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?

\[ p(w_t | w_0...t-1) \]

\[ p(w_i | w_0...i-1, w_{i+1}...N) \]

This is silly right?
UV-Fluorescence Steampunk Lamp

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


Solution:
Adversarial (2018) → specifically AFLite (Sakaguchi 2020)

Don’t go anywhere!

Next Talk!
Gratuitous Popups!
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

Validation accuracy over examples that differ by the single word $w$

# of dataset examples that differ by the given single word $w$

- over
- milk
- dry
- spoon
- cold
- on
- glue
- before
- after
- bottom
- paper
- top
- water
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?

<table>
<thead>
<tr>
<th></th>
<th>Hollow</th>
<th>Long &amp; thin</th>
<th>Flexible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straws</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Toothpicks</td>
<td>N</td>
<td>Y</td>
<td>N</td>
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<td>PVC Pipe</td>
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<td>Y</td>
<td>Y</td>
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<tr>
<td>Steel Pipe</td>
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<td>Y</td>
<td>N</td>
</tr>
</tbody>
</table>
How do we want to learn it?

A little bit of both?
Physical Commonsense

What’s out here?

Written Knowledge

Knowledge

*Shapes are not to scale

Thanks!

http://yonatanbisk.com/piqa