

# The Hard Choices Game Explained



*Nanette Brown*

*Philippe Kruchten*

*Erin Lim*

*Robert L. Nord*

*Ipek Ozkaya*

Version 2.0  
June 2017

The Hard Choices game is a simulation of the software development cycle meant to communicate the concepts of uncertainty, risk, and technical debt. In the quest to become market leader, players race to release a quality product to the marketplace. By the end of the game, everyone has experienced the implications of investing effort to gain an advantage or of paying a price to take shortcuts, as they employ design strategies in the face of uncertainty. The audience for this paper is the facilitator of the game who is using it for educational purposes to communicate principles of technical debt and architectural investment. The paper provides instructions for playing the game, suggestions for changing the game to add more learning opportunities, and topics for discussion of what the game reveals about the development cycle for a piece of software.

---

## INTRODUCTION

While agile methods are very appealing to practitioners and get a lot of attention in industry, software development organizations face difficulties in applying these methods in projects of increasing scale. A key issue we have identified in large industrial settings is the lack of attention to architectural design and development. One tenet of agile software methods focuses on delivering working software early and often, to demonstrate observable benefits to the end users. This is frequently achieved by focusing on the “skin” of the system and deferring or ignoring some of the deeper architectural issues. By taking shortcuts, projects incur “technical debt” that grows; some projects may even collapse under the weight if the debt is not recognized and properly managed.

The Hard Choices game was developed to give participants a better understanding of the strategies they employ during software development and the implications of investing effort to gain an advantage or paying a price to take shortcuts. Discussion during the debrief session after the game may touch on the following topics:

- technical debt and investment
- how to assess changing conditions and impediments
- how individual and collective strategies change as projects progress

---

Software Engineering Institute  
Carnegie Mellon University  
4500 Fifth Avenue  
Pittsburgh, PA 15213-2612

Phone: 412-268-5800  
Toll-free: 1-888-201-4479

[www.sei.cmu.edu](http://www.sei.cmu.edu)

The Hard Choices game represents the development cycle for a piece of software. In the quest to become market leader, players race to release a quality product to the marketplace.

---

## PLAYING THE GAME

Hard Choices takes about an hour to play and includes a debriefing session afterward so that players can discuss their playing experiences. The game may be played by two, three, or four people. Players compete against each other and race to the finish. The player with the most points at the end of the game wins.

### Setting up

The Hard Choices game board represents the activities of a software development release. In their quest to become the market leader, players compete against each other to release their products to the market place. Players earn points for landing on a square with a tool (representing rewards for investing in technical infrastructure) or by not finishing last (representing rewards for speed to market).

The materials for play include the Hard Choices game board, a six-sided die, markers that players move around the game board, tool cards as counters for rewards, and bridge cards as counters for penalties.

### Rules of play

The goal of the game is to accumulate the most points. Players accumulate points by collecting tool cards and crossing END ahead of their competitors. At the end of the game, the person with the most points wins. At the beginning of the game, the facilitator should not inform the players that the game may consist of multiple rounds.

1. One position on the board is marked START, and another is marked END. All players place their markers on the START position. Players begin with zero rewards and penalties.
2. Each player rolls the die to determine who goes first; the highest roll wins. Play then proceeds clockwise.
3. During a turn, each player rolls the die to determine how many spaces to move:
  - The player moves his or her piece the number of spaces indicated on the die minus the number of penalties incurred (i.e., the number of bridge cards that the player holds).
  - A player may choose to move in any direction, including backward, within a single roll of the die. (For example, if a player rolls a 5, he or she may move 2 squares forward and then 3 squares backward, ending up 1 square in back of the original square.) This increases the opportunity for a player to land on a tool card, at the expense of making progress on the board.
  - Once the first player has crossed END, the players remaining on the board may move only in the forward direction.
4. The first player to cross END gets 7 points, the second gets 3 points, and the third gets 1 point. Players also get 1 point for each tool card. To enter the

END cell, the player should roll anything equal to or greater than the number of remaining squares. The game ends when one player remains on the board. That player stops and doesn't get to take any more turns. He or she gets points for each tool card but doesn't get points for crossing END. The player with the most points at the end of the game wins.

### Hard Choices squares

When a player crosses a "hard choices" square, he or she must decide whether to go over the shortcut bridge or to go the long way and try to collect one or more tool cards.

### Hard Choices – bridges and tool cards

1. Bridges count as one movement, similar to squares.
2. A player who chooses to go over a shortcut bridge must collect a bridge card. Each bridge card subtracts 1 from subsequent rolls of the die.
3. A player may get rid of a bridge card by skipping a turn anytime during the game.
4. If a player lands on a tool square
  - A player may collect only one card for a given square within a given round. That is, the player may not use the ability to move backward to re-cross a tool square and collect a second card for that square.
  - A player may return a tool card any time for a free turn.

Do you take the time to gather more tools, or do you take a shortcut?

### Playing rounds

When the players have finished the first round, the facilitator should announce the second round and add another board (suggesting a second release).

- Plan about 30 minutes to play through a round.
- Players play this second round with the rewards and penalties from the previous round in play. This applies to all subsequent rounds.
- To gain understanding of how technical debt compounds over time, players usually will complete at least two rounds of the game. The facilitator may cut short the second round if he or she feels the participants have understood the underlying concepts of the game.
- The facilitator may announce as many rounds as he or she feels is required for participants to fully experience the underlying concepts of the game. Players may request to play on when they have devised new strategies and wish to see the results. Most likely the game will not run to more than two or three rounds.

The facilitator may use a "game changer" prior to the start of each new round (with the exception of the first round). The facilitator can introduce any one of those listed below or have them printed on cards that one player picks from at random.

Game changers reinforce the role of the rewards (tools) and penalties (bridges) and the uncertainty of conditions. Here are some suggested game changers:

- Holders of hammer cards can cross bridges without penalty if they give back the card.
- For each saw card held by a player, add 1 to each die roll.
- For each screwdriver card held by a player, subtract 1 from each die roll.
- Holders of the screwdriver cards give back a bridge card for each screwdriver card owned.
- Each card is now worth a higher or lower number of points; for example, hammer cards are now worth 5 points each.

---

## DEBRIEF SESSION

The facilitator may conduct a debrief session at the end of the game or at the end of each round. Conducting a debrief session at the end of the first round gives the players an opportunity to discuss analogies to software development and play with that in mind during the second round.

The facilitator can lead discussion by asking

- What just happened? Gather data.
- So what? Generate insight.
- Now what? Figure out what to do differently.

### What just happened?

Ask players how they experienced the game and what strategies they employed. Some observations might be

- I was learning as I went along.
- If I had known there would be another round, I would have done things differently.
- I needed to reevaluate my strategy at every roll and take into account where the other players were on the board and how many cards were in play.
- When I saw the other person skipping a turn to retire bridge cards, I did the same thing since I was at a similar spot on the board.
- I took every possible shortcut.
- I kept changing direction during each role to be able to collect as many tools as possible.
- I never turned in a tool card since I thought the points were more valuable than the extra turn.

“Playing Hard Choices stimulated a lot of discussion and reflection on the current real-life strategies for balancing quality, budget/schedule, and features on a project.” —feedback from a game session hosted at Agile Vancouver

Hard Choices is a game to communicate the concepts of uncertainty, risk, options, and technical debt.

- I traveled over the earliest bridge, but that didn't help. If I had taken the bridge later, I would have been better off.
- The die did not help me, and I kept rolling very low numbers; hence no matter what, I could not advance or collect cards.
- Shortcuts hurt more if you take them early; later on they are not so bad.
- Bridges provide short term gain but slow you down in the long term.
- It is human nature to take a shortcut.
- Finishing first doesn't mean you win.

### So what?

Ask players to discuss how their experiences in the game relate to the strategies they employ during software development in the face of uncertainty. Ask them how this relates to the choices they make—in investing effort to gain an advantage or paying a price to take shortcuts—and their implications.

Key concepts to discuss include

- Decisions, strategies – Ask the “Shortcut Takers” and “Card Collectors” to explain why they chose that strategy. Ask whether they switched strategies over the course of the game.
- Release planning – Discuss modeling the employment of strategies and the flow of decision making, using the game to simulate software design from the point of view of making (or not making) decisions and the consequences over the course of a software release (or multiple releases). Ask whether the strategies employed are typical of the projects the players are involved in.
- Technical debt, architecture investment – Discuss strategies in terms of the categories of technical debt elaborated by Fowler and McConnell, in particular short-term versus long-term. Those who sat out a turn to pay back the debt could be employing strategies to maximize their long-term wins, especially in the second round. Ask how architecture can provide options.
- Refactoring, architecture redesign – Discuss what this game suggests about strategies for incurring and managing technical debt. Players have the choice to stop and refactor (skip one or more turns depending on the amount of technical debt to be repaid).

### Now what?

Ask people what they will take away from the experience and what they might do differently as a result. Some takeaways might include

- A new term to describe a problem or experience, such as technical debt. The metaphor helps people understand the problem and remember the concept.
- Finishing first isn't enough.
- Karma – what you did in the past carries forward.

- A better appreciation for the way debt accumulates – not making decisions has consequences and accumulates debt. As one player noted, “I didn’t think that bridge penalties would affect movement the way it did.”
- A new way to communicate with project members and managers about the relationship of investment and debt
- Strategy (anticipation) in the face of uncertainty and competition (adaptation)

Beyond facilitating discussion on the above topics, a facilitator has other options. You might ask participants to write down insights on a post-it and put it on an “Aha wall” at the end of the first round (without discussion), and again at the end of the second round. Then have a discussion. The topic of how to vary the game rules can also result in fruitful discussion with the participants.

---

## VARIATIONS

Discussing variations often comes up during the debrief session. It can be an effective way of extending the analogy and making connections to the software development process. Here are some variations that have been discussed during the debrief sessions.<sup>1</sup>

### Movement

A player may move his or her piece in any direction but may not switch directions in mid-move. This would decrease the opportunity for a player to land on a tool card.

The game board could be enhanced to include one or two gates, where a player cannot move backward beyond a gate. A player can move back and forth locally, but there are points beyond which a player cannot recover, requiring him or her to live with the consequences of early decisions.

### Penalties

Different strategies for paying back penalties could be devised. For example, rather than being allowed to pay back a penalty at any turn in the game, players might be allowed only at the beginning of the second round.

### Team play

Rather than competing individually, players on a game board work as a group and compete against other players on other game boards. The goal is for each team to get everyone across as quickly as possible with maximum points.

The metaphor of technical debt helps people understand the problem and remember the concept.

---

<sup>1</sup> If you do decide to change the game, keep in mind that it works best if you start simple and then layer on additional concepts. We would enjoy hearing from you about your experience.

The Hard Choices game is available for download under a Creative Commons license.

### **Technical decisions**

Technical decision cards might be used instead of symbolic tool cards for technical participants. Instead of using bonus cards with generic tools, substitute cards that describe decisions that need to be made at the choice points on the game board. These should be simple and rely on keywords such as “design a database.” A player draws a card, reads it aloud, and decides to make the decision or not. Making a “yes” decision means taking the long way around; making a “no” decision means taking a shortcut across the bridge.

### **For more information**

The Hard Choices game is related to the SEI work in architecture and technical debt. For more information, visit

*[http://www.sei.cmu.edu/architecture/research/arch\\_tech\\_debt](http://www.sei.cmu.edu/architecture/research/arch_tech_debt)*

### **Acknowledgments**

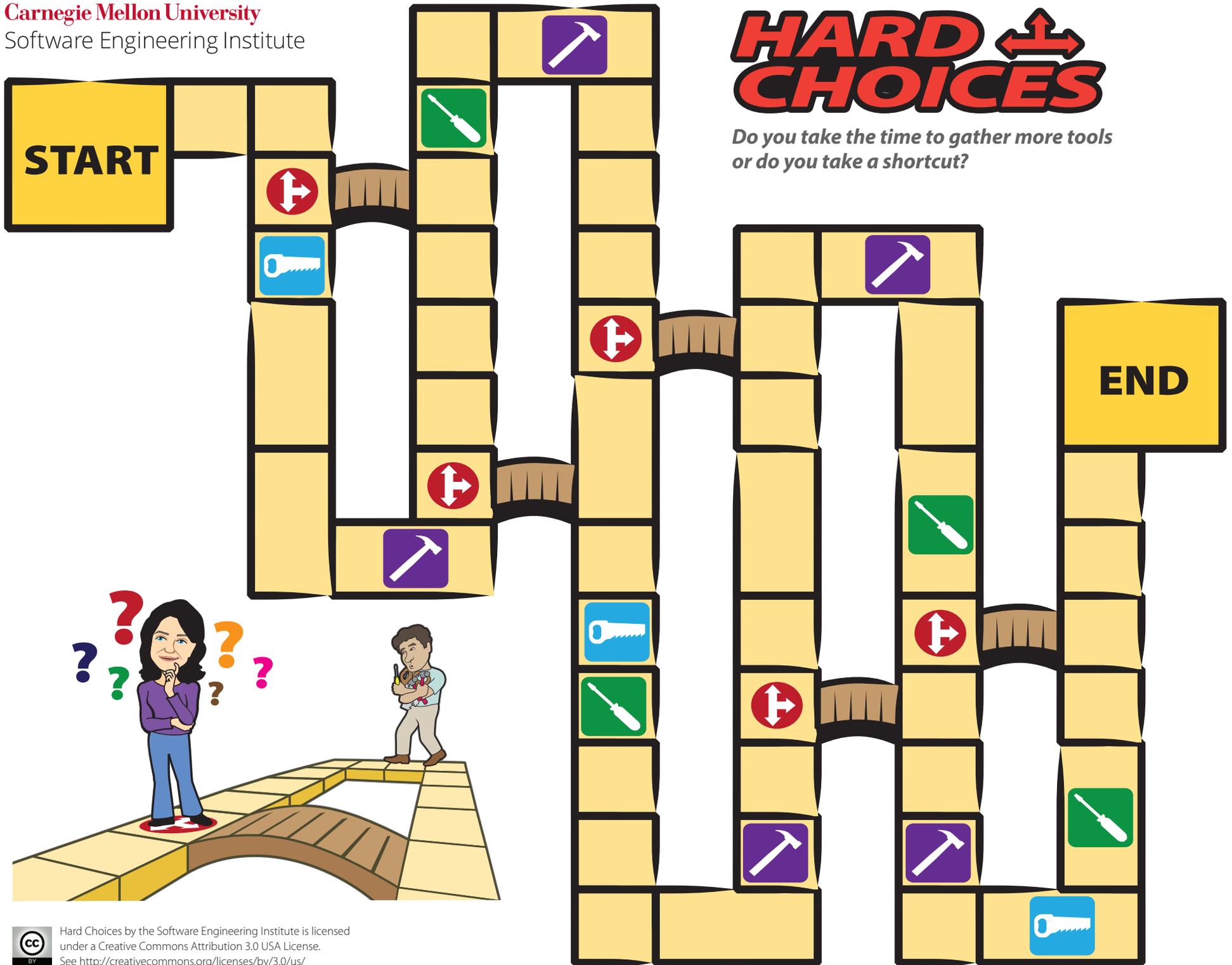
The Hard Choices game is adapted from Short Cut: Game About Speed and Risk, by Quality Tree Software, Inc.

It is developed as part of the Carnegie Mellon Software Engineering Institute Independent Research and Development Project Communicating the Benefits of Architecting with Agile Development in collaboration with the University of British Columbia.

We would like to thank Chris Sims for introducing us to creating agile learning games and the shortcut game, SuZ Garcia for helping us develop the concept of the game, and our colleagues at the SEI for enthusiastically playing early versions and offering feedback.

# HARD CHOICES

*Do you take the time to gather more tools or do you take a shortcut?*



# HARD CHOICES

## Start of Play

- The game may be played by 2–4 people.
- Each player rolls the die to determine who goes first. The highest roll wins. Play then proceeds clockwise.

## Player Movement

During a turn, each player rolls the die to determine how many spaces to move:

- The player moves his or her piece the number of spaces indicated on the die minus the number of penalties incurred (i.e., the number of Bridge Cards that the player holds – see below).
- A player may choose to move in either direction or in both directions within a single roll of the die. (For example, if a player rolls a 5, he or she may move 2 squares forward and then 3 squares backward, ending up 1 square in back of the original square.) This increases the opportunity for a player to land on a tool card, at the expense of making progress on the board.
- Once the first player has crossed END, the players remaining on the board may only move in the forward direction.

## Special Squares

### *Hard Choices Squares*

When a player crosses a Hard Choices Square, he or she must decide whether to go over the Shortcut Bridge or go the long way and try to collect one or more tool cards.

## *Bridges and Bridge Cards*

- Bridges count as one movement, similar to squares.
- When a player lands on or crosses over a Shortcut Bridge, he or she must collect a Bridge Card. Each Bridge Card that the player holds subtracts one from subsequent rolls of the die.
- A player may get rid of a Bridge Card by skipping a turn anytime during the game.

## *Tool Squares and Tool Cards*

If a player lands on a Tool Square

- The player collects a Tool Card.
- A player may collect only one Tool Card for any given Tool Square within a given round. That is, the player may not move backward to re-cross a Tool Square and collect a second card for that square.
- A player can return a tool card any time for a free turn.

## End of Play

- To cross the END cell, a player must roll a number equal to or greater than the number of remaining squares.
- The game ends when only one player remains on the board. The final remaining player must stop and may not take any more turns.

## Points

### *Market Leader Points*

- The first player to cross END gets 7 points, the second gets 3 points, and the third gets 1 point. The last player remaining on the board gets no Market Leader points but can collect Tool Points.

### *Tool Points*

- In addition to Market Leader Points, each Player collects 1 point for every tool card that he or she holds at the end of the game.

## Winning!

The player with the most points at the end of the game wins.

## Credits

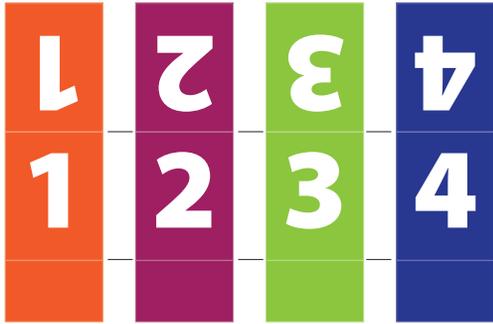
The Hard Choices game is adapted from *Short Cut: Game About Speed and Risk*, by Quality Tree Software, Inc. It was developed as part of the Carnegie Mellon University Software Engineering Institute Independent Research and Development Project Communicating the Benefits of Architecting with Agile Development in collaboration with the University of British Columbia.

The Hard Choices game is related to the SEI work in architecture and technical debt. For more information, visit [sei.cmu.edu/architecture/research/arch\\_tech\\_debt](http://sei.cmu.edu/architecture/research/arch_tech_debt)

Before cutting the markers out, score the player markers.



Fold like a tent card and tape



-1 movement



-1 movement



-1 movement



-1 movement



-1 movement



-1 movement



-1 movement



-1 movement



-1 movement



-1 movement



-1 movement



-1 movement



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point



+1 point

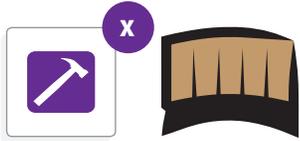


+1 point



+1 point

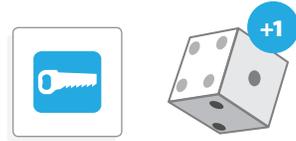
## GAME CHANGER



### EFFECT

Holders of hammer cards cross bridges without penalty if they give the card back.

## GAME CHANGER



### EFFECT

Holders of saw cards add 1 for each saw card to each die roll.

## GAME CHANGER



### EFFECT

Holders of screwdriver cards subtract 1 for each screwdriver card from each die roll.

## GAME CHANGER



### EFFECT

Holders of screwdriver cards give back a bridge card for each screwdriver card owned.

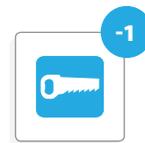
## GAME CHANGER



### EFFECT

Hammer cards are now worth 5 points each.

## GAME CHANGER



### EFFECT

Saw cards are now worth -1 points each.

## Game Changer Cards

Game Changer cards alter the rules of the game by tweaking values or mechanics. When using Game Changer cards:

- At the end of the first round, a player fans out the cards, showing only the blank side.
- Another player selects one, turns it over, and reads it to the others.
- That rule is now in effect for this round.

---

## Contact Us

Software Engineering Institute  
4500 Fifth Avenue, Pittsburgh, PA 15213-2612

**Phone:** 412/268.5800 | 888.201.4479

**Web:** [www.sei.cmu.edu](http://www.sei.cmu.edu) | [www.cert.org](http://www.cert.org)

**Email:** [info@sei.cmu.edu](mailto:info@sei.cmu.edu)

Copyright 2017 Carnegie Mellon University. All Rights Reserved.

This material is based upon work funded and supported by the Department of Defense under Contract No. FA8702-15-D-0002 with Carnegie Mellon University for the operation of the Software Engineering Institute, a federally funded research and development center.

The view, opinions, and/or findings contained in this material are those of the author(s) and should not be construed as an official Government position, policy, or decision, unless designated by other documentation.

References herein to any specific commercial product, process, or service by trade name, trade mark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by Carnegie Mellon University or its Software Engineering Institute.

NO WARRANTY. THIS CARNEGIE MELLON UNIVERSITY AND SOFTWARE ENGINEERING INSTITUTE MATERIAL IS FURNISHED ON AN "AS-IS" BASIS. CARNEGIE MELLON UNIVERSITY MAKES NO WARRANTIES OF ANY KIND, EITHER EXPRESSED OR IMPLIED, AS TO ANY MATTER INCLUDING, BUT NOT LIMITED TO, WARRANTY OF FITNESS FOR PURPOSE OR MERCHANTABILITY, EXCLUSIVITY, OR RESULTS OBTAINED FROM USE OF THE MATERIAL. CARNEGIE MELLON UNIVERSITY DOES NOT MAKE ANY WARRANTY OF ANY KIND WITH RESPECT TO FREEDOM FROM PATENT, TRADEMARK, OR COPYRIGHT INFRINGEMENT.

[DISTRIBUTION STATEMENT A] This material has been approved for public release and unlimited distribution. Please see Copyright notice for non-US Government use and distribution.

Internal use:\* Permission to reproduce this material and to prepare derivative works from this material for internal use is granted, provided the copyright and "No Warranty" statements are included with all reproductions and derivative works.

External use:\* This material may be reproduced in its entirety, without modification, and freely distributed in written or electronic form without requesting formal permission. Permission is required for any other external and/or commercial use. Requests for permission should be directed to the Software Engineering Institute at [permission@sei.cmu.edu](mailto:permission@sei.cmu.edu).

\* These restrictions do not apply to U.S. government entities.

DM17-0377