

EMA Meets the BIRD

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Overview

- Background and motivation
- Review EMA
- Modeling a dynamics emotional incident

Emotion

Cognitive

Emotion is a mental phenomena

- Arises from physiological & cognitive processes
- Associated with key cognitive functions
 - Focusing mental, sensory resources
 - Influencing beliefs
 - Informing decision-making
 - Preparing action and reaction
 - Learning and long-term adaptation



Emotion

Cognitive



Physical

Emotion is a physical phenomenon

- Emotion processes associated with specific physical behaviors
 - Facial expression
 - Body language and posture
 - Voice
 - Behavioral dynamics



Emotion

Cognitive



Physical



Social

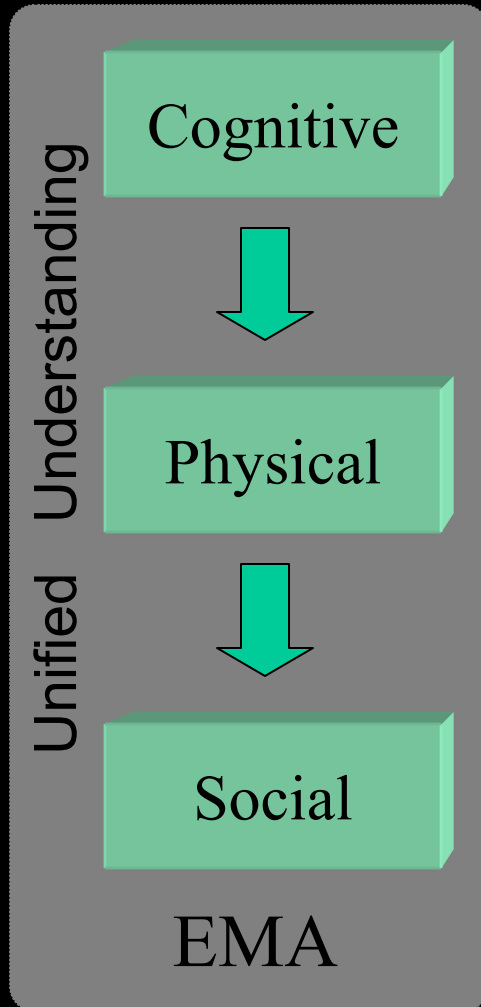
Emotion is a social phenomenon

Emotion is a signal that influences the behavior of others

- Emotional contagion
- Social referencing



Why are we interested?



Goal is to develop unified computational framework for modeling, simulating, explaining and exploiting these phenomena

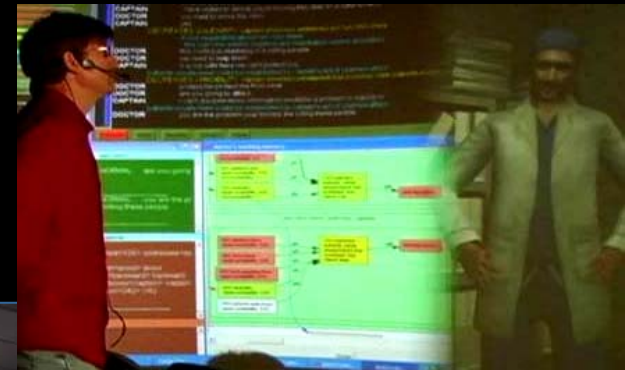
- To inform intelligent system design
 - By drawing on insights from emotion's supposed cognitive/social function
- To inform emotion theory
 - By concretizing theory and developing methodological tools
- To drive applications
 - Education, Training and Health Interventions

Social Learning Environments

Explore emotionally charged social interactions in safety of VR

Virtual Role Play

Learner interacts with Virtual Humans





Virtual Humans

- Computer-generated simulations of humans
- Users interact with virtual humans
 - Playing mentors, teammates, adversaries, etc.
- Behaviors not pre-scripted
 - Behave by understanding situation and reasoning about possible responses to events
- Communicate in natural language
 - Coordinated gestures and non-verbal communication
- Understand social situation
- Respond emotionally to situation
 - Affects the way they perform tasks & interact socially
 - Affects gaze, face, gestures, posture



SASO: Dealing with Doctors

- ***Pedagogy:*** Training Negotiation Skills under high stress, emotional conditions
- ***Goal:*** Persuade doctor to re-locate clinic

Intended as integrated research prototype, not full training system

Work with Bill Swartout, Jon Gratch, Ed Hovy, Shri Narayanan, David Traum





Doctor's Emotions

- Doctor's evolving perception of negotiation on moving the clinic
 - Moving clinic order is undesirable, but avoidable
 - Emotion: Anxiety for his patients
 - Cope: Avoidance Response (ignore)
 - As trainee persists
 - Emotion: Fear, Increased anxiety, Anger
 - Cope: Attack, defend against threat
 - Offer of badly needed medical supplies is desirable
 - Emotion: Hope for his patients
 - Cope: Constructive Problem Solving

EMA

**A computational model of
emotions**

Theoretical Perspective

- **Appraisal Theory** (Arnold, Lazarus, Frijda, Scherer)

Emotion arises from an *evolving subjective interpretation* of person's relation to their environment and informs cognitive and physical acts

- Leventhal & Scherer's *Conceptual Level* of processing

(e.g. planning, social attributions, language)

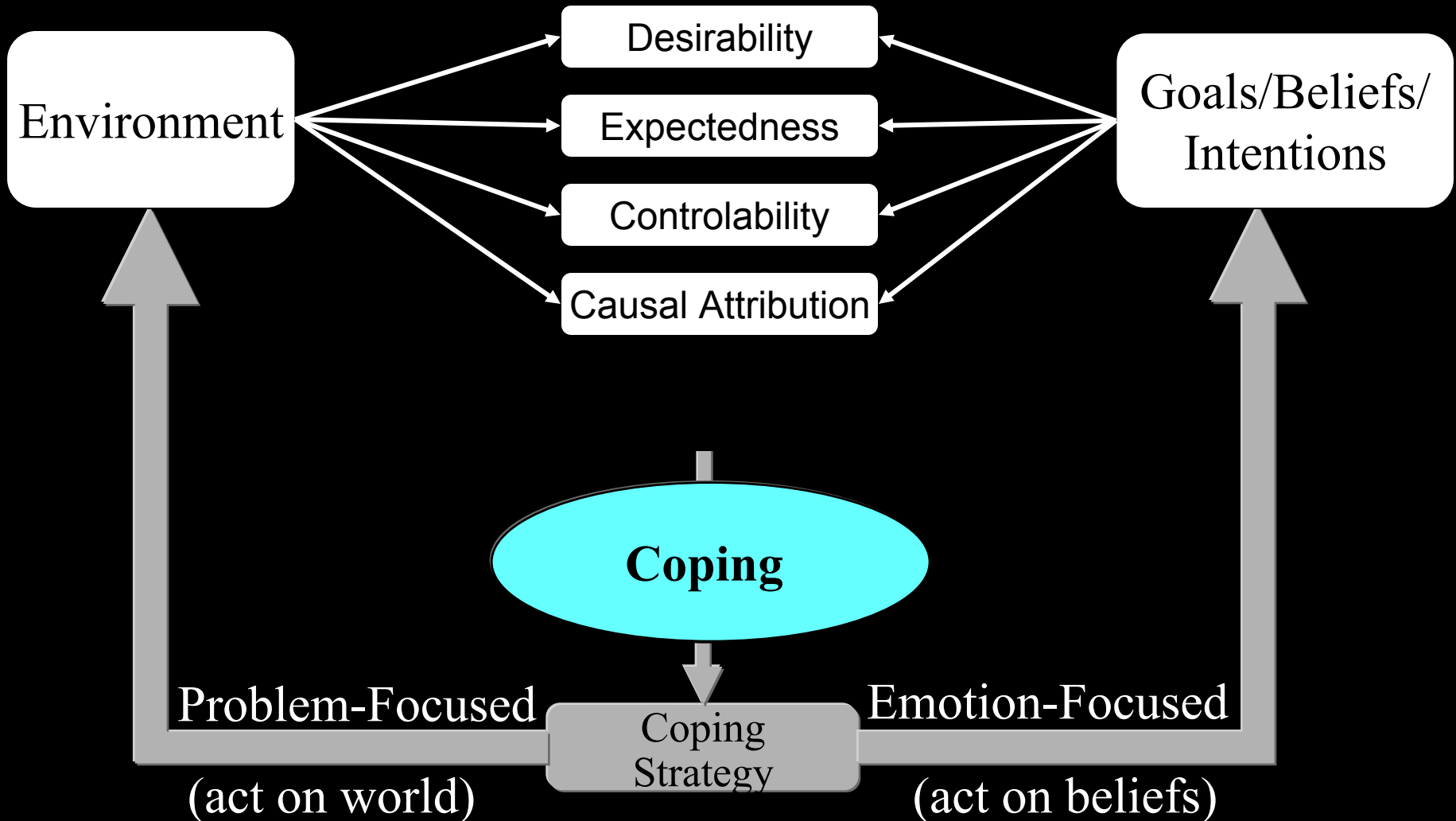
- Constructive theory

- Model the cognitive processes that inform / are informed by emotion

Emotion epiphenomena: what matters are appraisals and the responses they evoke

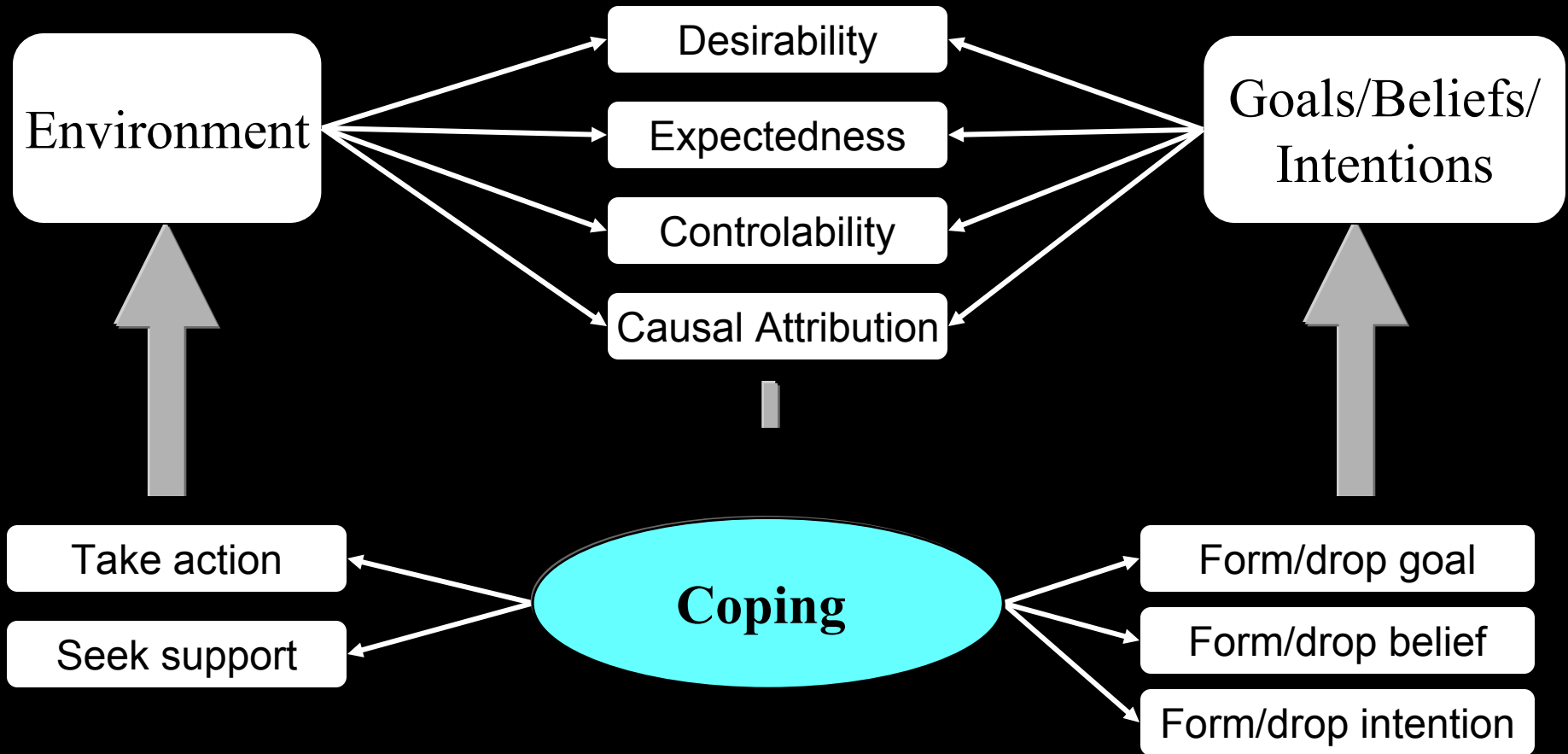
Appraisal Theory

Smith and Lazarus⁹¹ cognitive-motivational-emotive system



Appraisal Theory

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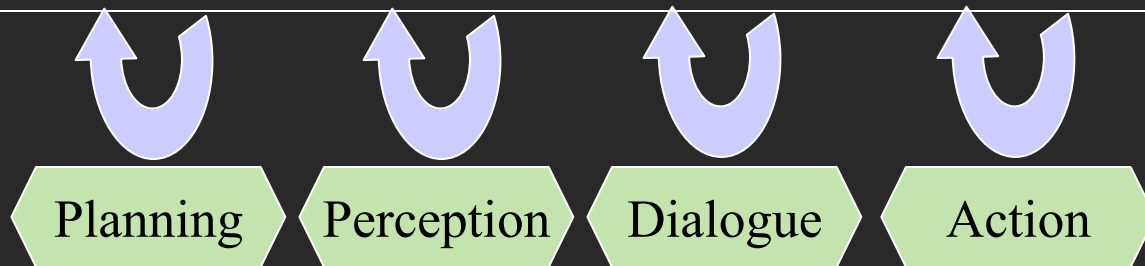
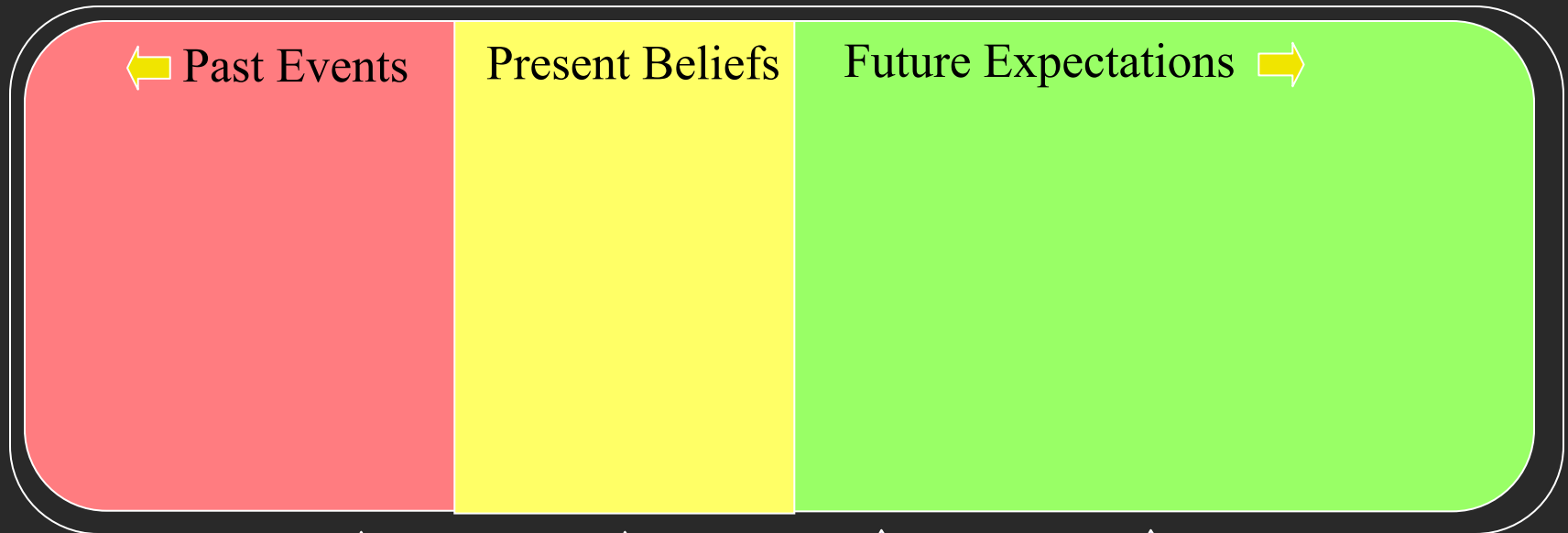
Appraisal Theory as architectural specification

- Provides high-level requirements
- How do we map this into an architecture
 - How do we represent the person-environment relation?
 - How do appraisal processes operate over this representation?
 - What is the relation between the processes of
 - Appraisal
 - Cognition
 - Coping
 - How do these interactions interact/unfold over time?

EMA Model of Appraisal and Coping

Reinterpret Appraisal theory from “AI/agent perspective”

Causal Interpretation of events, beliefs, desires, intentions

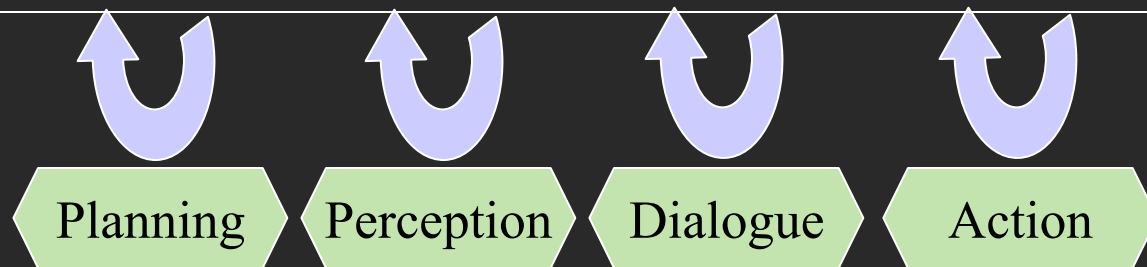
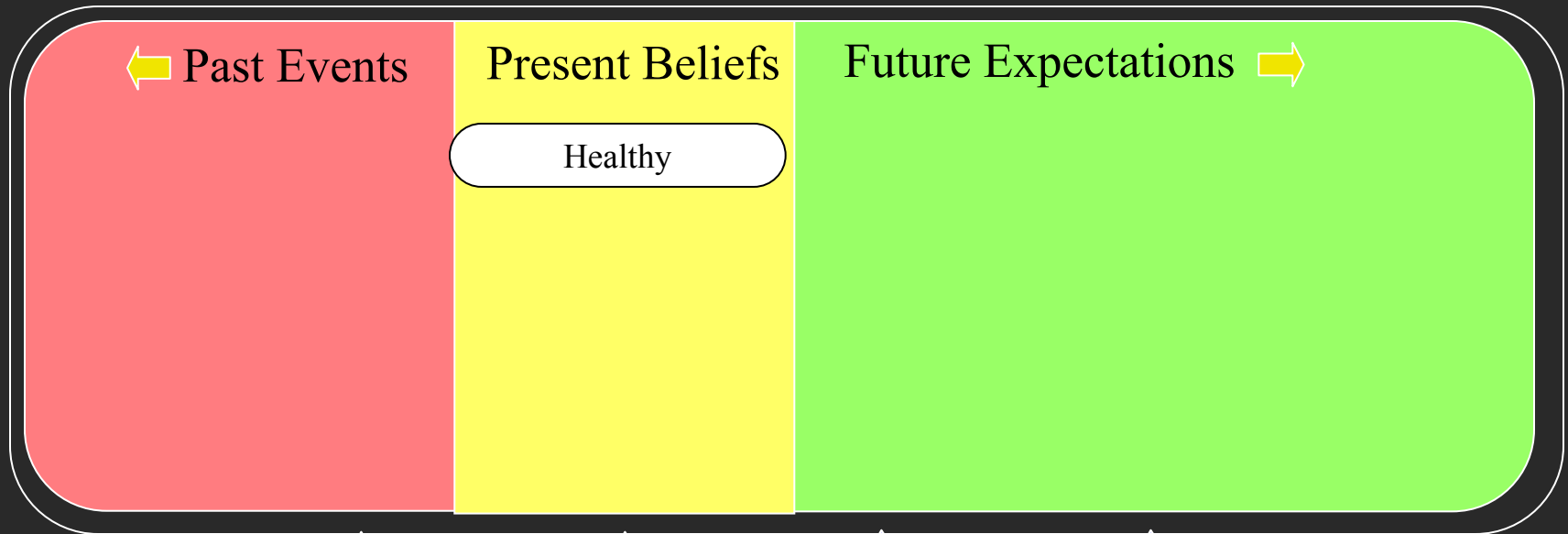


Cognitive Operations / Inference

EMA Model of Appraisal and Coping

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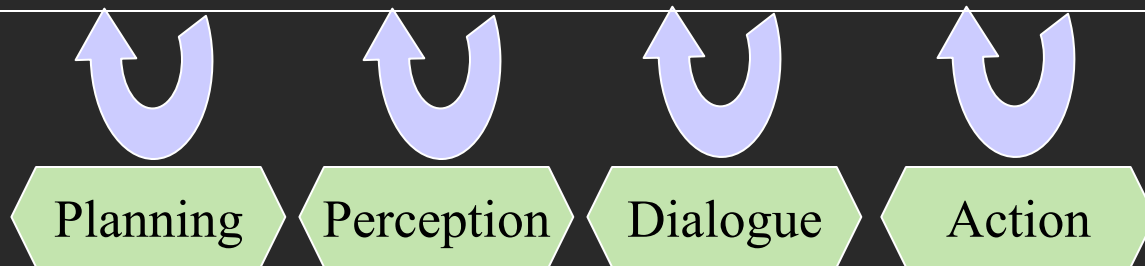
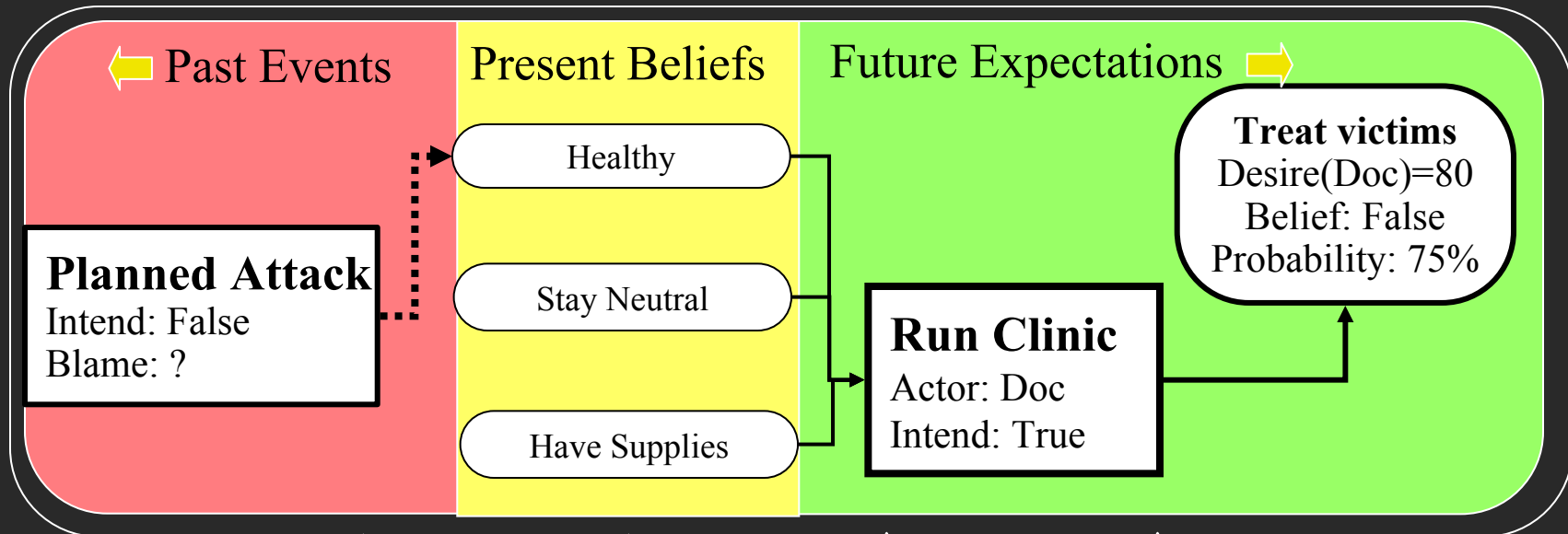


Cognitive Operations / Inference

EMA Model of Appraisal and Coping

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Causal Interpretation of events, beliefs, desires, intentions



Cognitive Operations / Inference

Modeling Appraisal & Coping

- Appraisal as evaluation of the causal interpretation
 - Define appraisal variables in terms of features of interpretation
 - Fast, automatic
- Coping as operators that suggest ways to change interpretation
 - Sequential, deliberate, mediated by focus of attention
 - Problem-focused → Take Action, Make Plans
 - Emotion-focused
 - **Denial/Wishful Thinking** → Change belief / likelihood
 - **Find silver lining** → Change utilities
 - **Shift blame** → Change causal attribution
→ Dialogue moves
 - **Distancing/acceptance** → Drop goal / intention
 - **Avoidance** → Change topic
→ Add goal (e.g., go to party)

Evaluation (Gratch&Marsella, JAAMAS2005, Mao&Gratch AAMAS05/06)

Stress and Coping Process Questionnaire (Perrez&Reichert92)

- Presents evolving situations
- Elicits self-reports of emotional state, Appraisals, Coping tendencies
- Identifies “normal” emotional trajectories

Encoded as causal theories in EMA

Results:

- EMA consistent with most trends

Table 1: Summary of main results

	Predicted Trend	EMA
1.1	Aversive more controllable	Yes
	Aversive more changeable	Yes
1.2	Controllability decreases	No
	Changeability decreases phases	Yes
1.3	Negative valence increases	Yes
	Good outcome strongly positive	Yes
1.4	Aversive yields more anger	Yes
	Loss yields more sadness	No
2.1	Low control → low problem-focused	Yes
2.2	Low control → passivity	Yes
3.1	Low ambiguity → low seek info	Yes
3.2	Low ambiguity → suppression	Yes
4	Low control → emotion-focused	Yes

Emotion Dynamics

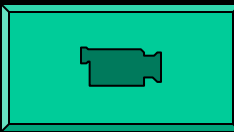


Emotion Dynamics

Surprise → Anger → Relief



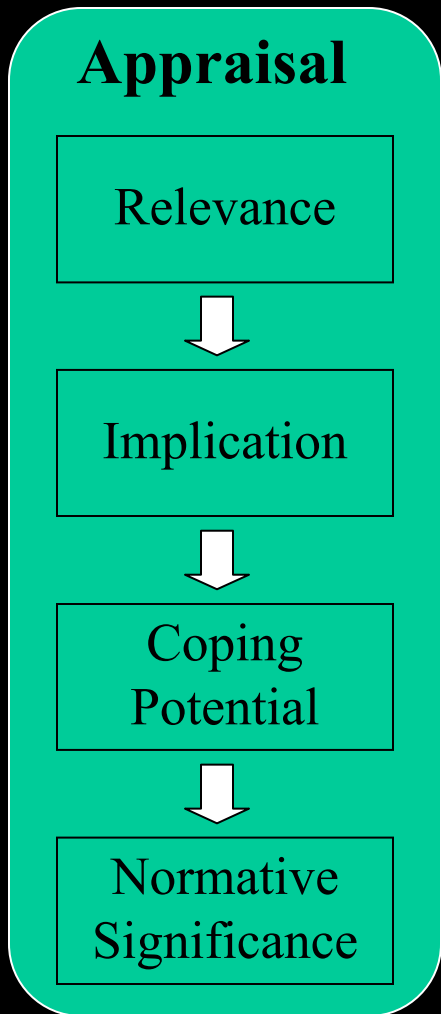
Emotion Dynamics



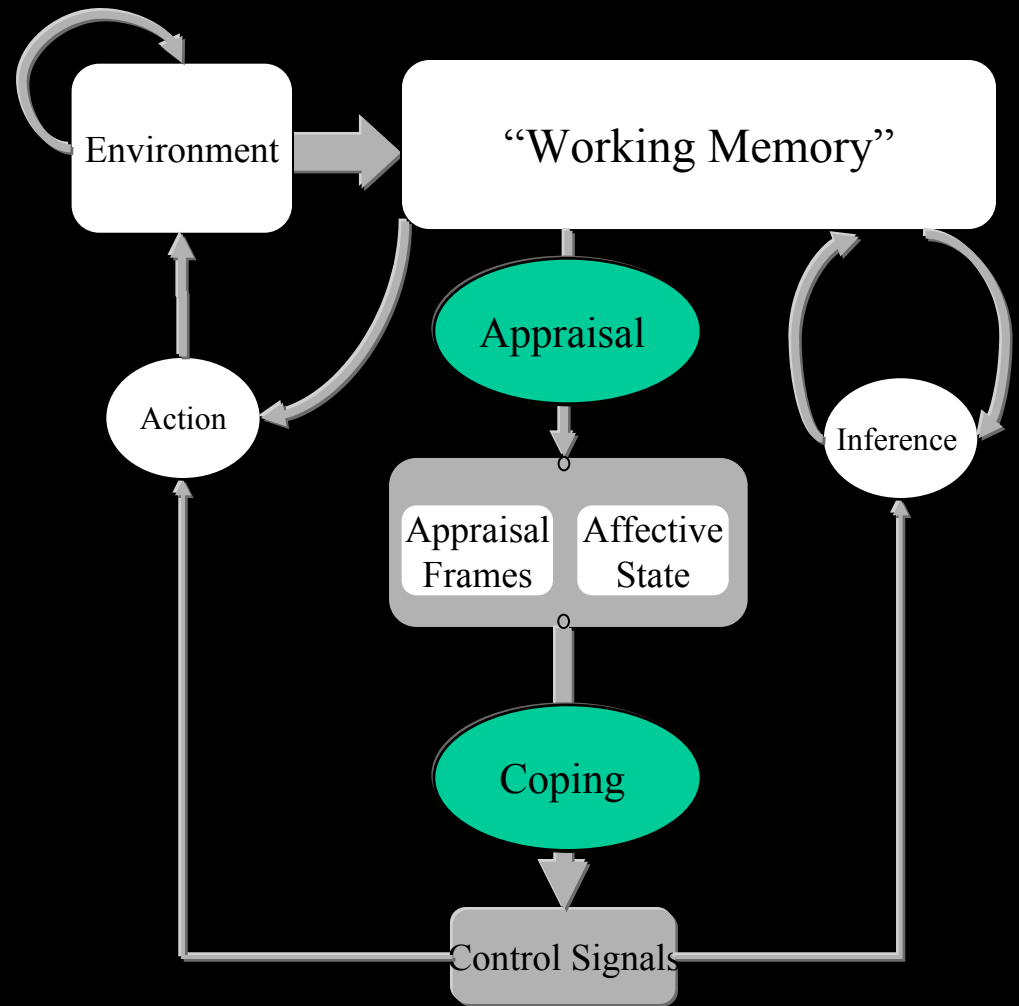


How might *similar* dynamics be modeled in EMA?

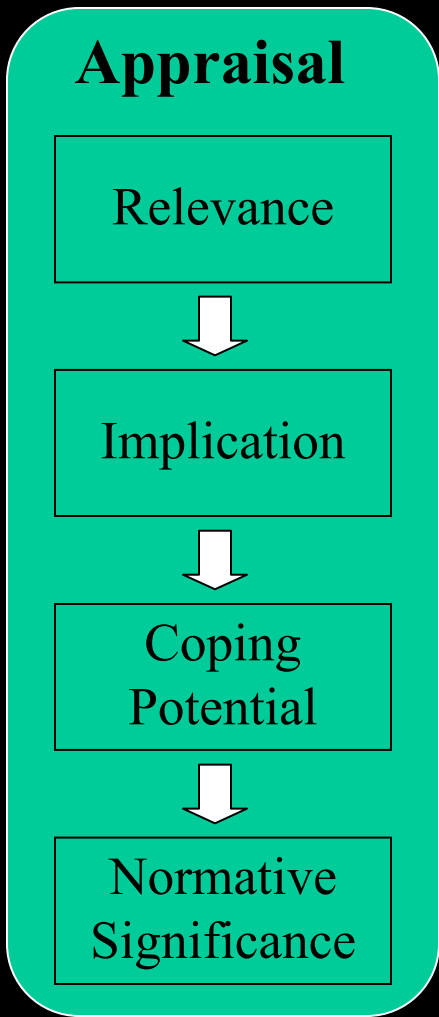
Scherer's Sequential Checking Model



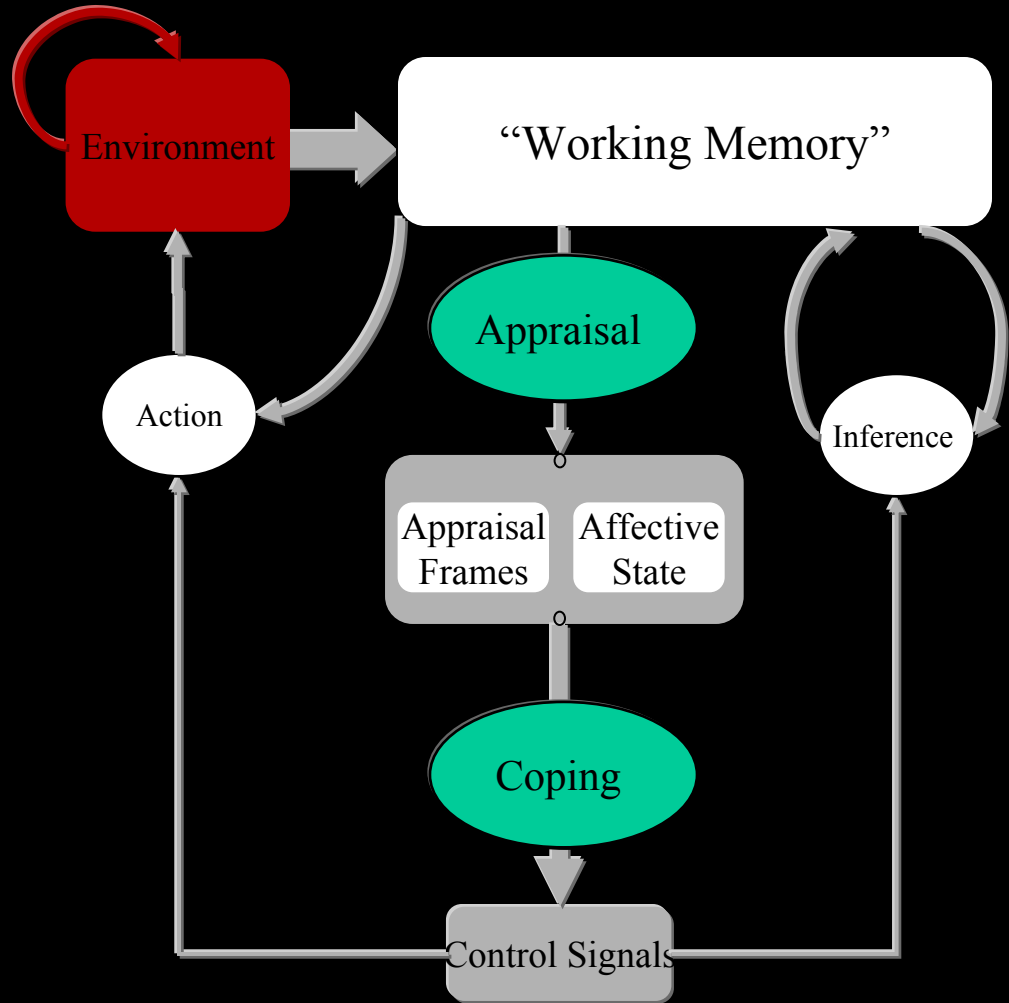
EMA



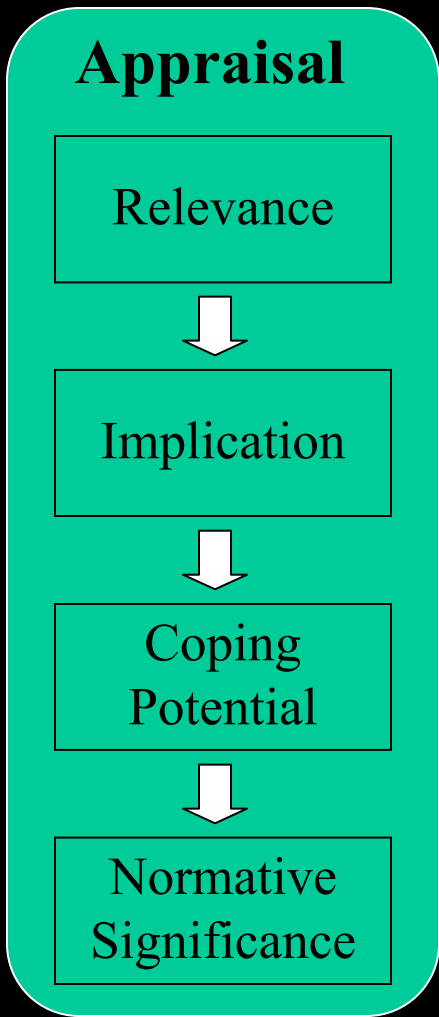
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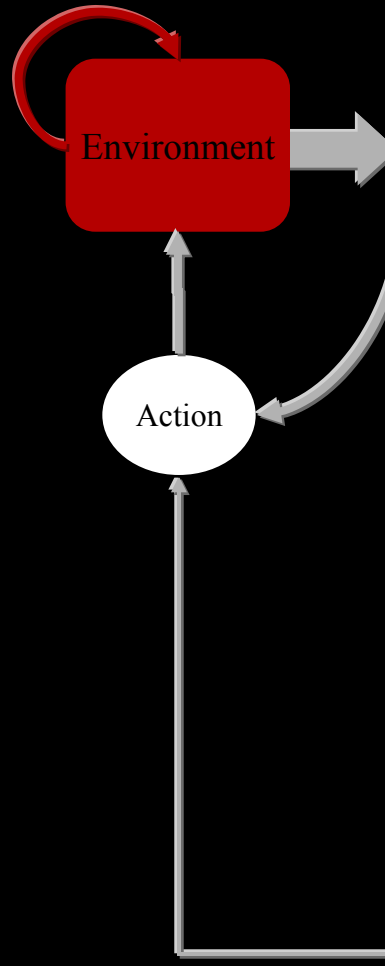
Dynamics in the world



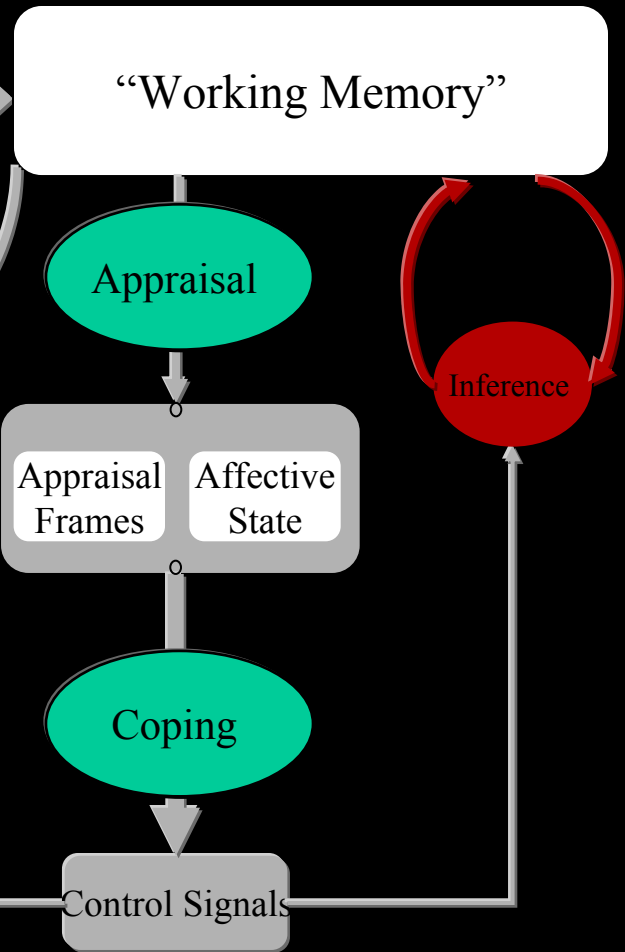
Scherer's Sequential Checking Model



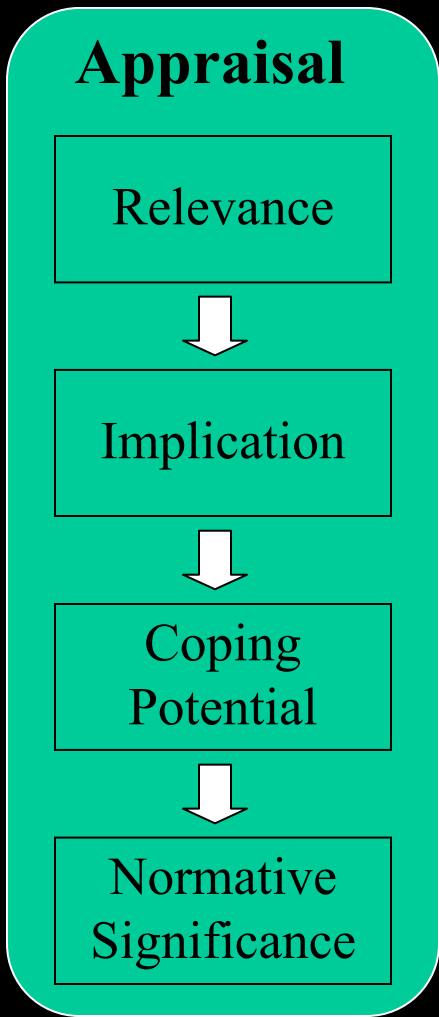
Dynamics in the world



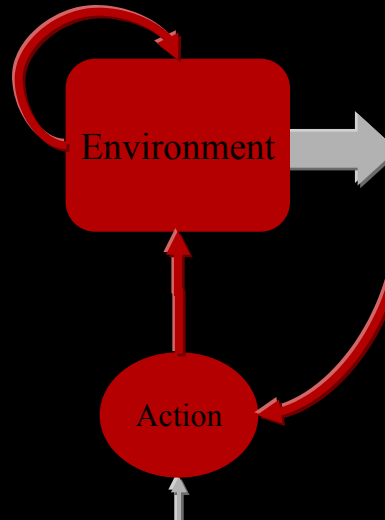
Dynamics in perceived world relationship



Scherer's Sequential Checking Model

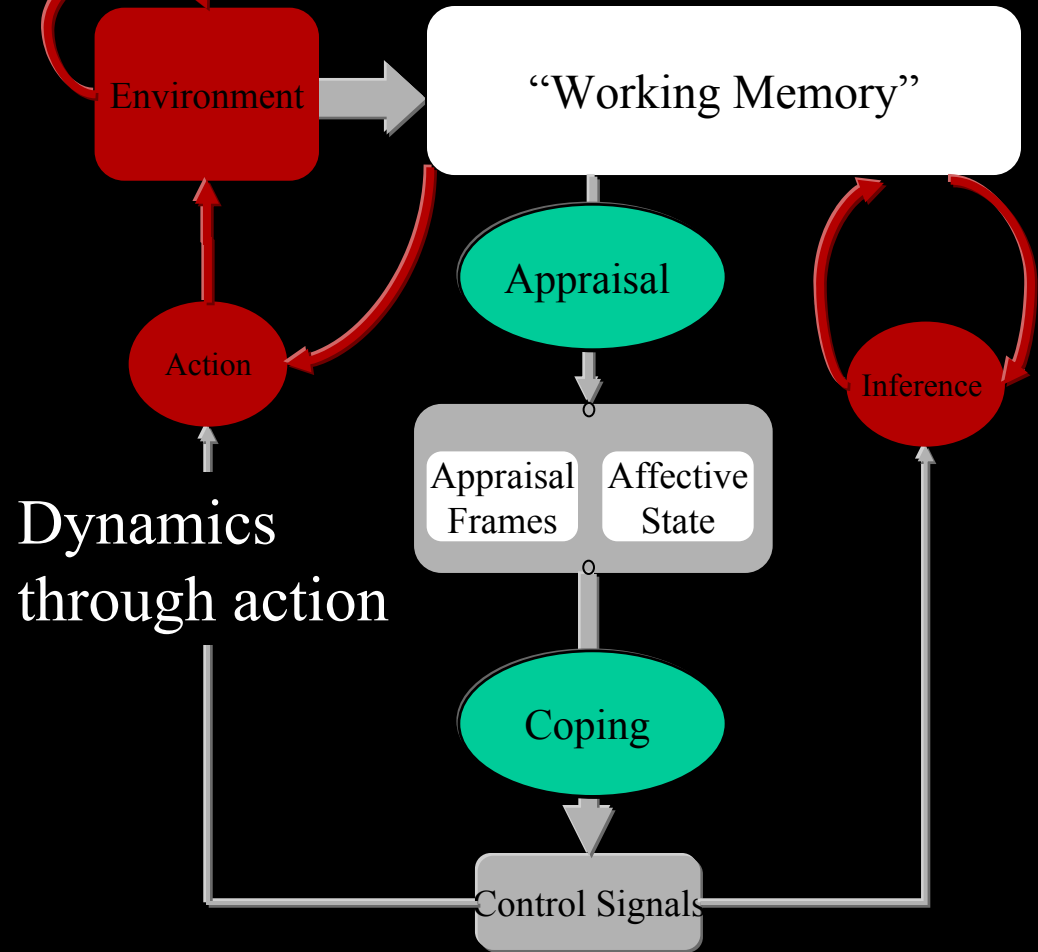


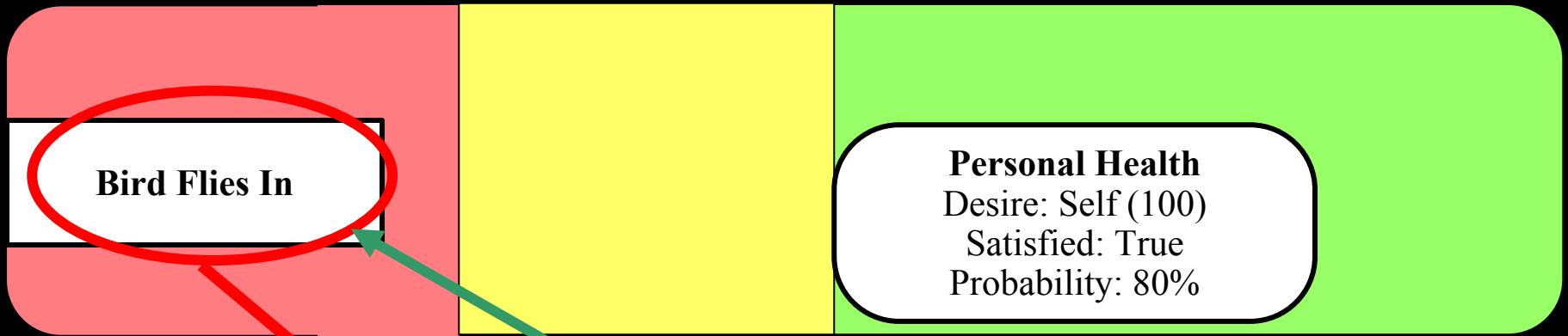
Dynamics in the world



Dynamics through action

Dynamics in perceived world relationship





Coping

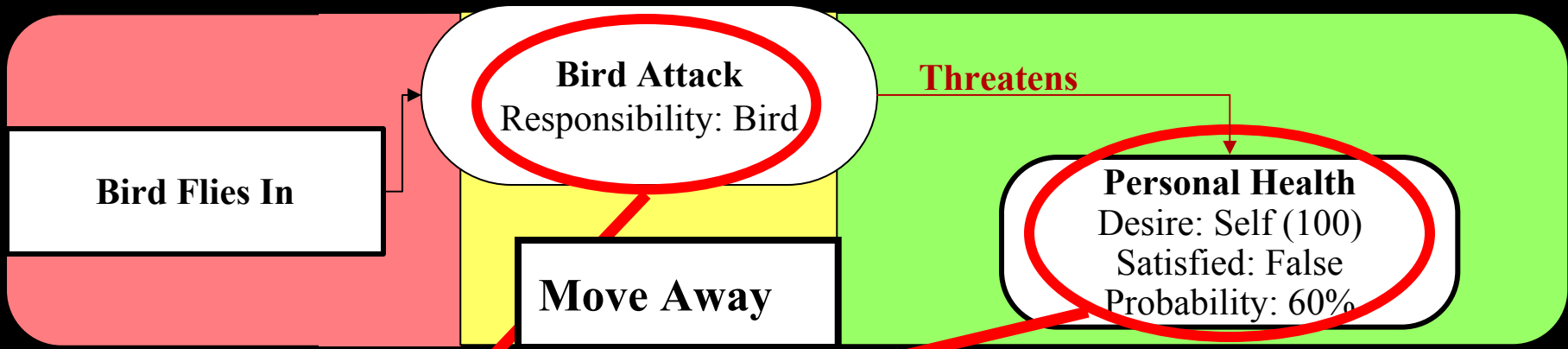
Perspective: Self
Unexpectedness: High
Controllability: Low
Blame/Credit: unresolved

Surprise

Seek Info

Coping: Seek More Information

Virtual Actor's Appraisal of Bird Flying in Window



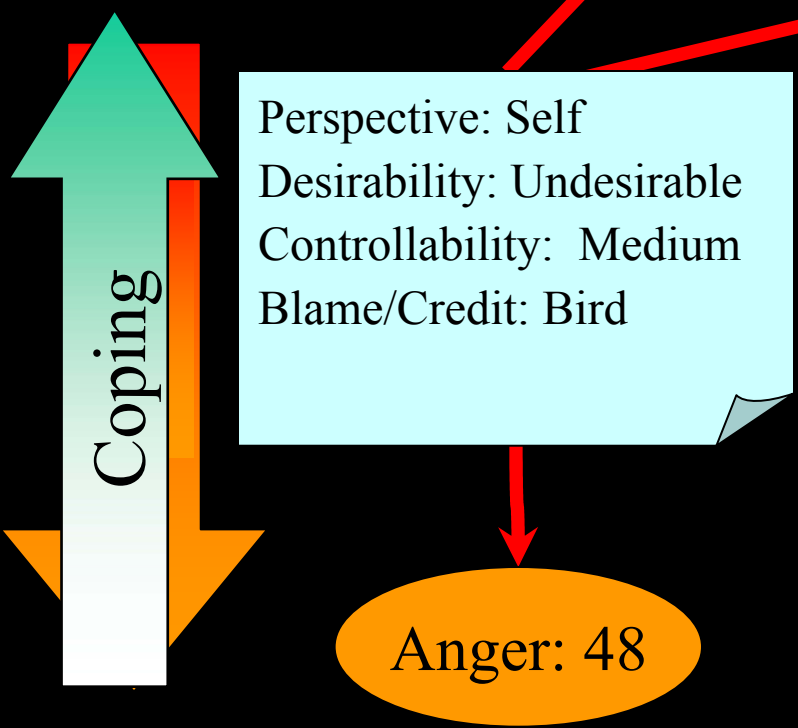
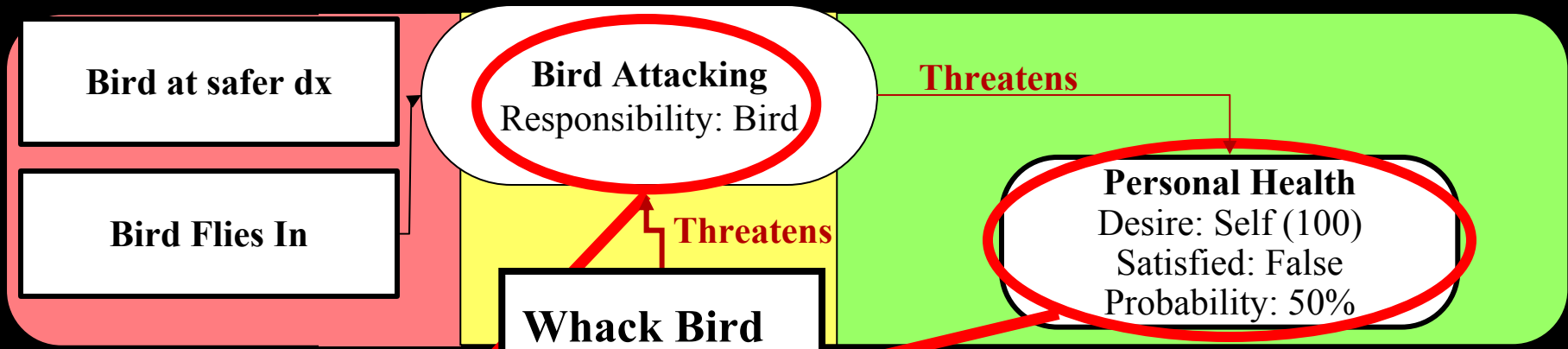
Perspective: Self
Desirability: Undesirable
Controllability: Low
Blame/Credit: Bird

Fear: 48

Avoid Threat

Coping: Avoid

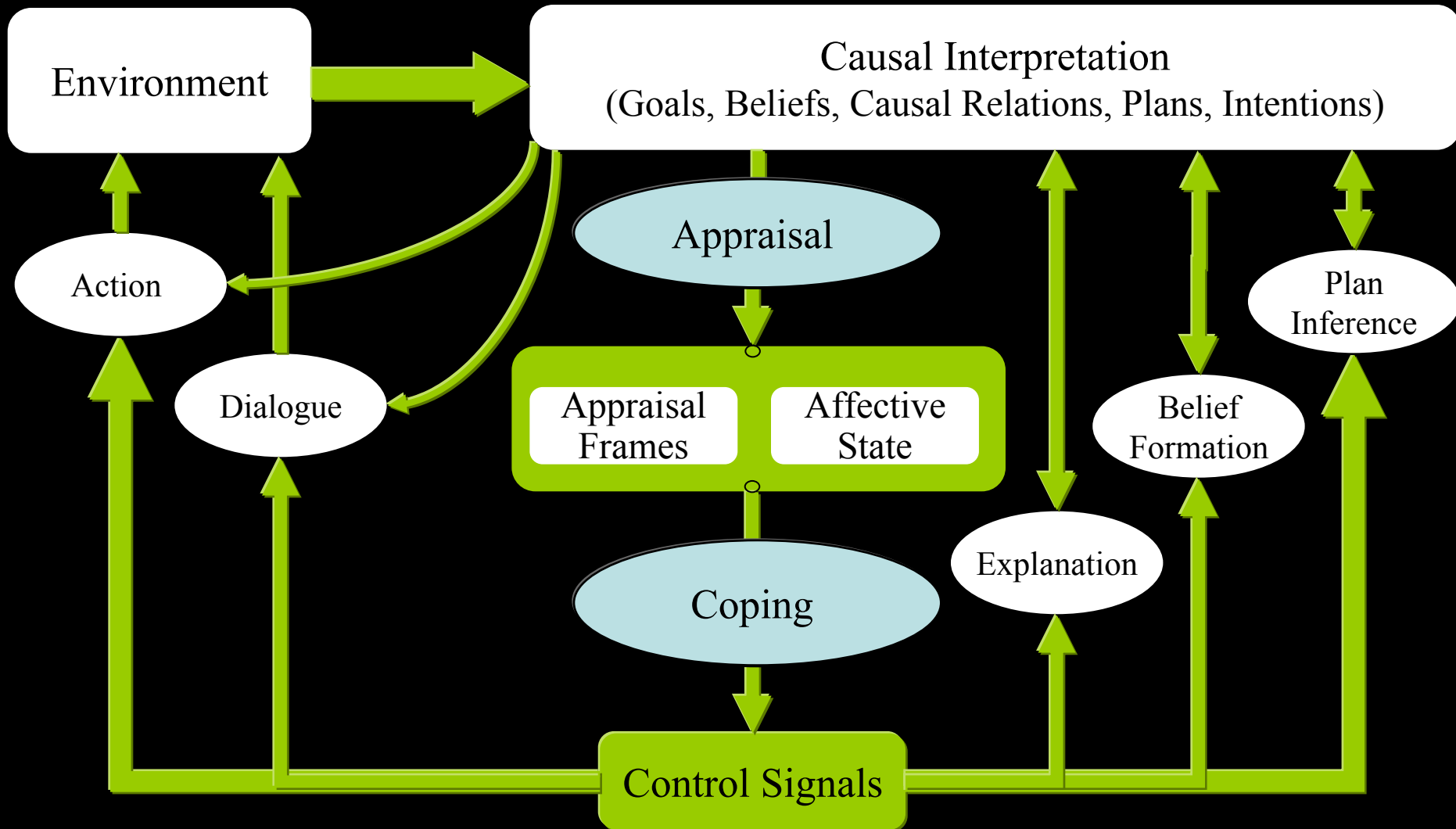
Further Inference: The Bird will attack



Coping: Plan

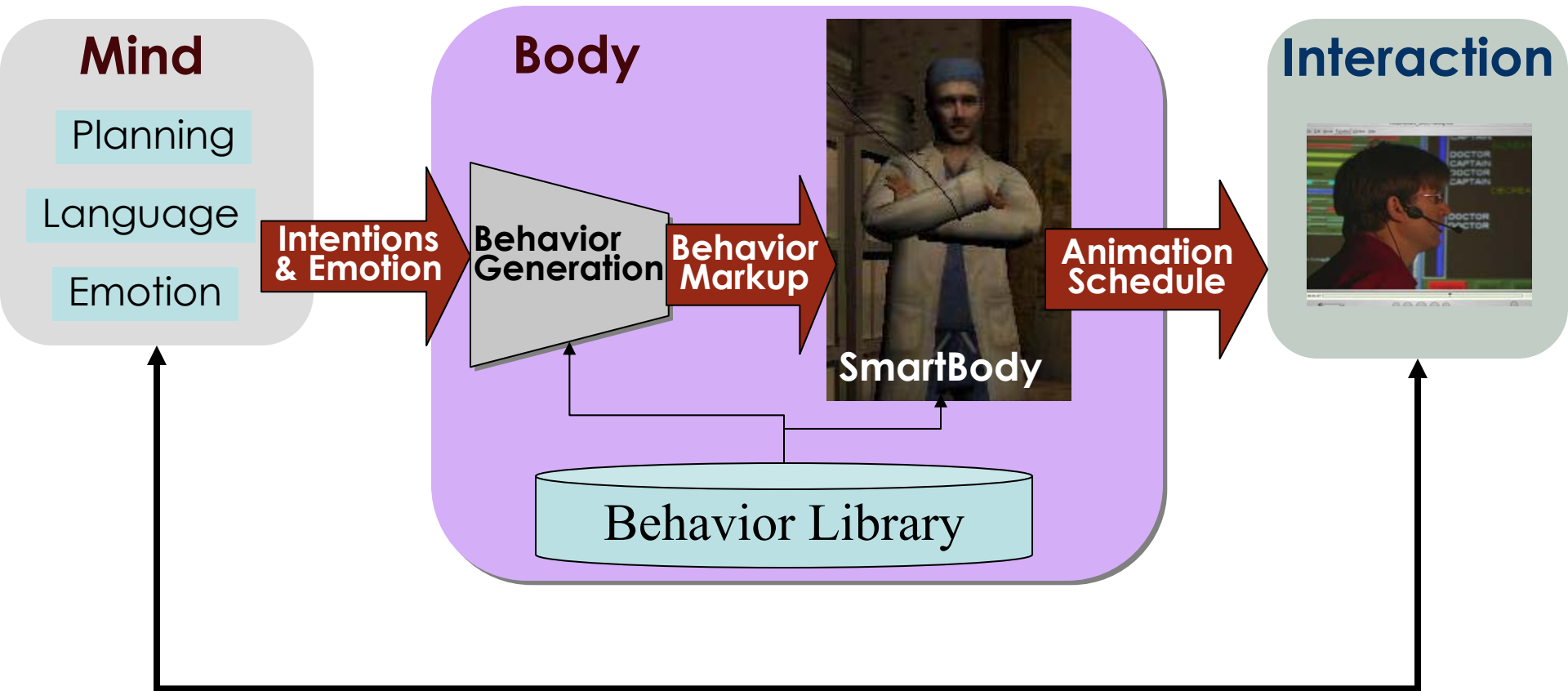
Re-Appraisal & Further Planning

Emotion as Meta-control system



Dynamics a function of coping/cognitive processes and evolving situation

Smart Body



Ongoing Work

- Continue emphasis on evaluations
 - SCPQ immersed
- Improved Bodies/Expressive Behavior
- Collaborations with psychologists
 - Appraisal Theorists
 - Nonverbal behavior
 - Clinical
- Mental health applications
 - Clinician training
 - Post-traumatic stress disorder
 - Adolescent violence



Conclusion

- EMA is computational model of appraisal
 - Emphasize role of coping in guiding inference
- Effective in deriving virtual characters
- May have value in concretizing theory
- An approach to studying dynamics