OPEN PATH GUIDING LIBRARY

PROJECT PROPOSAL: SANDBOX

Dec. 10, 2025. ASWF TAC Meeting

Presenter:

Sebastian Herholz

Rendering-Engineer/Researcher at

Ex-Intel / Soon-Blender

Sponsor:

Kimball Thurston

CTO at Wētā FX

AGENDA

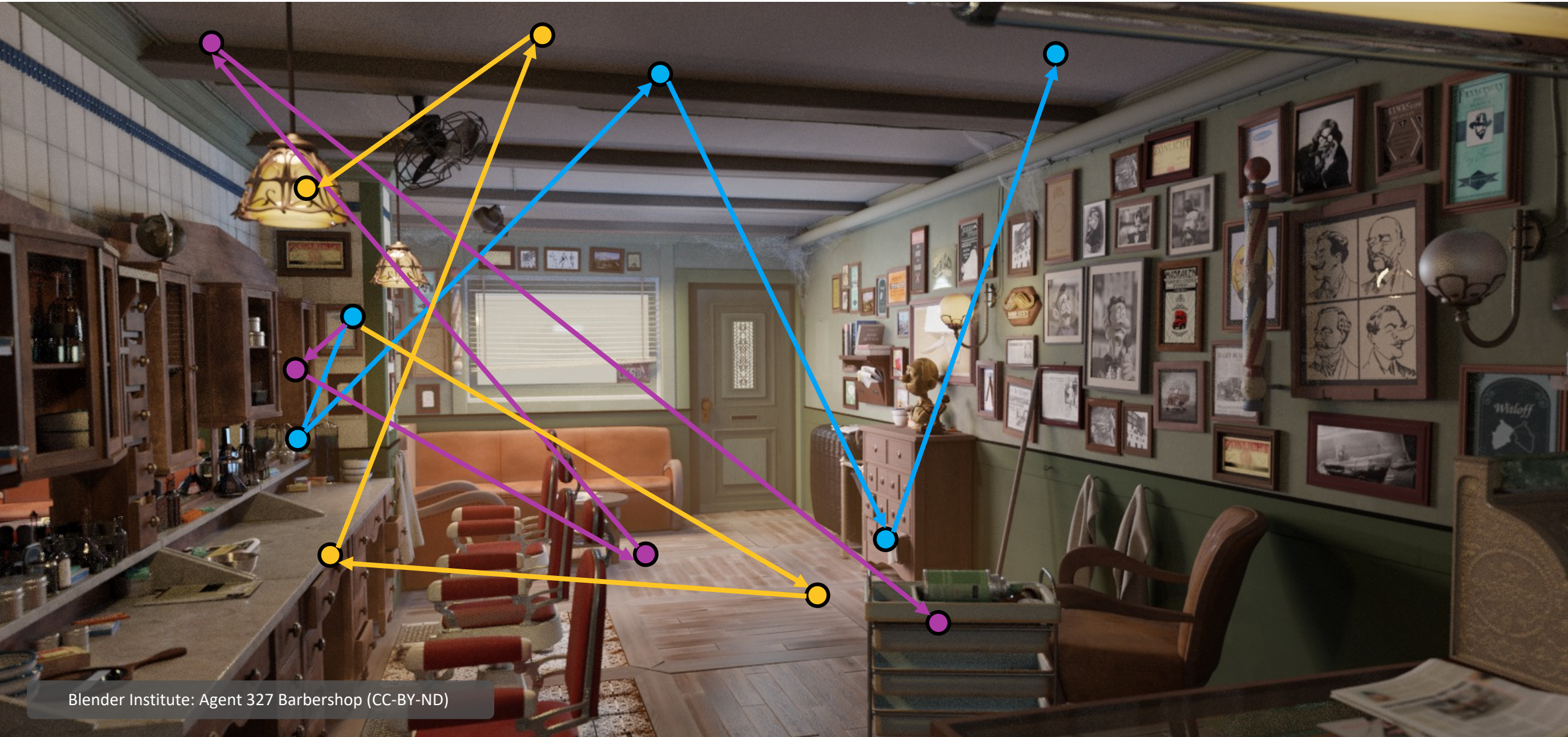
- Introduction into Path Guiding
- What is Open PGL and what does it offer the VFX-Industry / Rendering Community?
- Current Project Status
- Discussion

ASWF /* ACADEMY SOFTWARE FOUNDATION

WHAT IS PATH GUIDING?

PATH TRACING

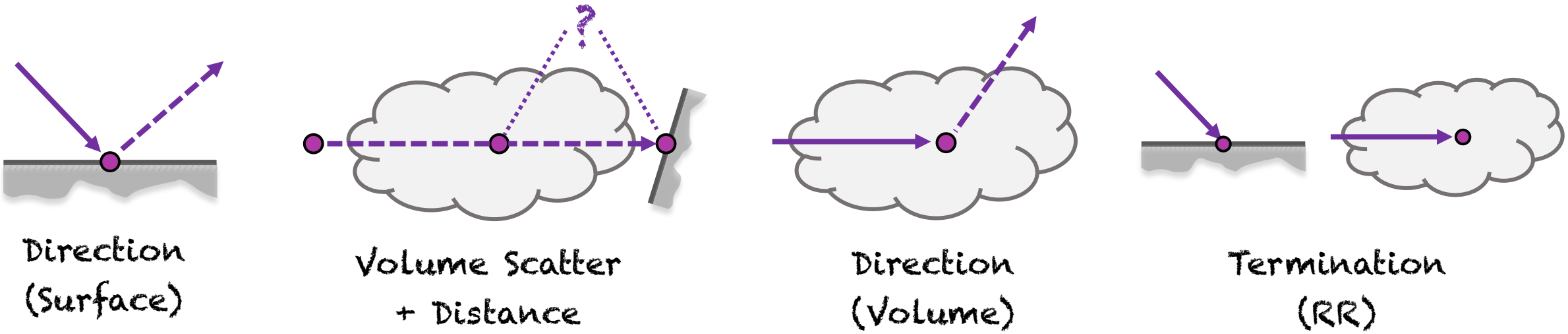
Path tracing-based rending is now the standard in VFX.



Blender Institute: Agent 327 Barbershop (CC-BY-ND)

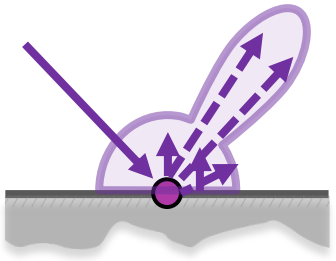
RANDOM PATHS

Generating a random path includes making **multiple local** decisions.

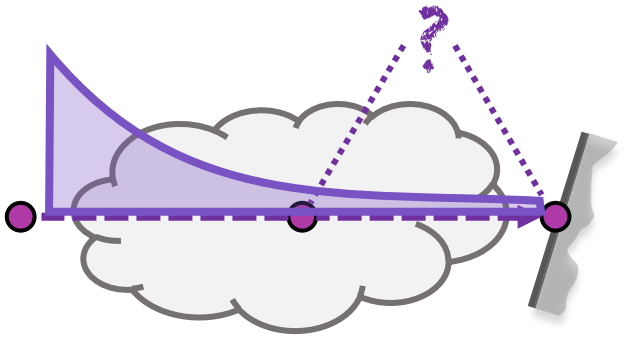


COMMON APPROACH

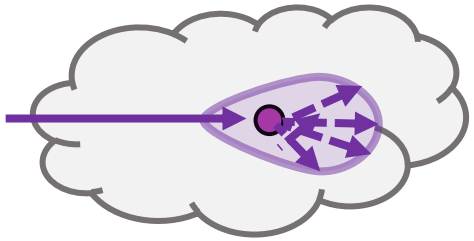
These decisions are usually made based on **local** scene properties.



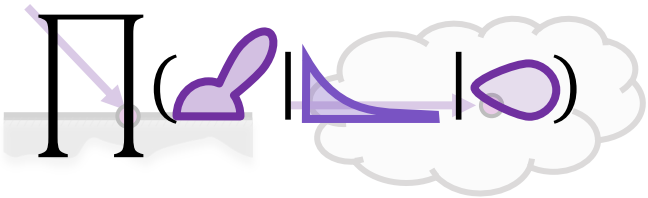
Material
(BSDF)



Volume
Transmittance (T)



Phase Function
(p)



Path Throughput
Weight

COMMON APPROACH

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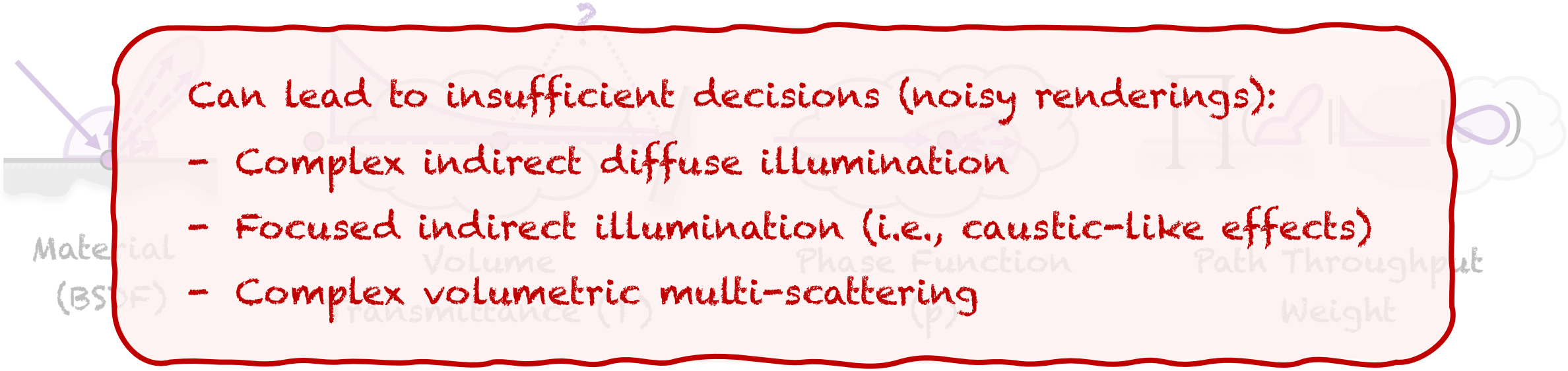
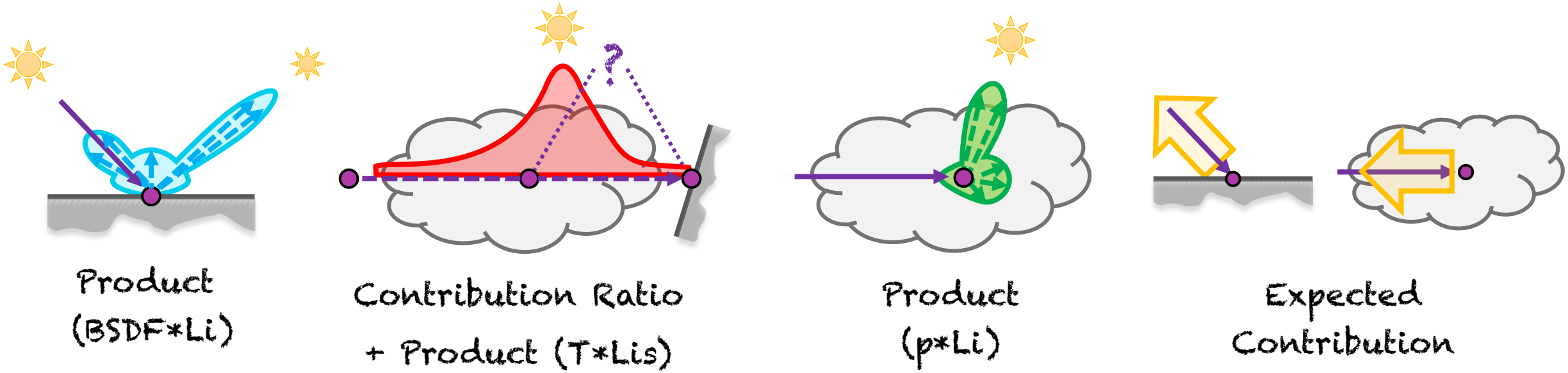


Can lead to insufficient decisions (noisy renderings):

- Complex indirect diffuse illumination
- Focused indirect illumination (i.e., caustic-like effects)
- Complex volumetric multi-scattering

HOW DOES PATH GUIDING WORK?

Improving local decisions by incorporating **approximated/learned** information of the **scene's light transport**.




Path guiding: OFF
SPP: 256


Path guiding: ON
SPP: 256

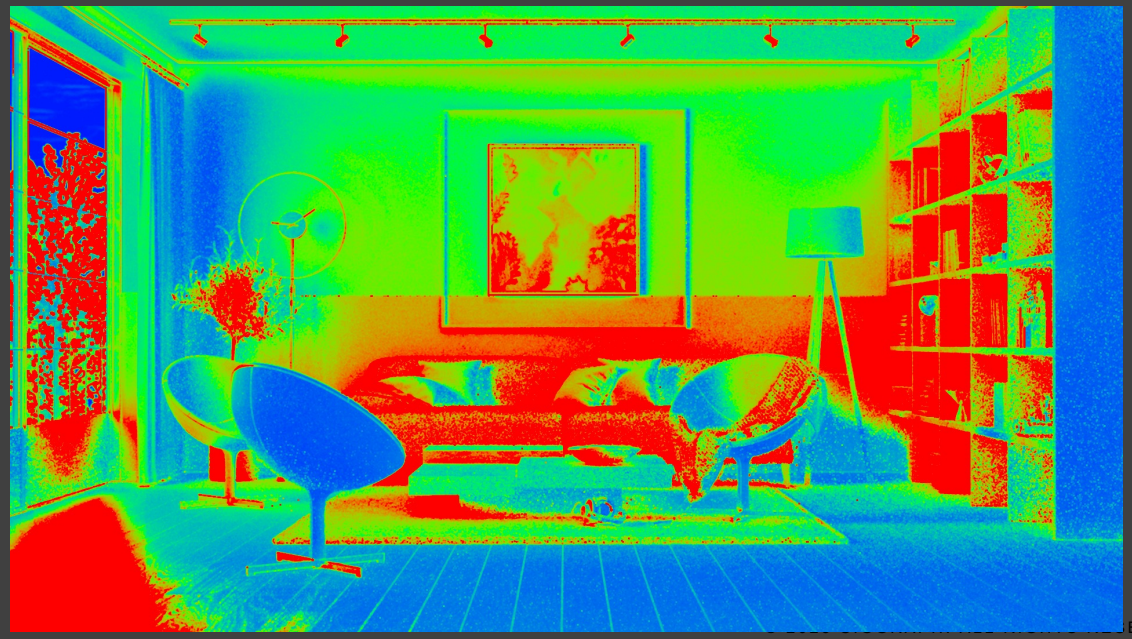

OFF
ON

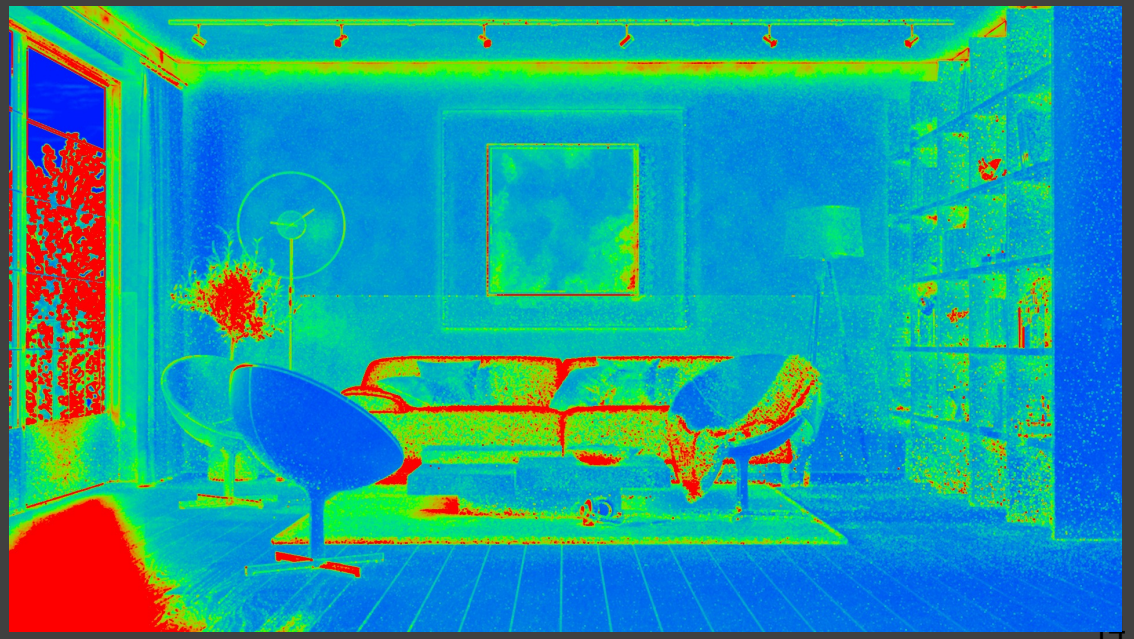

Interior scene created by: Chaos 3D Team
chaos
V-Ray

chaos V-Ray

Path guiding: Off
50min 35sec

Path guiding: On
34min 11sec





ERVED.


Volume scene created by: Chaos 3D Team
chaos
V-Ray

chaos V-Ray

Path guiding: Off
1h 53min 59sec

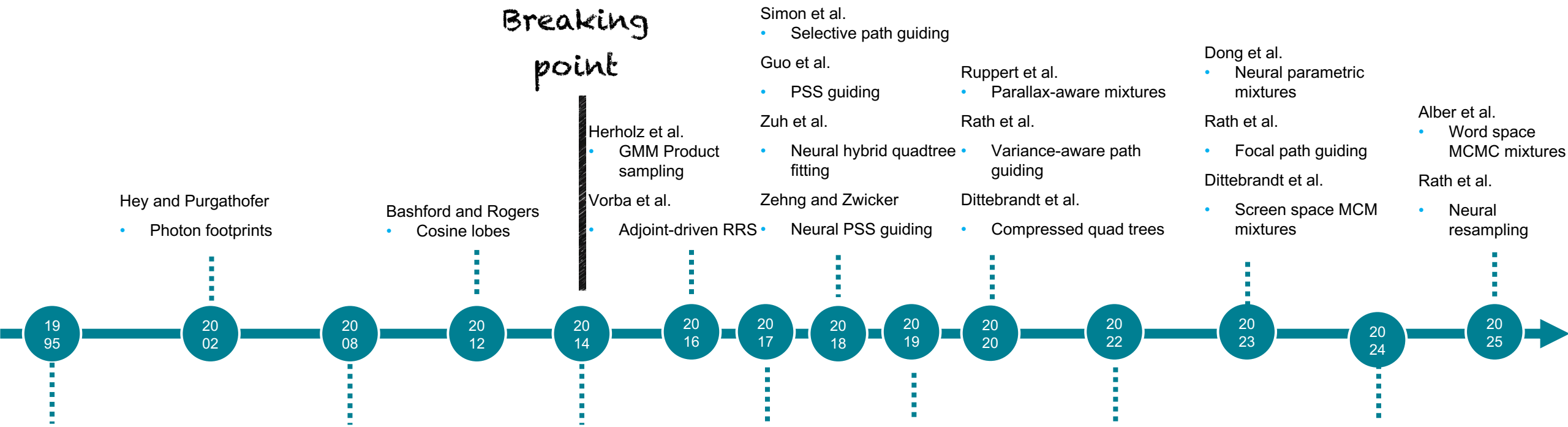
Path guiding: On
41min 41sec

ERVED.


Path guiding: OFF


Path guiding: ON

PATH GUIDING: ACADEMIC RESEARCH HISTORY



SIGGRAPH 2019 COURSE: PATH GUIDING IN PRODUCTION

[Vorba et al. 2019]

- First course on path guiding and how it was massively used by Wētā FX in production
- Demonstrated production use cases and some new algorithms

CHALLENGES INTEGRATING PATH GUIDING IN PRODUCTION

- Too many path guiding options/algorithms
  - Which one to choose?
- Research vs Production
  - Research solutions often need additional work to become production-ready
- Knowledge retention
  - Implementing and integrating path guiding is non-trivial
  - Knowledge (nitty-gritty details) leaves with the person who integrated it

INTEL'S OPEN PATH GUIDING LIBRARY

- Open-source Path Guiding Library (Apache 2.0)
  - First released 2022
- Combines and extends multiple research solutions, making them production-ready
- Easy to integrate into production and research Renderers:
  - C and C++ API
- Multi-platform support:
  - CPU: x86, ARM (highly SIMD-optimized)
  - GPU (**WIP**): CUDA, SYCL, HIP, …

CURRENT ADOPTERS

SIGGRAPH 2025 COURSE:
PATH GUIDING IN PRODUCTION AND RECENT ADVANCEMENTS

[Herholz et al. 2025]

- Presented nitty-gritty details about how to robustly integrate PG in production renderer.
- Disney Animation shared their experiences using PG in production.

DISNEY'S FEEDBACK USING OPENPGL IN PRODUCTION

Zootopia 2 is the first released movie using OpenPGL

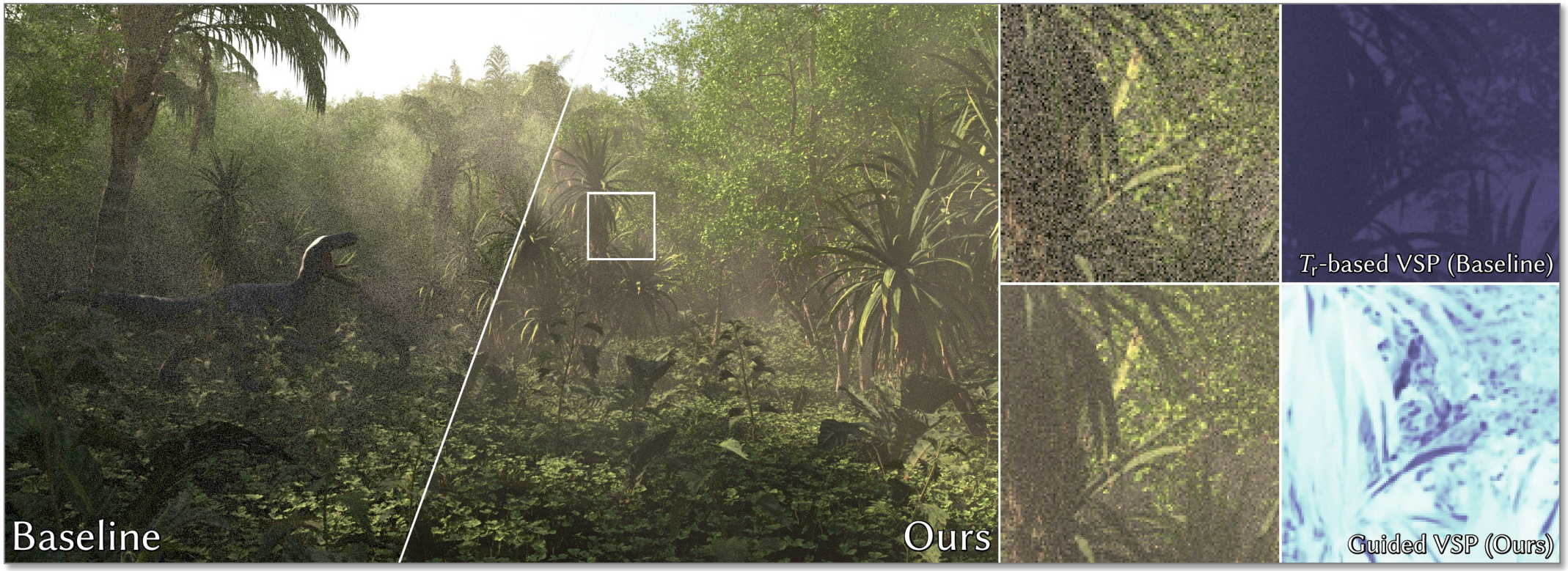
- Significant Rendering Efficiency Increase
  - **1.6x** average speedup in scenes with complex lighting (**33x** peak)
- Fewer Workarounds
  - Reduced Light Transport Simplification (roughening)
  - Less reliance on Firefly Clamping
- Reliable Rendering Times
  - More efficient of artists time, allowing for more room for artist iteration and creativity
  - Complex lighting setups **just** rendered on target
  - Reduced failed tech-checks & troubleshooting

© Disney

RESEARCH COLLABORATIONS

- Collaborative research projects on path guiding and its practicability
- Co-supervised Master thesis or Ph.D. projects

VOLUME SCATTERING PROBABILITY GUIDING



[Xu et al. 2024]

- Guiding the binary volume scattering decision
- Framework to increase and decrease VSP for homogenous and heterogenous volumes

CURRENT PROJECT STATE

- GitHub (https://github.com/RenderKit/openpgl)
  - Source code (Apache 2.0)
  - Issue tracking
  - Main website (Readme.md)
- Releases:
  - Current: v0.7.1
    - Used in at least two productions already
  - Next: v0.8.0
    - Adding Volume Scatter Probability Guiding
- Example integrations:
  - Blender's Cycles
  - PBRTv4 https://github.com/OpenPathGuidingLibrary/pbrt-v4
  - SIGGRAPH2025 Course material https://sherholz.github.io/siggraph2025-path-guiding-course

CONTRIBUTIONS

- Main Developer/Maintainer:
  - Sebastian Herholz (Ex-Intel / soon-Blender)

- External Contributions (mostly one-time):
  - Addis Dittebrandt (KIT): Directional Quadtrees
  - Brecht Van Lommel (Blender): Apple ARM port
  - Anthony Roberts (Linaro): Windows ARM port
  - Dian Nikolov (Chaos): Build script optimizations
  - Kehan Xu (ETH): Volume Scattering Probability Guiding
  - Thomas Metais (Illumination): Bug Report

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Multiple vendors and studios showed interest in contributing to OpenPGL when it is part of the ASWF and not owned by a vendor.

WHY ASWF?

- Shared open-source philosophy
- ASWF is an open industry and vendor accepted collaboration platform
  - Increases willingness to and reduces hurdles for external contributions
- OpenPGL is looking for a new home
  - At August 2025 Intel decided to discontinue the project
- Bridge between research and VFX industry

DISCUSSION