

**INTERNATIONAL ORGANISATION FOR STANDARDISATION
ORGANISATION INTERNATIONALE DE NORMALISATION
ISO/IEC JTC 1/SC 29/WG 11
CODING OF MOVING PICTURES AND AUDIO**

ISO/IEC JTC 1/SC 29/WG 11 **N16542
Chengdu, CN – October 2016**

Source: Requirements
Title: Summary of Survey on Virtual Reality
Status: Final



Summary of MPEG VR Questionnaire Results

Introduction

- In August and September 2016, MPEG conducted an informal Survey to better understand the needs for standardisation in support for VR applications and services.
- MPEG received 185 responses to the Survey
- This document summarises the results of the Survey
- The Summary does not list individual comments; these have been analysed by MPEG and are reflected in the Conclusions, which are also included in this Survey
- This result summary can be distributed to interested parties. It has also been sent to the Respondents.

Instructions given to respondents

ISO/IEC SC29/WG11, also known as the Moving Picture Experts Group (MPEG), is aware of the immense interest of several industry segments in content, services and products around Virtual Reality (VR). In order to address market needs, MPEG has create the following survey.

In order to provide some context, consider the following definition for Virtual Reality: "Virtual Reality is a rendered environment (visual and acoustic, pre-dominantly real-world) providing an immersive experience to a user who can interact with it in a seemingly real or physical way using special electronic equipment (e.g. display, audio rendering and sensors/actuators)."

MPEG believes that VR is a complex ecosystem and that already deployed technologies can begin to fulfill the very high commercial expectations on VR services and applications, but standards-based interoperability for certain aspects around VR is required. Therefore MPEG is in the process of identifying those technologies that are relevant to market success in order to define an appropriate standardization roadmap. The technologies considered include, but are not restricted to, video and audio coding and compression, metadata, storage formats and delivery mechanisms.

This questionnaire has been developed with the goal of obtaining feedback from the industry on the technologies whose standardisation may have a positive impact on VR adoption by the market. The questionnaire will be closed

on 23rd September 2016. Should this deadline not be manageable for you, please contact the organizers and we will attempt to accommodate your request for a possible extension.

Please attempt rate/answer all items in the questions. However, while we seek complete answers, we are also interested in receiving partially filled out questionnaires.

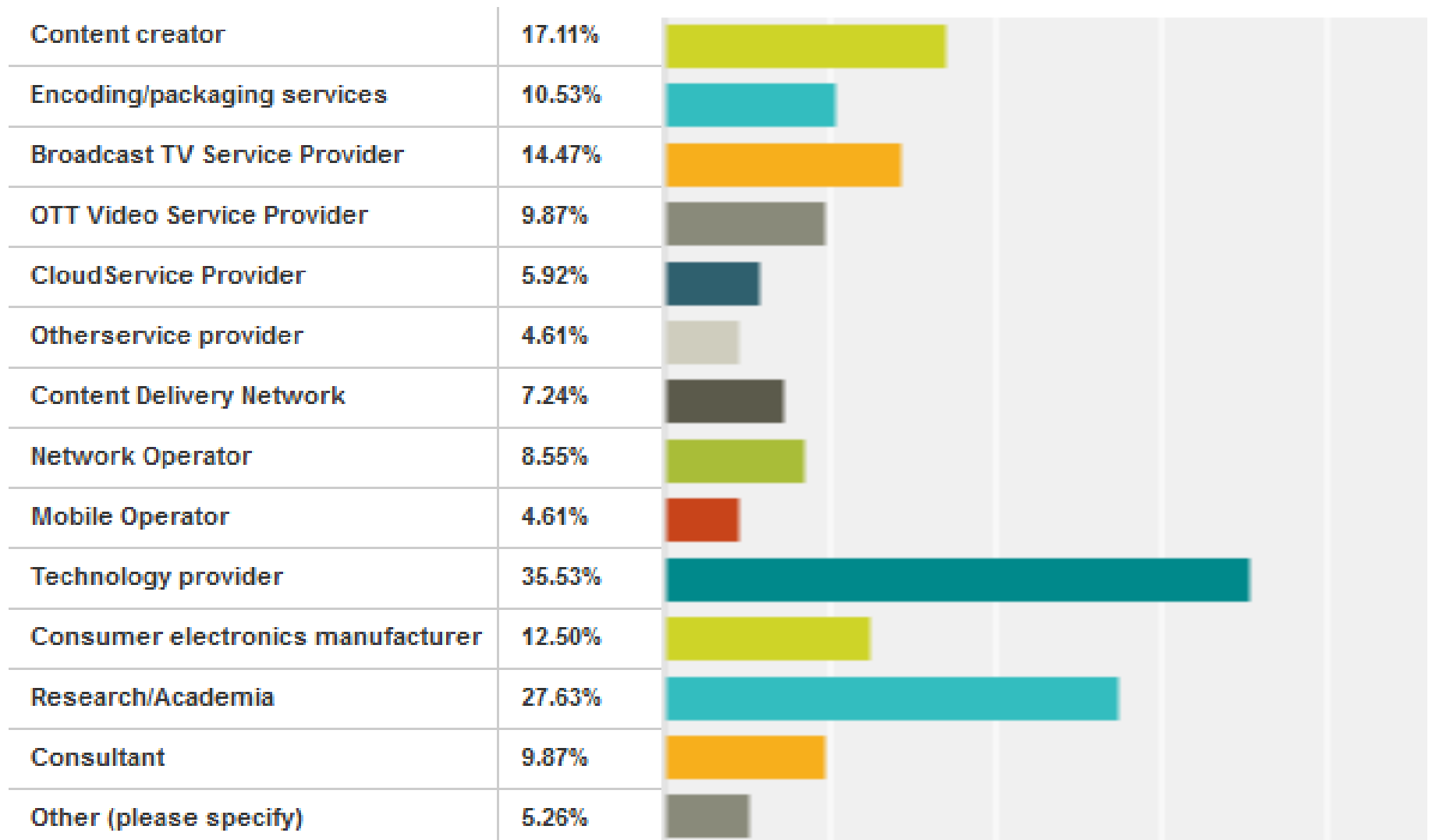
Please use the comment box below a question if you wish to make a comments or suggestions. You may also use the comment box at the very end of the questionnaire for general comments. The use of comment boxes is encouraged because they help us disambiguate your answers to our questions.

Thank you for participating in our survey. Your feedback is important.

The Chairs of the MPEG Virtual Reality Ad-hoc Group

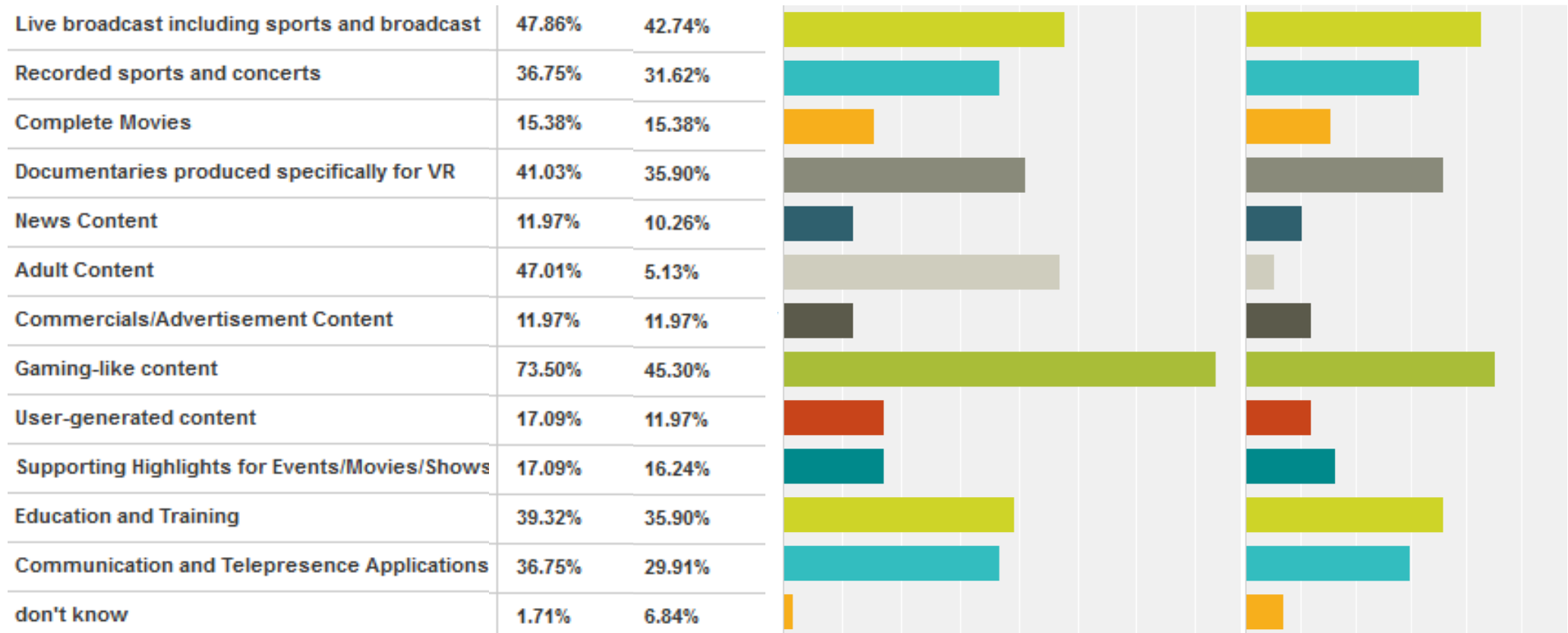
Result Summary

What Business are you in?



Use of VR is for ...

General “you” General “you”

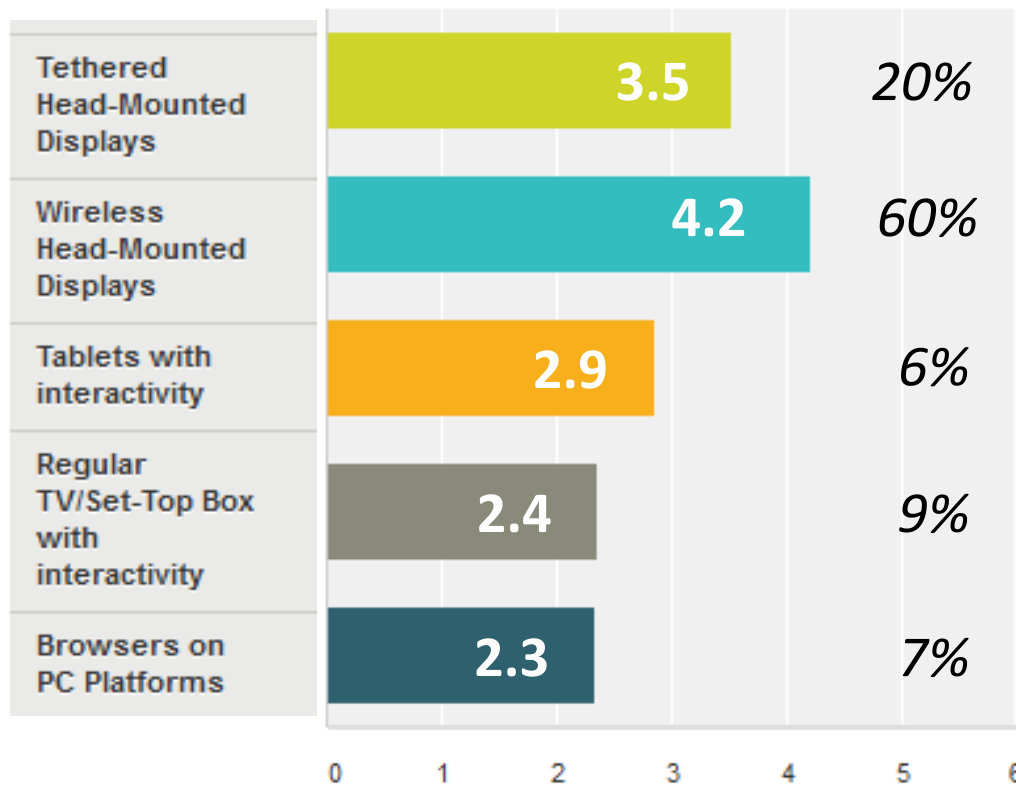


Other mentions:

- *Episodic content (<30 min)*
- *Professional support tools.*
- *Remote sign language interpreting*
- *Too little options, believe for almost all of them*
- *Note, like many in the industry, VR does not represent 360 degree video solutions and can only be for rendered content.*
- *Eventually VR will be used everywhere and will replace existing services*

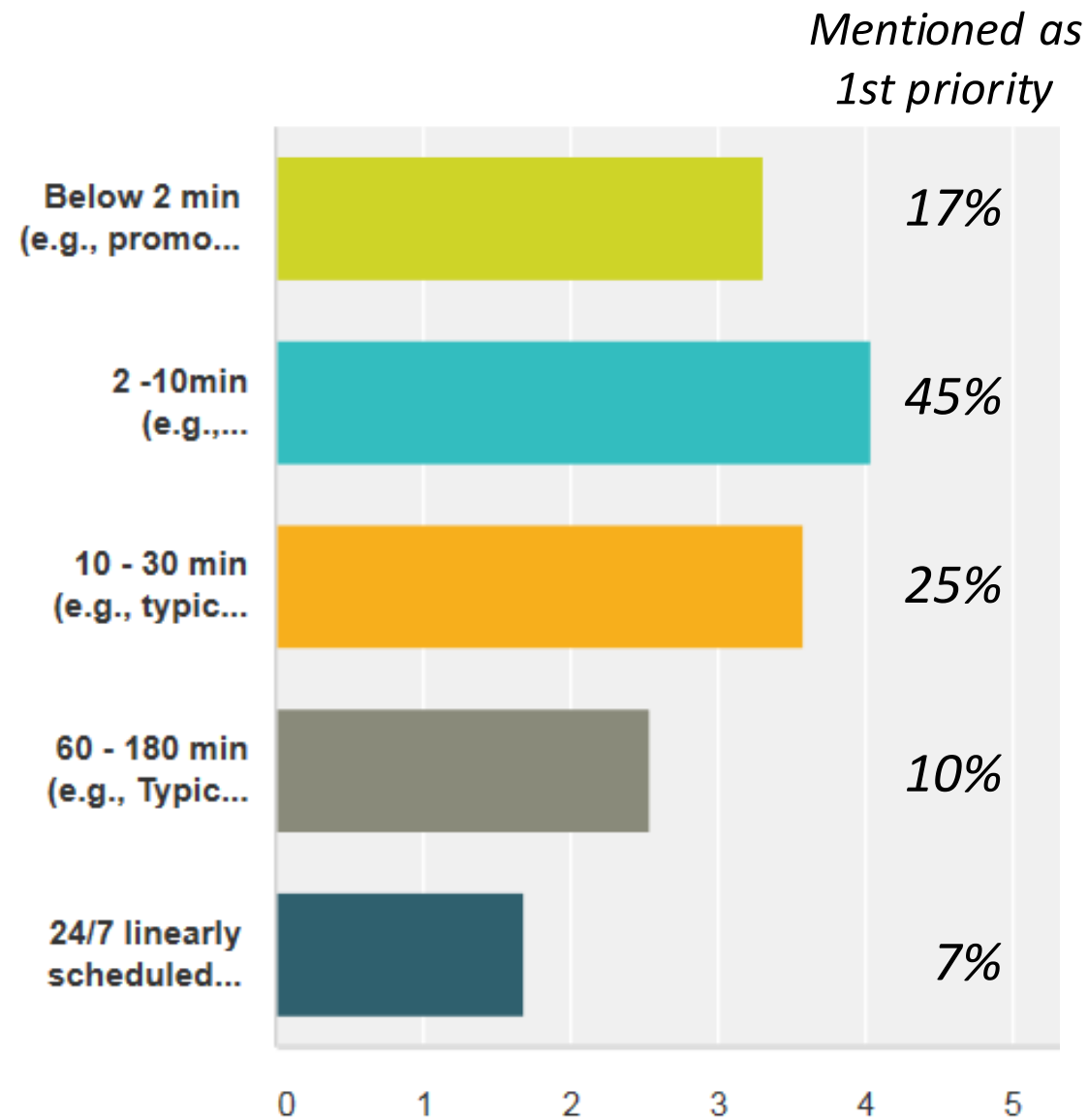
Most relevant devices?

*Mentioned as
1st priority*

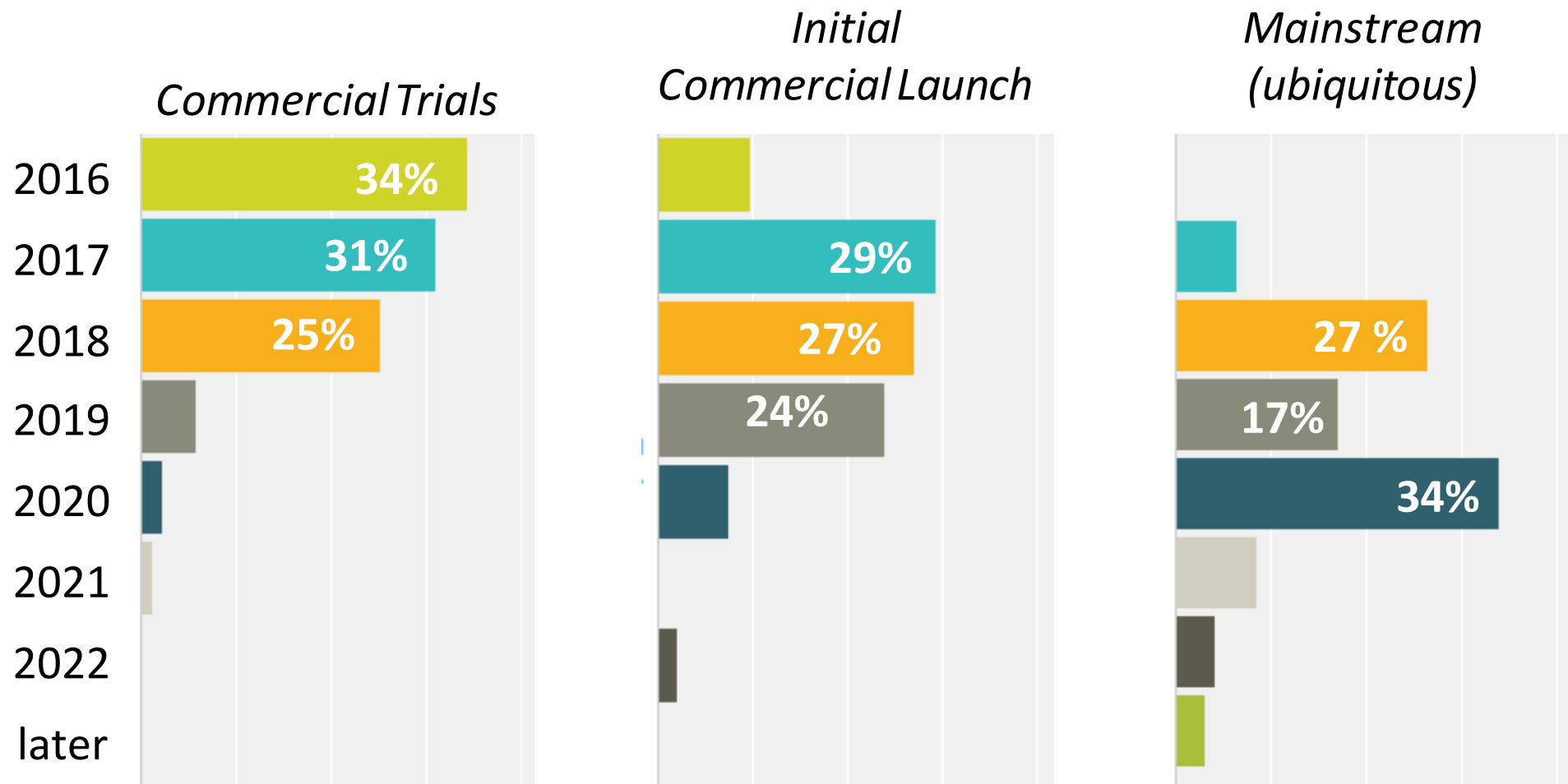


Conclusion: VR will be used on all these devices, while HMDs are considered the most important, especially wireless ones.

Typical Content Duration?

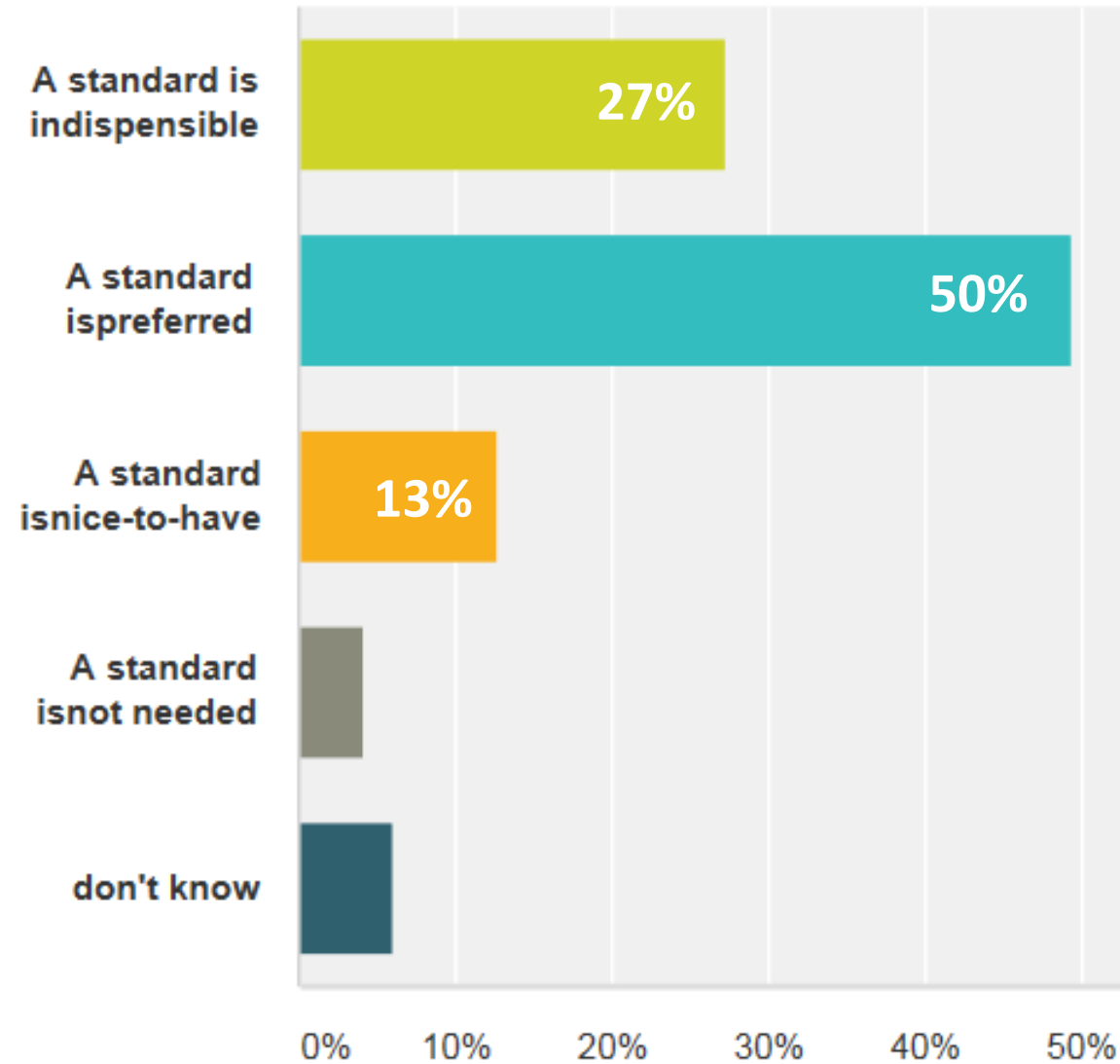


Deployment timelines?

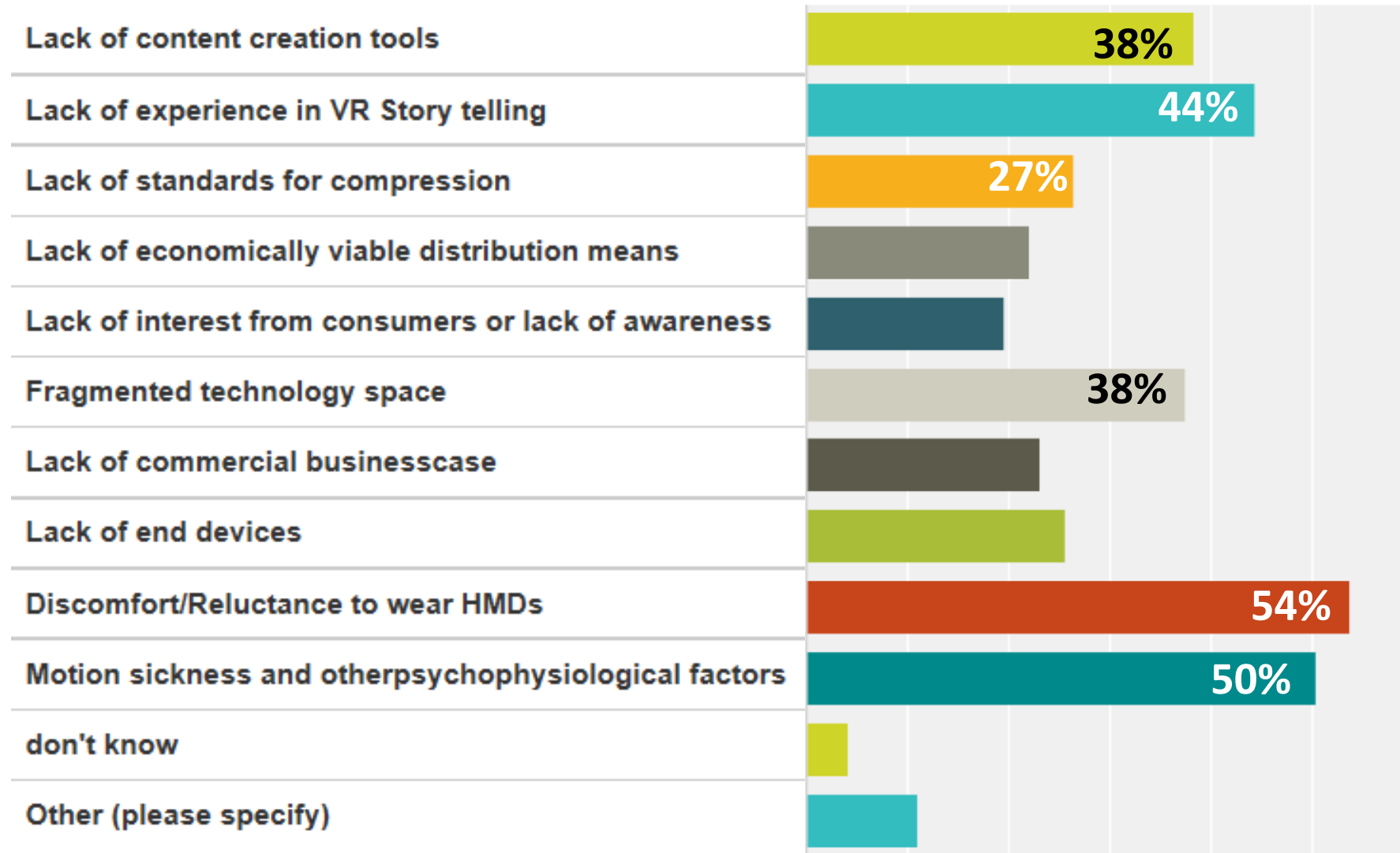


- Commercial trials this and next year.
- Launches starting seriously next year
- Mainstream in 2-4 year timeframe

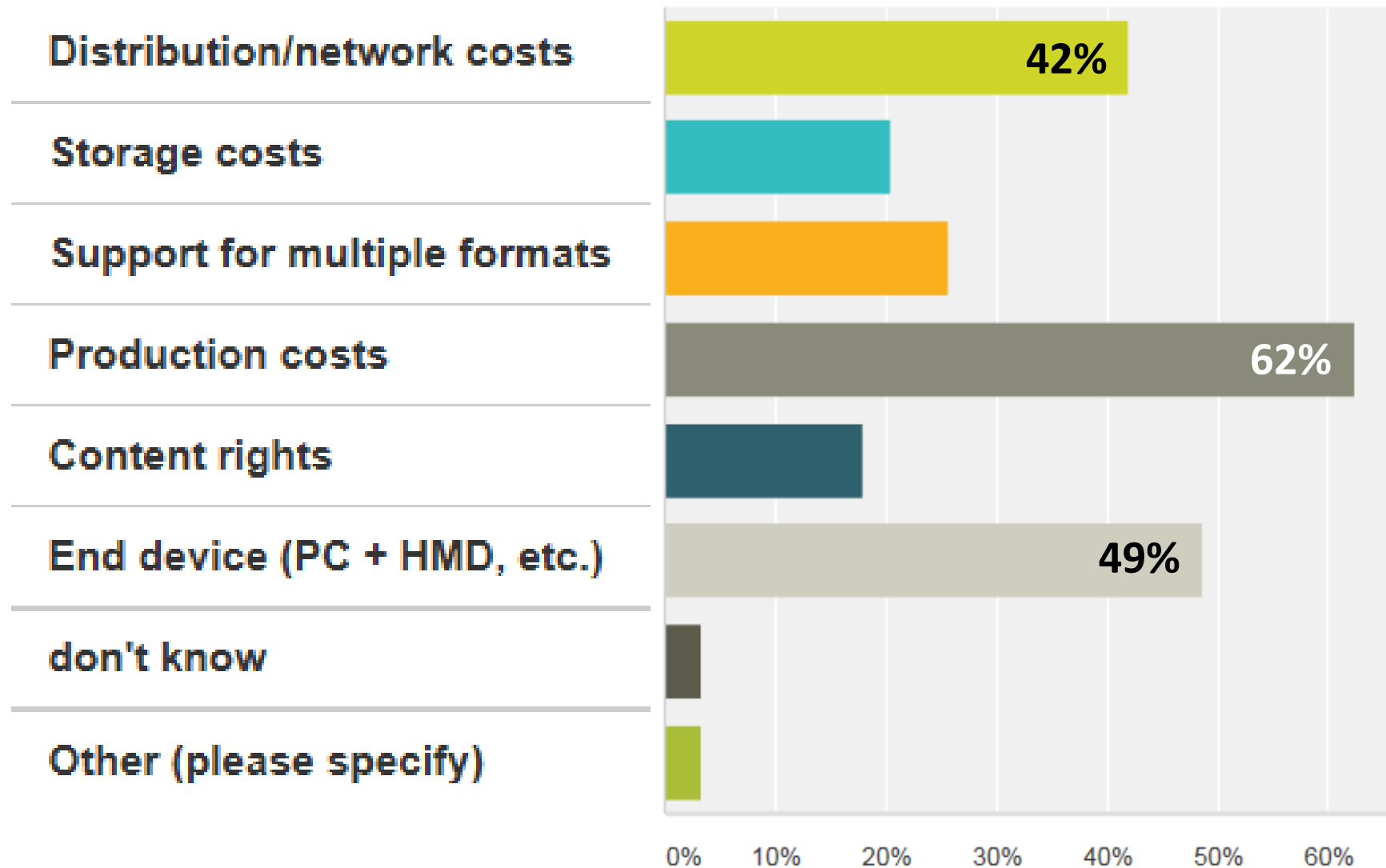
How about standards?



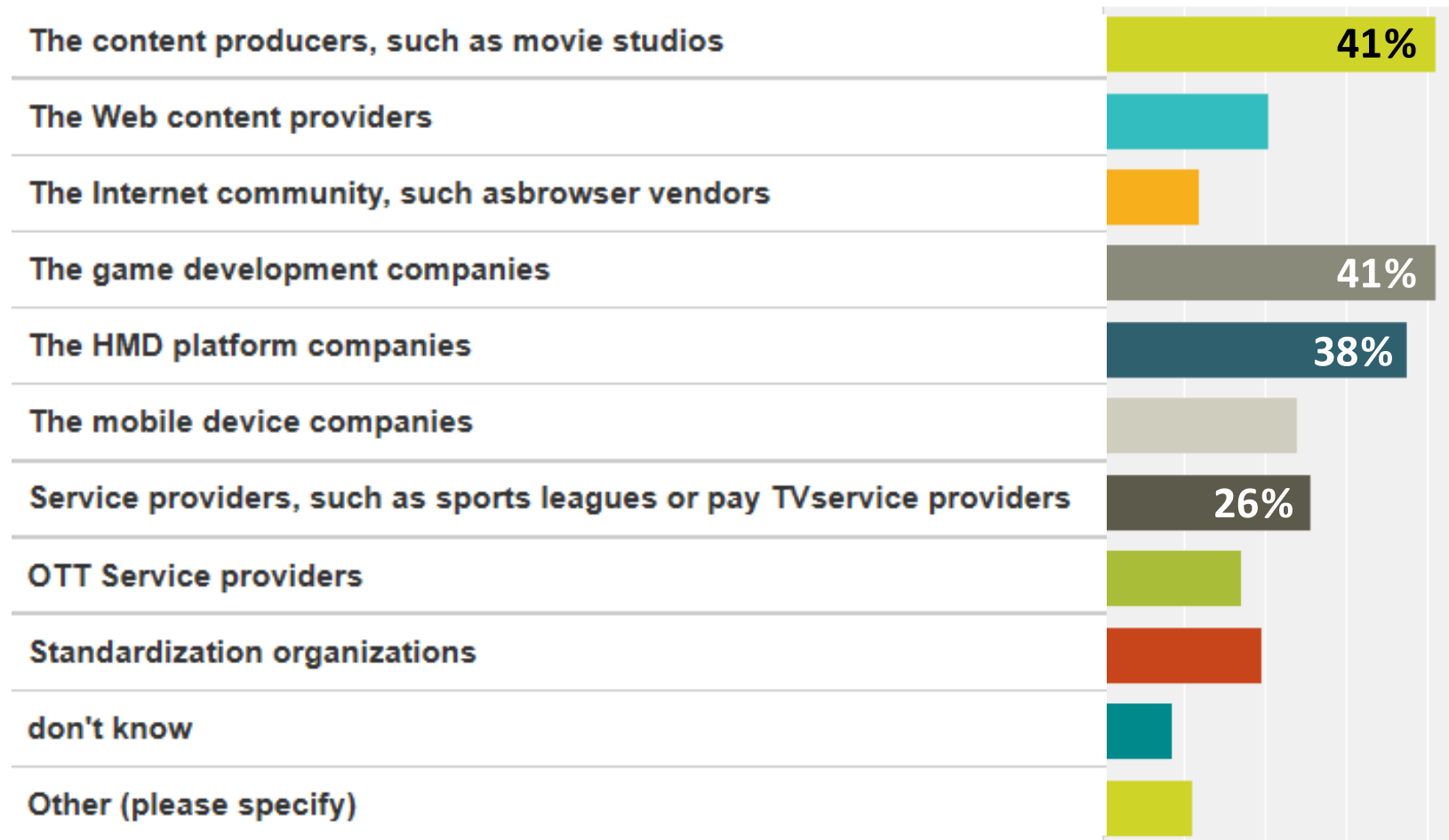
What Hurdles/Obstacles?



Major Cost Factors?

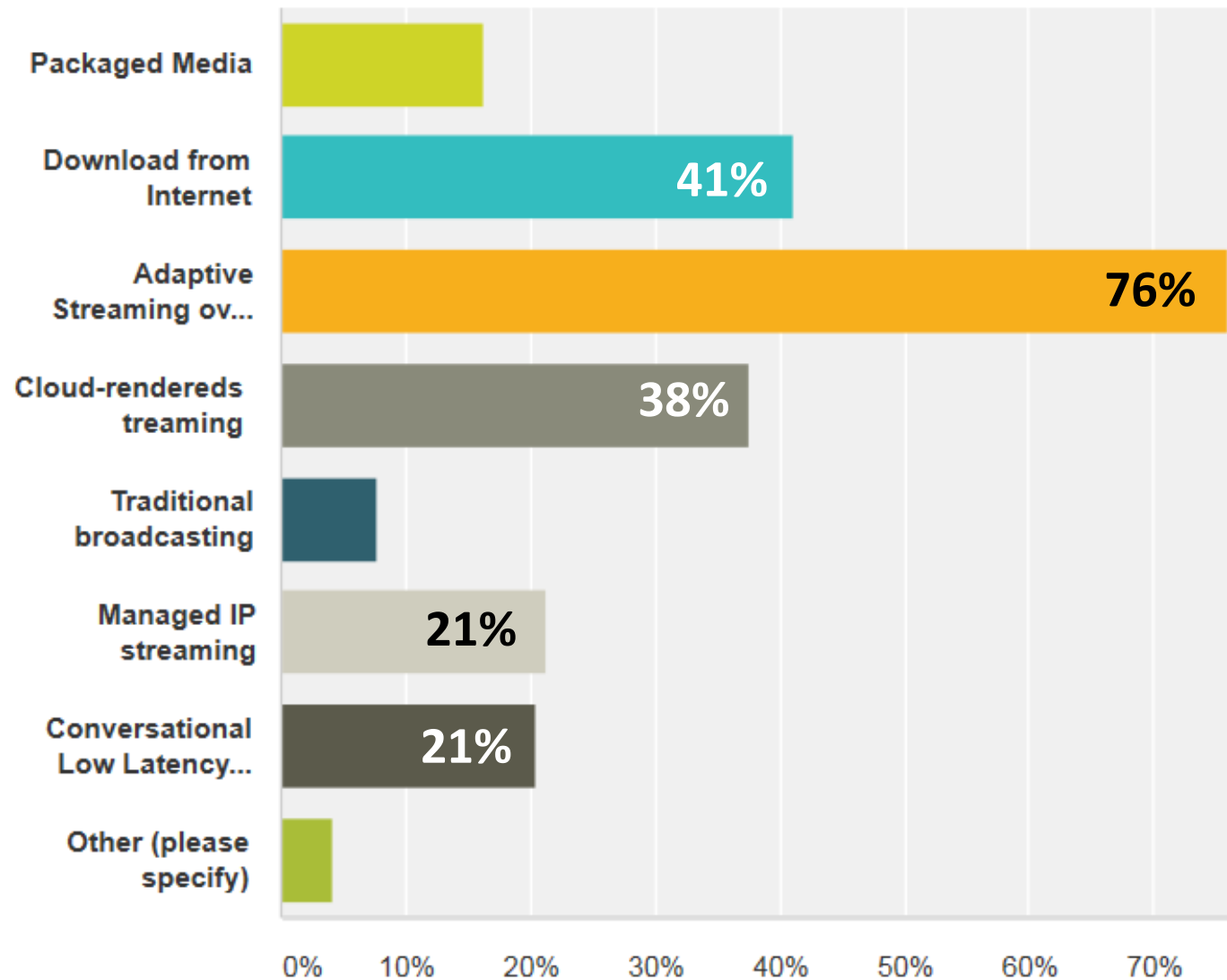


Who Selects Technology?



Content is King, also here (Game Development is also Content creation)
Consumers were mentioned quite a few times under "Other"

Most Important Delivery Means?



What Motion-Photon Latency vs. Bitrate is required?

- A very elaborate question that not everyone completed. A rough summary is as follows:
 - At least 10 -20 Mbit/s required at 5 msec
 - 20 - 40 Mbit/s sec required at 10 msec
 - No consensus at 20 msec (100 Mbit?)
 - Never good enough at 50 msec or higher

Video Production Formats in the near Future?

less than 360 degree spherical video with 3 degrees of freedom (head stays in place but user can look around)

37%

full 360 degree spherical video with 3 degrees of freedom

65%

spherical video with 6 degrees of freedom (user can also move around)

44%

monoscopic 3D video

stereoscopic 3D video

35%

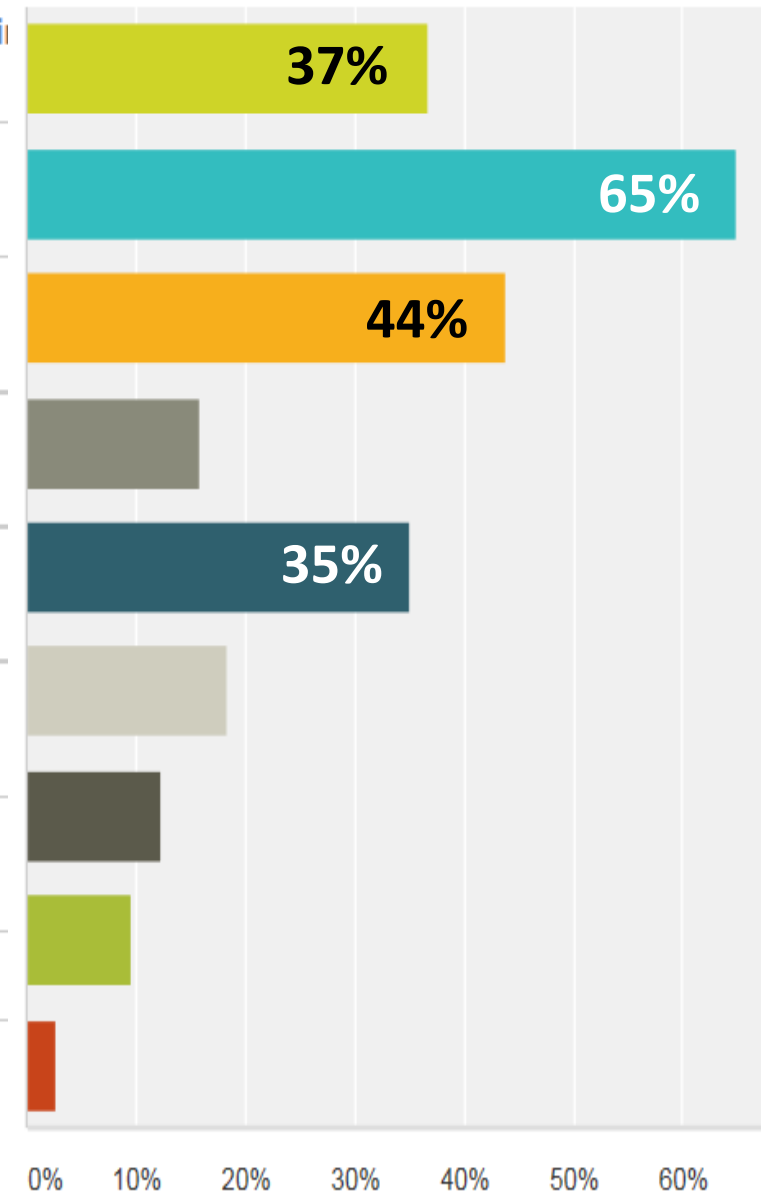
Light fields

Point clouds

do not know

Others (please specify)

0% 10% 20% 30% 40% 50% 60%



HEVC (including extensions) sufficient?

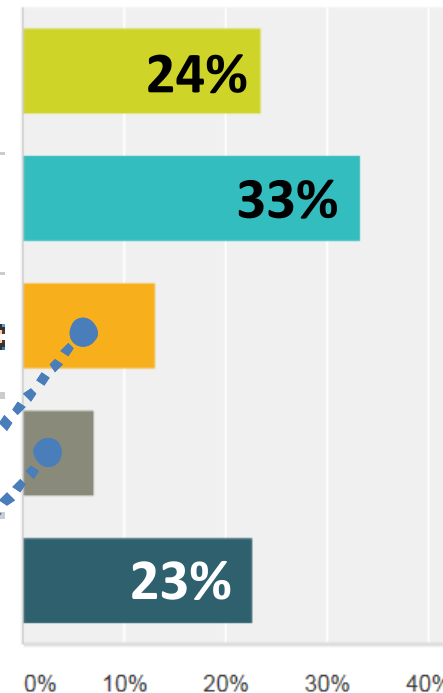
Yes, single decoder is sufficient

Yes, but multiple parallel decoders are necessary

Yes, with some adjustments (please specify shortc

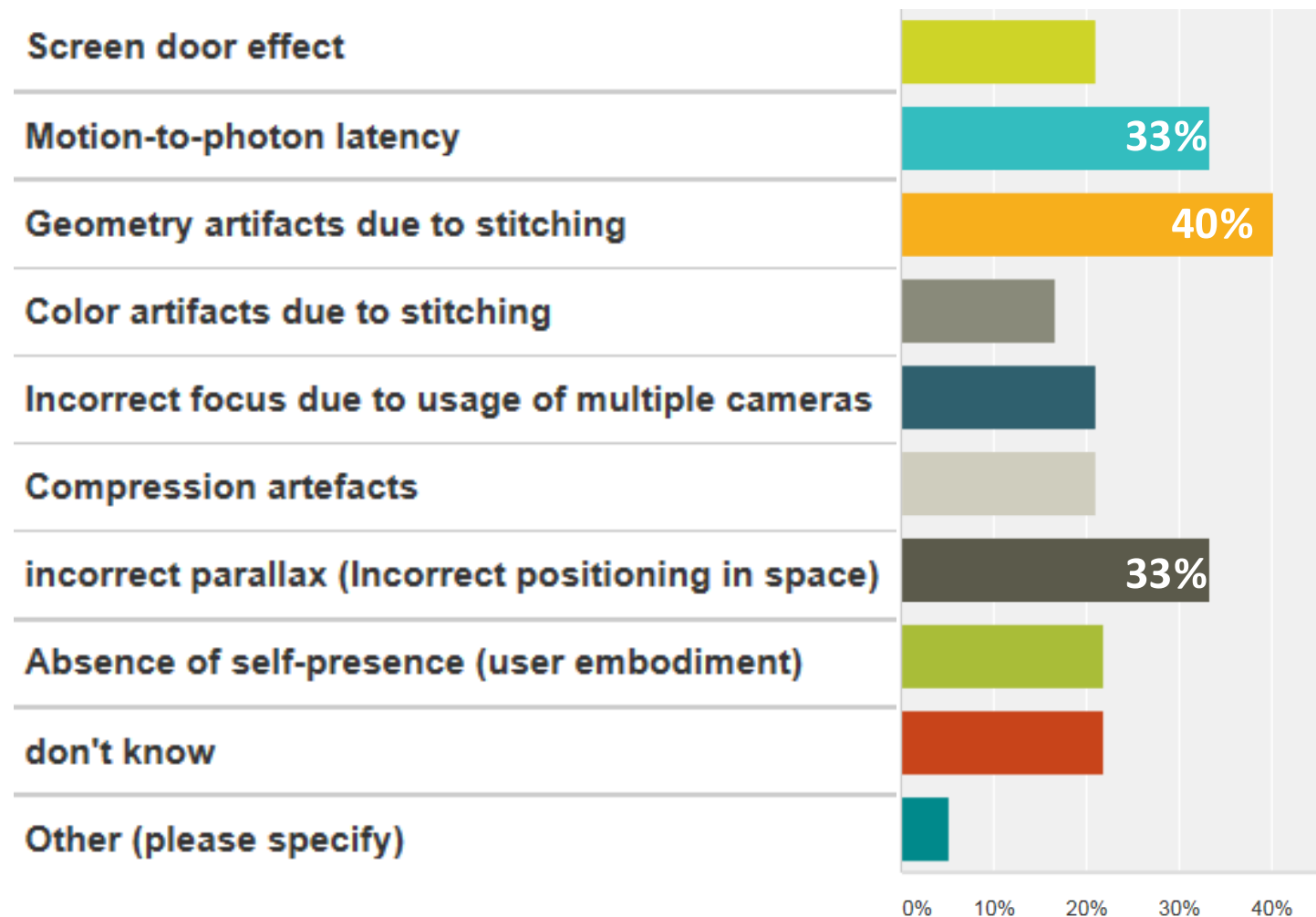
No (please provide comments in Comment box)

Don't know



MPEG has analyses "write-in" comments

Quality Issues with 360 / 3 Degrees of Freedom?



Low resolution mentioned multiple times in comments

Minimum Ingest Format Reqs?

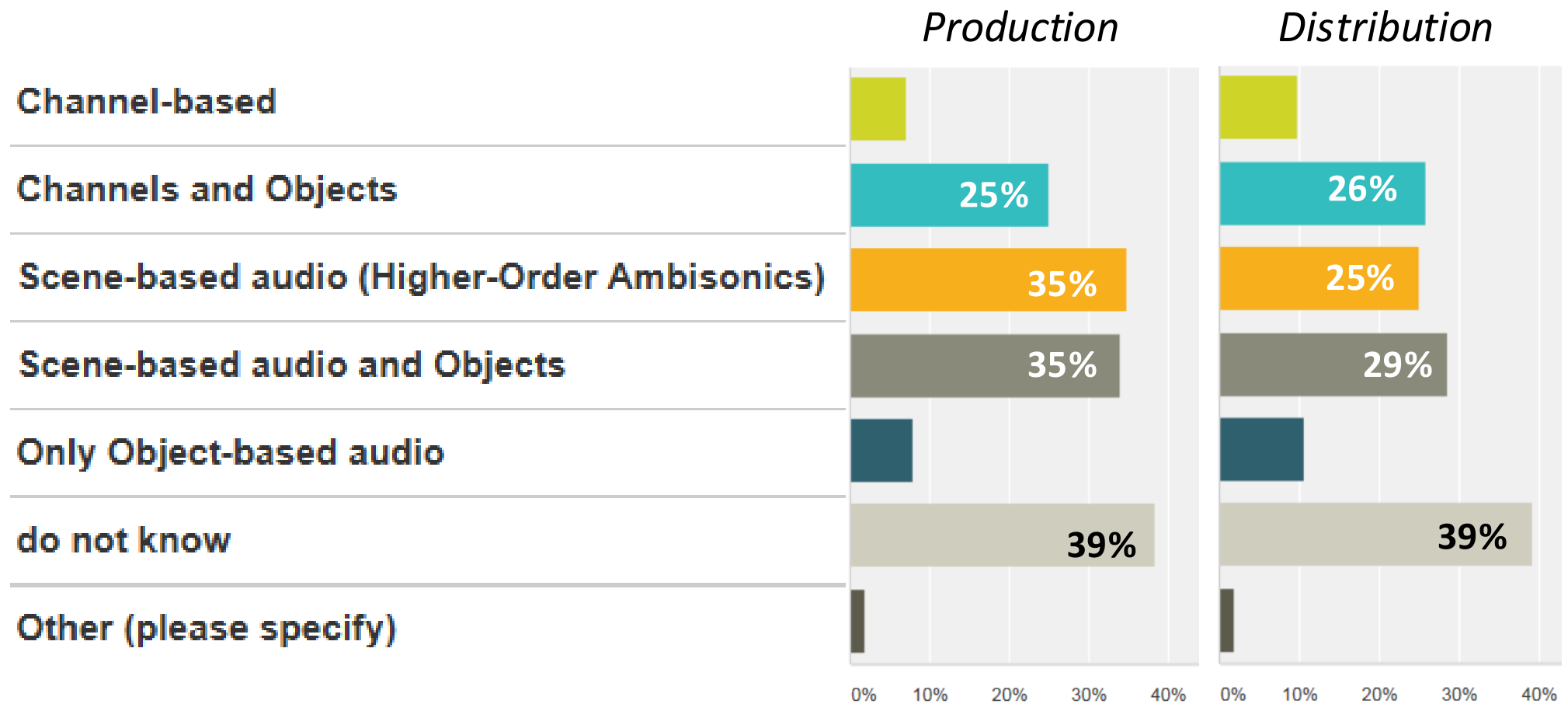
- A very elaborate question that not everyone completed. A rough summary:
 - 30 fps inadequate, although maybe at 6k and up ...
 - 60 fps acceptable at 4K and up
 - 90 fps and higher perhaps doable at HD; good enough at 4k+

Minimum Reqs per Eye?

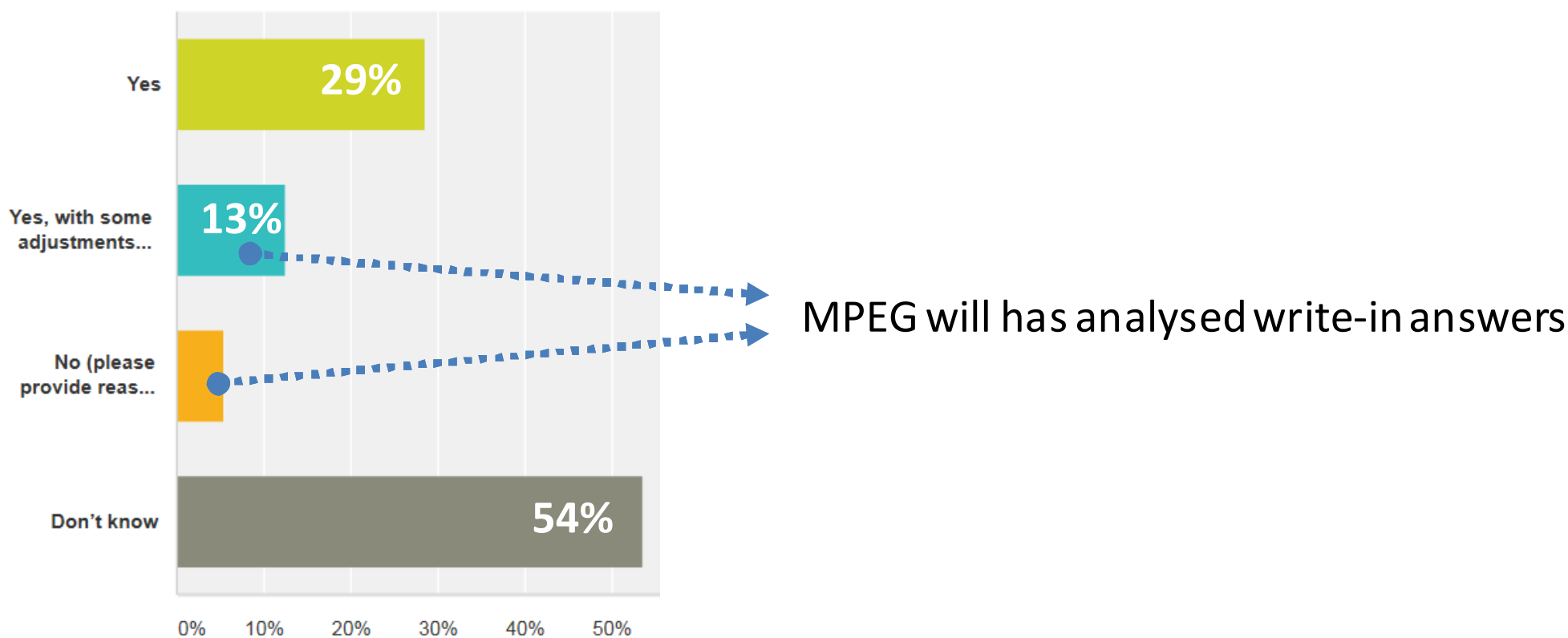
- A very elaborate question that not everyone completed. A rough summary:
 - 30 fps never good enough, well, maybe at 8k and up?
 - 60 fps usable at 4k and up
 - 90 fps and higher clearly usable at 4k and up, but not at HD

3D Audio for VR in near future?

(max 3 answers)

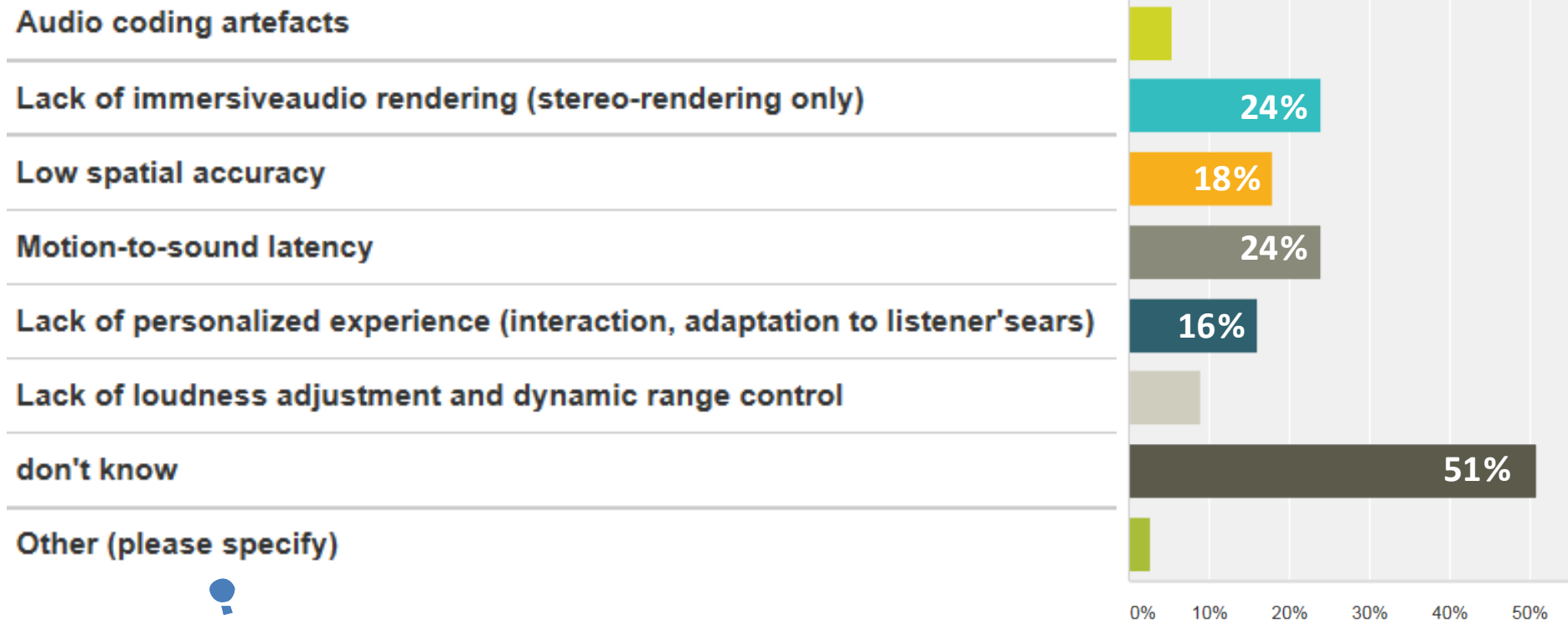


MPEG-H 3D Audio Sufficient for Initial Deployments?



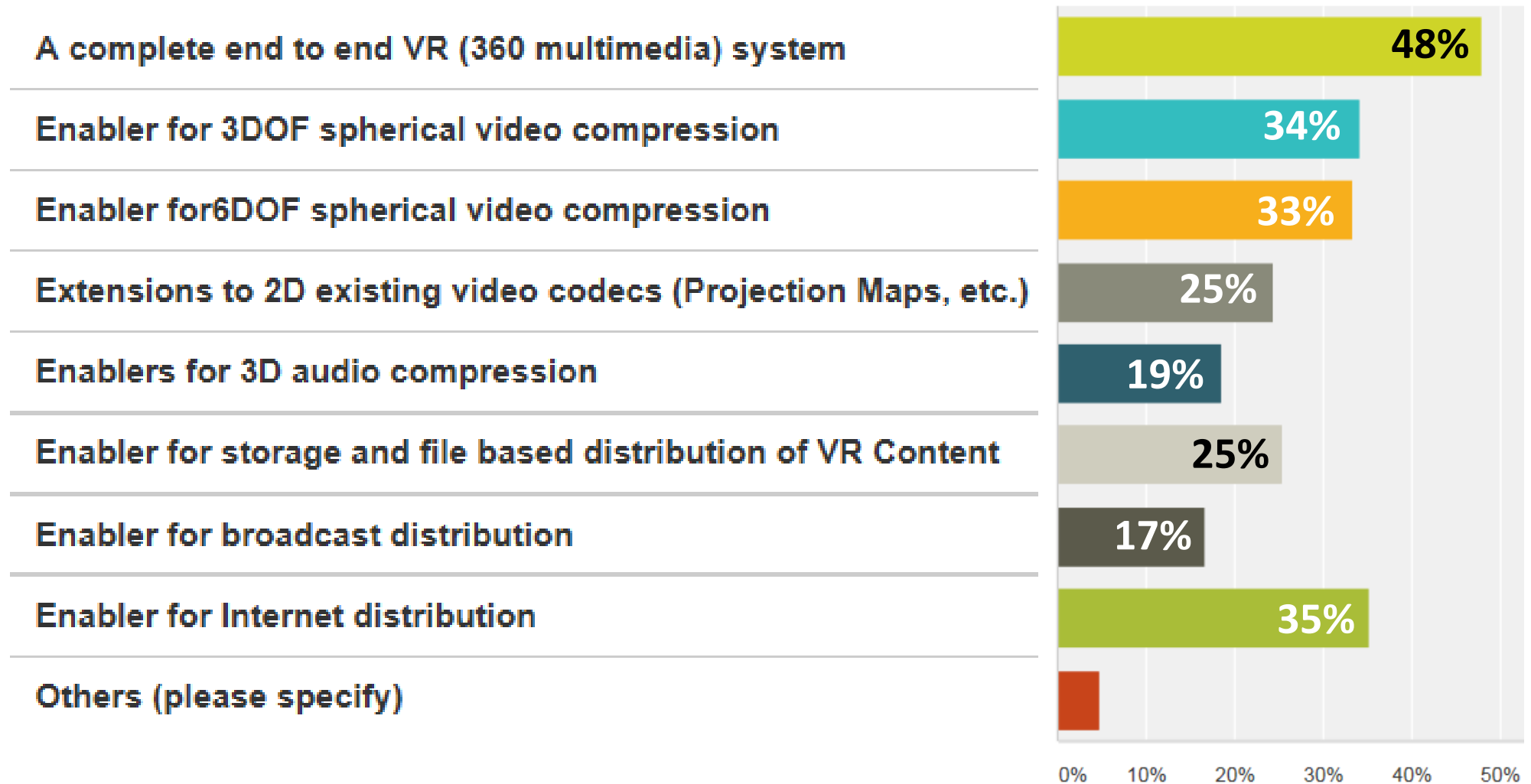
Which Quality Issues with 3D Audio?

(max 4 answers)



MPEG will analyse write-in answers

What Specs should MPEG Create?



Conclusions

There is a significant interest in having standards

- An analysis learns that there is no significant difference between MPEG participants and non-participants
- MPEG should deliver compression tools, make for a less fragmented technology space; and support short motion-to-photon delay

Application space:

- The focus is now on 360 Media with 3 Degrees of Freedom (monoscopic or stereoscopic)
- There is a clear interest in 6 Degrees of Freedom.

Business Models

- Broadcast is considered an interesting business model by a significant amount of respondents, which raises the question if broadcasting brings specific requirements, and whether broadcast as a service also implies broadcast as a distribution model. Most respondents seem convinced that adaptive streaming is the best way to distribute VR content.

Transport

- Adaptive streaming is considered very important
- There is also an understanding that it needs to get better, i.e. more adaptive to viewing direction (in terms of motion to photon delay)

Video

- Most respondents believe that HEVC is useful, but a significant amount believe that extensions may be desired or required, e.g. in tiling support, or the use of multiple decoders.

- No clear picture emerges on quality requirements for video, although it is clear that very high resolutions are desired. Current VR quality is not yet enough for a good experience, and MPEG should provide tools that enable higher quality.
- Respondents also indicate that MPEG-defined projection methods are desirable.
- Coding technologies will be required to support experiences with 6 degrees of freedom

Audio

- Many respondents did not have an opinion on Audio, but those that did, think that the required tools are available and may need to be profiled.

General

- There is a need to look at the interaction between projection mapping and video coding, and to find optimal solutions.
- Requirements from those who create the content are important, as content creators are seen as an important factor in determining what tools are used.

Timing:

- The survey gives a fairly uniform picture when it comes to deployment timelines:
- Commercial Trials: 2016 and 2017, then levelling off
- Initial Commercial Launch: 2017/2018
- Mainstream: 2018 to 2020