

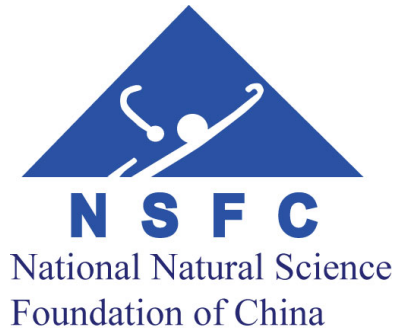
BEHAVIORAL MODELING IN SOCIAL NETWORKS FROM MICRO TO MACRO

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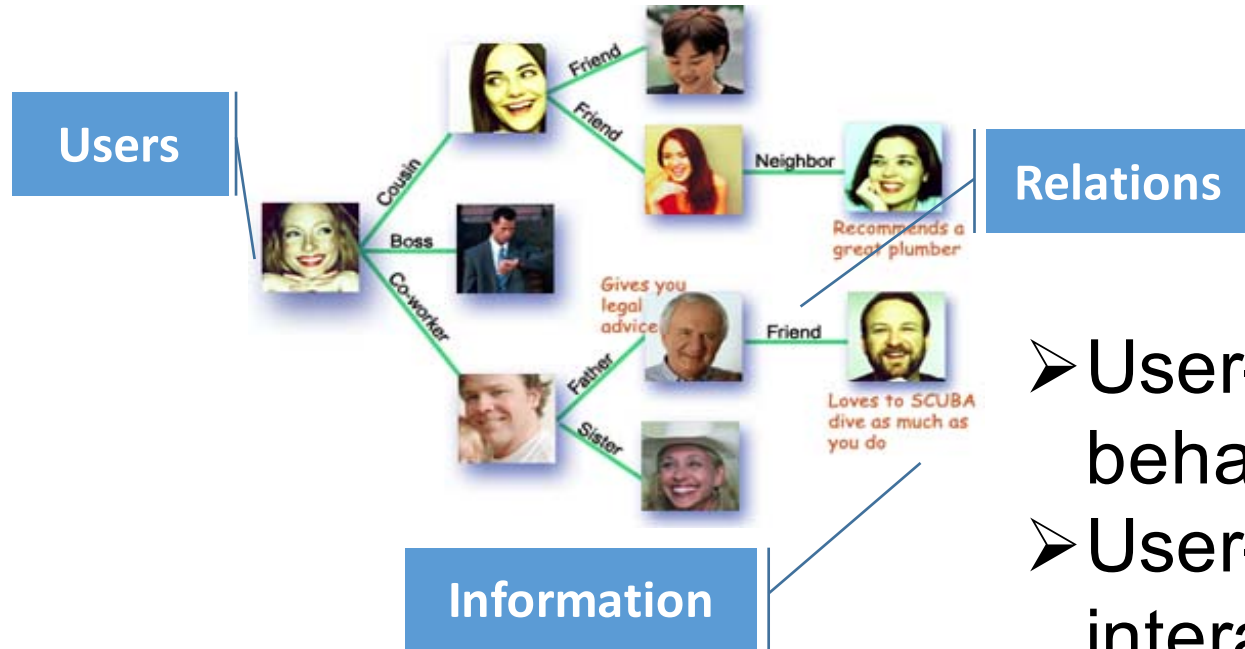
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INTRODUCTION

Behavior Modeling in Social Networks

User Behavior



- User-user interaction behaviors
- User-information interaction behaviors

User behavior is a fundamental element in social networks

Behavioral Modeling

Understanding

Predicting

Intervening

Applications of Behavioral Modeling

Recommendation

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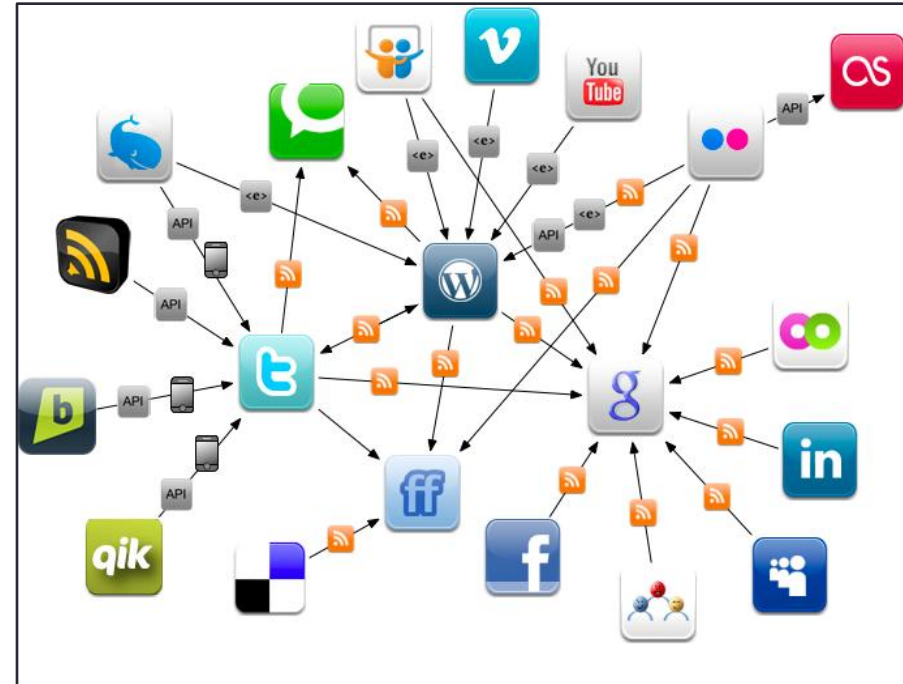
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Scientific Significance of Behavioral Modeling

Physical World



Online Social Networks



The human behaviors are broadly and deeply recorded in an unprecedented level.

This is the first time that we can get insights of human behaviors and the society from large scale real data.

Six Disruptive Basic Research Areas, by DOD

Basic Research Areas



- Six Disruptive Basic Research Areas
 - Engineered Materials (metamaterials and plasmonics)
 - Quantum Information and Control
 - Cognitive Neuroscience
 - Nanoscience and Nanoengineering
 - Synthetic Biology
 - Computational Modeling of Human and Social Behavior

VI. Computational Models of Human Behavior



A fundamental understanding and predictive capability of human behavior dynamics from individuals to societies.

- **Enabled capabilities**

- Predictive models supporting strategic, operational, and tactical decision making and planning
- Real time cultural situational awareness
- Immersive training and mission rehearsal
- Cross cultural coalition building

- **Key research challenges:**

- Conflicting theories
- Data management and fusion
- Mathematical complexity
- Validation of models

Costly Punishment Across Human Societies

Joseph Henrich,^{1,2} Richard McElreath,³ Abigail A. Alexander-Berg,⁴ Juan Carlos Cardenas,⁵ Nathalie Heinrich,⁶ Carolyn Loeferle,⁶ Frank M.

Recent behavioral experiments aimed at understanding cooperation have suggested that a willingness to punish, may be part of human psychology and, however, because most experiments have been so generalizations of these insights to the species has results from 15 diverse populations show that (1) to administer costly punishment is unequal behavior varies substantially across populations with altruistic behavior across populations. These gene-culture coevolution of human altruism and cooperation needs to explain.

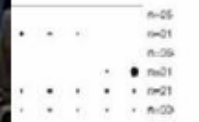
For tens of thousands of years before formal contracts, courts, and constitutions, human societies maintained important forms of cooperation in domains such as hunting, warfare, trade, and food sharing. The scale of cooperation in both contemporary and past human societies remains a puzzle for the evolutionary and social sciences, because, first, neither kin selection nor reciprocity appears to readily explain altruism in very large groups of unrelated individuals and, second, canonical assumptions of self-regarding preferences in economics and related fields appear equally ill-fitted to the facts (1). Reputation can support altruism in large groups; however, some other mechanism is needed to explain why reciprocity should be linked to prosociality rather than selfish or neutral behavior (2). Recent theoretical work



tion (3). Such experiments have even begun to probe the neural underpinnings of punishment (4, 5).

These results are important, because the of costly punishment can explain the pieces of the puzzle of large-scale cooperation. However, like previous and games used to study altruism, experiments have been conducted almost exclusively among university students, not know whether such findings the peculiarities of students and/or on industrialized societies or whether indeed capturing species character earlier research used experimental 15 diverse societies to measure punishing behavior (1, 16). We found social self-interest could not explain as in any of the 15 societies studied. found much more variation in game than previous studies with university had found. Similarly, until costly are is studied in more societies and university students, it is difficult to importance for explaining human

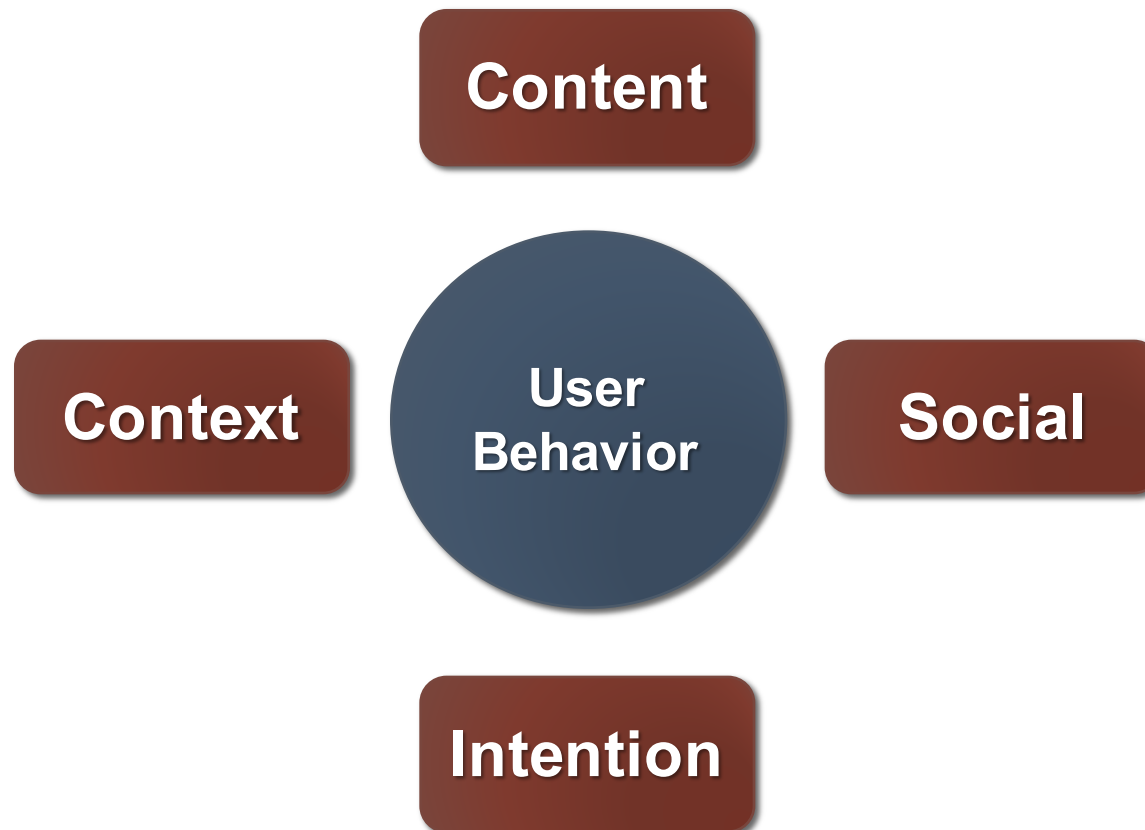
tion to estimating how widespread using whether costly punishment with altruistic behavior is valuable. If the evolution of costly punishment societies in which costly punishment will elicit stronger norms and prosociality, because the



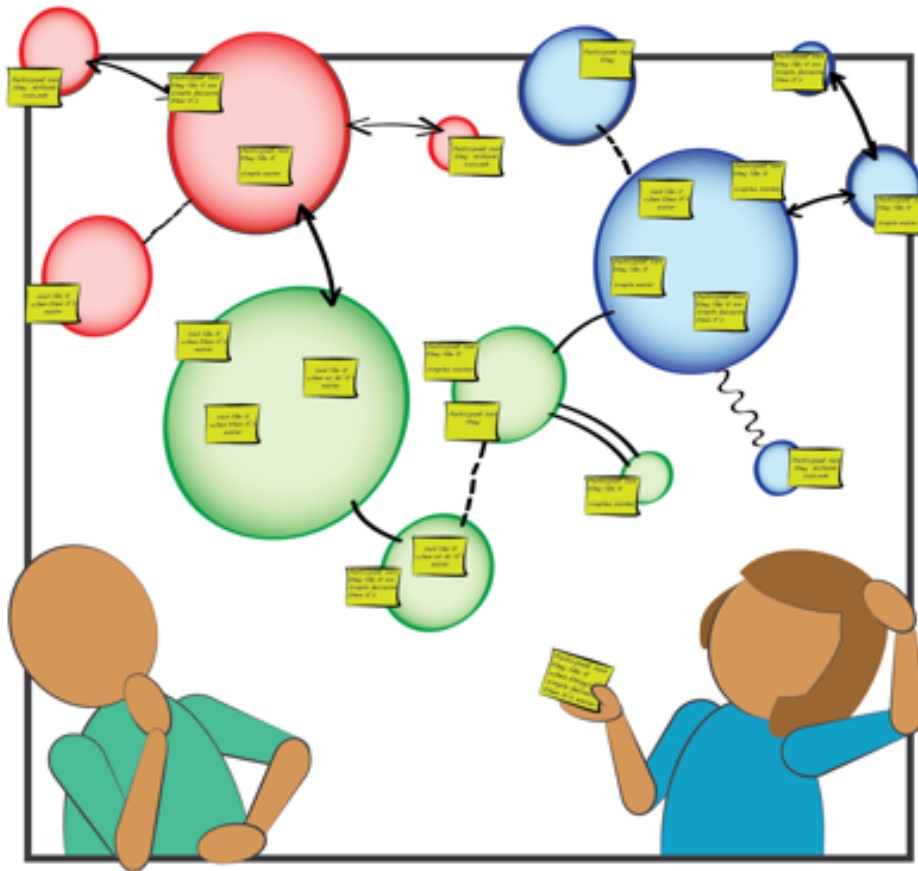
- **Measures of success**

- Early success of simple models
- Success of social network analysis
- Prediction of crowd tipping points

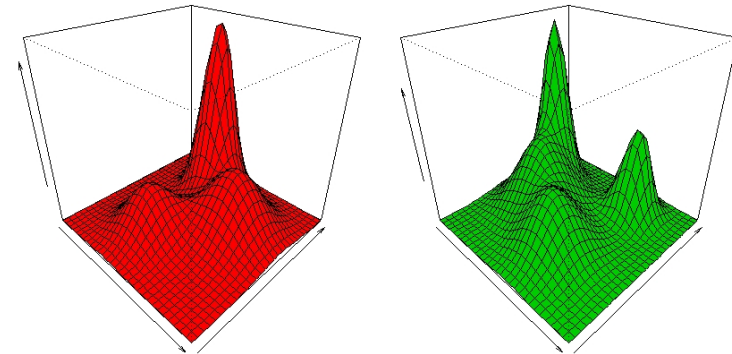
User Behaviors are Complex



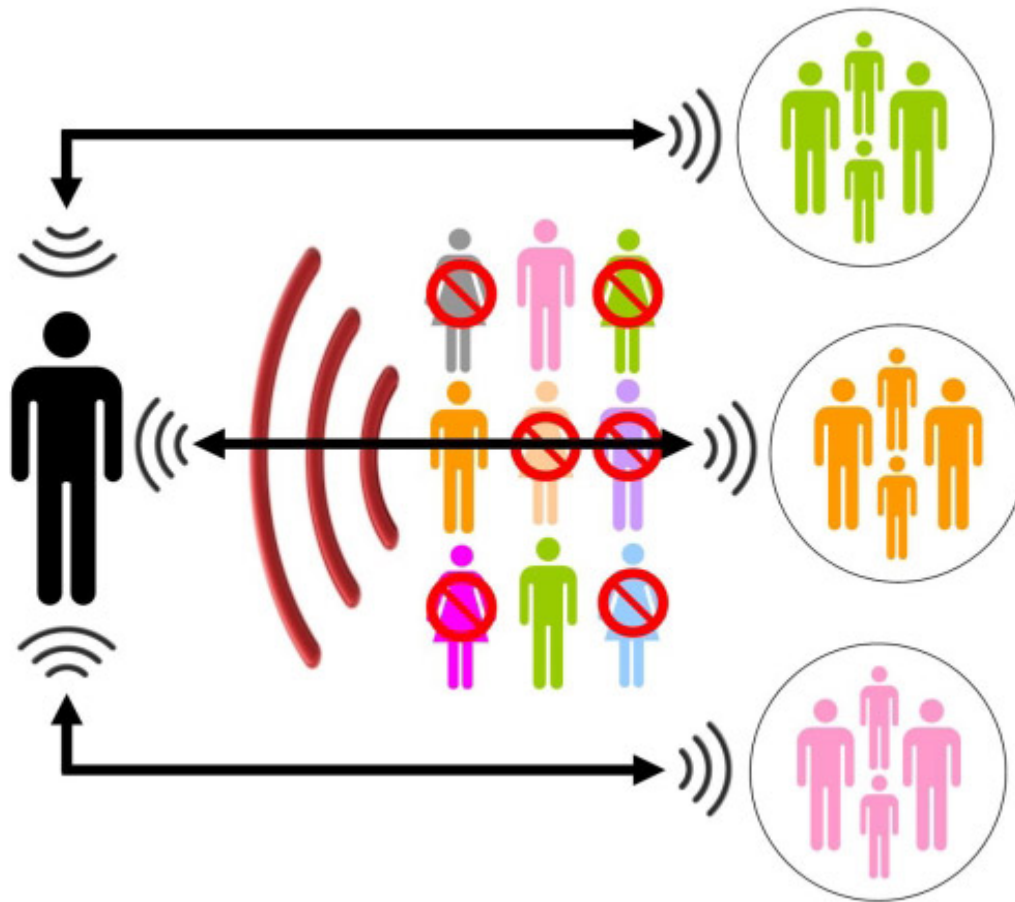
Content Related



User preference is an important driving factor for user behavior modeling.



Social Related



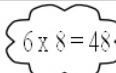































User behavior in social networks are highly dependent on social peers.

Context Related



Rich context info in social networks. How to couple them with behavioral modeling?

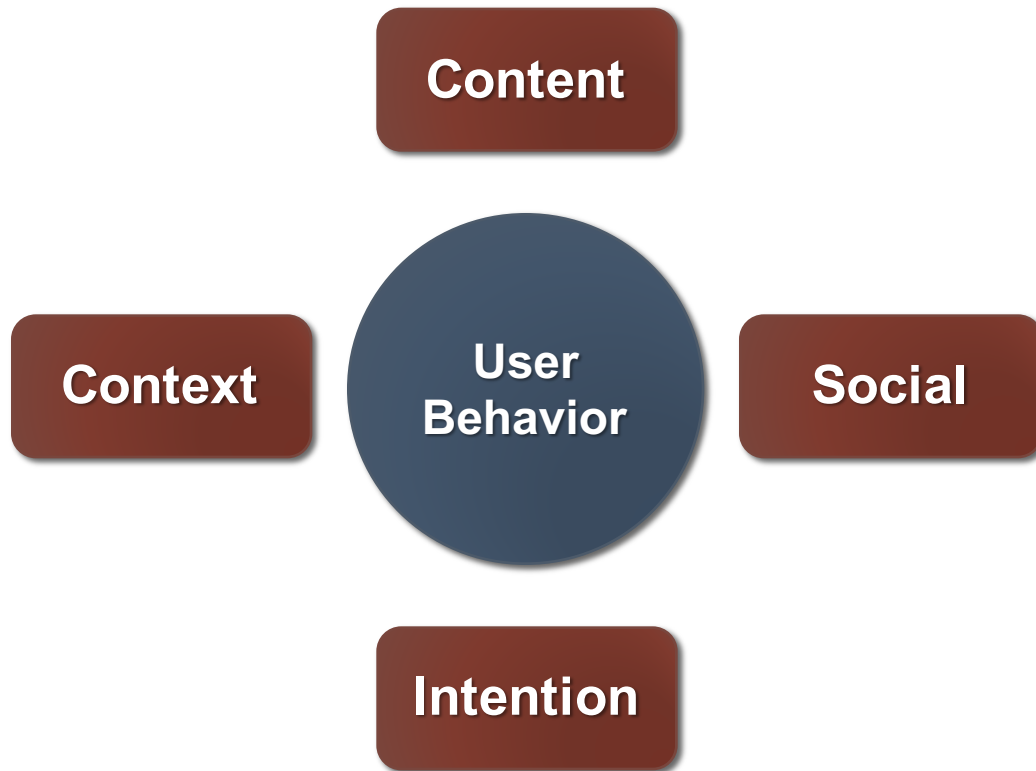
Intention Related

REWARDS	# TICKETS GIVEN		CONSEQUENCES	# TICKETS TAKEN AWAY	
 Extra Math	+5		 HITTING	-3	
 Getting along WELL with others	+3		 BULLYING	-4	
 Good Table Manners	+4		 TEASING	-1	
 LOVE & RESPECT	+5		 LYING	-2	
 Obeying the FIRST TIME	+3		 THROWING A FIT	-3	
 Calm & Quiet in STORE	+3		 Ignoring Parents	-4	
 Extra Reading	+2		 SCREAMING or YELLING	-1	
 CLEANING up after PLAYING	+2		 BAD SPORT	-2	

A nontrivial part of user behaviors are from profitable and social purposes.

Intention can account for the behaviors that cannot be well interpreted by content, social and context.

Behavioral Modeling

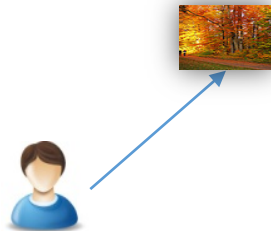


- ❑ Understand single factors
- ❑ Understand their couplings
- ❑ Unify them for behavior modeling and prediction

Granularities of User Behavior

User Behavior

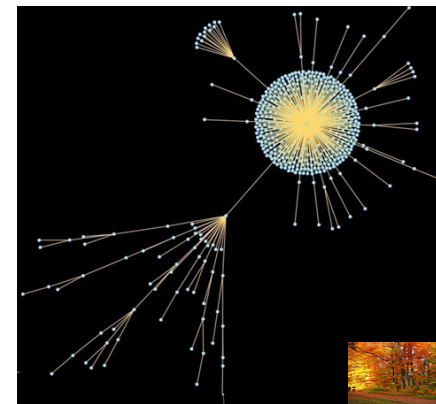
Microscopic



Personalized

Individual behavior analysis
and prediction

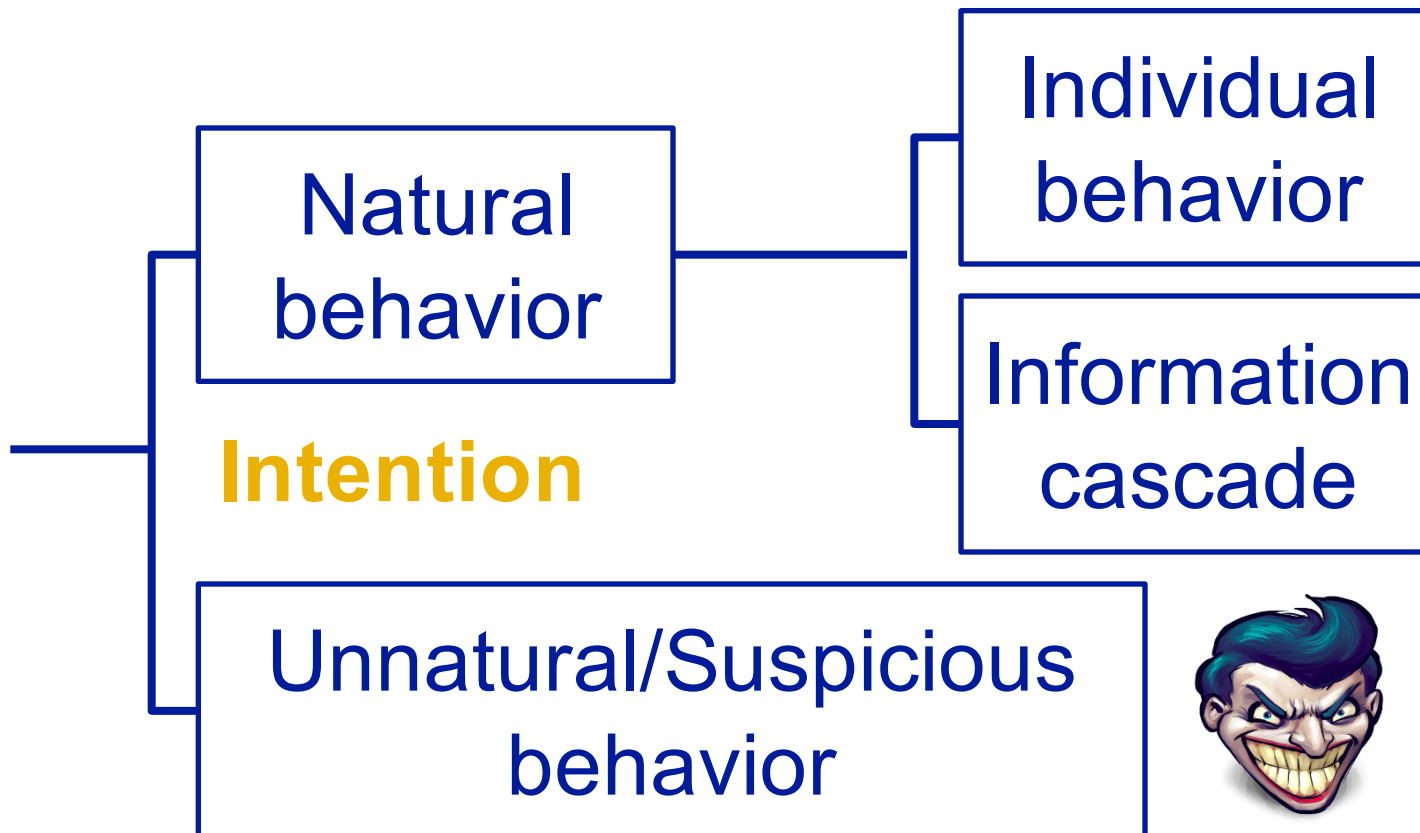
Macroscopic



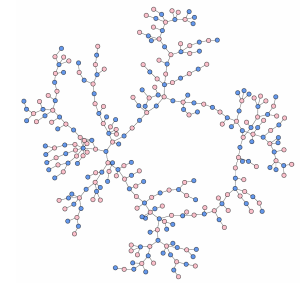
Global

Propagation analysis and
prediction

In This Tutorial



Micro



Macro



Outline

- ❖ Prediction for natural behavior
 - ❖ Modeling individual behavior (MICRO)
 - ❖ Modeling information cascade (MACRO)
- ❖ Detection for unnatural behavior
 - ❖ Suspicious behavior detection