

**Pickford Film Center
DOCTOBER DOCUMENTARY FILM FESTIVAL, 2017
Film Discussion Guide**

**ALPHA GO (2017)
A documentary film by Greg Kohl**

<https://www.mountainfilm.org/festival/personalities/greg-kohs>

THE STORY:

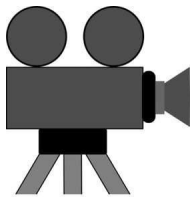
“The ancient Chinese board game Go has long been considered the holy-grail for artificial intelligence. Its simple rules but near-infinite number of outcomes make it exponentially more complex than chess. Mastery of the game by computers was considered by expert players and the AI community alike to be out of reach for at least another decade. Yet in 2016, Google's DeepMind team announced that they would be taking on Lee Sedol, the world's most elite Go champion. The match was set for a weeklong tournament in Seoul in early 2016, and there was more at stake than the million-dollar prize.

Director Greg Kohs' absorbing documentary chronicles Google's DeepMind team as it prepares to test the limits of its rapidly evolving AI technology. The film pits machine against man, and reveals as much about the workings of the human mind as it does the future of AI.”

—Ian Hollander

THE CAST:

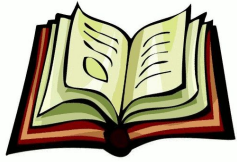
Frank Lantz, Director, New York University Game Center
Demis Hassabis, Co-Founder and CEO, DeepMind
Shane Legg, Co-Founder and Chief Scientist, DeepMind
David Silver, Lead Researcher, DeepMind
Lee Sedol, 9p World GO Professional
Aja Hung, Lead Programmer, DeepMind
Fan Hui, 2p Go Professional, European Go Champion
Janice Kim, 3p Go Professional
Andrew Jackson, Vice President Operations, American GO Association
Yuan Zhou, 7p Go Professional
Julian Schrittwieser, Software Engineer, DeepMind



DOCUMENTARY STYLE:

Bill Nichols, film educator, has written many texts on documentary styles and his analysis is distilled in the article cited here. He categorizes documentaries into 6 styles.

<https://www.videomaker.com/article/c06/18423-six-primary-styles-of-documentary-production>



USING THIS GUIDE:

The following questions were created to help the viewers draw key themes and ideas from the details of the film that reinforce CCSS for Middle School: ELA, MATH, COMPUTER SCIENCE, NEXT GEN. SCIENCE

VOCABULARY and CONCEPTS

Artificial intelligence (AI)
Algorithm
Deep Reinforcement Learning
Deep Neural Networks

Intuition
Anthropomorphism
Systems Neuroscience

THE ANCIENT GAME OF GO:

GO was invented by the ancient Chinese and is considered to be the most complex of all board games to be developed by humans. Therefore, GO has been the long-standing “grand challenge” to the AI community.

1. Do YOU enjoy playing strategy board games? Have you ever played CHESS? Have you played GO? If you have played GO, tell your classmates about your experience. Would you be willing to teach them?
2. Frank Lantz describes GO as “putting your hand on the ‘3rd rail’ of the universe. What does he mean by that?
3. Lantz also says that players not only “want to play GO, but they want to understand what ‘understanding’ is.....what it truly means to be human.” Explain. Have you ever played a strategy game that taught you **anything** in return for the experience of playing?
4. From a young age, Lee Sedol was intensely tutored by Go Master, Yuan Zhou. Now a master himself, Sedol hopes to use his personal innovation and creativity to bring something new to the game. After competing with the AlphaGo program, what new ideas from Sedol do foresee?
5. Besides GO, what else have the ancient Asian cultures given to the rest of the World? Draw on your prior knowledge or research the origins of silk, compass, abacus, acupuncture, rudder, planetarium, gunpowder, wheelbarrow, seismograph, kites.

A.I. DESIGN PROCESS:

The documentary captures an historic moment for computer science and artificial intelligence (A.I.). Prior to the accomplishments of DeepMind, computers were able to beat champion chess players because the computer was programmed with an algorithm that powered through all possible combinations of Chess moves. (See Resources on the 1997 chess match between Gary Kasparov and IBM’s Deep Blue computer in Resource section.)

But the ancient Chinese game of GO is much more complicated than chess. The number of possible moves is nearly infinite. To solve this complexity issue, the DeepMind team created a program that mimics human-styled intuition and the human brain's neural network. They built a program that taught the computer to think and learn on its own, based upon its own experiences of success and failure, as does the human brain. The program combined the best techniques from machine learning (Deep Reinforcement Learning) and Systems Neuroscience. (More on this subject; see excellent youtube video on DeepMind linked from Resources)

1. As you watched the documentary, what steps in the design process did you learn about?
2. Did the formulas and schematics on the white boards tell you anything about the design process or the languages of programming? Explain.
3. The design team was comprised of people with different skill sets. Can you name any of these skill sets? Is it a good idea to form multi-disciplinary teams in order to solve complex design problems?
4. If you are interested in working in the AI industry, what training would you need? Would you also need to be an introvert? (see resource section for helpful links)
5. These are the components of AlphaGo's program. Explain the function of these components and how they work together.
 - Policy Network
 - Value Network
 - Tree Search
6. How many steps ahead was AlphaGo able to search? Is any human being capable of that much foresight?

HUMANITY VS. MACHINE:

FAN HUI's MATCH

1. Fan Hui thought that it would be simple to win against a mere 'program.' Why did he think this? But when Fan Hui lost all five of the matches, what was his reaction?
2. Hui and other tell us that GO is a "mirror" reflecting the self. When he lost the games, he said "I don't understand myself anymore." Explain.
3. After losing all 5 games, his friends were concerned about his emotional well-being as the internet gossip about him was brutal. Yet, in preparation for the ultimate match of AlphaGo vs. Sedol, Hui was invited back by the DeepMind team to find any remaining "bugs" in the AlphaGo program. What aspects of Hui's character (the mirrored 'self') earned him the privilege of returning to DeepMind?

4. Hui found a “weakness” in the program that the team called “tricky lumps of knowledge” and “delusions.” When used to describe human behavior, what does “delusional” mean? How can a computer program be “delusional”?

LEE SEDOL’S MATCH

As a World Go Champion eighteen times, Lee Sedol is a ‘national figure’ in South Korea and so there was huge media attention for his competition with AlphaGo last year. In Asian culture, GO is one of the 4 Noble Accomplishments so a GO master like Sedo is seen to be both very smart and also very noble.

1. Including a board game among aesthetic accomplishments such as music, painting and poetry tells us a great deal about Asian values and customs. Explain.

- Is there any parallel in the US? Can you identify American cultural values?
- What do painting, music, poetry and Go have in common?
- Do you think American culture will value its intellectuals more or less in the future? Explain.

2. When Sedol began the tournament, he pronounced its very high stakes. “I am going to do my best to protect human intelligence.” What does he mean? Do you champion his goal or did you root for the computing team, the creators of the AlphaGo program? Defend your position.

3. Go Master Yuan Zhou told us that “on the surface, GO is a game, but inside, it has a very deep philosophy. The Go board reflects the individual who is playing. The truth is going to show itself on the board.” As the tournament began, Hui said that he could feel Sedol’s “spirit, courtesy, calm and mental strength.” Through the week of play, we learned a great deal more about Sedol.

- If the game is a “mirror” of one’s true self, what “truth” did we observe about Sedol’s character? His intellect? His strategies?
- What responsibilities burdened his thoughts and actions?
- Was he “noble” in any way?
- Sedol played against an entire team of intelligent and skillful human beings who designed a machine to be super-human smart. Is this a fair contest?

MOVE 37: INTUITION and CREATIVITY

Move 37 of Sedol’s game 3 received a lot of commentary because it was seen as “original” thinking on the part of the machine. Both the professionals and AlphaGo’s evaluation data agree that Move 37 indicated original and creative thought on the part of AlphaGo.

Sedol: “I thought Alpha Go was based on probability calculation and it was merely a machine. But when I saw this move, I changed my mind. Surely AlphaGo is creative. This move was really creative and beautiful.”

Hui: This move is very special because with this move, all the stones played before work together” like a network, they link together. “It’s very special.”

Sedol: “This move made me think about Go in a new light. What does creativity mean in Go? It was a really meaningful move.”

Your turn. What does Move 37 indicate to YOU? AlphaGo can envision play up to 151 steps into the future. Was Move 37 a “probability calculation” or an act of intuition or creative thinking? Or was it something else?

INTRIGUE AND CONCERN:

AlphaGo beat the world’s best GO player three times! A hush fell over the observing crowd. At the press conferences, Sedol told the audience “I think I have to apologize first. If I had been able to play better or smarter, the results might have been different. I think I disappointed too many of you this time. I want to apologize for feeling so powerless. I’ve never felt this much pressure, this much weight. I think I was too weak to overcome it.”

INTRIGUE:

1. What is intriguing about an A.I. machine beating the world’s very best GO player by using a move that seemed “creative” and “original”?
2. Cade Metz, senior staff writer at Wired says that the “specific ideas that are driving AlphaGo are going to drive our future.” The programming model for AlphaGo mimics human neural networks to operate Big Data and achieve surprising results that go beyond what programmers alone can do.” What positive outcomes can you envision for general-purpose A.I.?

CONCERN:

1. Do you have any concerns that AI machines of the future would be able to exceed their programming parameters and begin to control their operators?? Are your concerns warranted?
2. DeepMind is considering assembling an ethics review board to predict and examine potential unintended consequences of AI technology. Do you think that an ethics team will be able to adequately predict the negative and positive impacts of a complex technology?
3. Some humans believe that technology will solve all of civilization’s problems yet that new technology creates more problems than it solves. Name technologies that have been both useful and destructive?
Hints:
 - DDT
 - Atomic energy
4. At the time of the innovation, did anyone predict the negative long-term impacts of these technologies before they were used? (Hint: Rachel Carson raised the alarm about the

harmful long-term effects of DDT on the environment but her ideas were not widely accepted until after her death.)

5. Research a new technology that may be made possible by developments in deep reinforcement learning—e.g. self-driving cars. Examine both usefulness and possible negative outcomes.

ANTHROPOMORPHISM

1. In the documentary, Demis Hassabis, acknowledges people’s concerns about A.I. exceeding its programmed parameters and turning on its operators. He explains that it is human nature to anthropomorphize things we don’t understand.. Define “anthropomorphize.”
2. Can you name AI characters in TV series, video games, films or science fiction that have been anthropomorphized—e.g. where machines exceed their parameters to become sentient beings? Are these evolved-beings benevolent or malevolent? Give examples.
3. DeepMind Software Engineer, Julian Schrittwieser, finds anthropomorphism a puzzling phenomenon. “It’s only a “program! Why did people call AlphaGo “he” or “she” when it is just a fairly simple computer program?” What is YOUR point-of-view?



FILM MAKING:

1. The match between Sedol and Alpha Go is emotionally very compelling to watch. How did the film-maker manipulate these elements of production to create suspense and heighten your emotions?

- Camera shots (e.g. closeups on Sedol’s nervous hands)
- Musical score
- Editing

2. What is the point-of-view of the film-maker? Does he side with man over machine or the other way around? Or does he try to stay impartial and just present the facts in a balanced way? Explain.

RESOURCES for FURTHER LEARNING:

HISTORY and ORIGINS OF THE GAME “GO”

<http://www.usgo.org/brief-history-go>

LEARN HOW TO PLAY GO

Learn how to play GO and start a club at your school at the American Go Association's website—for Kids and Teens.

http://www.tigersmouth.org/viewpage.php?page_id=2

HISTORIC CHESS MATCH:

Grandmaster Gary Kasparov vs. Deep Blue by IBM

<http://www.espn.com/video/clip?id=11694550>

<http://www-03.ibm.com/ibm/history/ibm100/us/en/icons/deepblue/>

Compare and contrast the chess and GO matches against computers. How are the event outcomes similar or different? Compare and contrast the reactions and strategies of Kasparov and Sedol. Compare how Kasparov reacted to being beaten by the computer to how Hui and Sedol reacted?

DEEPMIND: Excellent youtube video about DeepMind. Important Viewing!!!

Google's DeepMind Explained—Self-Learning A.I.

<https://www.youtube.com/watch?v=TnUYcTuZjpM>

TED TALKS: Negative and Positive Implications of Artificial Intelligence

The incredible inventions of intuitive AI | Maurice Conti

What do you get when you give a design tool a digital nervous system? Computers that improve our ability to think and imagine, and robotic systems that come up with (and build) radical new designs for bridges, cars, drones and much more -- all by themselves. Take a tour of the Augmented Age with futurist Maurice Conti and preview a time when robots and humans will work side-by-side to accomplish things neither could do alone

<https://www.youtube.com/watch?v=aR5N2jI8k14>

Can we build AI without losing control over it?/Sam Harris

Scared of superintelligent AI? You should be, says neuroscientist and philosopher Sam Harris -- and not just in some theoretical way. We're going to build superhuman machines, says Harris, but we haven't yet grappled with the problems associated with creating something that may treat us the way we treat ants.

<https://www.youtube.com/watch?v=8nt3edWLgIg>

Star Trek Voyager, Season 2, Episode 17 "Dreadnought." Implications and consequences of a complex weapon that can think for itself.

WHAT'S NEXT FOR ALPHA GO?

AlphaGO blog: <https://deepmind.com/blog/exploring-mysteries-alphago/>

Learn about the next planned competitions between AlphaGO and elite GO players in China in 2018. Read more about the impacts of AlphaGo on the future of GO game strategies and its applications in other areas.

EXPLORE STEM CAREERS:

US Department of Labor's Occupational Outlook Handbook Career Exploration has a career-interest inventory and access to information, videos, and charts about job projections, and data.

<http://www.bls.gov/k12/students.htm>

Washington Career Bridge is a product of the WA Workforce Training and Education Coordinating Board. It provides: a career quiz for students to assess their interests, a college search, state labor market data on how much jobs pay in Washington, and detailed information on nearly 6,000 education programs, including performance results for those programs. The site also includes a Pay for School section, giving students and their families information on how to fund their education.

www.CareerBridge.wa.gov