

# Camera Metadata Survey

VES Tech - Camera Metadata WG.

**Sam Richards**



# VES Tech Camera Metadata WG.

- Focus on how camera metadata is used in VFX pipelines.
- We are not a standards body.
- Working with other groups such as MovieLabs, so we don't diverge.
- Focus is conventional plate based, not virtual production.
- Identify VFX Artists who can guide us on what is needed.
  
- Members include: Joseph Goldstone, Sam Richards, Michele Sciolette, Dave Stump ASC, Cassidy Pearsall

# Camera Metadata Survey

- Developed a survey to help start discussion.

# What best describes your professional role?

Application Software developer

3

Matchmove Artist

3

In-house software developer

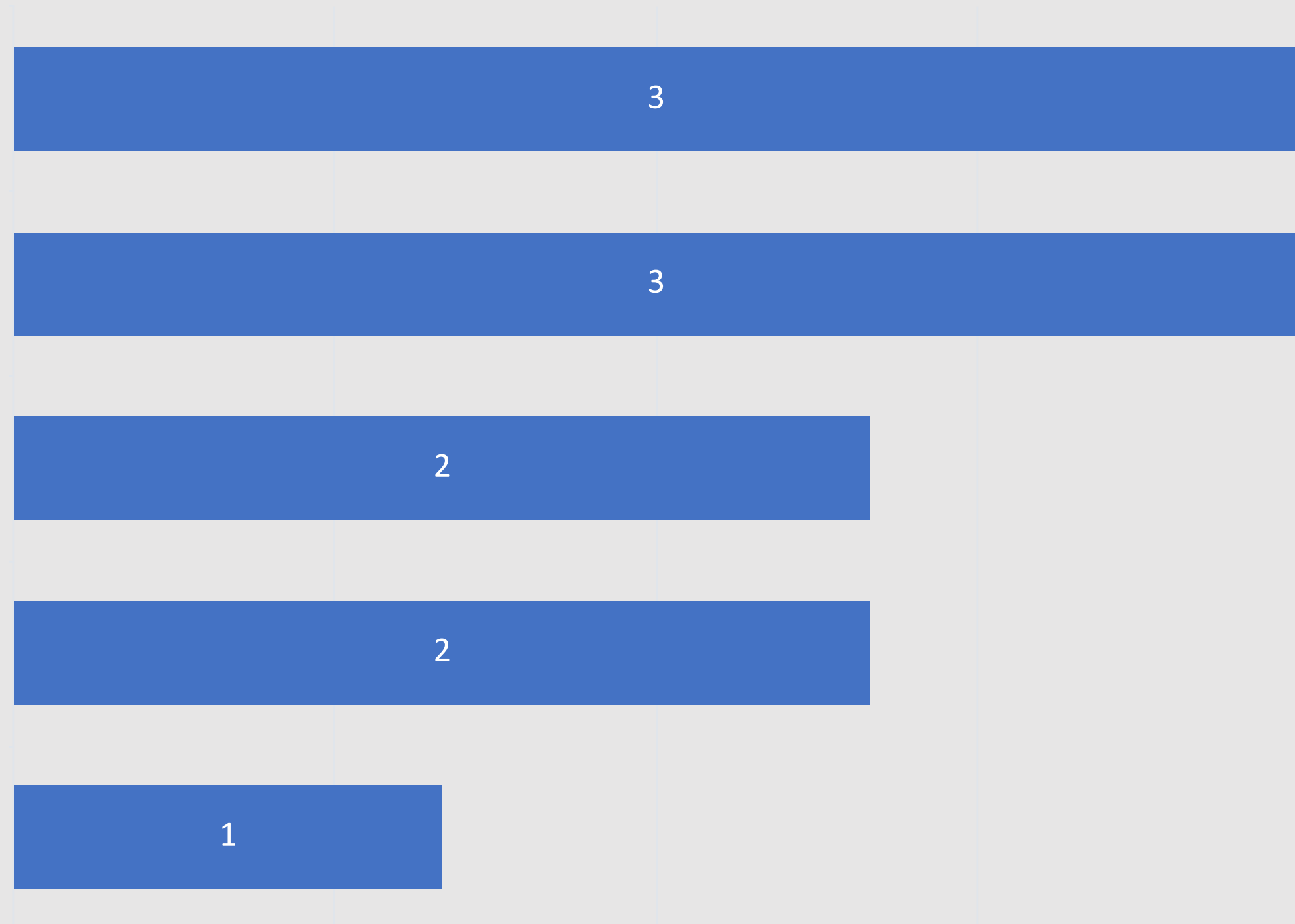
2

On-set matchmove supervisor

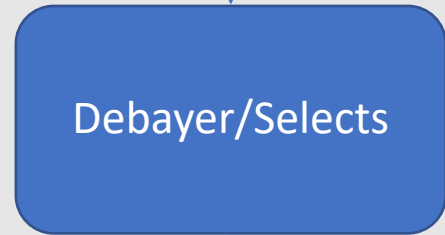
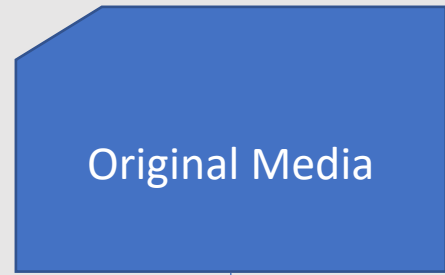
2

Virtual production

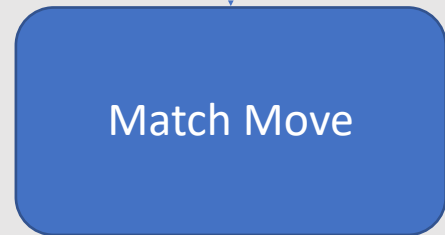
1



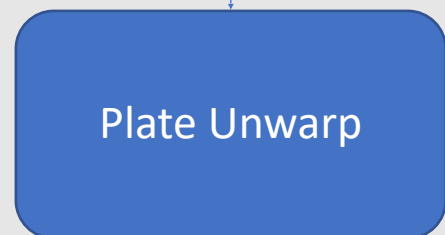
# General Workflow



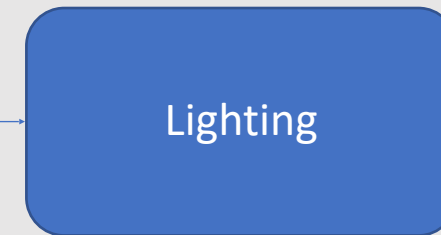
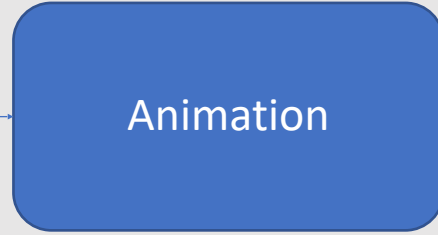
Mostly debayered at an outside facility.



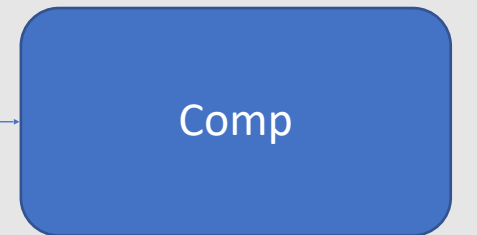
Match-moving tools are the rare examples that support lens-distorted plates.



Undistortion represented by file-naming conventions.



Render using ST-Map  
Or warp going into comp



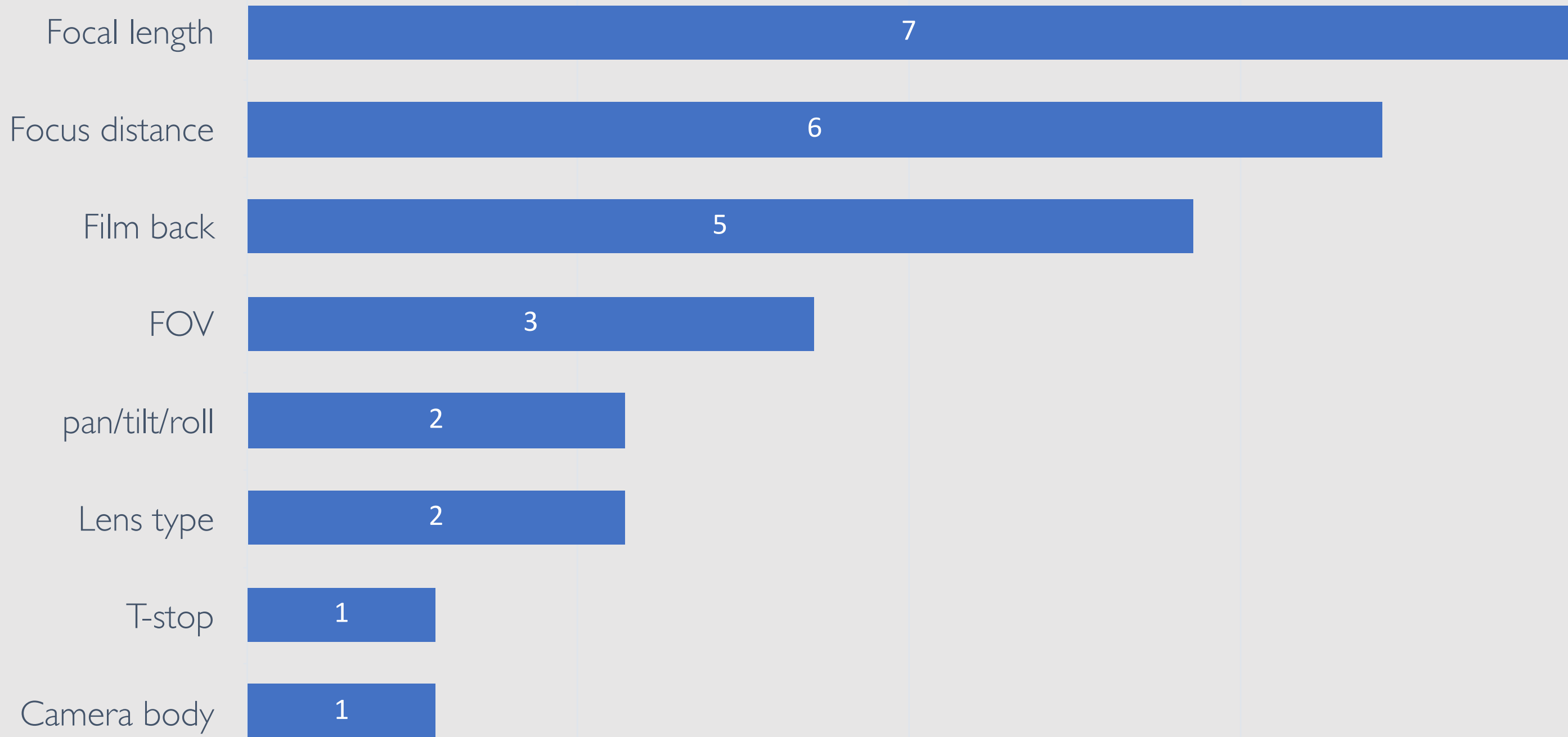
Depth of Focus  
Handled by Eye

Most DCC Tasks typically assume pinhole camera

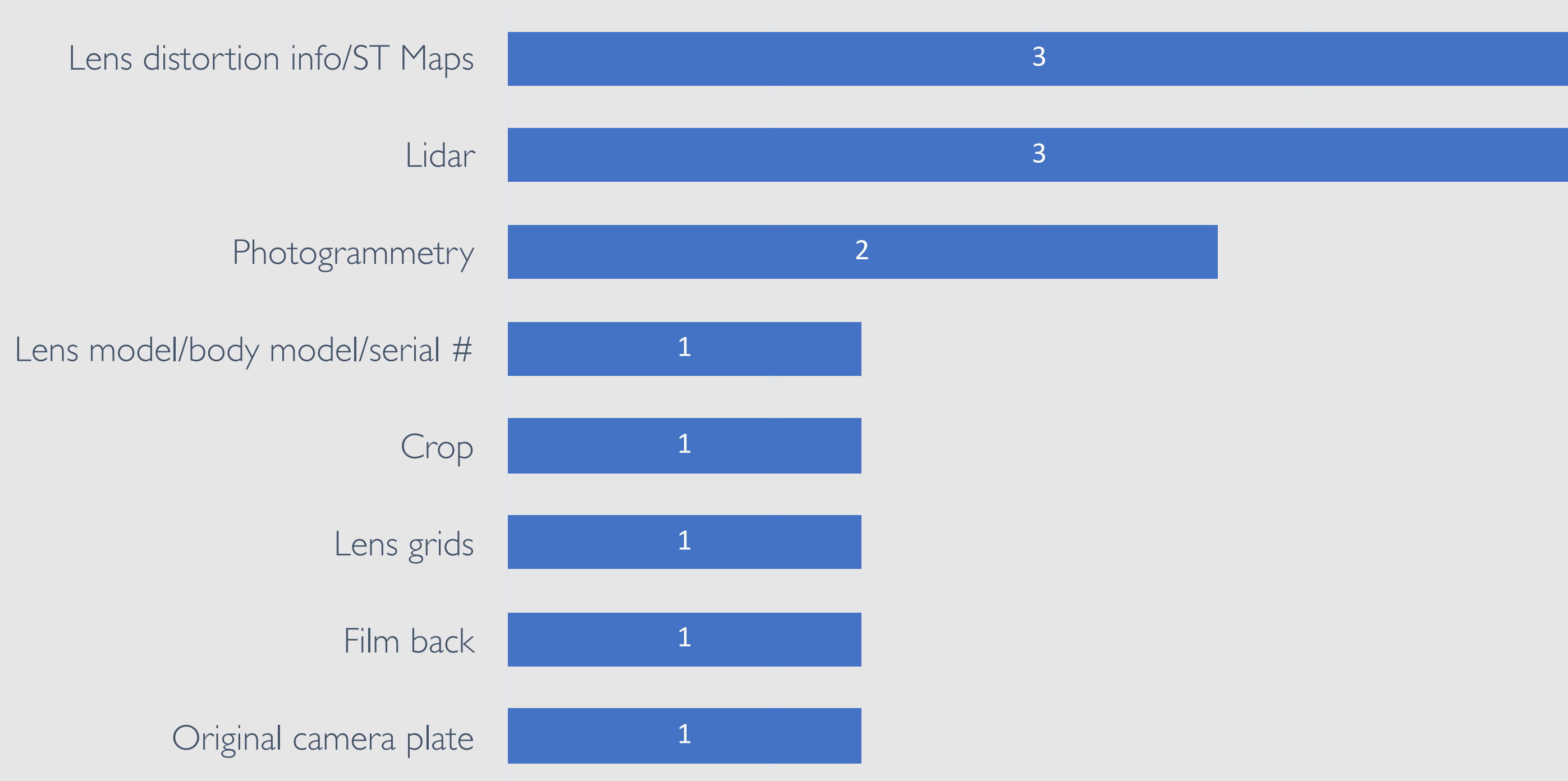
Distorted Elements

Undistorted  
Elements

# What metadata would you need to be able to deliver the best possible result?

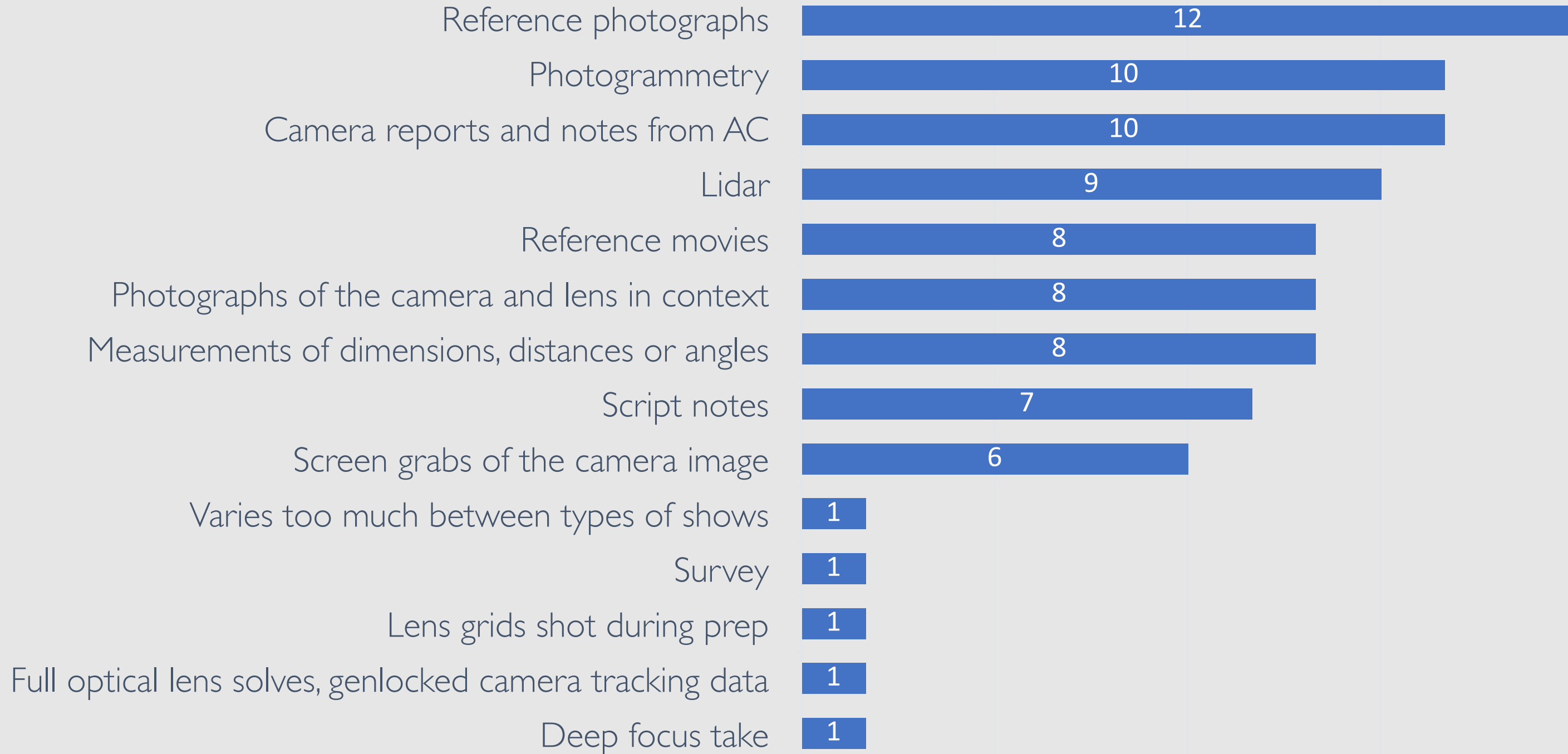


# And what would you want to be able to deliver the best possible result?





gathered when a setup is ready for shooting, but before the first take starts? Select all that apply.



# The above info is provided to

Match move

14

Compositing

13

Editorial

6

Turnover

5

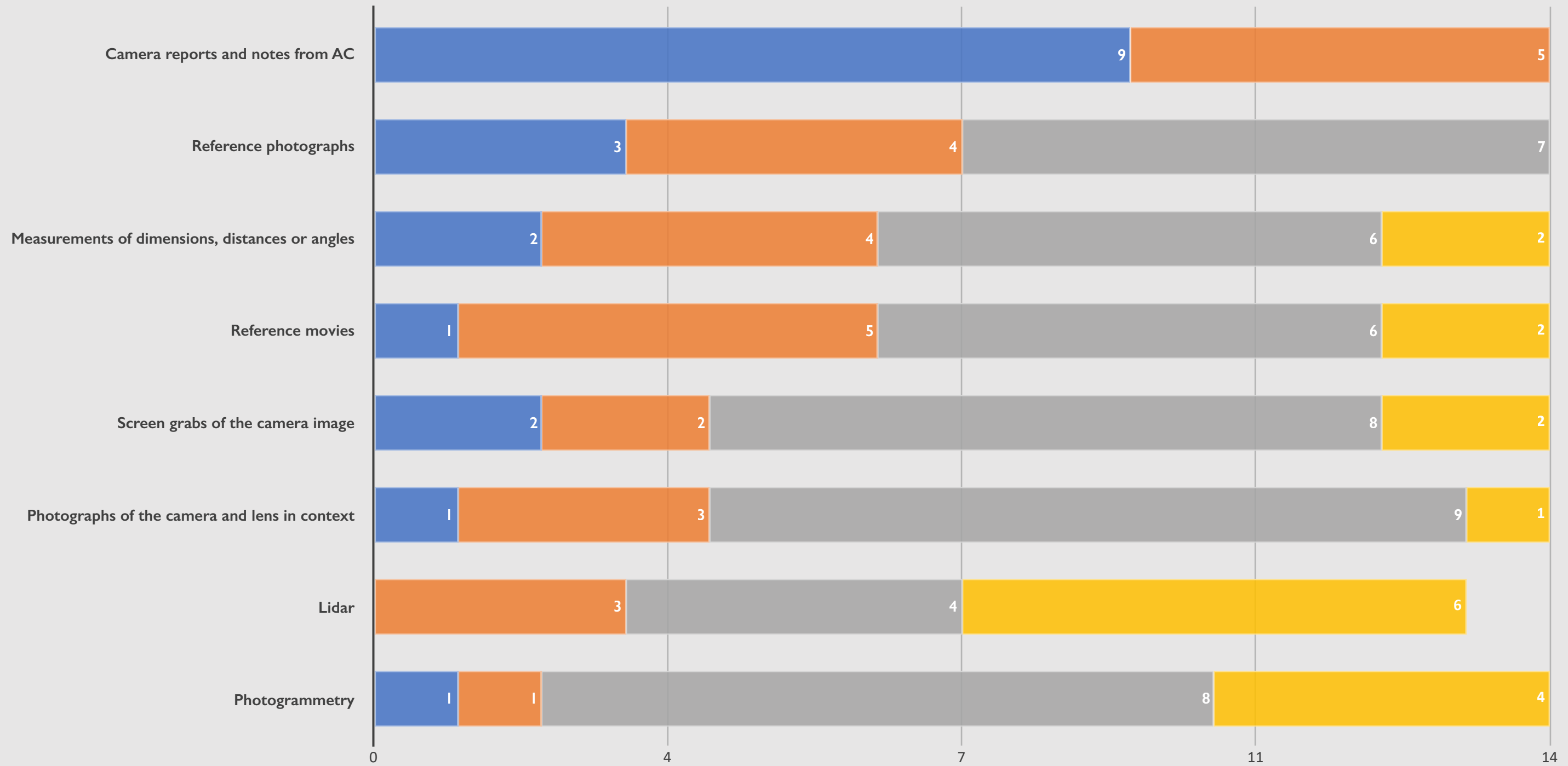
Lighting

1

Layout

1

# Info gathered per-take?



General Workflow | Focal Length | Lens Distortion | Lens Shading | Tilt/Roll/Pan

# How often do you receive lens or camera metadata about a show you're working on?

25% of the time

5

About half

4

Never

2

Always

2

75% of the time

1

General Workflow | Focal Length | Lens Distortion | Lens Shading | Tilt/Roll/Pan

# What are your biggest challenges around receiving lens or camera metadata?

Metadata was captured but never shared with VFX

7

No metadata exists

7

Metadata was never captured

5

Metadata was incomplete

3

Media in proprietary format

2

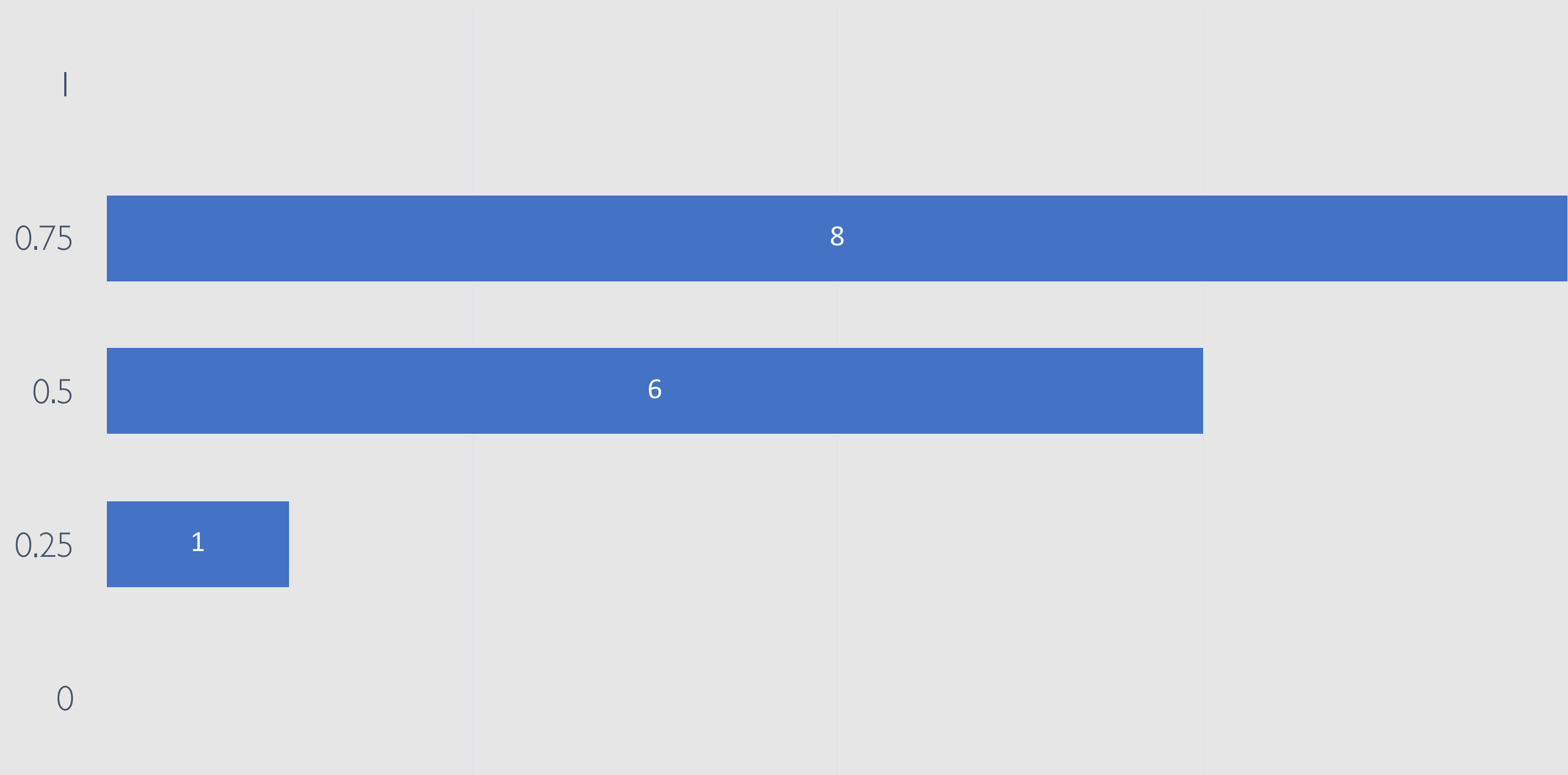
Wouldn't use it

1

Artist it isn't in just the right format, they use match move software

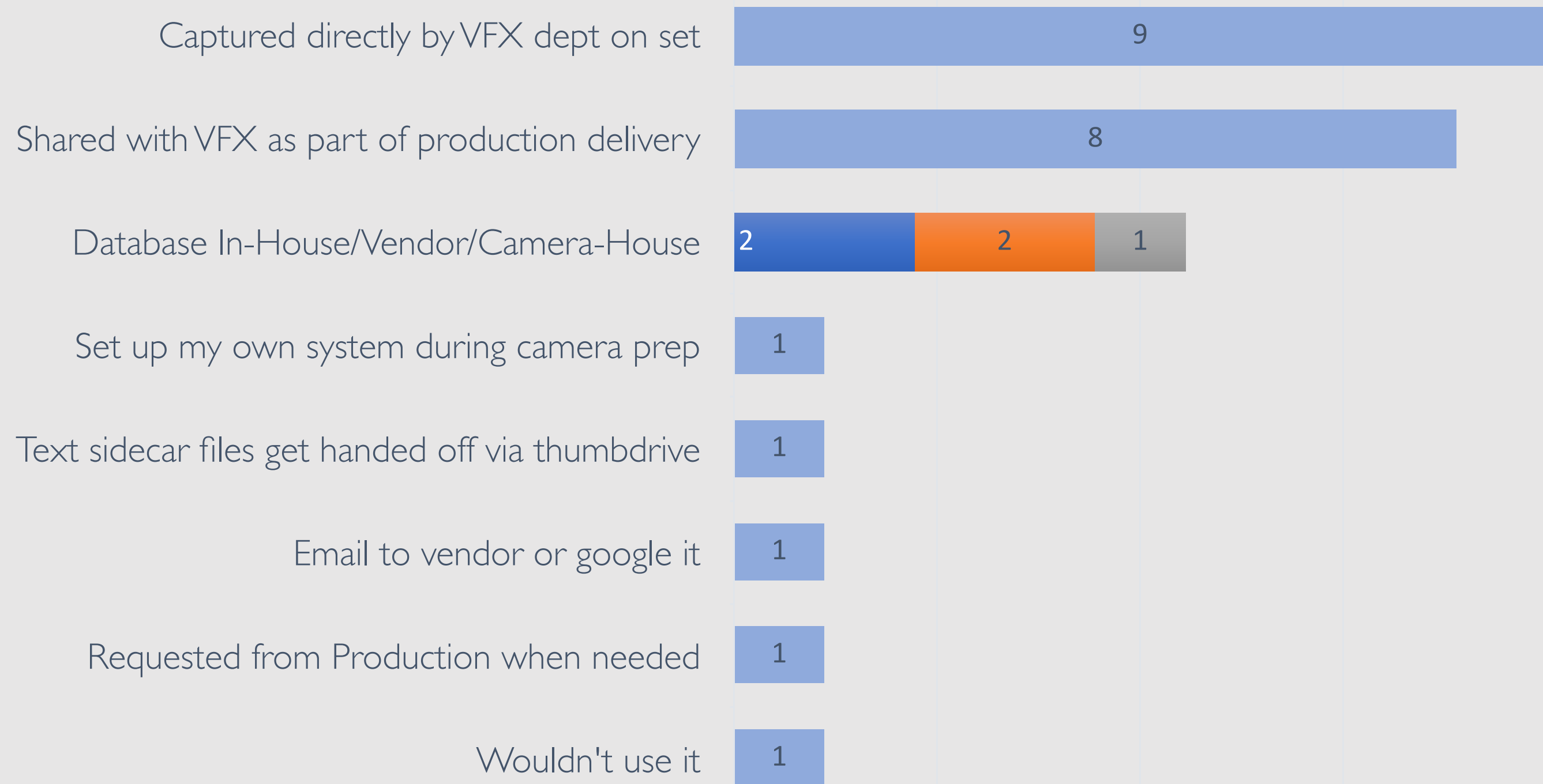
1

# How reliably do you trust the metadata you receive?



General Workflow | Focal Length | Lens Distortion | Lens Shading | Tilt/Roll/Pan

# How do you usually receive information or metadata about a lens?

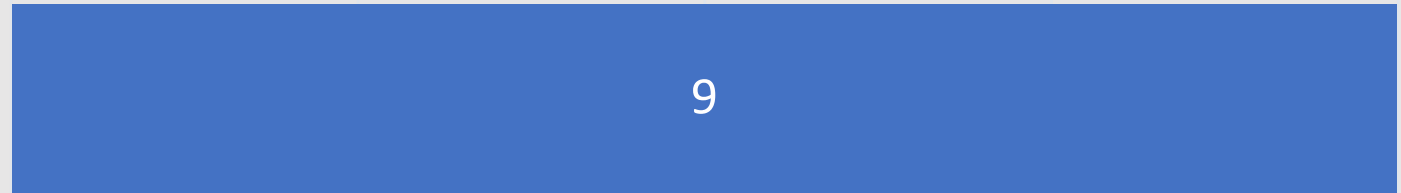


# Focal Length

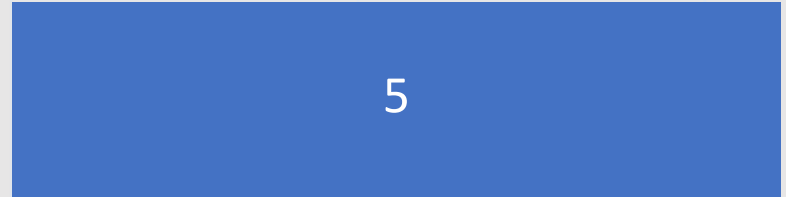


# Which of these most closely models how your artists think of focal length:

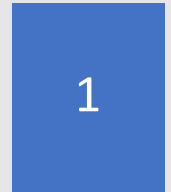
l length next to the index mark for a zoom - nominal focal length



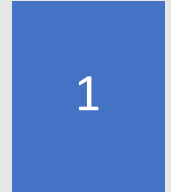
e between the pinhole and the image plane - pinhole focal length



ack principal point and the back focus point - effective focal length



FOV



# Focal Length

- Pinhole focal length - used by CG Artists
- Nominal focal length - used on the lens label
- Effective focal length - used in lens distortion mapping

These three are NOT the same.

# Focus distance being defined between the subject and what position?

of the camera that the 1st AC [Assistant Camera] measures from

8

The image plane

3

the lens entrance pupil position (assuming that the chart is in focus)

3

plane representation, otherwise tell us what the metadata means.

1

“Don’t know”

1

# What do seems to be the actual focus distance metadata coming back from the set?

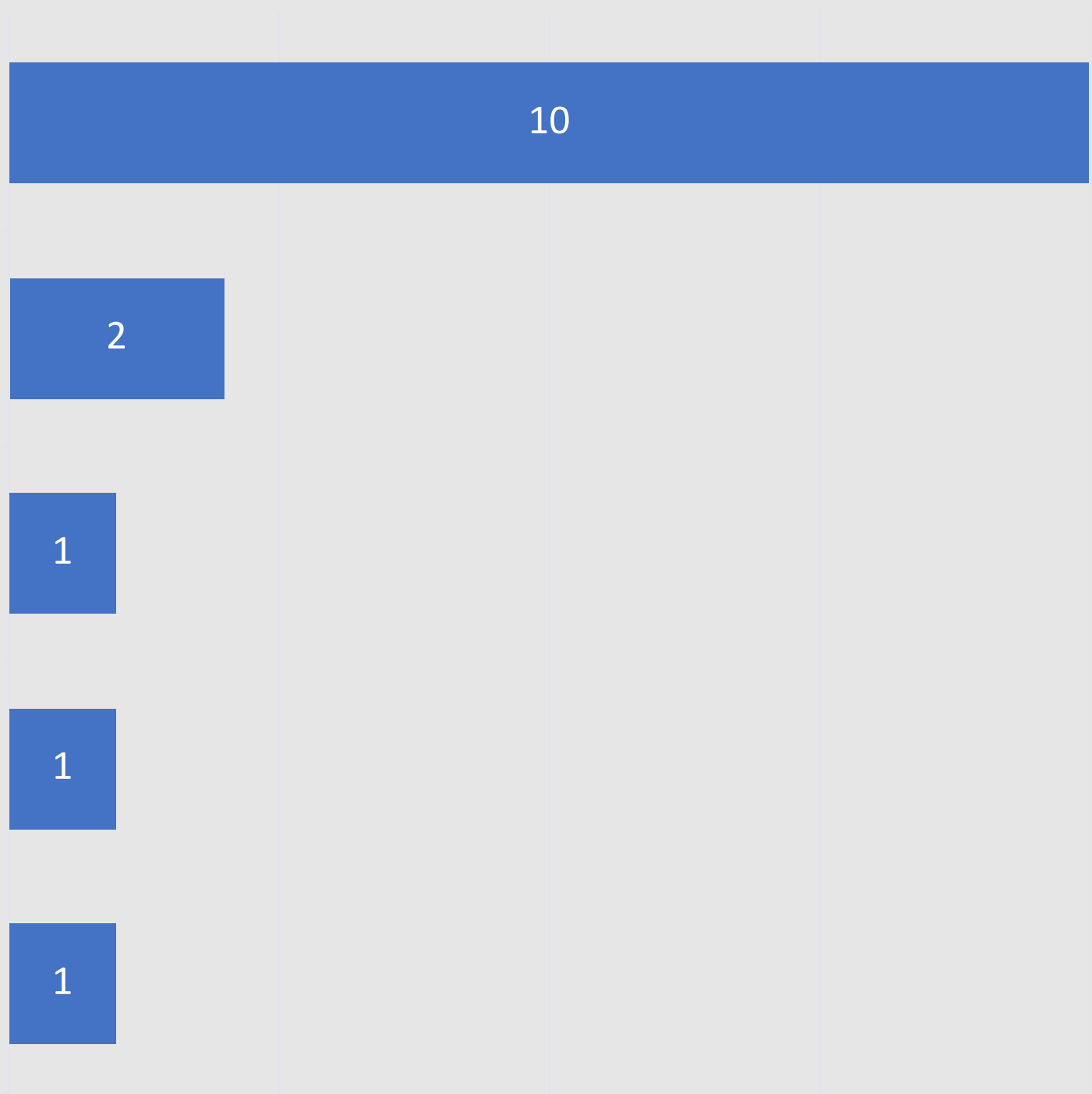
mark') on the side of the camera that the 1st AC measures from

The image plane

image plane, otherwise we need to know what this data represent

The lens entrance pupil position (assuming the subject is in focus)

“Don't know”



# What is your sophistication level regarding depth of field information?

Focus distance: explicit metadata  
Near and far focus: derived metadata

6

Focus distance: artistic determination  
Near and far focus: artistic determination

6

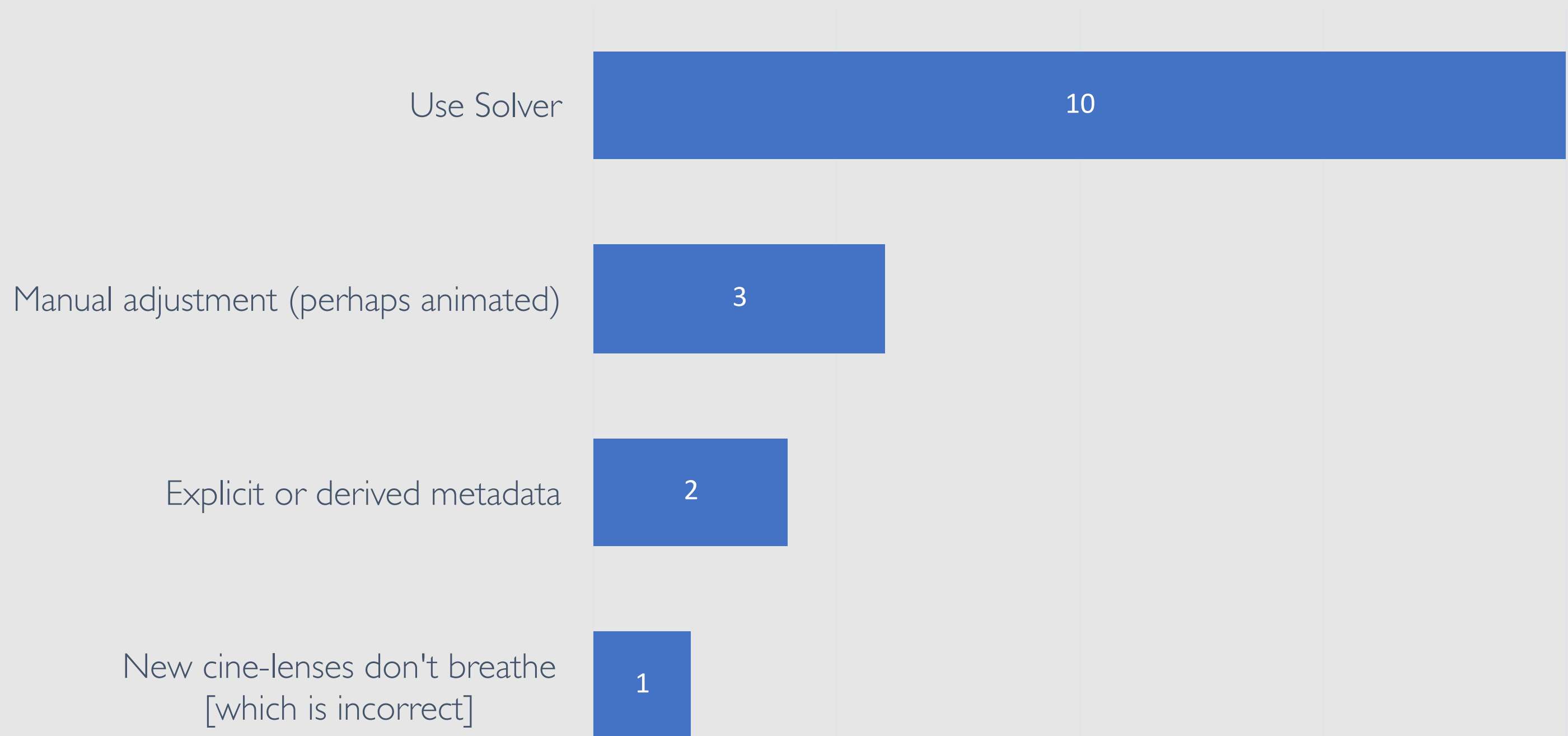
Focus distance: explicit metadata  
Near and far focus: artistic determination

3

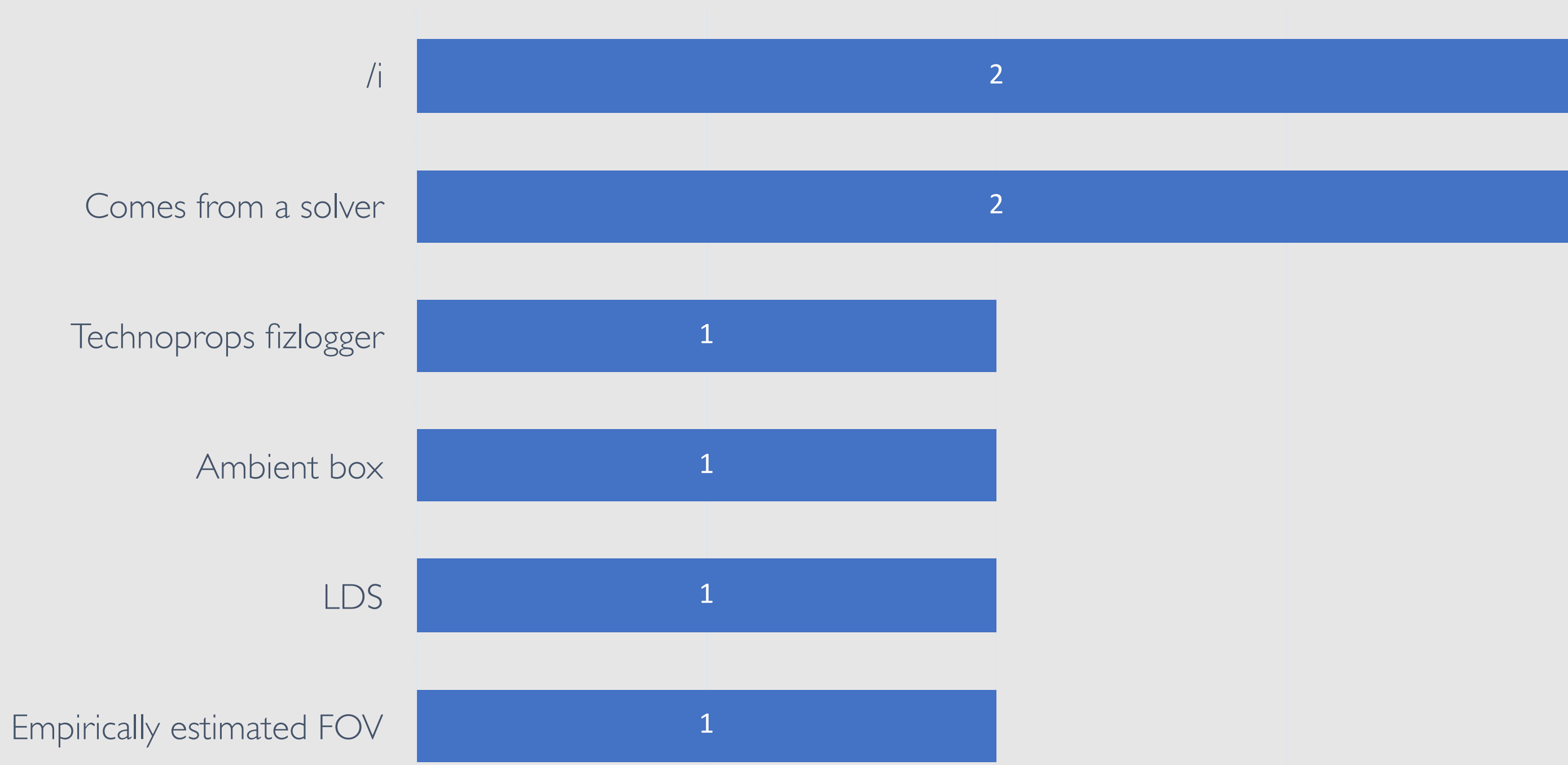
Focus distance: explicit metadata  
Near and far focus: explicit metadata

1

# the image goes into or comes out of focus; in other words, the lens breathes. How do you handle this?



# FOV, please list the lens families giving you this metadata and the way (LDS, /i, external Ambient box, etc.) ...you get it:



# Lens Distortion

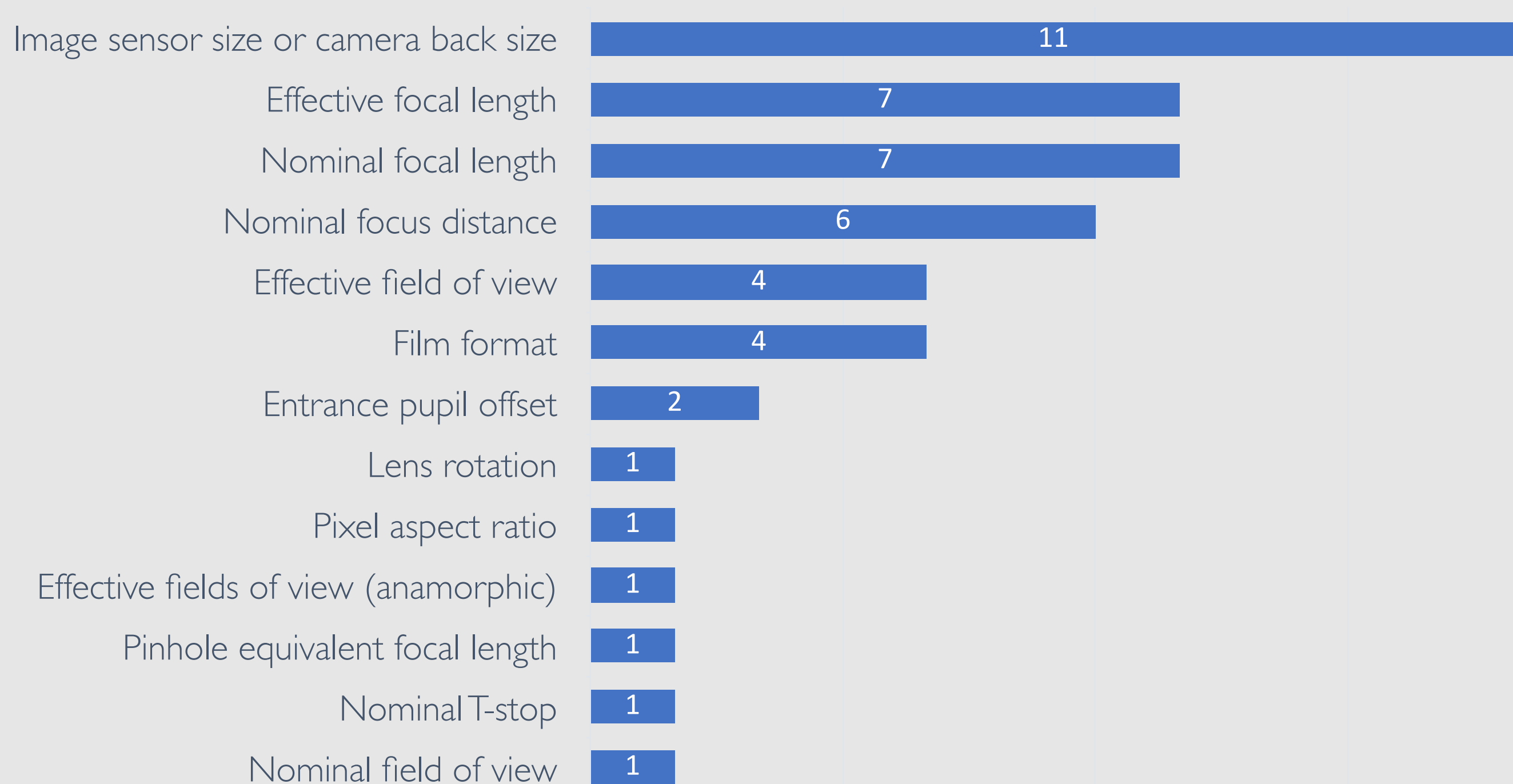
- Typically removed either with in-house tools or DCC App
- Ideally lens is characterized with camera body or bodies on which it will be mounted.
- Internal lens filters ignored.
- Characterized using a lens-grid, either portable or mounted.
- **Acceptable residual distortion highly application dependent (0.5 to 10 px)**



# Lens Distortion Interpolation.

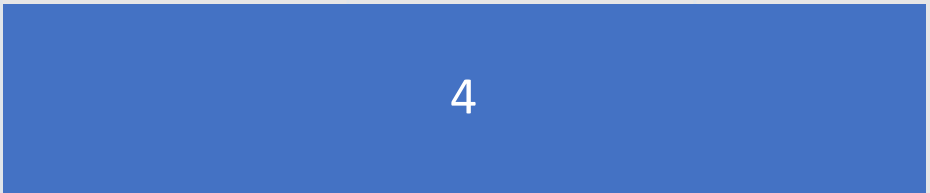
- Typically distortions are measured for a limited number of focus distances and interpolated.
- Zoom lenses are similarly interpolated for different focal lengths.

# Which of these are used in your lens distortion model?

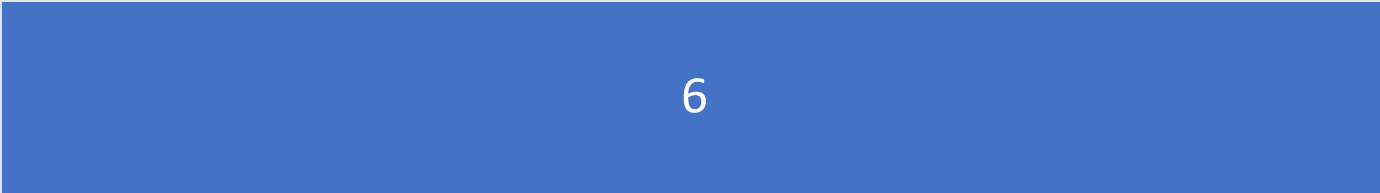


# Lens equations vs. lens maps

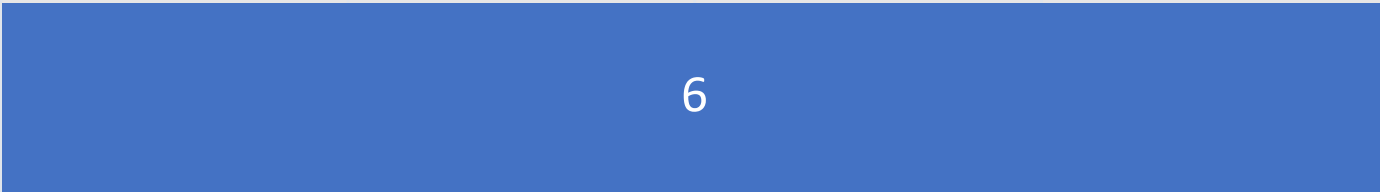
Tools rely on 2D map images to describe lens distortion and shading



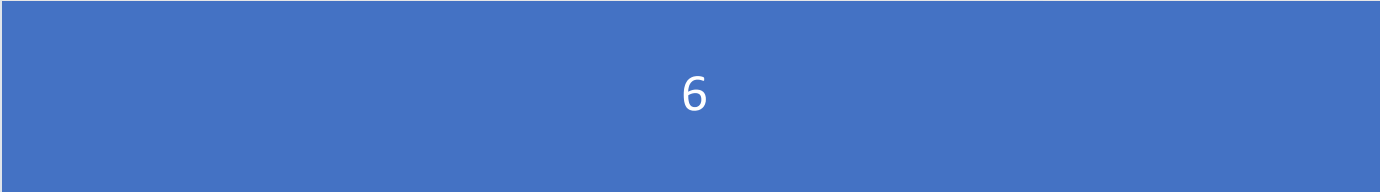
Some tools only work with equations and others only work with maps



Some tools work best with equations and others work best with maps



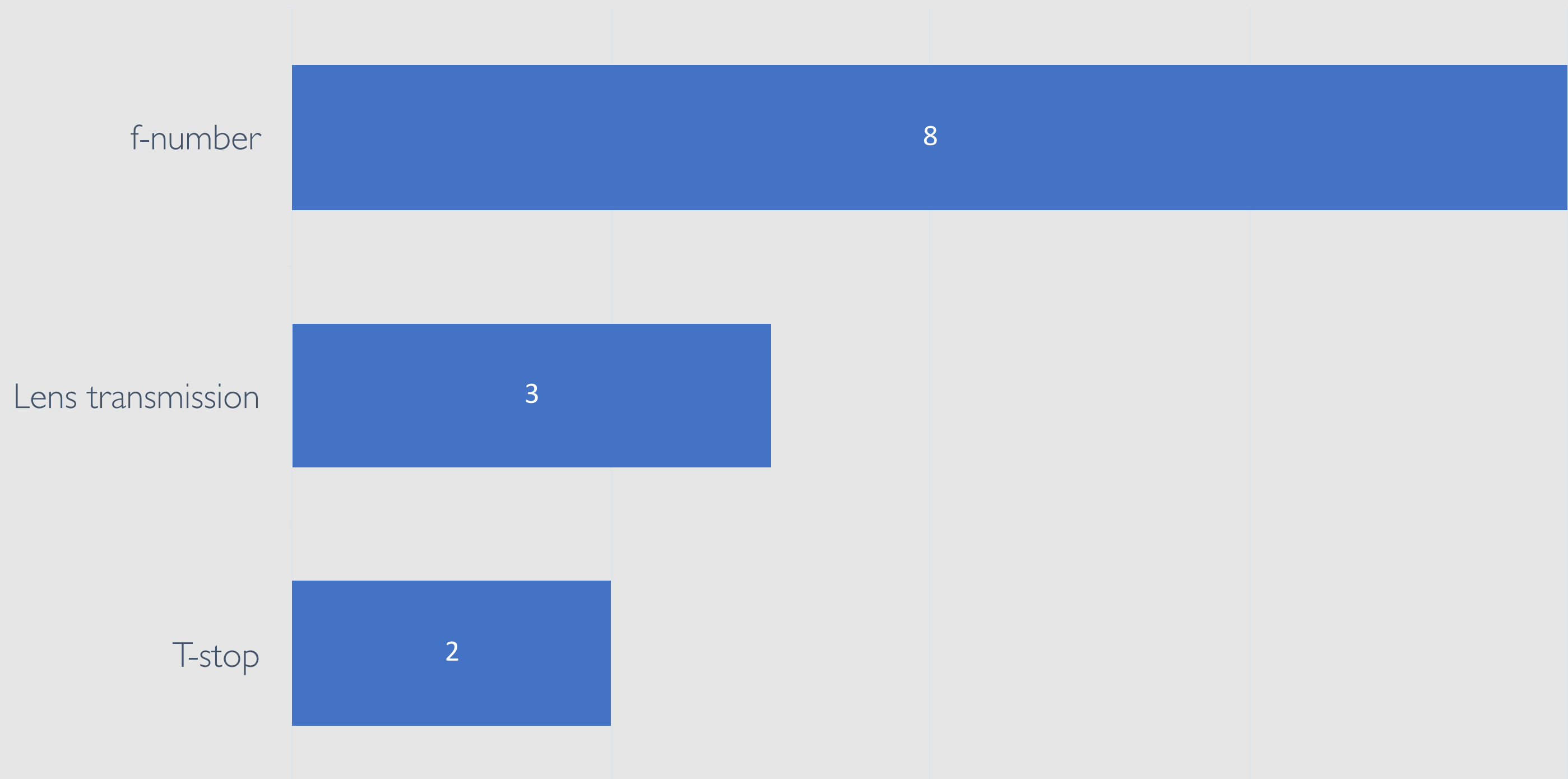
All our tools use equations to describe lens distortion and shading



# Lens Shading

- Mostly the incorrect assumption is that the transmission is uniform across the lens.

# Which of these do you use in your DCC applications? Check all that apply.



# Tilt/Roll/Pan

# Tilt/Pan/Roll Accuracy.

- When asked what accuracy would be required, we mostly got an answer in the .001 to .01 range, with a number of respondents wanting sub-pixel accuracy.
- This seems reasonable if we expect the results to be used as an absolute and not discarded to get the solver to answer.

# Sensor Update Frequency.

- The minimum update frequency was 24fps
- There seemed some preference towards typically getting at least a 2x sample rate of the FPS.
- Not a clear consensus on what would be too much.
- Consensus on getting metadata for rotation order.
- 43% would prefer angles in quaternions.



# What is the minimum required update rate for low-level camera-body accelerometer, gyrometer and magnetometer data?

**Relative**

**Absolute**

nX frame rate

1

100

1

1X frame rate

4

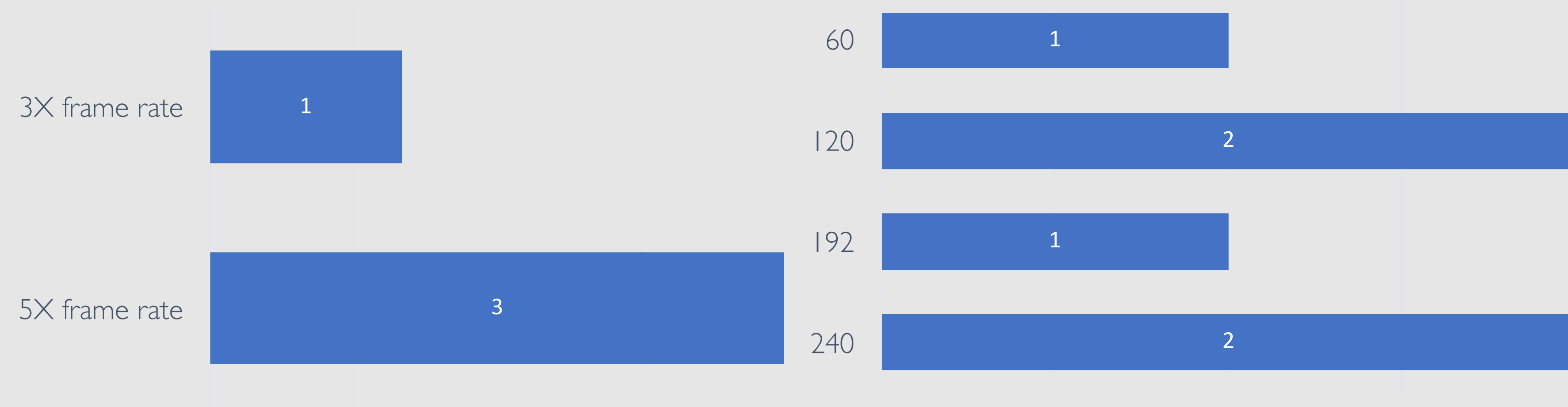
24

3

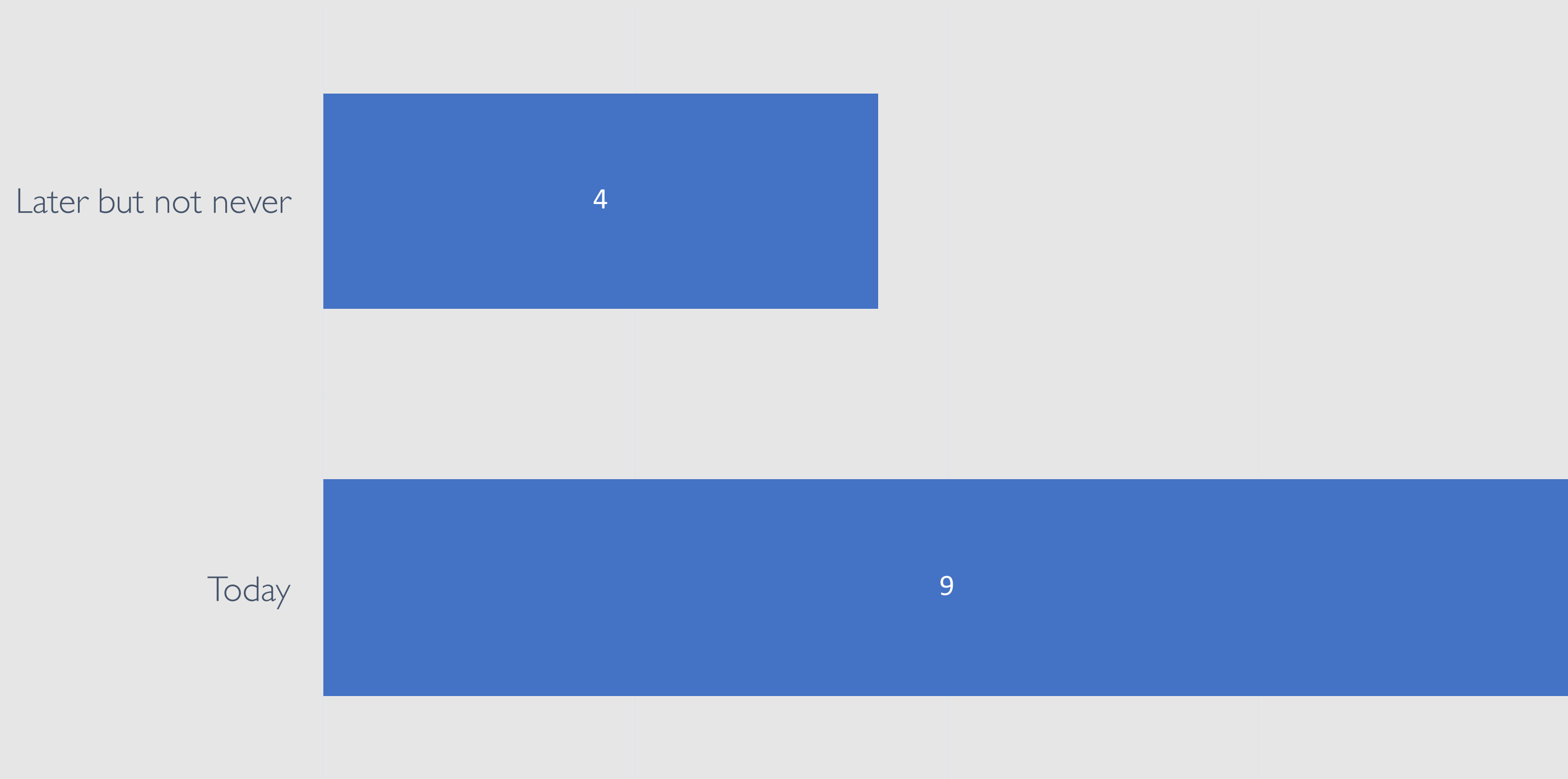
At what point would increasing the update rate for low-level camera-body accelerometer, gyrometer and magnetometer data feel like overkill?

### Relative

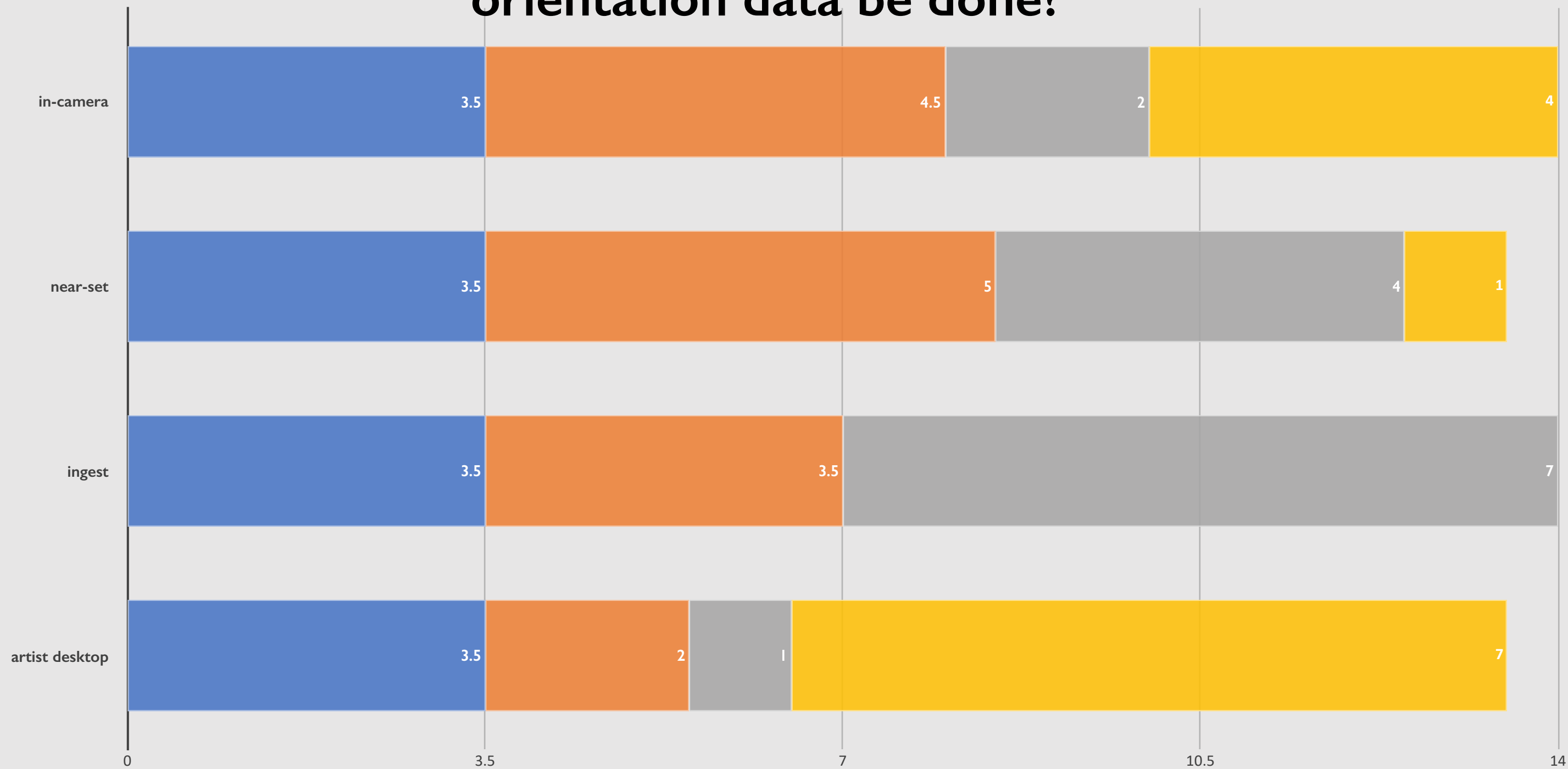
### Absolute



# When would you see benefit from lower-level metadata such as lens accelerometer, gyrometer and magnetometer data?



# Where should low level-sensor data be converted into high-level position and orientation data be done?



General Workflow | Focal Length | Lens Distortion | Lens Shading | Tilt/Roll/Pan

# Future Work

- Circle of confusion vs. explicit near and far focus.

# Contact Us

Email: [ves-tech-camera-metadata@googlegroups.com](mailto:ves-tech-camera-metadata@googlegroups.com)

