# NetLogo CBR Extension

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# Structure

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# Basic concepts

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Normally a case base consists of a series of cases, each of these cases consist of:

- state
- decision/activity
- outcome

The state can be anything such as the bank balance of the agent. The decision/activity might be to install central heating. The outcome might be straight forwardly yes or no. It might be probability, or it might some arbitrary decision/activity metric for use elsewhere.

# Basic concepts (continued)

A state and decision/activity are presented to the case base. The case base is searched for the closest match (if there is one) and the outcome of that match is given.

A NetLogo case consists of a state in any of the standard Netlogo variables, such as list, number, string, etc. This is strictly defined by the `cbr:lambda` which is the comparator program used to determine the "distance" the three cases:

- case A
- case B
- referent case R

are relative to ecah other.

# Basic concepts (continued)

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That is, if:

- the case A is 'closer' to the referent case R than the case B using `cbr:lamda` to the referent case R then `cbr:lt` is returned
- the case B is 'closer' to the referent case R than the case A using `cbr:lamda` to the referent case R then `cbr:gt` is returned
- the case B is 'same distance' to the referent case R than the case A using `cbr:lamda` to the referent case R then `cbr:eq` is returned
- the case B is 'closer' using `cbr:lamda` to the referent case R then `cbr:lt` is returned

# Basic concepts (continued)


Now when we need to decide whether a case matches one in the case base, we just bubble through the entire case base until we get the closest match or matches. The comparison method is always the same, i.e. the comparator program, denoted `lamda` herein, iff this routine when presented with three cases, can tell you which is closest to the referent case or whether they are comparable at all.

A default comparator program is provided, but this operates purely on state , does not consider the decision or outcome. For more information then please consult the NetLogo CBR documentation which may be found here.

`https://gitlab.com/doug.salt/cbr`

# Basic concepts (continued)

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[fragile]
The lamba can be specified in the code and must have the following parameters:

- case-base
- yes-case
- no-case
- reference-case

So the code for a bespoke comparator might look like this in NetLogo:

```
to-report comparator-pattern [ some-case-base yes-case no-case reference-case]
  ; ...
  report cbr:lt
  ; ...
  report cbr:gt
  ; ...
  report cbr:eq
  ; ...
  report cbr:incmp
end
```

# Core commands

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- `cbr:new` - creates a new case base.
- `cbr:add` - adds a case to a case base
- `cbr:match` - returns the closes match
- `cbr:outcome` - queries a case for its outcome
- `cbr:decision` - queries a case for its decision
- `cbr:lambda` - set the default compartor progam

# Other commands

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- `cbr:combine` - combines two case bases.
- `cbr:all` - returns all the cases as a list.
- `cbr:matches` - returns more than one match if it exists.
- `cbr:state` - gets the state of a particular case.
- `cbr:remove` - removes a particular case.
- `cbr:set-time` - sets the time at which a particular case base was created. This is done automatically at insertion into the case base. This commands just allows a degree of additional flexibility.

# Other commands (continued)


- `cbr:get-time` - queries the querying of the time for a particular case.
- `cbr:set-earliest` - sets the tick before which all case bases will be "forgotten".
- `cbr:get-earliest` - allows the querying of the former.
- `cbr:forget` - "forgets" all cases which are too old.
- `cbr:set-rank` - sets the rank in the event of a tie breaker. the former.
- `cbr:get-rank` - allows the querying of the former.

# Easy example

`cbr:new` to set a new case base, so:

```
set simple-case-base cbr:new
```

To add a new case then:

```
set some-case cbr:add simple-case-base ["lays eggs" "breathes
air"] "bird" .01
```

where the first field is the case base object, the second is the state `["lays eggs" "breathes air" ]`; the third is the decision, `colorredbird`, and the last is the outcome, which in this case is a probability of 0.1.

# Easy example (continued)


Add repeated multiple cases and then query using `cbr:match` or `cbr:matches`, thus:

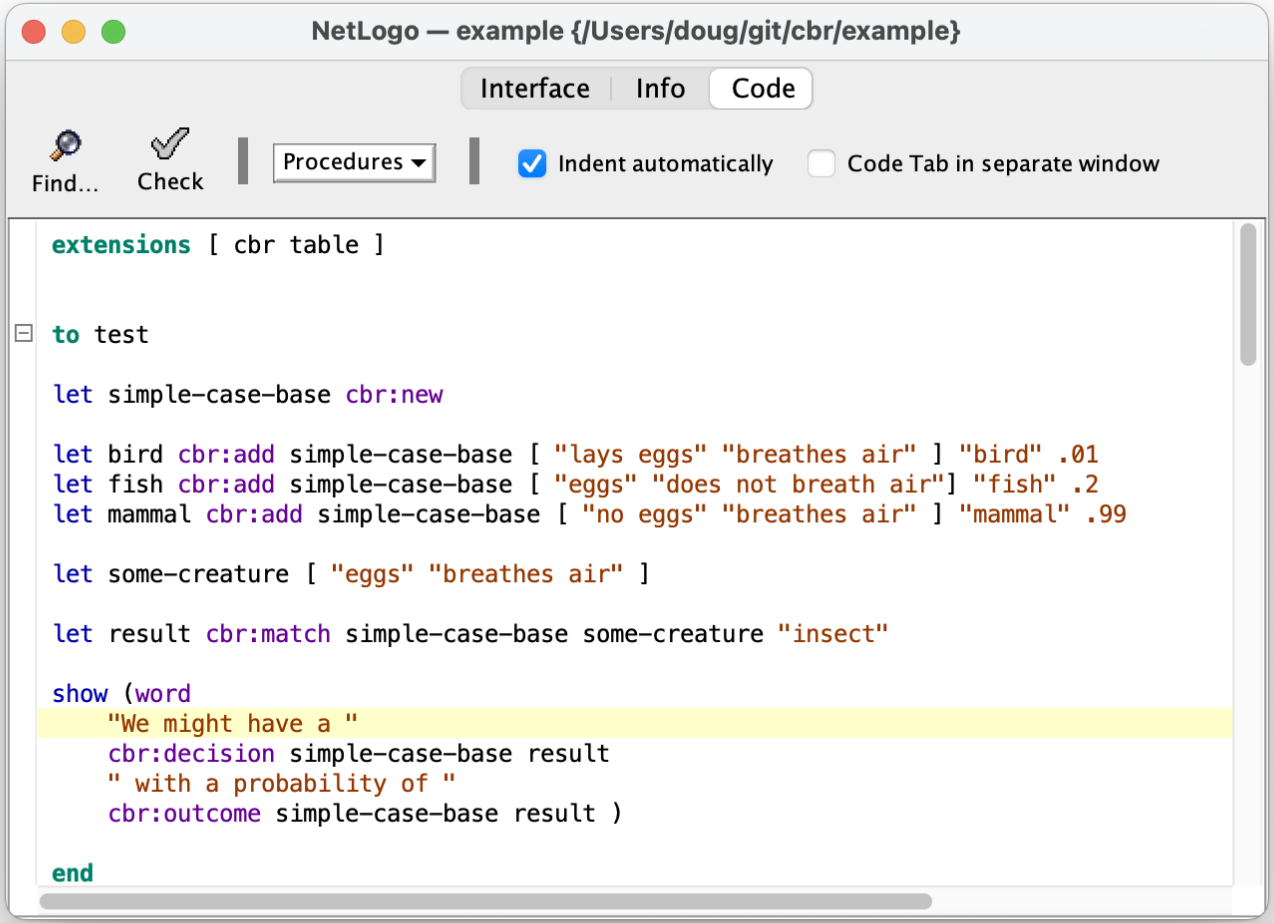
```
let some-creature [ "lays eggs" "breathes air" ]
let result cbr:match simple-case-base some-creature "bird"
```

So this constructs a "reference" case base to match, consisting of the state`some-creature`, and the decision `"bird"`.

This is using the standard, in-build comparator. For more details on this please see the docmentation in the github repository `https://gitlab.com/doug.salt/cbr`.

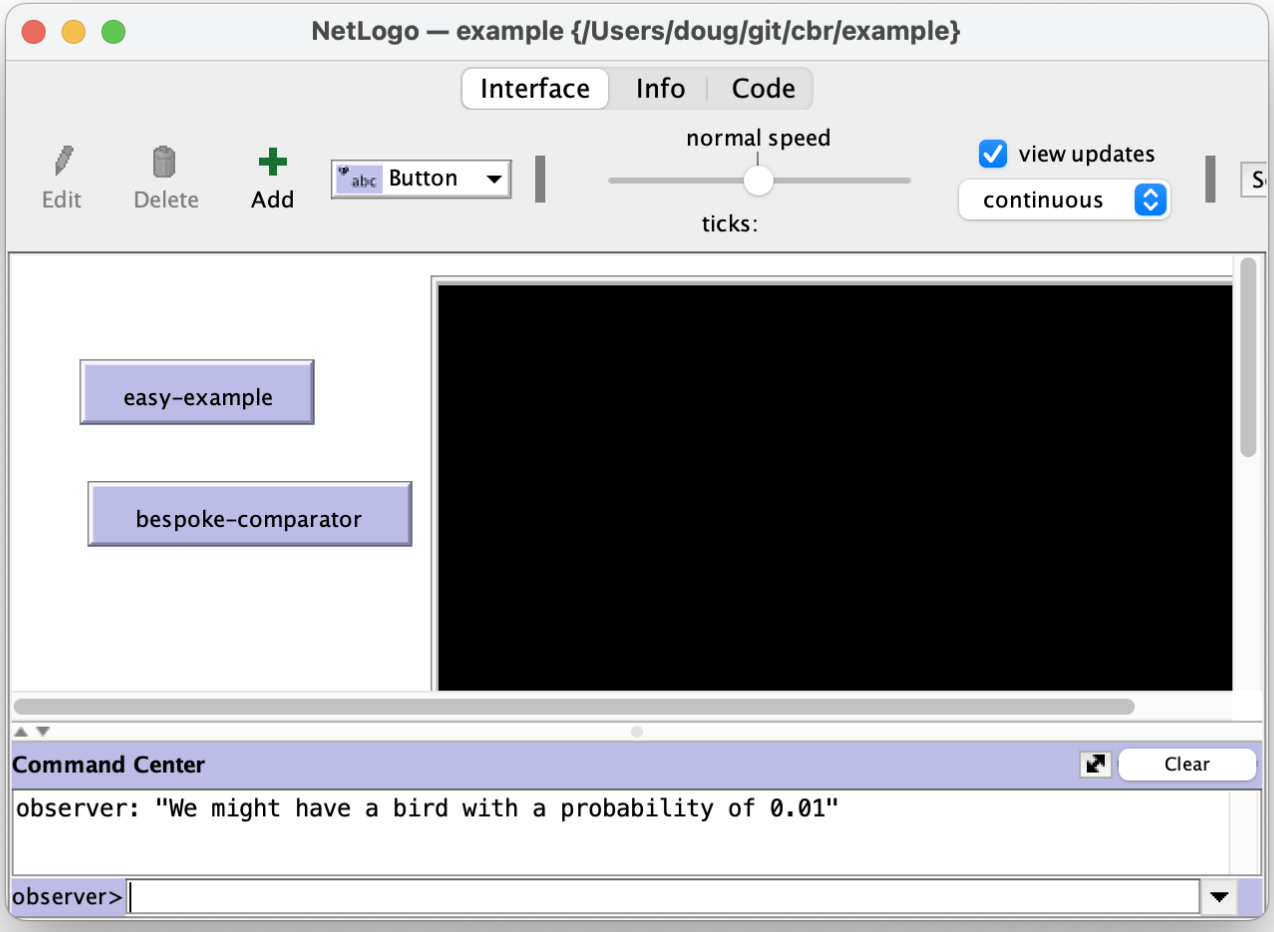
# Easy example (continued)

So this here we another exmaple the code looks like eventually:



# Easy example (continued)

And this is the result of clicking the "simple example" button.



# Bespoke lambda


So the default comparator is not that brilliant, so we can implement our own:

```
cbr:lambda simple-case-base some-comparator
```

Where the comparator starts with:

```
to-report [a-case-base src-case obj-case ref-case]
```

Where this routine must return `cbr:lt`, `cbr:gt`, `cbr:eq` or `cbr:incmp`. And that is it.

The only small problem being that there is a bug in the comparator by the looks of things which needs fixing.

Any questions?

Thank you very much