AGENTIFIED
ARGUMENTATIVE LEARNING

Emanuele De Angelis, Cnr-IASI, Italy

Maurizio Proietti, Cnr-IASI, Italy

Francesca Toni, IMPERIAL, UK

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Imperial College London | Department of Computing | SAKS IASI | erc European Research Council | The Royal Society | Royal Academy of Engineering | J.P.Morgan

from

ARGUMENTATIVE LEARNING (w/ABA Learning)

- learn ABAFs from (possibly) very few examples
  to make run-time inference about previously unseen examples
- learnt ABAFs may admit no or several extensions,
  failing to determine definite (non-)acceptance of unseen example

to

AGENTIFIED
ARGUMENTATIVE LEARNING (w/ABA Learning)

- **actions**: consulting an external source (human, agent or data repo)
- **observations**: learning the outcome of the consultation

NON-FLAT ABAFs w/ "actionable assumption"

NON-FLAT ABA FRAMEWORKS

a variant of the Nixon diamond problem

```
quaker(a) ←        quaker(b) ←        republican(c) ←
```

facts

```
voted(X,against_war) ← pacifist(X)
voted(X,pro_war) ← militarist(X)
```

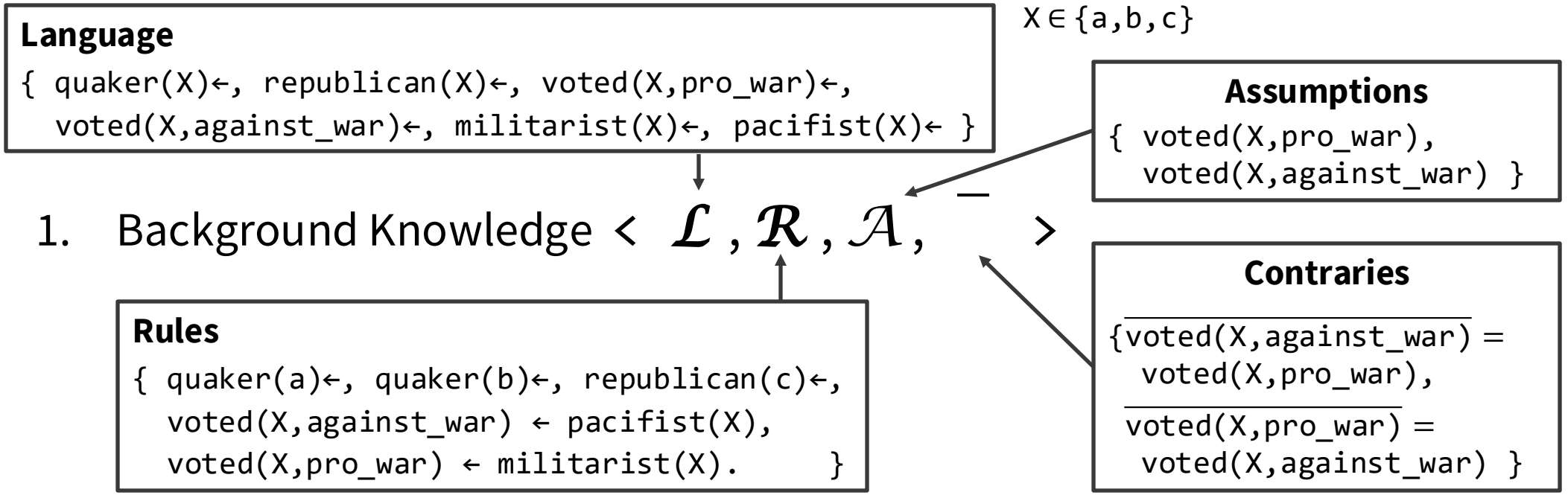
rules

heads of the rules are **assumptions**

$$\overline{\texttt{voted(X,against\_war)}} = \texttt{voted(X,pro\_war)}$$

$$\overline{\texttt{voted(X,pro\_war)}} = \texttt{voted(X,against\_war)}$$

ARGUMENTATIVE LEARNING w/ABA Learning



2. Positive examples **Ep** = { pacifist(a), pacifist(b), militarist(c) }
3. Negative examples **En** = { militarist(a), militarist(b), pacifist(c) }
4. Learnable Predicates **T** = { pacifist, militarist }

ABA LEARNING at work

Rote Learning	pacifist(X) ← X=a	militarist(X) ← X=c
Folding	pacifist(X) ← quaker(X)	militarist(X) ← republican(X)

No more rules to learn:
LEARNING COMPLETED!

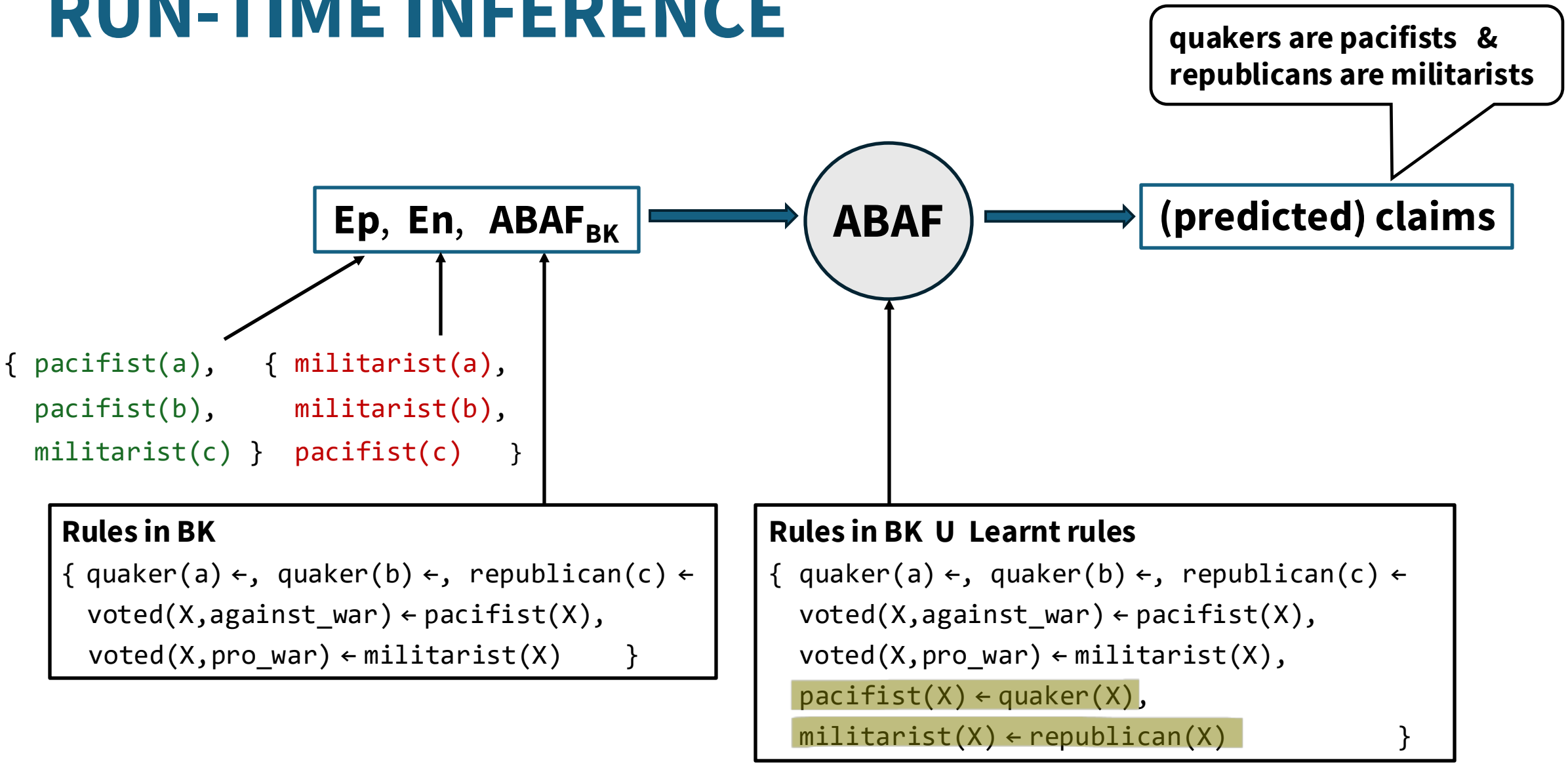
```
quaker(a) ←        quaker(b) ←        republican(c) ←
voted(X,against_war) ← pacifist(X)
voted(X,pro_war) ← militarist(X)
```

Rules in the Background Knowledge

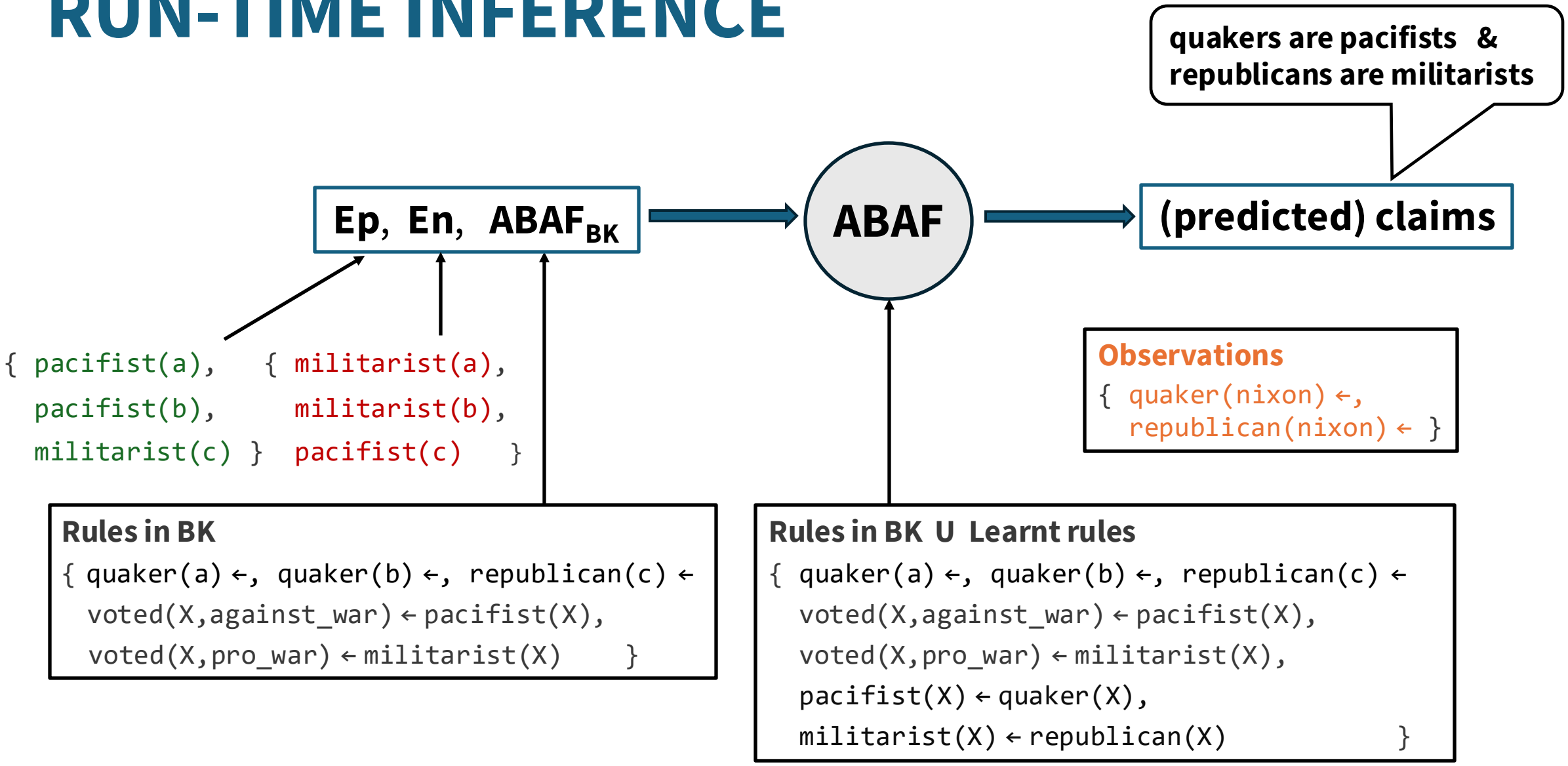
```
pacifist(X) ← quaker(X)
militarist(X) ← republican(X)
```

Learnt rules

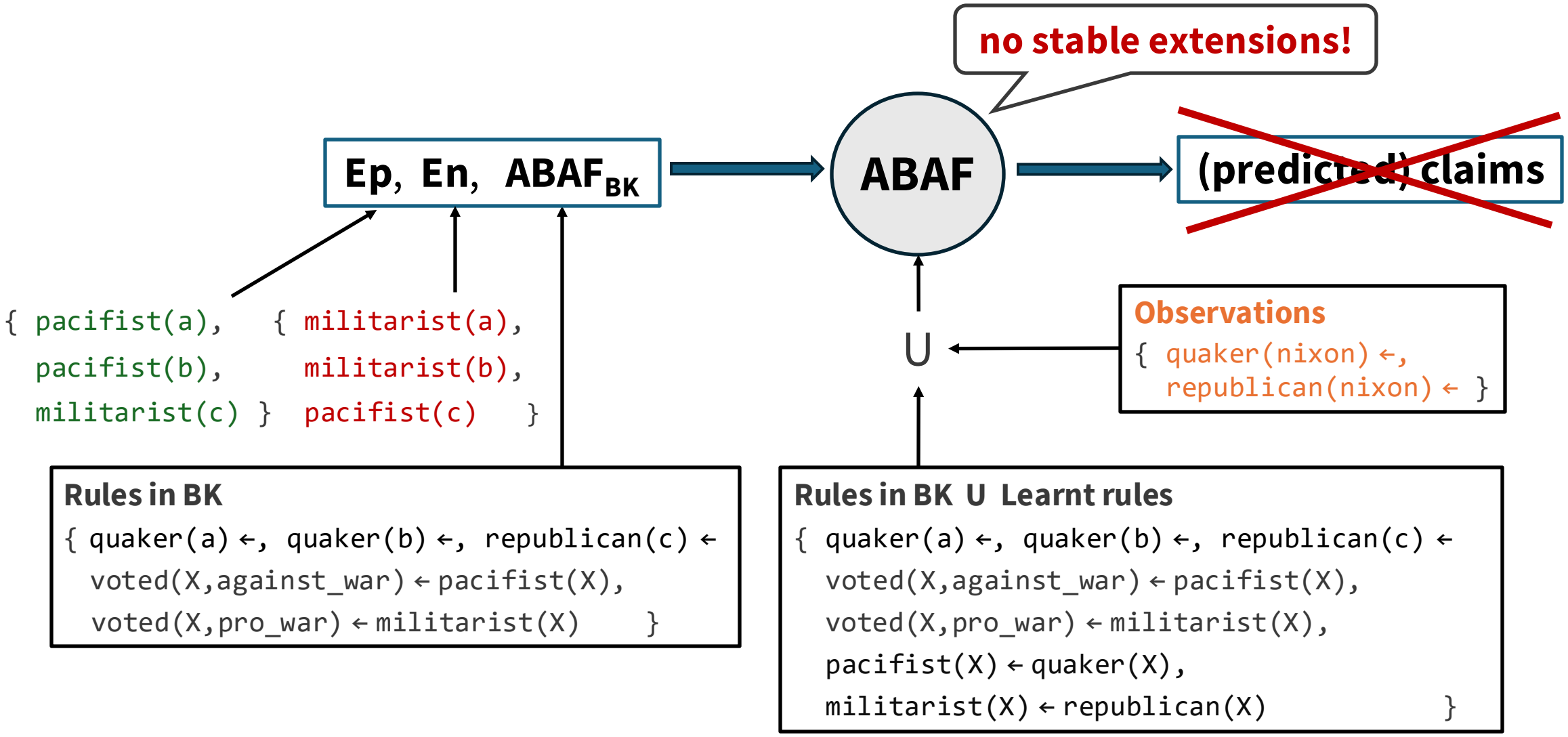
RUN-TIME INFERENCE



RUN-TIME INFERENCE



RUN-TIME INFERENCE



ABA LEARNING at work

```
quaker(a) ←     quaker(b) ←     republican(c) ←
voted(X,against_war) ← pacifist(X)
voted(X,pro_war) ← militarist(X)
```

Rules in BK

```
pacifist(X) ← quaker(X), normal_quaker(X)
militarist(X) ← republican(X), normal_republican(X)
```

Learnt rules

Learnt rules are rendered defeasible by applying **assumption introduction**

```
pacifist(X) ← quaker(X), normal_quaker(X)
militarist(X) ← republican(X), normal_republican(X)
```

Learnt rules

$$\overline{\texttt{normal\_quaker(X)}} = \texttt{abnormal\_quaker(X)}$$
$$\overline{\texttt{normal\_republican(X)}} = \texttt{abnormal\_republican(X)}$$

ABA LEARNING at work

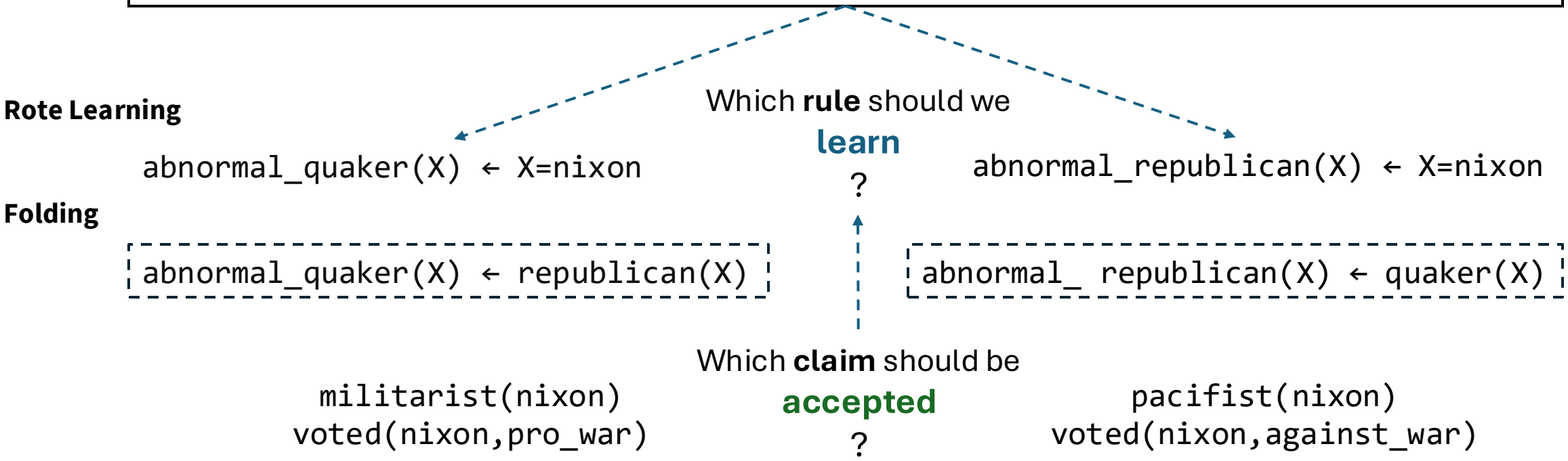
quaker(a) ← quaker(b) ← republican(c) ←

voted(X,against_war) ← pacifist(X)

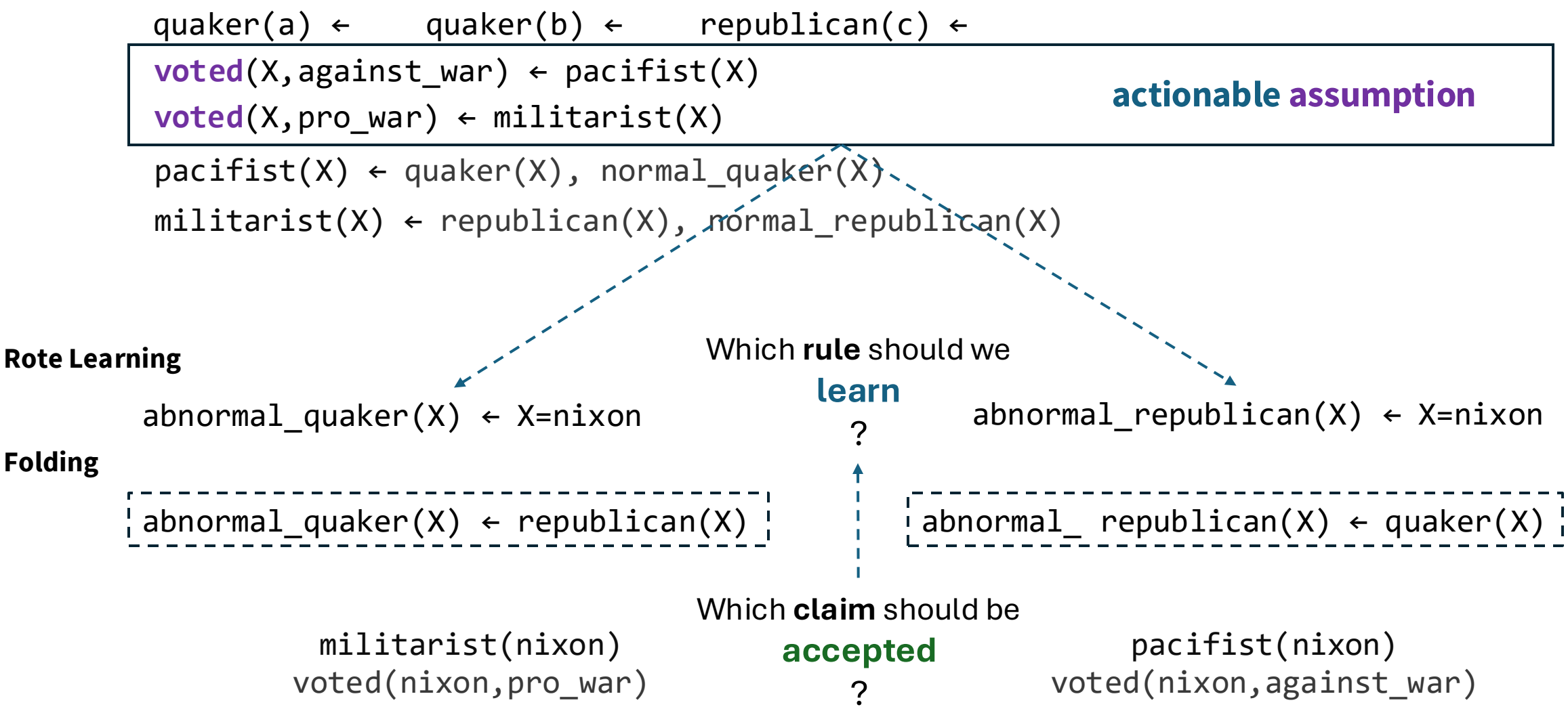
voted(X,pro_war) ← militarist(X)

pacifist(X) ← quaker(X), **normal_quaker**(X)

militarist(X) ← republican(X), **normal_republican**(X)



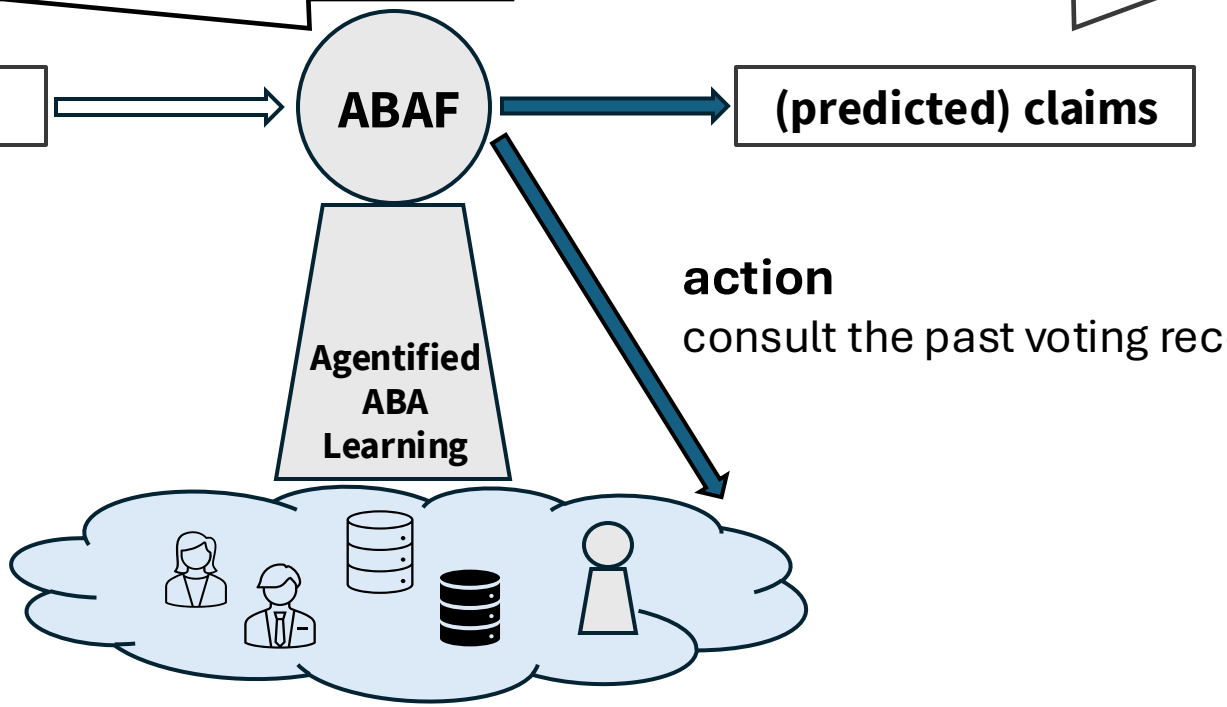
AGENTIFIED ABA LEARNING at work



AGENTIFIED ABA LEARNING at work

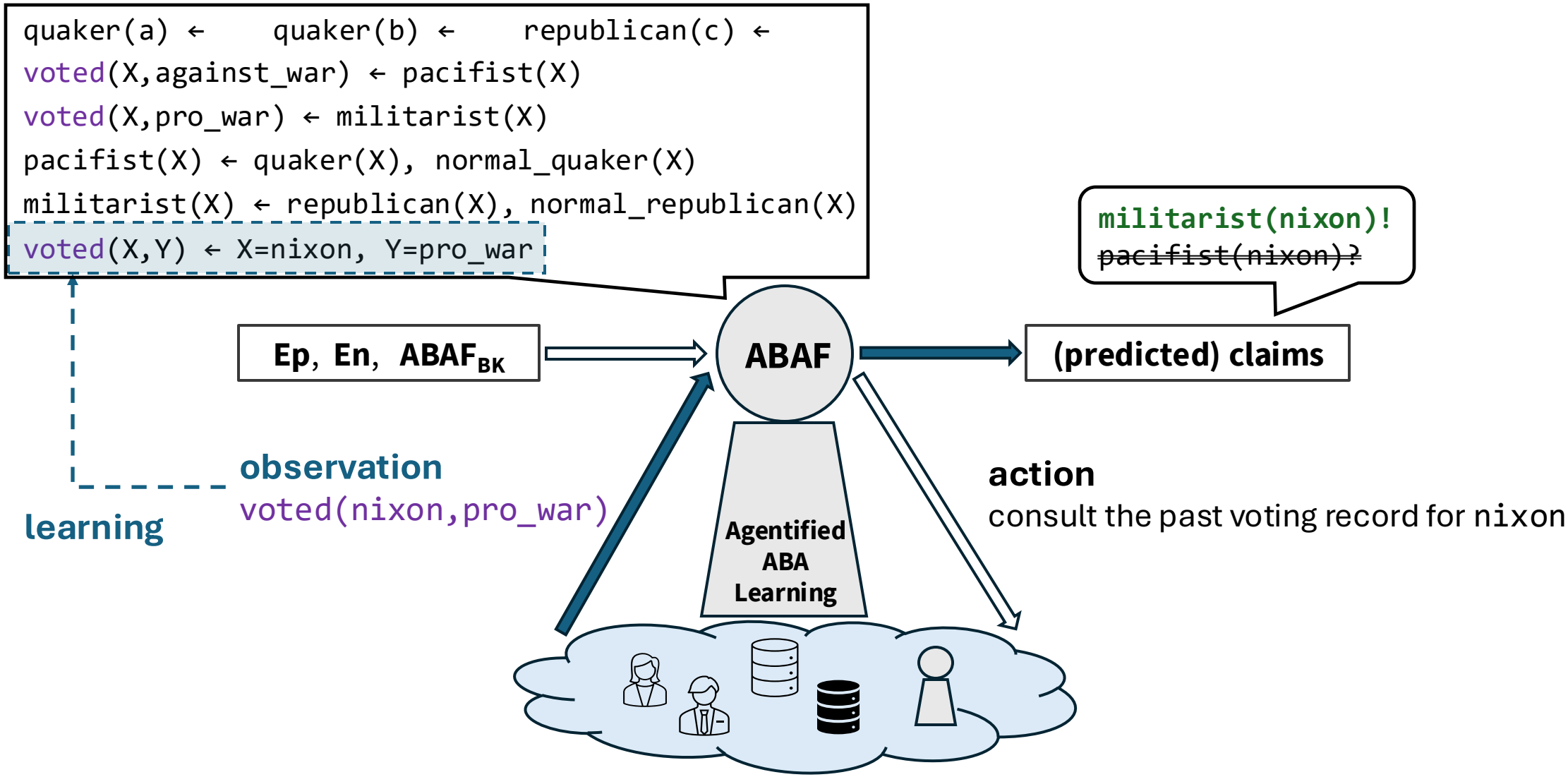
```
quaker(a) ←     quaker(b) ←     republican(c) ←
voted(X,against_war) ← pacifist(X)
voted(X,pro_war) ← militarist(X)
pacifist(X) ← quaker(X), normal_quaker(X)
militarist(X) ← republican(X), normal_republican(X)
```

```
militarist(nixon)?
pacifist(nixon)?
```



action
consult the past voting record for nixon

AGENTIFIED ABA LEARNING at work



CONCLUSIONS

- **Novel vision** for **argumentative agents**
  learning from examples & performing actions to generate targeted expansions of their knowledge
- **Enhancement of ABA Learning**
  leveraging on non-flat ABAFs
- **TODO**
  turn the **vision**
  into an **algorithm**