Resilience and Information Discontinuity across Organizational Scales of Human Ecosystems

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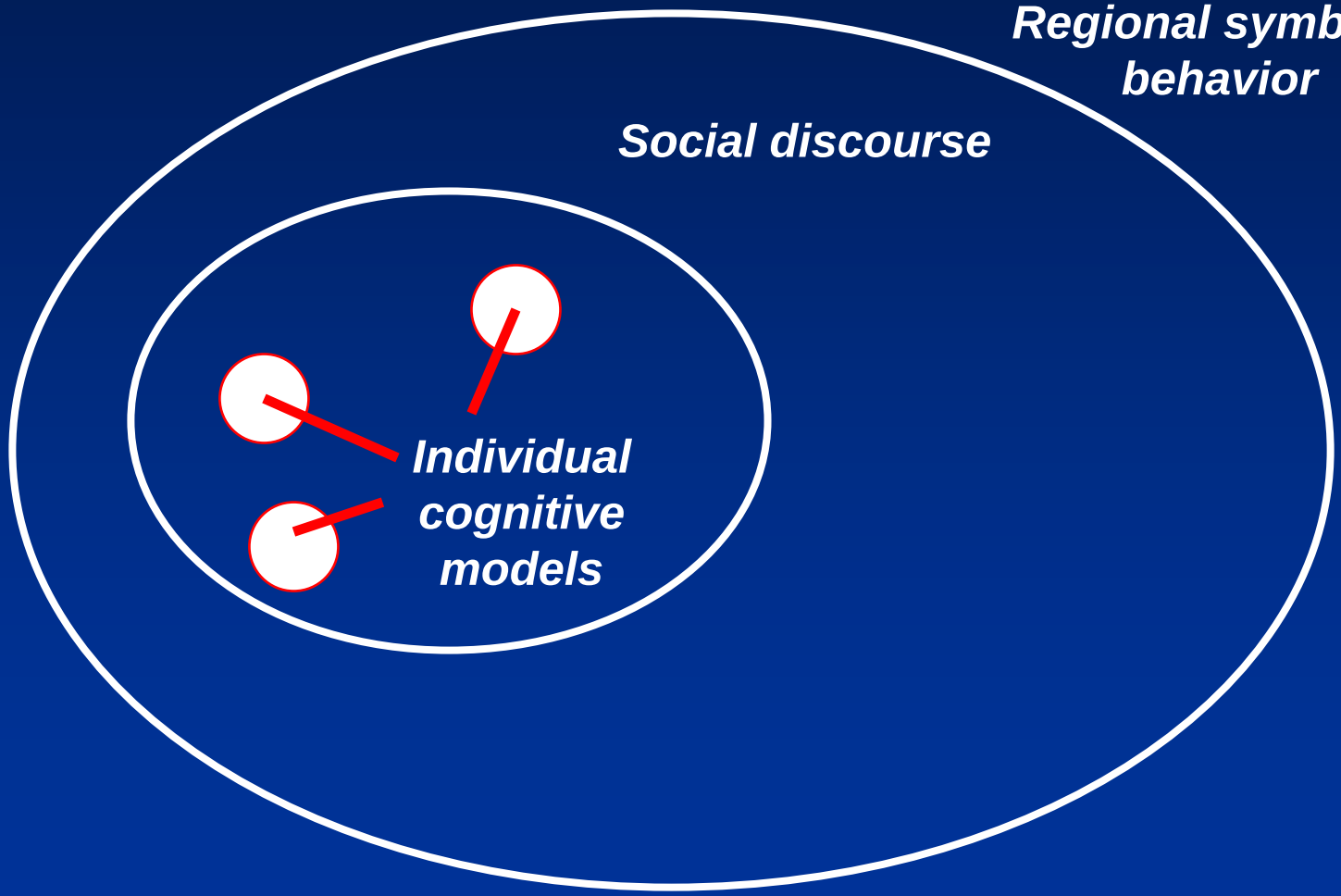
Fundamental Questions

Why can human systems fail to respond to environmental change?

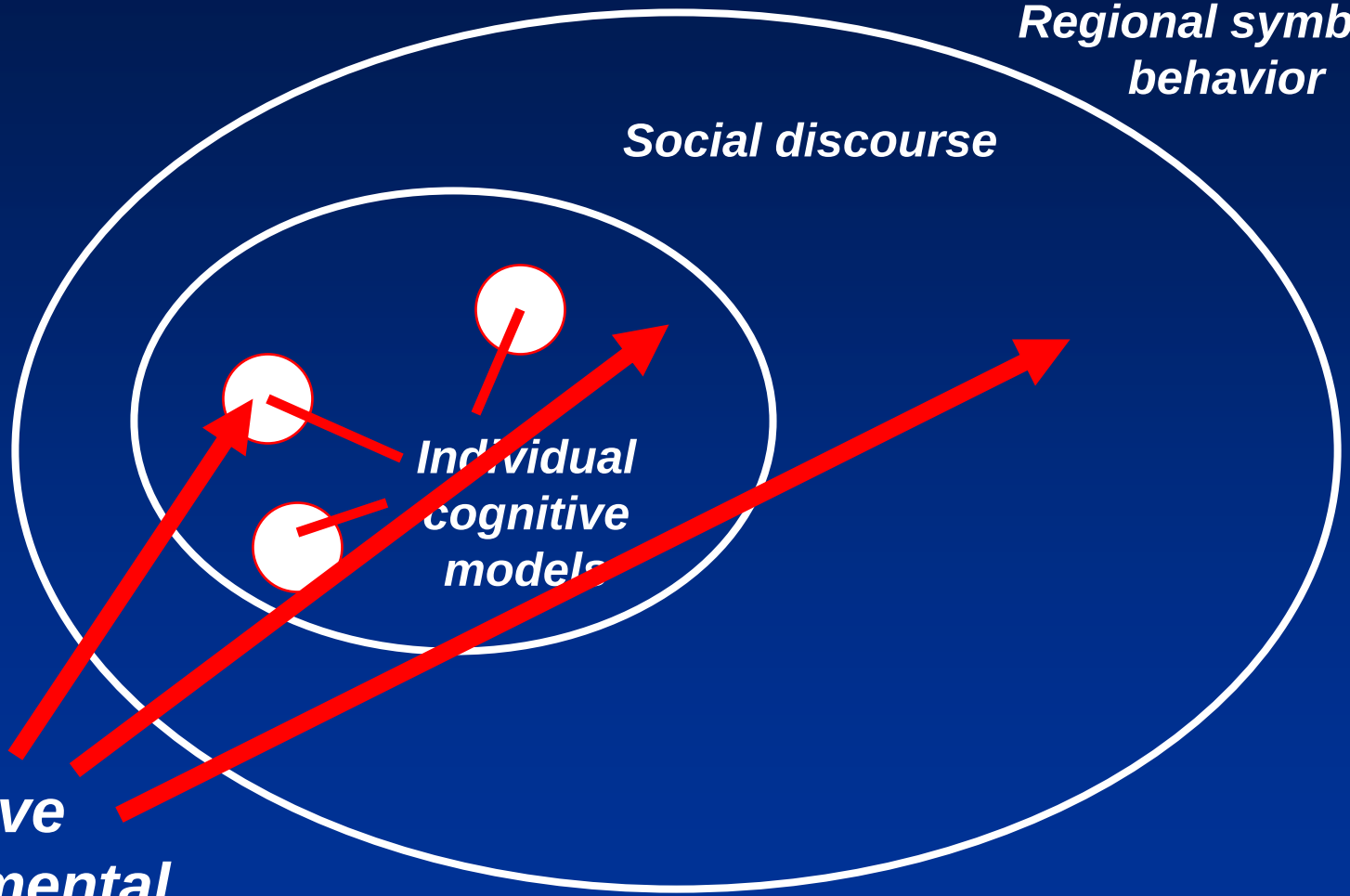
Why are some human ecosystems not resilient?

Resilience: ability to reorganize after disturbance

Hierarchically Nested Information Systems



Resilience = Informational Redundancy Across Scales



Comparative Approach

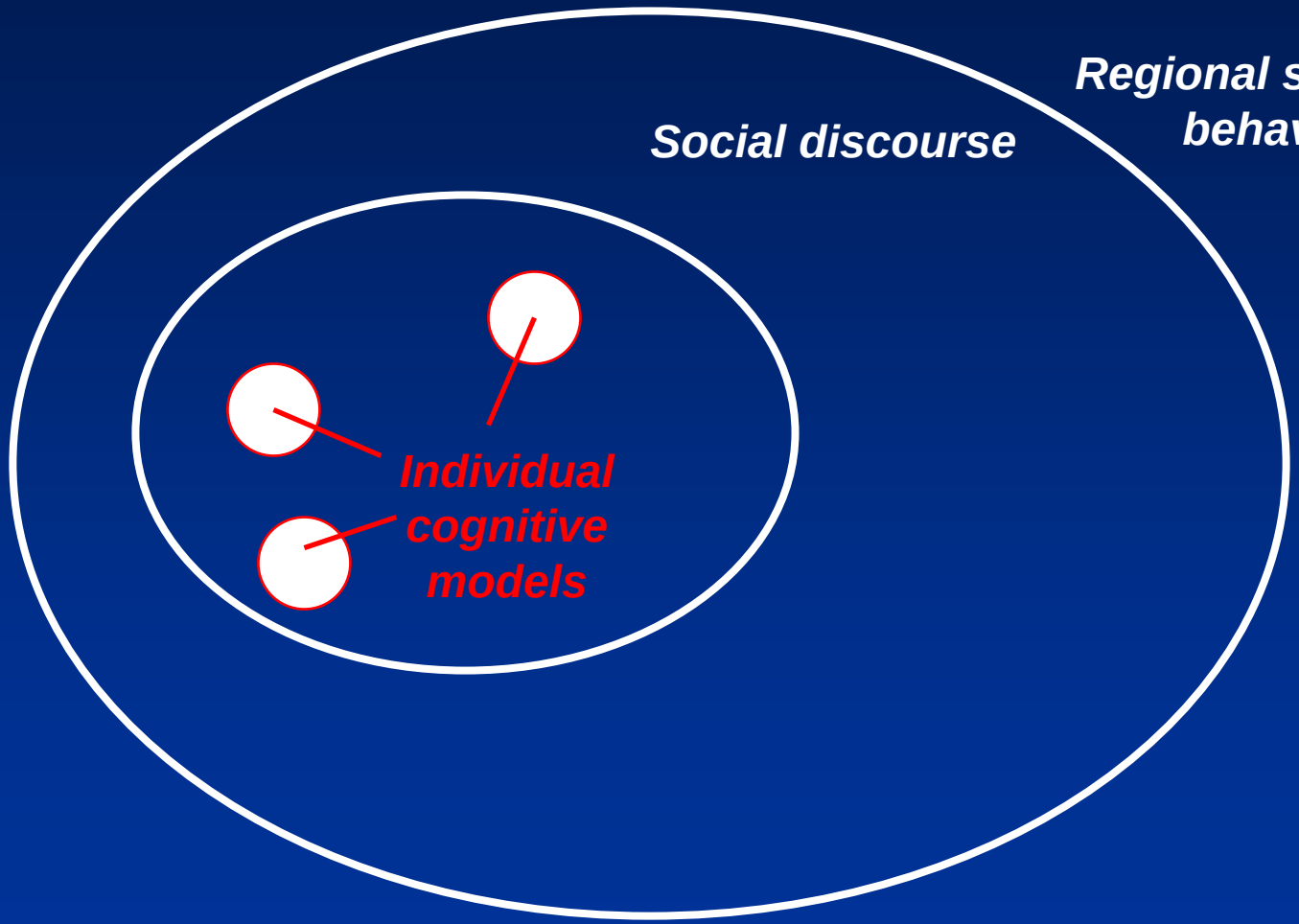
Maya medicinal plant use

(migration is disturbance)

Urban water use in the American Southwest

(drought is disturbance)

Individual Cognitive Models



Logical Inconsistency in Cognitive Models

- Maya explanations of plant curing are based on plant taste
- helps identify useful phytochemicals

Example:

Q: “Why does *Salvia Lavanduloides* cure cough?”

A: “Because it’s bitter. Bitter plants cure cough.”

Later that interview . . .

Q: “Why does *Verbena litoralis* cure diarrhea?”

A: “Because it’s very bitter.”

Q: “Does *Verbena litoralis* cure coughs?”

A: “No.”

Q: “You said earlier that bitter plants cure coughs, why doesn’t this one cure coughs?”

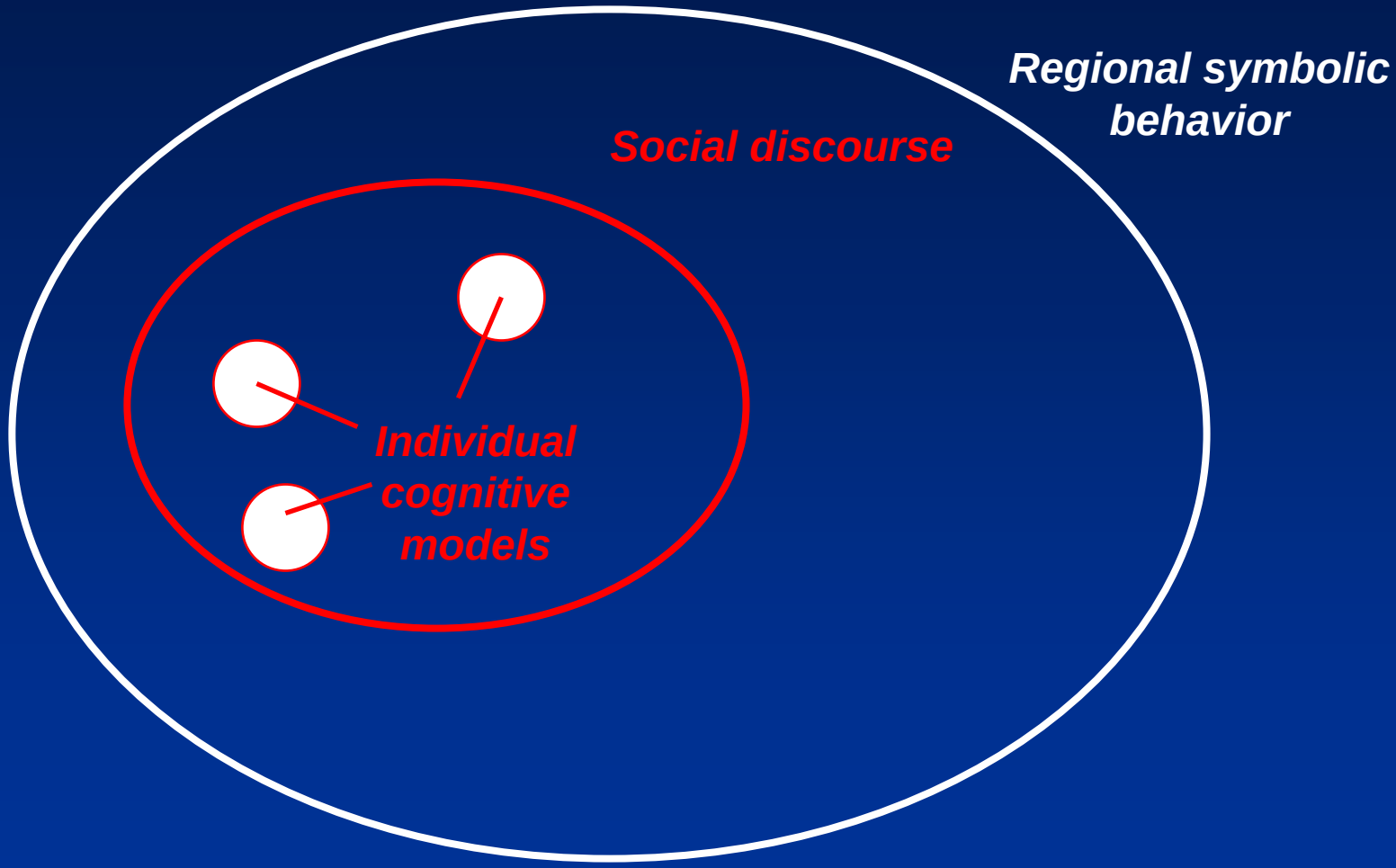
A: “I don’t know . . . well, it’s just . . . I don’t know, that’s just the way God made it.”

Self-contradiction = 29%
(in 53 interviews)

How can such logical inconsistencies persist?

Is the (informational) system resilient?

Social Discourse



Hierarchically Nested Discursive Structure

Primary themes (in order):

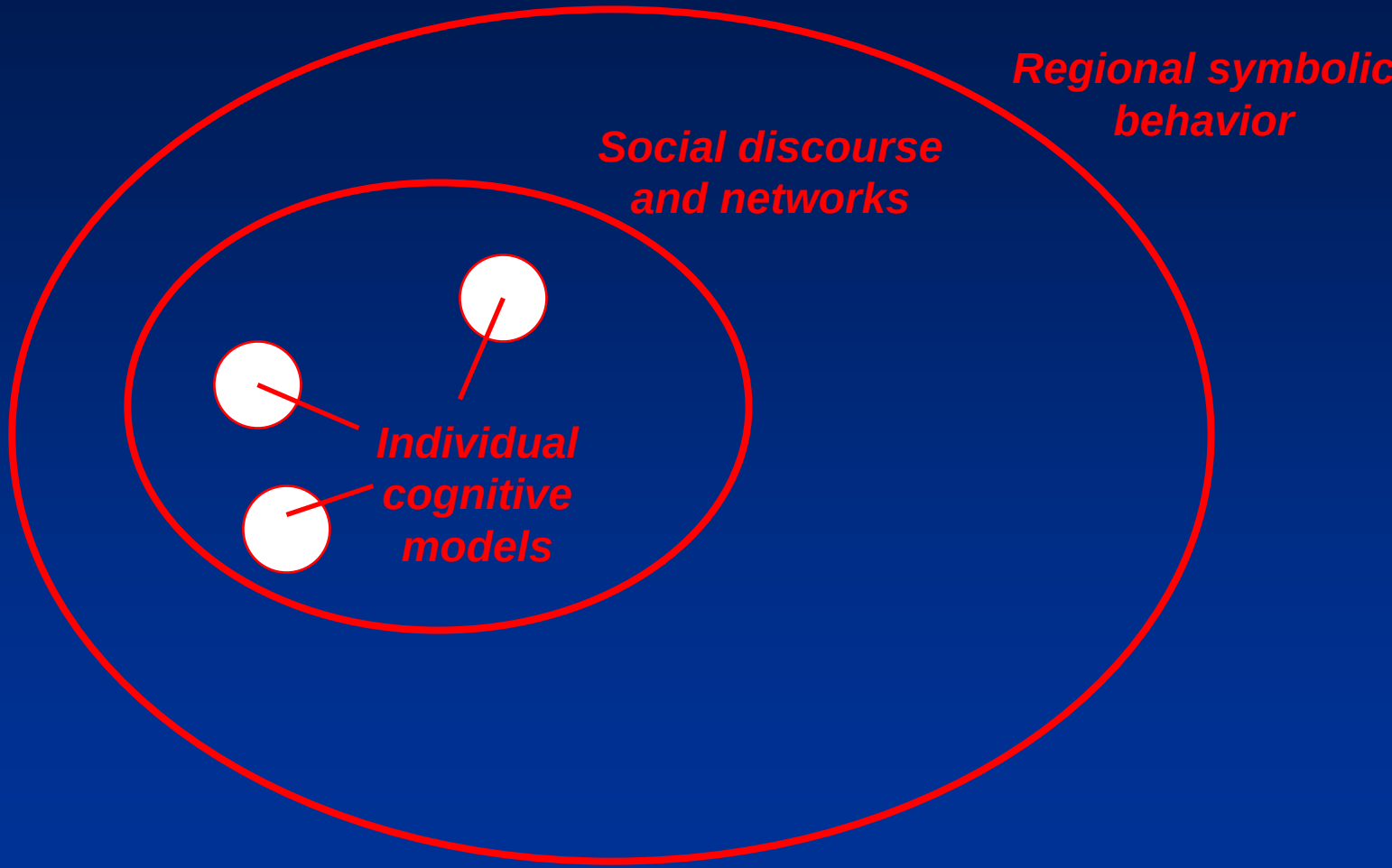
1. Socially-situated event
2. Legitimacy of speaker
3. Safety of information
4. Symptoms
5. Plant efficacy
6. taste, hot/cold, a plant's location

Migratory Disturbance Response

- logical inconsistencies were “glossed over” by more compelling themes in discourse
- explanatory models were changed to fit new plants

Is this resilient?

Large-scale Processes



Cognitive Dissonance

Cognitive Dissonance

- Logical contradictions in individual models can cause *extreme* cognitive dissonance

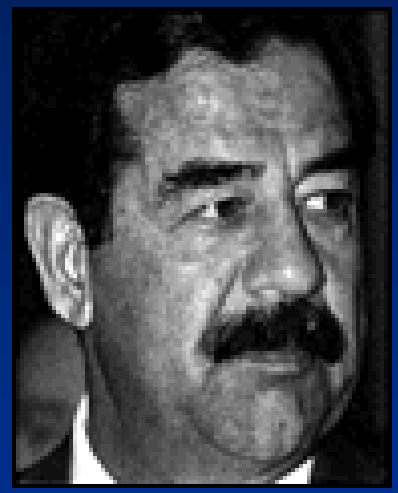
Evasive Strategies

1. Change behavior
2. Shift attention to socially relevant themes
3. Abstracting: “that’s just the way God made it”

These can be manipulated . . .

Symbolic Manipulation of Cognitive Dissonance

"Good and Evil . . ."



- Symbolic manipulation reduces cognitive dissonance
- reduces *social* dissonance

Is This Resilient?

- Feedback of critical information is NOT the primary motivation
- Logical inconsistencies proliferate
- How can such complex human systems cope with disturbance?

Many don’t . . .

Lowland Classic Maya

Soviet Union

Others do . . .

- Maya curers manipulate abstraction:

"Sometimes plants are hot, sometimes cold. We find the cures. God made a plant to cure every illness. We find them."

Maya Medicinal System

- But, curers' experimentation is integrated with epidemiological and ecological contexts
- credibility based on immediate results
- environmental feedback at multiple scales = redundancy
- medicinal plants remain 1st line of defense in new environment (71% of cases)
- system resilient to *extreme* disturbance of migration

Phoenix Arizona?

- In 8th year of a (possible) 20-year drought
- Total reservoir system: 42% of capacity
- Is this system resilient?

Logical Inconsistency

"I know it's a desert, and it seems weird [to have a lawn], but kids need a place to play, they need grass . . ."

- *homeowner*

Evasive Strategies in Phoenix

Current research includes creating dissonance

(excerpt from interview #11):

. . . after talking about water supply and droughts . . .

Q: . . . so you have a pool . . .

A: yeah. It's small.

Q: Does it use a lot of water?

A: (hesitating) "You know . . . here's what I don't understand, why are they spending all this money on Mars? Why don't they build a . . . uh . . . a big plant to change salt water?

Abstract = The technological fix; "us" vs. "them"

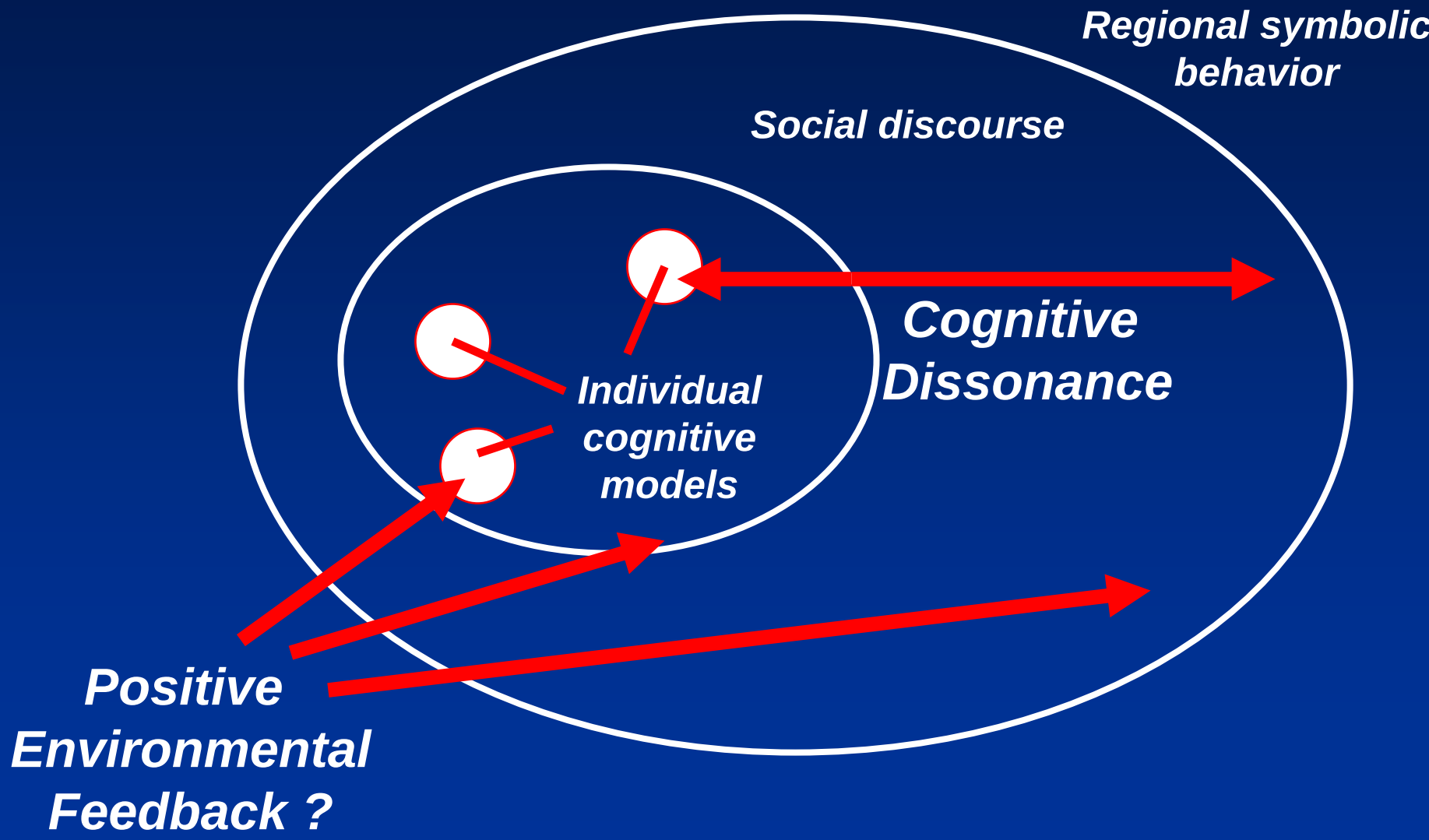
“Smart growth” and “water conservation” conflict with public’s models?

“We will continue to grow, it's going to look a little bit different. You'll find less turf areas. You'll find more [desert landscaping]. Smaller yards, but we will continue to grow.” - *water manager*

“I like it here. Now that we’re here, I’d rather not have more people moving in.” - *homeowner*

“The key to surviving this drought, and the future, is reducing per capita water use.” - *water manager*

Is the Phoenix System Resilient?



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