

Programming Behavior

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Behavioral Build File

```
projectN_control( )  
projectN_enter_params( )  
projectN_visualize( )  
projectN_reset( )
```

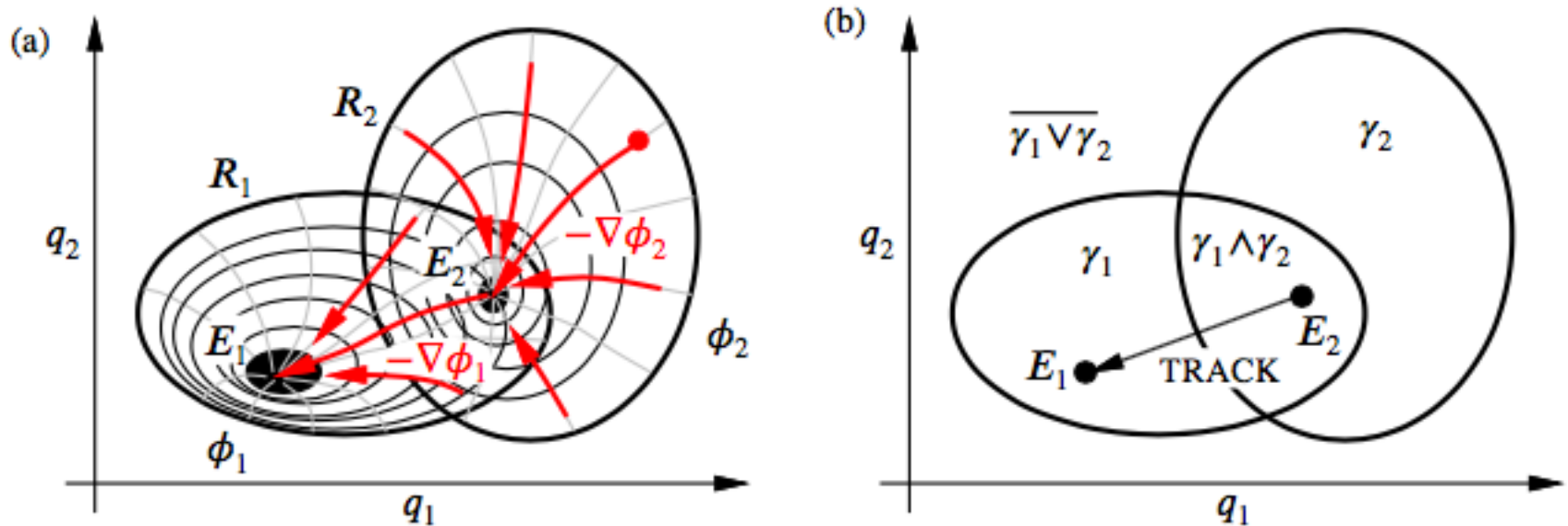
also establishes specific convention for states and actions:

action: any procedure that can be used to define new *recommended* setpoints

states: the dynamic status of eligible actions

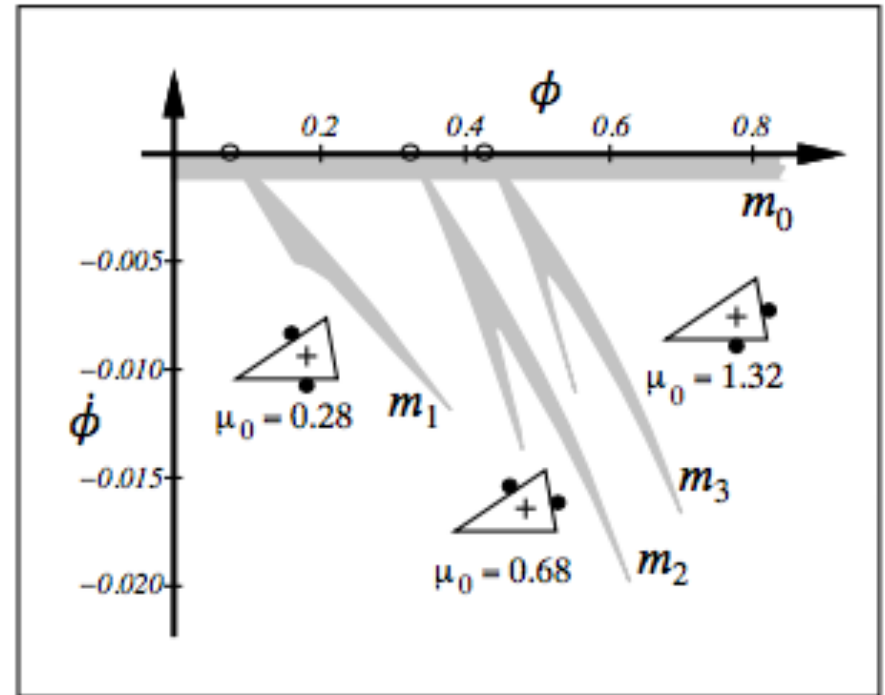
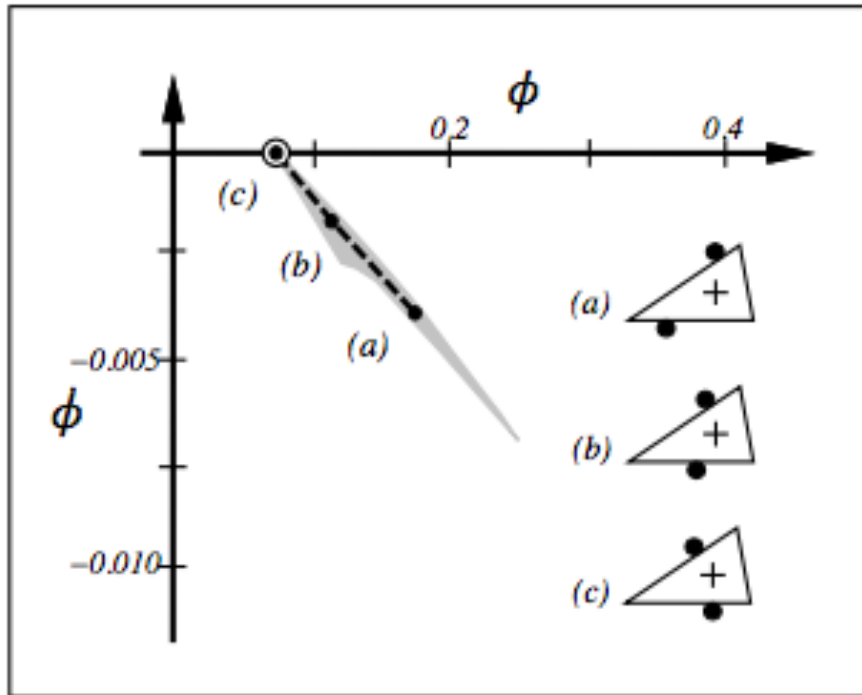
A Landscape of Attractors

"funnels"

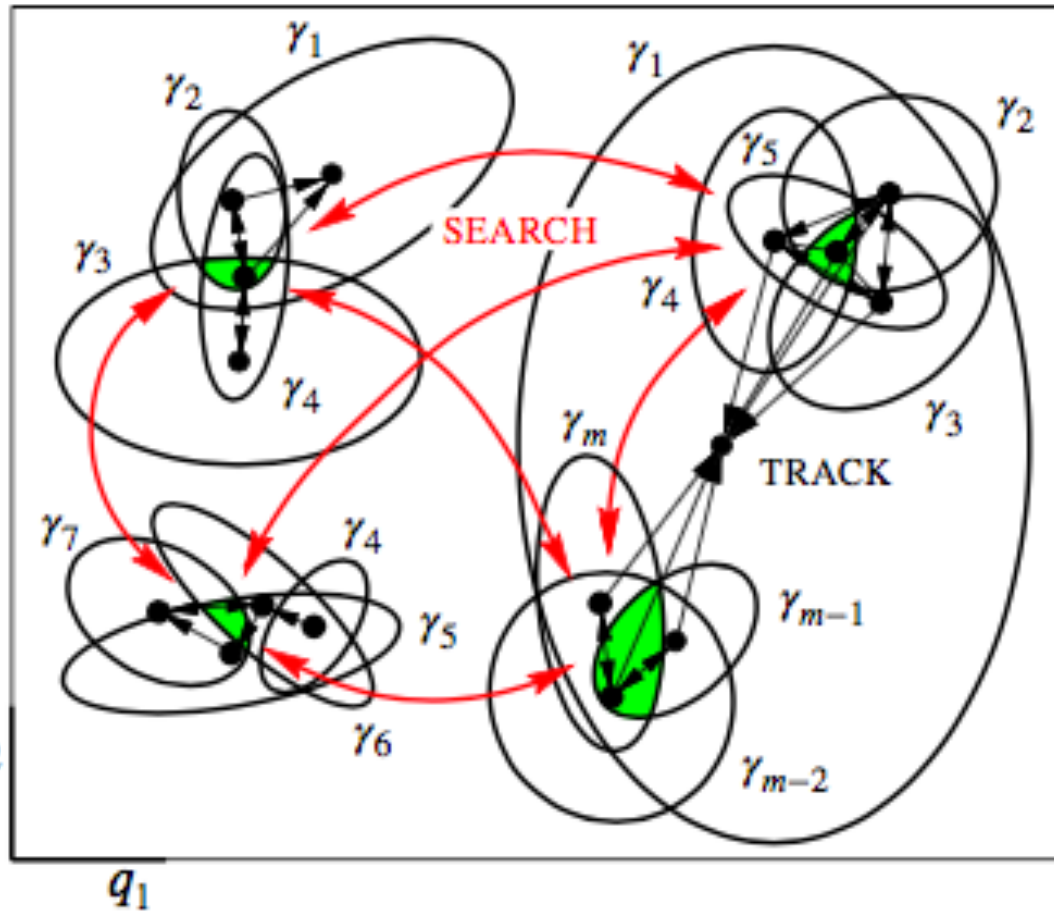


Emilio Bizzi - equilibrium setpoint theory - frog legs
 Marc Raibert - hopping platforms, Atlas, spot mini

Control State Feedback



A Landscape of Attractors

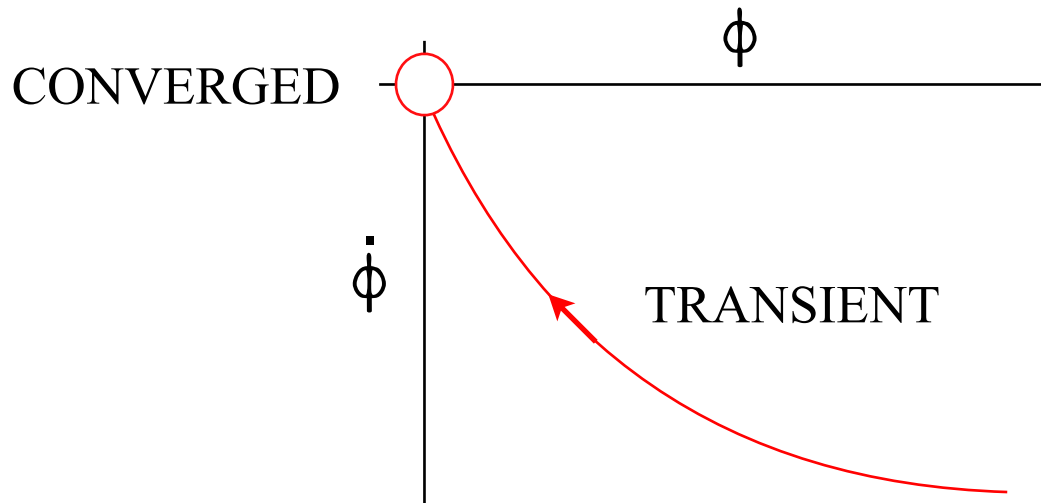


a taxonomy of action:

Search

Track

Control State Feedback: Roger



actions return γ :

$$\gamma = 0 \text{ (undefined)}$$

$$= 1 \text{ (} |J_c| > \varepsilon \text{)}$$

$$= 2 \text{ (} |J_c| \sim 0 \text{)}$$

0: (NO_REFERENCE)

1: (TRANSIENT)

2: (CONVERGED)

the reference stimuli is not detected

stimuli are detected, not converged

controller converged to the setpoint

**ALL ELIGIBLE ACTIONS RETURN THEIR INTERNAL STATE
to inform decisions about which recommended setpoints to use**

Multi-Modal State

$$s = [\gamma_0 \dots \gamma_N]$$

actions return γ :

$$\gamma = 0 \text{ (undefined)}$$

$$= 1 \text{ (} |J_c| > \varepsilon \text{)}$$

$$= 2 \text{ (} |J_c| \sim 0 \text{)}$$

unique integer state:

$$s^* = \gamma_0(3^0) + \gamma_1(3^1) + \dots + \gamma_N(3^{N-1})$$

$$0 \leq s^* \leq 3^N$$

SearchTrack(): State-Action Table

```

/*****
/*   SearchTrack()
/*****

double recommended_setpoints[NACTIONS]; // NACTIONS = NTRACK + NSEARCH

\\ let NTRACK =2
internal_state[0] = TRACK0(roger, time); // assigns values to recommended_setpoints[0]
internal_state[1] = TRACK1(roger, time); // assigns values to recommended_setpoints[1]

// for N=2
state = internal_state[1]*3 + internal_state[0];
switch (state) {

    case 0:
        \\ choose action[i] 0 <= i < NACTIONS
        \\ submit_setpoints(recommended_setpoints[i]);
        \\ break;
    case 1:
    case 2:
        .
        .
        .
    case 8:
}
return_state = TRANSIENT;

```

// TRACK1 TRACK 2
// NO_REFERENCE - NO REFERENCE

// NO_REFERENCE - TRANSIENT
// NO_REFERENCE - CONVERGED

**a convention for
programming, planning, & learning**