Augmenting the Surgeons senses

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Intuitive Surgical
Surgery Has ancient origins

Trephination started in the Neolithic at least 7000-10,000 years ago – a practice that evolved independently in many areas of the world, with the highest concentration of activity in Peru and Bolivia. Evidence for it also is found in Europe, Asia, New Zealand, some Pacific Islands, and North America.
Advent of Anesthesia
Open Surgery
At what price?
1980’s - introduction of laparoscopy

Dr. Philippe Mouret ~ 1987

Credited with first lap chole procedure in France in 1987

Laparoscopic oophorectomy (removal of the ovaries)
Laparoscopy reaches limitations...

Note: graph depicts today’s adoption of laparoscopic surgery by specialty.
In the late 80’s and early 90’s, only lap chole would have seen significant adoption.
Robotic-assisted laparoscopy?

% Penetration

Gastrointestinal  Gynecologic  Urology  Cardiac

Procedure Complexity

MDI, 2002-2004 MIS forecast
Origin of telepresence

- Nuclear material Telemanipulation
- Master-slave relationship
1980’s - robotic advancements

- 1980’s offered tremendous advancements in microelectronics and computing
- As a result, robotic telepresence technology began to reach new heights (and depths)

- Nuclear material robotic arm ~ 1981
- Deep Sea Robotics ~ 1985
- Robot “Jason Jr.” Titanic wreck ~ 1986
- NASA Robotic Arm ~ 1981
Perfect timing? Late 80s early 90s...

- Robotic telepresence technology begins to flourish
- Laparoscopy technology hits limitations in complex surgical procedures
- Opportunity to use robotic technology to overcome laparoscopic challenges recognized by several institutions at the same time:
da Vinci is born...

SRI - preliminary schematic drawing

MIT - low friction pulley design

da Vinci Standard System - 1999
Robotic Systems - Single Site Surgery

Laparoscopic Single Port Surgery
- 2D Vision
- Unstable Endoscope
- Counter-Intuitive Control

- da Vinci Single Port Surgery
- 3D Vision
- Improved Ergonomics
- Stable Endoscope
- Tremor Filtering
- Intuitive Control
Robotic Systems - *da Vinci* Single Site

- Using *da Vinci Si* system with 8.5mm 3D HD endoscope
- Curved Instrument Cannulae
- 5mm, non-wristed, semi-rigid instruments

(da Vinci Single Site prototype)
Taking surgical precision and technique beyond the limits of the human hand
Opportunity out of a Necessity
Taking surgical precision and technique beyond the limits of the human EYE
Revascularization Evaluation
Real time microscopy
Taking surgical precision and technique beyond the limits of the human EYE
How We Perceive Color
Color Overlay
Displaying the information usefully
Visual clutter
Other inputs?
Augmented Capabilities = Superpowers