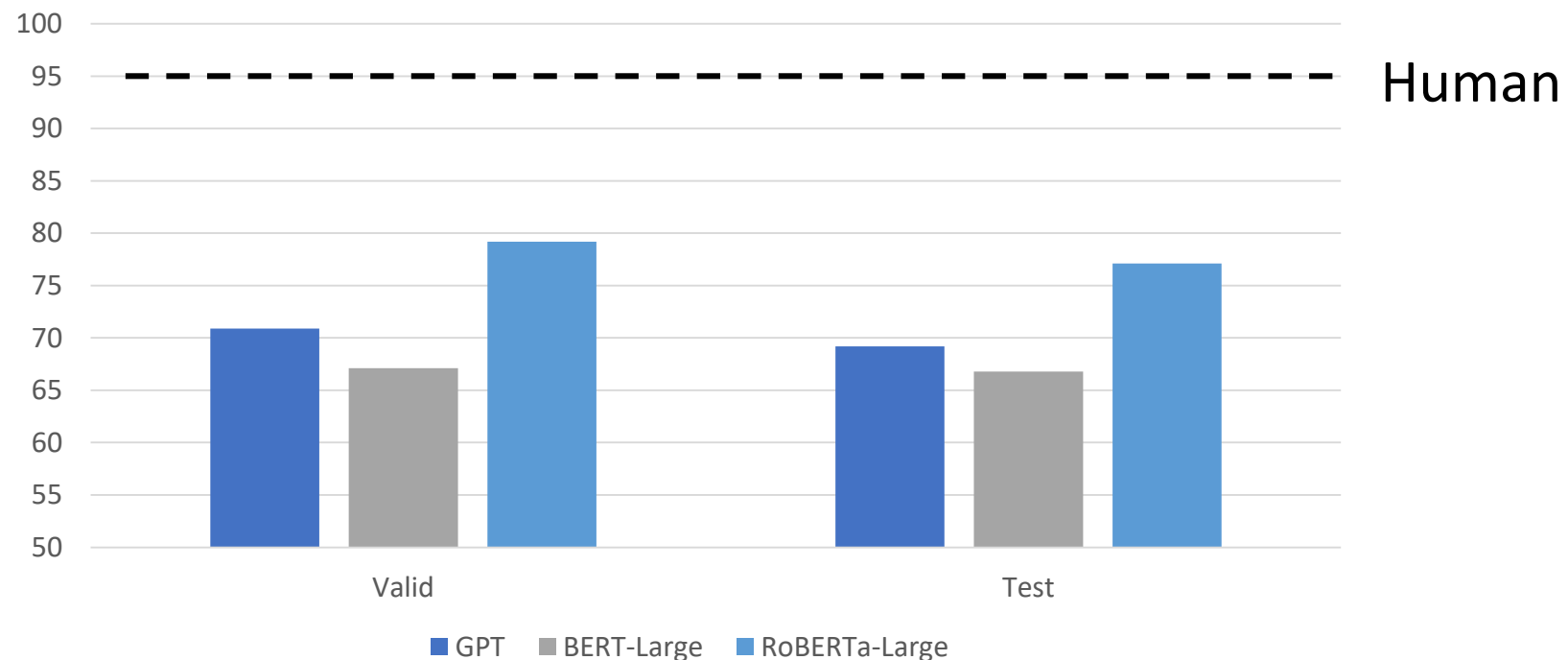
Keep boundary



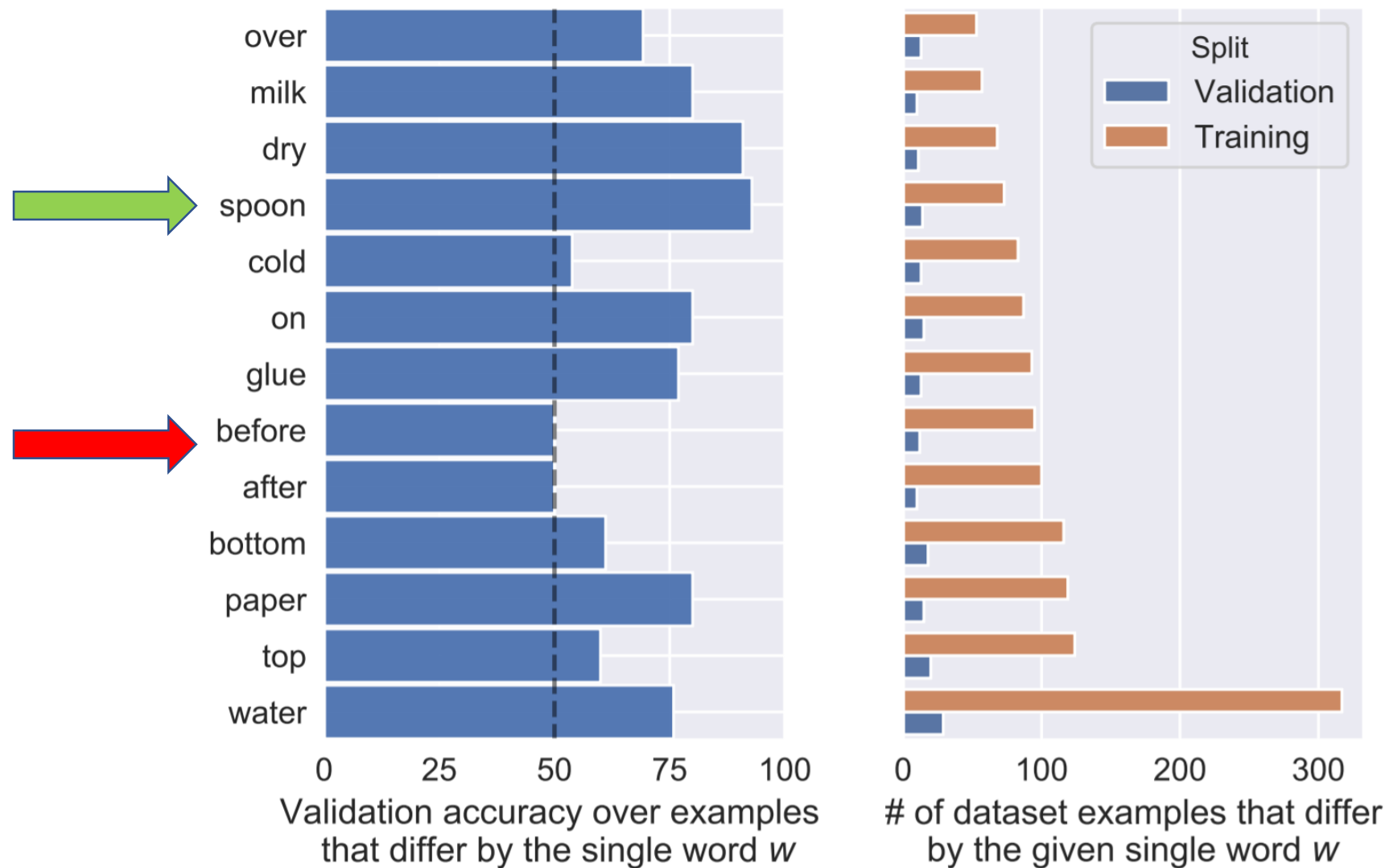
5,000 examples / classifier

# Dataset & Baselines

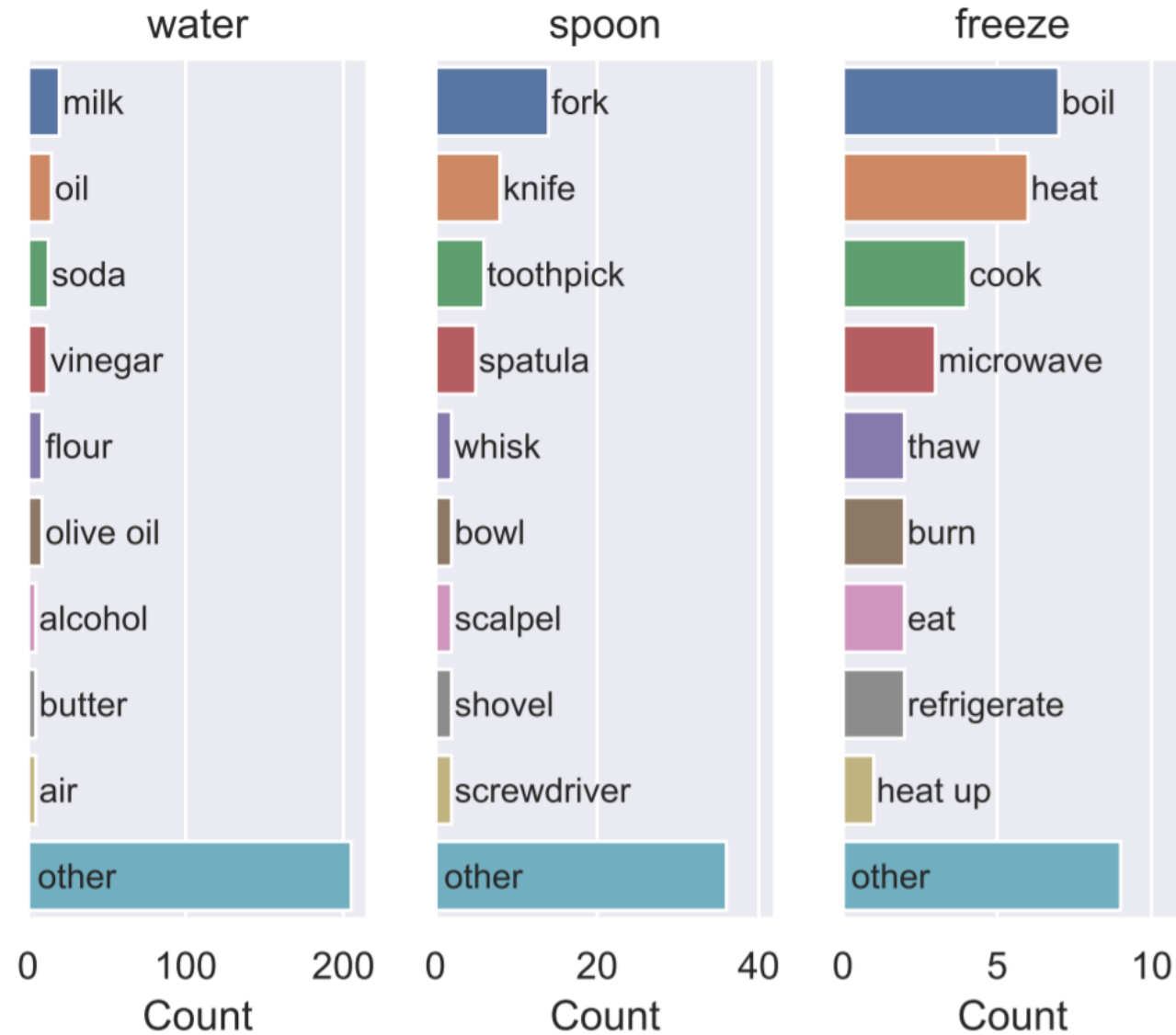
- Trivial patterns removed
- Dataset balanced
- 16K Training, 2K Validation, 3K Testing



# A single word



# Common replacements



# Qualitative

[Goal] Best way to pierce ears.

[Sol1] It is best to go to a professional to get your ear pierced to avoid medical problems later. ✓

[Sol2] The best way to pierce your ears would be to insert a needle half inch thick into the spot you want pierced. ✗

[Goal] How can I quickly and easily remove strawberry stems?

[Sol1] Take a straw and from the *top* of the strawberry push the straw through the center of the strawberry until the stem pops off. ✗

[Sol2] Take a straw and from the *bottom* of the strawberry push the straw through the center of the strawberry until the stem pops off. ✓



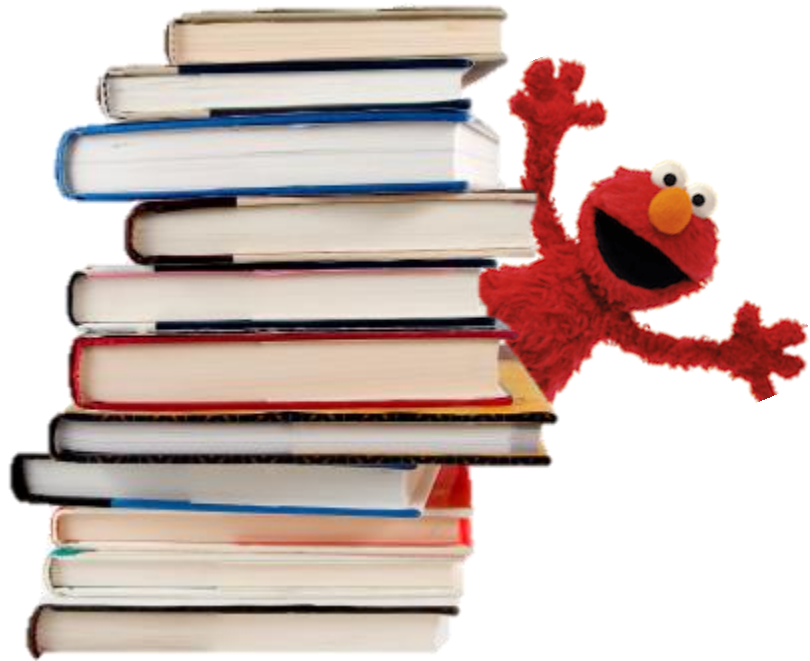


# What do we want to learn?



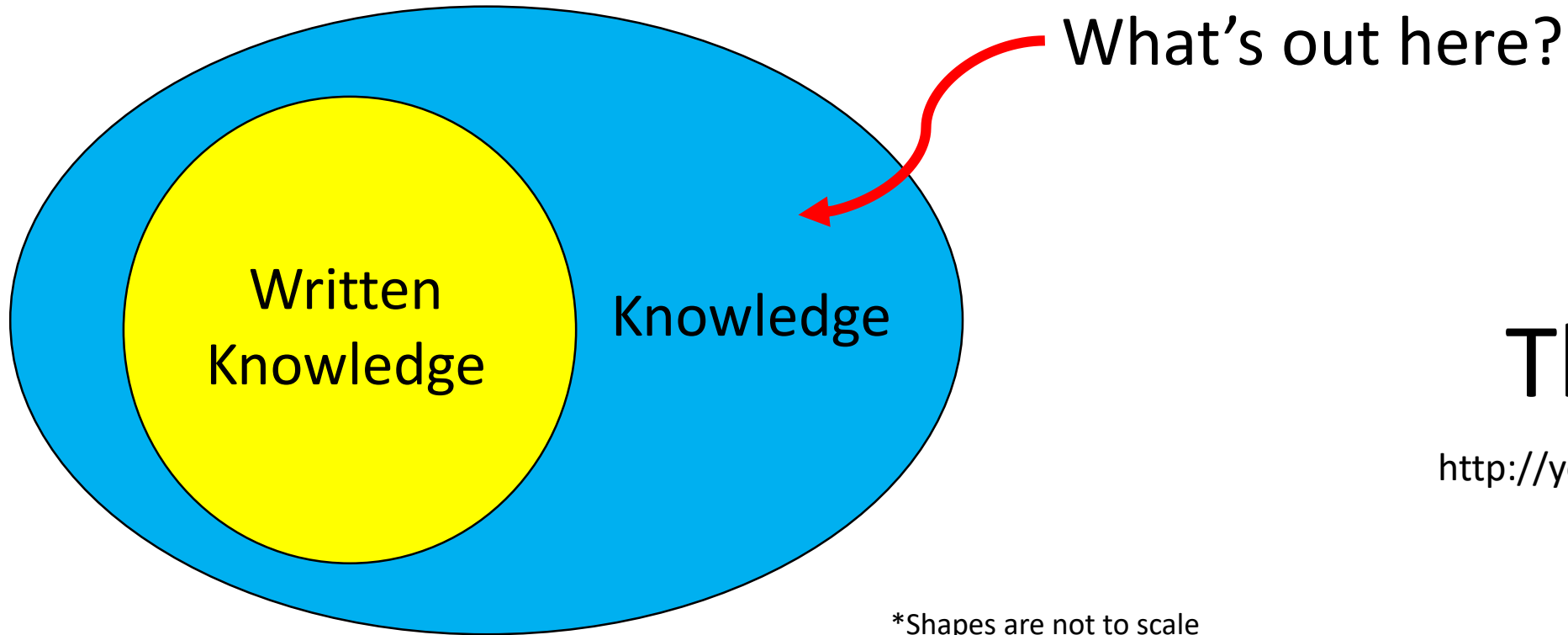
	<b>Hollow</b>	<b>Long &amp; thin</b>	<b>Flexible</b>
Straws	Y	Y	Y
Toothpicks	N	Y	N
Chopsticks	N	Y	N
PVC Pipe	Y	Y	Y
Steel Pipe	Y	Y	N

How do we want to learn it?



A little bit of both?

# Physical Commonsense



Thanks!

<http://yonatanbisk.com/piqa>