Hypotheses Engineering: first essential steps of experiment-driven software development

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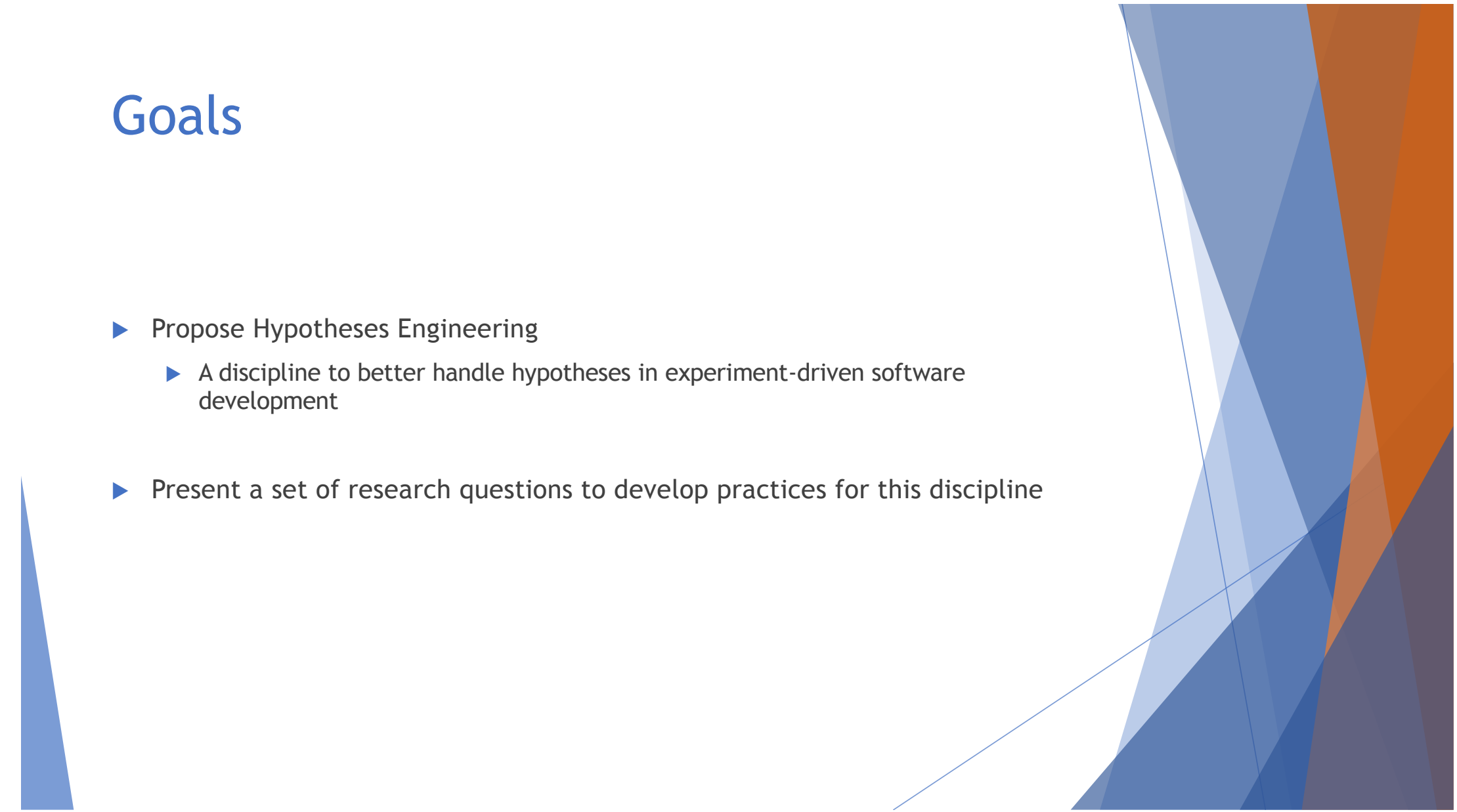
Goals

- Propose Hypotheses Engineering
  - A discipline to better handle hypotheses in experiment-driven software development
- Present a set of research questions to develop practices for this discipline

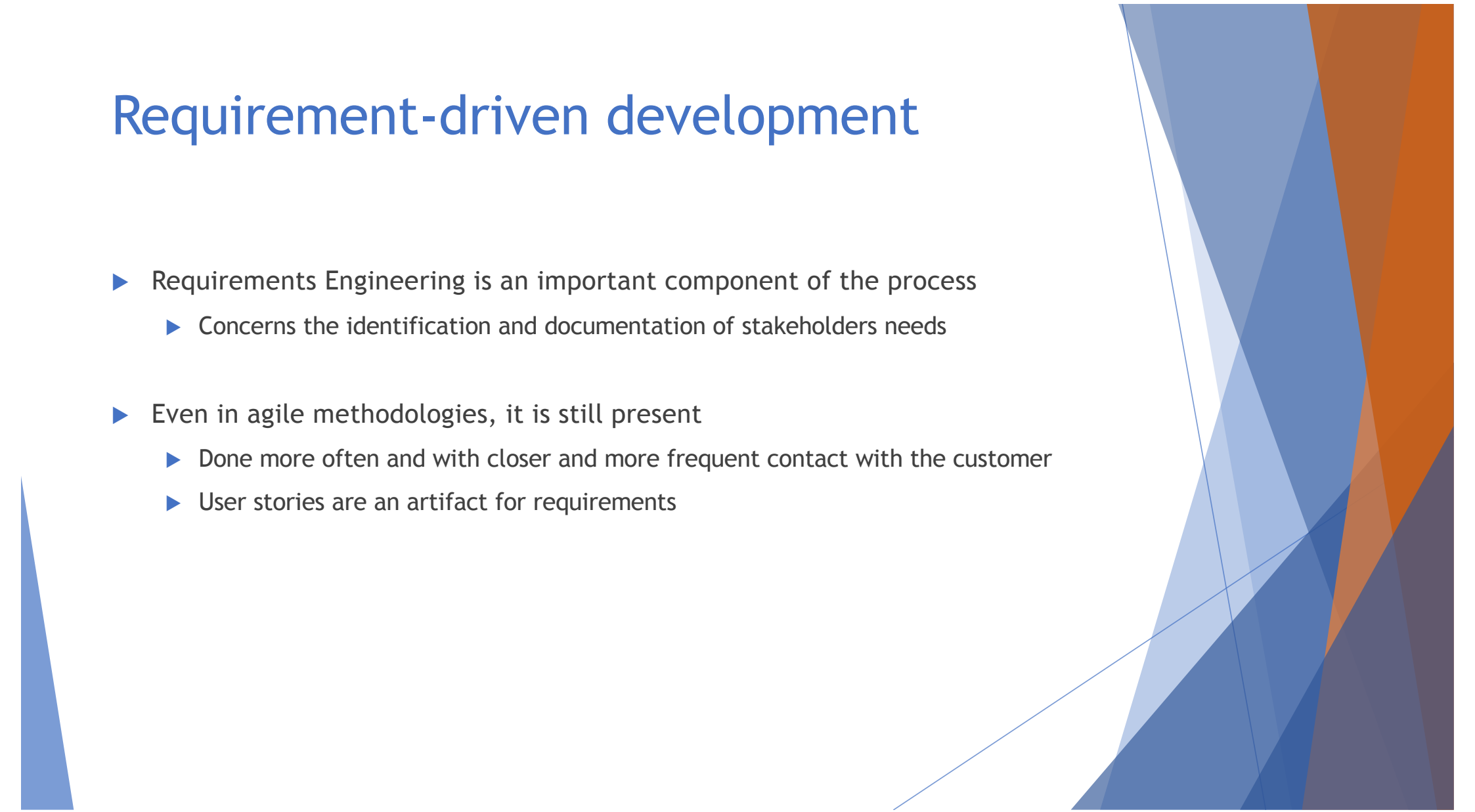


Experiment-driven software development

- The use of experiments to build features that the user really wants
- Experiments: testing product assumptions applying scientific methods with the purpose of supporting or refuting these assumptions
- Bosch et al. (2018) identified three approach to software development
  - Requirement-driven development
  - Outcome/data-driven development (experiment-driven)
  - AI driven development

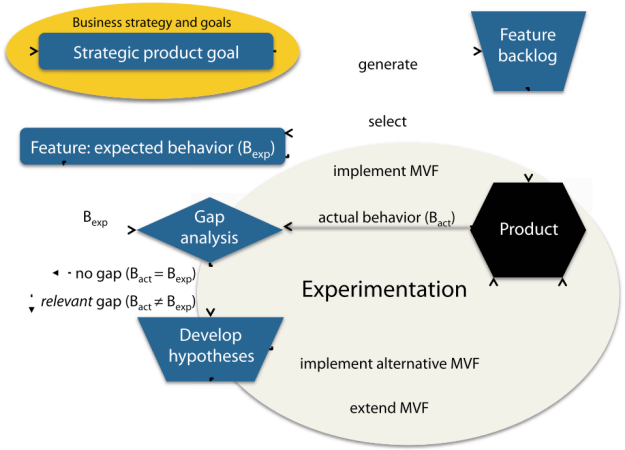
Requirement-driven development

- Requirements Engineering is an important component of the process
  - Concerns the identification and documentation of stakeholders needs
- Even in agile methodologies, it is still present
  - Done more often and with closer and more frequent contact with the customer
  - User stories are an artifact for requirements

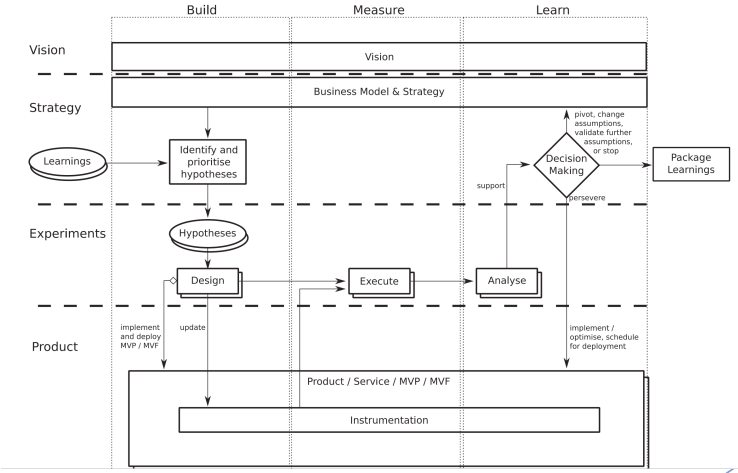


Experiment-driven development models

HYPEX (Olsson and Bosch, 2014)

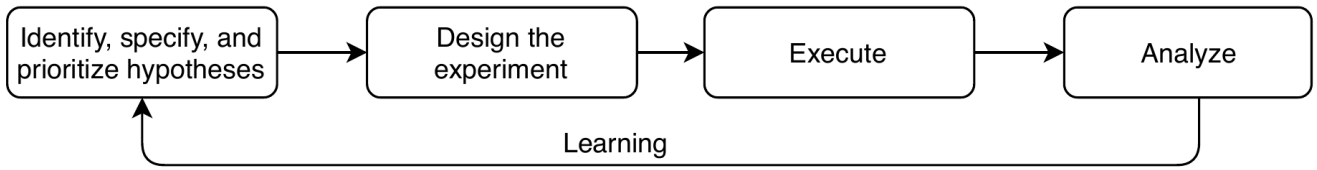


RIGHT (Fagerholm et al., 2017)

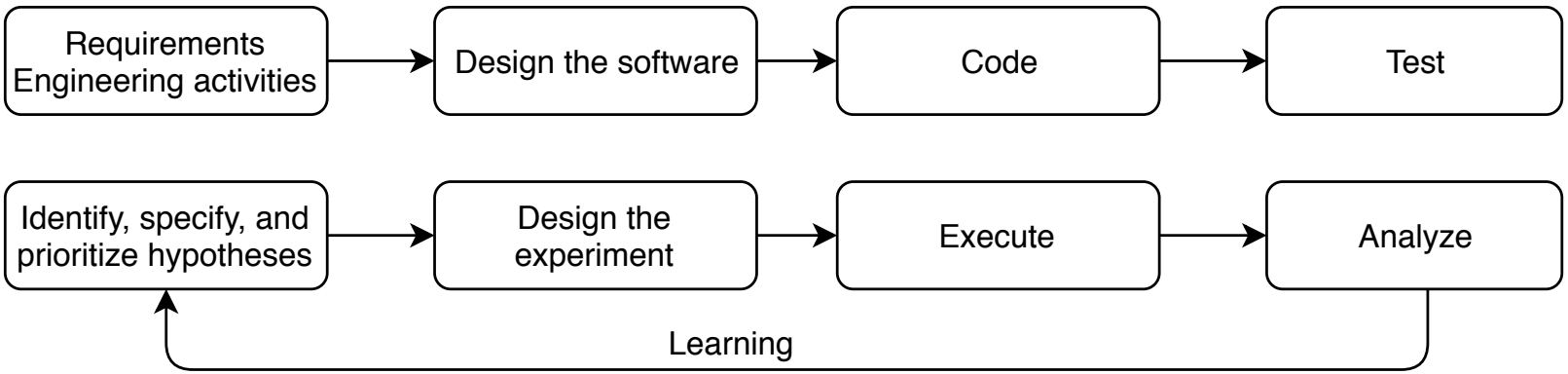


Experiment-driven development models

- All were influenced by the Build-Measure-Learn loop from the Lean Startup methodology (Ries, 2011)
- A common denominator:

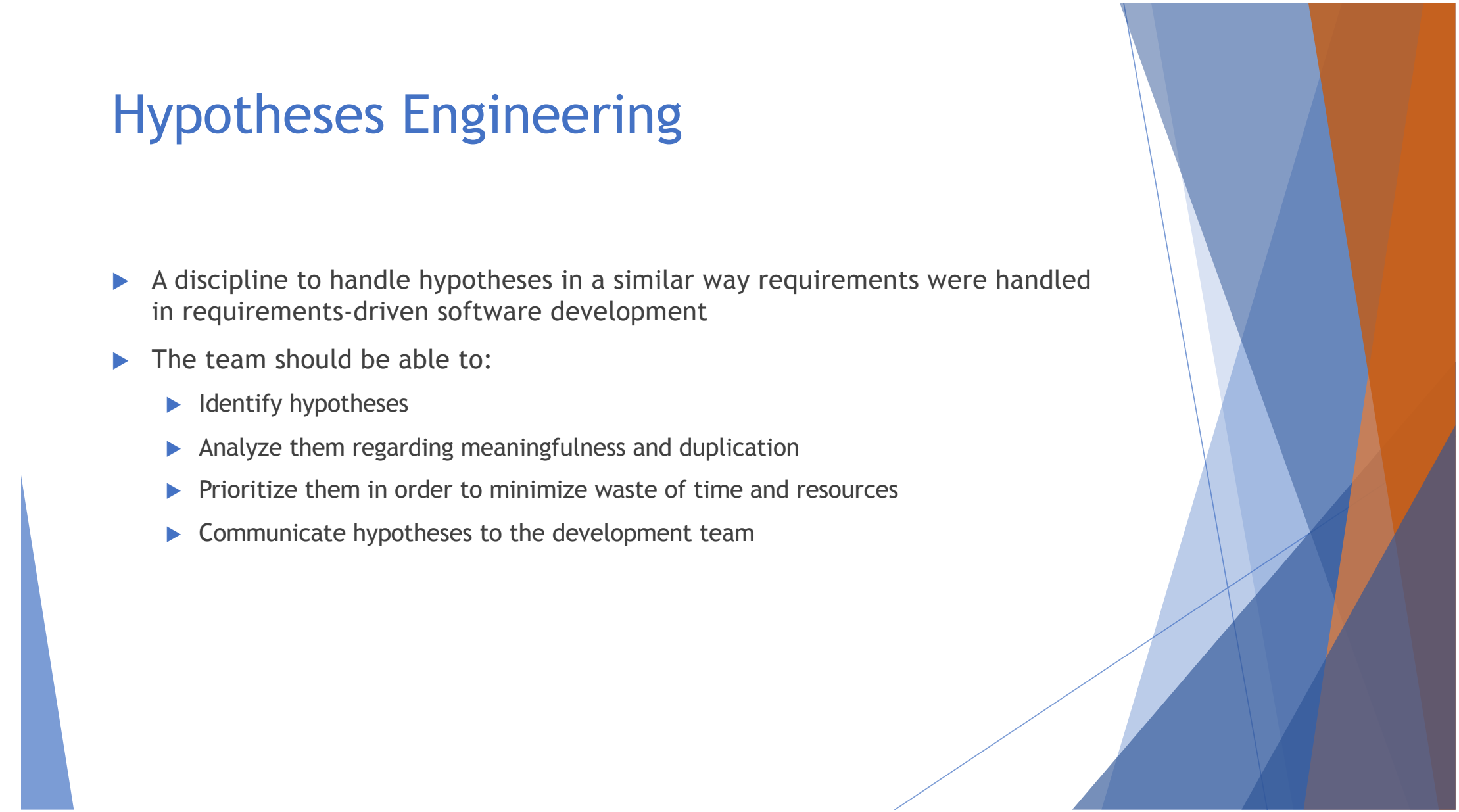


Requirement vs Experiment-driven software development



Hypotheses Engineering

- A discipline to handle hypotheses in a similar way requirements were handled in requirements-driven software development
- The team should be able to:
  - Identify hypotheses
  - Analyze them regarding meaningfulness and duplication
  - Prioritize them in order to minimize waste of time and resources
  - Communicate hypotheses to the development team



Hypotheses Engineering

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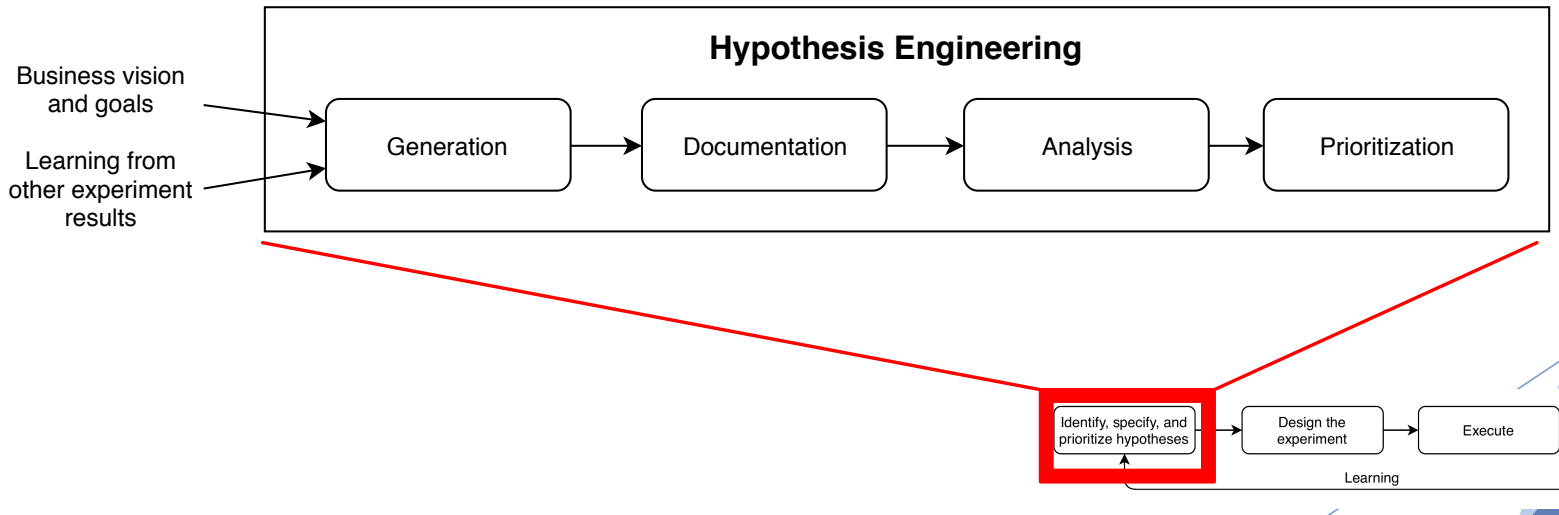
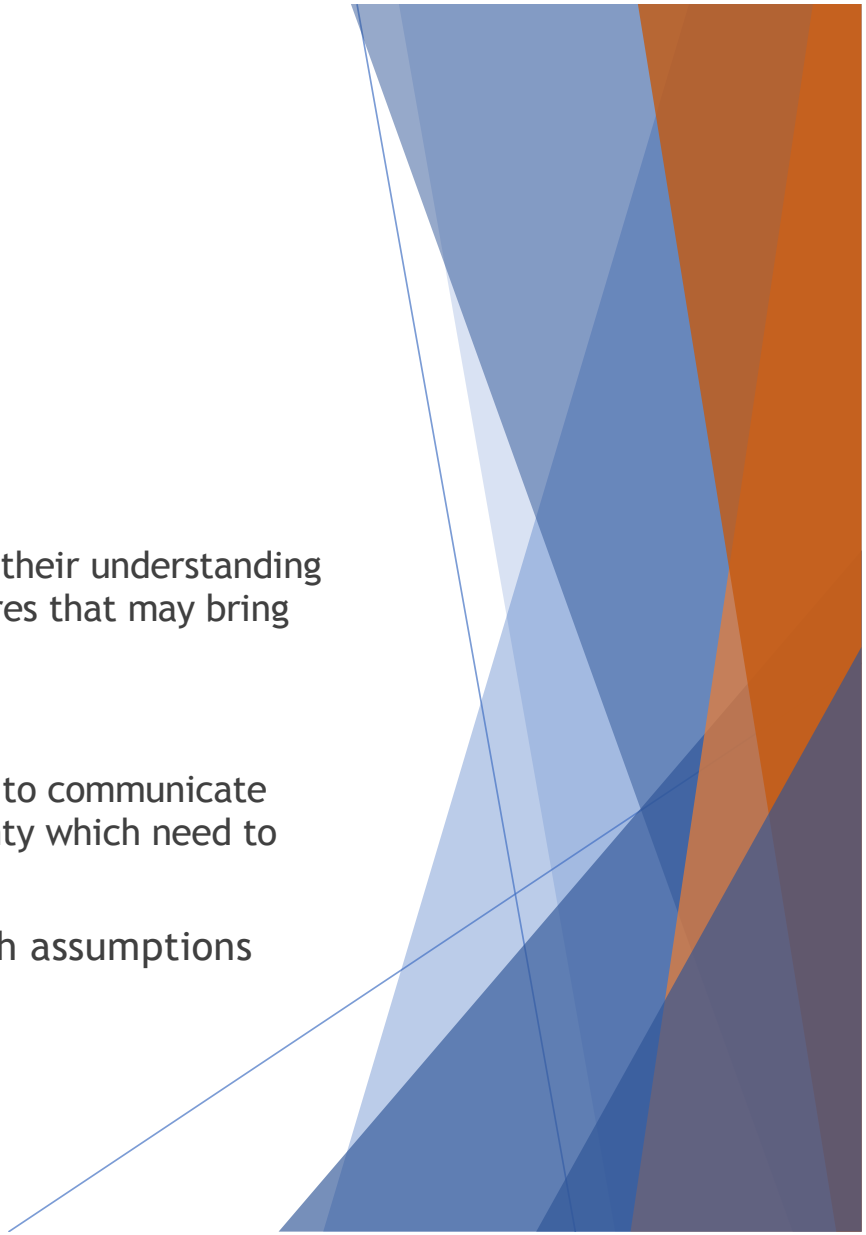


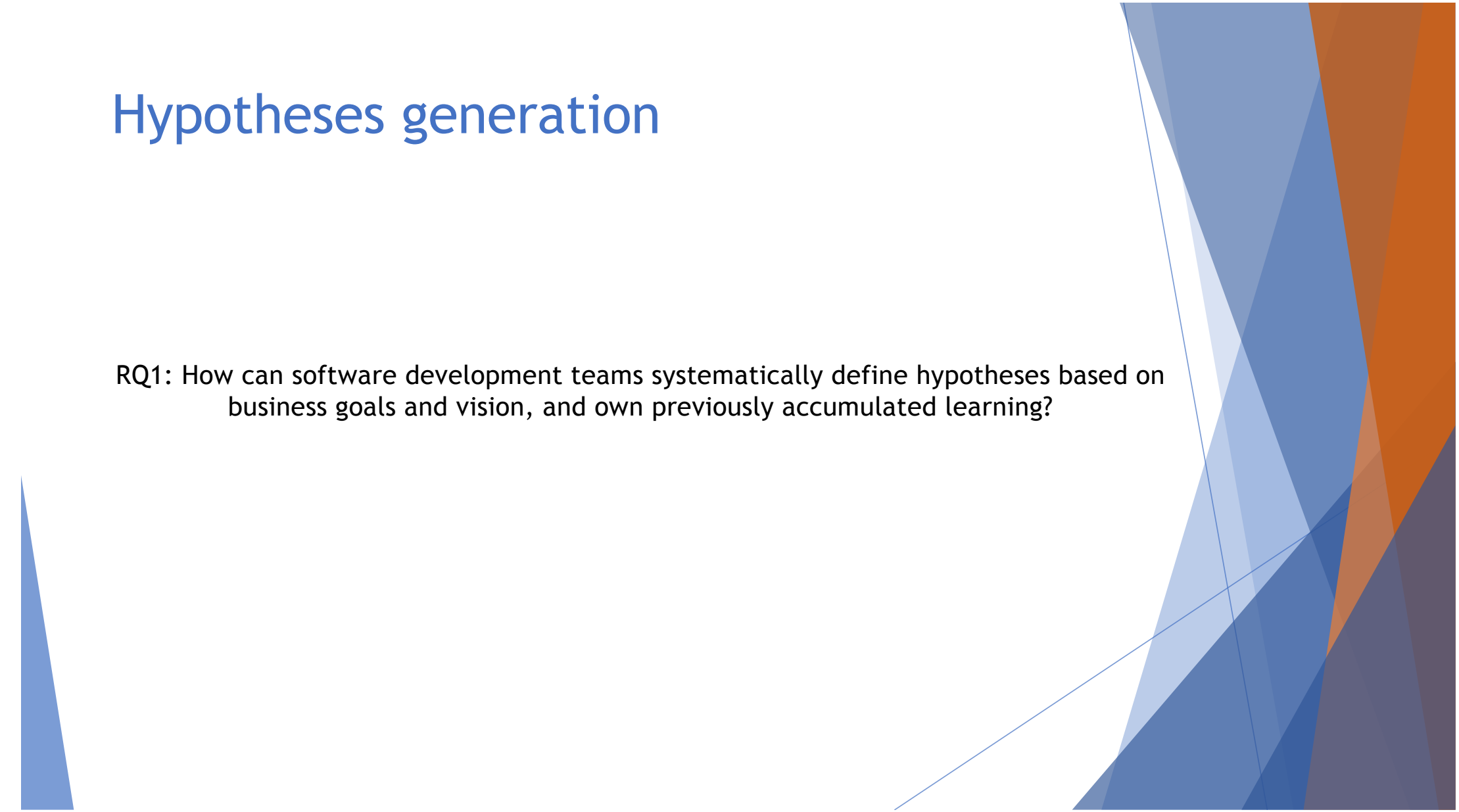
Hypotheses generation

- Discussed briefly in the literature so far
- HYPEX: first practice is feature backlog generation
  - Product management and product development staff “based on their understanding of customer needs and strategic business goals” generate features that may bring value to customers (Olsson and Bosch, 2014)
- RIGHT
  - “analysis and product owner work with a data scientist role […] to communicate the assumptions of the roadmap and map the areas of uncertainty which need to be tested” (Fagerholm et al., 2017)
- Common theme: business goals and vision to determine which assumptions have to be experimented



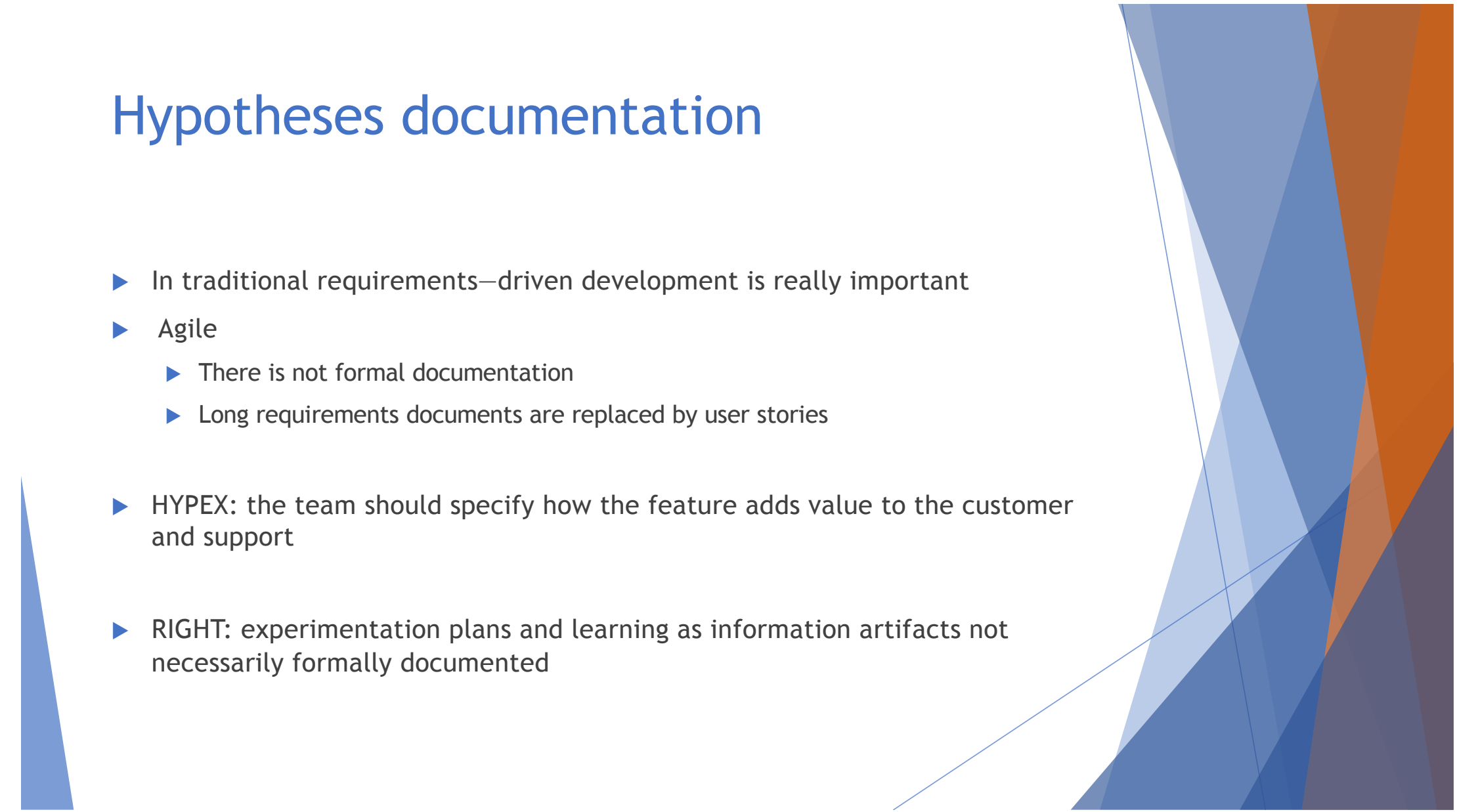
Hypotheses generation

RQ1: How can software development teams systematically define hypotheses based on business goals and vision, and own previously accumulated learning?



Hypotheses documentation

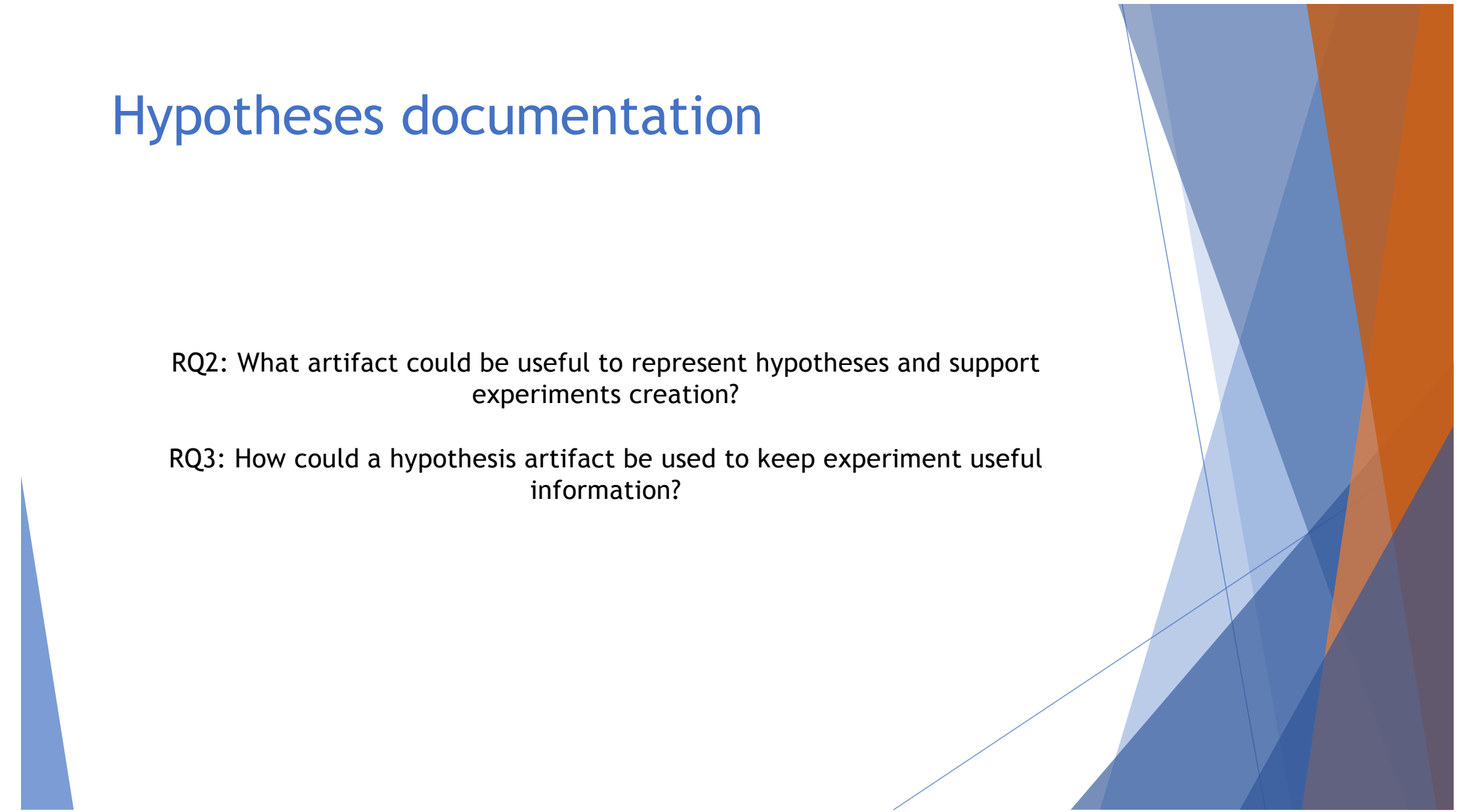
- In traditional requirements—driven development is really important
- Agile
  - There is not formal documentation
  - Long requirements documents are replaced by user stories
- HYPEX: the team should specify how the feature adds value to the customer and support
- RIGHT: experimentation plans and learning as information artifacts not necessarily formally documented



Hypotheses documentation

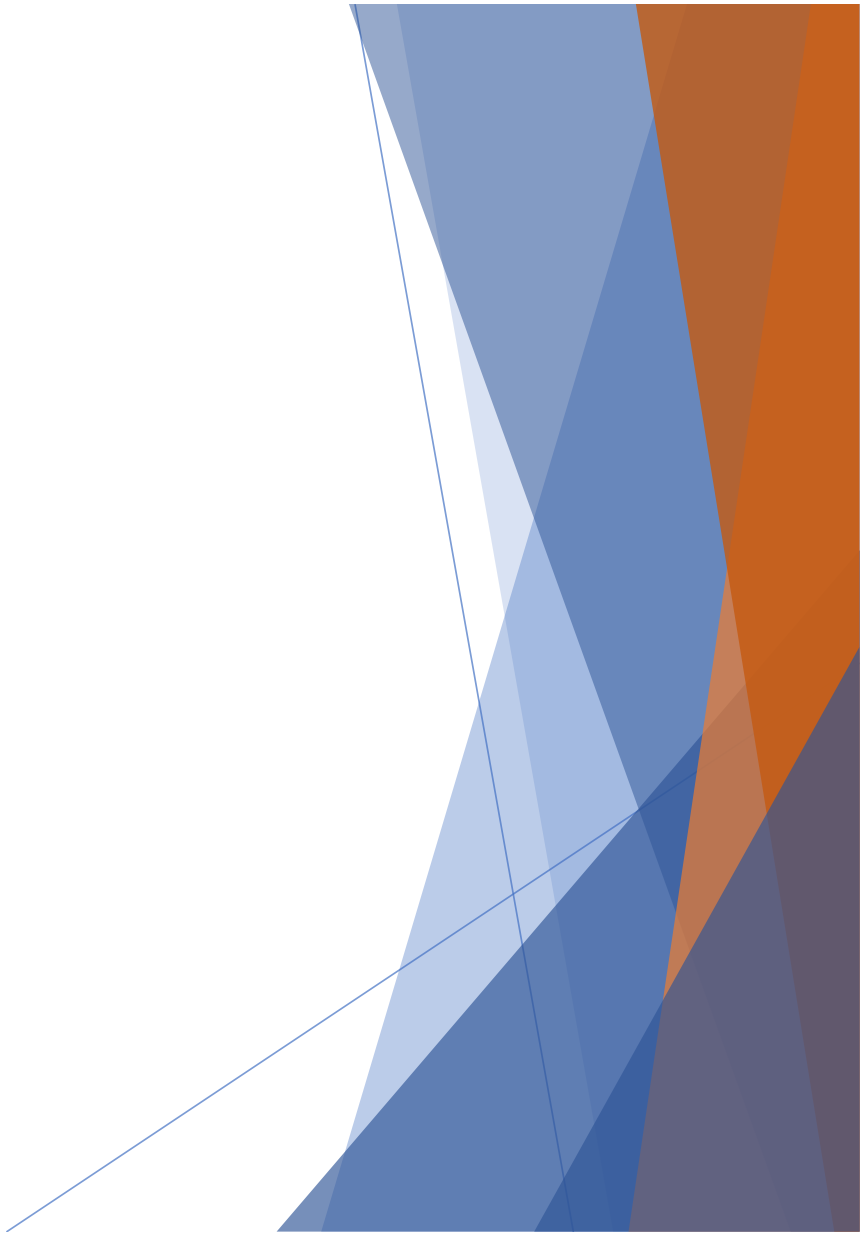
RQ2: What artifact could be useful to represent hypotheses and support experiments creation?

RQ3: How could a hypothesis artifact be used to keep experiment useful information?



Hypotheses analysis

- Concerns similar to requirements:
  - Hypotheses not well-explained
  - Not possible to perform an experiment
  - Consistent and not-duplicated

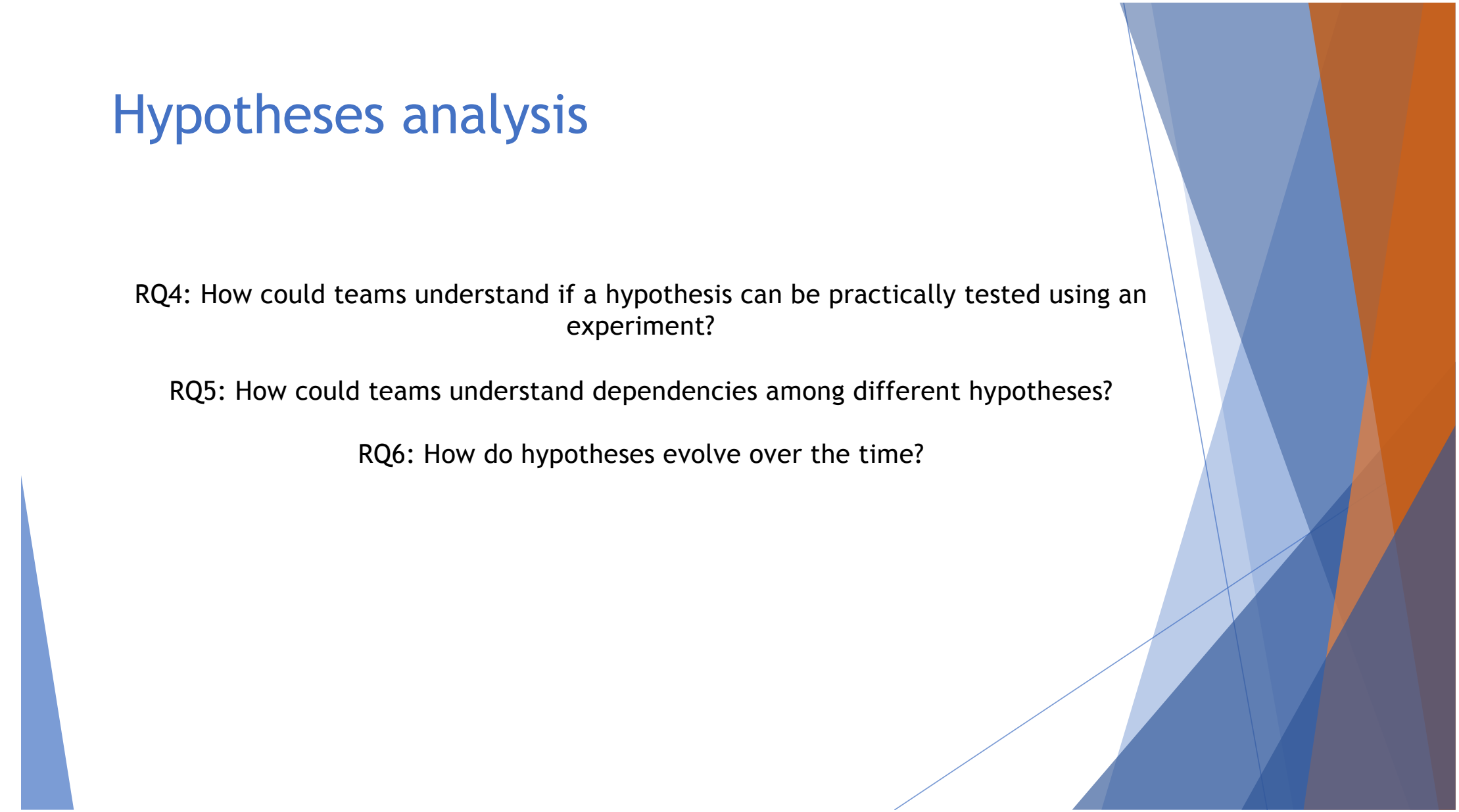


Hypotheses analysis

RQ4: How could teams understand if a hypothesis can be practically tested using an experiment?

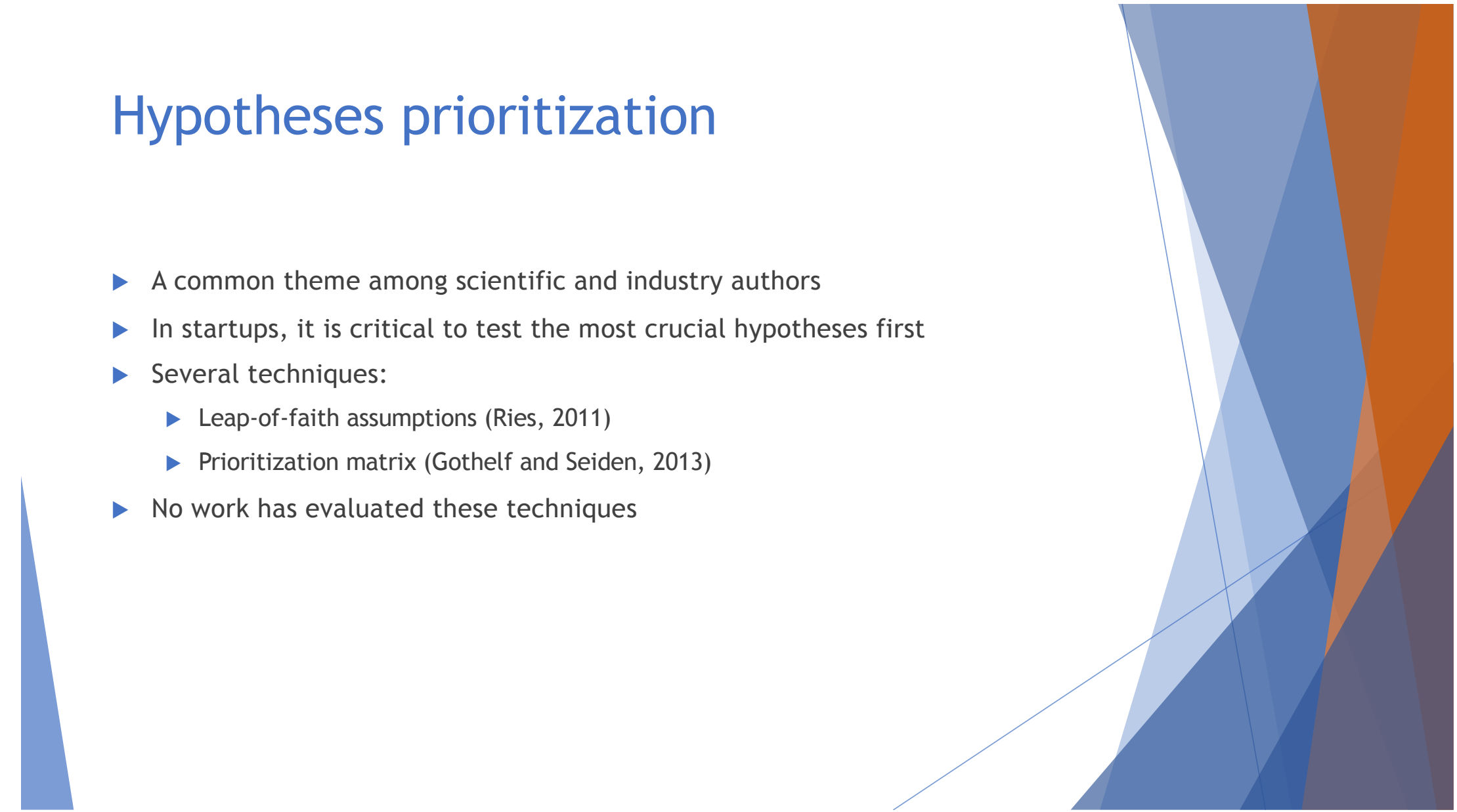
RQ5: How could teams understand dependencies among different hypotheses?

RQ6: How do hypotheses evolve over the time?



Hypotheses prioritization

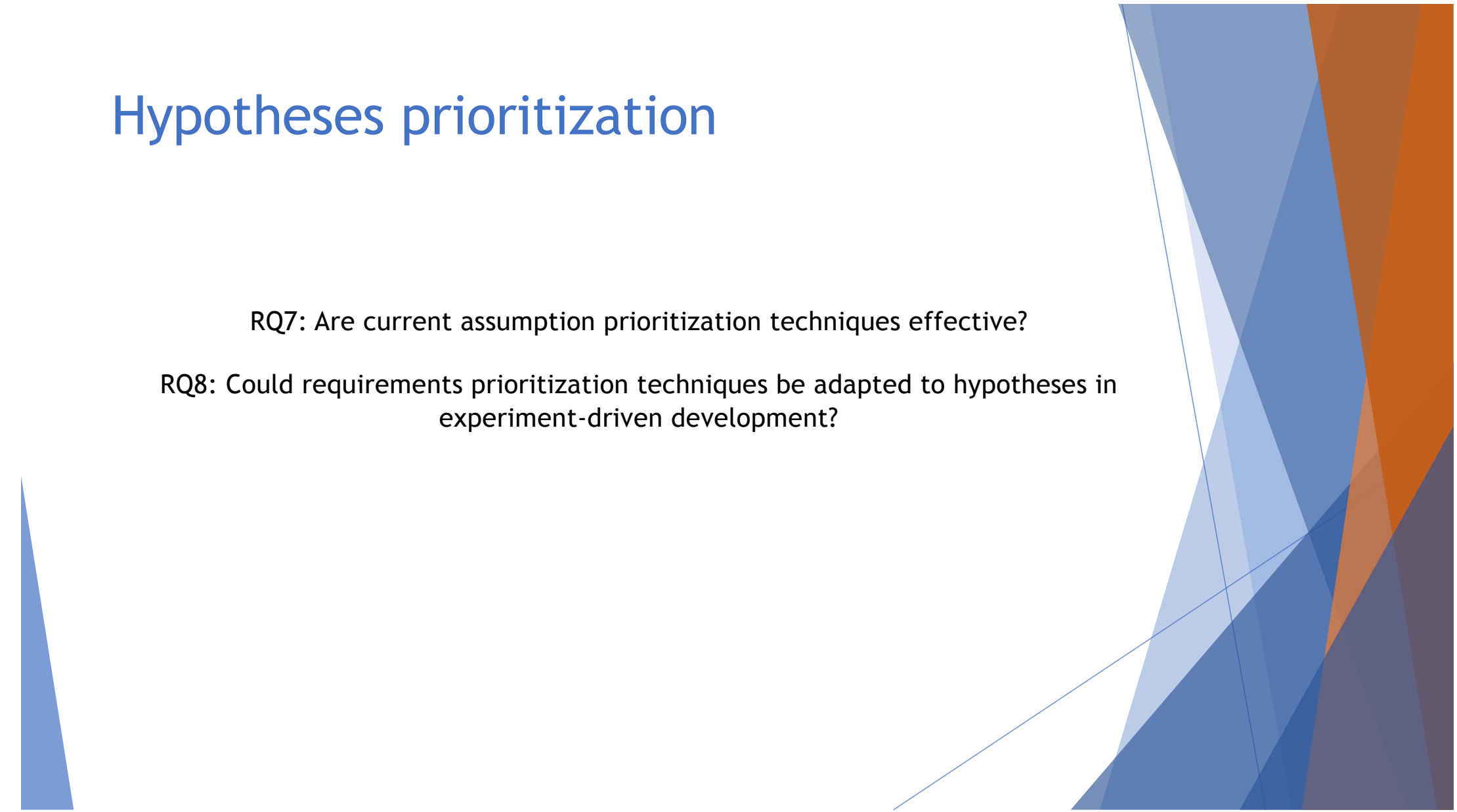
- A common theme among scientific and industry authors
- In startups, it is critical to test the most crucial hypotheses first
- Several techniques:
  - Leap-of-faith assumptions (Ries, 2011)
  - Prioritization matrix (Gothelf and Seiden, 2013)
- No work has evaluated these techniques



Hypotheses prioritization

RQ7: Are current assumption prioritization techniques effective?

RQ8: Could requirements prioritization techniques be adapted to hypotheses in experiment-driven development?



Conclusions

- In this position paper, we proposed a Hypothesis Engineering discipline
  - Tailored to experiment-driven software development
  - Contrast to Requirements Engineering

- Notes:
  - The steps does not mean that it will follow a linear approach
  - Maybe there are different techniques for different stages of product development