

# Transmissive Mirror Device based Near-Eye Displays with Wide Field of View

**Kazuki Otao**, Yuta Itoh, Hiroyuki Osone, Kazuki Takazawa, and Yoichi Ochiai  
University of Tsukuba, Pixie Dust Technologies, Inc.



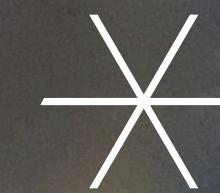
# GENERATIONS / VANCOUVER 12-16 AUGUST

# SIGGRAPH 2018

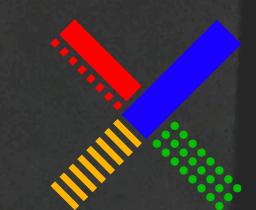


# Digital Nature Group

*University of Tsukuba, Yoichi Ochiai Laboratory*



 Pixie Dust Technologies, Inc



# DIVERSITY

# 2 Project in Emerging Technologies



[Otao et al. 2018]

# 2 Project in Emerging Technologies

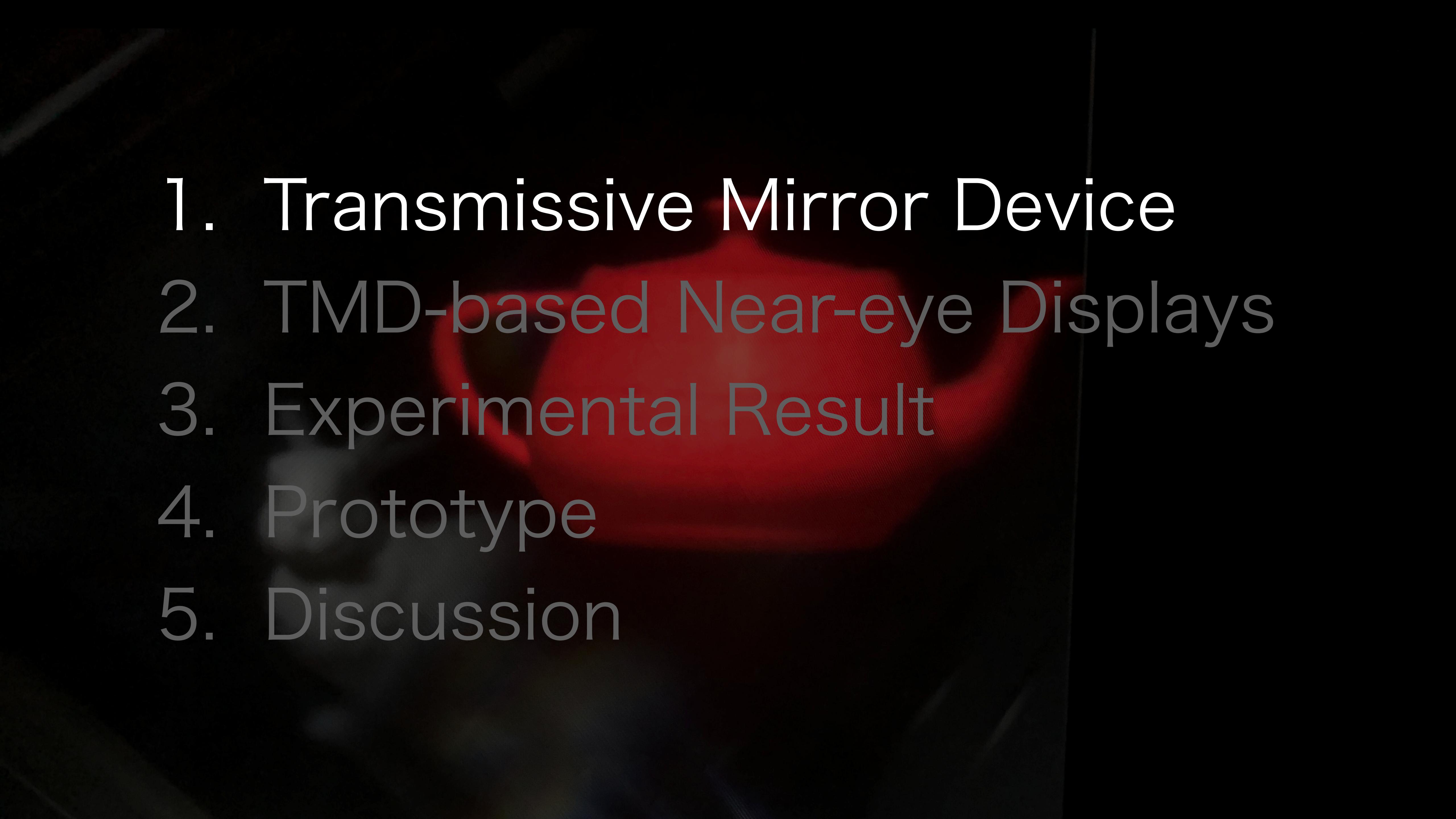


[Otao et al. 2018]

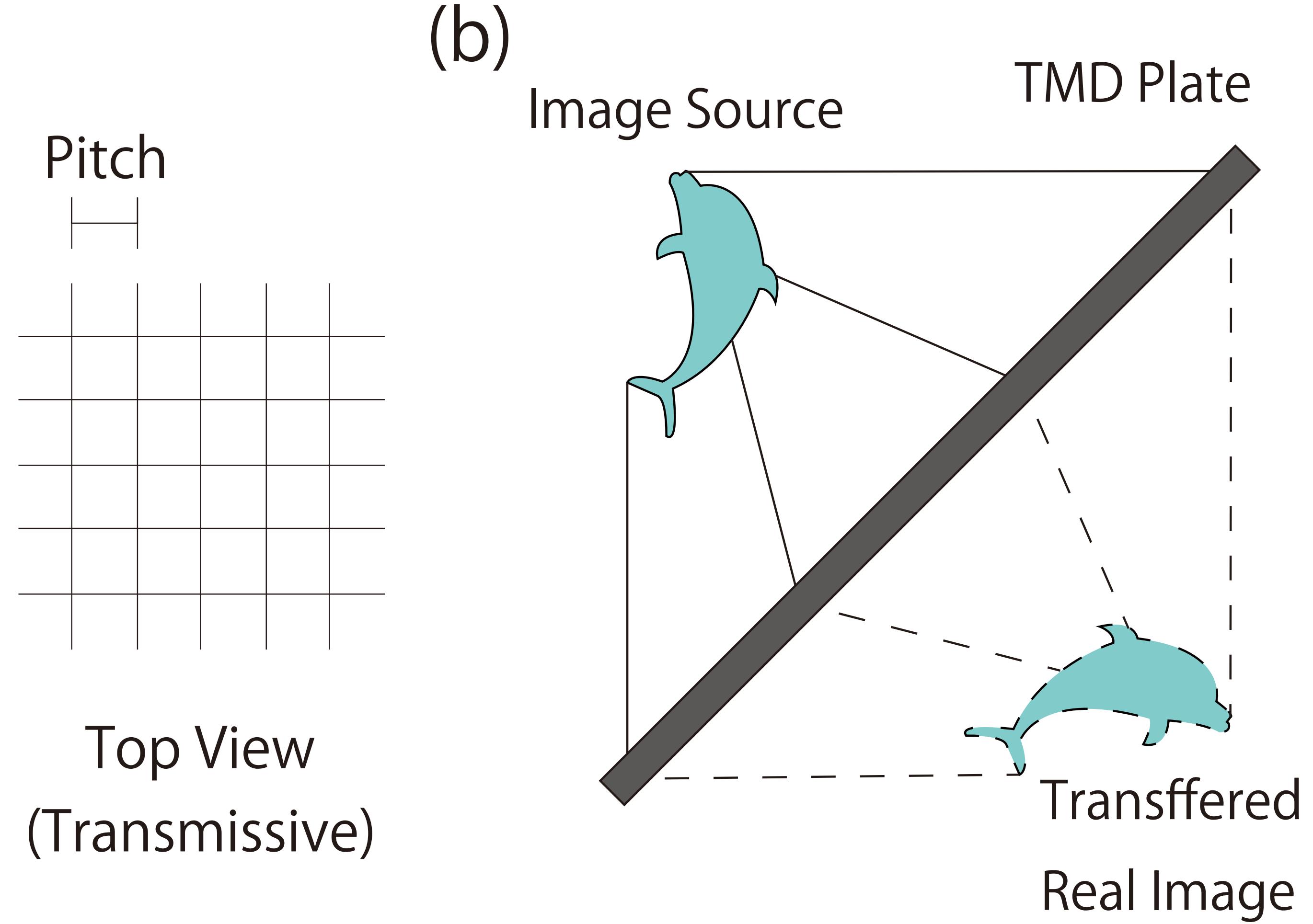
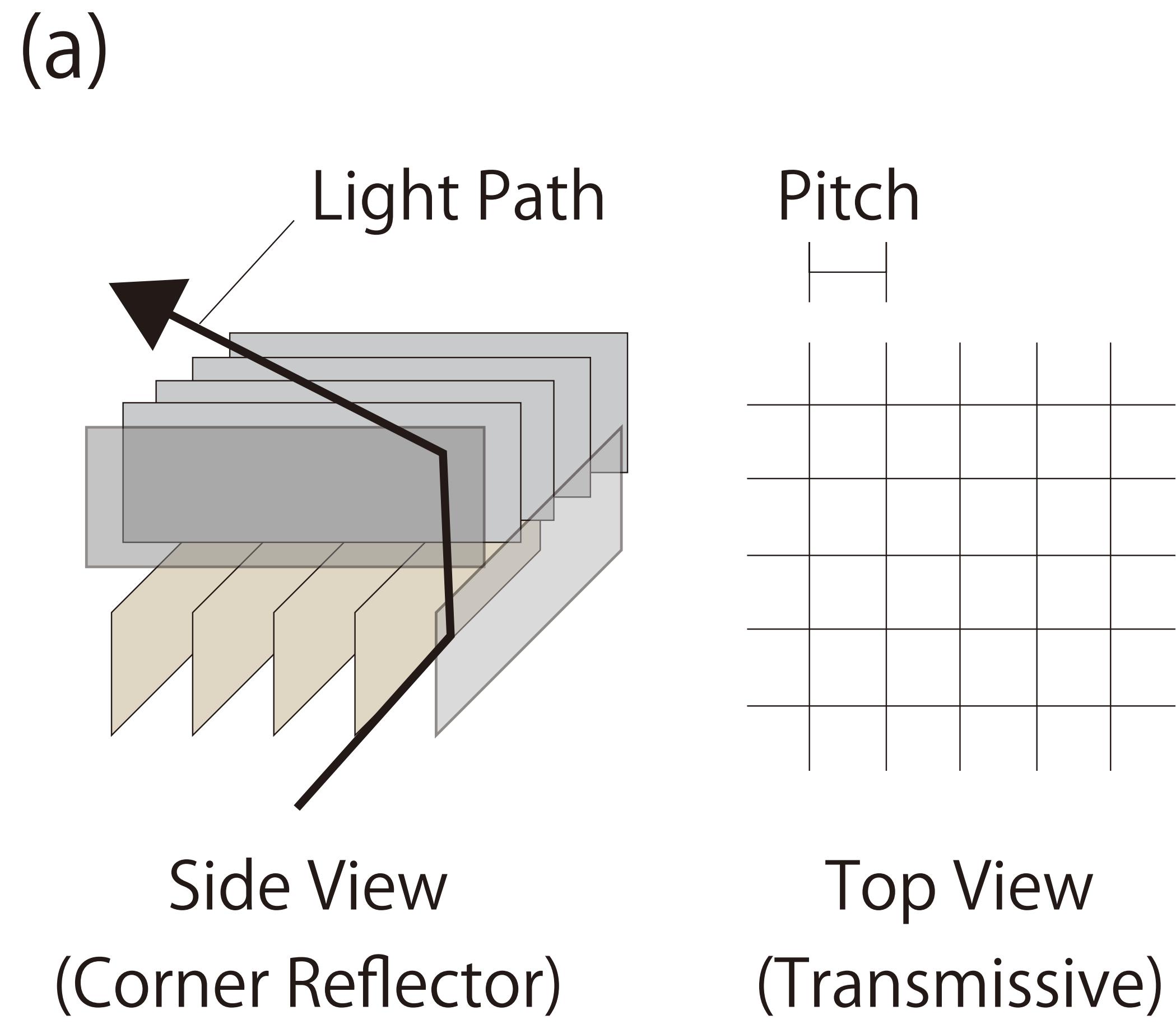
# 2 Project in Emerging Technologies



1. Transmissive Mirror Device
2. TMD-based Near-eye Displays
3. Experimental Result
4. Prototype
5. Discussion

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# TMD (Transmissive Mirror Device)



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# TMD (Transmissive Mirror Device)



**HaptoCloneAR**  
[Yoshida et al. 2017]  
(SIGGRAPH 2017 E-Tech)



# TMD (Transmissive Mirror Device)

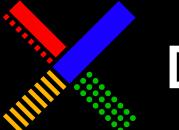


# TMD (Transmissive Mirror Device)

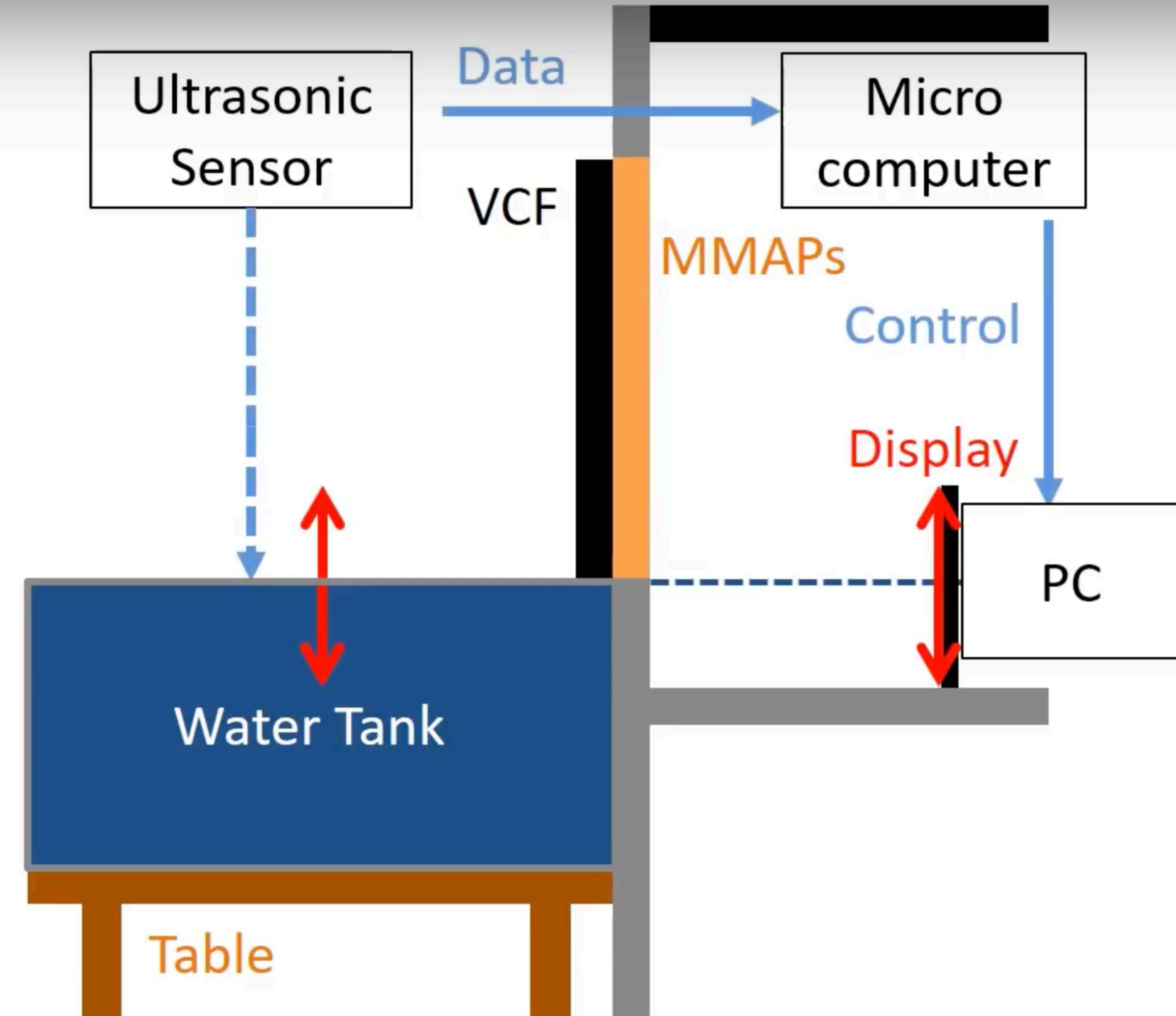


## FairLift

[Matsuura and Koizumi. 2018]  
(SIGGRAPH 2018 E-Tech)



# TMD (Transmissive Mirror Device)



# TMD (Transmissive Mirror Device)



	Dihedral Corner Reflector Array (DCRA)	Slit Mirror Array (SMA)	Crossed Mirror Array (CMA)
Structure			
Size	200 $\mu\text{m}$	0.5 mm	4 mm
Product Name	Parity Mirror	Aerial Imaging Plate / Aska 3D Plate	

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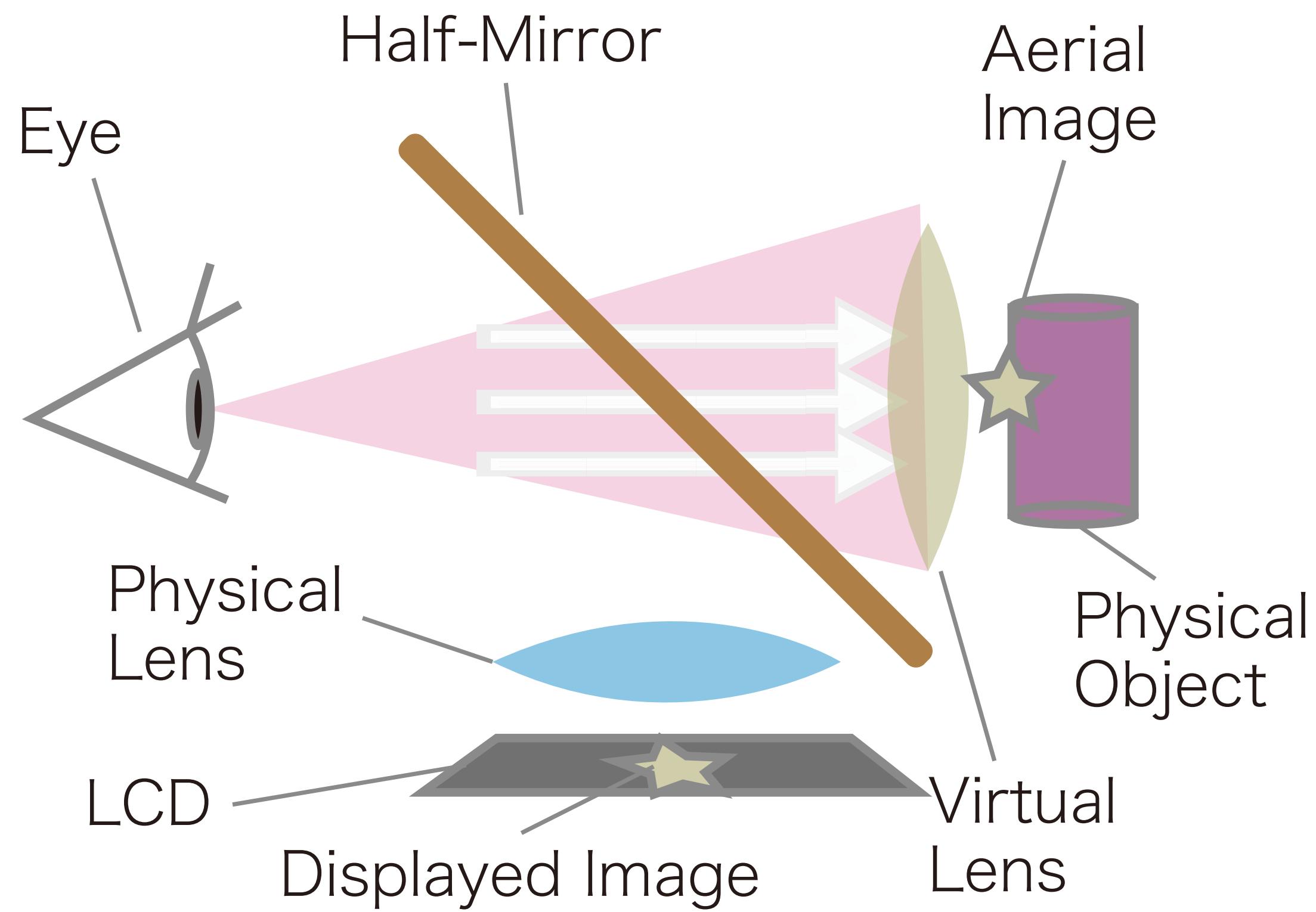
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# Transmissive Mirror Device based Near-Eye Displays

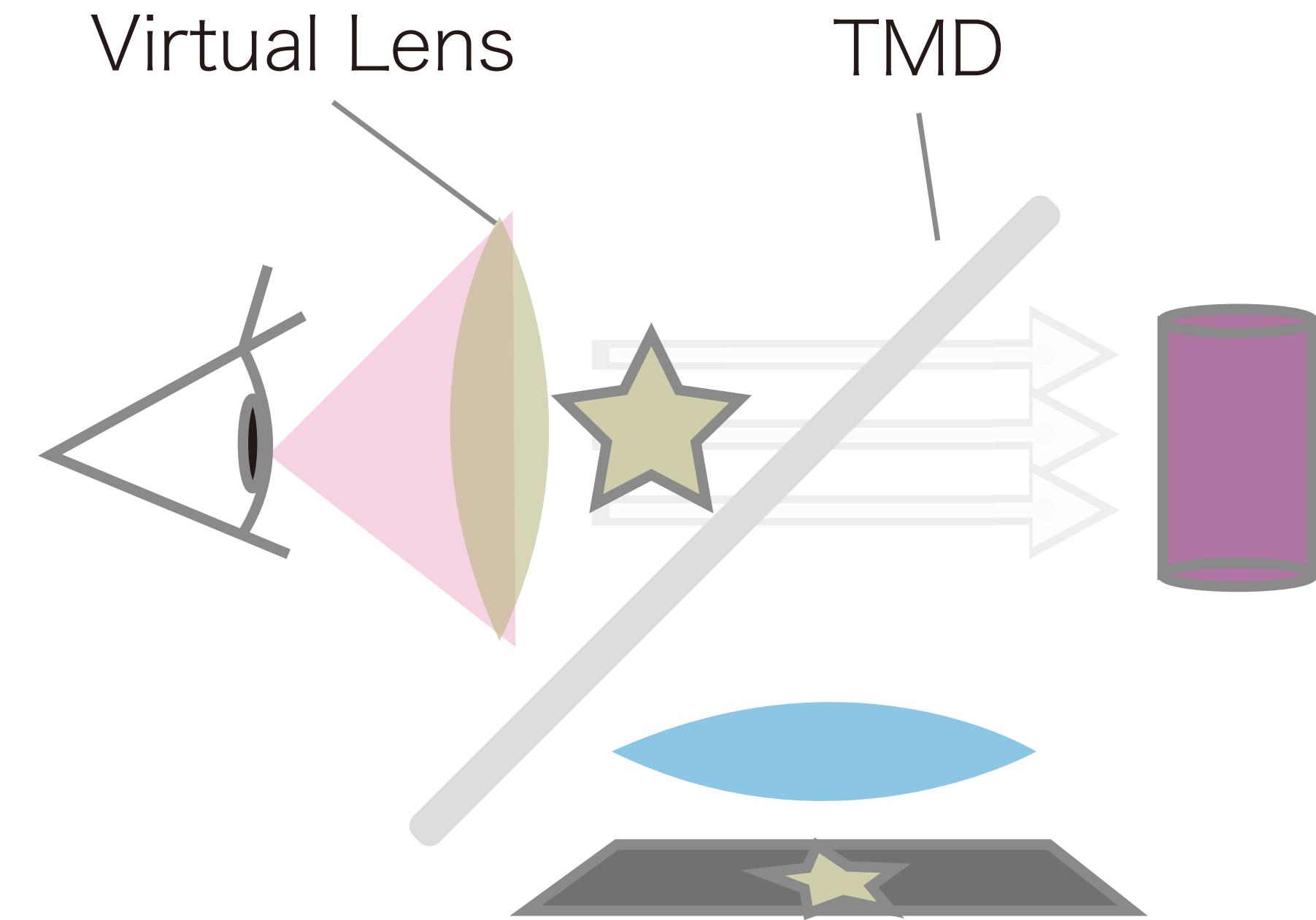


Half-Mirror + Eyepiece

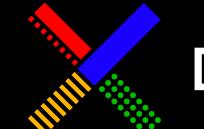


Long optical path, Narrow viewing angle

TMD + Eyepiece



Short optical path,  
Larger viewing angle



# Transmissive Mirror Device based Near-Eye Displays



Meta 2



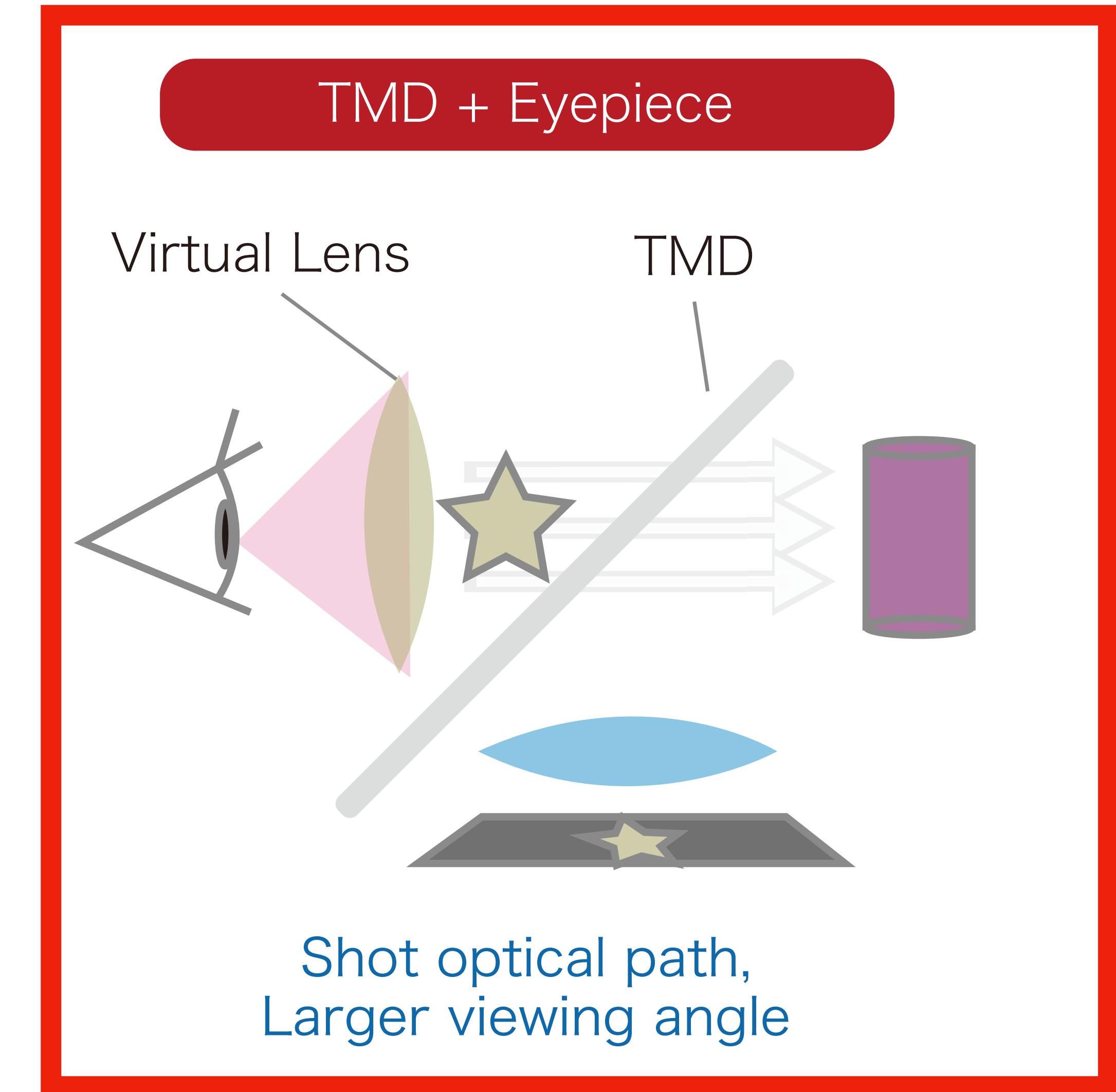
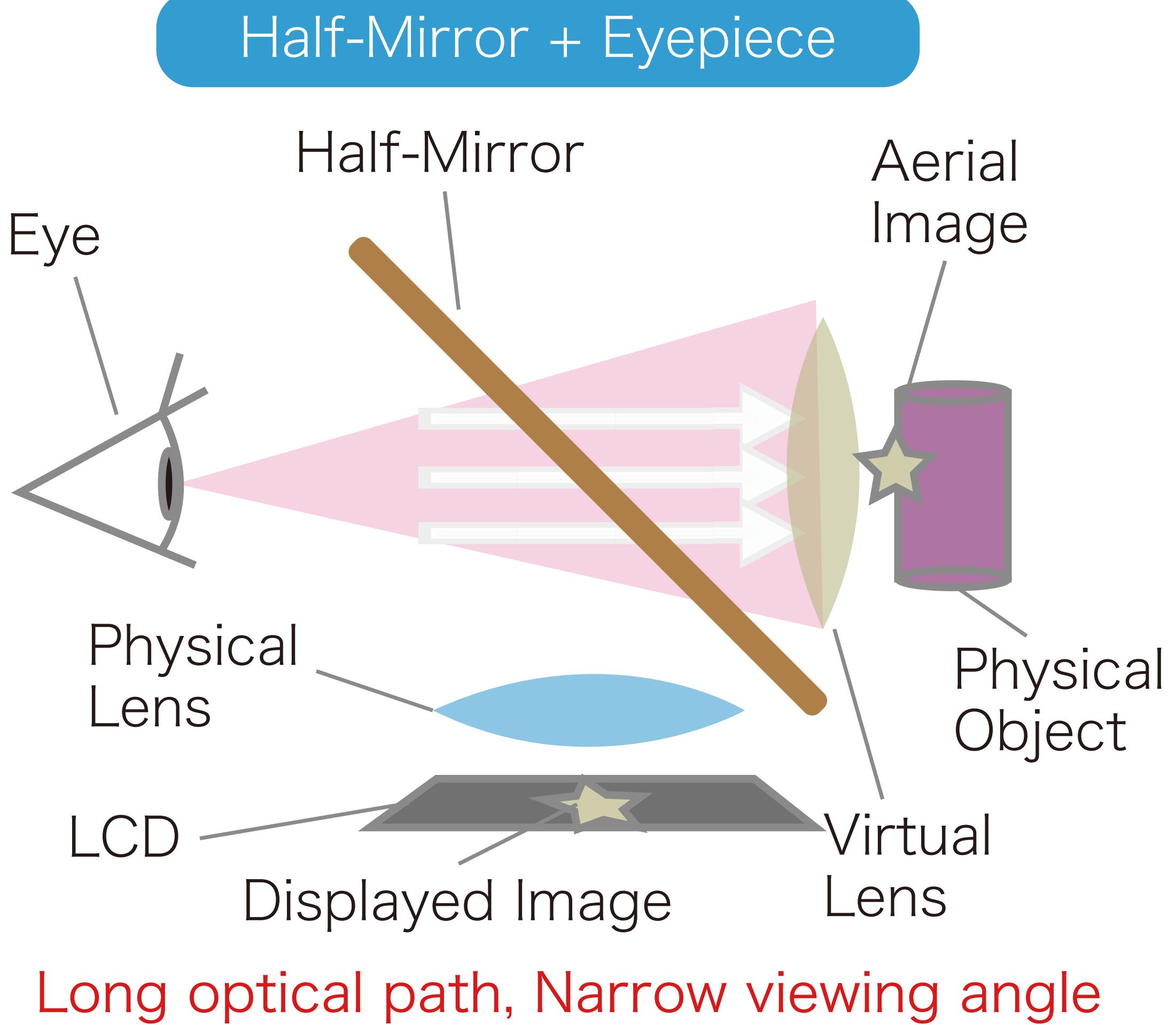
[metavision.com](http://metavision.com)

Project North Star



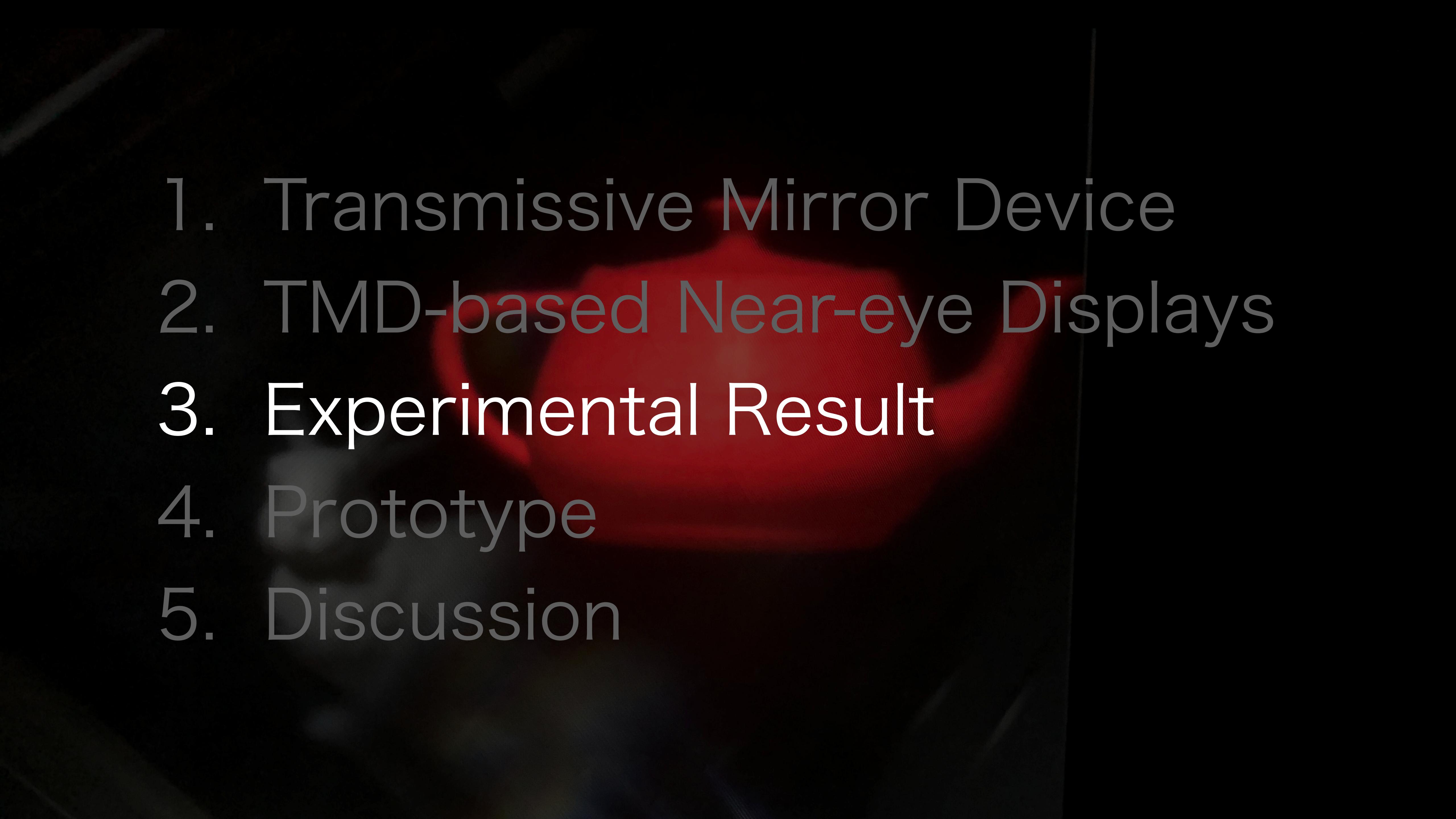
<https://developer.leapmotion.com/northstar/>

# Transmissive Mirror Device based Near-Eye Displays

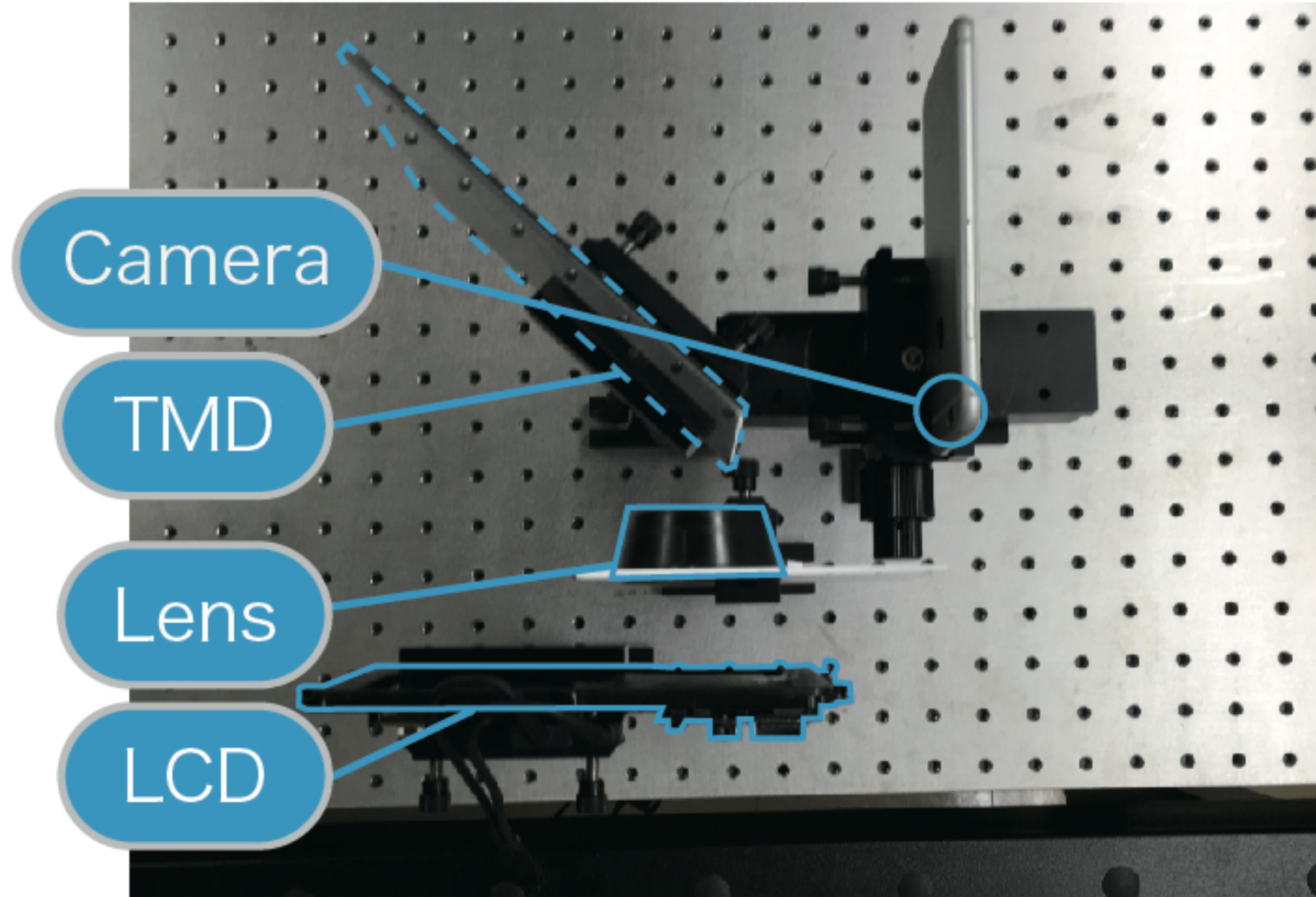


# Transmissive Mirror Device based Near-Eye Displays

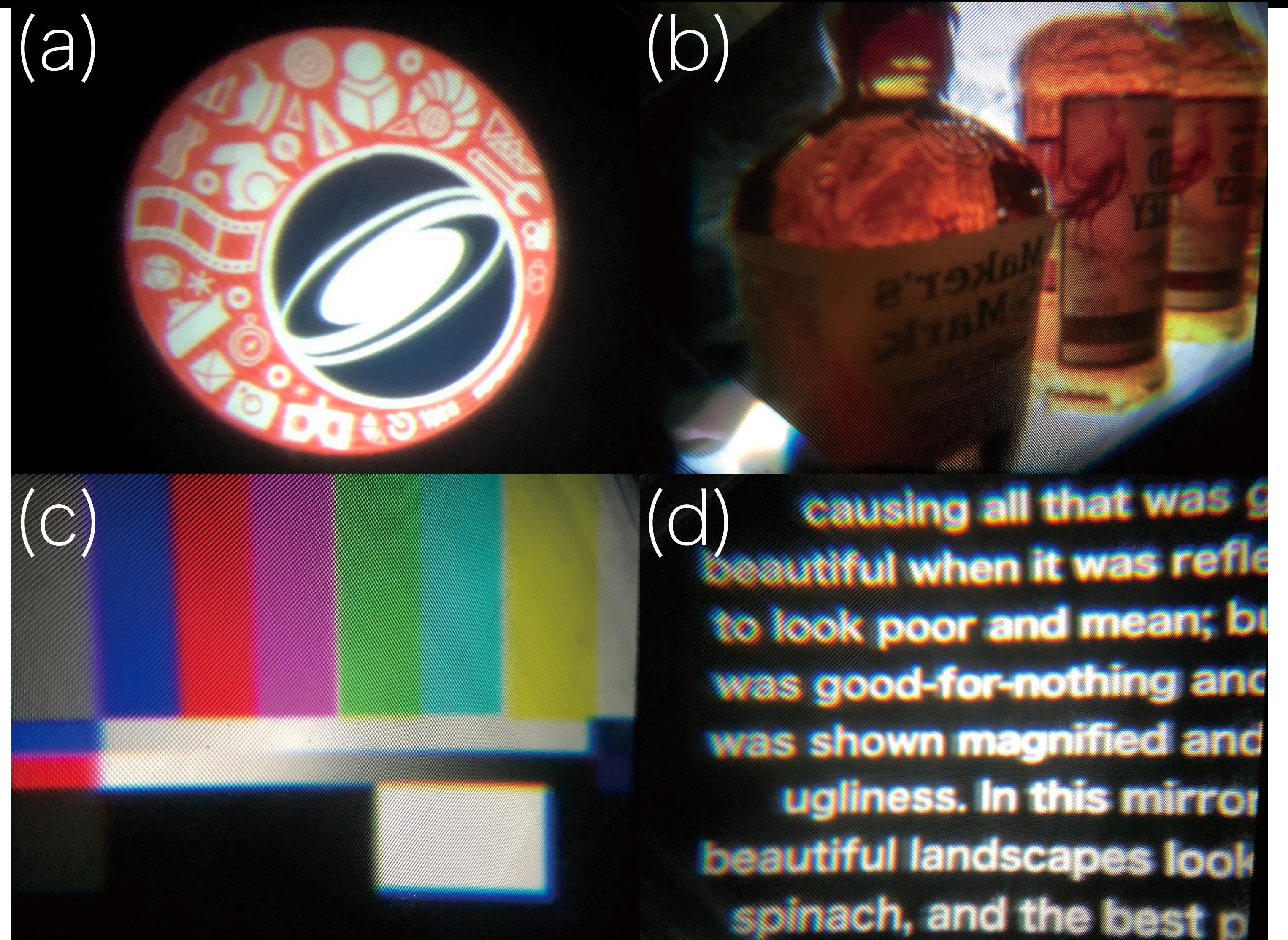


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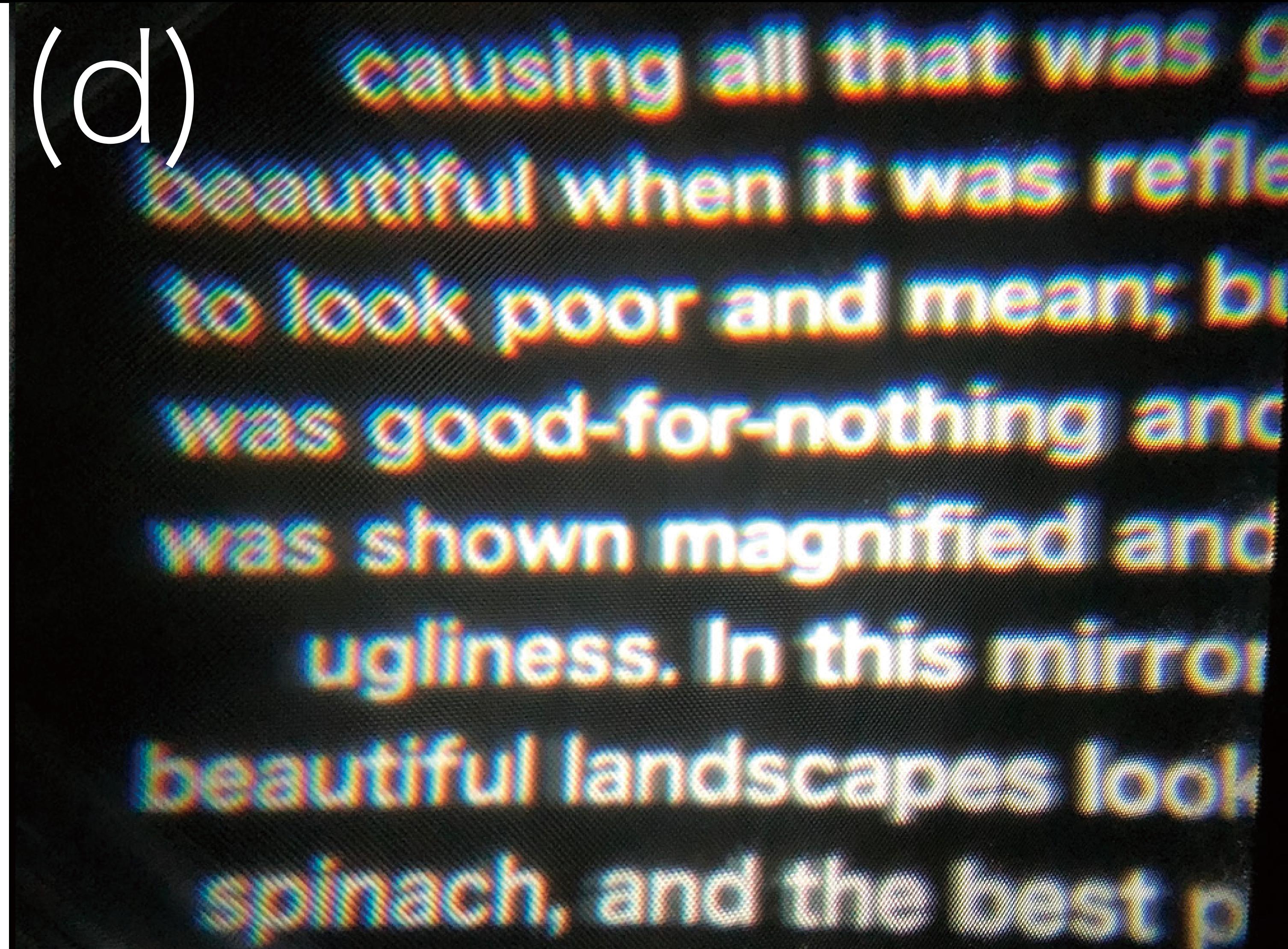
# Experimental Result - System Setup



# Experimental Result - Obtained Image



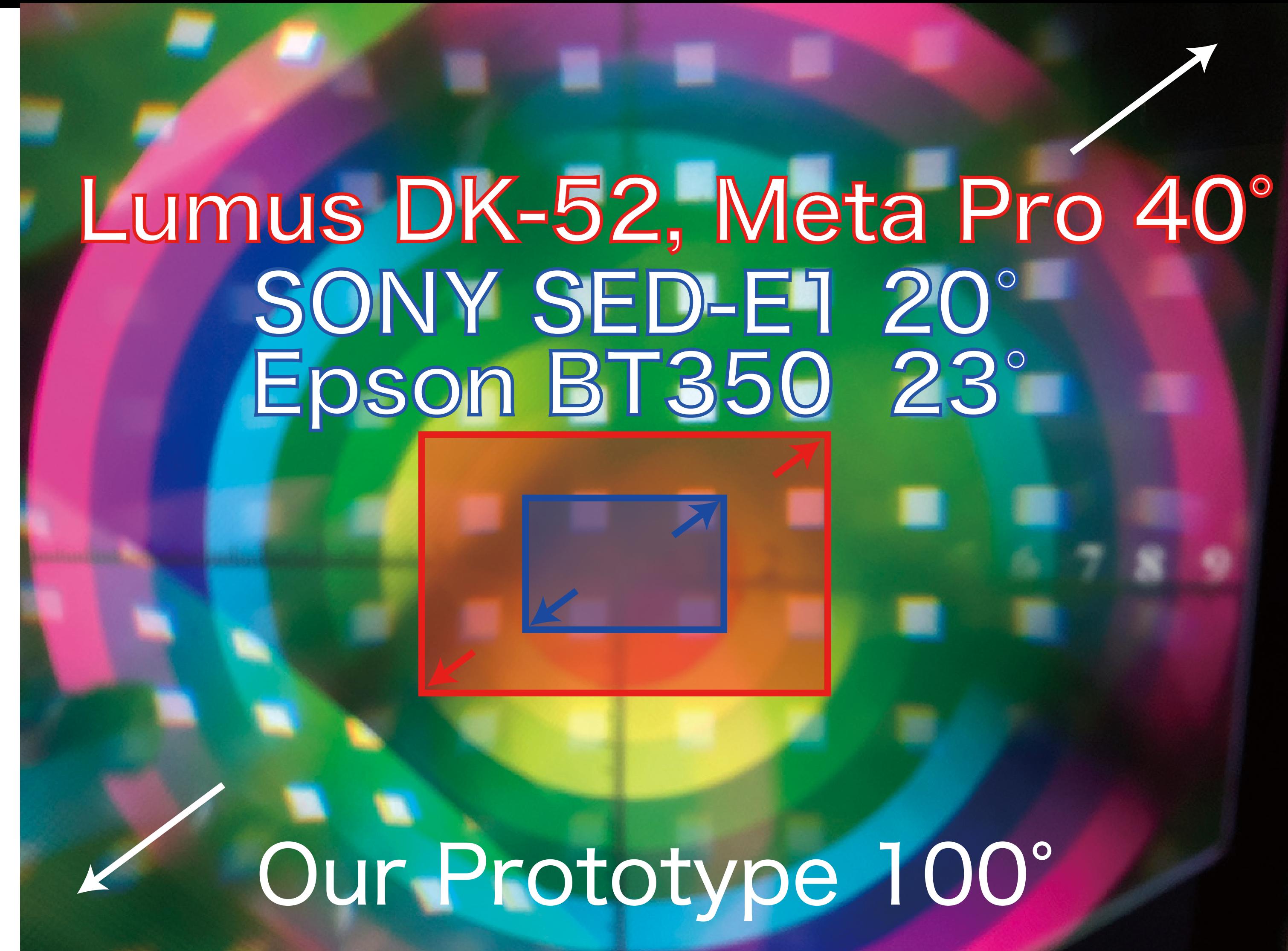
# Experimental Result - Obtained Image



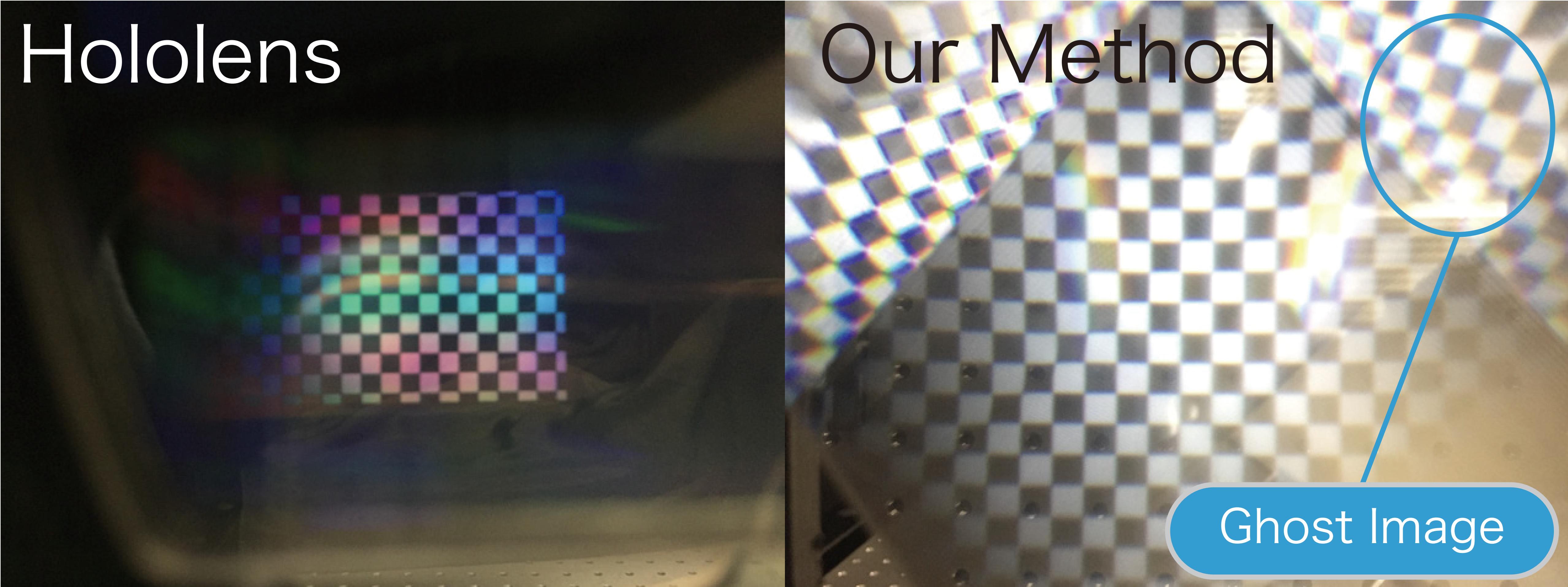
# Experimental Result - Obtained Image

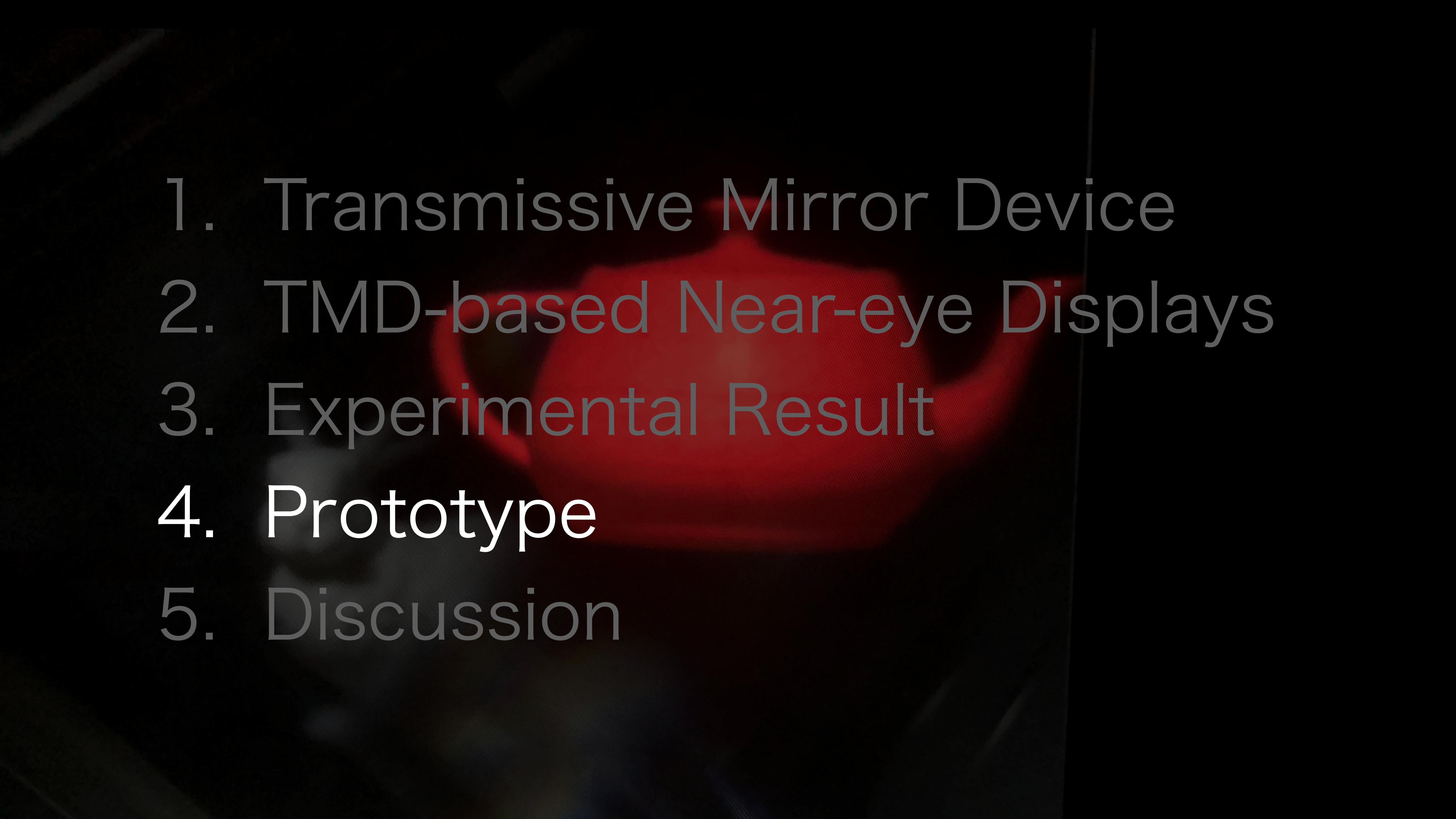


# Experimental Result - Field of View



# Experimental Result - Ghost image



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# Prototype

## HMD

Based on Oculus Rift DK2

Weight: 403g



## LCD

Resolution: 1134x 750

Size: 125mm x 71mm

## TMD

Size: 140mm x 116mm

Pitch size: 0.5mm

# Prototype

HMD

Based on Oculus GO

LCD

Resolution: 2560 × 1440

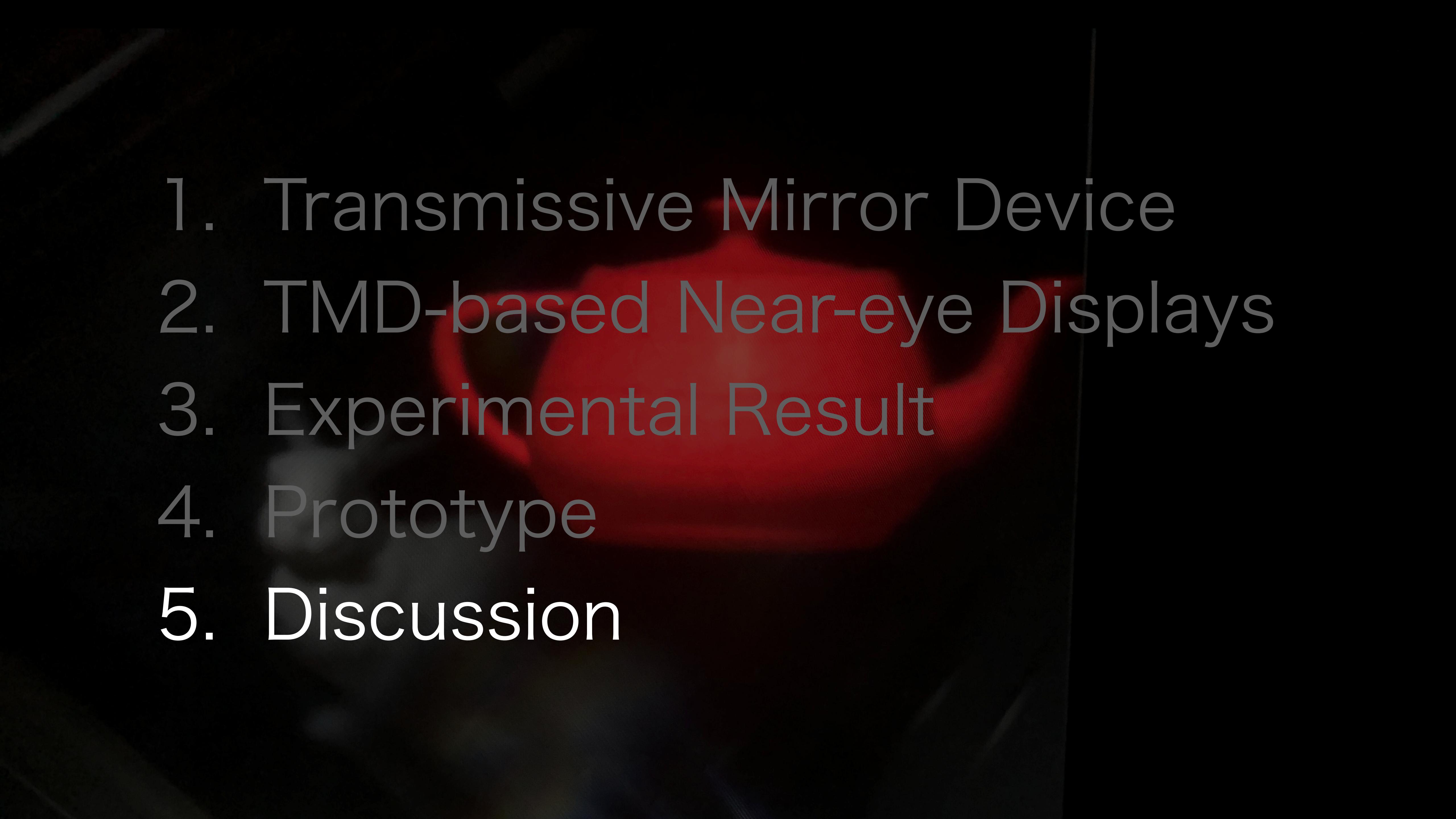
Size: 121.5 mm x 68.5 mm

TMD

Size: 140mm x 116mm

Pitch size: 0.5mm

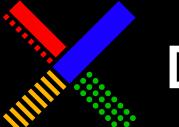


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# Discussion - See-through Capability



→ Low transparency

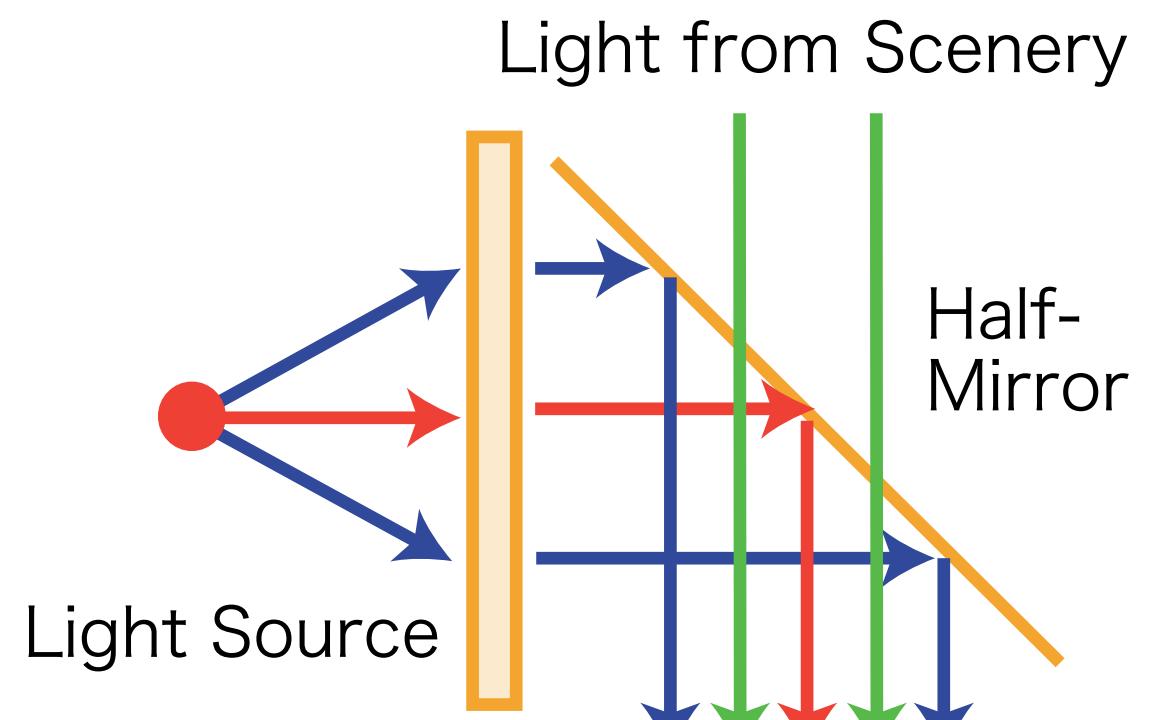


# Discussion - Ghost Image

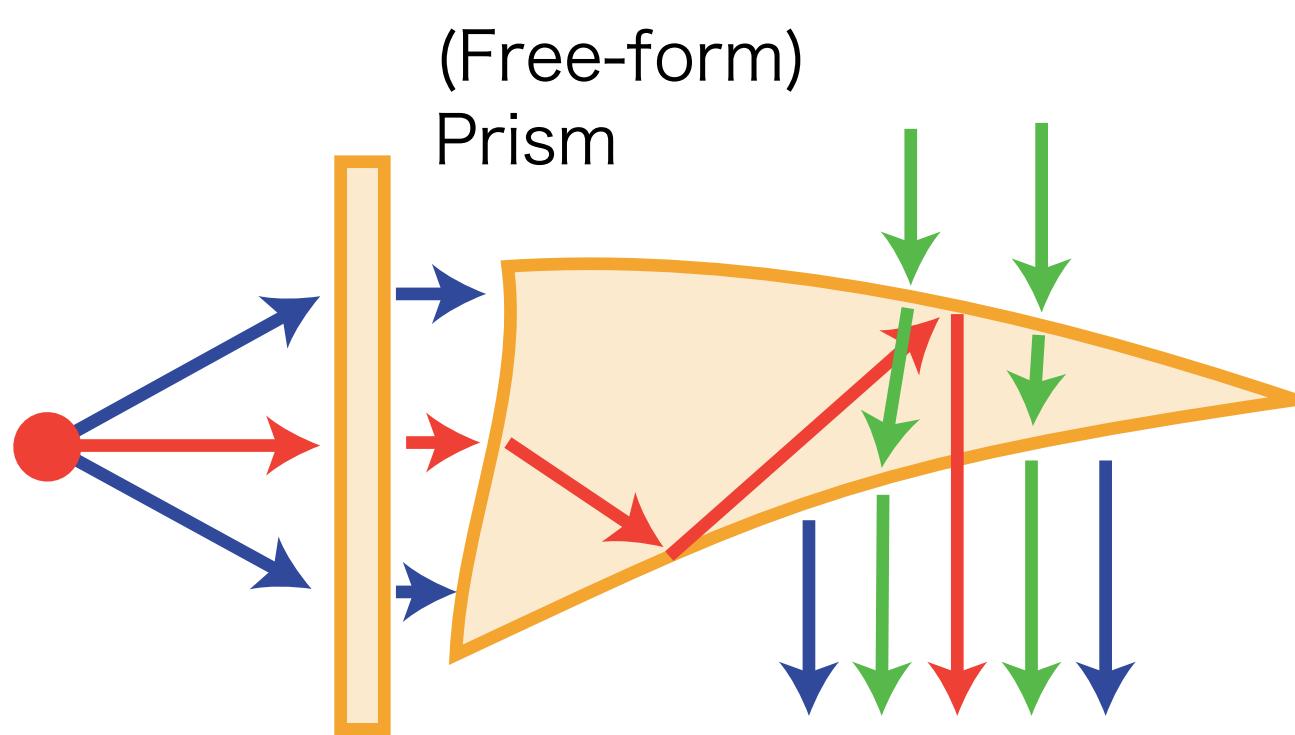


- Optical path length is short, wide viewing angle
- Simple configuration
- ✗ See-through Capability
- ✗ Ghost image

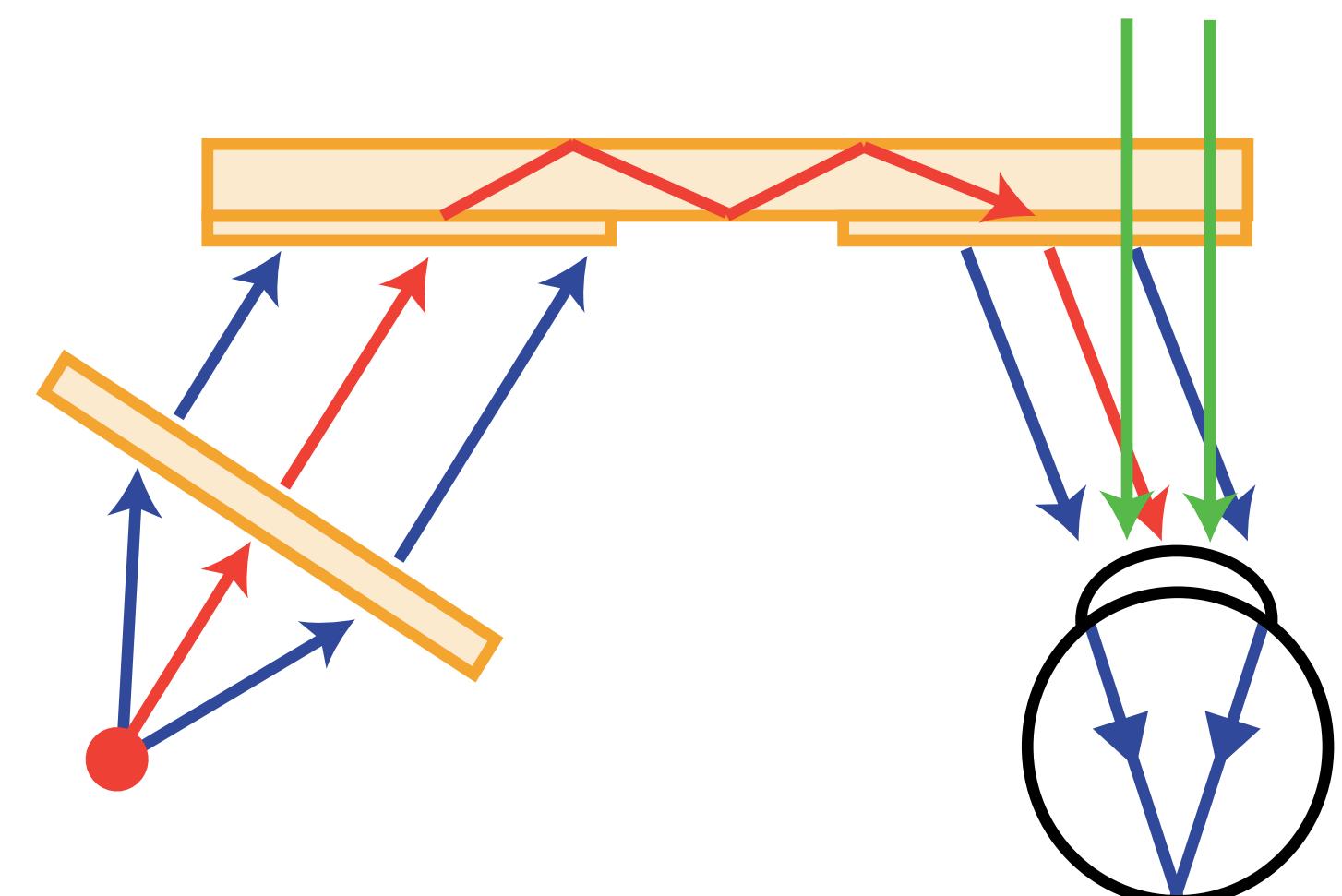
# Advantages and Disadvantages



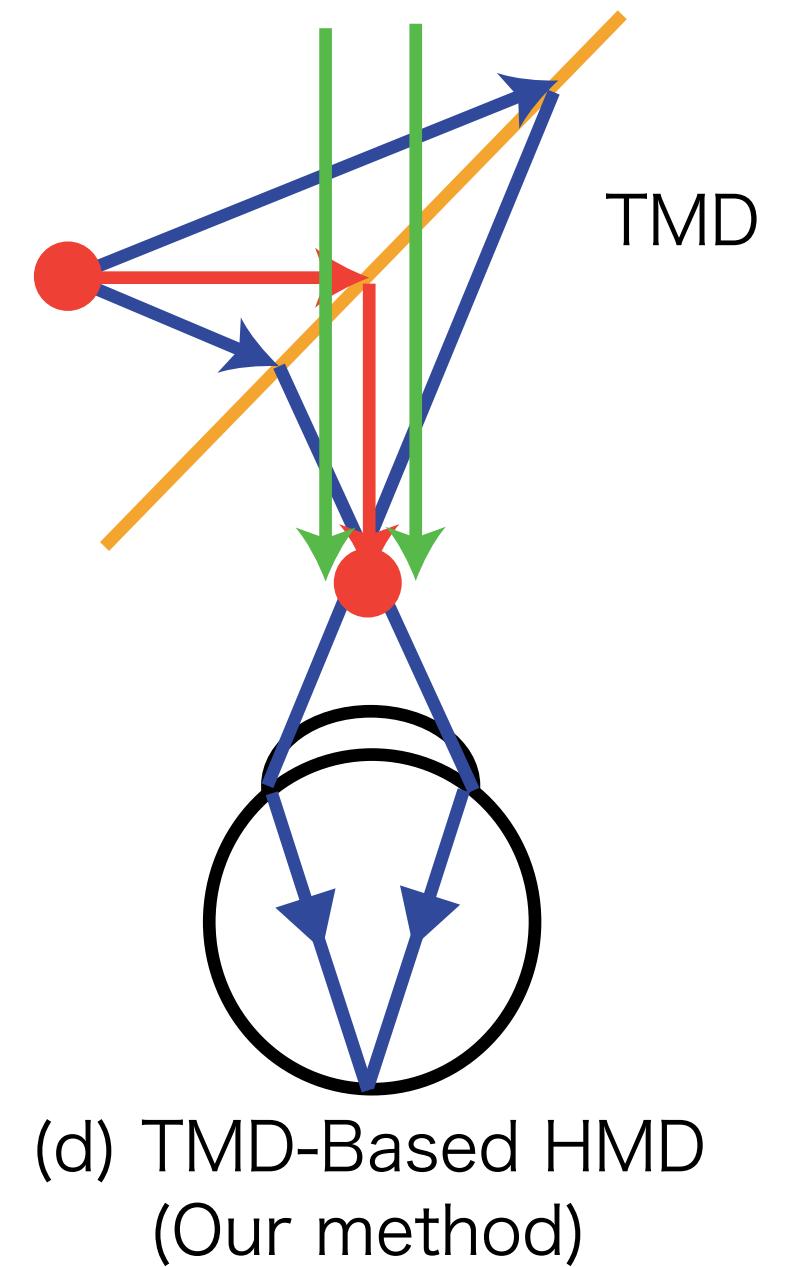
(a) Half Mirror-Based HMD



(b) Prism-Based HMD



(c) Waveguide-Based HMD



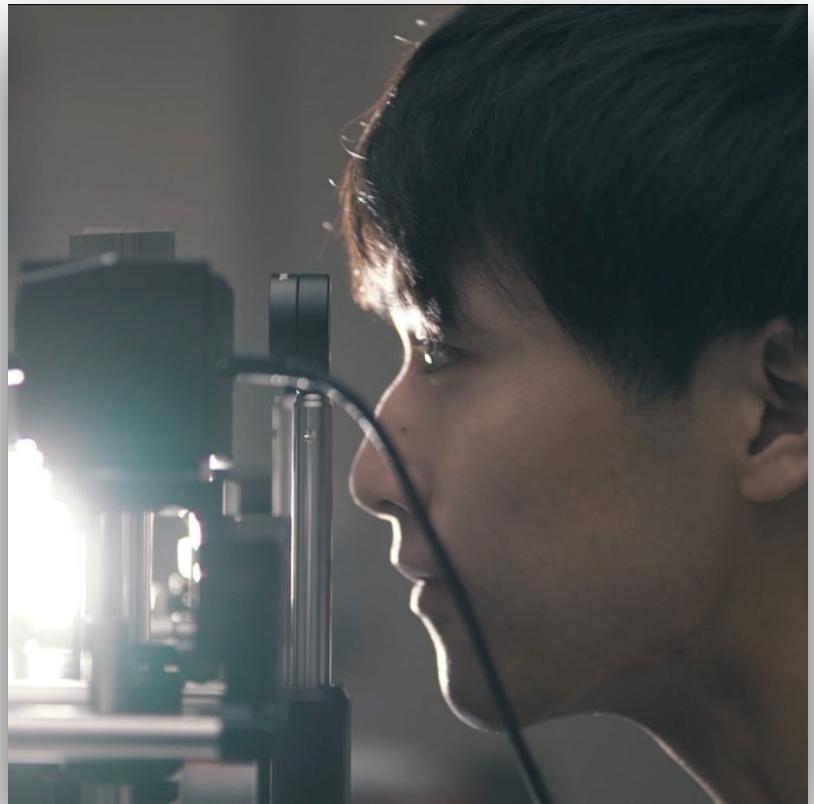
(d) TMD-Based HMD  
(Our method)



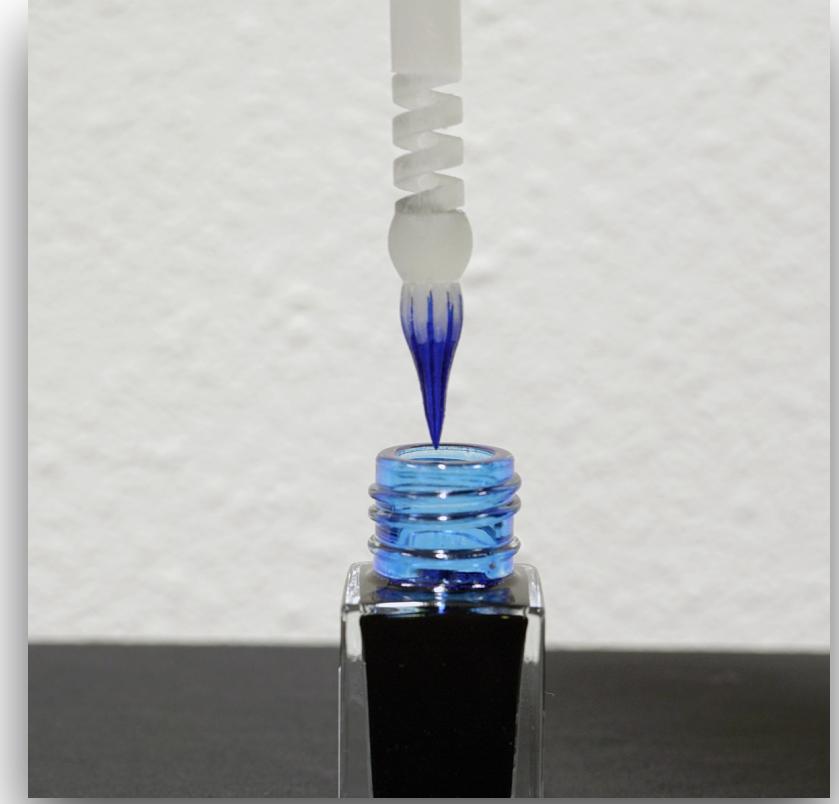
# Digital Nature Group and Pixie Dust Technologies, Inc.



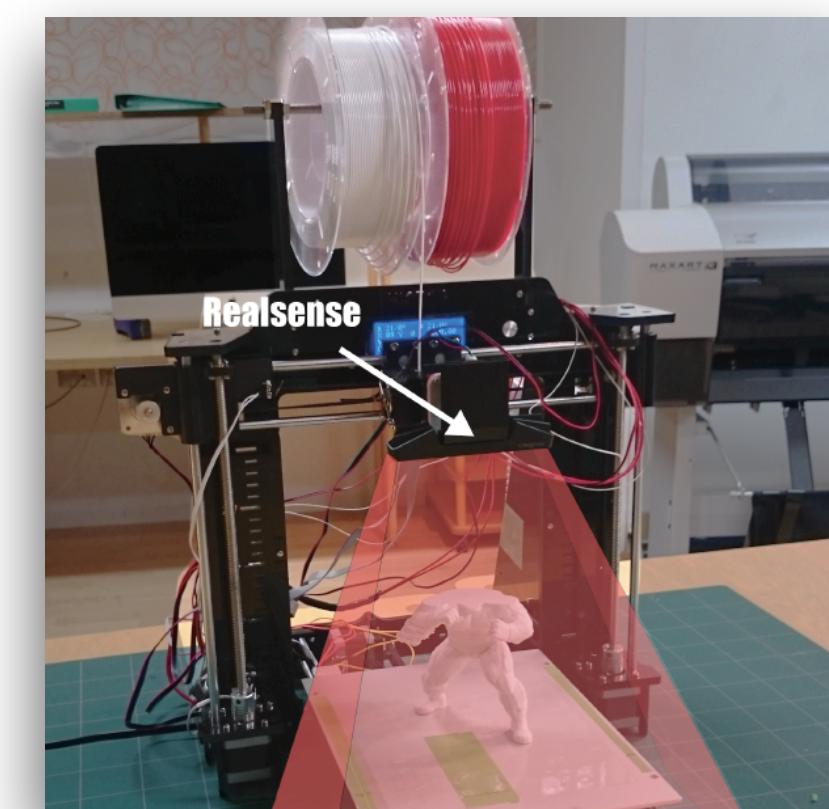
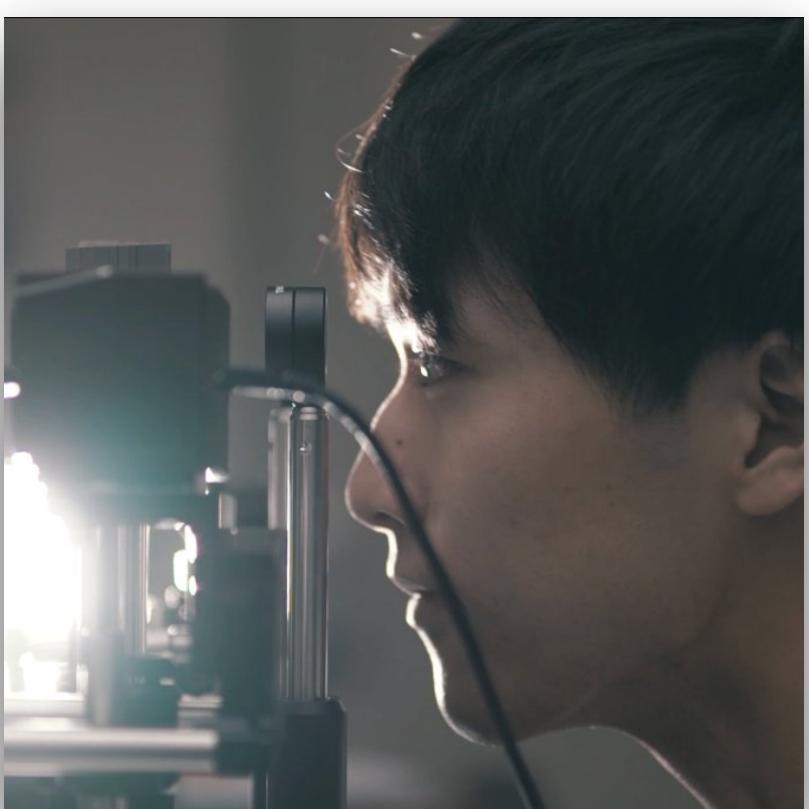
## E-Tech (2 Project)



## Studio (2 Project)



## Posters (4 Project)



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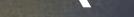


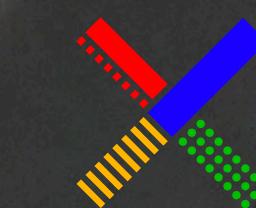
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