Consumer Robotics in the Age of Accelerations

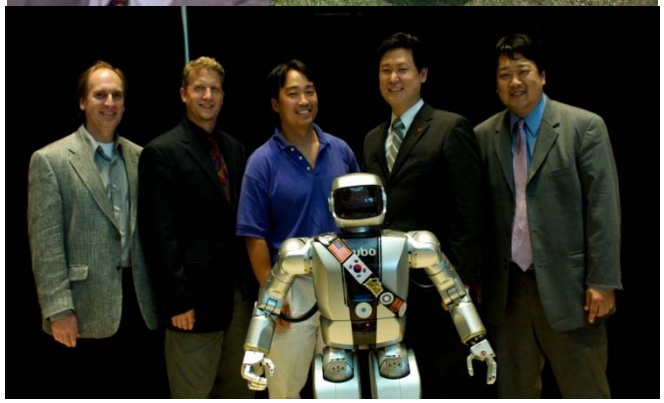
International Society of Service Innovation Professionals (ISSIP) – NSF Workshop on Next Generation Smarter Service Systems

March 29-30, 2017

Paul Oh – Lincy Professor of Unmanned Aerial Systems

University of Nevada, Las Vegas (UNLV)

Re-Inventing Myself… Again



- 2000-2014 at Drexel University
- 2001: Disaster-response focus (near-Earth UAVs)
- 2007: Globalization focus (humanoids as case study)
- 2013: DARPA Robotics Challenge (DRC) Trials (failure)
- 2014: Move to UNLV (FAA Designation)
- 2015: DRC Finals (Cinderella Story)

Life in Las Vegas

Putting Vegas on the (hi-tech) Map

Researcher finds redemption, possible hotel deal after robotics ...
Computerworld - Jun 16, 2015
The robotics team led by **Paul Oh**, a professor of mechanical ... At the DARPA Robotics Challenge, the **UNLV** team earned six out of eight ...

UNLV Is Playing A Pivotal Role In The Future Of Robotics
KNPR - Feb 29, 2016
Paul Oh is one of the people making sure of that. Oh is the Director of the Drones and Autonomous Systems Lab at **UNLV** and he and his team ...

- Workforce Challenges
- What is "Made in Nevada"
- Eco-system

Robo-Universe: High-Tech Nexus for Robot Technology and Innovation

Author: Paul Oh
UNLV

Robo-Universe in Las Vegas: Where the Education meets Inspiration and Innovation

Motivation:
- Robotics and unmanned systems are ... es
- Technologies both attract and de... ce
- Workforce are both providers ... rvices
- Robo-Universe would be ...
- Transformative: help ... igh-tech identity

Objective: Rob... a combination of where the "Smiths... meets "Universal Studios" for:
- Sm... (public, STEM, research)
- ... d vision (robot world of tomorrow)
- ... s: innovative "robot-themed" rides (e.g. ... s, robot animals, ,mecca-suits)

Value:
- Vegas land is suitable (50-100 acres)
- Vegas experience building theme...
- Workforce: construction and ...
- Attracts new workforce f...
- Workforce for unique ... e.g. underwater robot ...
- Attendance: T... year; with high-tech ... cation programs for childre...
- Think... as a "must-see" place while in ... repeat visits due to changes in robot te... gies

...eps:

Recruit team to create business plan: need roboticists (UNLV), landscape architects, theme park consultants, business developers. ROM Cost: 12-month effort at $3M

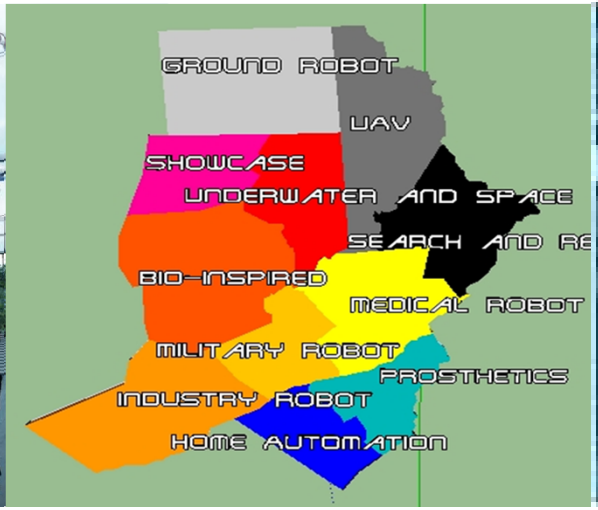
Schedule:

Based on business plan, Robo-Universe can be constructed as a 3-Phase effort spread over a 5-year schedule.

Contact: Prof. Paul Oh, UNLV, paul.oh@unlv.edu

P. Oh Blue-Sky Idea: Roboland

Notional Roboland: Smithsonian + Epcot + Universal Studios

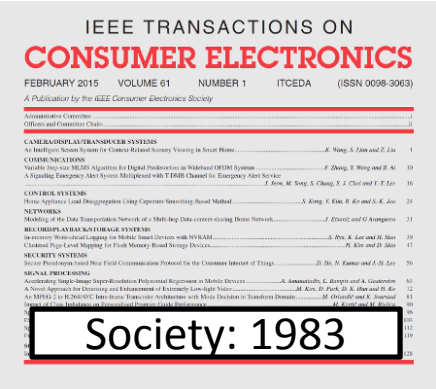


- “Iron Man Store”: Bionics
- World-Class R&D
- E-Sports, Holodecks

- Immersive Environments
- 40M+ Visitors - 90% occupancy
- 170,000 CES

- Need to Create an Ecosystem – not a Theme Park
- Ecosystem revolves around Consumers
- Vegas and Roboland as nexus for consumer robotics

What is Consumer Electronics/Robotics – Academically?



Society: 1983

RAS: 1984

"Strives for the advancement of the theory and practice of robotics and automation engineering and sciences and of the allied arts and sciences"

"The engineering and research aspects of the theory, design, construction, manufacture or end use of *mass market electronics*, systems, software and services for consumers".

"Technologies that will make our lives safer and easier"

Consumer Electronics Show (CES) in Las Vegas: 170,000+ people, 3000+ exhibitors, and 400+ robotics companies

The “Walkman” in Robotics

1979: Sony Walkman kicks off “consumer electronics”
2002: Roomba launched. 10M units sold. The “Walkman” of Vacuum Cleaners
2009: Makerbot launched. 100K sold. “Walkman” manufacturing for the “masses”
2013: DJI Phantom released. 70% of market. The “Walkman” of quadcopters

“The lines between consumer electronics and consumer robots will be blurry”

- Easier, powerful, connected, cheap: *microprocessors and sensing*
- Ubiquitous data and algorithm access: *cloud-computing*
- Networking at zero-marginal cost: *IOT*
- Quick, customizable, affording manufacturing: *3D printing*
- Advances in data-analysis and visualization: *big data and VR*

What were the technologies and science that *enabled* these “Walkman” products?

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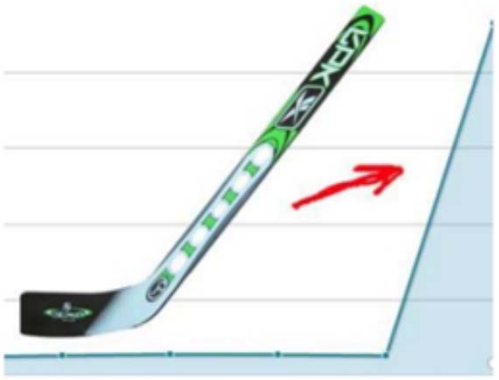
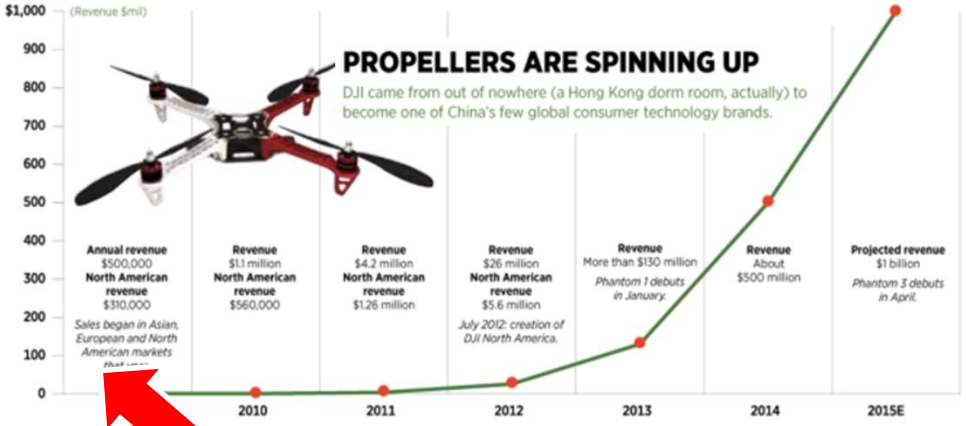
Hockey Stick Graph and UAVs

Hockey Stick Curve

noun

A chart with a slow initial growth rate that suddenly increases to a much faster growth rate that continues indefinitely. The resulting chart takes the shape of a hockey stick.





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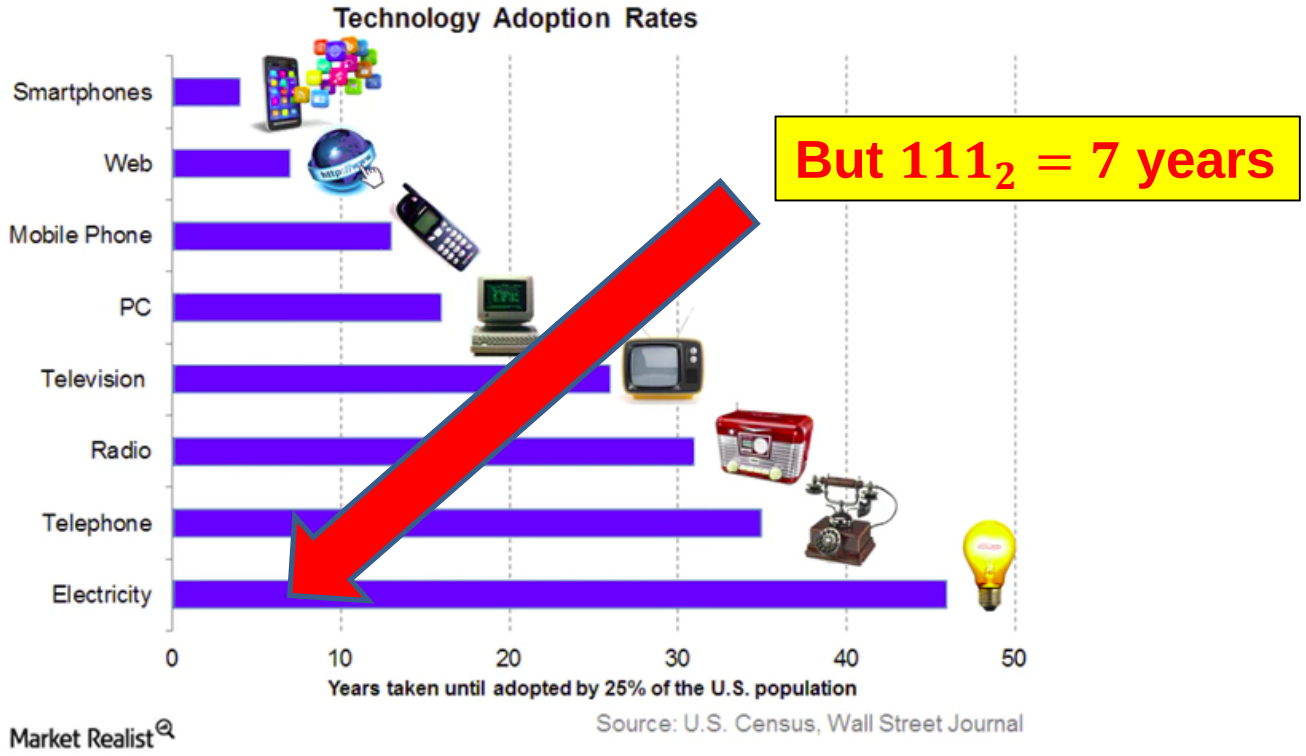
UAV Academics Timeline

- 2002: Collision Avoidance focus
- 2003: LIPO Batteries
- 2004: Carbon Fiber
- 2005: Brushless DC motors
- 2007: Cameras, GPS, IMU
- 2008: Lower-cost LIDAR

Great for 3Ps:
Proposals, Publish, PhDs

DJI: YACL - Yet Another Control Law

Tech Adoption Rates: Not 111 years



But $111_2 = 7$ years

1985: Robotic Surgery

1984: 3D printer

2001: DARPA Organic Air Vehicle

2007: DARPA Urban Challenge

2015: DARPA Robotics Challenge

1995: Intuitive Surgical (2000 FDA approval)

1989: Stratasys founded; 2009 Makerbot

2010: Parrot AR Drone at CES

2011: Nevada 1st state driverless car laws

2022: ???

Robots and Adoption Rates < 10 years ?

2017 IEEE RAS Winter School on Consumer Robotics

Hypotheses: Vegas Hotels are suitable testbeds for consumer robotics

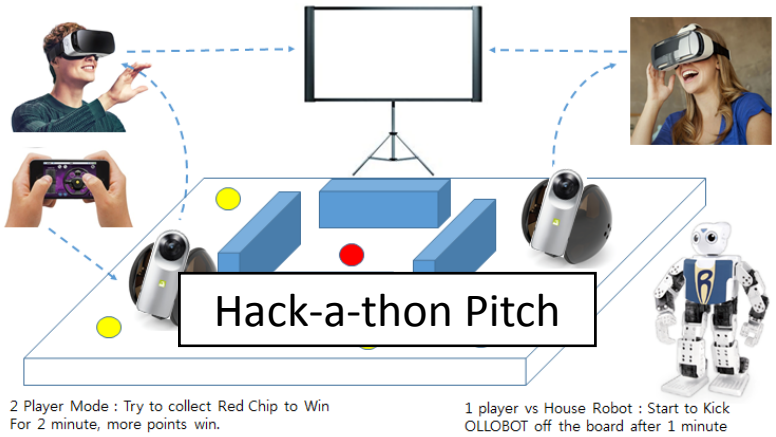
1. Hotel Operations
   - Check-in
   - Housekeeping
   - Guest Engagement

2. Food-and-Beverage
   - Show intermission
   - Banquets

3. Entertainment
   - Theatre excess capacity
   - Shows past expiration date

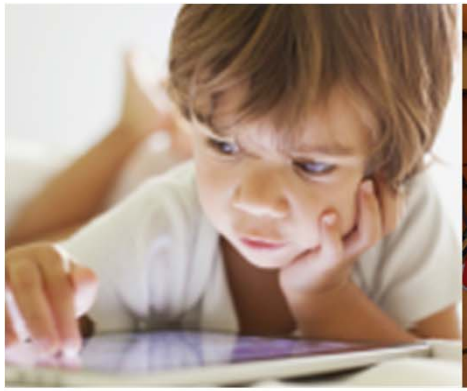
4. Gaming
   - Changing demographic
   - Monetizing E-Sports

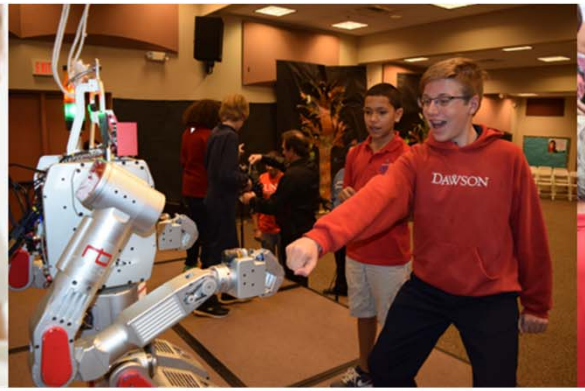
5. Retail
   - Skilled workforce
   - Theft

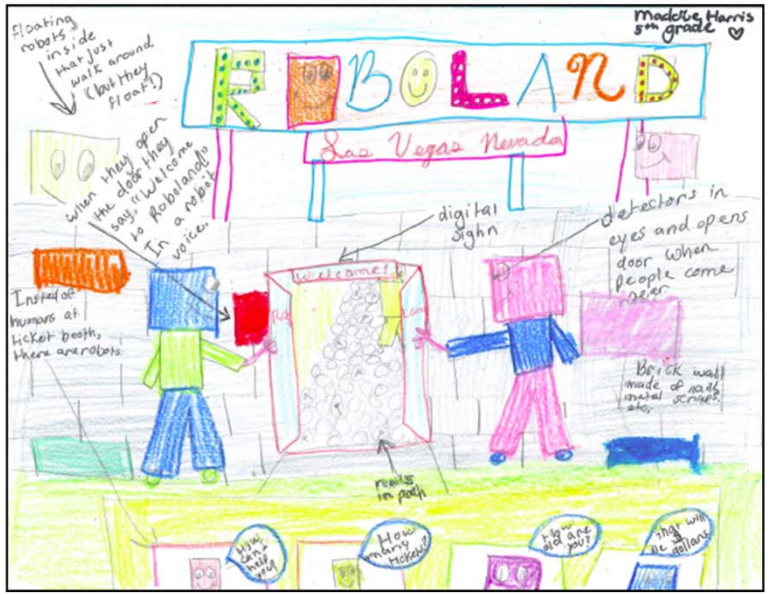


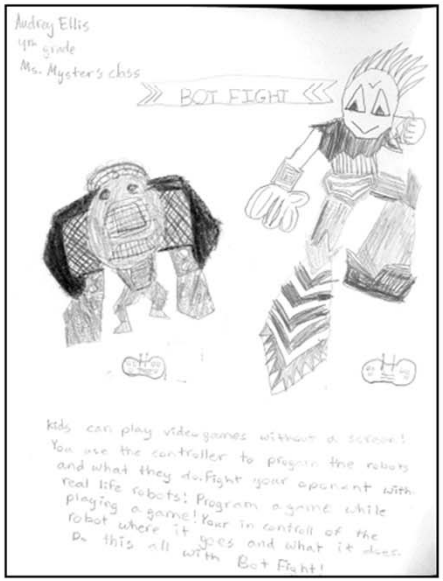
Parting Words

- Line between “Consumer Electronics” and “Consumer Robots” blurry
- Hockey Stick Graph: Focus the engineering for the masses
- Second-half of the chessboard: Age of Accelerations
- Technology (Robot) Adoption Rate: less than 10-years
- Creating an Eco-system: Roboland, Vegas and the Nexus for Consumer Robots









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