

# The Effect of Goal Revelation on Computer-Mediated Negotiation

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1

## Study Focus

Value of goal revelation in bilateral strategic negotiation.

- Allocation of scarce resources,
- Uncertainty about participants' interests and dependencies,
- Outcome depends on joint agreement.

Contributions

- An argument-based goal-revelation protocol that outperforms non-revelation protocols.
- An open-source empirical test-bed for investigating decision-making.

## Goal Revelation is Costly

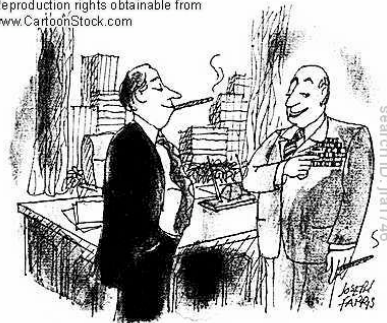
A company is negotiation a takeover of a struggling competitor.

Unions fear liquidation.

Company reveals it is committed to keeping competitor afloat.

Unions demand no job-cuts.

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"This one is for the takeover battle with Khavis, Grable & Cox, this one for..."

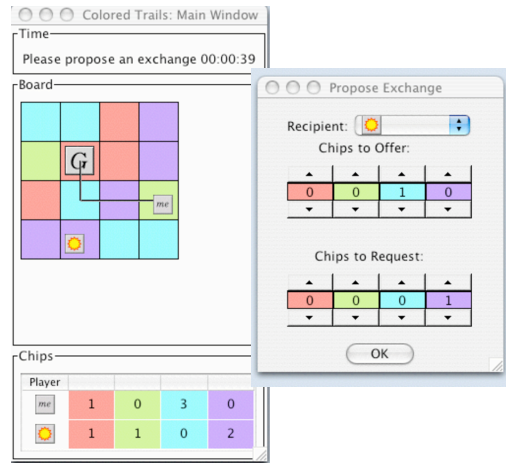
## Colored Trails (CT) [Grosz and Kraus '04]

Colored Trails is a test-bed for investigating decision-making in task settings

CT is a family of games

- includes a board of colored squares and goals
- players are allocated colored chips; surrender chips of appropriate color to move around the board.
- proposer player can suggest an exchange to responder player who can reject or accept

# CT Scenario Example



# Scoring and Payment

- 100 point bonus for getting to goal
- 10 point bonus for each chip left at end of game
- 15 point penalty for each square in the shortest path from end-position to goal
- Performance does not depend on outcome for other player.

6



# Colored Trails: Motivation

Analogue for task setting in the real world

- chips represent resources; paths represent plans; getting to goal equals task completion.
- vivid representation of large strategy space.
- Promotes cooperation as compared to abstract representations (e.g., normal form tables) [Gal et al. 2007]

Flexible formalism

- manipulate dependency relationships by controlling chip and board layout.
- family of games that can differ in many aspects.

7



# Setting

Two possible alternating offer protocols.

- Position based negotiation (PBN)
- Interest based negotiation (IBN)

Played the same set of games in both conditions.

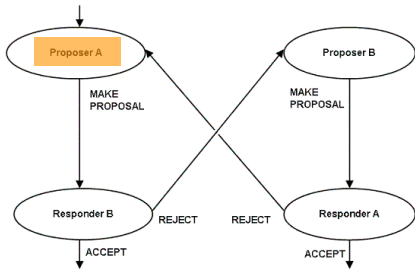
- Players cannot see each other's goal.

Hypothesis:

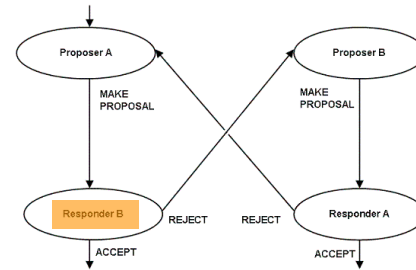
- Revealing goals will lead to the realization of different paths and to more agreements.

# Position Based Protocol

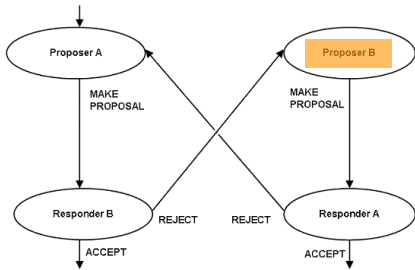
[Rubinstein '85]



# Position Based Protocol



# Position Based Protocol



Game Board - Name 20  
 Your Role: Proposer

Phases Display

Phases	Time Left
> Communication Phase <	> 3:43 <
Movement Phase	0:05
Feedback Phase	0:05
Communication Phase	4:00

Board Display

Player Chips Display

me	1	1	0	3
o	1	2	1	0

Colored Trails Taskbar - Name: 20

Taskbar

Connect... Propose Transfer

Colored Trails: Path Finder

Path Finder Controls

Player: me

Chip Changes: 0 0 0 0

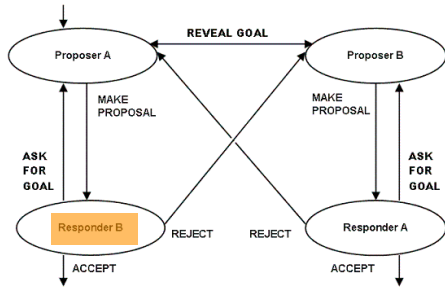
Find Path Reset

Path Finder Results

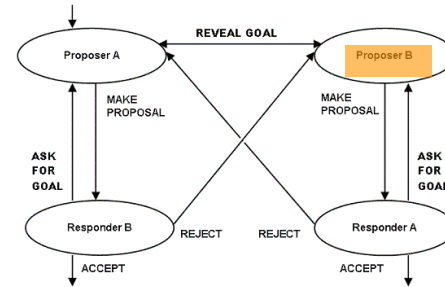
Can Move	To Goal	Missing	Surplus
1	1		
3	1		
3	1		
2	2		
2	2		
2	2		
1	5		
1	5		
2	4		

Display Path On Board

# Interest Based Protocol



# Interest Based Protocol



The screenshot shows the 'Colored Trails' game interface. It includes a 'Phases Display' table, a 'Board Display' grid, and a 'Player Chips Display' table.

Phases	Time Left
> Communication Phase <	> 3:47 <
Movement Phase	0:05
Feedback Phase	0:05
Communication Phase	4:00

Player	Red	Green	Blue	Yellow
me	1	3	1	0
o	1	1	0	3

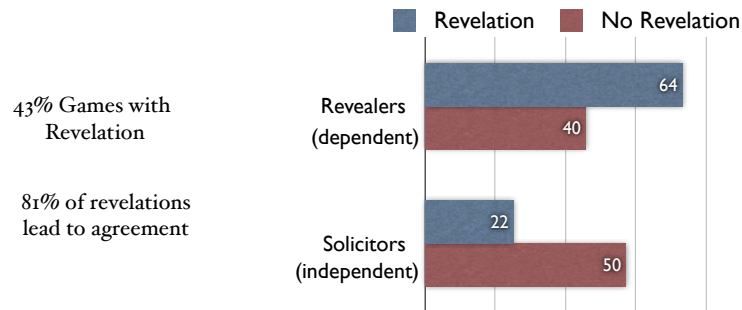
# Methodology

In each condition, 12 subjects played the same 65 different board layouts.

Board layouts were generated according to various criteria (e.g., dependency relationships).

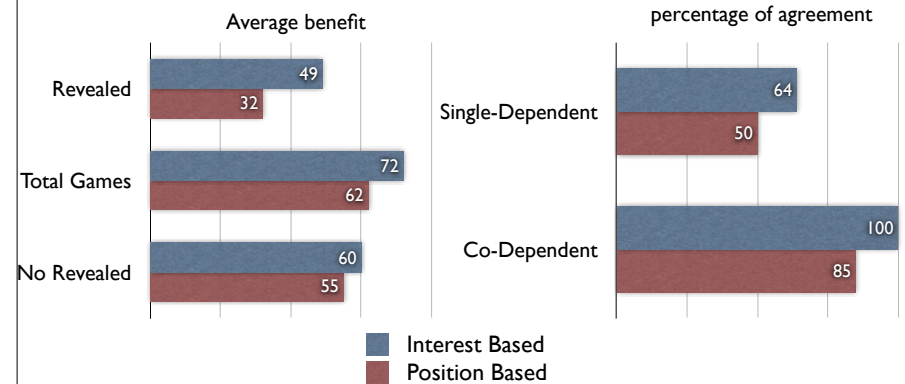
Subjects were compensated in accordance to performance.

## Results: Interest Based Negotiation



Solicitors engage in helpful behavior to dependent revealers

## Results: Between Condition



Pairwise Game Comparison

## Conclusion

Interest-based negotiation works:

- Allows parties to reveal their interests in a controlled fashion.
- Mechanism for dependent parties to seek help from independent parties (see paper for details).
- Outperforms position-based protocols.

Future work

- Randomized protocols for goal revelation.
- Computer agents.

## Colored Trails

[www.eecs.harvard.edu/ct/ai](http://www.eecs.harvard.edu/ct/ai)

Interesting for people to play:

- analogous to task settings;
- vivid representation of strateg space
- Possible for computers to play

Can vary in complexity

- repeated vs. one-shot setting;
- availability of information;
- communication protocol.



# Colored Trails

Public Beta release (~500 downloads)

Used by researchers in US, Canada, Holland, Belgium, Australia, Lebanon, Israel, Jordan, Dubai, Iran(?).

On-going projects

- evolution of group solidarity as a function of common interaction,
- modeling interruptions in user-system interaction,
- advice-seeking in complex strategic environments,
- coalition formation under uncertainty,
- cross-cultural effects of human-computer decision-making

A road map

- deployment on the web
- scaling up to hundreds of subjects
- public depository of experimental designs