The Game of Go
from ancient art to modern research

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Games as Art

Game play is an *art*.

1. Conscious production or arrangement of elements in a manner that affects the sense of **beauty**

2. **Skill** that is attained by study, practice, or observation

   - culturally ubiquitous

We offer *Go* to you as a high example of this art.
History of Go

China – Go is called “Wei-chi”
Earliest references are from 6th century BC China in Confucius’ Analects
Legends: Emperor Yao (2357-2255 BC) invented Go to help his son learn.
Shun (2255-2205 BC) invented Go to teach his son.
Learn what? Patience, strategy.
By 7th century AD, the game had reached Japan via a Japanese emissary, who was sent by the Japanese court to the city of Chang’an during the T’ang dynasty.

Chinese records of the Sui Dynasty (circa 618) make reference to the Japanese playing Go.

*Kojiki*, recorded in 712, in man’yogana (mismash of Chinese and Japanese language)
Heian Period
794-1185

- Go was popular at imperial court by mid 8th century in Japan
- Male and female characters in *The Tale of Genji* (~1000 AD) play Go.
- Genji scrolls created in late Heian.
Chapter 3 - Utsusemi
Illustrated scroll mid-18th c.
Genji observes women playing go.
Woodblock Prints and Go
Images by Toyokuni III (also known as Kunisada) a woodblock print artist of the Edo Period. 1786-1864

Series: The Tale Of Genji

Date: Circa 1844
Chapter 42 - Prince Niou

Prince Niou observes Yugiri’s daughters (Genji’s granddaughters) playing Go.
Chapter 49

The Ivy

~1843-1845
Toyohara Chikanobu’s
“Woman playing go and a woman watching”
1898
Tokugawa Period

- Go became popular among the warrior class.
- Tokugawa Ieyasu appoints Sansa, a famous Go player, to a prestigious position in 1603.
- Tokugawa shogunate supports Go and the four schools are created.
- 1868 shogunate falls, Meiji period (rapid westernization) Go less popular.
Meiji Period 1868-1912 and Onward

- April 1, 1878 first Go column in a Japanese newspaper
- Go columns still exist today
- Go TV show
- Many Go tournaments
- Professional Go players
  - Japanese, Korean, Chinese, American
1951 Kawabata Yasunari’s novel, *Master of the Go* was published. About a real game in 1938.
Japanese Pop Culture

“Hikaru no go”
- created “Go” boom
- 1998 manga/cartoon
- 200 chapters in 23 volumes

Go in pop-culture
East and West

Film
- A Beautiful Mind (2001)
- Teenage Mutant Ninja Turtles III (1993)
- Hero (2002)
American Television

- “24” (2003) Season 3 Episode 15
- “Star Trek Enterprise” (2003) 2.22
- “Ally McBeal” (1997) 2.37
- “JAG” (1995) 2.10 “The Game of Go”
How To Play Go

- 9-by-9 practice board, 40 black pieces and 40 white pieces
- The player with black pieces begins.
- Black and White alternate placing pieces on grid intersections.
Groups, Liberties, and Capture

- **Groups** – sets of pieces that touch along grid lines
- **Liberties** – empty grid intersections adjacent to a group
- When the last liberty of a group is occupied, that group is **captured**.
One-Capture Go

To familiarize yourself with placement, groups, liberties, and capture, play this simplification of Go:

The first to capture one or more opponent pieces wins.
Illegal Moves: Suicide and Ko

- **Suicide** – occupying the last liberty of one’s own group
- **Ko**
  - Repetition of a previous board situation
  - Means “eternity” in Japanese
  - Would make the game infinite
Object of the Game

- Score = surrounded empty intersections + captured pieces
- To pass, give the opponent a stone
- After both pass, players
  - discuss territory, inevitable captures
  - resume play if disagreement
  - Otherwise, remove captured pieces, fill neutral intersections, and score
Let’s Play Go!

- Let’s defer other details (e.g. handicaps, komi scoring).
- Time to play Go!
- We’re here for your questions.
Artificial Intelligence (AI) for Go

- In the 90’s AI began to exceed human performance in Chess (e.g. Deep Blue vs. Kasparov).
- Today, AI techniques play at a level of a weak player with months of experience.
- Why?
Chess AI in a Nutshell

- Computers play expert Chess by **lookahead** and **good evaluation**
  - looking ahead through millions of move sequences per second, and
  - performing good, fast assessments of board positions.
- On average, a Chess player has **35** possible moves per turn.
Computer Go Difficulties

- On average, a Go player has **235** possible moves per turn.
- For typical search depths, Go would have ~50% more digits in the number of moves.

<table>
<thead>
<tr>
<th>Search Depth</th>
<th>Avg. Chess Positions</th>
<th>Avg. Go Positions</th>
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Computer Go Difficulties

- Also, good assessments of board positions are more difficult for Go.
- So, computer Go programs can neither look ahead as far nor make use of such lookahead as well as Chess programs.
- Hope: research in pattern recognition, associative memories
Conclusion

- Go is
  - the oldest game still played in its original form
  - a form of art
  - a current challenge of AI research
  - fun!
What Next?

- Go resources online:
  - gobase.org
  - en.wikipedia.org/wiki/Go_(board_game)
  - AGA: www.usgo.org

- Go equipment: www.samarkand.net

- Free Go software
  - Igowin: www.smart-games.com
  - glGo: www.pandanet.co.jp/English/glgo