Questioning the Board Resource Sheet

School of Education
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COMPLEX PLAY LAB

Download a digital copy of the poster here: https://csboardgames.github.io/sigcse2019/

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Selected Bibliography:

*We approached our review through a snowball sampling method, based on the four foundational papers cited below. Each of these papers provided a systematic review of various dimensions of both games and physical kits related to CSed. Our own contribution is a focus on **board games** with a specific content area of **computer science education** within the larger design space described by these papers.*

1. Paulo Eduardo Battistella, Christiane Gresse von Wangenheim. 2016. Games for teaching computing in higher education – a systematic review. *IEEE Technology and Engineering Education* 1, 3: 8–30.
2. Benjamin Ian Gibson. 2013. Educational Games for Teaching Computer Science. University of Canterbury, Christchurch, NZ. Retrieved September 12, 2018 from https://ir.canterbury.ac.nz/handle/10092/9239
3. Casper Harteveld, Gillian Smith, Gail Carmichael, Elisabeth Gee, and Carolee Stewart-Gardiner. 2014. A Design-Focused Analysis of Games Teaching Computer Science. In *Proceedings of Games+ Learning+ Society 10*, 109–118.
4. Junnan Yu and Ricarose Roque. 2018. A Survey of Computational Kits for Young Children. In *Proceedings of the 17th ACM Conference on Interaction Design and Children* (IDC '18), 289–299. https://doi.org/10.1145/3202185.3202738

Game Analysis Chart:

	Collaboration/Competition	Economic Accessibility	Embodied Cognition	Emotional Accessibility	Intersecting Interests	Non-literate Audience	Play With Family	Rules Negotiation	Unplugged
Bits and Bytes				■					■
C-jump		■	■	■				■	
CodeHopper			■	■		■			
Code Monkey Island				■			■		
Coder Bunnyz	■	■	■	■	■		■		
codingFarmer	■		■	■					
Giggle Chips				■		■	■		
Littlecodr	■					■	■		
Potato Pirates	■			■					■
Problems and Programmers	■								
Process State Transition				■					
Robot Turtles					■	■	■		■
Robot Wars							■		
Shortcut	■			■					
//CODE Series		■		■			■		■

Details on categories on chart:

Collaboration/Competition:

Board games improve learning through their multiplayer nature.

Economic Accessibility:

Board games are cheaper than computing resources. It is unlikely this is still the case given new affordable options in both hardware and digital CS ed games.

Embodied Cognition:

Due to players maintaining the game state, board games promote players embodying CS concepts through play.

Emotional Accessibility:

Board games are more emotionally accessible than computers. Includes negative statements about "traditional" programming. (It's "frustrating", "less fun", etc.) None of the games addressed the question of transfer from board games to programming.

Intersecting Interests:

The designers made a board game because they enjoy CS and board games.

Non-literate Audience:

Board games can be designed to support learning pre-literacy.

Play With Family:

Children can play board games with their families.

Rules Negotiations:

The process of manually enacting and debating rules aids learning.

Unplugged:

Board games can function in environments where computing resources aren't present.

Full Game List:

Altogether we identified 26 games through our snowball sampling method, and we selected 15 that were theoretically interesting for our research questions (rows highlighted in green below). We have presented our entire dataset of games below, which we believe is a valuable resource for other scholars working within this domain. Descriptions for games have been pulled directly from the developers or designers of the product.

Game Title	***Brief Description***	***Link***
Bits and Bytes	"The goal of Bits and Bytes is for each player to guide their character (program) to their home planet, Ram, by issuing instructions (turn right, turn left, move forward, turn around). At the same time they have to avoid Walls, Bugs and the dreaded CPU."	http://www.bitsandbytes.cards
C-Jump	"Discover fundamentals of computer programming by playing a board game! c-jump helps children to learn basics of programming languages, such as C, C++ and Java."	http://c-jump.com/
CodeHopper	"This active game keeps bodies busy while young brains gain valuable practice in sequencing, decision making and following commands just like a computer. Bright foam mats that link together create a flowchart of fun and simulate the logic of computer code."	http://mindware.com
Code Master	"Make programming fun by learning the basics without a computer! In Code Master, your Avatar travels to an exotic world in search of power Crystals. Along the way, you use programming logic to navigate the Map."	https://www.thinkfun.com/products/code-master/
Code Monkey Island	"Code Monkey Island is the most exciting educational board game in the world. It teaches kids how to use and master the fundamentals of computer science, and is played in thousands of homes, schools, libraries, and after school camps around the world."	None
Coder Bunnyz	"Easy to get started, focuses on concepts. Program your robot bunny game token smartly with your code cards to eat the carrot and reach the destination before the others do! Play with different destinations or move to the next levels."	http://www.coderbunnyz.com/

codingIsGood	"In this two-player game (ideal for kids in 5th grade and above), players challenge each other in their understanding of Python concepts. At the beginning of the game, players divide each deck equally among themselves, The players challenge each other by picking cards strategically from their decks and asking the questions from the cards to their opponent. If you answer correctly, the card pile increases in size … After you run out of cards, whoever ends up with more cards wins!"	None
codingFarmer	"Coding Farmers is the first ever board game to teach real programming concepts to children as young as seven years. This innovative and ground-breaking game exposes kids to a language used widely by both students and software engineers, the Java programming language. Made by kids, for kids, we can guarantee it'll be fun to play and learn!"	https://codingfarmers.net/
Control Alt Hack	"Control-Alt-Hack™ is a computer security-themed card game designed to be entertaining, give a glimpse into white hat hacking, and highlight some of the more surprising aspects of computer security."	http://www.controlalthack.com
[d0x3d!]	"[d0x3d!] is a board game designed to introduce a diverse body of students to network security terminology, attack & defend mechanics, and basic computer security concepts."	http://d0x3d.com
Giggle Chips	"Giggle Chips uses learning through play to help empower young children ages 18 months - 6 years for the world of STEM. Our educational Game: ABC Computer Science Game Cards is a fun, family and teacher friendly classic card matching game that teaches children STEM Concepts, numeracy skills, the alphabet, numbers, and colors."	https://www.gigglechips.co/
Hacker	"Can you outsmart cybercriminals? Defend the world from cybercriminals by joining the white hat hacker team Oblivion! Play the role of a coder, hacker, and security engineer in 40 beginner to expert challenges. Program your agents to collect data chips while avoiding viruses and alarms. As you discover how a hacker can damage your programs, you will learn how to secure them from future attacks! Each of the 40 challenges includes three phases of play for a total of 120 coding puzzles. Teaches: CONCURRENCY and SECURITY MINDSET"	https://www.thinkfun.com/products/hacker/
Littlecodr	"Littlecodr is an insanely fun card game that introduces code to kids ages 4 and up. Using simple action cards, kids get to program their parents or friends to do crazy things while they learn concepts like coding and logic, linear thinking, prototyping and debugging."	http://littlecodr.com/
PM Master	"Trivia-style board game with questions about Project Management on different knowledge areas, such as scope, time and quality management. The player, who first responds correctly one question of each of the nine knowledge areas, wins the game."	http://www.gqs.ufsc.br/pm-master/
Potato Pirates	"Potato Pirates is a swashbuckling game of carbs and strategy, perfect for families, educators, geeks, you name it. Learn fundamental computational thinking concepts in just a 30 minutes game - all without a computer."	https://www.potatopirates.game
Problems and Programmers	"Problems and Programmers is an educational card game that we have developed to help teach software engineering."	https://www.ics.uci.edu/~emilyo/papers/ICSE2003.pdf
Programmer's Nightmare	"In Programmer's Nightmare, players take turns laying out program instructions with "ownership bits" on the cards they play, creating a long line of interrelating program instructions that become more complicated as the program builds. Finally, a player will play a RUN card and set the program running. Who will survive the convolutions of the program?"	http://www.silcom.com/~tomjolly/pn.htm
Process State Transition	"[In Process State Transition] students discover the complex management issues associated with the management of processes, including deciding which processes to suspend, activate, or dispatch, and how to queue and prioritize processes."	None

Notable Women in Computing	"The idea for a card deck started during an annual camping trip in the high Sierras. Katy and Jessica (mother and daughter) were discussing Katy's joint research poster with Susan. Jessica suggested a card deck to highlight 54 of the women as a way to help other technical women interact with the stories of leaders in the profession."	http://www.notabletechnicalwomen.org/
On the Brink	"On the Brink is the first in a series of games designed to build the mental skills needed to fully grasp the concept of coding. All of the games are screen-free for a unique, unplugged play experience. Each of the 40 On the Brink challenges contains a map of colored squares. Each color has pre-programed moves for your Robot to perform. Use your problem-solving skills to determine the moves that will successfully get your Robot from start to finish. On the Brink is a fun and challenging step up from more simple sequencing games like Robot Turtles."	https://www.thinkfun.com/products/on-the-brink/
Robot Races	"Dance, spin and jump your way to the finish line, playing an active game that teaches early coding logic ideas, by asking you to map your path from point A to point B."	https://www.alexbrands.com/product/infant-preschool/alex-toys-future-coders-robot-races/
Robot Repair	"Robot Repair is the third in a series of games designed to build the mental skills needed to fully grasp the concept of coding. All of the games are screen-free for a unique, unplugged play experience. In each of the 40 Robot Repair challenges you're given a robot to fix. Within the Robots are wires that need to be activated by Power Cells. Using logical deduction and the clues given, insert the Power Cells correctly and repair the robots."	https://www.thinkfun.com/products/robot-repair/
Robot Turtles	"A fun way to learn to code! The most backed board game in kickstarter history sneakily teaches preschoolers the fundamentals of programing, from coding to functions, while making silly turtle noises!"	http://www.robotturtles.com/
Robot Wars	"A fun filled coding game that can be enjoyed by kids, adults and families alike. Introduces how a computer (or robot) executes the code through sequential logic. Java code is blended into English commands so that anyone who can read English can play this game."	https://www.indiegogo.com/projects/robot-wars-board-game-introduce-coding-to-kids
Rover Control	"Rover Control is the second in a series of games designed to build the mental skills needed to fully grasp the concept of coding. All of the games are screen free for a unique, unplugged play experience. Each of the 40 Rover Control challenges contains a map. The trouble is, the pathways on the map are colorless and the Rover is programmed to only travel on colored pathways. You'll need to figure out how to color the pathways so the Rover can complete its mission. Rover Control is a fun and challenging step up from our award winning programming logic game Code Master."	https://www.thinkfun.com/products/rover-control/
Shortcut: Computer Basics	"Computer Basics is a game to teach people basic computer skills. You roll a die, put a place holder on a square, and then answer questions from different categories (Hardware, Software, Internet, Navigation, General). If you answer the question correctly you move forward by putting your pawn where the place holder is. If you answer incorrectly it is the next player's turn. The first one to the finish wins."	None