

# Assessing the validity a computational model of emotional coping

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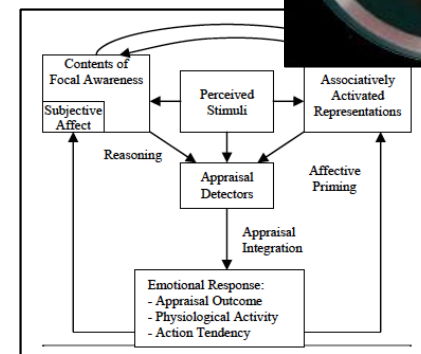
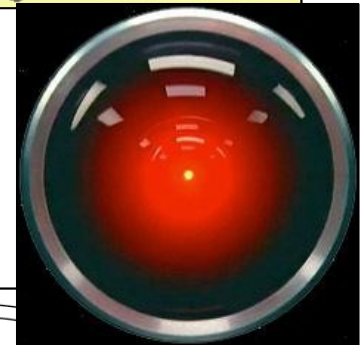


**AFOSR**



# Why computationally model emotion?

- To inform applications
  - Virtual Humans for Education, Training and Health Interventions (Marsella et al., 2000)
  - Human Computer Interaction (Lisetti, 2005)
  - Student modeling (Conati & MacLaren, 2004)
- To inform intelligent system design
  - By drawing on insights from emotion's cognitive/social function
  - Simon 68; Minsky 85; Scheutz, & Sloman, 2001
- To inform emotion theory
  - Computational tools for social science research (ISRE09)



# Why validate?

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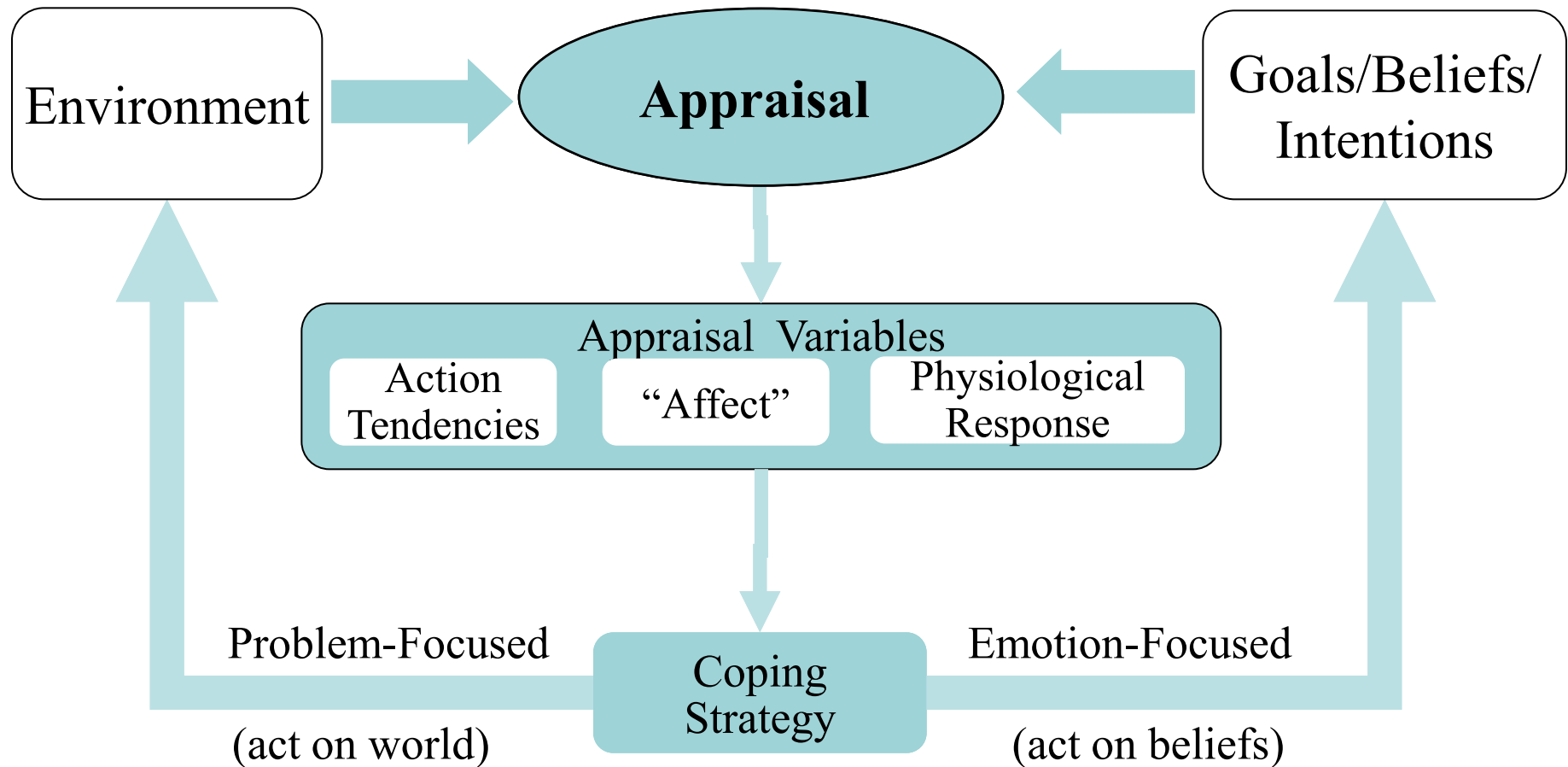
- Many models, but little evidence of validity
  - Models typically evaluated in context of application
  - Specific contribution of emotion model often unclear
- Focus on “Behavioral Fidelity” as a criteria
  - Is the behavior of the component consistent w/ human data
  - Gold standard for programs that must model/simulate human behavior (recognition, user modeling, simulations)
  - Not necessarily the best standard for certain effects
    - E.g., actors

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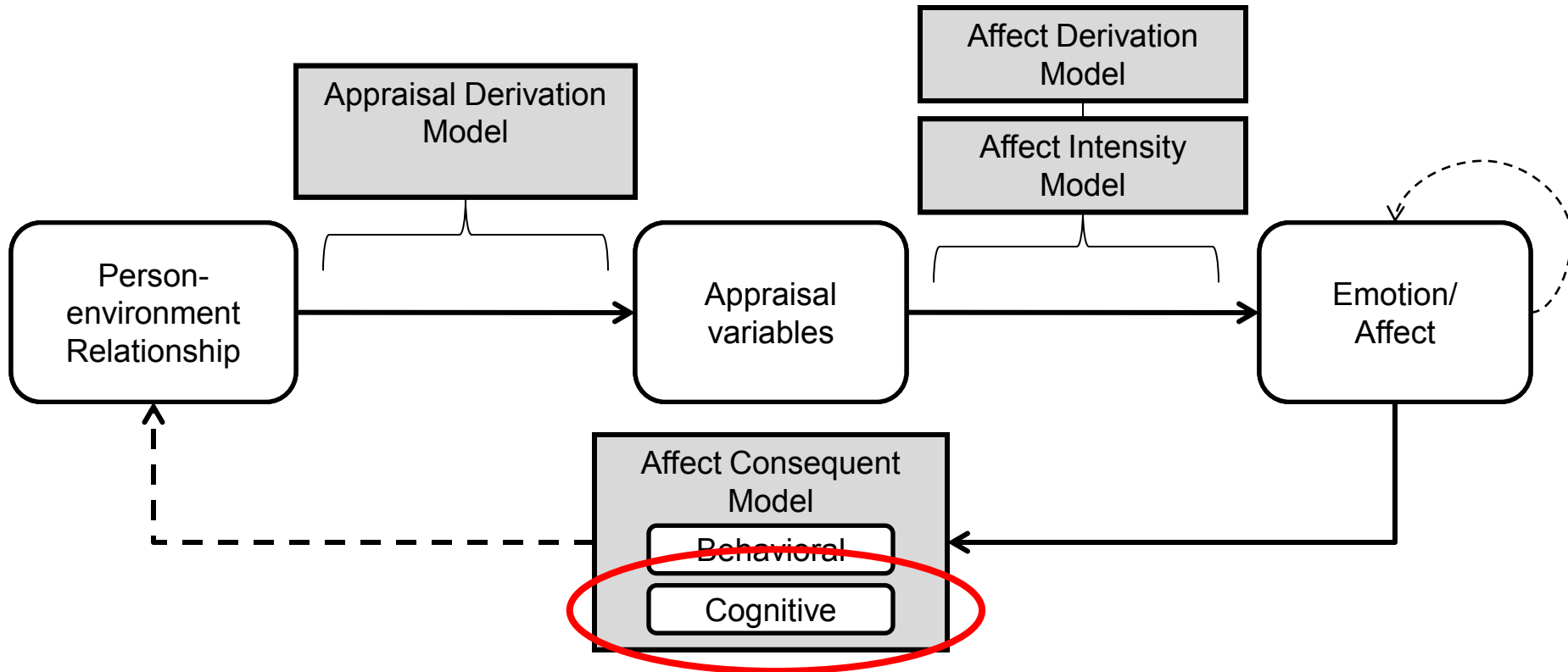
# EMA: A Computational Model of Emotions

# Theoretical Framework: Appraisal Theory

(Smith&Lazarus91)



# A component model view of appraisal models



## ■ Question for today's talk

- What are the cognitive consequences emotional response?

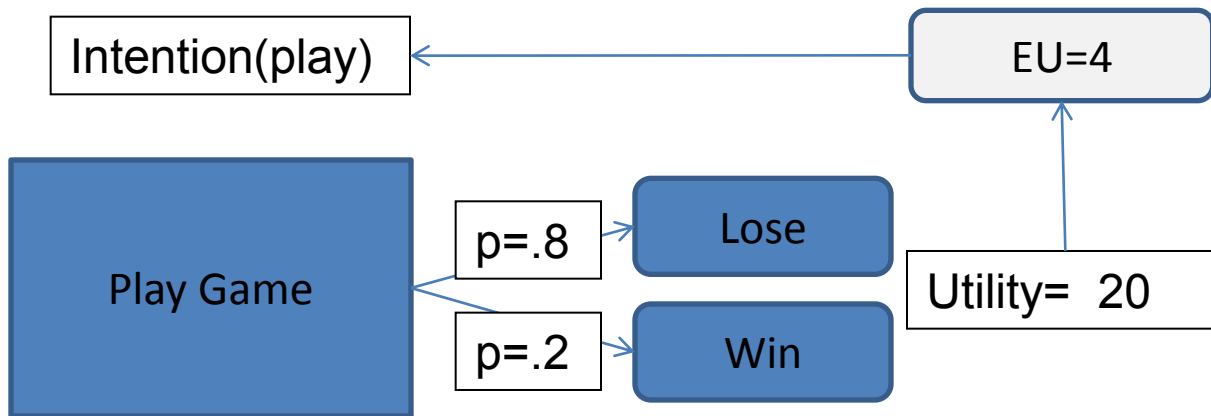
# Focus here: EMA's Model of Coping

- **Attention-related coping:**
  - *Seek information:*
  - *Suppress information:*
  
- **Belief-related coping**
  - *Shift responsibility:* Alter probability of pending desirable (undesirable) outcome or assume intervening act or actor will improve desirability.
  - *Wishful Thinking:*
  
- **Desire-related coping**
  - *Distance :*
  - *Positive reinterpretation/silver lining*
  
- **Intention-related coping**
  - *Plan/Act*
  - *Seek instrumental support:*
  - *Make amends*
  - *Procrastination:* Alter intention to achieve a desired state
  - *Resignation:.*
  - *Avoidance:*

Alter utility of desired (threatened) state

Alter intention to achieve a desired state

# Contrast with Decision-Theory



# Contrast with Decision-Theory



Coping → Appraisal → Coping

# Fundamental question: Coping predictions

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- **Decision theory decouples decision and motivation**
  - Preferences *fixed* over time
  - Preferences don't alter beliefs
- **Emotion findings argued these are coupled through coping**
  - Emotion-biases on decision making (Loewenstein & Lerner, 2003)
  - Cognitive dissonance (Festinger57; Kunda90;)
  - System of Thoughts (McGuire & McGuire, 91)
  - Almost no attempt to computationally model
    - (Marsella&Gratch; Dias)
- **Can EMA predict emotion-bias effects?**
  - Distancing
  - Resignation
  - Wishful thinking

# Coping Study

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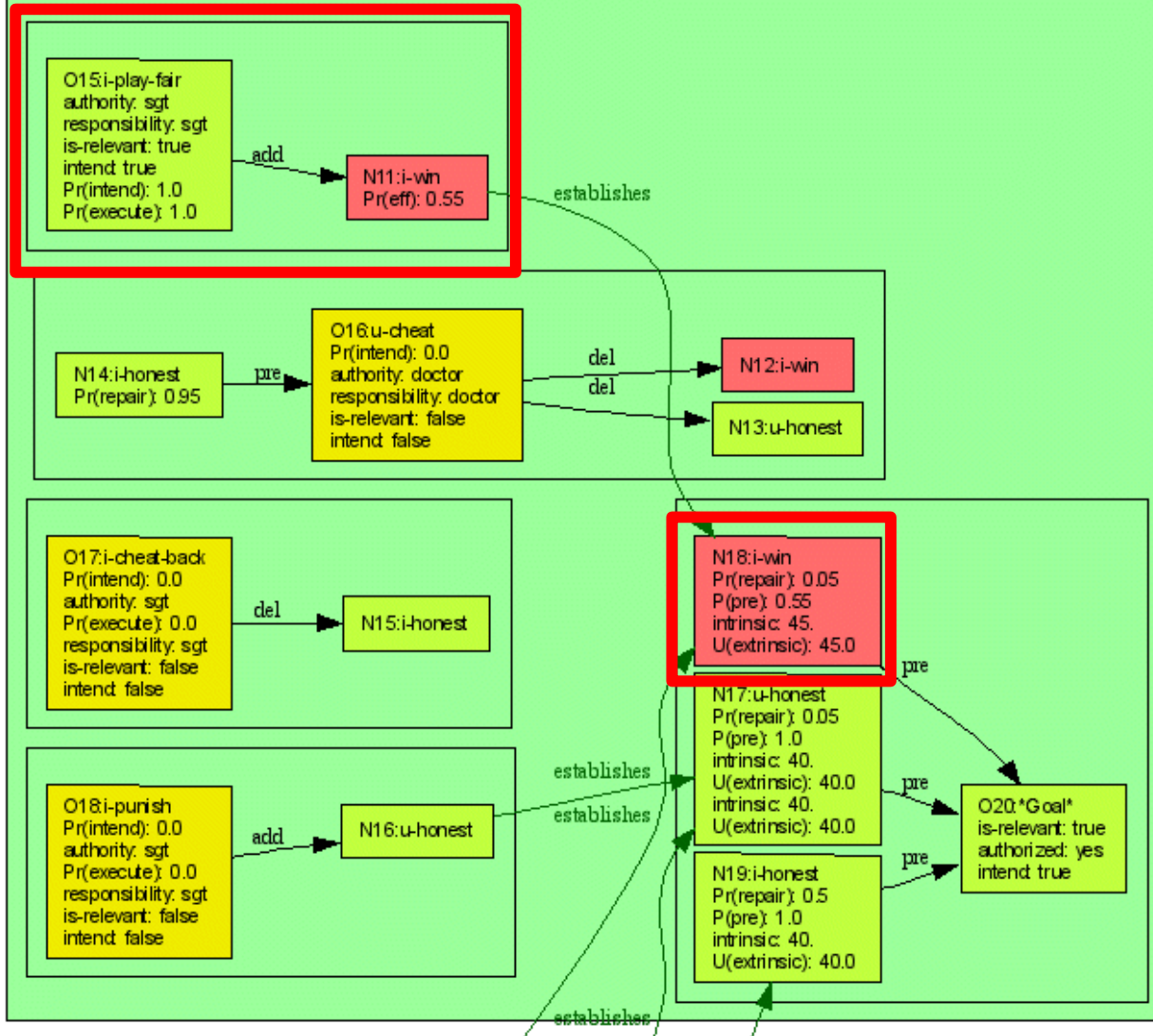
- **Use *Model Driven Experimentation Paradigm***
  - Use EMA to generate task specific predictions
  - Evaluate predictions through human subject experiments
- **Competitive Turn-based strategy game**
  - Partial Observability / uncertainty
  - Opportunities for deception
  - Social emotions
  - Dynamic: situation shifts over time



**OBJECTIVE:** examine dynamics of coping responses as goal of WINNING facilitated or threatened

- **Question: How do people cope with the emotions winning or losing gives rise to?**
- **Do results corroborate EMA model predictions?**

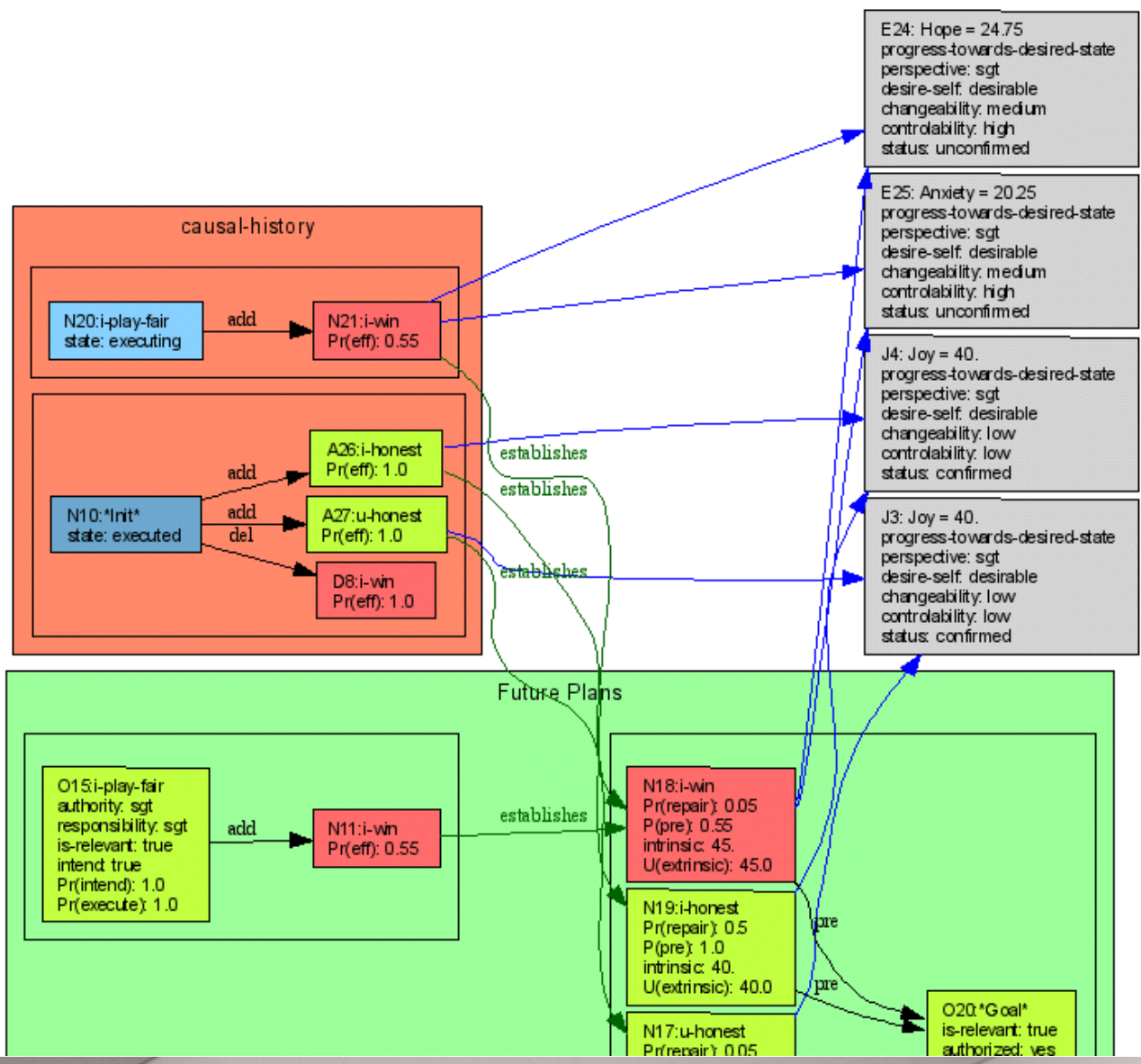
## Future Plans



## EMA Predictions

## Task Model

- Developed and validated in 2 pilot studies
- People have two goals
  - Winning
  - Fairness
- Most subjects assume the game is fair
  - Can ignore cheating/fairness for main analysis

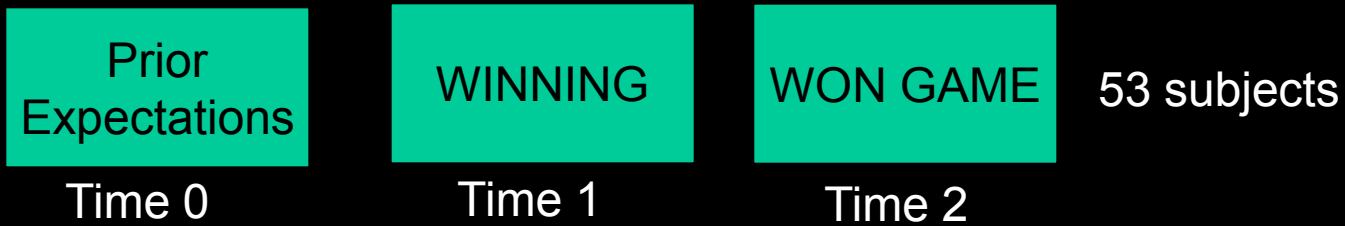


# EMA Predictions

## EMA

- Automatically derives emotion and coping tendencies from task model
- Automatically updates in response to game events
- Appraisals and coping tendencies constitute a set of predictions that can be tested against data

# Human subjects study 101 participants (2 conditions)\*



Coping Questionnaire



Hidden Camera

Confederate



Subject



# EMA's Coping Predictions

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## Beliefs, desires and intentions will change

- **Distancing:**
  - H1: Perceived utility of winning will drop as player loses
    - H1a: Goal utility predicts intensity of effect
- **Resignation:**
  - H2: Willingness to play will drop as player loses
    - H1a: Goal utility predicts intensity of effect
- **Wishful thinking:**
  - H3: Losing interacts with utility to predict probability bias
    - Players that want to win will perceive higher win probability in lose condition

# Additional Questions to address

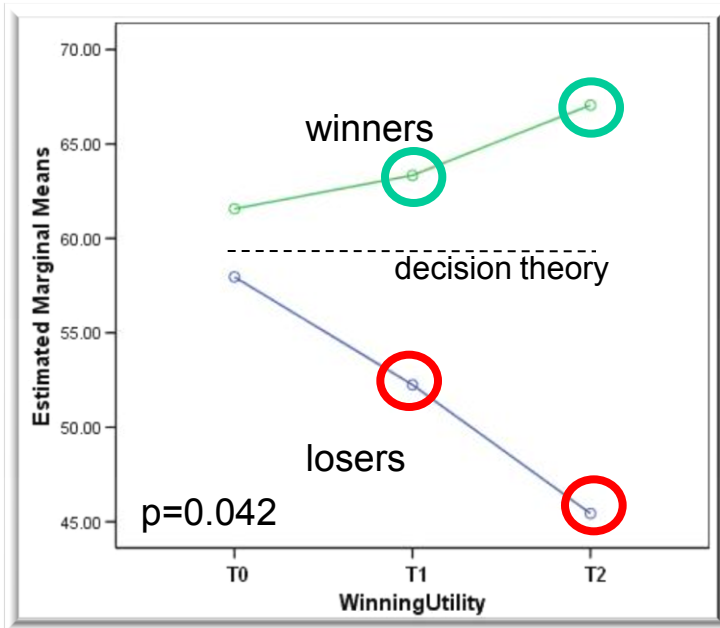
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## Use study to propose refinements and extensions to EMA

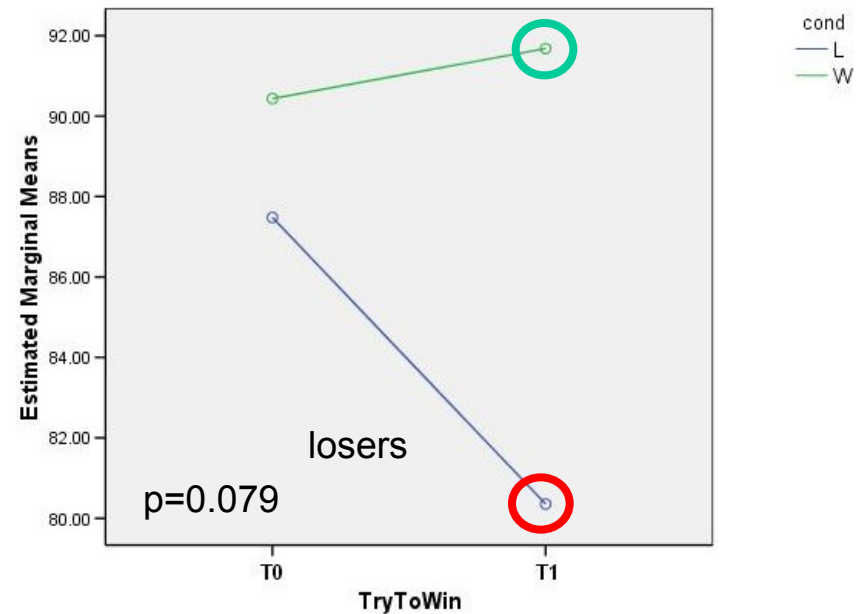
- **EMA makes no predictions in the case of positive emotion**
  - How will winning impact distancing, resignation, wishful thinking?

# Results for H1 & H2: Distancing and Resignation

Self-reported desire to win



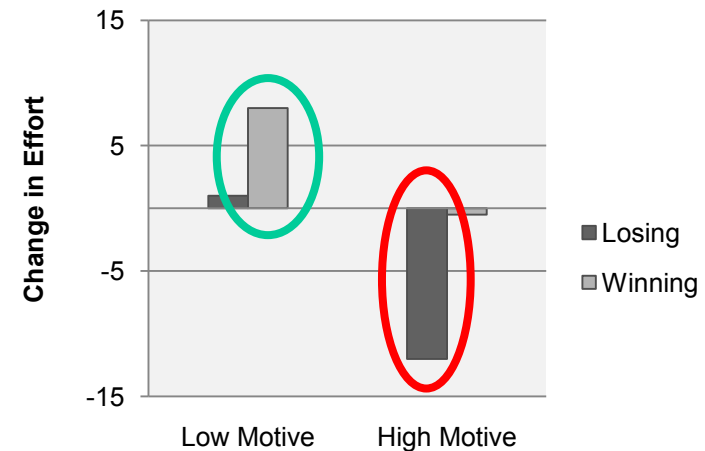
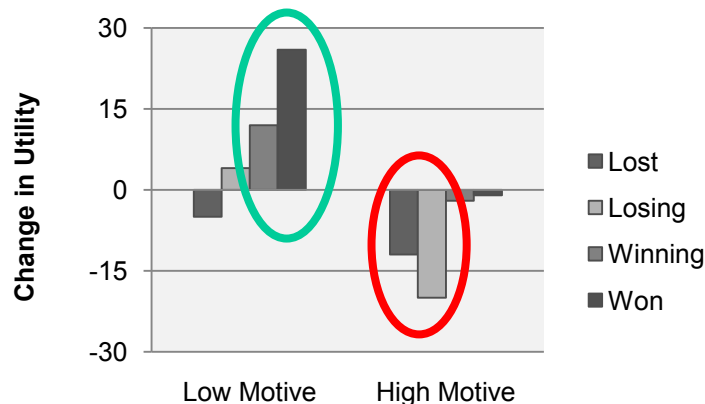
Self-reported willingness to play



- H1 and H2 supported: losers distance and resign
- But also “coping” with winning observed
  - EMA implementation makes no prediction

# Results for H1a & H2a: Utility's impact

- H1a and H2a also supported: utility does impact intensity of distancing and resignation response
  - In Lose condition: Subject's with initial high desire to win distanced and resigned more
  - *In Win condition: Subject's with initial low initial desire to win became more engaged (EMA makes no prediction)*



# Results: Wishful thinking

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- **Probability-bias observed not what predicted**
  - Prediction: utility and probability positively correlated (losing cond.)
  - Observed: utility and probability weak negative correlation (losing cond.)
    - » nearly significant  $R = -0.23$ ,  $p=0.11$
    - utility and probability positively correlated (winning cond.)
      - »  $R = 0.46$ ,  $p<0.0001$
- **Support for motivated beliefs BUT Inconsistent with EMA predictions**
- **Possible explanations**
  - High motivation leads to stronger emotions
    - Valence impacts critical vs heuristic thinking styles (Clore&Storbeck06)
  - High motivated subjects are more skillful at battleship

# Discussion

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- **Overall, results suggest that coping moves subjects toward more positive emotional states**
  - Distancing and resignation of losing, high motive subjects reduces negative emotionality of threat to high utility goal
  - Over-optimistic wishful thinking of winning high motive subjects enhances positive emotions
  - Increased engagement of winning, low motive subjects enhances positive emotions from previously unattainable goal

# Summary

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- **Constructed paradigm for investigating unfolding emotional situations**
- **Support for coping predictions of EMA model**
- **Demonstrated emotion-biases in decision-making**
  - Inconsistent with classical decision models (decision/game theory)
  - Some success in modeling these biases
  - Identified several limitations in our coping models

# Open issues (just starting to scratch surface)

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- **Alternative explanations**
- **Decision dynamics**
  - Explored monotonically-evolving decisions (losing vs. winning)
  - Should explore other trajectories
    - does early failure impact future perceptions when circumstances improve?
- **Individual differences**
  - Subjects with low motivation to win show very different behavioral/coping patterns
  - Other appraisal/dispositional factors seem to improve predictions
    - Social Value Orientation
    - Personality
    - Cultural factors?
- **Social factors**
  - Battleship is a competitive game (theory of mind factors)

# Thank You

Questions?



# Results: Wishful thinking

