The talk is specific to Manipulation research, not all of robotics.
Take home message

We are primed for a second robotic manufacturing revolution
What was the first revolution? A few years ago I foolishly agreed to write a brief history of early manipulation research, and this is what I came up with. There are several different ideas about the birth of robotics. Different creation myths. These reflect viewpoints of different disciplines and perhaps different applications. To tell the story quickly, teleoperated manipulation, came to prominence starting around WWII because of nukes. Industrial robotics arose before computers. Incredibly. The mechanical engineers tuned up the mechanisms, and then computers became cheap enough and voila, the first robotic manufacturing revolution. Watershed moment, perhaps, introduction of PUMA in 1981.

Today my goal is to discuss the coming second revolution, but mostly I want to focus on manipulation. We have learned about manipulation from all of these eras. But I need to add two more eras. Before telerobotics, more general tools. Several MYA. I’m going to walk quickly through the history of manipulation.
Manipulation
before robots
before teleoperation
before tools
Published on Mar 21, 2012
- Species: Mountain Gorilla (Gorilla beringei beringei)
- Description/Behavior: adult feeding on thistle root; [Researchers such as Dick Byrne have paid much attention to the complex sequences of food processing (especially thistle leaves) in relation to learning/imitation theory. Other researchers focus on handedness in connection to brain hemispheric specialization and the evolution of language.]
- Location: Volcanoes National Park, RWANDA
- This video was filmed during University of Arizona's Primate Studies Field School (July 2011) in Rwanda with faculty instructors, Dieter & Netzin Steklis. Find out more about this field school by visiting www.wild-minds.org
- Filmed by: Wulf Steklis, Bernd Steklis, Netzin Steklis, Dieter Steklis (file=mg_feeding_thistle SB 2011.MPG)
Byrne et al. studied mountain gorilla food preparation behavior and identified almost 200 primitive actions. Gorillas, one activity, 200 primitive behaviors. How many would it take for humans, across all activities?
Manipulation
before robots
before teleoperation
with tools
Manipulation before robots with teleoperation with tools
Manipulation
with robots
with teleoperation
with tools
When you buy an industrial arm, there is no hand. It isn’t just for manipulation, it could move a spray gun around, or a welding torch, or a camera.
When you buy an industrial gripper, you don’t get fingers. You are supposed to make your own, to fit the object you want to grasp. True in 1981, and true today.
Beautiful
Cool

In factories

Practical hands are simple.
Practical hands are simple. Not just for industrial arms, but for telerobotic surgery.
This isn't a Davinci tool, but it is similar.
Practical hands are simple.
Robotic manufacturing: the next revolution

• Current approach dates from the 1981 revolution

• What technology will create the next revolution?
  • Perception?
  • Intelligence?
  • Mechanisms?

Previous revolution was result of advances in control and mechanisms, and the last piece of the puzzle advent of affordable computers. So, what component technologies might touch off the next revolution.
Perception? 3D sensing e.g. Kinect? Recent progress in computer vision?
Intelligence? Machine learning, big data? The cloud?
How do we produce the next revolution?

• Attract great roboticists
• Partner with great manufacturing engineers
• Commitment to manufacturing

The last revolution. Early 1980’s. Manufacturing was cool. Great people were totally committed to manufacturing. We have to make it cool again. That should not be hard. Everybody loves to use their hands, to make things. Should we connect with Maker movement?

Commitment to manufacturing is key. Manufacturing is the source of understanding, and the test of our progress. Source of understanding: they know more about manipulation than we do. But that knowledge is embedded in systems and in engineers’ heads. Test of progress: deployment of technology in automation is a high bar. They are not contrived problems, toy task domains. Not designed to show off your cute idea. You are competing in the biggest league, the global economy, and competing against human manipulation, specifically human intelligence, mechanisms, and perception.
Take home message

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