Socially Intelligent Infrastructure
Vision and Challenges in a Sociotechnical Systems Perspective

Munindar P. Singh
singh@ncsu.edu
https://www.csc.ncsu.edu/faculty/mpsingh/
(With Nirav Ajmeri, Ali Hajibabaie, Leila Hajibabai, Özgür Kafalı, Pradeep Murukannaiah)

Department of Computer Science
North Carolina State University
Sociotechnical Systems

Current AI research: atomistic, single-agent decision-making focused on ethical dilemmas
Current social sciences research: Not computational in outlook
Values: Largely Universal Motivations and Goals

Values: mental representations of beliefs and goals; provide vocabulary for social interaction to achieve cooperation

Maslow’s hierarchy of needs

- Biological organisms
- Coordinated social interaction
- Survival and welfare of groups

Socially intelligent infrastructure

- Embodies human values and interactions
- Treats end users as active entities
- Adapts at multiple timescales
Socially Intelligent Infrastructure: Criteria

Criteria

- User centrism
- Multiple stakeholders
- Satisficing
- Societal objectives
- Individual objectives
- Adapting for cooperation
- Adaptivity
Infrastructure for Electrical Vehicle Charging

Multiple stakeholders with partially aligned objectives
Understanding both user and societal objectives

Socially Intelligent Infrastructure

Optimization:
- Pricing decisions
- Reliability & flexibility
- Sustainability incentives
- Traffic and travel demand

User-centric Criteria:
- State-of-charge
- Charger location
- Pricing scheme
- Travel & waiting time

Adaptive Control Loop
Lika Charging App: A Conception

Possible screen for user request entry

Transparency and explanations to the user

Ability to nudge users toward prosocial choices to shape demand
Socially Intelligent Infrastructure: Examples

- Transportation
- Food sharing
- Urban spaces
- Healthcare
Socially Intelligent Infrastructure: Ingredients

- Adaptive control
- Prediction user needs
- Shaping demand
- Technical tier
- User interaction

Components
Challenge: Governance of Socially Intelligent Infrastructure

Continually align sociotechnical systems and principals
Judgments of ethicality of STS: Relative to principals’ values
Judgments of compliance by principals: Relative to STS

Sociotechnical System

- Negotiation of STS
- Norms
- Accountability
- Fairness
- Transparency
- Validation vis à vis Values of Members

Principal (with Agent)

- Reasoning
- Values
- Autonomy
- Nonexploitation
- Access
- Revelation
- Verification vis à vis Norms of STS

Inform influence encompass constitute
Challenge: Accountability for Resilience and Innovation

Accountability: $\geq 2$ parties: one to call another to account for its actions

Alternatives vary on accountability

- X will arrive before Y
  - Global constraint
    - Accountable: no one
    - Enforce it globally
    - Constraint fails
      - Out of luck?
  - X commits to Z
    - Accountable: X to Z
    - X arrives early?
      - X may violate it
        - Social control
        - Not blame and sanction: subsequent to accounting
        - Not traceability: a supporting mechanism
    - Y commits to Z
      - Accountable: Y to Z
      - Y arrives late?
        - Y may violate it
        - Social control
        - Not blame and sanction: subsequent to accounting
        - Not traceability: a supporting mechanism
    - W commits to Z
      - Accountable: W to Z
      - W persuades X or Y?
        - W may violate it
        - Social control
        - Not blame and sanction: subsequent to accounting
        - Not traceability: a supporting mechanism

- Alternatives vary on accountability

- Global constraint
  - Accountable: no one
  - Enforce it globally
  - Constraint fails
    - Out of luck?

- Alternatives vary on accountability

- Global constraint
  - Accountable: no one
  - Enforce it globally
  - Constraint fails
    - Out of luck?

- Alternatives vary on accountability

- Global constraint
  - Accountable: no one
  - Enforce it globally
  - Constraint fails
    - Out of luck?

- Alternatives vary on accountability

- Global constraint
  - Accountable: no one
  - Enforce it globally
  - Constraint fails
    - Out of luck?

- Alternatives vary on accountability

- Global constraint
  - Accountable: no one
  - Enforce it globally
  - Constraint fails
    - Out of luck?

- Alternatives vary on accountability

- Global constraint
  - Accountable: no one
  - Enforce it globally
  - Constraint fails
    - Out of luck?

- Alternatives vary on accountability

- Global constraint
  - Accountable: no one
  - Enforce it globally
  - Constraint fails
    - Out of luck?

- Alternatives vary on accountability

- Global constraint
  - Accountable: no one
  - Enforce it globally
  - Constraint fails
    - Out of luck?

- Alternatives vary on accountability

- Global constraint
  - Accountable: no one
  - Enforce it globally
  - Constraint fails
    - Out of luck?

- Alternatives vary on accountability

- Global constraint
  - Accountable: no one
  - Enforce it globally
  - Constraint fails
    - Out of luck?
Challenge: Ethics in the Infrastructure
Values, outcomes, and accountability from a sociotechnical perspective

~Consequentialism

Realizes stakeholder values

~Deontological Ethics

Balances requisite criteria

Technical components, promoting values

Norms, reflecting values

Affordances for ethics

Low complexity of decision making

~Virtue Ethics

Ethics applied in an STS

Promotes freedom

Accountability, improvement

Basis for reconsidering norms

Conducive to innovation

∼Consequentialism

∼Deontological Ethics

∼Virtue Ethics
Thanks!

- Pradeep Murukannaiah, Özgür Kafalı, Catholijn Jonker
- Sponsors: National Science Foundation, Department of Defense

http://www.csc.ncsu.edu/faculty/mpsingh/