Collaborative Strategic Board Games as a Site for Distributed Computational Thinking

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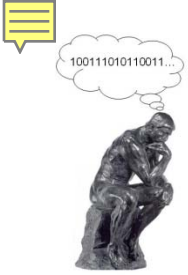


Motivation

- "Contemporary strategic board games represent an informal, interactional context in which complex CT takes place"
- CT can be easily observed if it is distributed among several participants trying to achieve a common goal (collaborative work/play)
- Board games might be profitable for anyone who wishes to understand CT and learning

Contribution

- "…description and evidence that complex computational thinking can happen spontaneously using non-traditional, non-computational media like strategic board games"

➢ Before reading the paper, and considering the other readings, did you think CT can exist outside of a computer? Examples?

Evidence of CT

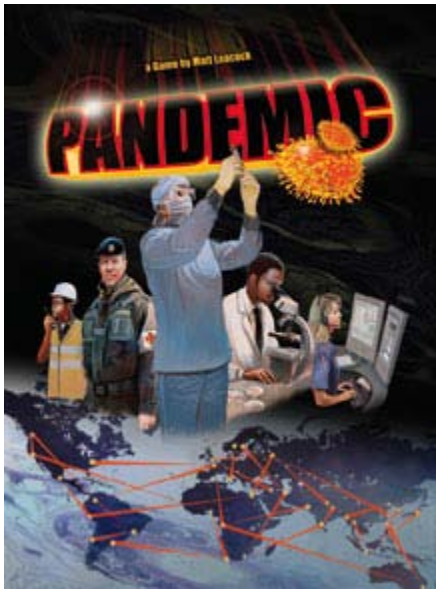
- Quantitative analysis of the student's CT makeup
- Quantitative analysis of code counts for instances of 'global' and 'local' CT
- Descriptive examples of CT

➢ Revisit these to discuss if they actually constitute evidence of CT…

Methodology

- Create a coding framework for distributed CT
- Observe/record 3 groups of players (3-4 players) play a strategy board game
- Decode recorded discourse using the coding scheme
- Extract qualitative examples of CT during gameplay

Pandemic



- Goal: eliminate four viruses by discovering their cure
- How: coordinate moves and utilize resources
- Different roles having different powers
- ‘Epidemic’ cards – spread diseases/outbreaks
- ‘Player’ cards – get resources and additional powers (rule exemptions)

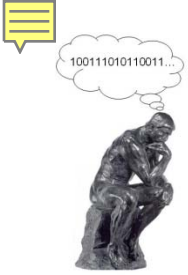
Pandemic board

Coding for CT

- Empirically-based approach where data have motivated the creation of the categories
- Interpretive analysis of recording excerpts was used to develop CT codes

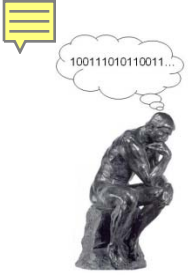
➢ Data-driven vs research-driven approach to CT; What are the pros and cons?

➢ What if they have decided upon the CT concepts beforehand? Maybe longer list?



Coding categories

Category	Description	Rationale
Conditional logic	Conditional logic is the use of an "if-then-else" construct.	Wing (2006); National Research Council (2009)
Algorithm building	An algorithm is a data "recipe" or set of instructions.	Papert's (1980) "procedural thinking"
Debugging	Debugging is the act of determining problems in order to fix rules that are malfunctioning.	Papert (1980); Wing (2006), NRC (2009); Abelson, Sussman, and Sussman (1996)
Simulation	Simulation is modeling or testing of algorithms or logic.	Wilensky and Reisman (2006)
Distributed computation	Distributed computation applies to rule-based actions.	National Research Council (2009)

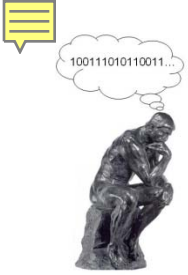


Distinguishing categories I

- Algorithm building vs Simulation

"...I could move ... here, that's 1. And then take out 1 there, then go to Tokyo, so 3. Wait, 1, 2 ... I could move here; and then just not do anything there; and then move to Tokyo; and then fly from Tokyo to where A is; and then give him this card so the beginning of his next turn ... he can play."

"...Essen, I have [the Essen card], so I could fly, I could take care of that during my turn. [I could address] that London outbreak after I take care of that. 'Cause that would take one, then I can fly to Essen, then move there. And then I can take the rest of that."



Distinguishing categories II

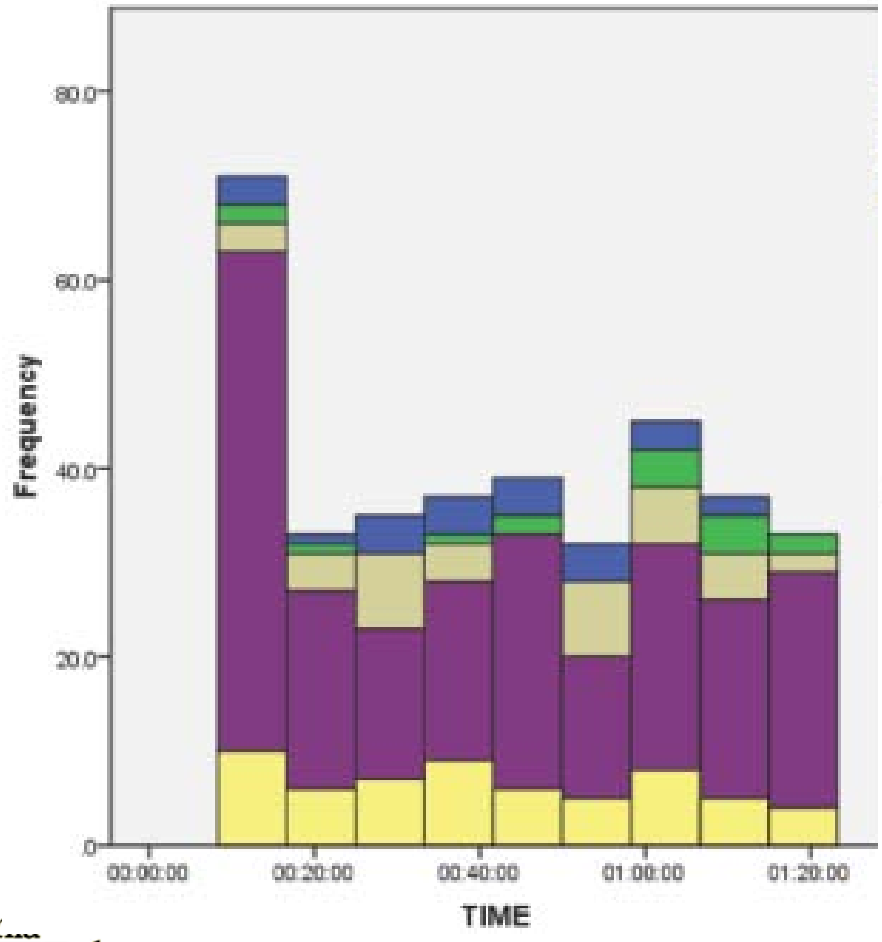
- Algorithm building vs Conditional logic

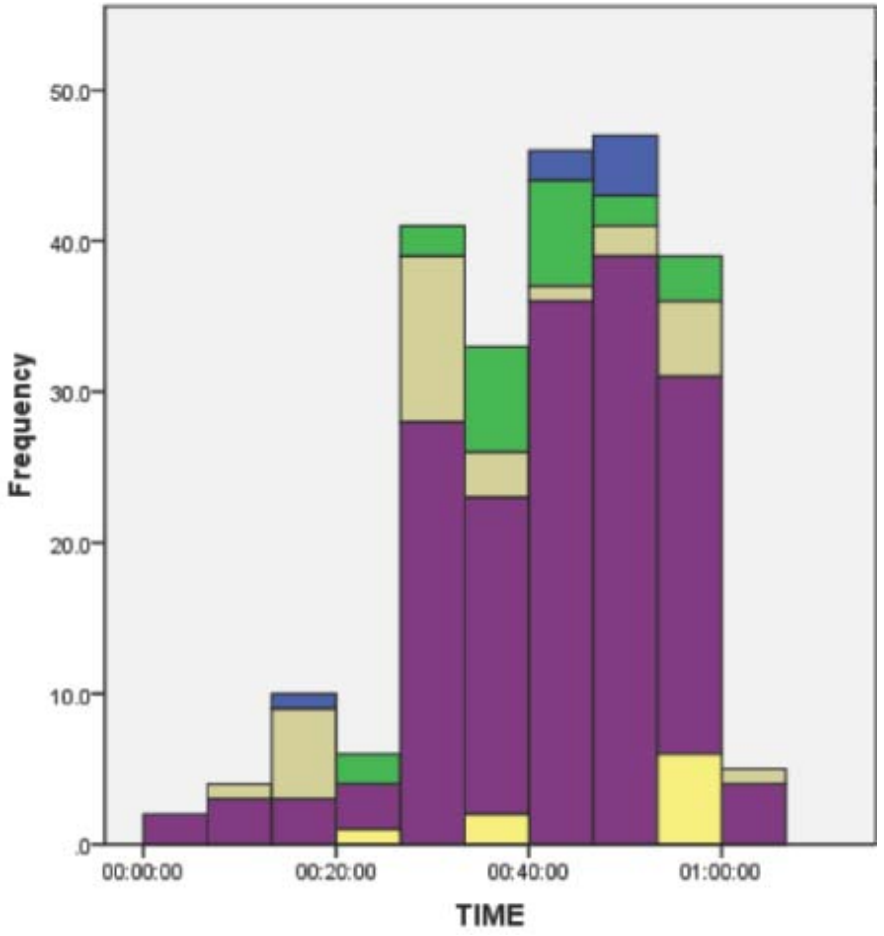
"...if I moved here, then that's one. And if I take out one there, then go to Tokyo, so 3. Wait, 1, 2… If I could move here, and then just not do anything there; and then move to Tokyo; and then fly from Tokyo to where A is; and then give him this card so the beginning of his next turn ... he can play."

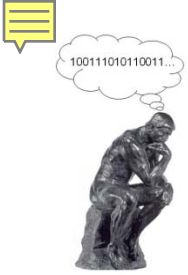
"...if Milan gets one more, that means Istanbul gets one, and if Istanbul had 3, that means Istanbul would start infecting ones next to it, too, and it would be like a chain reaction."

Results

"Distributed computation was consistently the most frequently occurring computational discourse for all groups."







Distinguishing categories III

- Distributed computation vs rest

Patrick: “Okay, for my turn first off I’m going to cure Lima... And then I’m going to move LJ. ... I’ll move you here because that way you’re only two away.” <- Simulation/algorithm

L.J.: “If you move me to one of your cards, and then I’ll teleport there.” <- Conditional logic

Michael: “But you can only trade the card of the one you’re standing in.” <- Debugging

L.J.: “Oh, that’s right.”

Michael: “Just because you have one, you can’t turn all of them in…”

Local and Global Logic

- Local logic relates directly to immediate actions being taken
- Global (abstracted) logic involves “higher order” relationships

➢ How can algorithm building be local? Isn’t the abstraction that makes algorithms reusable?

➢ Global logic more similar to multi-agent programming or parallel processing?

Discussion I

CT quality and quantity depends on:

- Internalizing a set of rules by the players (conditional logic & debugging)
- Devise strategies for optimizing behavior (algorithm building & debugging)

➢ Do you see other CT constructs that could potentially manifest through board games?

Discussion II

Board games advantages:

- Coordination for rule understanding and group strategy formation (distributed comp.)
- Debugging is associated with the process of internalizing and learning the rules.

➢ Do you consider distribution of labor or cognitive load a CT component?

Discussion III

- Strategic board games should be intentionally designed to develop CT
- Increase participation to computational activities through their diverse appeal

➢ Researchers either seek new ways to teach CT or instill CT concepts in other domains. What is the best approach?

➢ What are the trade-offs of teaching CT with board games instead of using a computer?

Evidence of CT (revisited)

- Quantitative analysis of the student's CT makeup
- Quantitative analysis of code counts for instances of 'global' and 'local' CT
- Descriptive examples of CT

➢ Were the authors convincing in their consideration of these evidence as CT?