ENGINEERING COLLECTIVE INTELLIGENCE: THE RIDE SHARING EXAMPLE

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The Sharing Economy
The Sharing Economy

Source: @WetPaintMENA
The Sharing Economy

source: PriceWaterhouseCoopers
Example: Ridesharing

• Over the past two years we’ve built the web-based ridesharing system *SmartShare*
• Study of human behaviour *in situ* to test models of human collaboration and algorithms for supporting it
• Part of a €6.8M project on *hybrid and diversity-aware collective adaptive systems*
• Preliminary user study in Israel, upcoming larger trial in Italy + lab experiments

[Link to project website](http://www.smart-society-project.eu)  
[@SmartSocietyFP7](https://twitter.com/SmartSocietyFP7)
SmartShare
Sharing app orchestration cycle

Discovery → Composition → Recommendation → Negotiation → Execution → Feedback → Discovery
Sharing app orchestration cycle

Discovery → Emergent Patterns → Composition → Recommendation → Negotiation → Execution → Feedback
Implemented orchestration architecture

- Flexible management of complex interactions between services
- Fully data-driven design of all components
- Blueprint for social computation platforms
Compositionality

• The meaning of 1+1 depends only on “1” and “+”
• If “1”=user and “+”=collaboration, what is “1+1”? 
• Can we predict/determine global outcome?
• Compositionality = Collectives + Context
• Two key questions
  • How to deal with large numbers of users and solutions
  • How to capture context accurately
• Long-term answer: allow users to influence algorithms
• Short-term answer: coarseness of user types and preferences
“Simple” matching

Matchmaking Duration

- 6 agents/group
- 9 agents/group
- 12 agents/group

Time (sec)

#Groups

1 2 3 4 5 6 7 8 9 10
Complex planning

- Calculating **strategically stable** routes using UK public transportation data and cars (>200,000 connections)
Composition

Users

Tasks
Composition

Users  Tasks
Composition

Users -> Tasks
Problems

- Different dimensions of collectives
  - As a type of similar people, or as a group of collaborators?
- Different properties of protocols for creating teams
  - Topological/hedonic preferences: different protocol requirements
- Different solution criteria depending on objectives
  - Optimality vs. availability vs. safety
- Eliciting user preferences while composing tasks
Designing incentives

• Global goals of interaction platforms can be supported by creating additional rewards
• Monetary and “virtual” benefits (badges, scoreboards etc) can be used – gamification
• Feedback mechanisms affect collective behaviour, provide additional incentives
The “social frame problem”

- Very large numbers of users, possibly small sets of user types/coarse preferences
- Parametrisation of search and solution mechanisms requires knowledge of parameters
- More customisability means less data – how can we balance adaptability with optimality?
- Recommendation and user-curated algorithm parameters might be the answer
Group task recommendation

- We don’t know whether a solution exists for a requested objective a priori (cannot just propose nearest “product”)
- Impossible to compute all possible solutions offline (and annotate them for retrieval), computation takes time
- We require agreement of all parties for a task to happen, i.e. solution must rank high on everyone’s preferences
- Data obtained from negotiation/execution/feedback refers to whole teams (correlated views), not just individuals
Toward adaptive orchestration

- Integrating data analysis/prediction facilities in software
- Exploiting coarse preferences to recommend globally desirable solutions
- Exploration of different coalition formation and task allocation algorithms
“The ethics slide”

**Promise**

- Man-machine collaboration
- Personalisation
- Collective intelligence

**Peril**

- Manipulation
- Surveillance
- Humans as cheap labour

*The ethics slide*
Conclusions

• Design of successful/useful sharing economy applications still a black art – ridesharing as an example
• Showed some early steps toward developing solid engineering principles for these types of systems
• Controversial: how much should we invest into
• Not discussed: Cultural and human factors – but extremely important!
• Long-term vision: Users co-design the systems and algorithms themselves, our systems provide support
Thank you!

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