

Automated Robots Will Perform Better Surgery Than Humans in 5 Years

Erik B. Wilson, MD, FACS

Professor of Surgery

Vice Chair of Surgery

Bariatric Surgery Medical Director Memorial Hermann Hospital

Division Chief, Minimally Invasive and Elective General Surgery

University of Texas Medical School at Houston

Disclosures

Johnson&Johnson-Teaching/Research

Medtronic-Teaching/Research

Intuitive-Teaching/Research

Gore-Teaching

Activ Surgical-Research

Boston Scientific-Teaching/Research

Endogenex-Research

CMR-Research

Distalmotion-Research

GI Windows-Chief Medical Officer

Dr. Higa's Disclosure

SkyNet



This Explains A LOT

What Is the Goal of Minimally Invasive Surgery?

Better minimally invasive surgery

1. More precise and accurate
2. More reproducible and consistent
3. Easier on the surgeon physically and mentally
4. More efficient--quicker

More minimally invasive surgery

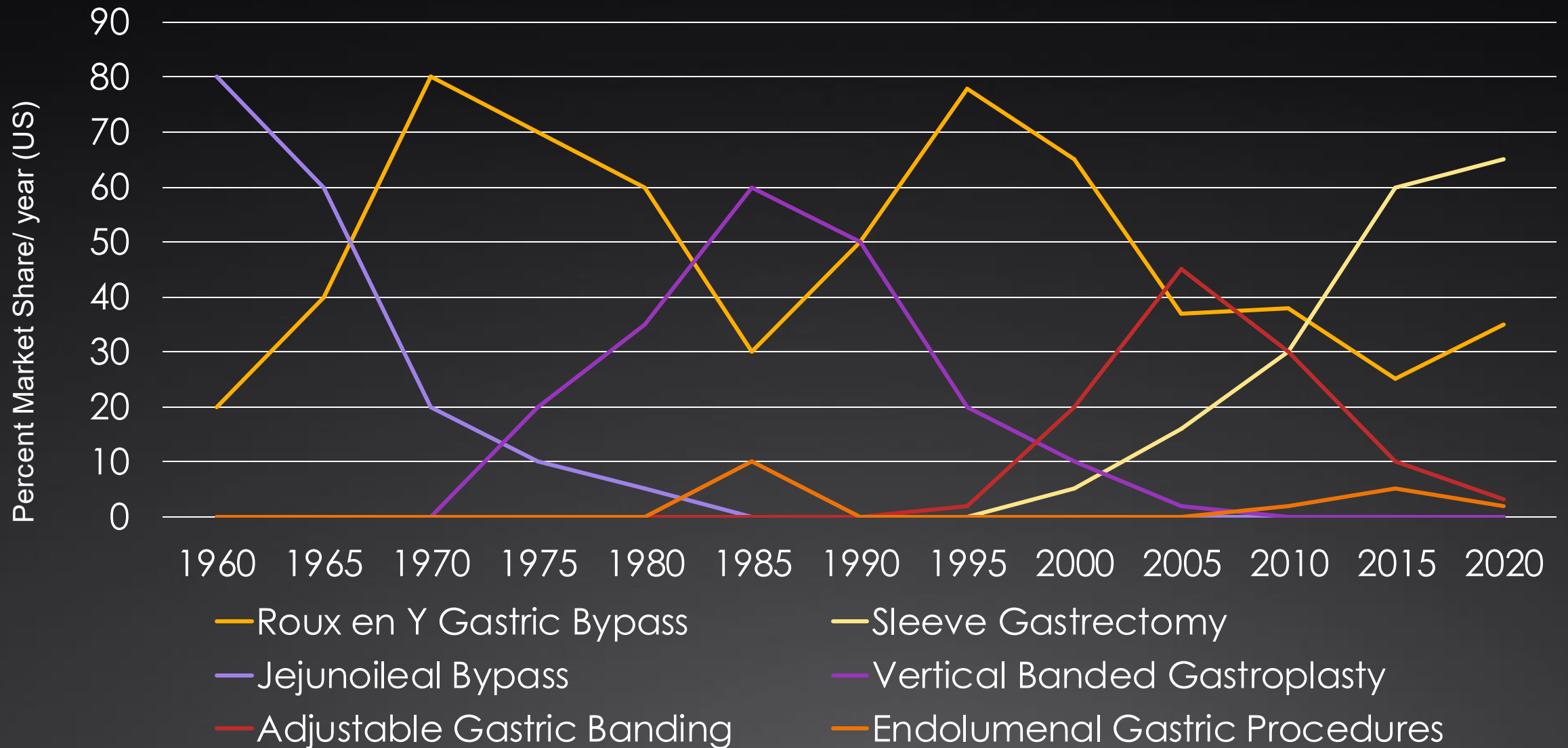
1. Stop open surgery
2. Optimize the procedure to the patient
3. Fewer incisions
4. No incisions

Surgeons want to operate at a high level and talk to patients about operating at a high level and that's it!

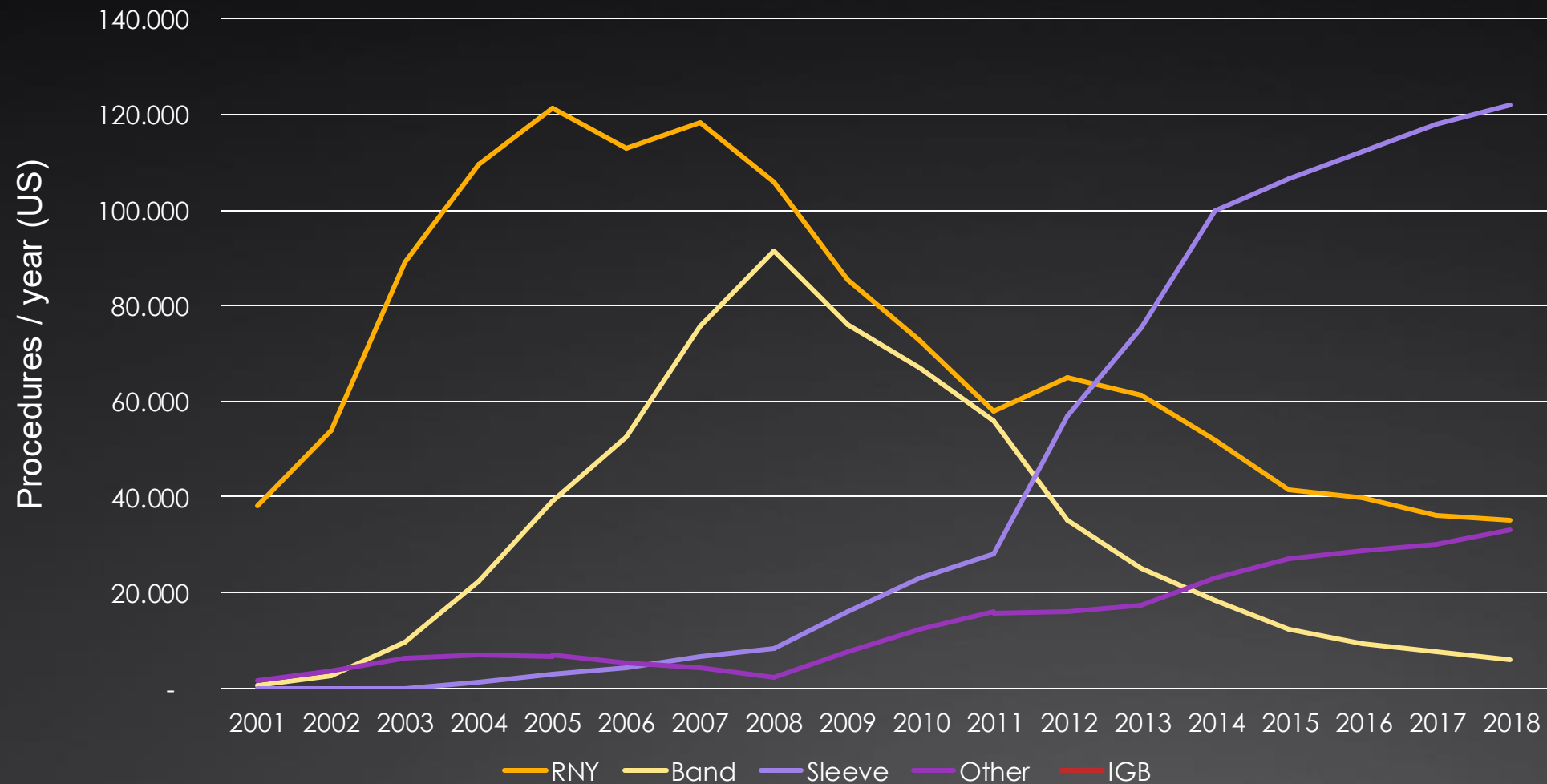
Digital is Driving the Process:

Robots, Telesurgery, Endolumenal, AI & Automation

Bariatrics are Driven to One Leading Procedure



Bariatric Procedures Should Balance with Better Understanding of the Disease and Treatment Incentives



Sleeve easier but doesn't make it better for each patient

Bypass wakes you up in the middle of the night

Bariatric surgeon growth was tied to band growth and now sleeve growth

One surgery all day long is good business

LET'S BE HONEST: WE HAVE SKILL SET ISSUES THAT DRIVE THIS

Democratizing Surgery and Bariatric Surgery with Robotic Platforms

Laparoscopic Trends

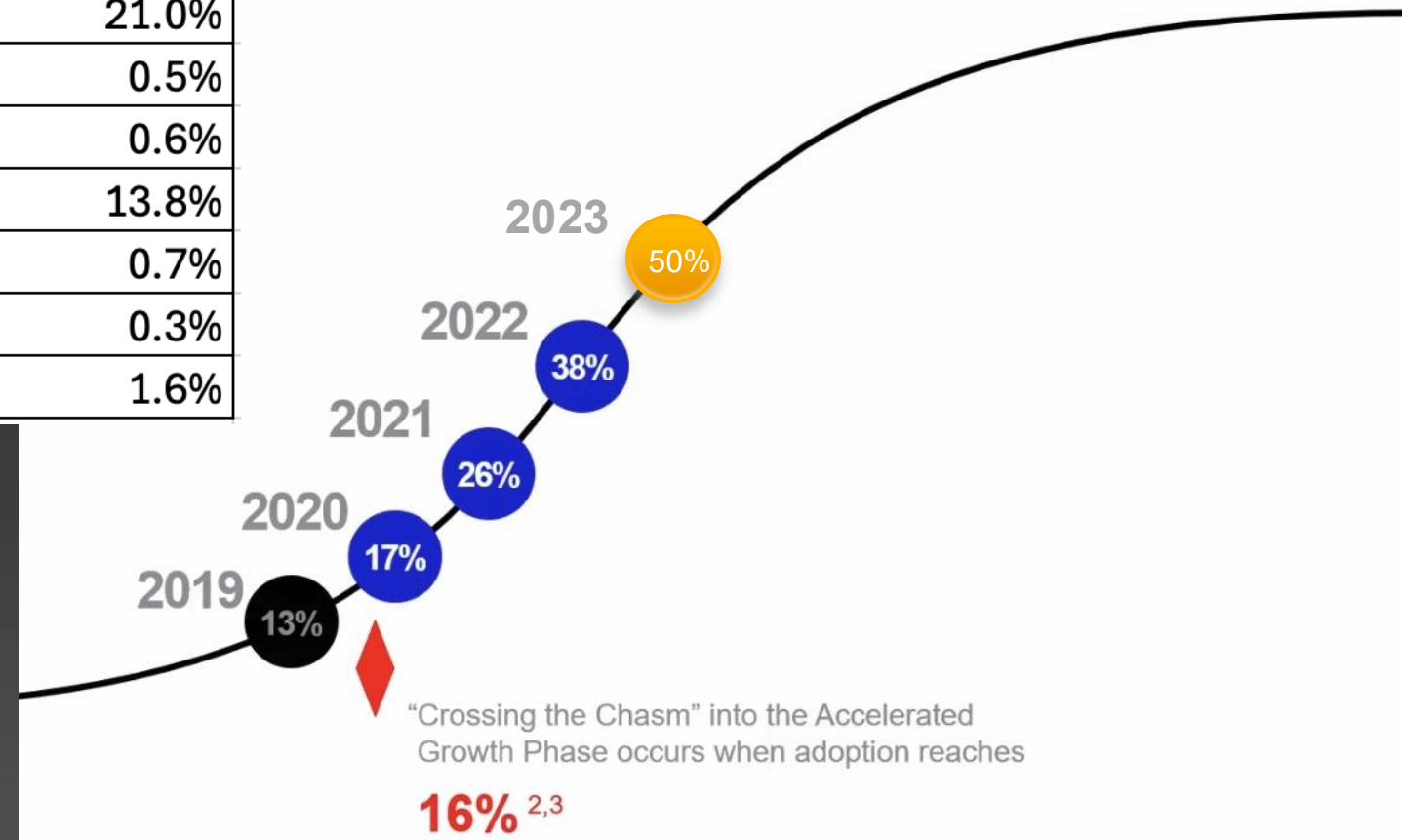
	2020	2021	2022	2023
Sleeve	63.2%	59.2%	59.5%	61.5%
RYGB	19.4%	19.8%	19.9%	21.0%
Band	1.1%	0.5%	1.3%	0.5%
BPD-DS	1.4%	1.7%	1.9%	0.6%
Revision	12.9%	14.0%	13.1%	13.8%
SADI	0.3%	0.5%	0.7%	0.7%
OAGB	0.9%	0.6%	0.5%	0.3%
Other	0.8%	3.8%	3.1%	1.6%

Growing Robotic Bariatric Surgery with Increasing Complexity

Robotic Increasing Anastomotic Cases:

Less sleeves more Bypass and Switch from 2020 to 2025 from Robotic Bari Surgeons

Thank You Intuitive!



Democratizing Surgery and Bariatric Surgery with Robotic Platforms

Growing Robotic Bariatric Surgery with Increasing Complexity

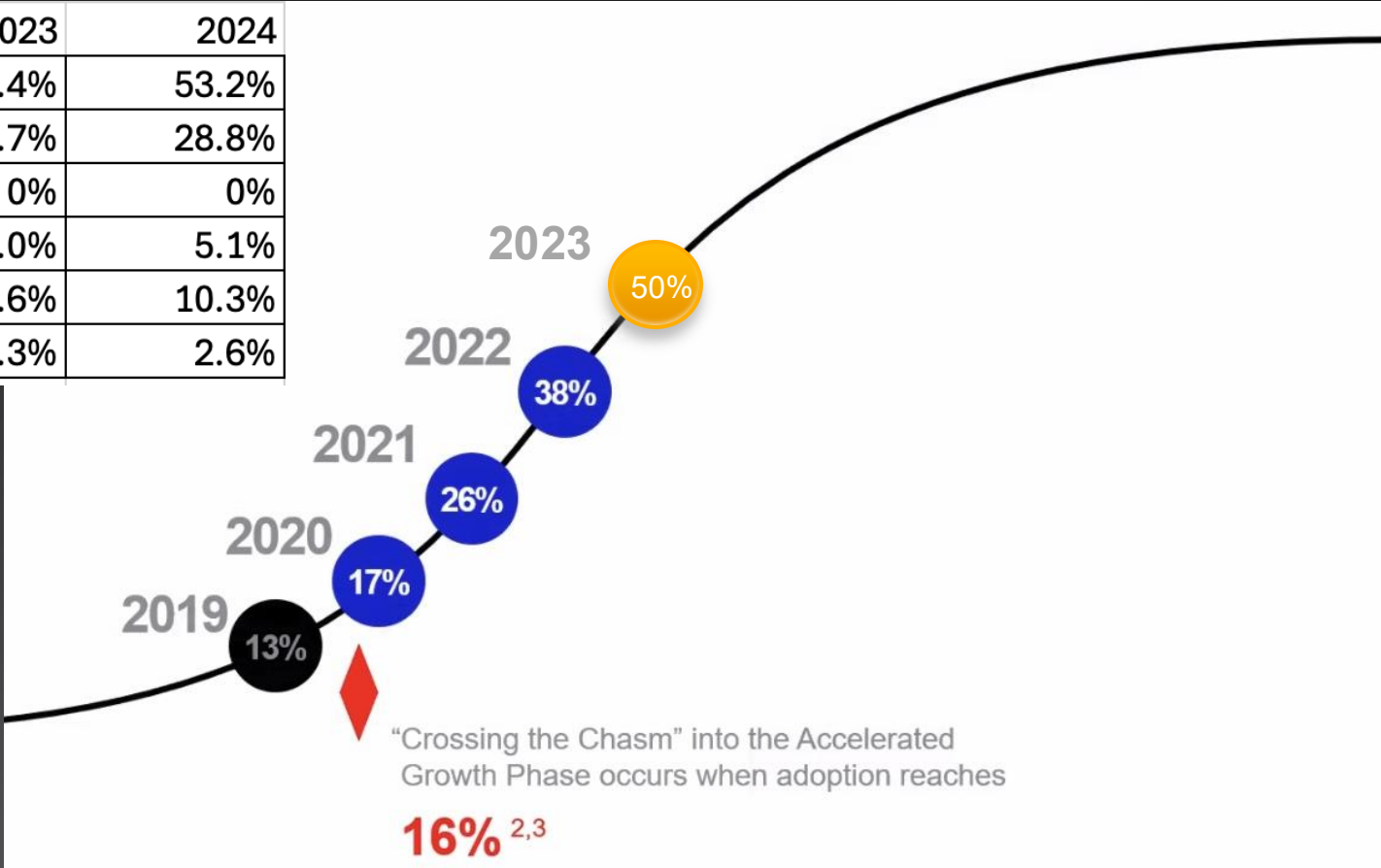
Robotic Trends

	2020	2021	2022	2023	2024
Sleeve	61.0%	60.7%	58.7%	56.4%	53.2%
RYGB	29.0%	29.3%	29.6%	28.7%	28.8%
Band	0%	0%	0%	0%	0%
BPD-DS / SADI	6.5%	6.5%	3.5%	4.0%	5.1%
Revision	3.5%	3.5%	7.9%	9.6%	10.3%
Other	0.0%	0.0%	0.5%	1.3%	2.6%

Robotic Increasing Anastomotic Cases:

Less sleeves more Bypass and Switch from 2020 to 2025 from Robotic Bari Surgeons

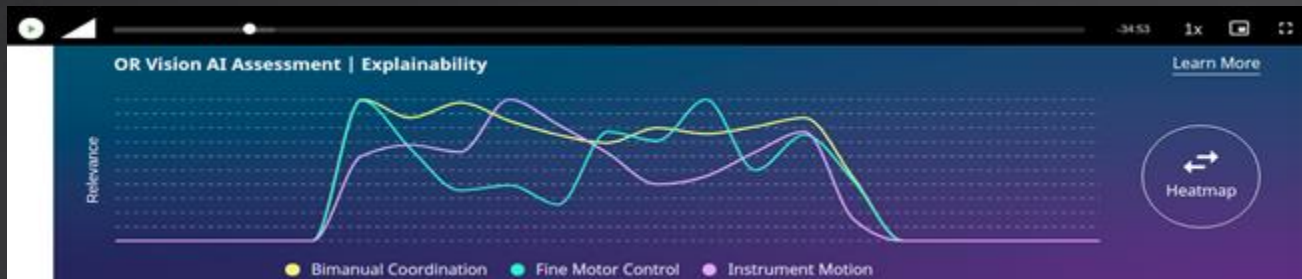
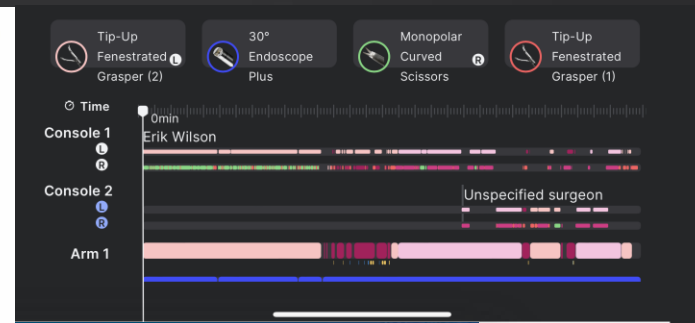
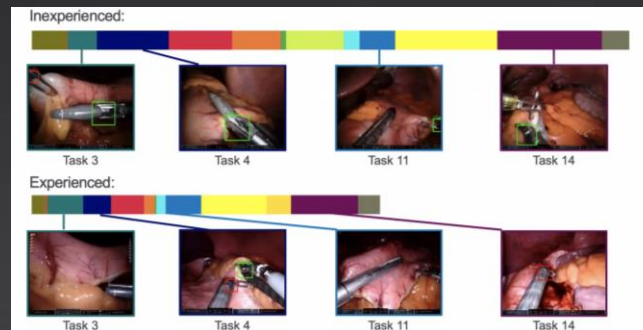
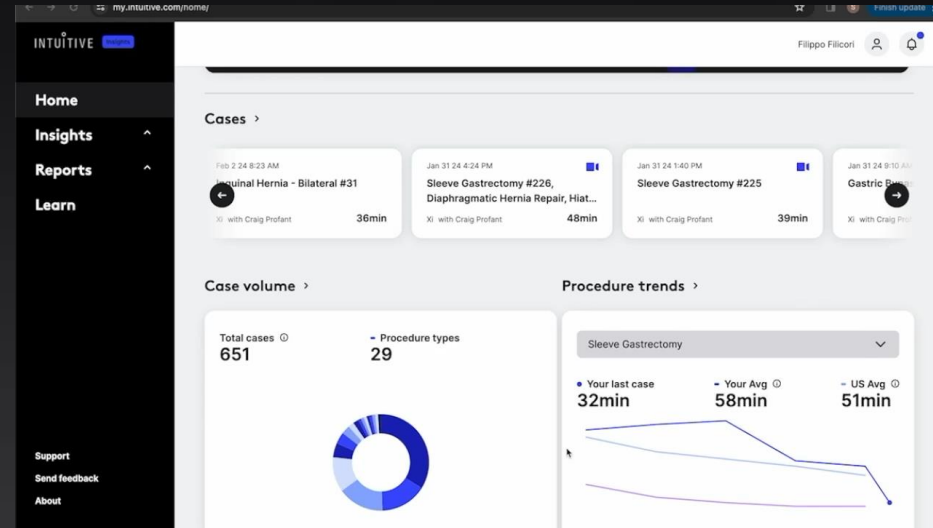
Thank You Intuitive!



AI in Bariatric Surgery

Video, Room, Kinematic, Ergonomic and EMR data

OR Black Box-Surgery Video, Room Video, EMR
Proximie-Surgery Video
Theator-Surgery Video, EMR
Touch Surgery-Surgery Video
C-SATS-Surgery Video
Activsight-Surgery Video
Versius-Surgery Video, Kinematic
Orpheus/Hub-Surgery Video, Kinematic
Apella-Room Video
Artisight-Room Video
CareSyntax-EMR
Qventus-EMR
Moon-Field and Surgeon Video

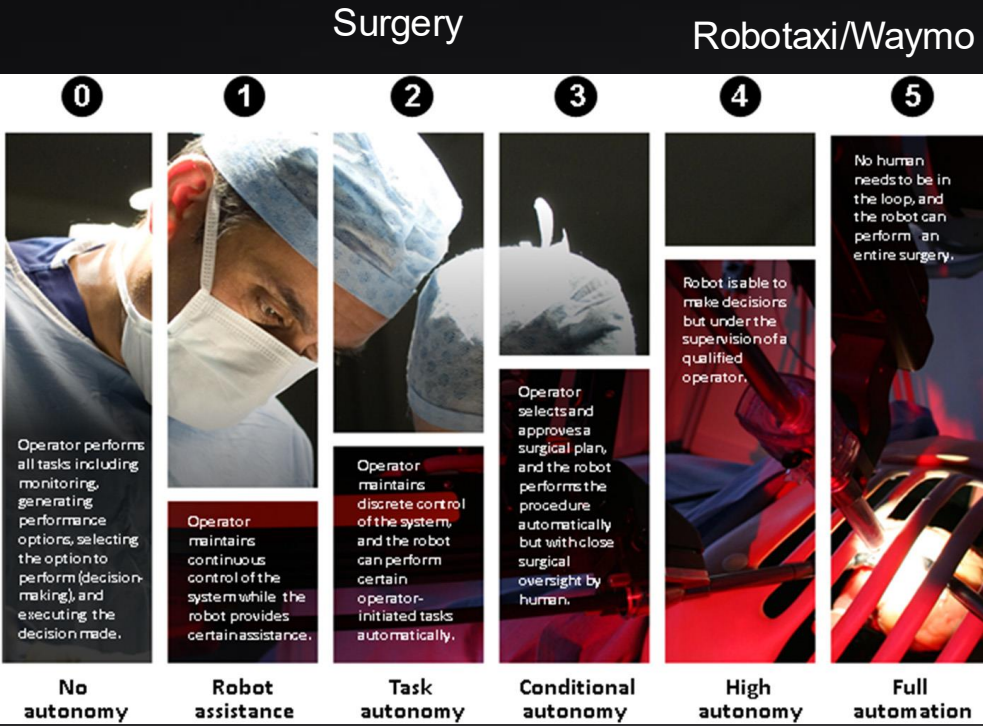


Surgical Digital Analysis Tools Lead to Autonomous Surgery?

- Makes everyone safer
- Makes everyone more efficient
- Doesn't annoy us
- Deploys easily
- Brings financial value
- Doesn't create false incentives



Task Autonomy



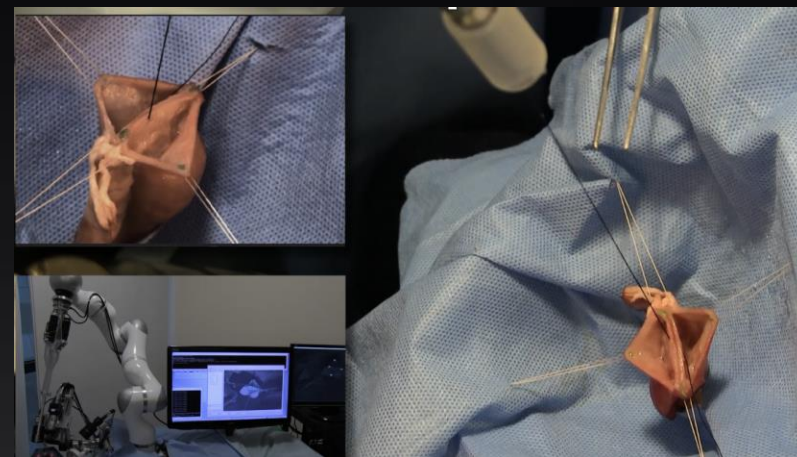
- Augments Visual Reality and Dexterity
- Long way from Level 5 surgery
- 100 years of autopilot and the human still sits in the cockpit

Surgery

Robotaxi/Waymo

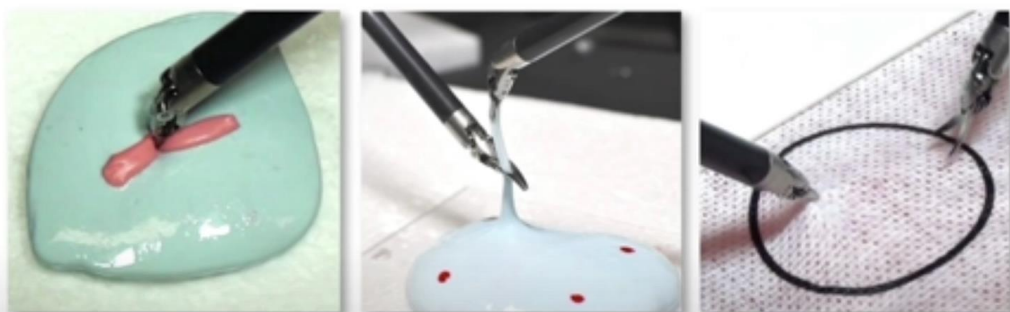
Task Autonomy

Reconstructions are more reproducible than dissections and allow for task autonomy potentially



Autonomous Robot Surgery

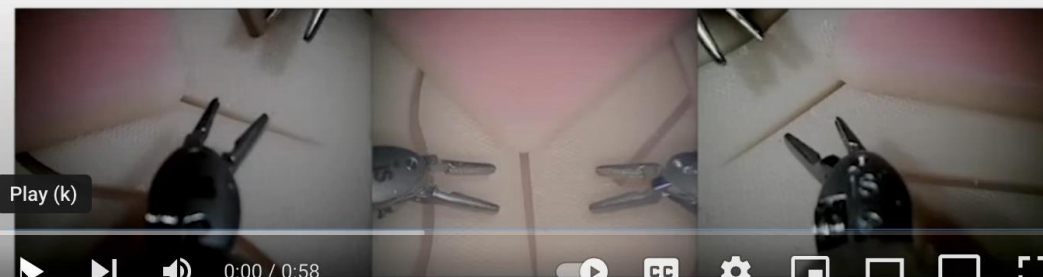
Performing Surgical Subtasks without Human Intervention
UC Berkeley, October 2014



Adithyavairavan Murali, Siddarth Sen, Ben Kehoe, Animesh Garg,
Seth McFarland, Sachin Patil, W. Douglas Boyd, Susan Lim,
Pieter Abbeel, Ken Goldberg



Surgical Robot Transformer: Imitation Learning for Surgical Tasks



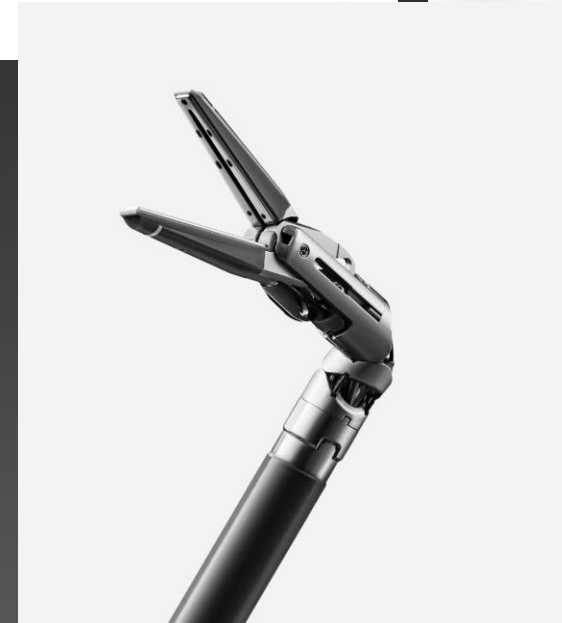
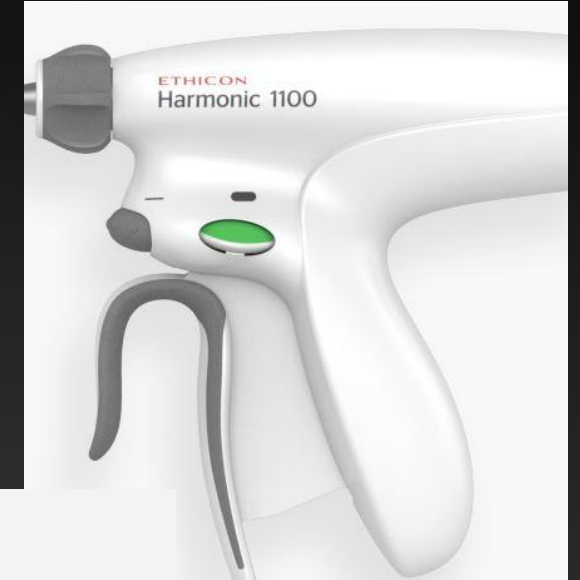
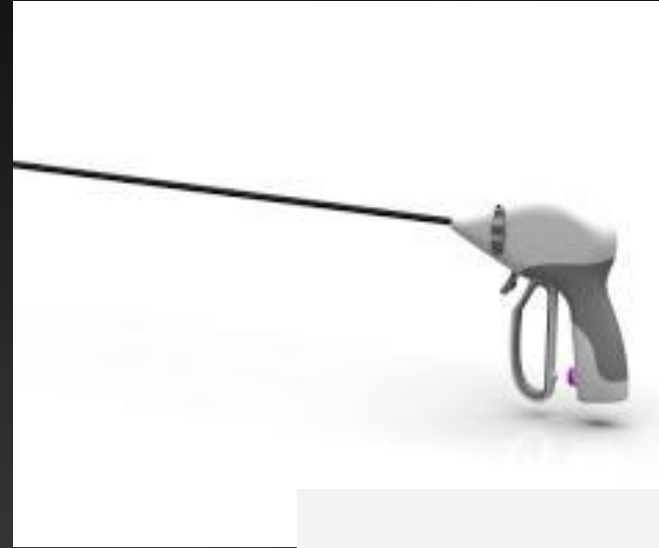
Play (k)

0:00 / 0:58

Advanced Energy/Vessel Sealers are Task Autonomous Systems



Histosonics Edison



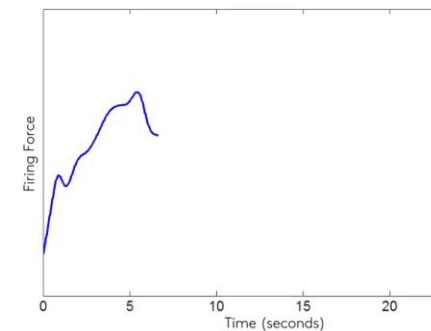
Motorized Staplers are Task Autonomous Systems

- * "SmartFire" pauses more frequently throughout a fire to allow more time for tissue to compression

Signia



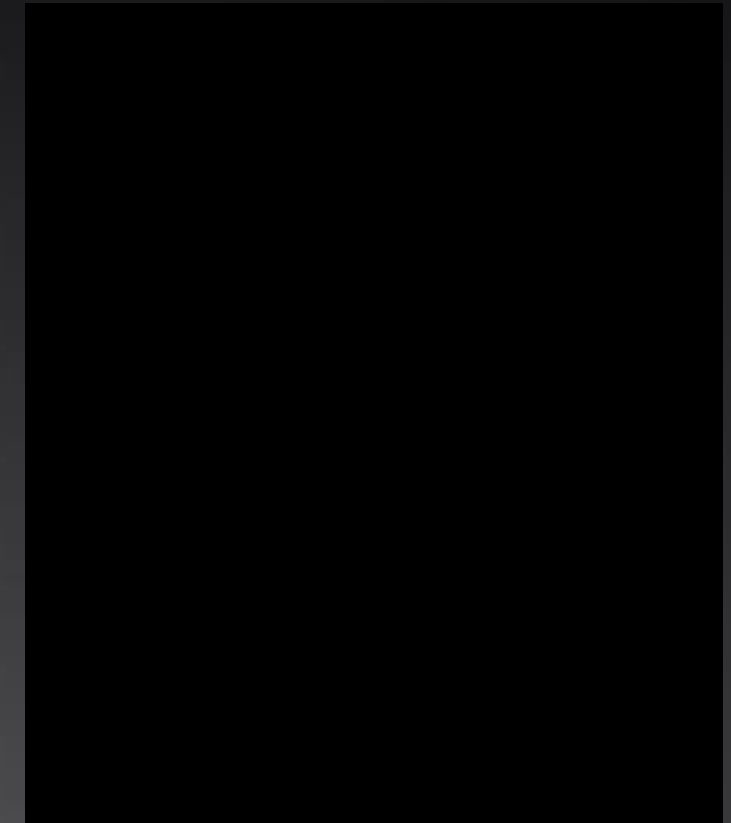
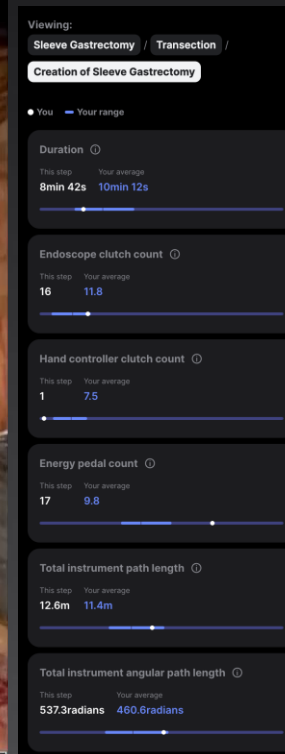
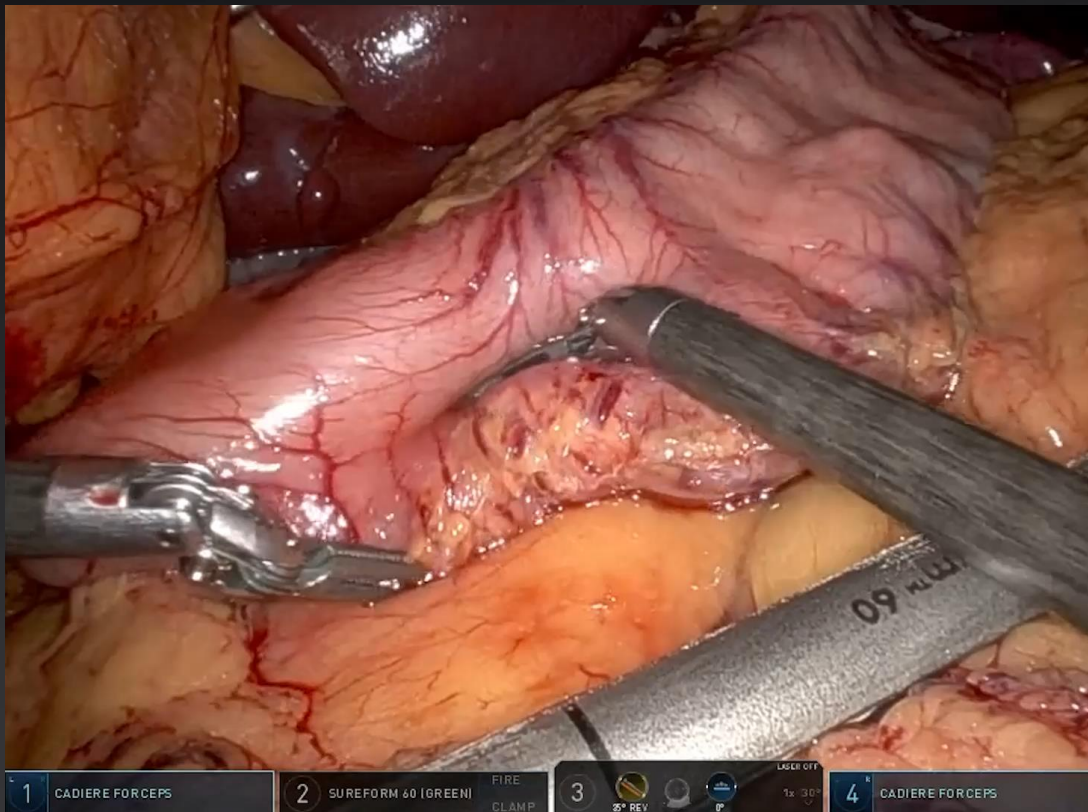
SureForm™ 60 with SmartFire™



First "Pause for Compression"
due to limit in forces being reached



Motorized Staplers are Task Autonomous Systems



● SureForm Stapler 60 ● Stapler Fire ● Cadiere Forceps

Using the Right Stapler and Angle for the Right Tissue

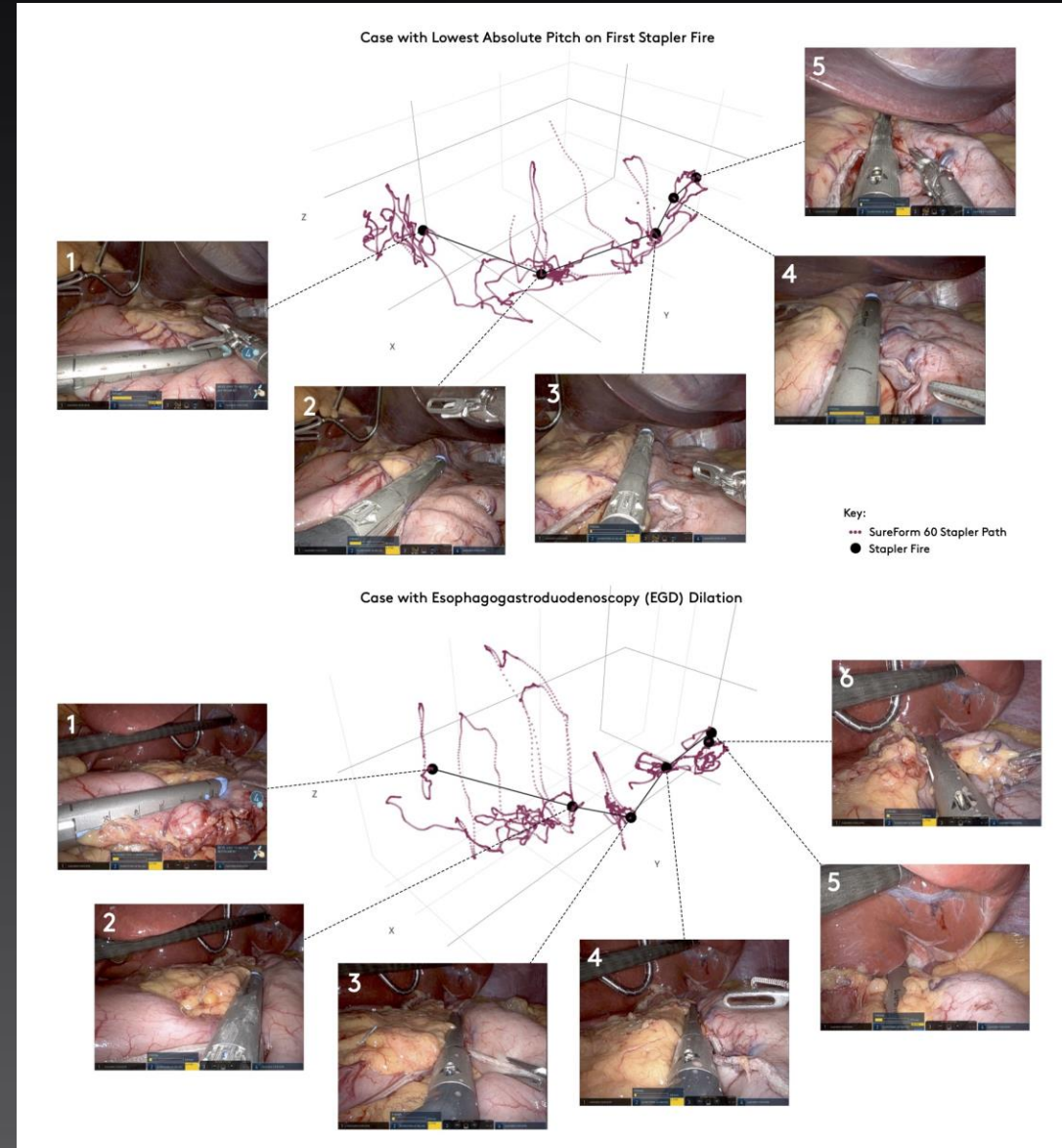
Characterizing Advanced Stapling Technique Using Objective Performance Indicators in Robotic-Assisted Sleeve Gastrectomy: A Retrospective Cohort Study

Sarah Choksi, MD^{1,2}, Bishaka Hirachan, BS^{1,2}, Jon Winalski, MD^{1,2}, Kavita Jain, MD^{1,2}, Ruben Salas-Parra, MD¹, Craig Profant, MD^{1,2}, Dimitre Stefanov, PhD^{1,3}, Max Bemiker, PhD⁴, Vikrom Dhar, MD^{1,2}, Mitchell Roslin, MD^{1,2}, Andrew Yee, PhD⁴, Filippo Filicori, MD^{1,2}

Objective Performance Indicators

Sureform stapler in 344 robotic sleeve gastrectomies and correlate these measures with postoperative outcomes.

1. Stapling angles correlate with postoperative PO intolerance and staple line leaks
2. Cartridge staple height and peak firing force do not correlate with postoperative bleeding .



Telesurgery and Task Autonomy

Get the experience to the patient

Within a hospital-one surgeon available for certain tasks

Within a hospital system-one surgeon for complex case support

Within a region/country/global-surgeon for remote complete surgery

Rural health deserts and emergency interventions

SPACE: Telesurgery and Task Autonomy Overlay when communication latency



Sovato delivers a comprehensive remote surgery solution:

1

Remote Connectivity of Third-Party Robotic Systems

High bandwidth, reliable, secure, and low-latency connection

2

Remote Surgery Orchestration Application

SaaS platform that manages disparate people, systems, tools, and data to support the complete remote surgical journey

3

Regulatory & Financial Models

Financial incentives and contracting strategies that support the scale and sustainability of remote surgery programs



Great But No One Really Wants This



The 1996 chess match of Gary Kasparov
vs. Deep Blue

Human vs. Machine



The 1996 Result:

Kasparov Beats Deep Blue
4 games to 2



Human vs. Machine



Deep Blue Beats

Kasparov: 3 ½ games to 2 ½

Human vs. Machine

IBM Stock rises 15%
in a single day



Human vs. Machine

Matches Continue

1999-2004

Deep Junior

Brutus

Hydra



Kasparov 2010: “Today, for \$50 you can buy a home PC program that will crush most grandmasters.”

Thus in Human vs. Computer in Chess?

Machine is BETTER

Question?

But What About Human vs.

Computer vs.

Human & Computer Together?

Advanced Chess 2005

Kasparov Creates an Advanced
Anonymous Chess Online
Tournament

Anonymous Participants can Be
All Human Teams, All
Computer Teams, or Hybrid
Teams

Advanced Chess 2014

Freestyle Battle 2014

Pure AI systems won 42 games

Hybrid “Centaur” teams won 53 games

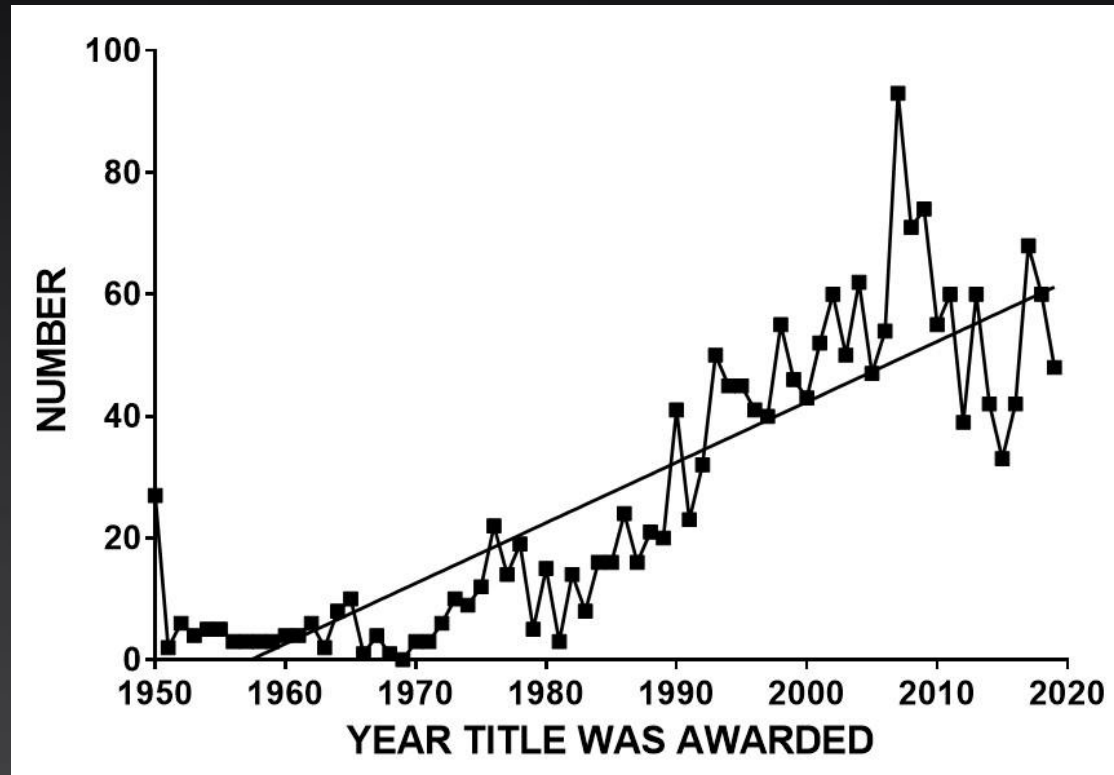
Best player Intagrand: Large team of humans and multiple computer programs

1997 vs. 2020

The number of grandmasters in chess (FIDE >2500) has more than doubled from 1997 to 2014.

Artificial Intelligence integration didn't make us worse at chess.

It made us much better.



Magnus
Carlsen

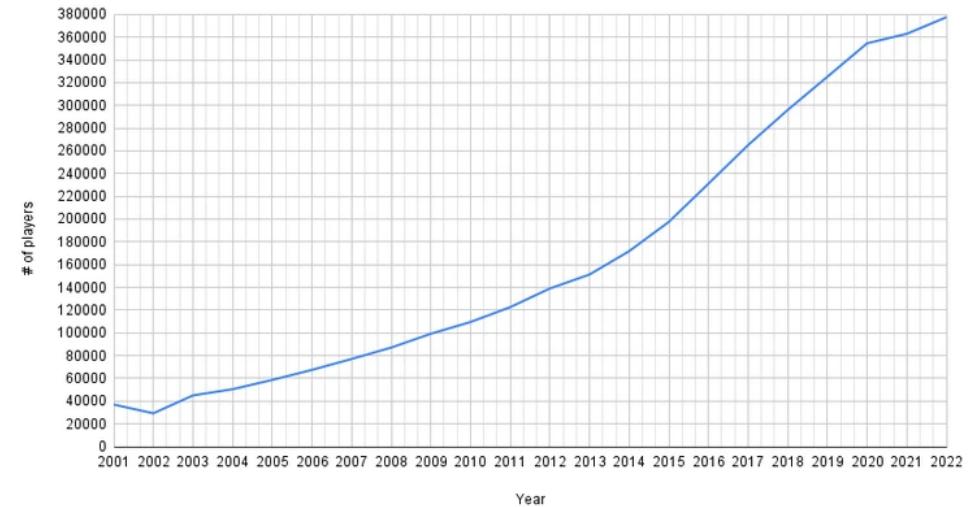
1997 vs. 2020

Automation didn't make
us worse at chess.

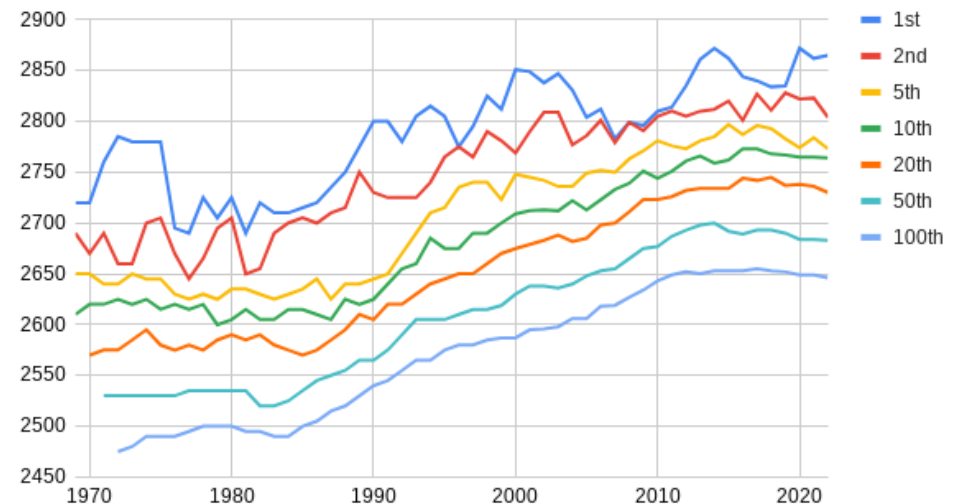
It made us much better.

It made us want to play
chess more.

Number of players registered in FIDE dataset



Player Ratings Over Time



Automation is Really Augmented Dexterity

Task focused automation is already here and better than surgeons

Automation is not about replacing surgeons: it's about making them better

* How?

- * Taking over mundane tasks where we lull ourselves into complacency, unconscious competence sometimes leads to lazy human moves

- * Good surgery is not about “good hands” really, it's about GOOD DECISIONS

- * When our bodies hurt or we are frustrated from physical or cognitive load, our decisions are not as good

- * Hybridization with computers makes use better and makes us want to be better: Humans need struggle and embrace struggle to be better



Erik B. Wilson, MD, FACS
Professor and Vice Chair of
Surgery
Division Chief, Minimally
Invasive Surgeons of Texas
University of Texas Health
Science Center at Houston



THANK YOU