

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.



Japan

- 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)

中国

ちゅうごく

China



Heian Period

794-1185

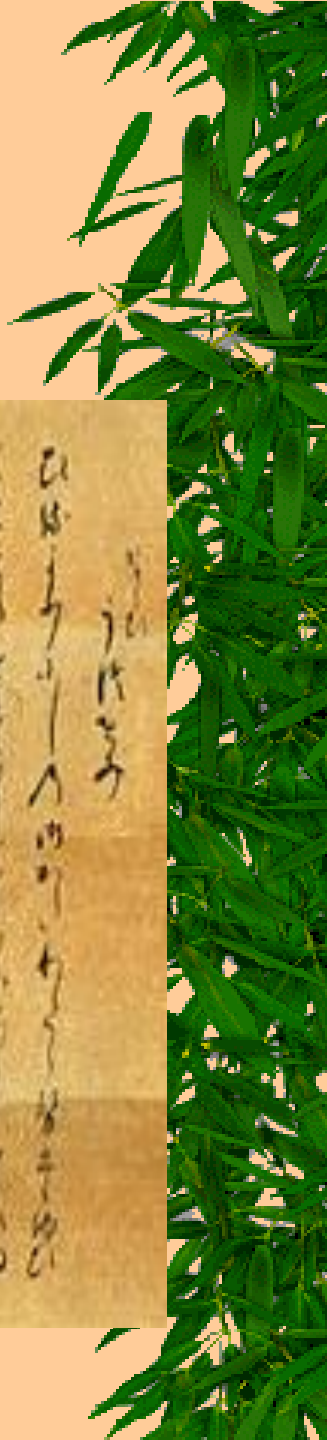
- Go was popular at imperial court by mid 8th century in Japan
- Male and female characters in *The Tale of Genji* (~1000 AD) play Go.
- Genji scrolls created in late Heian.



Chapter 3 - Utsusemi

Illustrated scroll mid-18th c.

Genji observes women playing go.



Woodblock Prints and Go

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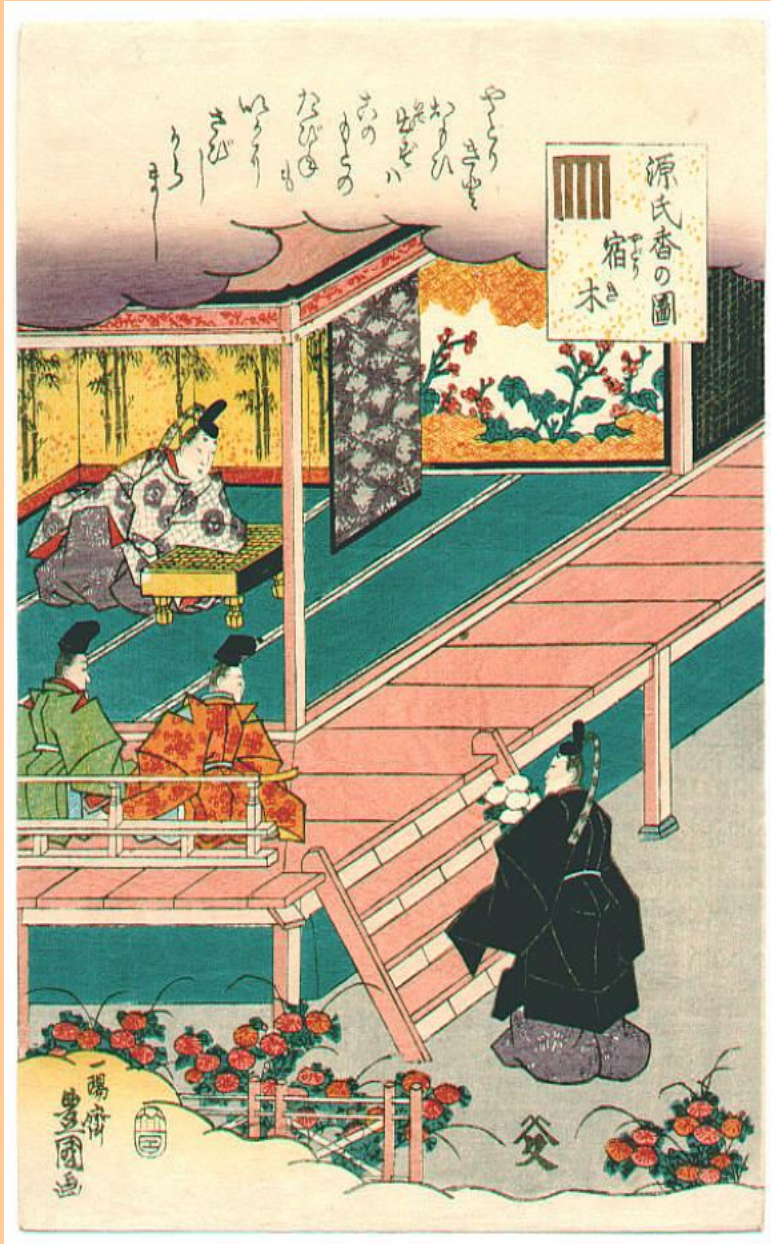
- **Images by Toyokuni III (also known as Kunisada) a woodblock print artist of the Edo Period. 1786-1864**
- **Series: The Tale Of Genji**
- **Date: Circa 1844**



Chapter 42 - Prince Niou

Prince Niou
observes Yugiri's
daughters
(Genji's grand-
daughters)
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
- 75 30 minute episodes as animated series including 2 New Year specials. January 2003-2004.



Go in pop-culture East and West

- Film

- A Beautiful Mind (2001)
- Teenage Mutant Ninja Turtles III (1993)
- Crouching Tiger, Hidden Dragon (2000)
- Hero (2002)



American Television

- “24” (2003) Season 3 Episode 15
- “Star Trek Enterprise” (2003) 2.22
- “Ally McBeal” (1997) 2.37
- “Andromeda” (2000) “Double Helix”
- “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.

Search Depth	Avg. Chess Positions	Avg. Go Positions
1	35	235
2	1225	55225
3	42875	12977875
4	1.5E+06	3.0E+09
5	5.3E+07	7.2E+11
6	1.8E+09	1.7E+14
7	6.4E+10	4.0E+16
8	2.3E+12	9.3E+18
9	7.9E+13	2.2E+21
10	2.8E+15	5.1E+23



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_\(board_game\)](http://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

