OPTICS TRADE

THERMAL IMAGING BINOCULARS

THERMAL IMAGING BINOCULARS

- completely changed traditional hunting
- **uninterrupted game observation**
  - physical obstacles: trees, rocks, undergrowth
  - climate obstacles: fog, smoke, rain

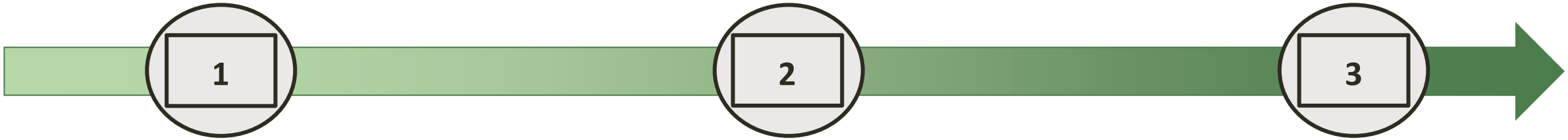
classic daytime and analog night vision

optics fail to see through obstacles!

- **dual-use devices:** daytime & nightime
- quick scan of large areas
- after the shot: finding game is easier
- thermal imaging **detects heat**

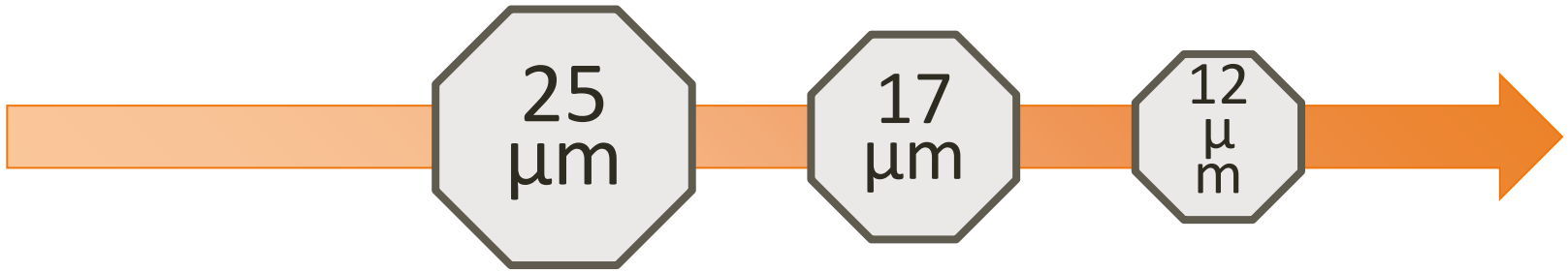
Sensor Resolution

- sensor = **heat detector**
- fast development → many upgrades

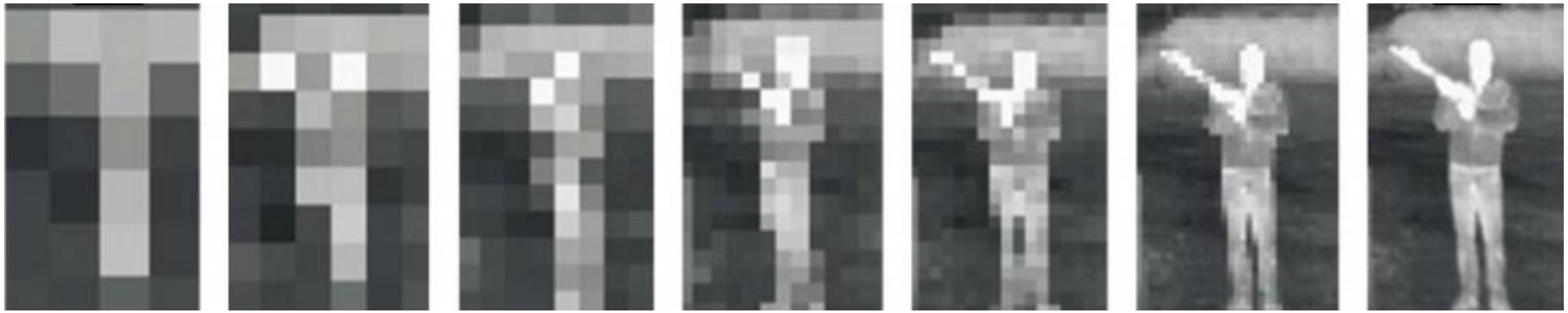


388x284	640x320	1260x800
• basic models • previous standard • affordable	• advanced models • current standard • expensive	• cutting edge models • best civilian available • super expensive

Pixel Size



- pixel size is shrinking
- unit of measurement: micron (µm)
- smaller pixels → **better, more detailed image**



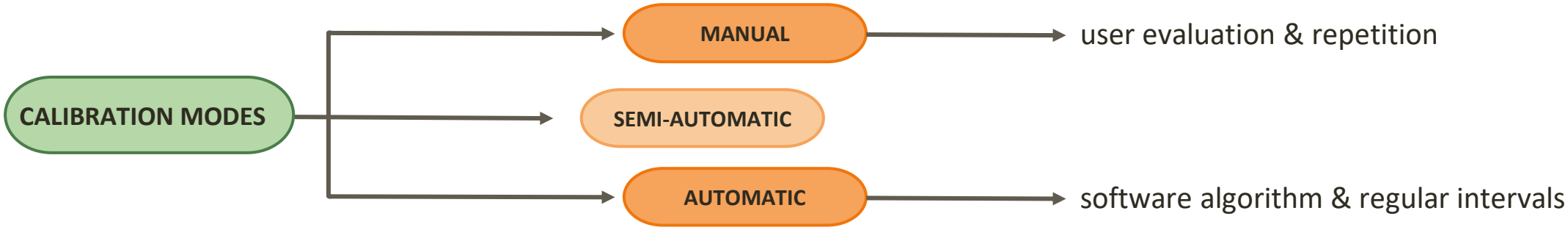
- display resolution =/= detector resolution
  - both are necessary for optimal device performance!

Noise Equivalent Temperature Difference (NETD)

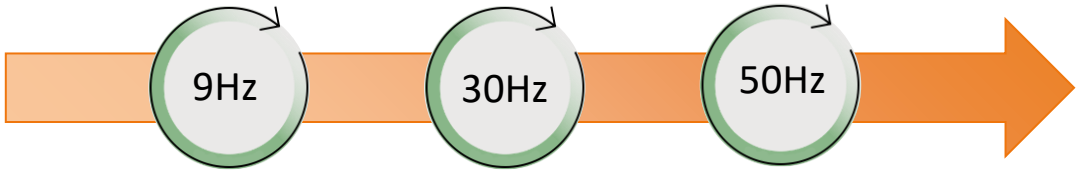
- temperature sensitivity
- the **smallest temperature difference** still **detected by the sensor**
- NETD factor → number of **details preserved**
- initial launches: > 60mK
- current standard: 40mk
- steady improvement

Sensor Calibration

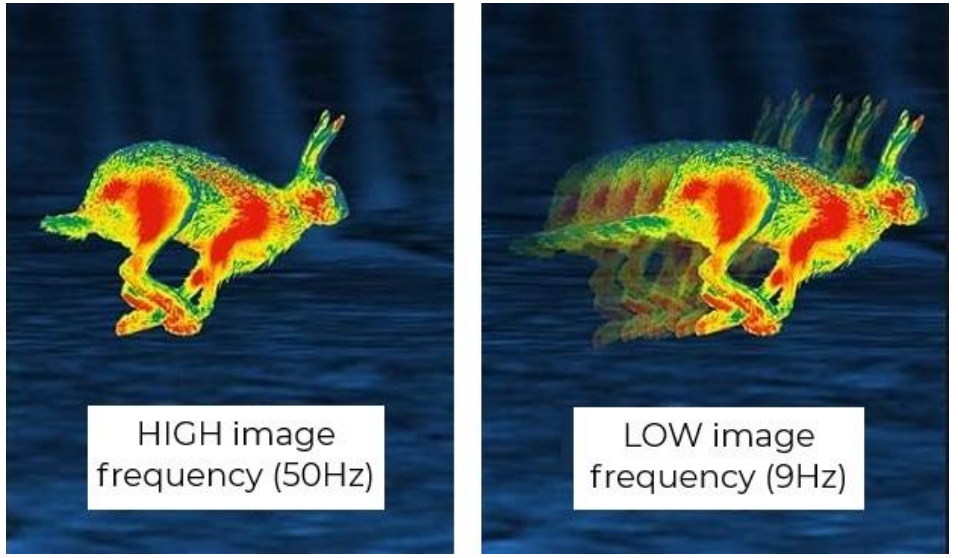
- objects at various ranges & differences in temperature
- image **quality decreases** with time and use
- sensor needs to be calibrated **every few seconds**
  - distinct “clicking” sound → shutters close → image on the display freezes
- shutterless calibration available in premium devices



Display Refresh Rate



- the number of image frames that appear on the display in each second
- measured in Hz
- above 30Hz → **brain perceives it as *movement***
- older civilian imagers: **9Hz**
  - visible gaps in-between frames
  - not recommended for observation of moving objects
- current standard: **30Hz**
- premium devices: **50Hz**
  - smooth operation



Lens Diameter

- bigger the lens > **more details** are preserved
- lens & sensor size **determine the FOV**

Lens Material

- **GERMANIUM glass**
- ultra-resistant
- good IR transparency
- low optical dispersion

METALLOID FORM (unrefined)

LENS FIBER (cut & polished)

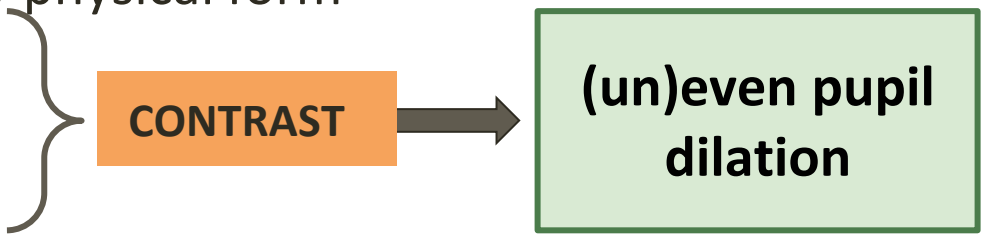
THERMAL IMAGING vs NV Binoculars

+ long detection range: **> 2000m**	- short detection range: **> 300m**
+ see **beyond** environment. obstacles	- limited by environmental obstacles
+ **heat sensor** → **invisible** to animals	- **IR illuminator** → **visible** to animals
+ **dual use**: day & night vision	- **single use**: night vision
- **lower resolution**	+ **higher resolution**
- display refresh rate: **30Hz**	+ display refresh rate: **50Hz**
- show **only warm parts** of the object	+ show **entire object** indiscriminately

OPTICS TRADE

Thermal Imaging BINOS vs SCOPES

- **no difference in technology** used, only physical form
- all thermal devices use **bright displays**
- **low-light environment**



- humans use **two eyes for seeing** > binoculars enable **natural viewing**
- scopes are cheaper and more handy
- user's personal preference
- *Which form offers faster transition from observing to shooting? (Debatable.)*

BOTH EYES ARE ENGAGED

BINOCULARS

even pupil dilation

VS.

ONLY ONE EYE IS ENGAGED

SCOPES

uneven pupil dilation

LRF Thermal Binoculars

- extremely **long detection ranges**: > 2000m
- accessing distance is hard
  - distance & depth impression → different than with plain sight
- considerable margin of error
  - objects seem further away
- innovation → **built-in laser rangefinders**

- **alternative methods** of accessing distance
- placing vertical lines
  - approximation not measurement!
- **3 observation modes**
  - red deer
  - boar
  - hare
- highly **unreliable**

CONSIDER: Specimens of the same animal species can greatly vary in size!

Physical Properties

- entirely waterproof
- thick rubber coating
- multi-layer lens varnish

} ultra-resistant and heavy-duty devices

- intentionally **imitate classic binoculars**
- bulkier and heavier than conventional optics

CLASSIC BINOS

VS.

THERMAL IMAGING BINOS

Power Sources

These are the 3 most commonly used power sources in thermal imaging optics.

integrated batteries

- cost-effective
- popular manufacturing choice
- smaller overall device size

generic removable batteries

- easily accessible
- back-ups
- fast energy drain
- environmentally unfriendly

specialized removable batteries

- can be purchased separately
- slower energy drain
- back-ups
- easy in-warranty replacements


OPTICS
TRADE