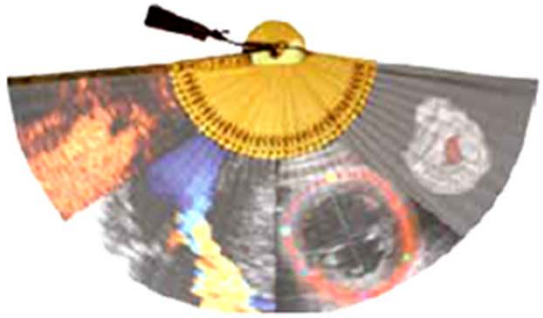

APCDE 2011

15th ASIAN-PACIFIC CONGRESS ON DOPPLER ECHOCARDIOGRAPHY

Diagnosis in your pocket:

Applications of hand-held echo

IL SUK SOHN, MD, PhD

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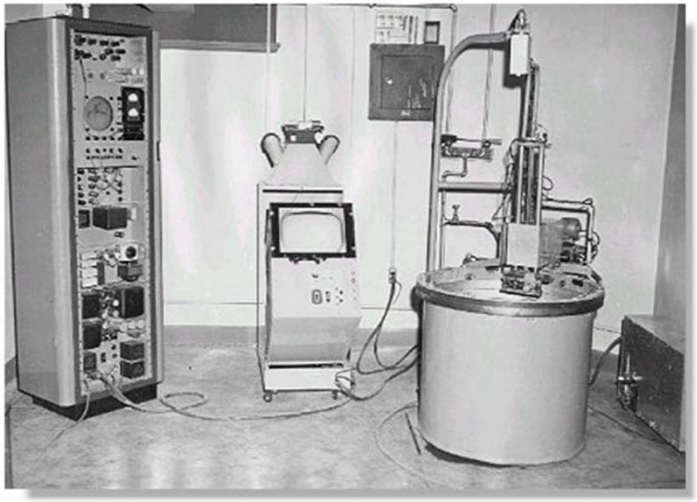
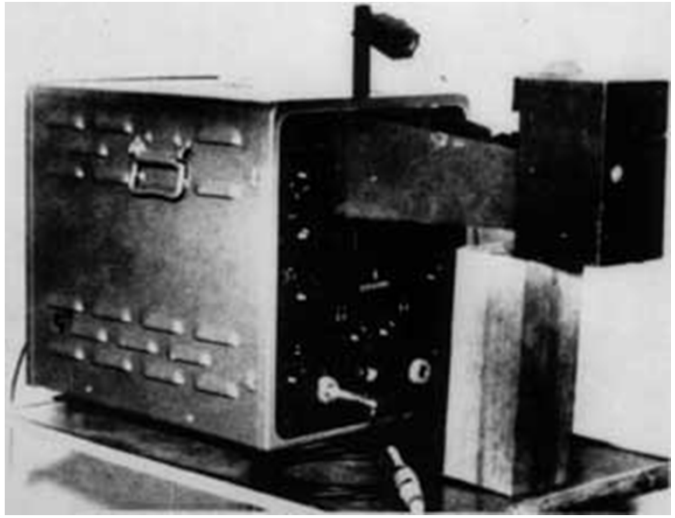
Evolution and Revolution in Echo

- **Past**
  - **History of Echocardiography**
    - **B-mode, M-mode, 2D, Doppler, TEE**
- **Current**
  - **3D, 4D, Contrast Echo, ICE, Speckle tracking…**
  - **Portable hand-carried (held) Echo**

    “Pocket Echo” “ Echo Stethoscope”
- **Future**
  - **Ultrasound smartphone**

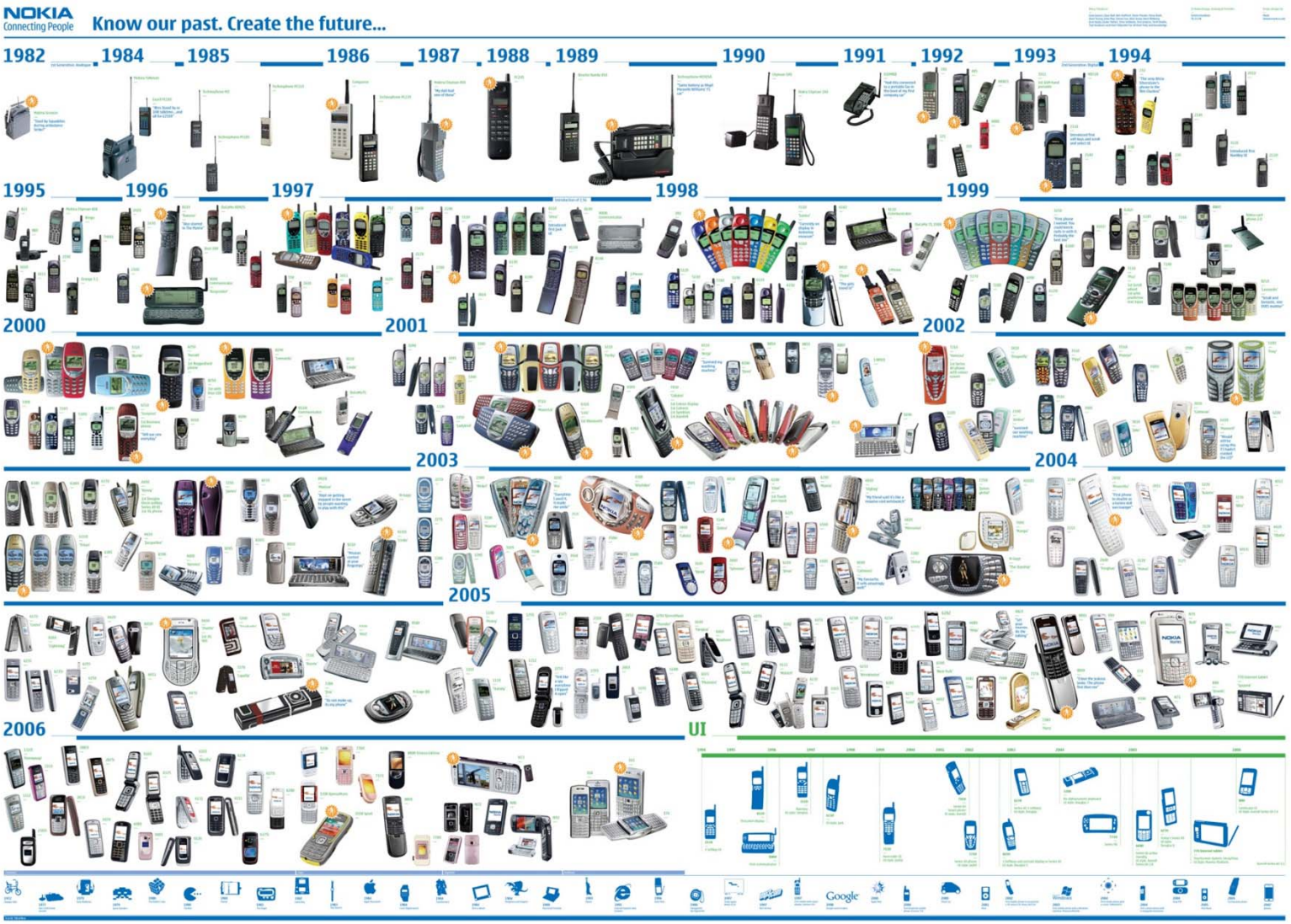
Evolution of Echo



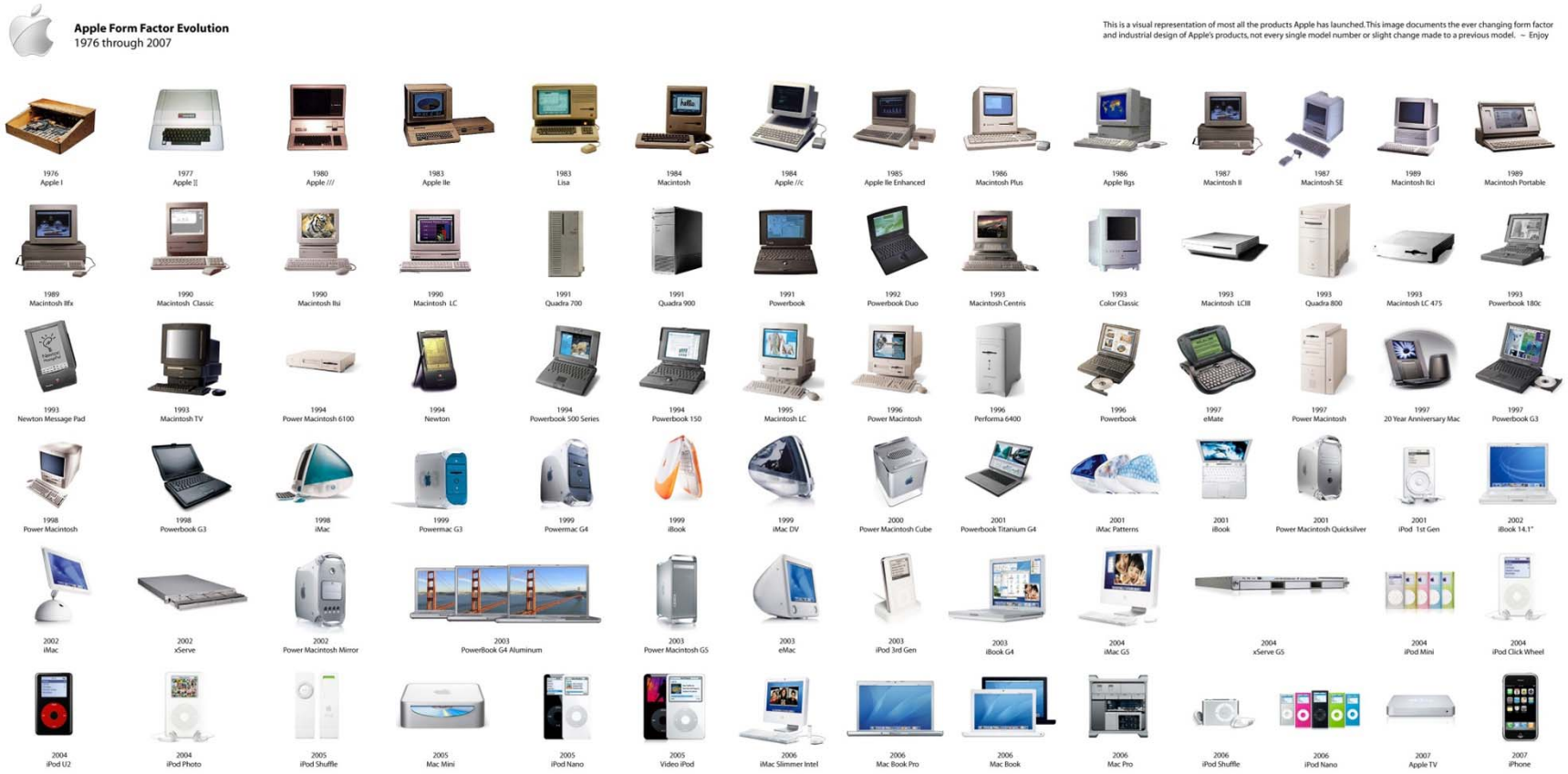


Evolution Is…Becoming Smaller ?

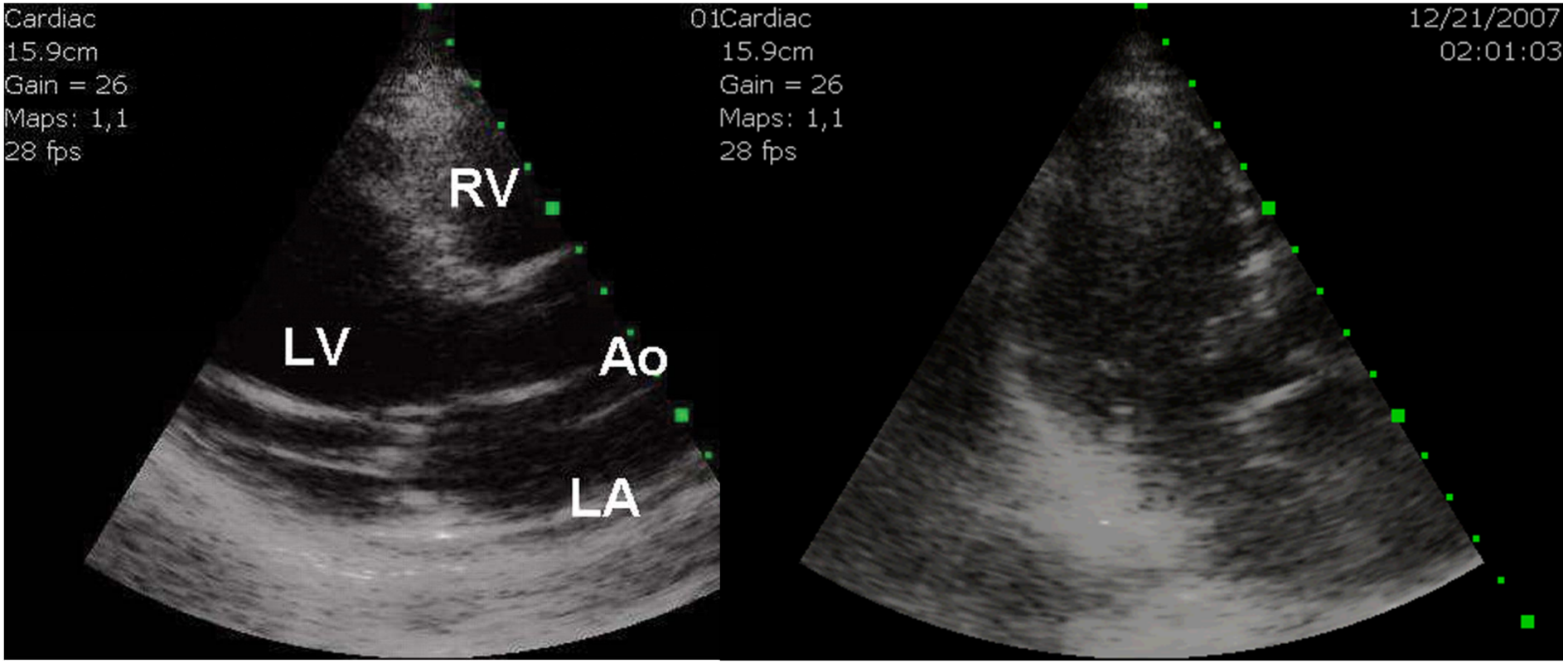
Evolution Is...Not So Simple !



Evolution Is...Almost Revolution !



Hand-held Echo: 2D quality

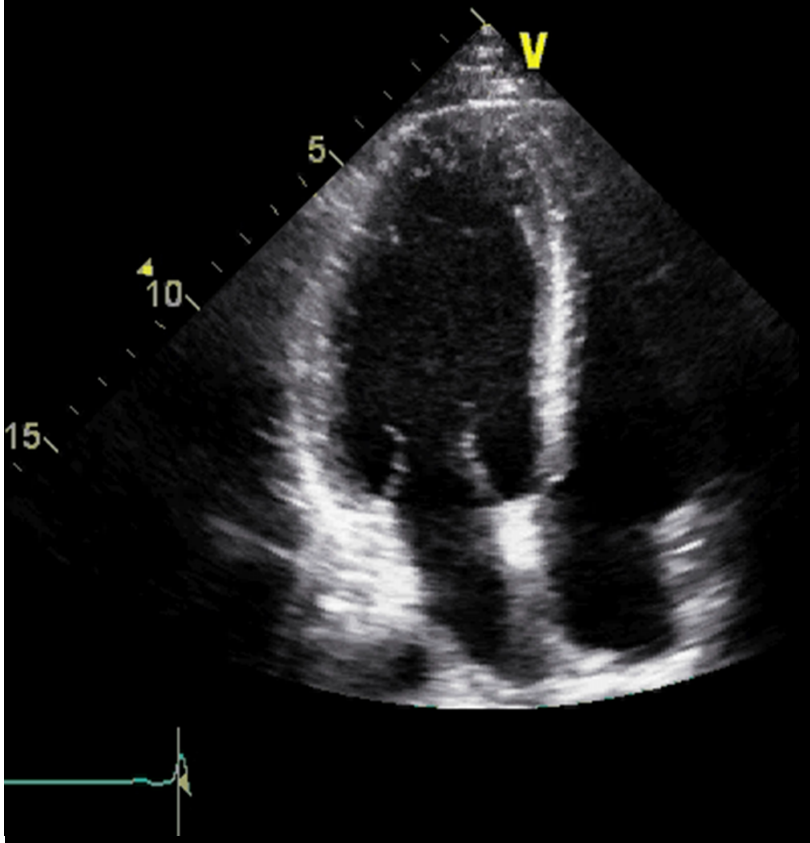


Acuson P10

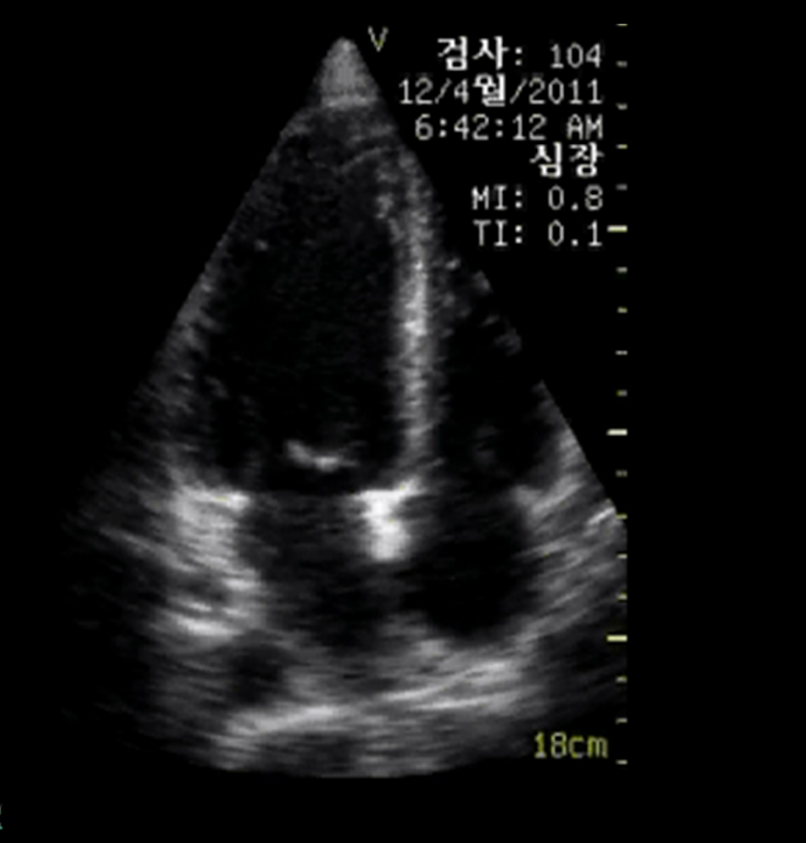
Egan et al. *Eur J Echocardiogr* 2008

Hand-held Echo: 2D quality

VIVID E9, GE

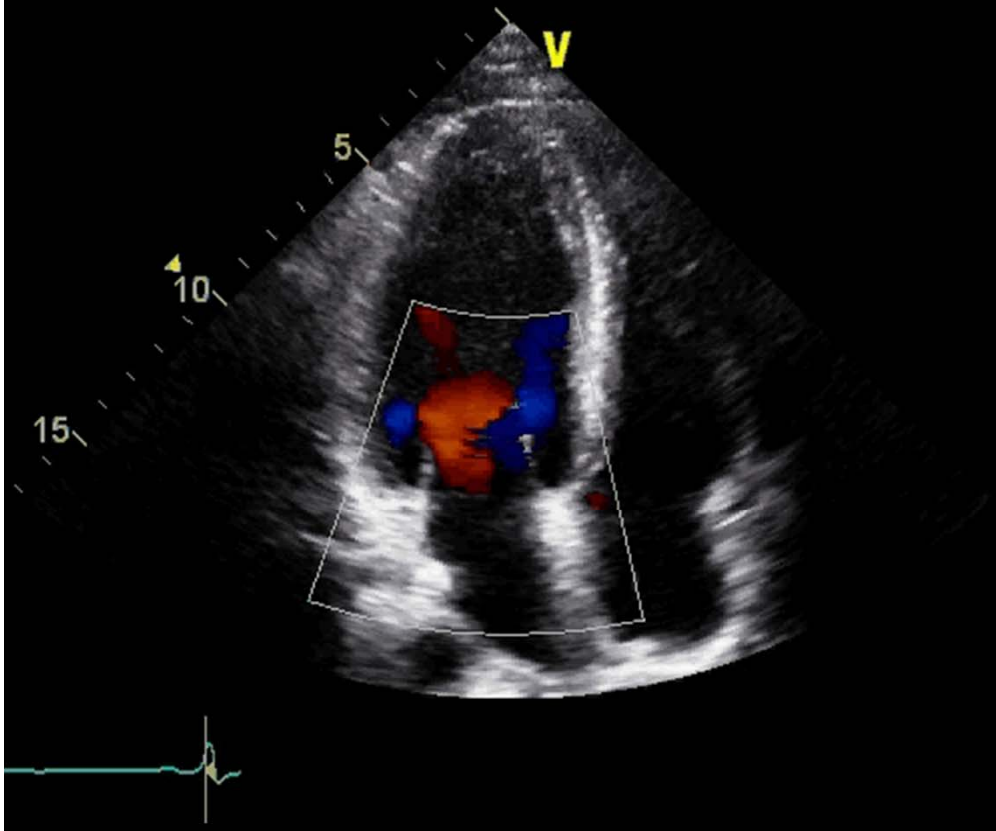


VScan, GE

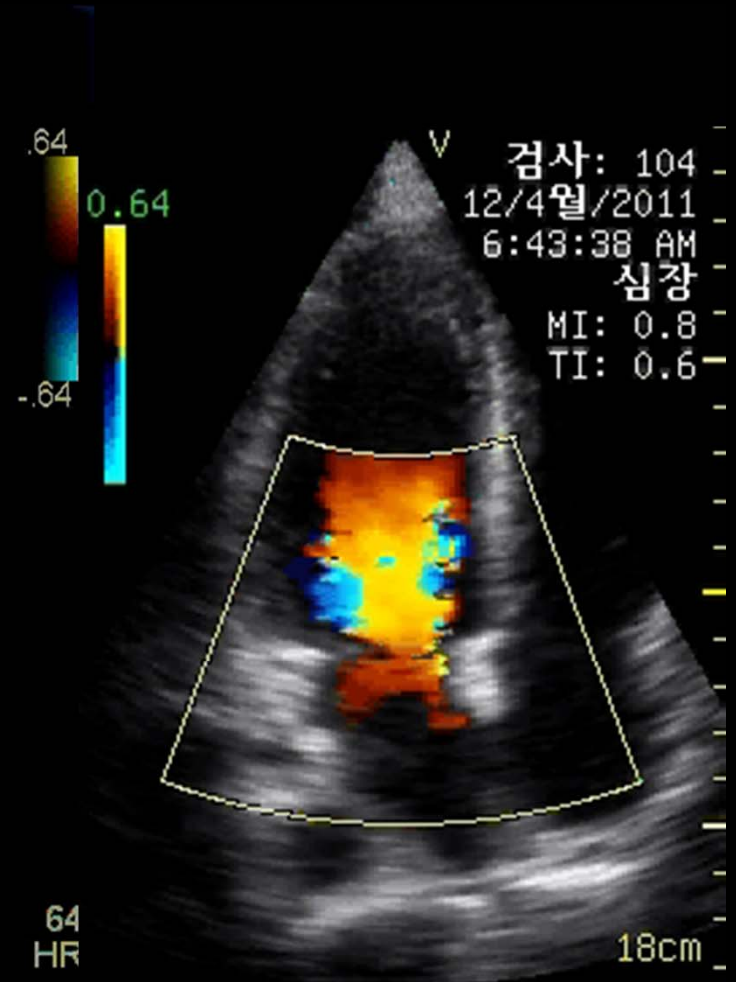


Hand-held Echo: Color Doppler

VIVID E9, GE



VScan, GE



Hand-held Echo

- **Medison Sonoace Pico**

see it all
MEDISON

Features
10.4" Color TFT LCD Display
2D, M-Mode, color and color power Doppler
Pulsed wave and **spectral Doppler**
Tissue harmonic and trapezoidal imaging

40GB Hard Disk Drive
DICOM wireless and USB connectivity

Applications
Cardiac
Interoperative
Musculoskeletal
Obstetrics and Gynecology
Orthopedic
Vascular

http://www.portableultrasound.com/portable-ultrasound-machines/

Hand-held Echo

- **Philips Optigo**

Imaging Modes

- 2D
- Color flow Doppler

Display

- 16.5 cm/6.5 in diagonal, 640 x 480 pixel LCD screen
- 60 Hz minimum refresh rate
- 300 nits minimum light output

Image Acquisition and Management

- Quick Review – retains image information in internal memory for scrolling review of 60 black-and-white or 20 color frames
- Image Export and Archiving – supports storage of still-frame image data in JPEG file format on a removable CompactFlash card for viewing, archiving, emailing, or printing from a personal computer or for direct print from a CompactFlash-compatible printer. (CompactFlash card, printer and computer accessories are not included.)

PHILIPS

sense and simplicity

http://www.portableultrasound.com/portable-ultrasound-machines/

Hand-held Echo

- **Sonosite 180 plus**

Features

5” TFT Color Liquid Display Crystal Screen
2D color with zoom
PowerMap Directional **Color Power Doppler**
Rechargeable Lithium Ion Battery
Education and training programs available
2.6kg with probe
Frame rate ~ 100 /sec

Applications

Abdominal
Obstetrics and Gynecology
Vascular

http://www.portableultrasound.com/portable-ultrasound-machines/

Hand-held Echo

- **Acuson P10**

SIEMENS
medical

Features

1.6 lbs (**0.725kg**)
3.7" LCD display
2.4 MHz phased array transducer
Tissue Grayscale Optimization Technology
SD Memory Card slot
PDA-style User Interface
Fundamental and harmonic 2D-mode)
Lifting screen-switch on-2DE: ~13s

Applications

Cardiology, Emergency Medicine
Obstetrics and Gynecology

http://www.portableultrasound.com/portable-ultrasound-machines/

Hand-held Echo

- **GE Vscan**

GE Healthcare

Features

Weight <1 pound (**0.45kg**)
Dimensions: 3″ wide by 5.3″ long
2D with color-coded blood flow imaging
Thumb-controlled user interface
USB docking station
Voice annotation
Can easily be linked to a PC for data export

Applications

Cardiac, Pediatric Cardiac, Abdominal,
Urological, Emergency Room,
Fetal, Pediatrics
OB-GYN

http://www.portableultrasound.com/portable-ultrasound-machines/

Pocket Ultrasound

GE Vscan

Night view at HAEUNDAE BEACH

Hand-held Echo *vs* Conventional TTE

- **Philips Optigo *vs* Philips SONOS 5500**
- **Mechanically ventilated patients, n=103**
  - Recording, 2 intensivist (Echo experience)
  - Interpretation, 1 cardiologist (Echo experience)
- **Hand-held Echo**
  - **Lower** diagnostic capacity (lack of **spectral Doppler**)
  - **Comparable** diagnostic capacity based on **2D**
  - Similar therapeutic impact

Vignon et al. Crit Care 2003

Hand-held Echo for LV dysfunction

- **Philips Optigo, SonoSite SonoHeart Plus** *vs* **Philips SONOS 5500**
- **Suspected LV dysfunction, n=88**
- **IVC collapse, LVEF(visual estimation) <40%**
  - **Agreement → 96%**
  - **Sensitivity in identifying LV dysfunction**
    - **IVC collapse (26%), LVEF (89%), BNP (94%)**

Vourvouri et al. Eur J Heart Fail 2003

Hand-held Echo for Consultant Cardiologist

- **Acuson P10**
- **1 consultant cardiologist**
  - **30 patients during a week on call**
  - **Focused scan < 4 min (PLAX, A4C)**
  - **LVEF (normal/abnormal)**
  - **LV dimension (dilated/non-dilated)**

  - **To assess LVEF, LVD → 23/30 (77%)**
  - **To obtain PLX, 28(93%), A4C, 23(77%)**

Egan et al. Eur J Echocardiogr 2008

Hand-held Echo in Emergency Dept.

- **Hand-held echo (HHE, Philips Optigo)**
  - 3rd year medical student → 4hr training
  - LV systolic function : normal/ abnormal
- **Acute chest pain, n=150**
  - with non-diagnostic EKG + normal biomarker
  - Death, MI in 30-day F/U
  - AMI incidence in study subjects (108/150)
    - 2/78(2.5%) in normal HHE
    - 6/30(20%) in abnormal HHE
  - Negative predictive value
    - 91%

Weston et al. Am Heart J 2004

Hand-held Echo in Outpatient Clinic

- **222 patients indicated standard Echo**
- **Same cardiologist (Echo experience)**
  - Performed HHE → reassess → confirm/ cancel the Echo
- **HHE performed in 108/222 pts**
  - **Definite Dx in 34/108 (31%) → avoid Echo**
  - **Inconclusive HHE, 74/108**

    → mainly due to lack of spectral Doppler
- **Agreement between HHE & standard Echo**
  - **73%** (kappa=0.4)

Trambaiolo et al. Heart 2007

Hand-held Echo in Developing Countries

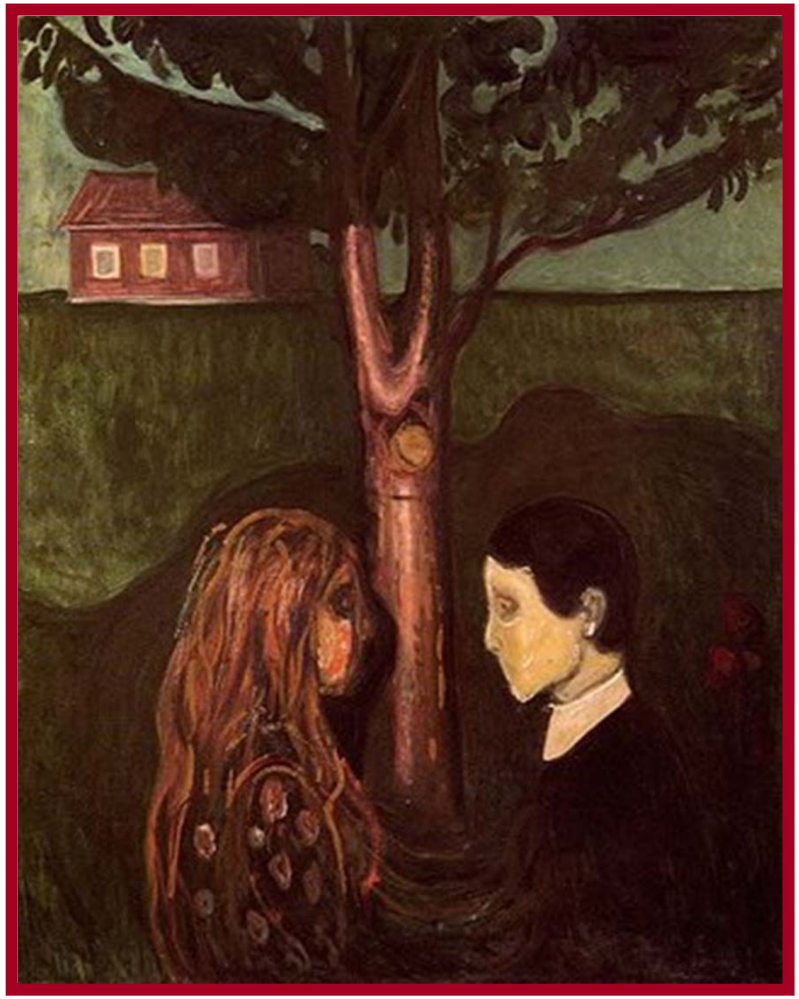
- **126 pts referred to a cardiology clinic in rural Mexico**
- **Found 86 cardiac findings**
- **Avoid further comprehensive Echo in 90% (113/126)**

Kobal et al. Am J Cardiol 2004

Hand-held Echo : Current

- **2D & Color Doppler** (*not* spectral Doppler)
  - **LVEF, wall motion, valve, pericardium, mass**
- **Portability & low cost**
- **Clinical applications**
  - **Emergency : AMI, Cardiac tamponade**
  - **Critical Care in ICU : Mechanical ventilator**
  - **Hemodynamic : IVC, shock patients, LVEF**
  - **Outpatient : Pre-echo screening, Consult**

Every Eye.. Same Eye ?



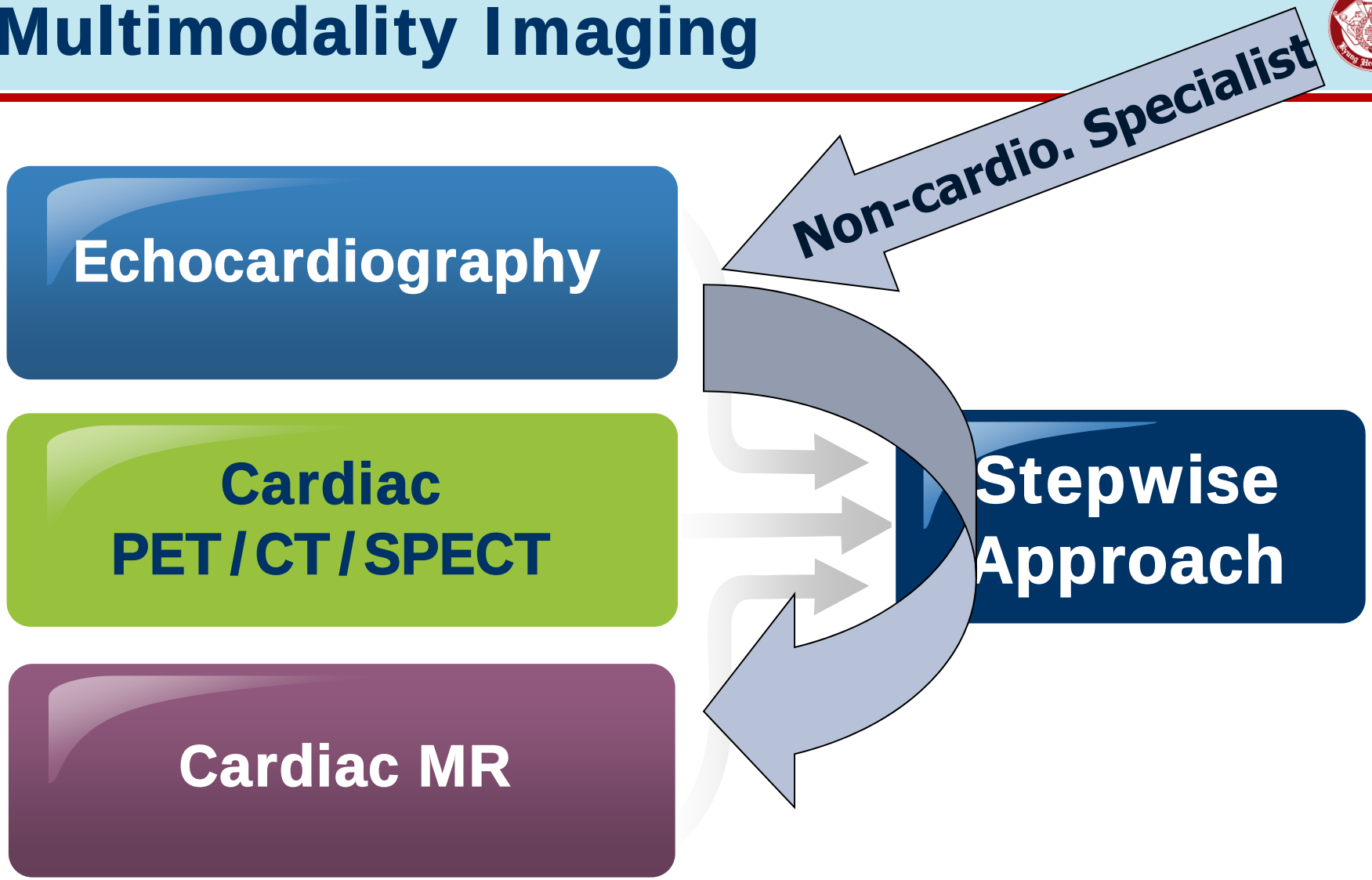
Edvard Munch (1863~1944). *Eye in Eye*, 1894

Every Eye.. Same Eye ?

Master

Beginner

Multimodality Imaging



..may lead to a lower level of expertise..

Thomas H. Marwick. *Eur J Echo* 2009

Recommendations, ASE

AMERICAN SOCIETY OF ECHOCARDIOGRAPHY REPORT

Hand-Carried Cardiac Ultrasound (HCU) Device: Recommendations Regarding New Technology. A Report from the Echocardiography Task Force on New Technology of the Nomenclature and Standards Committee of the American Society of Echocardiography

Minimal training (ASE recommended) Level 1

Level	Number of personally performed examinations	Number of personally interpreted examinations	Objectives	On completion
1	Total 75	Total 150	Introductory experience	Perform with supervision
2	Total 150	Total 300	Performance, interpretation	Perform independently
3	Total 300	Total 700	Laboratory director and teacher	

Seward et al. J Am Soc Echocardiogr 2002

Recommendations, EAE

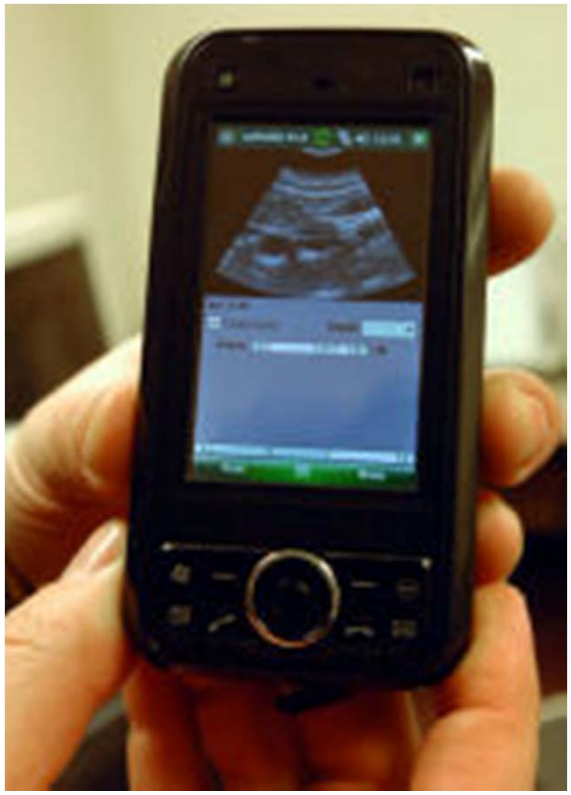
European Heart Journal (2011) **32**, 385–392
doi:10.1093/eurheartj/ehr001

CARDIOPULSE

The use of pocket size imaging devices: a position statement by the European Association of Echocardiography[1]

Pocket size imaging devices are a tool to complement physical examination and not a device for a complete diagnostic ECHO examination. Luigi P. Badano, EAE President discusses the developments for CardioPulse

Hand-held Echo : Now or Near Future



Ultrasound smartphone + USB probe

Washington Univ. Computer Science and Engineering

Applications of hand-held Echo

- **Hand-held Echo**
  - **2D & Color Doppler**
    - **Ischemic heart disease, Valve, Heart failure**
  - **Role in ED, ICU, OPD (echo stethoscope)**
  - **Small, high quality, in-expensive, low energy**

- **Growing users → how are they accredited ?**
  - **Training and quality control**

Thank you for your attention !

APCDE 2011

15th Asian-Pacific Congress on Doppler Echocardiography