



# A History of Serious Games

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# Resource vs. Presentation

- There is way too much material here to talk through in 90 minutes.
- This slide deck is meant to be a shared resource for the community.
- You will find it posted at
  - ❖ Modelbenders.com
    - Select “Technical Papers”
  - ❖ Slideshare.net
    - Search “History of Games”





# Industries Using Serious Games



## Military



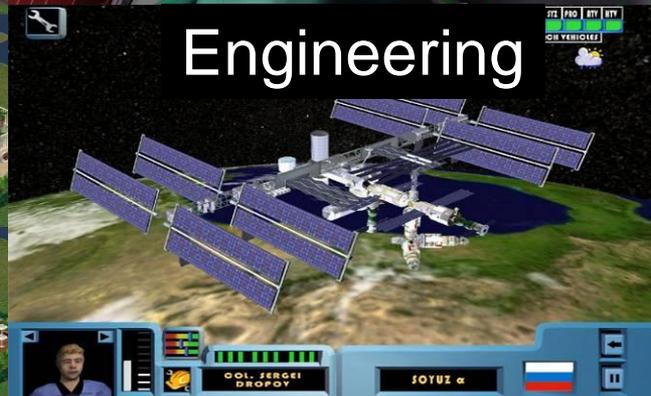
## Medicine



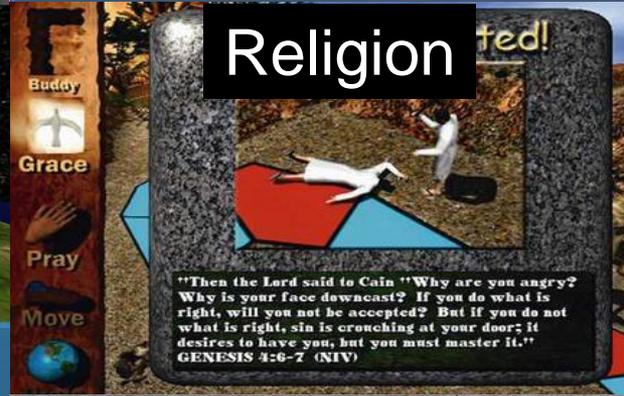
## Emergency Mgt



## City Plan



## Engineering



## Religion



## Space Explore



## Machinima



## Politics



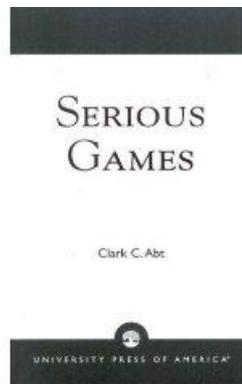
- Ancient Games
- Board Games
- Military Games
- Electronic Games
- Edutainment
- Serious Games
- References via Wikipedia

# 1970 Serious Games Definition

“Reduced to its formal essence, a game is an activity among two or more independent decision-makers seeking to achieve their objectives in some limiting context. A more conventional definition would say that a game is a context with rules among adversaries trying to win objectives.

“We are concerned with serious games in the sense that these games have an explicit and carefully thought-out educational purpose and are not intended to be played primarily for amusement.”

Abt, C. (1970). *Serious Games*. New York: The Viking Press.



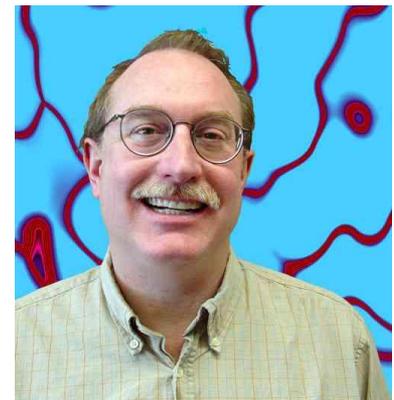
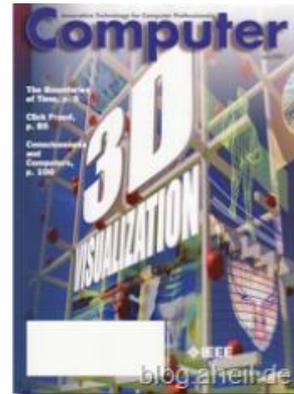
# 2005 Serious Games Definition

**Game:** “a physical or mental contest, played according to specific rules, with the goal of amusing or rewarding the participant.”

**Video Game:** “a mental contest, played with a computer according to certain rules for amusement, recreation, or winning a stake.”

**Serious Game:** “a mental contest, played with a computer in accordance with specific rules that uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives.”

Zyda, M. (September 2005). “From visual simulation to virtual reality to games”.  
*IEEE Computer.*



- **Ancient Games**
- Board Games
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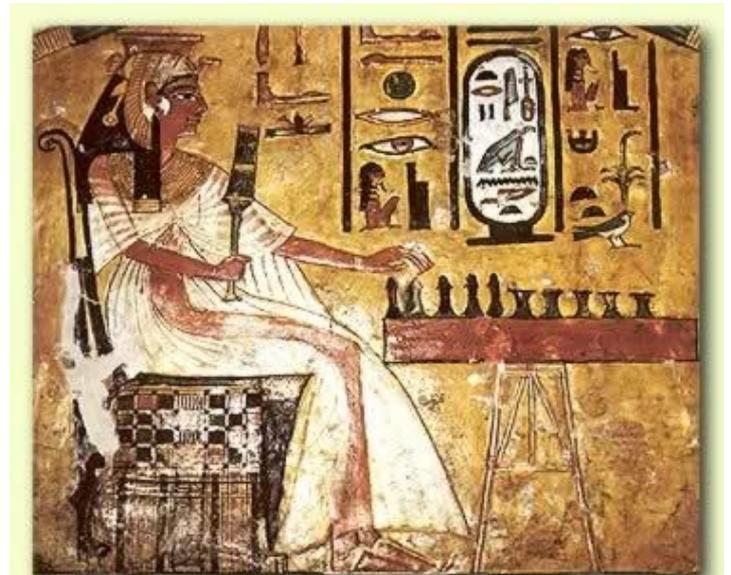
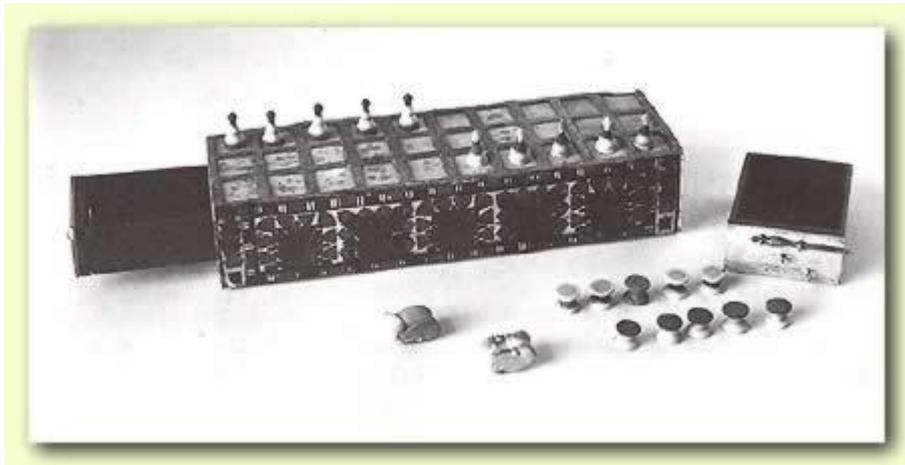
# Dice, 3000BC

- Fortunetelling with Sheep's Knuckle Bones came from India to Africa around 40,000BC
- ★ But the earliest known dice were from Iran around 3,000BC
- Note the idea that the game contains and reveals knowledge that is otherwise hidden from the player.
  - ❖ In 3,000BC this knowledge was extracted from mystic sources – the mists of superstition
  - ❖ In 2,000AD the knowledge is extracted from complexity – the mists of mathematics and logic



# Senet, 3000BC

- Move 7 pieces around the Senet board
  - ❖ Used knucklebones as dice\*
- Egyptian Ancestor to Checkers or Draughts
- Religious mysticism. The space you end at forecast good or bad fortune
- ★ Entertainment and a mystical window



# Royal Game of Ur, 2600BC

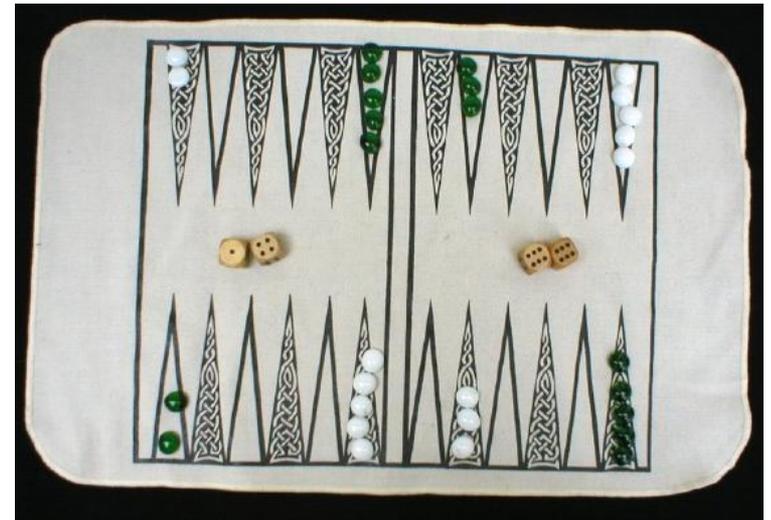
- Game is called “Ur” for the city where it was found.
- A race competition for 2 players around the board and back to the beginning\*
- Rosettes give player another turn\*
- The next step is using dice\*



\* Indicates historical opinion. No direct evidence available.

# Backgammon, 2500BC

- ★ Also found at Ur
  - ❖ Perhaps the Las Vegas gaming equivalent of the ancient world
- Combines luck (dice/sticks), skill (choice of move), and power of the gods (rules)
- Throwing sticks are early 2-sided dice
  - ❖ Also early version of “coin toss”



# Liubo, 1500BC

- Chinese game of battle that morphed into a racing game between 1500BC and 1200AD
  - ❖ Generals and Pawns
  - ❖ Become Fish, Owls, and Stones
- As with many others the exact rules have disappeared



# Mancala, 1400BC

- Began as an accounting tool for trading goods
- Evolved into a form of entertainment
  - ❖ A means of gambling on cattle, sheep, and goods
- Does being good at Mancala make you better at trading animals and food?



# Lessons Learned

- Games have always had a serious purpose
  - ❖ Fortune Telling
  - ❖ Religious Divination for Weather, Politics, Disease
  - ❖ Accounting for crops, animals, and trade
  - ❖ Battle Planning
  - ❖ Gambling
- Game mechanisms began to emerge 5000 years ago
  - ❖ Random number generator, playing board, rules, strategies
- “Serious” is from the perspective of the society
  - ❖ Fortune Telling and Divination in 3000BC are equivalent to the use of mathematics and science in 2000AD to understand a complex universe and to make intelligent decisions

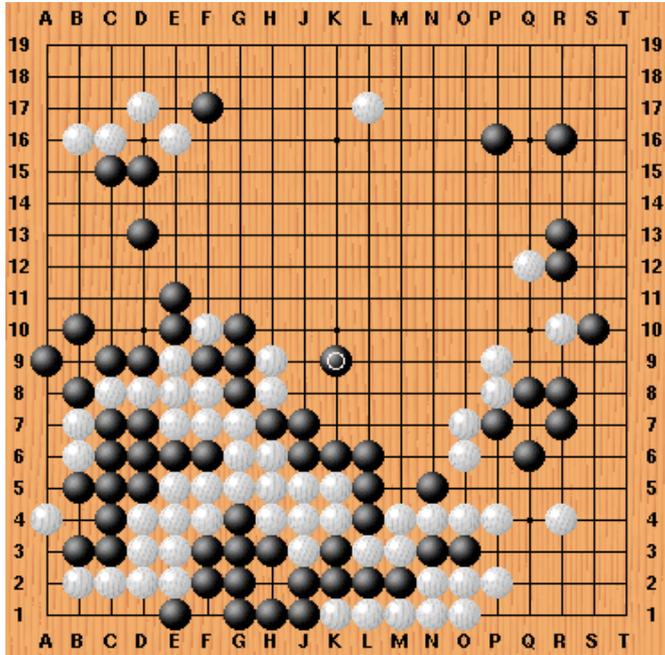
- Ancient Games
- **Board Wargames**
- Military Games
- Electronic Games
- Edutainment
- Serious Games
- References via Wikipedia

# Wei Hai, 3000BC

- ★ Name means “encirclement”
- Abstract board on which players placed colored stones
- Details of game have not survived
- Believed to be similar to Japanese game of *Go*



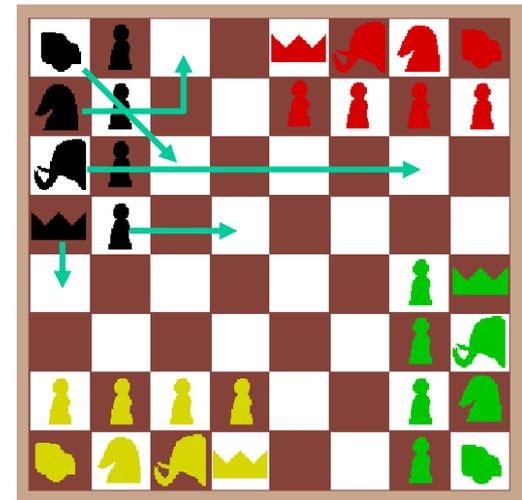
# Go, 2300BC



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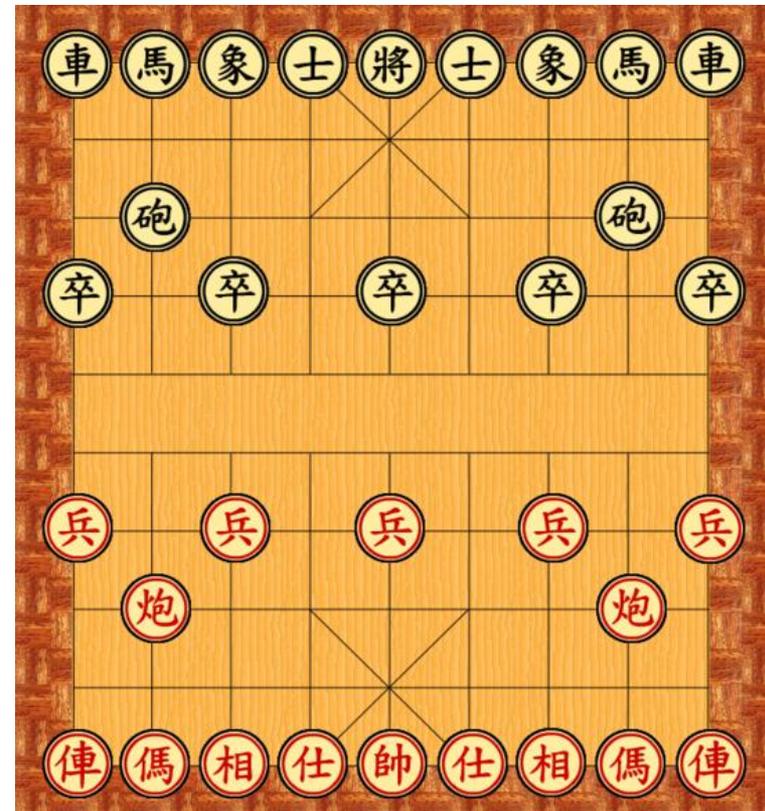
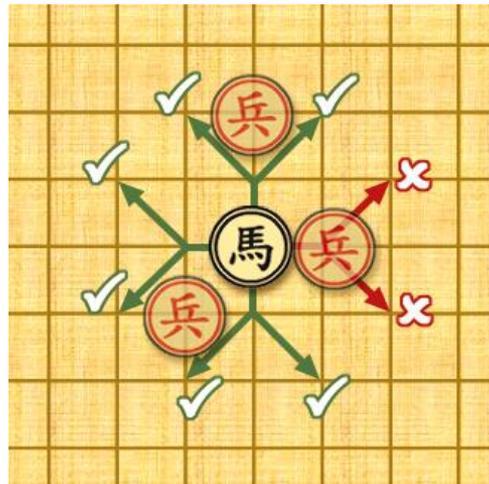


# Chaturanga, 500BC



# Xiangqi, 200BC

- Influences of Go and Chaturanga
  - ❖ Encirclement
  - ❖ Unique identity to pieces
  - ❖ Strategic movement of pieces
- Used for military strategy
- Korean variant “Janggi”
  - ❖ No central river



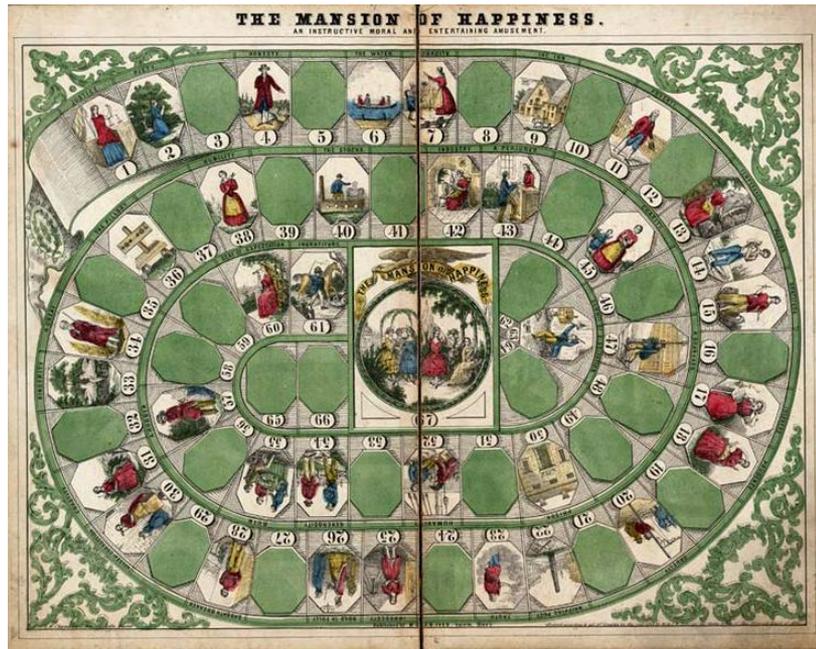
# ★ Chess, 500AD

- European evolution of Indian Chaturanga
- “Checkmate” is English form of Persian “Shah Mat”, which means “dead king”



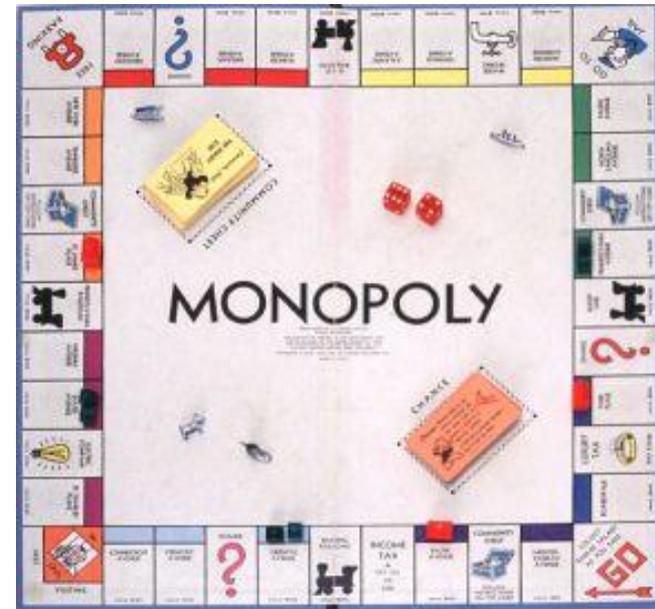
# Mansion of Happiness, 1843

- Serious Game of its time ... Social Principles and Morals
  - "WHOEVER possesses PIETY, HONESTY, TEMPERANCE, GRATITUDE, PRUDENCE, TRUTH, CHASTITY, SINCERITY...is entitled to Advance six numbers toward the Mansion of Happiness.
  - WHOEVER gets into a PASSION must be taken to the water and have a ducking to cool him...
  - WHOEVER possesses AUDACITY, CRUELTY, IMMODESTY, or INGRATITUDE, must return to his former situation till his turn comes to spin again, and not even think of HAPPINESS, much less partake of it."
- An entertainment of young George Parker



# Monopoly, 1936

- George Parker founded Parker Brothers in 1883
  - ❖ Invented *Banking* in 1887
  - ★ Bought Monopoly rights from Charles Darrow in 1936
- Monopoly games distributed by the Red Cross to POWs in WWII
  - ❖ Board contained 2 files and a compass
  - ❖ Hollow piece contained a map of the area printed on silk
  - ❖ Real German, Italian, and Austrian money was mixed with the play money



# Scrabble, 1938

- Alfred Butts created and manufactured the game at home in 1938
  - ❖ Failed to Sell Any
- James Brunot bought the rights in 1948
  - ❖ Failed to Sell Any
- In 1952 Jack Strauss, President of Macy's, played the game on vacation and placed a big order for his stores
  - ❖ Letter counts unchanged from 1948. Rules simplified.



# Family Board Games, 1920+

- Stratego, 1920, Diplomacy, 1954, Risk, 1959
- Wargaming quick and fun
- Diplomacy was originally a play-by-mail game
  - ❖ Format often used for strategy games like chess and wargames



# Lessons Learned

- The board game form and the rules that govern it evolved over many centuries
- Strategies for controlling territory vs. capturing enemy pieces have been at odds for over 2000 years

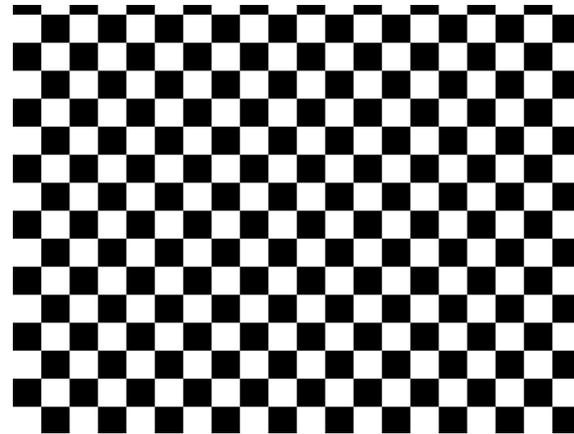
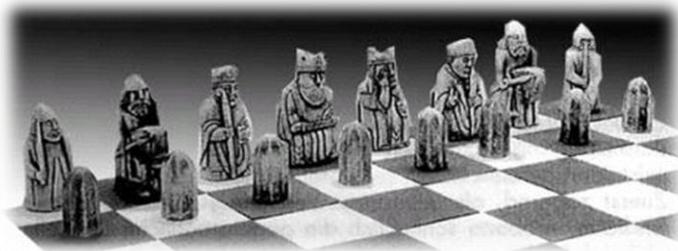
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# Wargaming in the Dirt



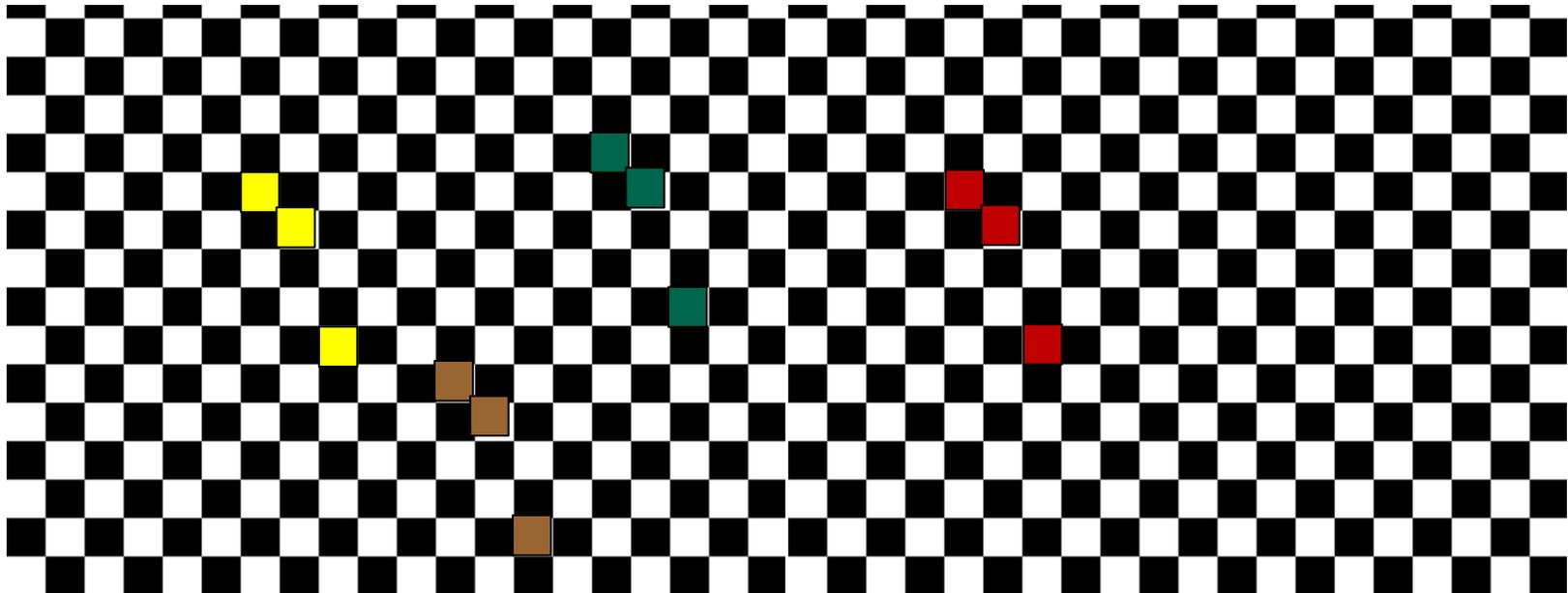
# Koenigspiel, 1664

- Invented by Christopher Weikmann
- 1664 Ulm, Germany
- Checkered Board with 30 Pieces
- King, Marshall, Colonel, ... Private



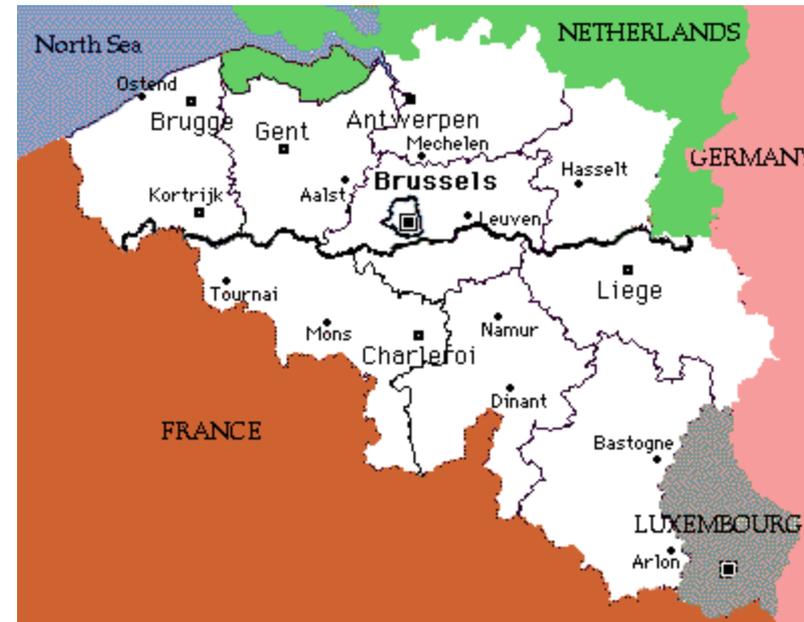
# War Chess, 1780

- Invented by Dr. C.L. Helwig
- 1780 Germany
- 1666 squares, 120 pieces
- Squares colored for terrain feature
- Aggregate units - Infantry, Cavalry, Artillery



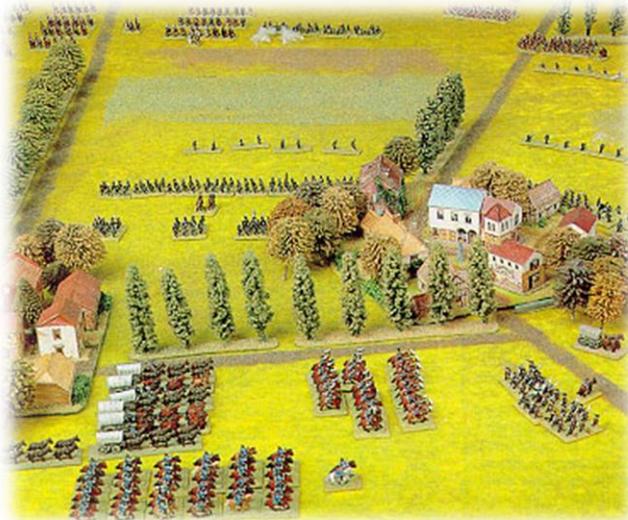
# Military School Wargame, 1797

- “Rules for a New Wargame for the Use of Military Schools”
- Invented by Georg Venturini in 1797
- 3600 squares
- ★ French-Belgian Border



# Kriegsspiels, 1811

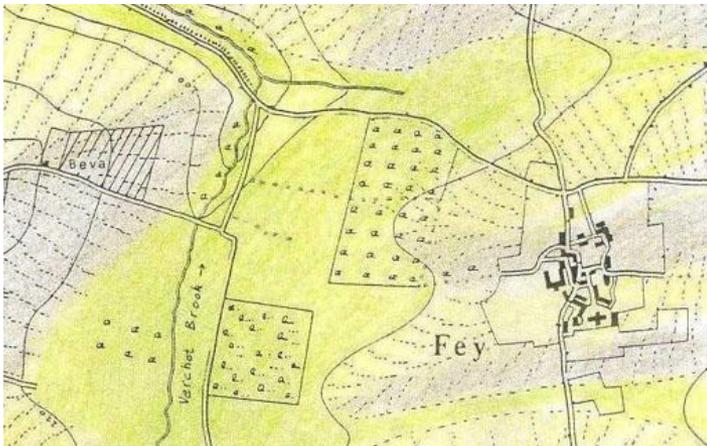
- Invented by Baron von Reisswitz in 1811
- Contoured terrain, porcelain soldiers
- Introduced the “General Idea”
  - ❖ Unique Scenario with Victory Conditions



# The American Kriegsspiel, 1879



- William Livermore and Hugh Brown in 1879
- Variable unit icons with strength, type, fatigue, ammunition, and task time indicators
- Topographic Maps
- Pegs-and-Holes firing board



# Naval War College, 1886

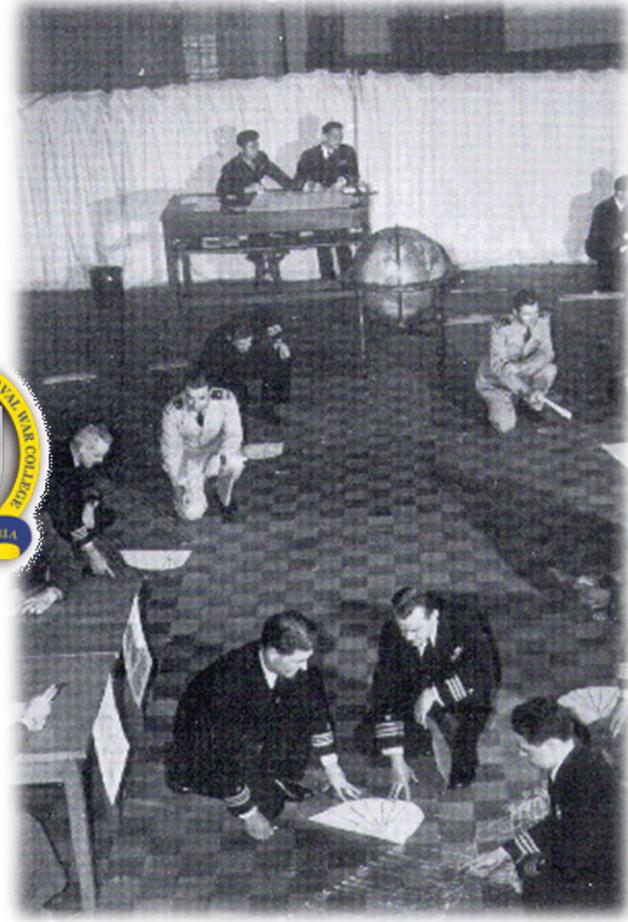
- Opened in 1884
  - ❖ Develop operational war fighting concepts through research and wargaming
- Wargaming introduced in 1886 by William McCarty-Little
  - ❖ Cardboard Ships and Gridded Paper
  - ❖ 1895 Studied British Naval Attacks on New York Harbor
- ★ 1897 Teddy Roosevelt presented new problem
  - ❖ Japanese/American fight for Hawaii



# Naval War College, 1900s



1895



1947



1914

# Birth of Miniature Games, 1903

- “The Naval Wargame”, *Scientific American*, 1903 by Fred T. Jane
  - ❖ Rules and tools for naval games of war
  - ❖ Later author of *Jane’s Fighting Ships*
- *Little Wars*, 1913 by H.G. Wells
  - ❖ Miniature soldiers and cannon
  - ❖ Terrain board & rules of operation
  - ❖ Championed firing toy cannons rather than calculations for determining outcome of war



# Lanchester Equations, 1912

- 1912 Differential Equations
- Predict combat outcomes based on historical data
- Establish a scientific basis for making combat decisions
- Create fundamental mathematical equations which capture the reality of combat

- Square Law (Direct Fire)

$$\frac{dD}{dt} = -k_d A$$

- Linear Law (Indirect Fire)

$$\frac{dD}{dt} = -k_d A D$$

- General Law

$$\frac{dD}{dt} = -k_d A^t D^t$$



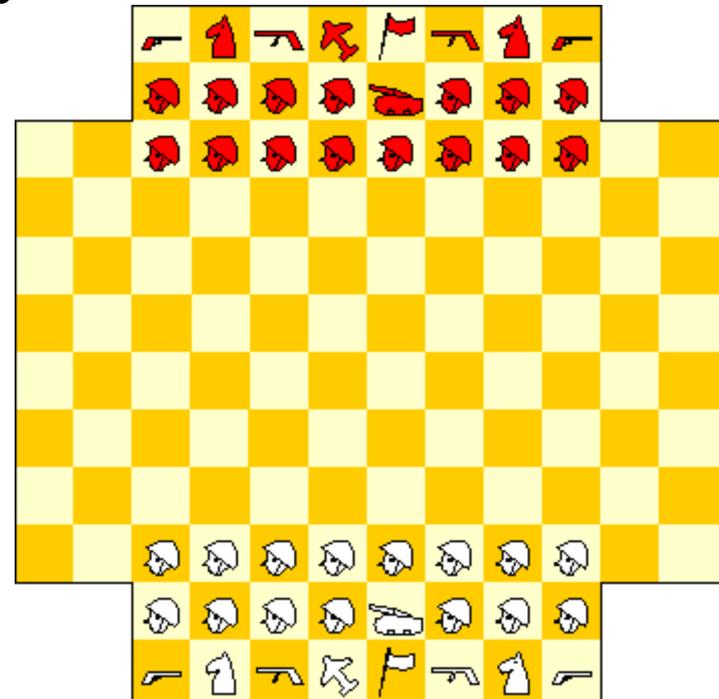
# Political-Military Gaming, 1929

- Invented by Eric von Manstein
- Explored German invasion of Poland
- Included players at many levels of leadership:
  - ❖ President of the League of Nations
  - ❖ Cabinet Members of Germany and Poland
  - ❖ Diplomats from both countries
  - ❖ Military Generals



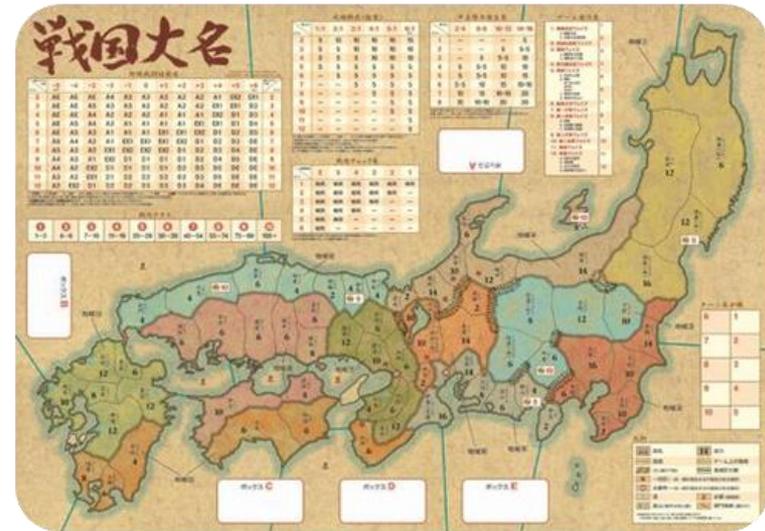
# Soviet Kriegsspiel, 1933

- Chess board with 2 rows added to each edge, 128 squares
- 24 pieces on each side
- Explicit representation of military forces of the early 20<sup>th</sup> century



# Japanese Wargaming, 1941

- Fall 1941 Japanese gamed Pearl Harbor Attack
  - ❖ Japanese War College in Tokyo
  - ❖ Partial success of attack is credited to wargames
- May 1943 gamed Battle of Midway
  - ❖ Aboard the Yamato, Flagship of the Combined Fleet
- Tokyo Naval War College
  - ❖ Host for regular “Table-top maneuvers”



# Game Theory, 1943

- Pioneered by John von Neumann
- The theory of decision making
- Analyzing consequences of actions in light of the actions of an opponent
- Maximize the desired outcome



		Attack				
		A	B	A	B	
A	39	30	A	15	24	Defend
B	24	42	B	30	12	

# First Computer Wargames, 1948

## Army Operations Research Office at Johns Hopkins University

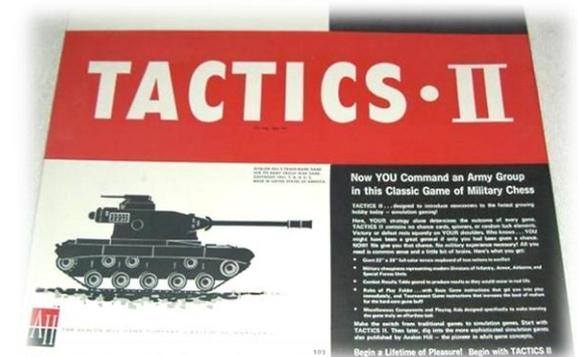
- “Air Defense Simulation”
  - ❖ Hosted on the Univac computer
  - ❖ North American air defense
  - ❖ Naval anti-aircraft guided missiles
- **CARMONETTE**
  - ❖ 1953 Computerized Monte Carlo Simulation
  - ❖ Tank/Anti-Tank (v.I), Infantry (v.II), Helicopters (v.III), Communications (v.IV)
  - ❖ Operational 1956-1970



Univac I

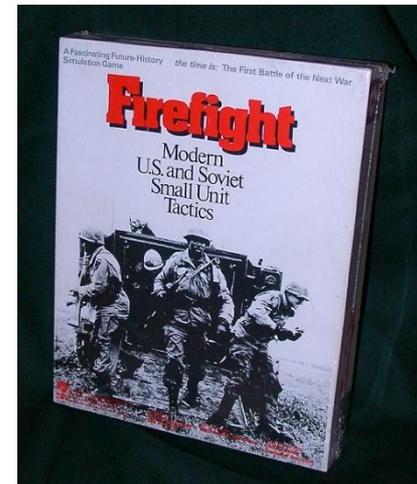
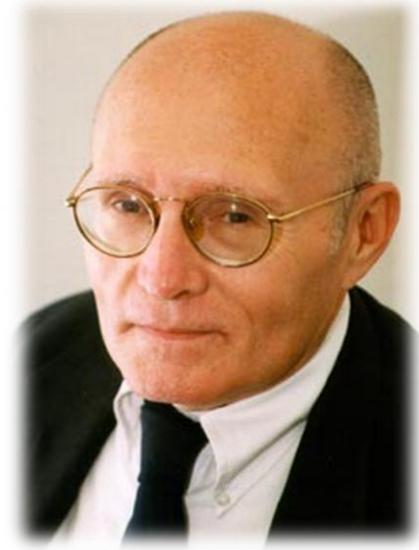
# Charles Roberts, 1952

- Roberts invents board game to “practice war” while awaiting his commission
- Introduces primary pieces
  - ❖ Grid System
  - ❖ Terrain Types
  - ❖ Military Units with Ratings
  - ❖ Combat Results Table
  - ❖ Die Role
- Published as “Tactics” in 1954
  - ❖ Sold 2,000 copies from 1954-58
- Started Avalon Hill in 1958



# Defense & Hobby Crossover, 1974

- “War games are the hobby of the over-educated.”
  - » Jim Dunnigan, SPI Founder
- DOD hires Simulation Publications Inc. (SPI)
  - ❖ 1974 Firefight - Platoon leader training
  - ❖ 1980 Strategic Analysis Simulation - Global warfare
  - ❖ \$40,000 contract to Jim Dunnigan

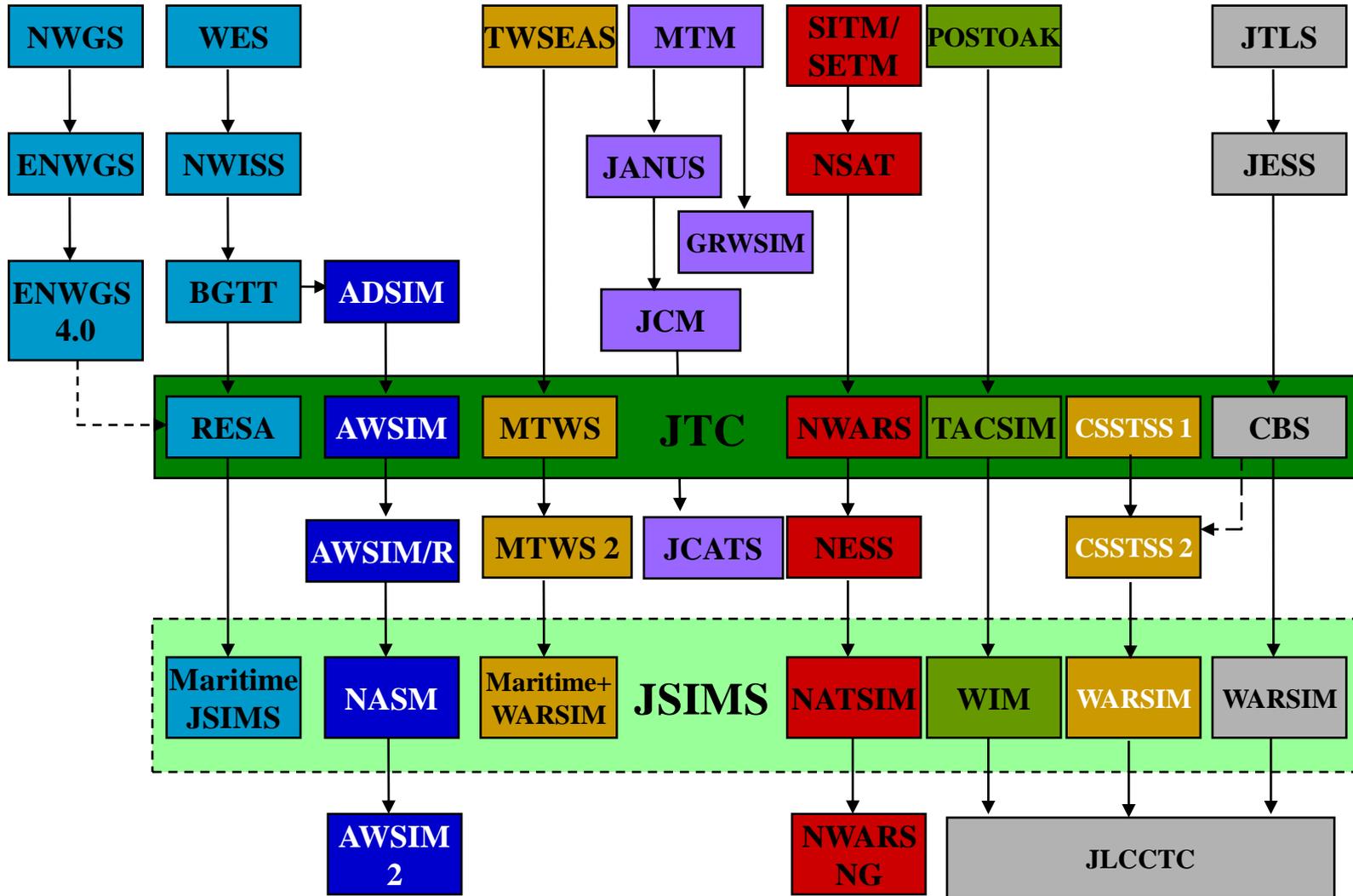




# Naval Warfare Gaming System, 1985

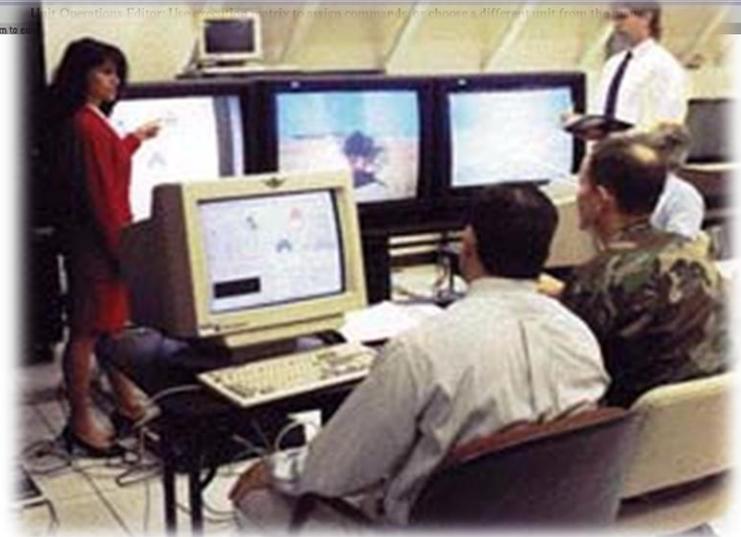
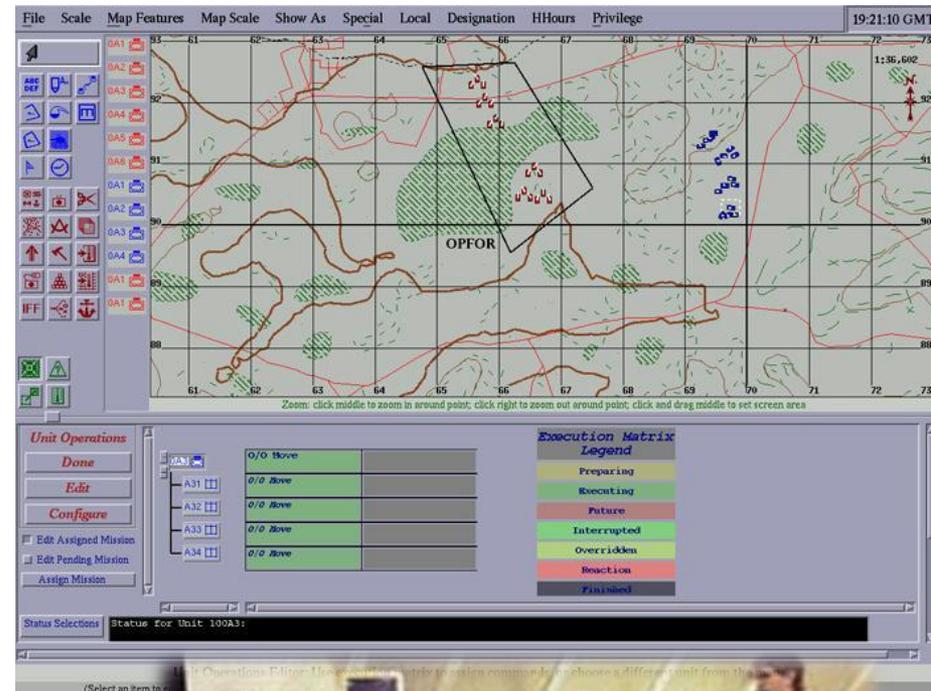


# Military Computer Wargaming Evolution



# ModSAF, 1990's

- Semi-Automated Forces systems are constructive simulations designed to stimulate virtual systems
- Operated like a wargame
- Data stream like a simulator
- Human orders augmented by AI



- The sophistication of modeling advances hand-in-hand with available computer technology
- The crossover of Entertainment and Serious applications is not new
  - ❖ It was part of ancient games. It was part of gaming in the 1800's and the 1950's

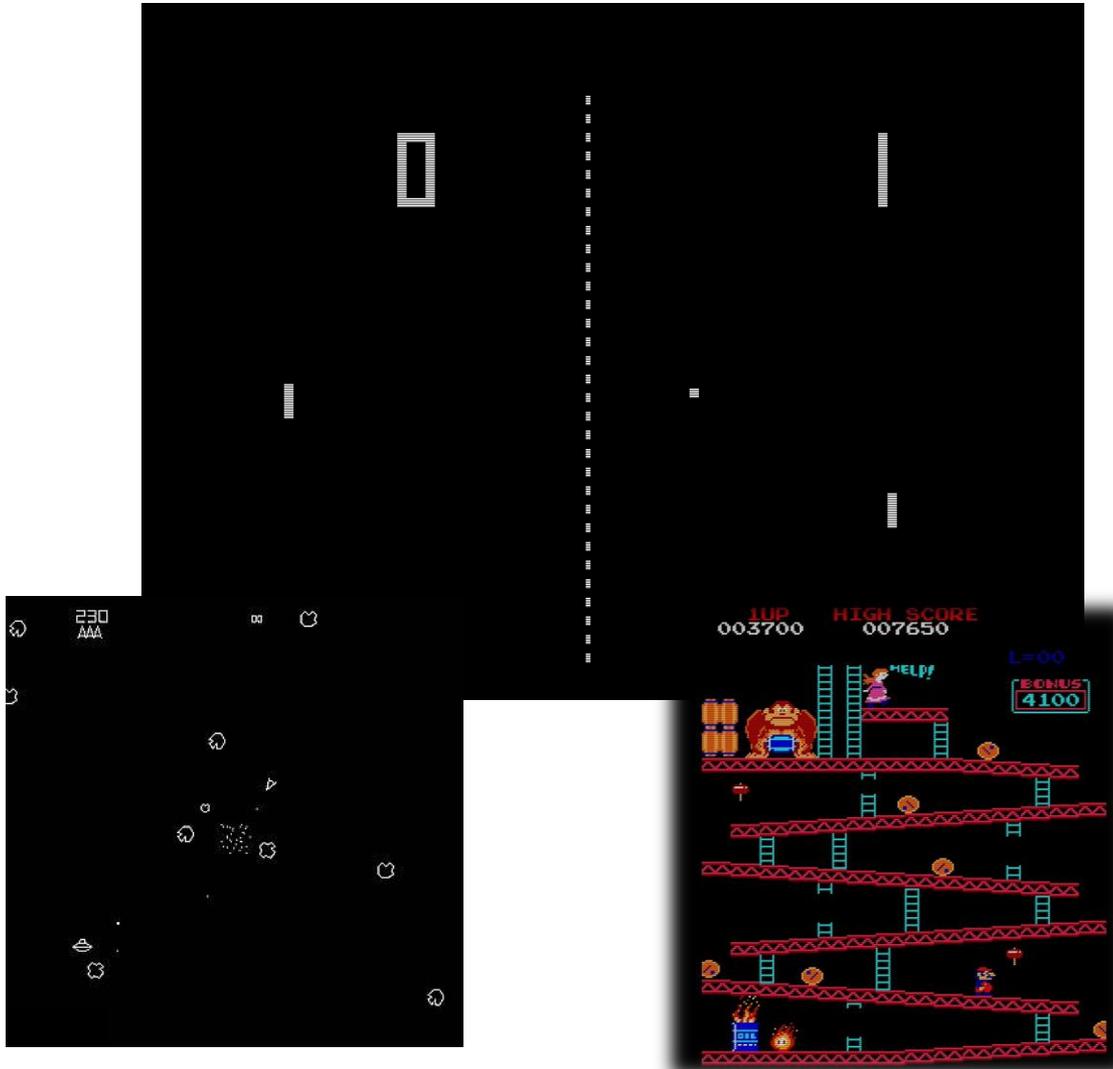
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# Spacewar!, 1961

- ★ First interactive computer game was invented at MIT
- Built on the DEC PDP-1 computer
- Used circular CRT



# Pong, 1972



© Copyright Atari

# Home Game Consoles, 1972



Magnavox Odyssey, 1972



Atari 2600, 1983



Nintendo Entertainment System, 1984



Sega Genesis, 1989



Super NES, 1991



Sega Saturn, 1994



Sony Playstation, 1995



Nintendo 64, 1996



Sega Dreamcast, 1998



Playstation 2, 2000



Game Cube, 2001



Microsoft X-Box, 2001



X-Box 360, 2005



Nintendo Wii, 2006



Playstation 3, 2006



# Panzer General, 1996

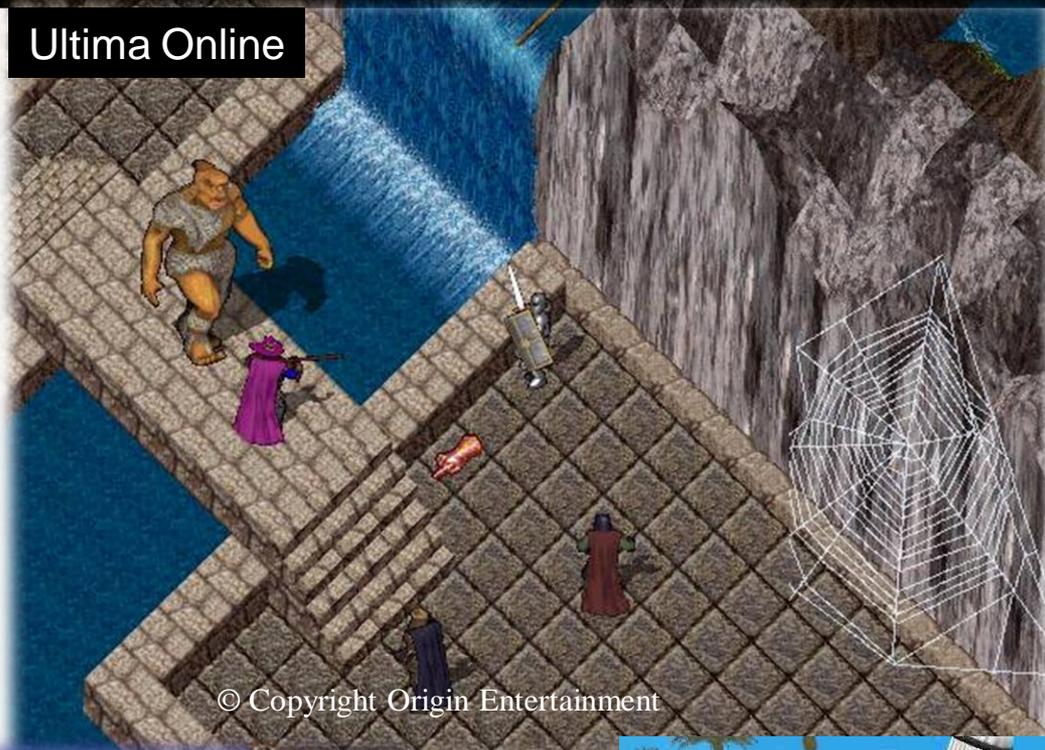
- Board game moved to the computer
- Add animation, sound, smoke, and fire – which do not effect the outcome, just the excitement



© Copyright SSI Software

# MMORPG, 1997

Ultima Online



© Copyright Origin Entertainment

WoW



© Copyright Blizzard Entertainment

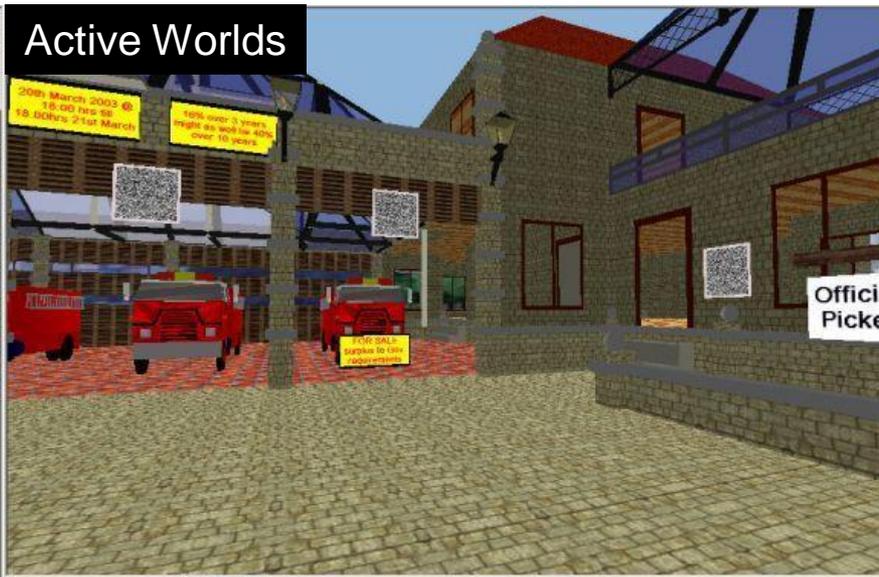
Everquest



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# Virtual Worlds, 1997

## Active Worlds



## The Sims Online



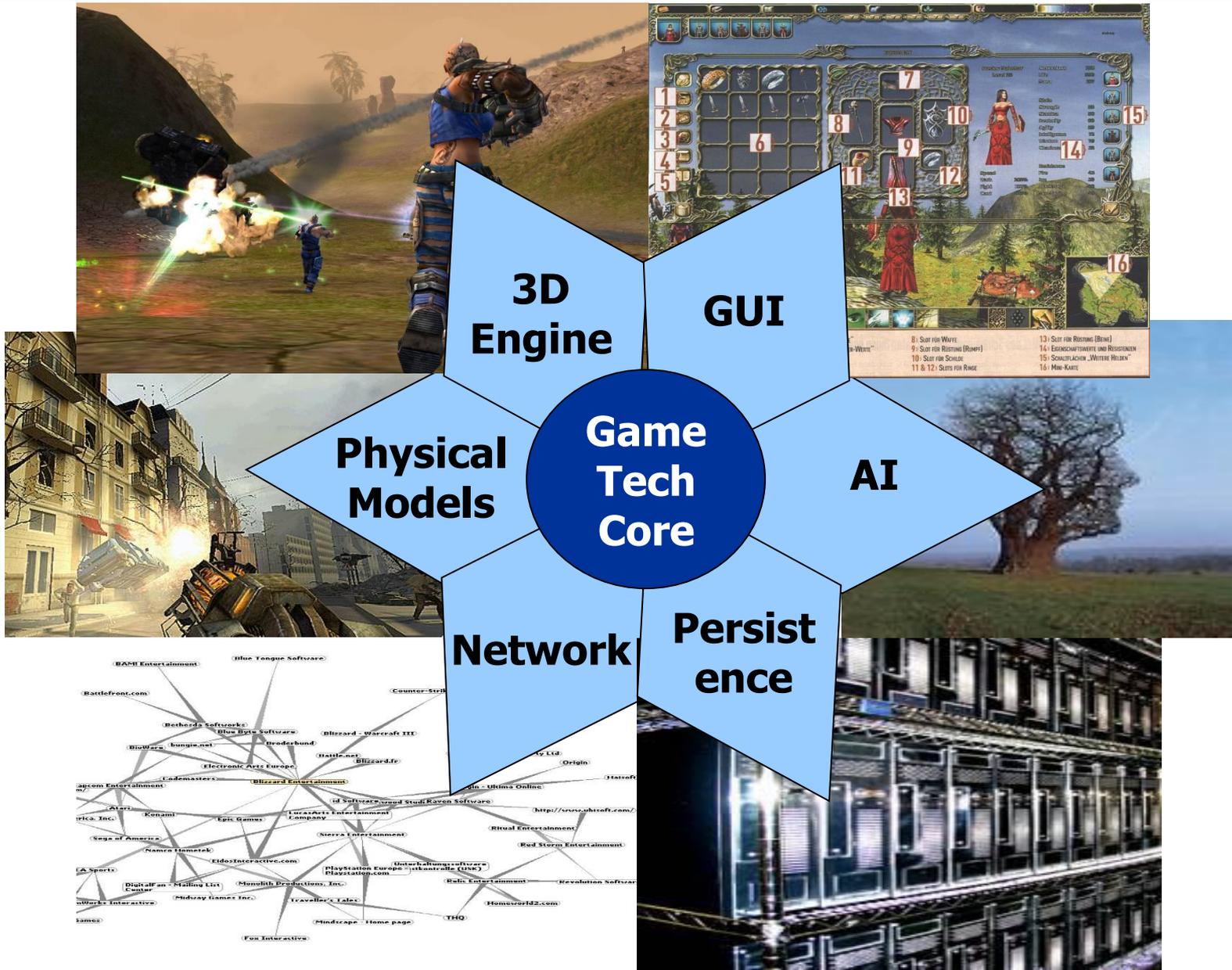
## There.com



## Second Life



# Game Technologies



- Computer games are one combination of a number of important computer technologies
- The “serious use” of games is another combination of these technologies
  - ❖ It is motivated by the gaming applications, but not identical to it

- Ancient Games
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# Educational Television, 1969

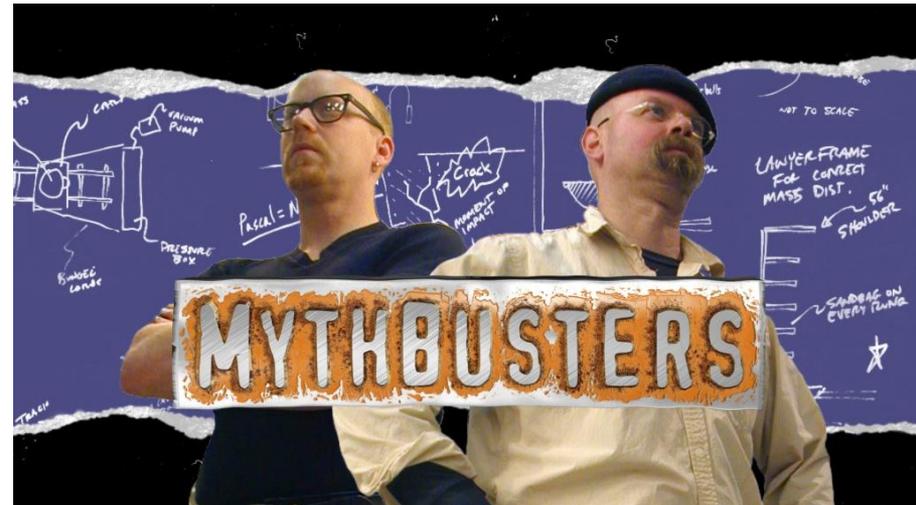
## ➤ From Sesame Street

- ❖ Started: November 10, 1969
- ❖ Numbers, Letters, Spelling, Math, Behavior, Social Issues



## ➤ To Mythbusters

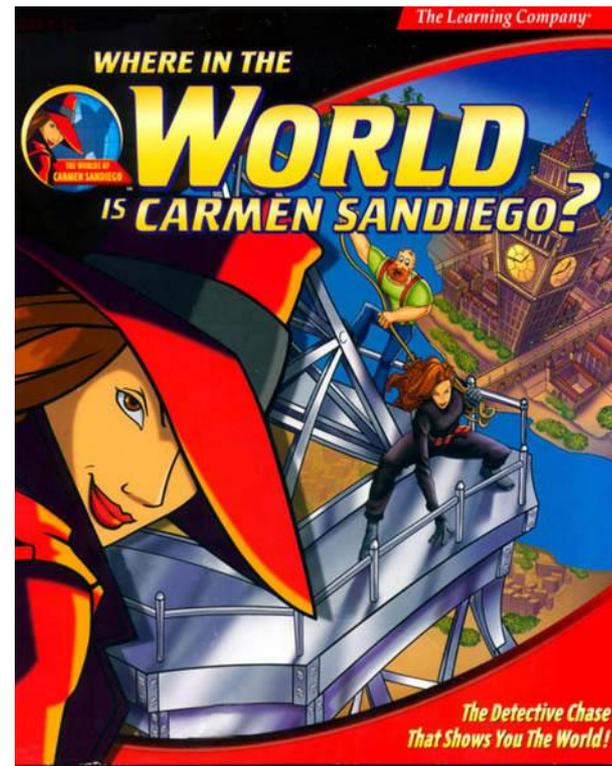
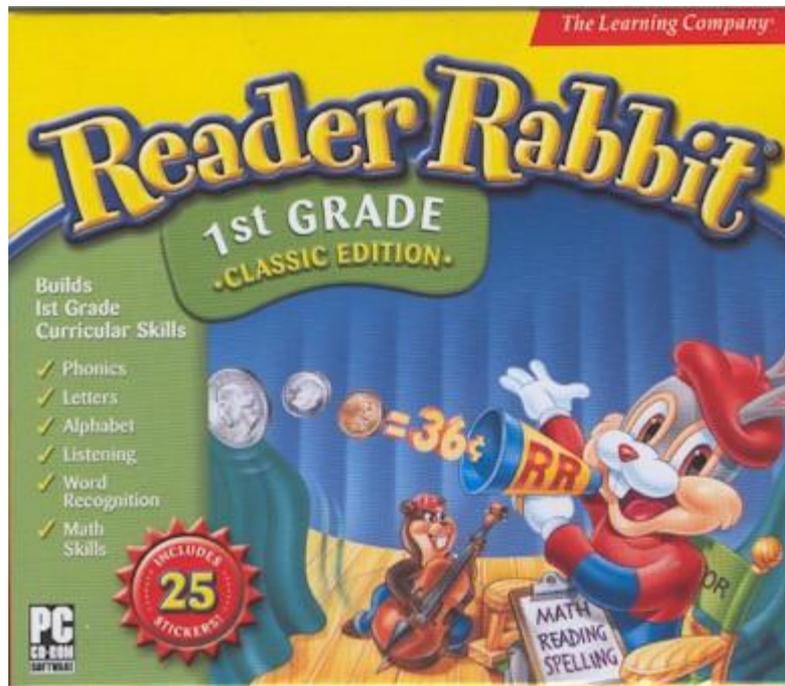
- ❖ Started: July 2006
- ❖ Science, Engineering, Methods of Experimentation



Up until the late 1960s, the use of television as an educational tool in the US was “unproven” and “a revolutionary concept” (Borgenicht, 1998)

# Educational Games, 1986

- Jump Start
- Math Blaster
- Reader Rabbit
- Carmen Sandiego



WHERE IN THE  
**WORLD**  
IS CARMEN SANDIEGO?



- Ancient Games
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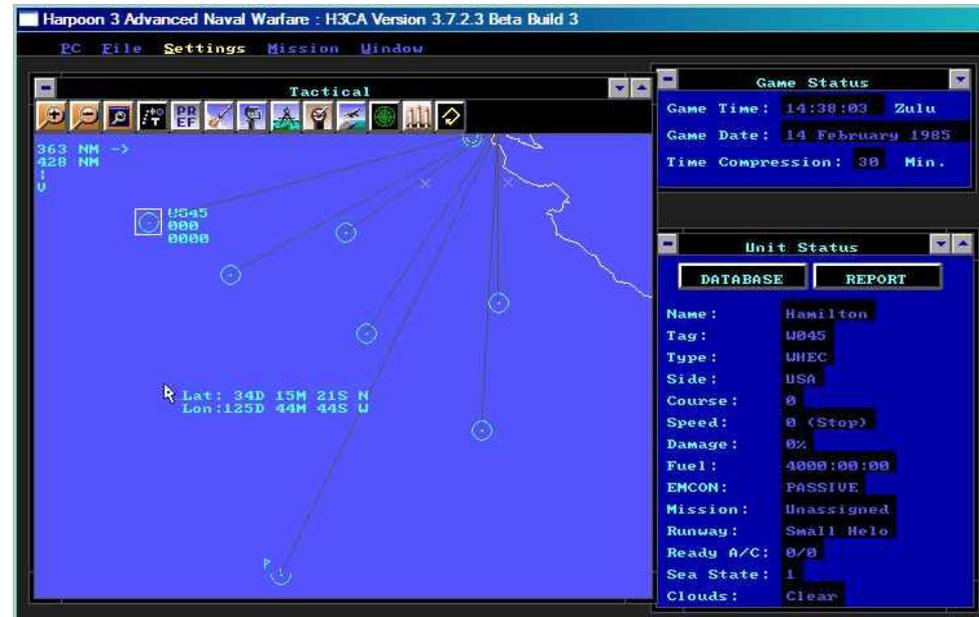
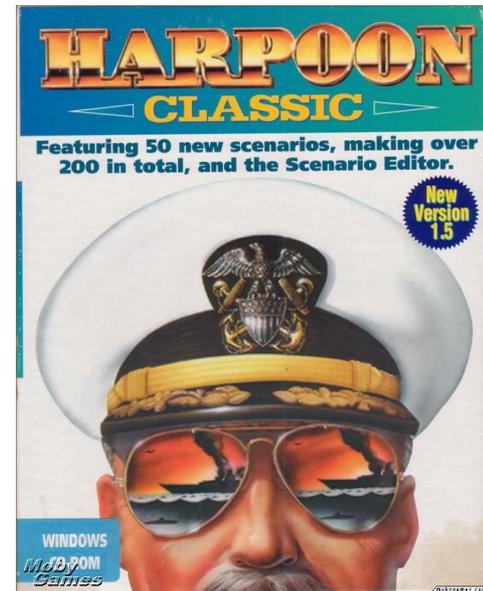
# SGI Flight, 1983

- **1983 Silicon Graphics demo program**
  - ❖ Written by Gary Tarolli
  - ❖ Inspired by Blue Angles air show at Moffett Field
  - ❖ Sales tool for SGI computers
- **Networking added in 1984**
  - ❖ Two machines on a serial cable
  - ❖ No interactions
  - ❖ 7 frames-per-second
  - ❖ Demonstrated at SIGGRAPH 1984
- **1985 Modification of Flight program**
  - ❖ Added shooting interactions
  - ❖ Message packets transmitted at frame rates
  - ❖ 10 player max because of bandwidth limitations
  - ❖ Dead reckoning added later to reduce network flooding



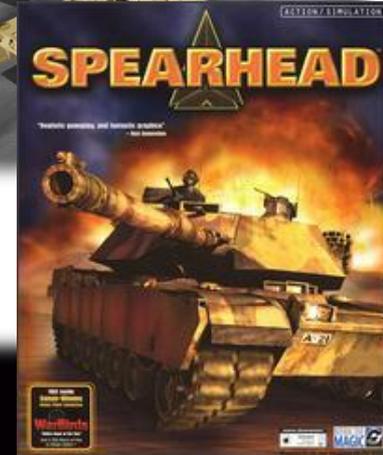
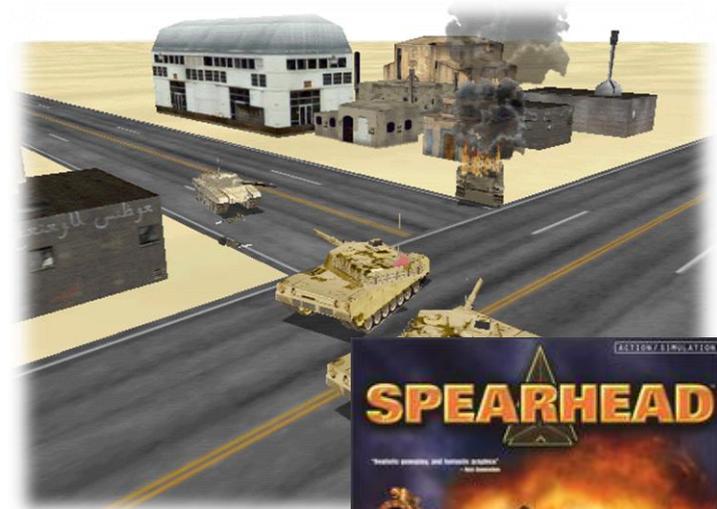
# Harpoon, 1989

- Based on miniature game by Larry Bond
- Two-sided naval combat during Cold War
- Entertainment and Military versions



# Spearhead, 1998

- MaK teamed with Interactive Magic
- Game version of SIMNET and DIS
- “DIS-lite” to support network multiplayer
- Allows all 4 tank station play
- Infrared visuals
- Typical military training levels



# Political & Medical Gaming

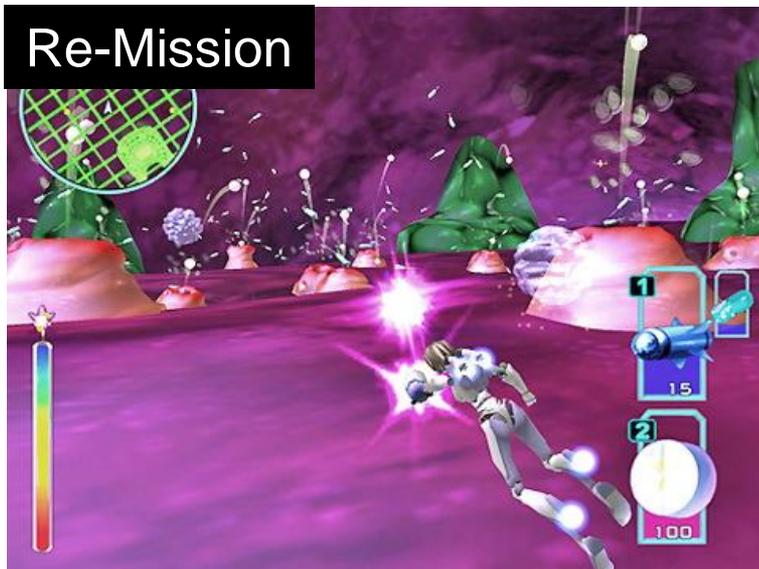
## Peacemaker



## Dean for America

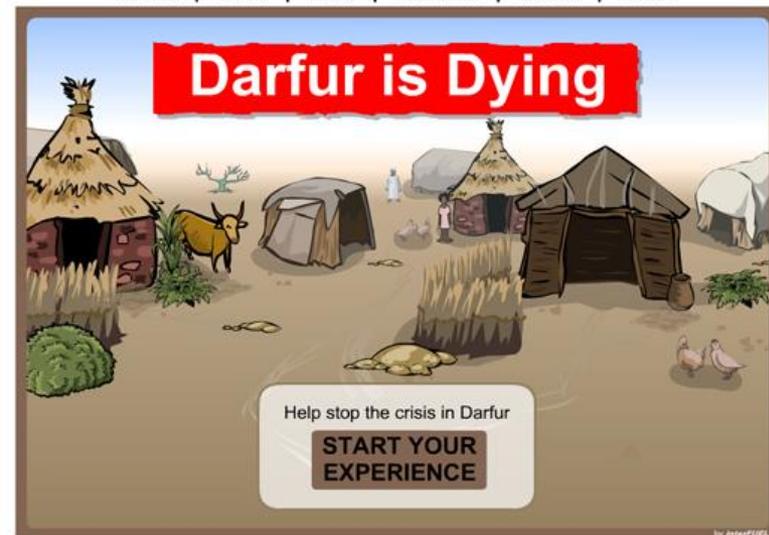


## Re-Mission



SEND TO FRIEND | BACKGROUND | TAKE ACTION | TRANSLATING DEVICE | ABOUT THE GAME | WHO'S PLAYING

## Darfur is Dying



# Religious Gaming

Left Behind



Ominous Horizons



In the story, we are portrayed as the sheep.

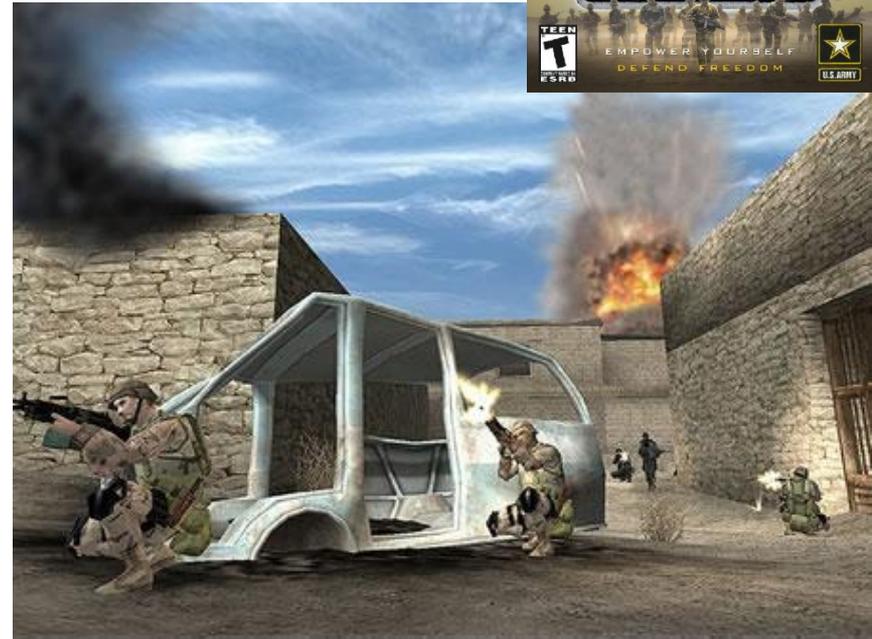
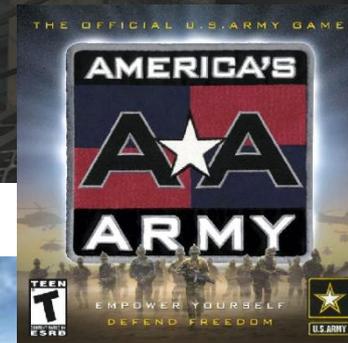
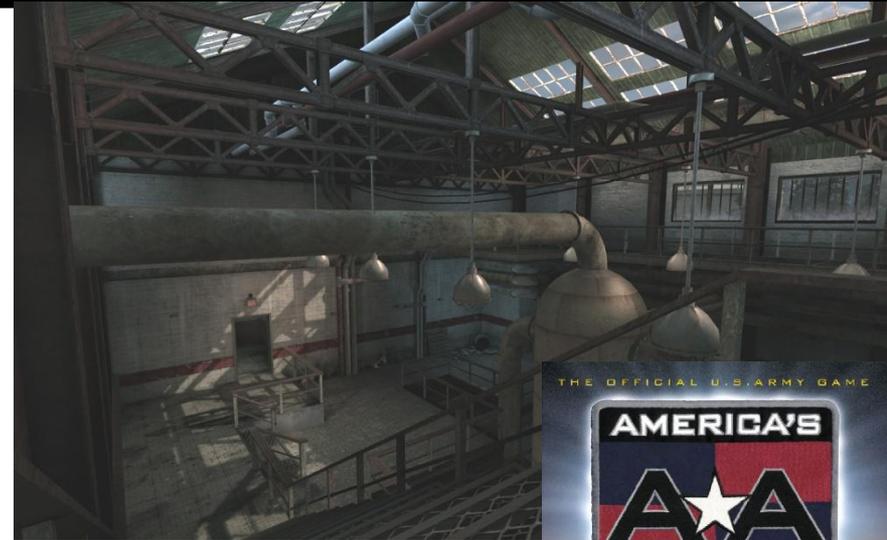
Press T if true or F if false.



Interactive Parables

# Americas Army, 2002

- AKA: Army Game Project
- Army recruiting tool created through partnership between
  - ❖ Army Accessions Command,
  - ❖ West Point, and
  - ❖ Naval Postgraduate School
- Potential recruits experience virtual Army training before entering death match combat levels
- Built on Unreal Engine 1.5, 2.0, 3.0
- Parents: COL Casey Wardynski and Dr. Mike Zyda,
- Multiple Spin-off products. Title is valuable Intellectual Property



# DARWARS AMBUSH, 2003

- DARWARS was a DARPA sponsored project (with JFCOM and USMC PM TRASYS) to create training systems that incorporate games and related learning technologies
- AMBUSH! was the game component built on the Operation Flashpoint game
- Transferred to PEO-STRI in 2006 for deployment to Army Units
  - ❖ Now deployed to 400 sites



# DARWARS Tactical Iraqi, 2003

- Language training game developed within the DARWARS program
- Conceived and created at USC ICT
- Spun-off as a commercial company and product



**Tactical**  
**LANGUAGE**  
**& CULTURE**  
Training System  
by **alelo** INC.



**PLAY.**



**LEARN.**



**COMMUNICATE.**

# Full Spectrum Warrior, 2004

- Joint Army/Entertainment title for the Xbox
- Create a game with entertainment-level quality, but with an embedded Army mission
- Dual-use Applications
- Microsoft agreed to support the title if it could be sold commercially as well
- USC ICT and Pandemic Studios
- Famous for having an Army-mode secret key which was immediately released on the Internet



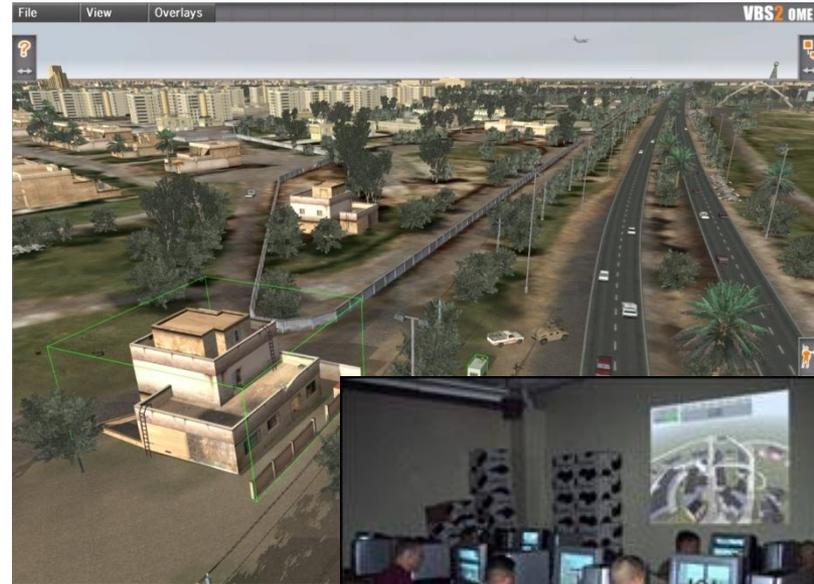
# BiLAT, 2006

- PC, game based, cognitive training tool used for developing skills in how to plan for and conduct successful bi-lateral meetings and/or negotiations in different cultural settings
- Key Learning Objectives – to develop skills in:
  - Negotiation Strategy
  - Cultural Awareness
  - Trust-Building Strategy
- Developed jointly by USC ICT, RDECOM STTC, ARL, and ARI
- Scheduled for deployment by PEO-STRI



# VBS2/Game After Ambush, 2009

- VBS2 from Bohemia Interactive via LaserShot
- \$17.7M contract to replace AMBUSH
- Acquired with out-of-the-box capabilities, no new development to meet requirements
- Scheduled to deliver 70 suites to 53 locations in 2009
  - ❖ Active, Guard, Reserve and Projection units
  - ❖ 3640 computers total
- ★ Licensed for use by anyone in the US Army or any Army project



# Future of Serious Games



## Promising Seeds

- Virtual Worlds
- Military MMOG
- Cloud Simulation
- Mini-Game Portal

## Dependencies

- Cyber Security
- Cloud Assurance
- 3D Web (no Plugin)
- Mobile Assurance

# Serious Games Showcase & Challenge

- Using Serious Games to identify innovative game-based solutions to training problems
- Challenge is open to student teams, small and large business, and government



**SERIOUS games**  
SHOWCASE & CHALLENGE

PRESENTED AT I/ITSEC 2006

**ENTER YOUR SERIOUS GAMES TODAY**

ARE YOU AN ASPIRING SERIOUS GAMES DEVELOPER?  
DO YOU HAVE A GAME BASED SOLUTION TO A MILITARY TRAINING NEED?

Be one of the 12 students and very small business development teams selected to present at the challenge

This is your chance to showcase your work in front of thousands of people on the I/ITSEC show floor

**ENTER YOUR MOD OR ORIGINAL GAME BY JULY 31ST**

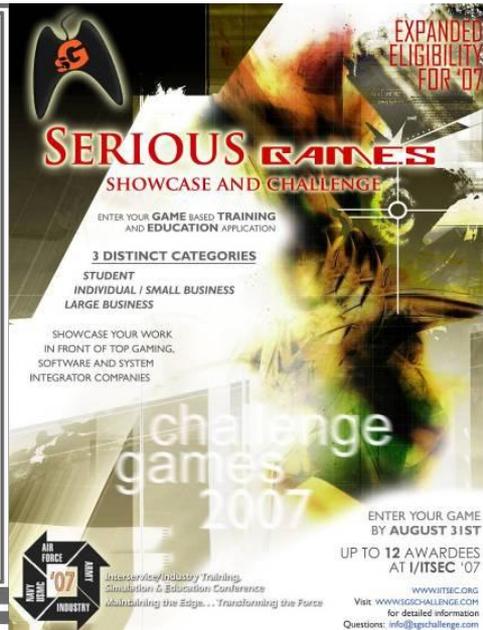
**WIN YOUR SHARE OF OVER \$20K IN CASH AND PRIZES**

WWW.IITSEC.ORG  
WWW.SGSCALLENGE.COM

Contact Barbara McDaniel at [bmcdaniel@nda.org](mailto:bmcdaniel@nda.org) or Debbie Dyson at [ddyson@nda.org](mailto:ddyson@nda.org) for more information.

TRAINING THE 21ST CENTURY JOINT FORCE  
MISSION FOCUSED TO ACHIEVE WARPUSHING EXCELLENCE

2006



**SERIOUS GAMES**  
SHOWCASE AND CHALLENGE

EXPANDED ELIGIBILITY FOR '07

ENTER YOUR GAME BASED TRAINING AND EDUCATION APPLICATION

**3 DISTINCT CATEGORIES**  
STUDENT  
INDIVIDUAL / SMALL BUSINESS  
LARGE BUSINESS

SHOWCASE YOUR WORK IN FRONT OF TOP GAMING, SOFTWARE AND SYSTEM INTEGRATOR COMPANIES

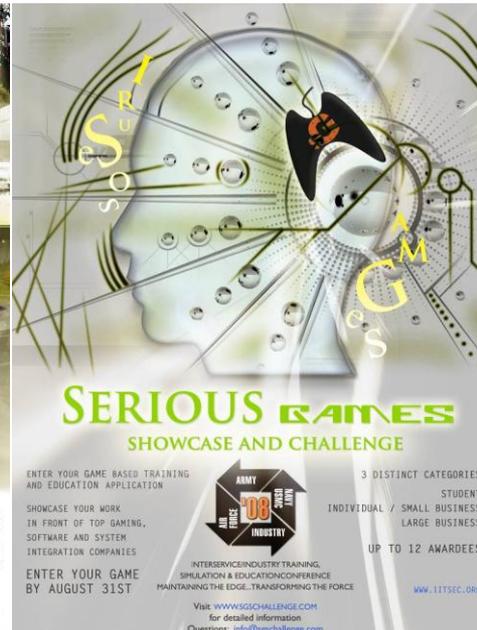
**challenge games 2007**

ENTER YOUR GAME BY AUGUST 31ST  
UP TO 12 AWARDEES AT I/ITSEC '07

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Industry/Industry Training, Simulation & Education Conference  
Unleashing the Edge... Transforming the Force

2007



**SERIOUS GAMES**  
SHOWCASE AND CHALLENGE

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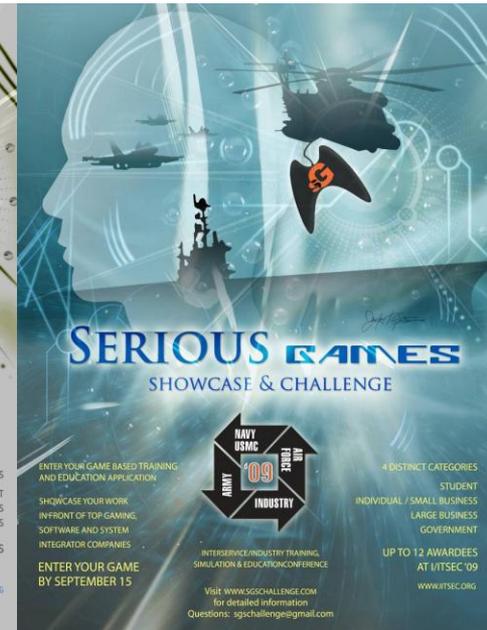
**ENTER YOUR GAME BY AUGUST 31ST**

**3 DISTINCT CATEGORIES**  
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UP TO 12 AWARDEES

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MAINTAINING THE EDGE... TRANSFORMING THE FORCE

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2008



**SERIOUS GAMES**  
SHOWCASE & CHALLENGE

ENTER YOUR GAME BASED TRAINING AND EDUCATION APPLICATION

SHOWCASE YOUR WORK IN FRONT OF TOP GAMING, SOFTWARE AND SYSTEM INTEGRATOR COMPANIES

**ENTER YOUR GAME BY SEPTEMBER 15**

**4 DISTINCT CATEGORIES**  
STUDENT  
INDIVIDUAL / SMALL BUSINESS  
LARGE BUSINESS  
GOVERNMENT  
UP TO 12 AWARDEES AT I/ITSEC '09  
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Questions: [sgchallenge@gmail.com](mailto:sgchallenge@gmail.com)

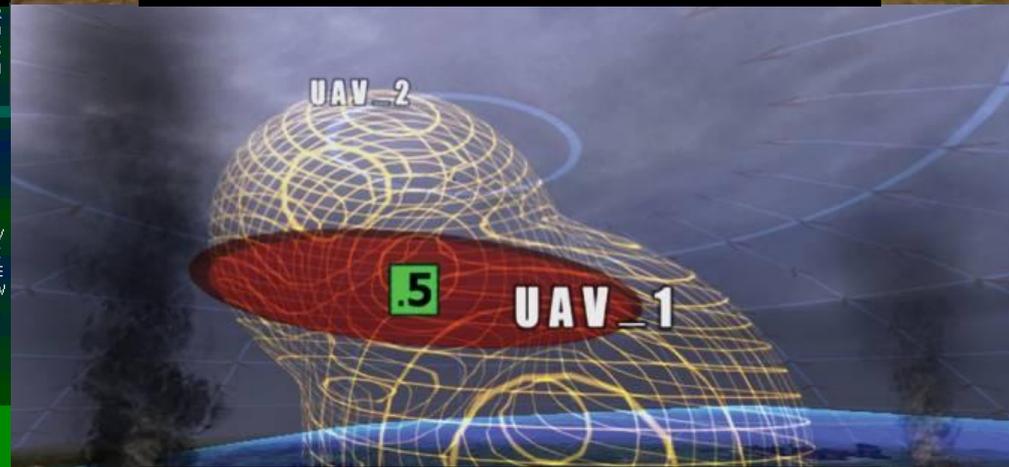
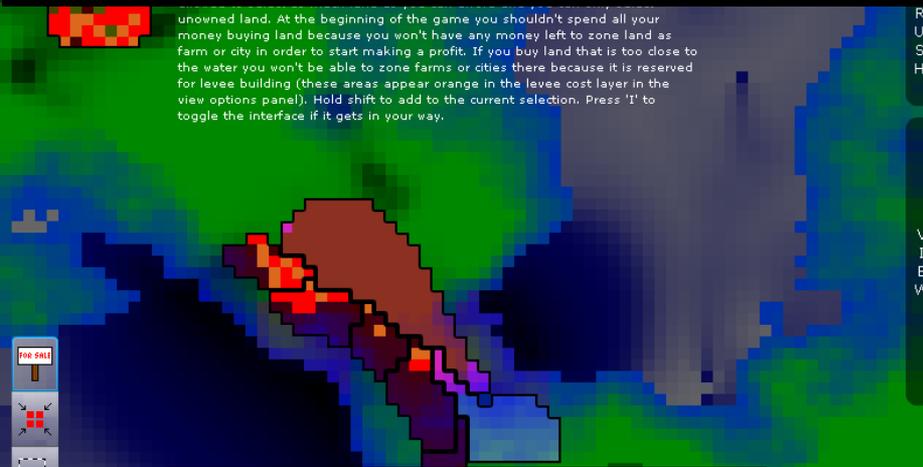
2009

# 2008 SGS&C Winners



**Small Business & Overall: Burn Center**

**People's Choice: Direct Action**



**Student: Age of Ecology**

**Government: Geo Commander**

# The Matrix vs. The Holodeck

2199AD



2500AD



The Matrix logo and original photography are copyright and appear courtesy of Warner Bros. Visit <http://whatisthematrix.com>

- New technologies – from television to computers – are always suspect when applied to training and education.
- What seems obvious to a later generation was not obvious or accepted when the technology first became available.
- What is the cause?
  - ❖ Cultural Fixation
  - ❖ Emotional Resistance
  - ❖ Technical Limitations
  - ❖ Lack of Vision and Imagination

# References

- Abt, C. (1970). *Serious Games*. New York: The Viking Press.
- Beck, J.C. and Wade, M. (2004). *Got game: How the gamer generation is reshaping business forever*. Boston, MA: Harvard Business School Press.
- Bergeron, B. (2006). *Developing serious games*. Charles River Media.
- Bushnell, N. (August 1996). Relationships between fun and the computer business. *Communications of the ACM*, 39(8), 31–37.
- Chatham, R.E. (July 2007). Games for training. *Communications of the ACM*, 50(7), 37–43.
- Federation of American Scientists. (2006a). R&D challenges for games in learning. Washington D.C.: Author.
- Federation of American Scientists. (2006b). Summit on educational games: Harnessing the power of video games for learning. Washington D.C.
- Herz, J. and Macedonia, M. (April 2002). Computer games and the military: Two views. *Defense Horizons*, 11.  
Online at <http://www.ndu.edu/inss/DefHor/DH11/DH11.htm>
- Kelly, H., et al. (July 2007). How to build serious games. *Communications of the ACM*, 50(7), 45–49.
- Kushner, D. (Aug 2002). The wizardry of id. *IEEE Spectrum*, 39(8), 42–47.
- Lenoir, T. (2003). Programming theatres of war: Gamemakers as soldiers. In Latham, R. (Ed.) *Bombs and Bandwidth: The emerging relationship between information technology and security*. New York: The New Press.  
Online at [http://www.stanford.edu/dept/HPST/TimLenoir/Publications/Lenoir\\_TheatresOfWar.pdf](http://www.stanford.edu/dept/HPST/TimLenoir/Publications/Lenoir_TheatresOfWar.pdf)
- Michael, D and Chen, S. (2005). *Serious games: Games that educate, train, and inform*. New York: Thompson Publishing.
- Orbanes, P.E. (2004). *The Game makers: The Story of Parker Brothers*. Boston: Harvard Business School Press.
- Postigo, H. (2003). From Pong to Planet Quake: Post-industrial transitions from leisure to work. *Information, Communications, and Society*, 6(4), 593–607.
- Prensky, M. (2001). *Digital game-based learning*. New York: McGraw Hill.
- Sheff, D. (1999). *Game over: Press start to continue*. Wilton, CT: Cyber Active Publishing.
- Smith, R. (January 2006). Technology Disruption in the Simulation Industry. *Journal of Defense Modeling and Simulation*, 3(1),  
Online at <http://www.scs.org/pubs/jdms/vol3num1/JDMSvol3no1Smith3-10.pdf>
- Steinkuehler, C. (January 2007). Massively multilayer online video gaming as participation in a discourse. *Mind, Culture, and Activity*, 13(1), 38–52.
- Zyda, M. (July 2007). Creating a science of games. *Communications of the ACM*, 50(7), 27–29.
- Zyda, M. (September 2005). From visual simulation to virtual reality to games. *IEEE Computer*, 38(9), 30–34.
- Zyda, M. (June 2006). Educating the next generation of game developers. *IEEE Computer*, 39(6), 25–32.

