



insightness[®]
sight for your device

Event-based Vision for Augmented Reality

Workshop on Event-based Vision, CVPR 2019

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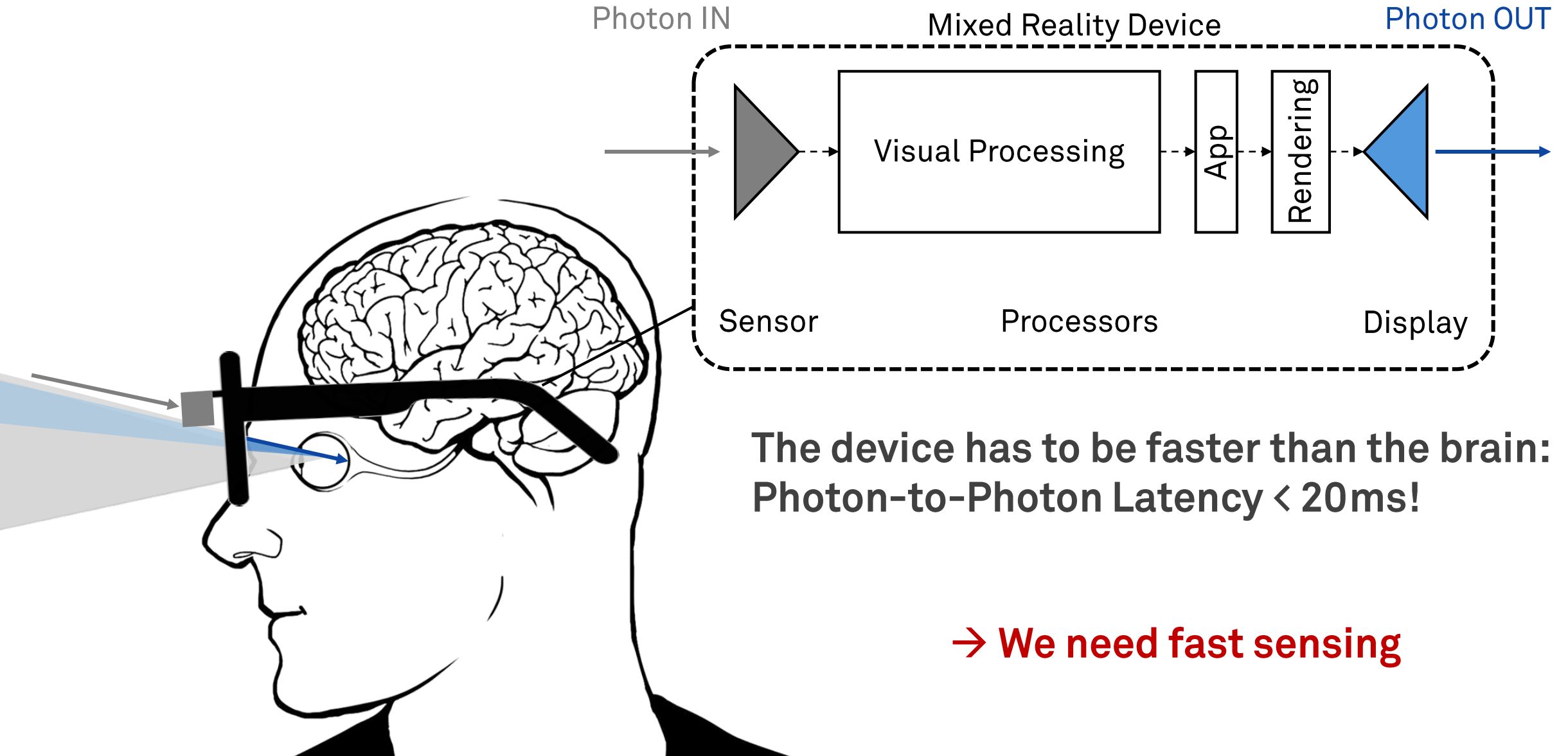
Our vision is truly convincing augmented reality

We need a device to display virtual content



and sensors to enable an interactive and immersive experience.

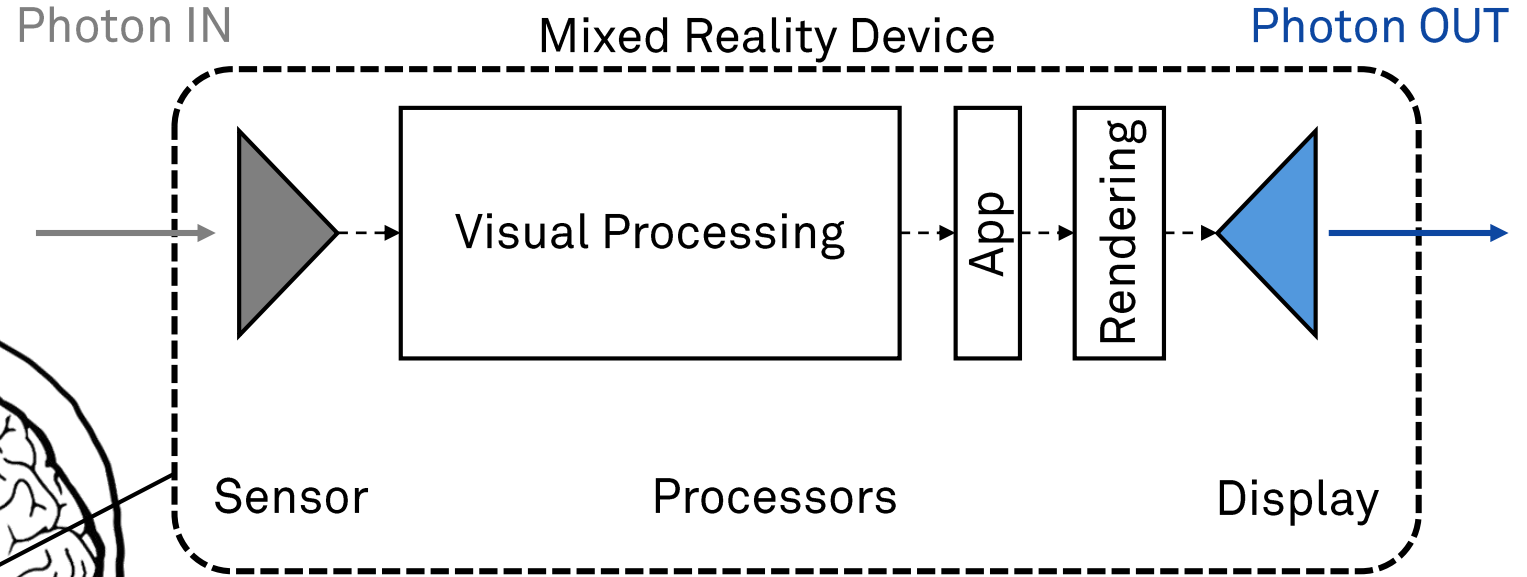
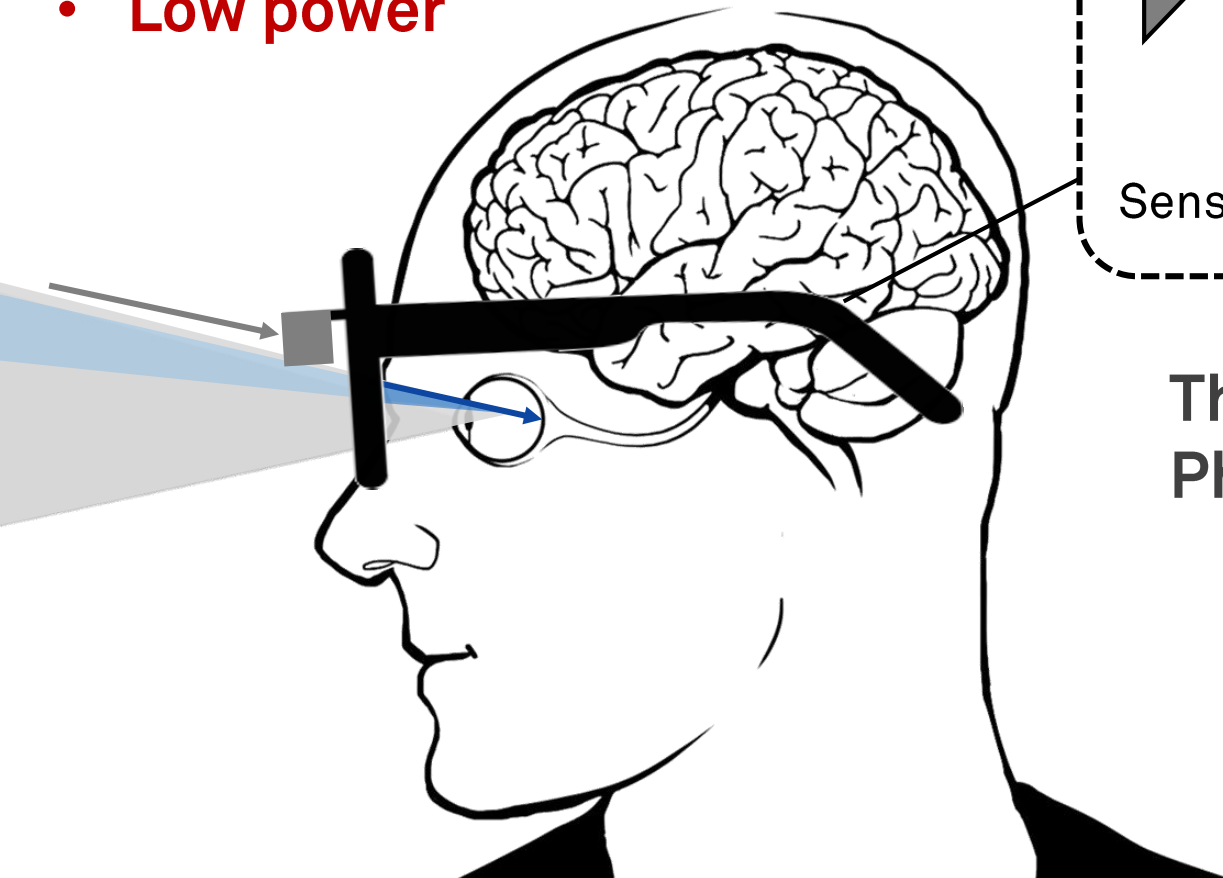
Tricking the Brain: Subconscious Latency



Tricking the Brain: Subconscious Latency

→ Event-based sensors provide always-on vision at:

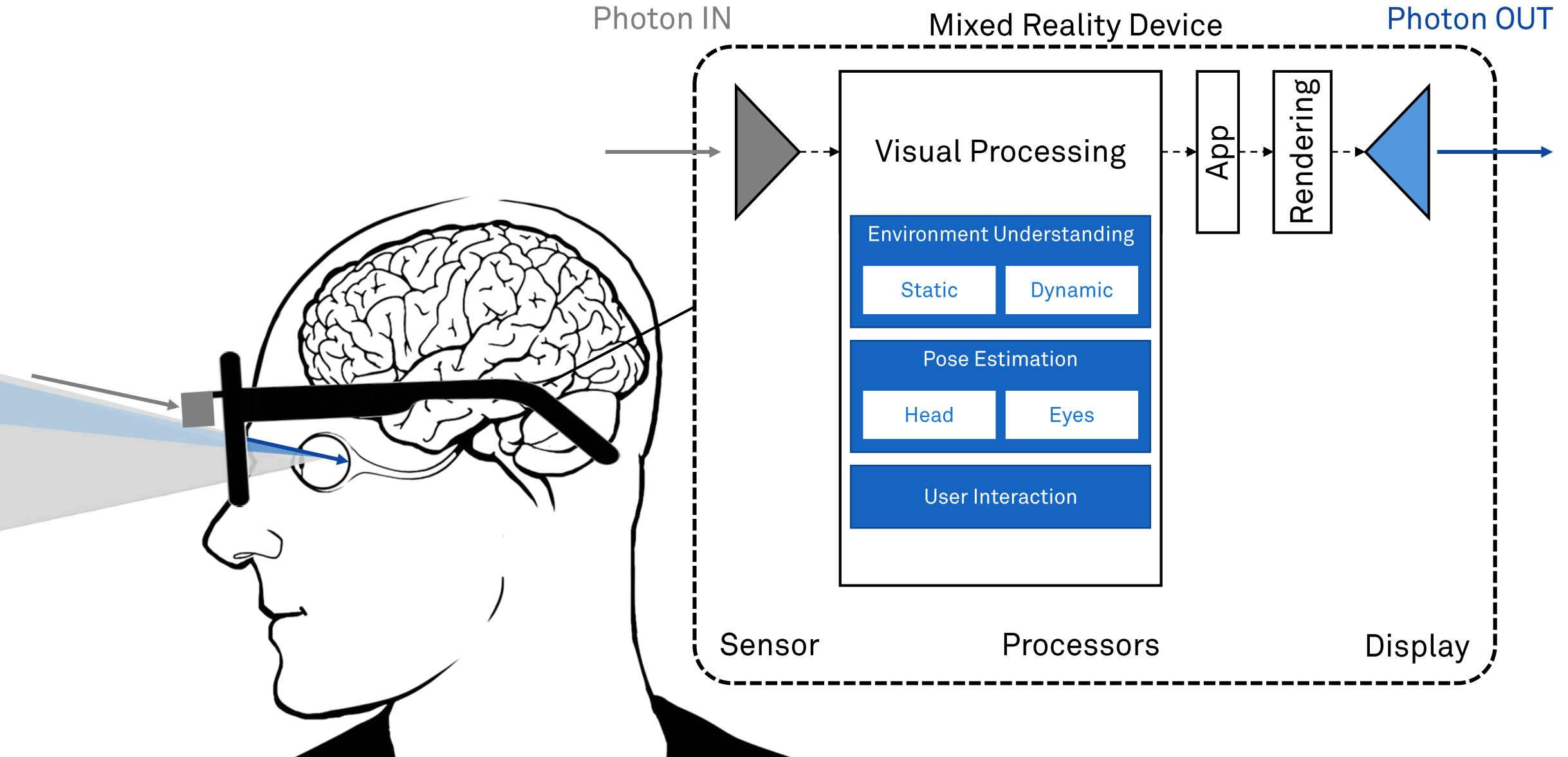
- Low latency
- High temporal resolution
- Low power



The device has to be faster than the brain:
Photon-to-Photon Latency < 20ms!

→ We need fast sensing

What Is Sensing Needed For?



Insightness

- Founded 2014 by PhD students as a spinoff of ETH Zurich and the University of Zurich
- Striving to improve the sensing system by...
 - ... developing our own, application targeted sensors
 - ... developing our own computer vision algorithms fitting the functionality of our sensors



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Combining Events and Frames: The DAVIS

- The basis of Insightness sensors, invented by our co-founders Raphael Berner and Prof. Tobi Delbrück
- Combined active pixel sensor readout with event-based readout:
 - Change events and a global shutter grayscale frame
 - Shared photodiodes but no interference
- Relevance for software:
 - «Conventional» computer vision on APS frames
 - Use events where they are strong: fast motion, low latency



Insightness Rino 3 (2018)

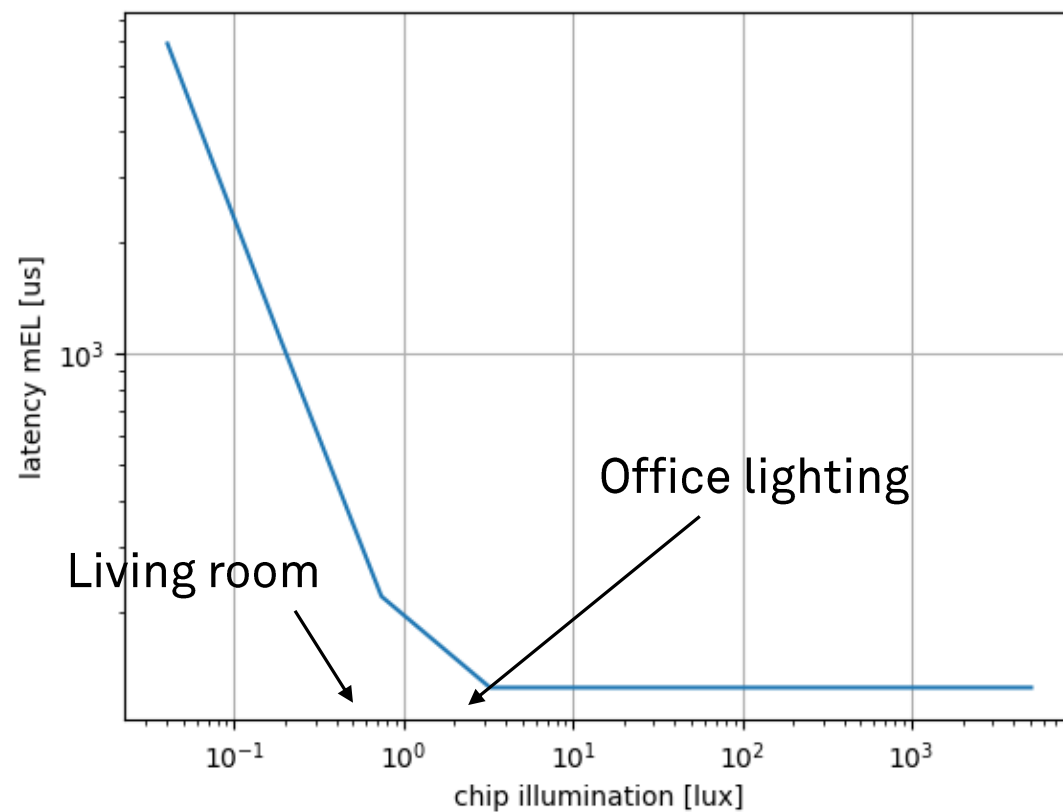
- Features events and global shutter grayscale frames on the same sensor (non-interfering)
- 320 x 262 px (~QVGA) resolution



Insightness Rino 3 (2018)

- Events:
 - > 100 dB dynamic range
 - Configurable sensitivity
 - Up to 10 kHz time resolution (configurable)
 - <1 ms latency for >1 lux chip illumination
 - > 50 Meps bandwidth
- APS frames:
 - Up to 30 Hz
 - 10 bit grayscale resolution
 - Global shutter
- IMU:
 - Invensense MPU-9250
 - 1 kHz
 - 9 DoF

Rino 3: Latency vs Illumination

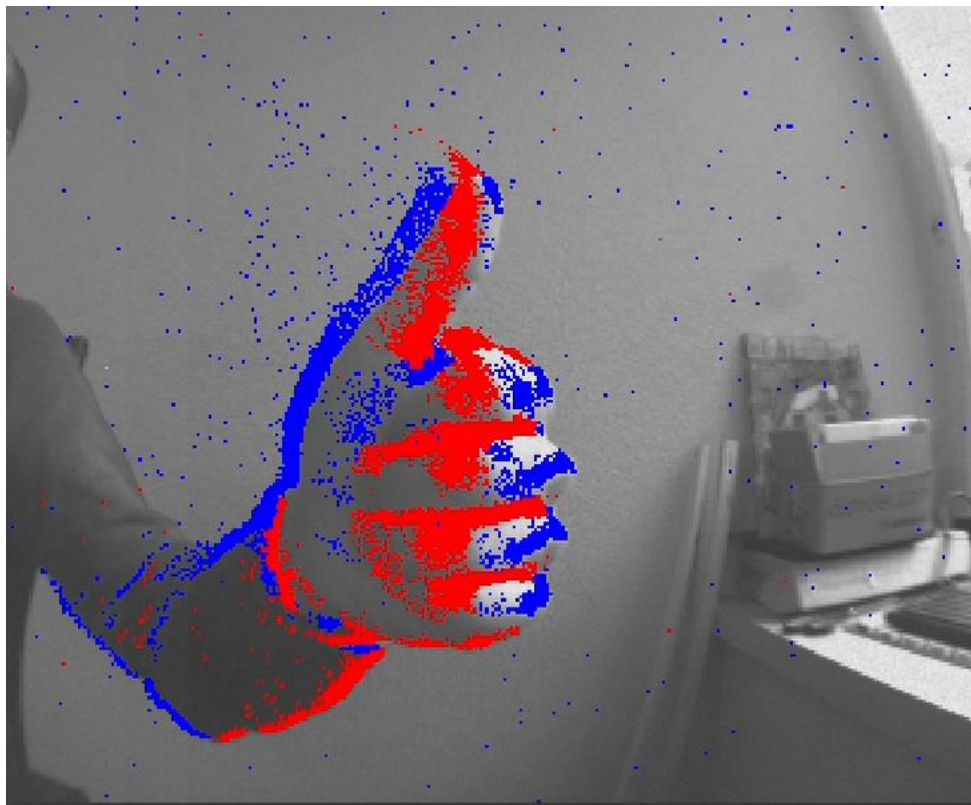


Insightness Rino 3 (2018)

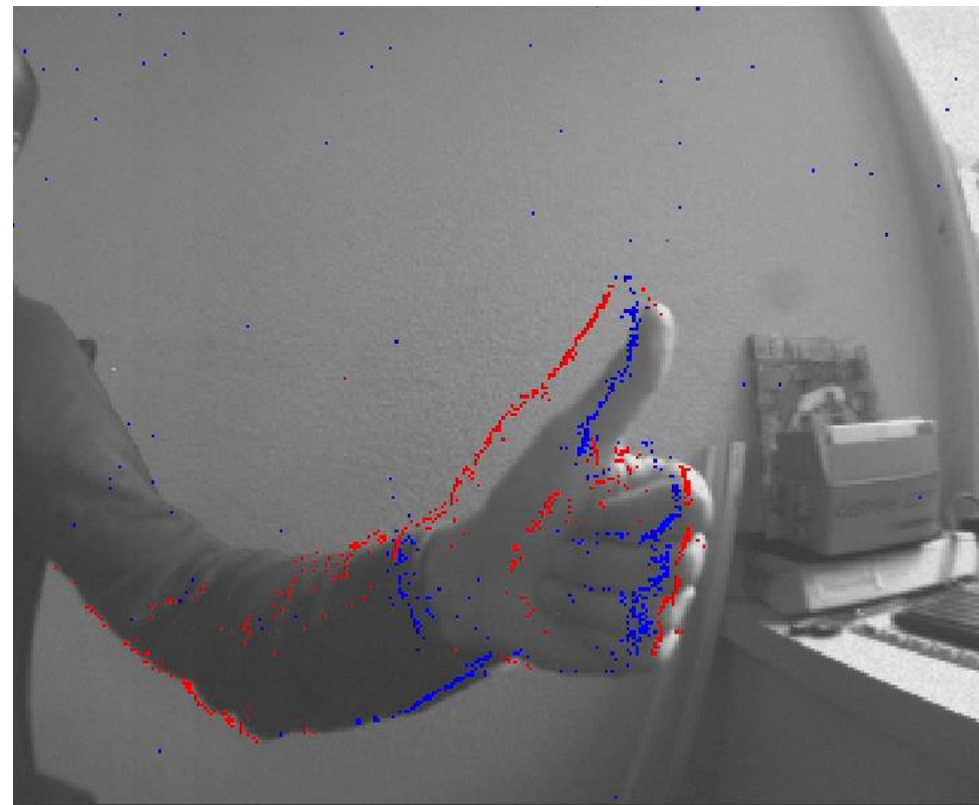
- Available as evaluation kit e.g. for research:
 - 35 x 35 x 28 mm sensor module
 - 15 g weight
- M12 lens mount
- USB 2.0 (~20 Meps bandwidth)
- C++ API
- ROS package available
(rpg_dvs_ros/dvs_msgs topics)



Insightness Rino 3 (2018)

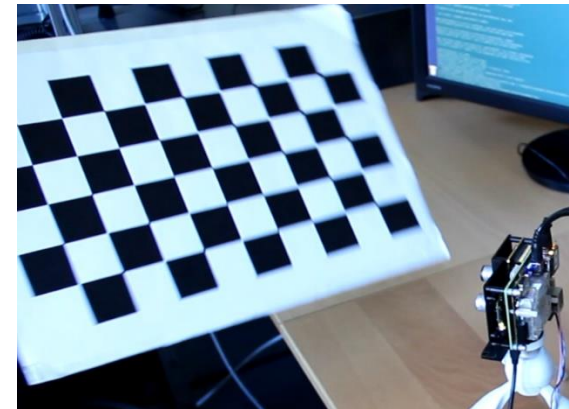
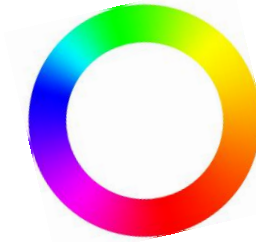
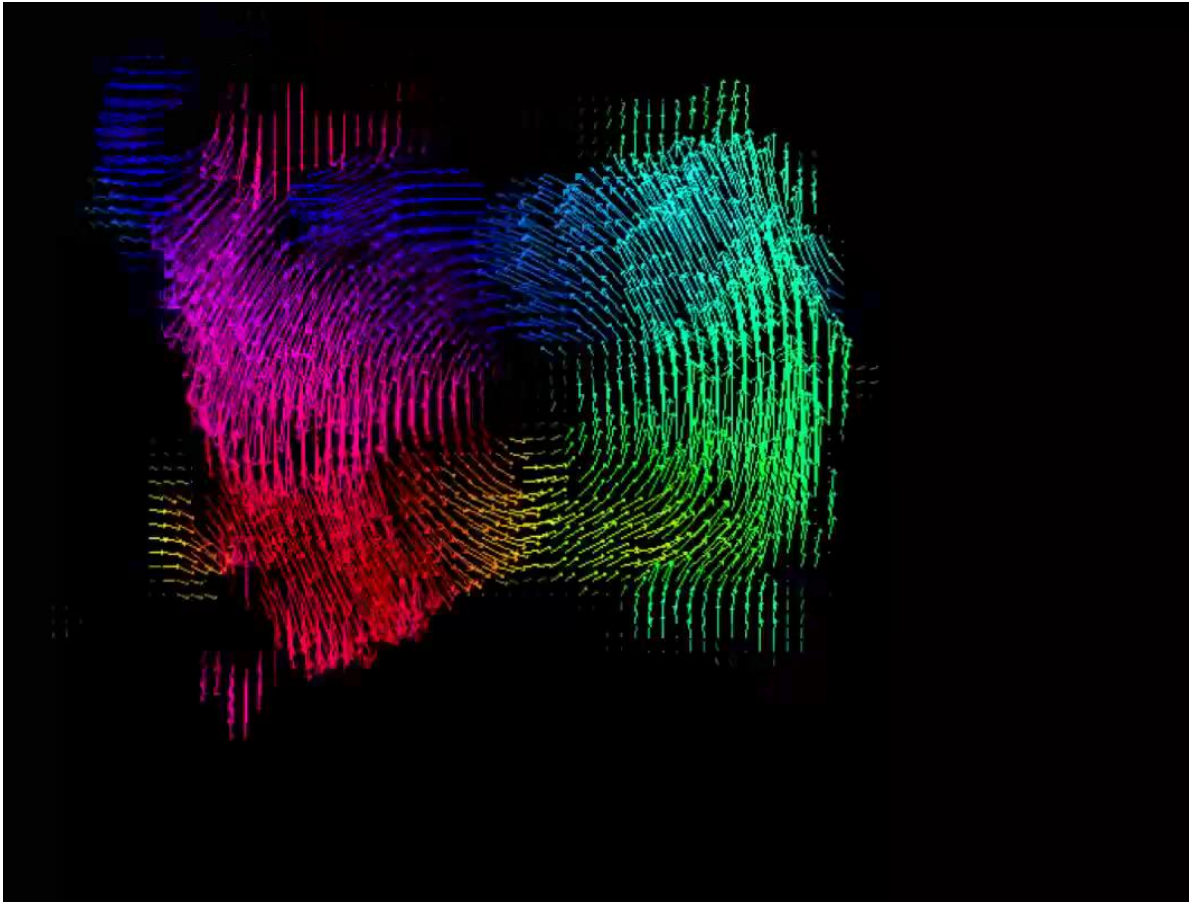


1x



0.1x

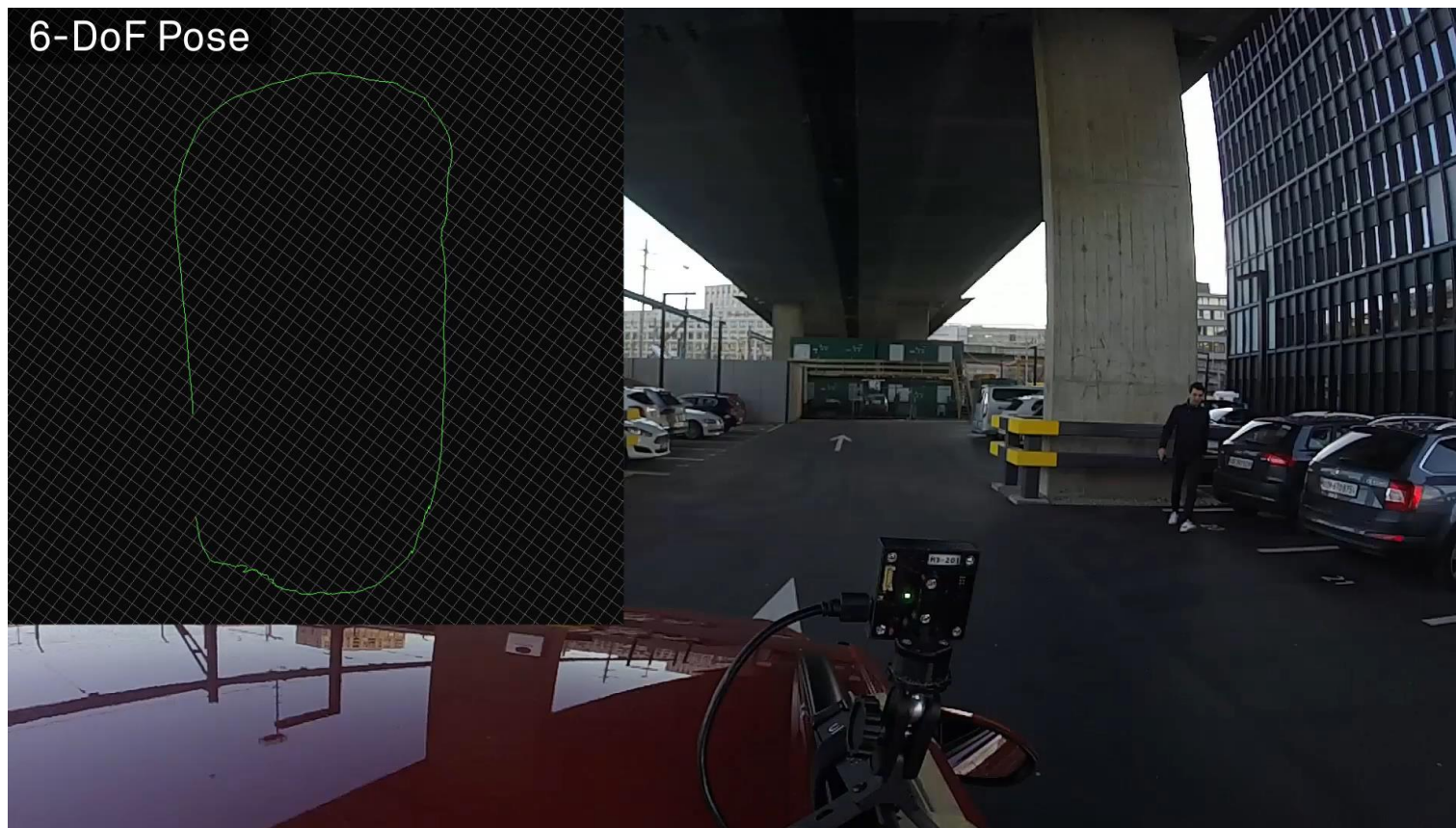
SW: Optical Flow Approximations (2016)



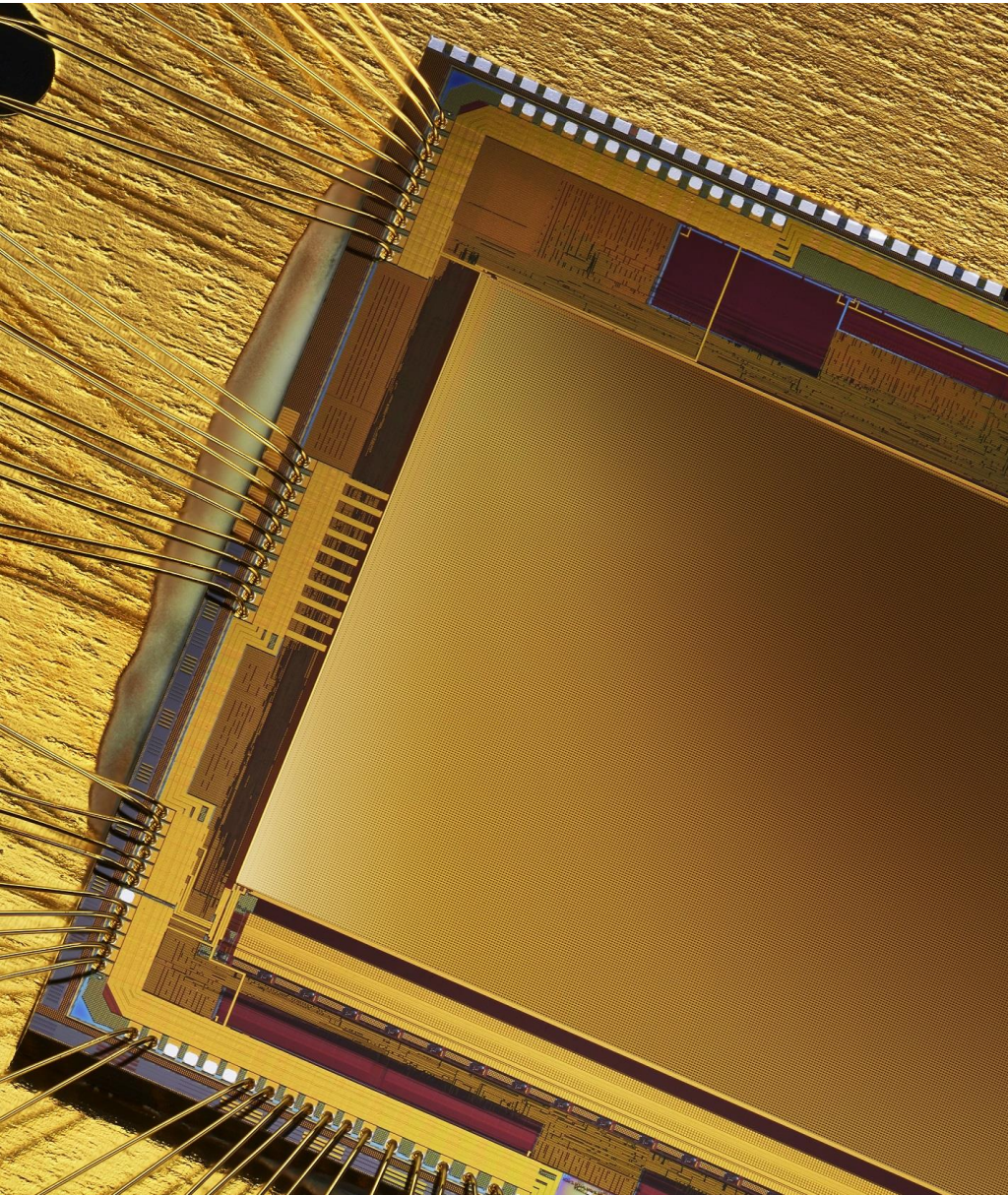
SW: Drones (2016)



SW: Visual Inertial Odometry (2017)



Introducing the Rino 4 (2019)

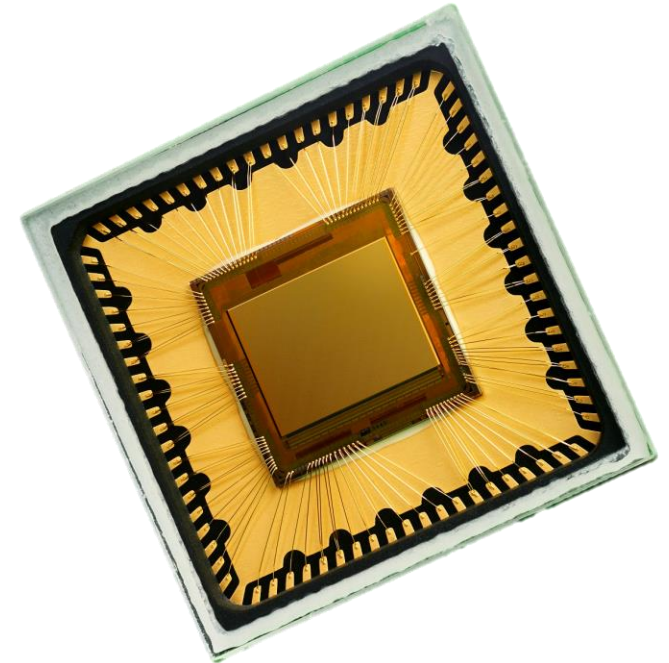


- 1024 x 768 pixels resolution
- Events and grayscale global shutter frames (non-interfering)
- Stacked BSI process
- 7.2 μm pixel pitch

Introducing the Rino 4 (2019)

- ~100% fill factor
- Optical format: 1/1.7"

Fits into compact
camera modules



©Huawei

Introducing the Rino 4 (2019)



- Configurable resolutions:
 - 1024 x 768
 - 800 x 600 (SVGA ROI option)
 - 640 x 480 (VGA ROI option)
- Evaluation kit:
 - M12 or C mount lens
 - USB 3.0 / MIPI
 - Includes 9 DoF IMU
 - C++ API
 - ROS package available
(rpg_dvs_ros/dvs_msgs topics)

Introducing the Rino 4 (2019)



- Events:
 - > 100 dB dynamic range
 - Configurable sensitivity
 - 10 kHz time resolution (configurable)
 - <1 ms latency for >1 lux chip illumination
 - > 80 Meps bandwidth
- Global shutter APS frame:
 - 30 Hz (full res.) – 50 Hz (VGA)
 - 10 bit grayscale

Introducing the Rino 4 (2019)



Available Q3 2019!

Insightness And You

- Get one of our evaluation kits:
 - Rino 3
 - Rino 4
- Get in contact for collaborations
- Join our team



Contact us: info@insightness.com



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Thank you

Are there any questions?

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