

PSL on RICA v1

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Processes



RICA Dataset:

```
51 glass,sand,More,reflective,"Material(A, glass) and Material(B, sand), so More(reflective(A), reflective(B))"  
52 glass,plastic,More,reflective,"Material(A, glass) and Material(B, plastic), so More(reflective(A), reflective(B))"  
53 glass,gold,More,reflective,"Material(A, glass) and Material(B, gold), so More(reflective(A), reflective(B))"
```

Predicates

Material:

Define that the object1 has material glass.

```
1 metal_item→metal
2 paper_item→paper
3 iron_item→iron
4 rock_item→rock
5 silicon_item→silicon
6 water_item→water
```

HasProperty:

Define that the property of each material (1 means high, 0 means low)

```
1 alcohol→transparent→1
2 alcohol→contain liquid→0
3 alcohol→crumple→0
4 alcohol→durable→0
5 alcohol→fragile→0
6 alcohol→good for drink→0
7 alcohol→hard→0
8 alcohol→heavy→0
```

HasProperty:

Define the comparison is more or less

```
1 iron_item→glass_item→good for drink→0
2 iron_item→glass_item→translucent→0
3 iron_item→glass_item→crumple→0
4 iron_item→glass_item→thin→0
5 iron_item→glass_item→durable→1
6 iron_item→glass_item→flat→0
```

Rules

10: $\text{Material}(I1, M1) \ \& \ \text{HasProperty}(M1, T) \ \& \ \text{Material}(I2, M2) \ \& \ !\text{HasProperty}(M2, T) \ \& \ I1 \neq I2 \rightarrow \text{More}(I1, I2, T) \wedge 2$

10: $\text{More}(I1, I2, T) \ \& \ I1 \neq I2 \rightarrow !\text{More}(I2, I1, T) \wedge 2$

Examples

Rule 1: Object1 is made of glass. Object2 is made of sand. The reflective of glass is high. The reflective of sand is low. Thus, Object1 is more reflective than Object2.

Rule 2: If object1 is higher than object2 for transparency, object2 is lower than object2 for transparency

Grounding

Define material property by ourself for HasProperty Predicates (assuming that CSKG will give these to us)

```
'glass': [
    ["transparent", "1"],
    ["clear", "1"],
    ['contain liquid', "1"],
    ['crumple', "0"],
    ['durable', "1"],
    ['flat', "0"],
    ['fragile', "1"],
    ['good for drink', "0"],
    ['hard', "0"],
    ['heavy', "1"],
    ['lightweight', "0"],
    ['opaque', "0"],
    ['reflective', "1"],
    ['rigid', "1"],
    ['thin', "0"],
    ['translucent', "1"],
    ['very reflective', "1"],
    ['white or black', "1"]],
```

```
"ceramic": [
    ["transparent", "0"],
    ["clear", "0"],
    ['contain liquid', "1"],
    ['crumple', "0"],
    ['durable', "0"],
    ['flat', "0"],
    ['fragile', "1"],
    ['good for drink', "0"],
    ['hard', "0"],
    ['heavy', "1"],
    ['lightweight', "0"],
    ['opaque', "1"],
    ['reflective', "1"],
    ['rigid', "1"],
    ['thin', "0"],
    ['translucent', "0"],
    ['very reflective', "0"],
    ['white or black', "1"]],
```

Results & discussion

Evaluation procedure

Use inference result to compare with the whole RICA Dataset.

If inference result is ≥ 0.5 , we think it is more.

If inference result is < 0.5 , we think it is less.

Accuracy: 87.3%

Inaccuracy Explain:

```
['glass_item', 'plastic_item', 'clear', 1]
['glass_item', 'ceramic_item', 'fragile', 1]
['glass_item', 'plastic_item', 'translucent', 1]
['glass_item', 'oil_item', 'translucent', 1]
['glass_item', 'metal_item', 'very reflective', 1]
['glass_item', 'silver_item', 'very reflective', 1]
['glass_item', 'plastic_item', 'reflective', 1]
['glass_item', 'gold_item', 'reflective', 1]
['paper_item', 'ceramic_item', 'fragile', 1]
['paper_item', 'carbon_item', 'white or black', 1]
['paper_item', 'sand_item', 'durable', 1]
['paper_item', 'ceramic or plastic_item', 'durable', 1]
['paper_item', 'plastic_item', 'lightweight', 1]
['paper_item', 'rubber_item', 'lightweight', 1]
['metal_item', 'lead_item', 'hard', 1]
['metal_item', 'gold_item', 'heavy', 1]
```

ceramic_item	glass_item	fragile	0.4041610360145569
glass_item	ceramic_item	fragile	0.1038965582847595