Haptics Symposium
Workshop on Haptic Interaction Design
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Haptic Interaction Design based on Users Experience

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Haptic Interaction Design

is that phase of product development where
the interaction with a product
that occurs through touch and manual control
is designed

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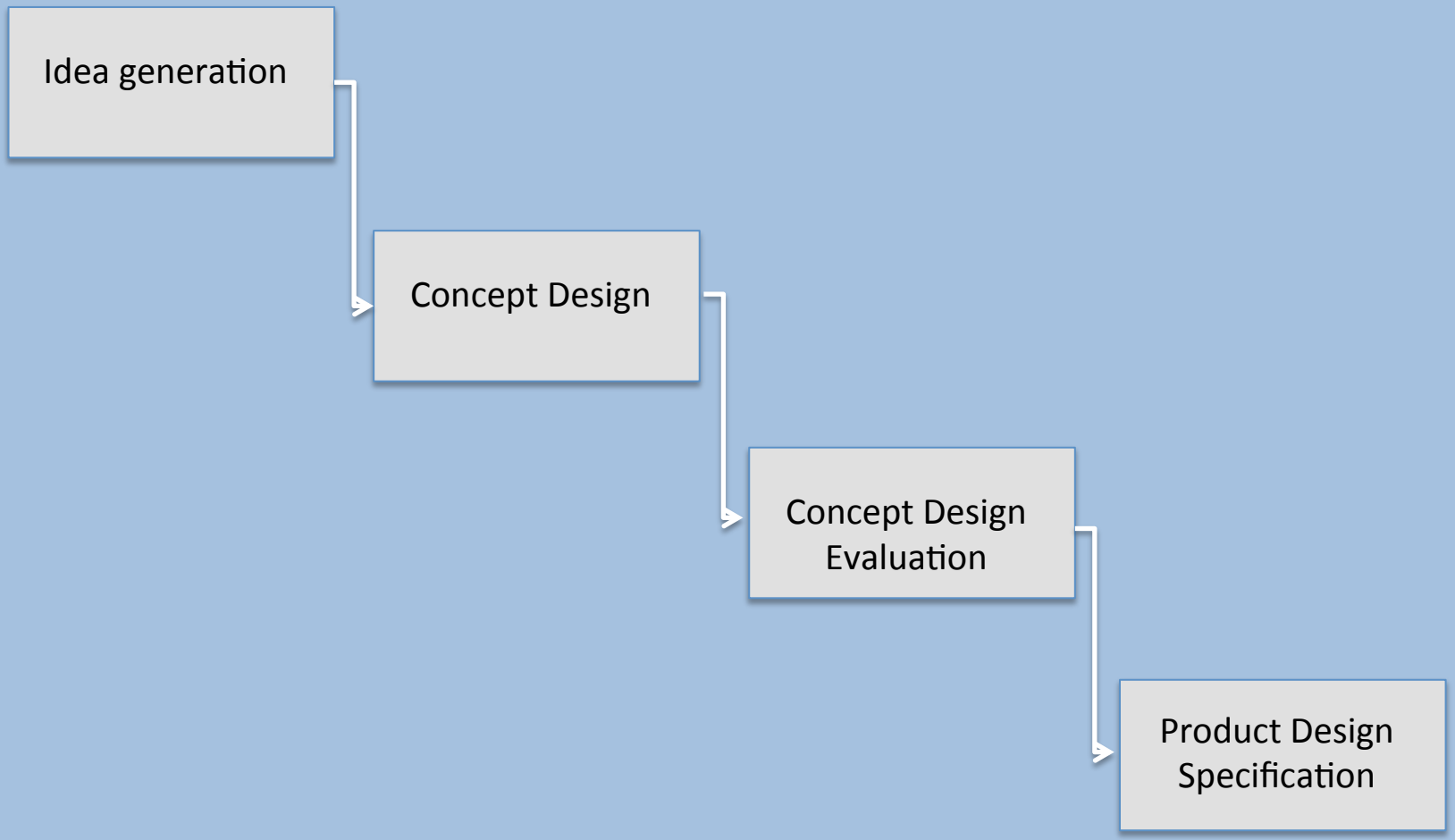
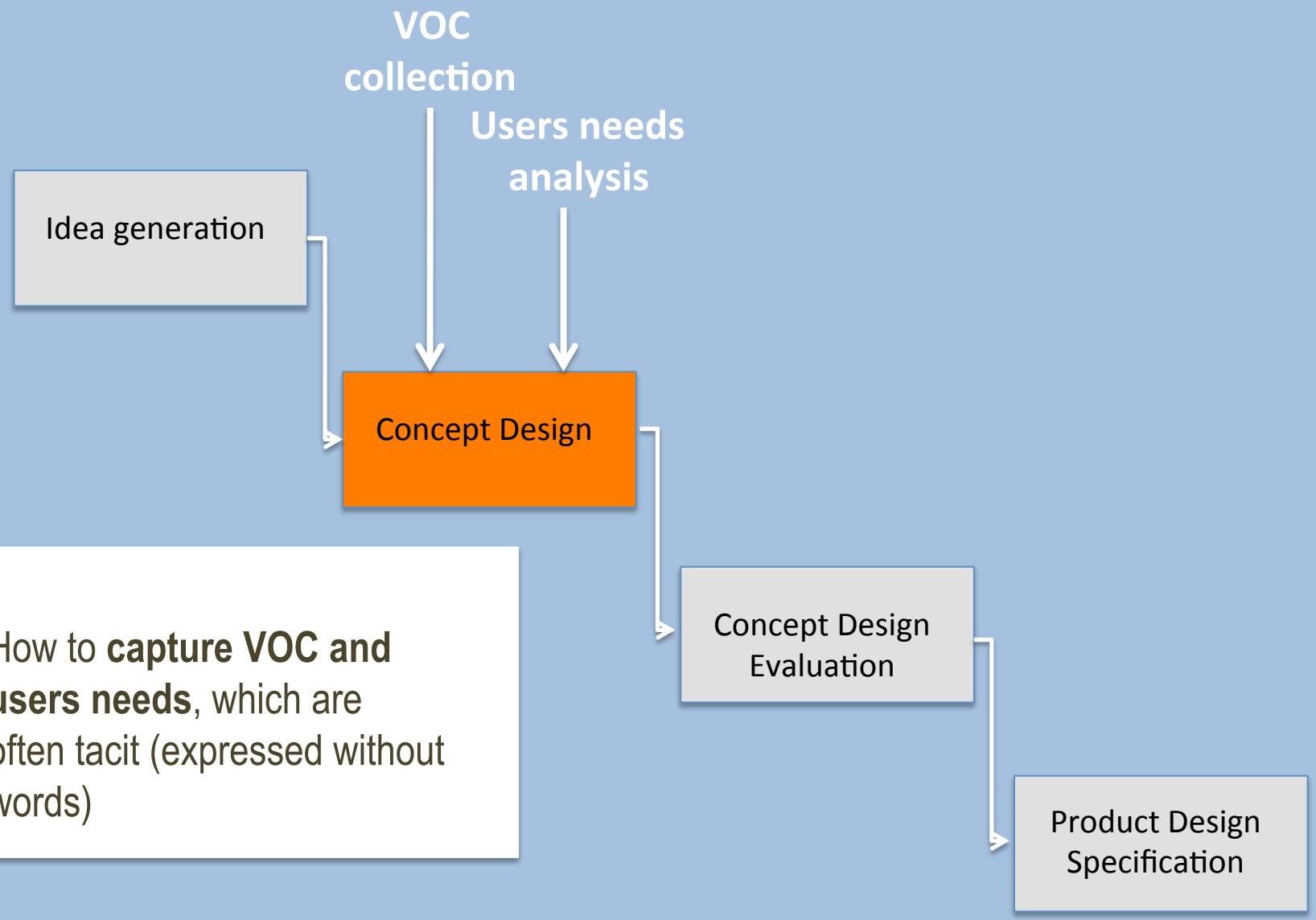
Key steps in new product development



Key steps in new product development



How to **capture VOC and users needs**, which are often tacit (expressed without words)

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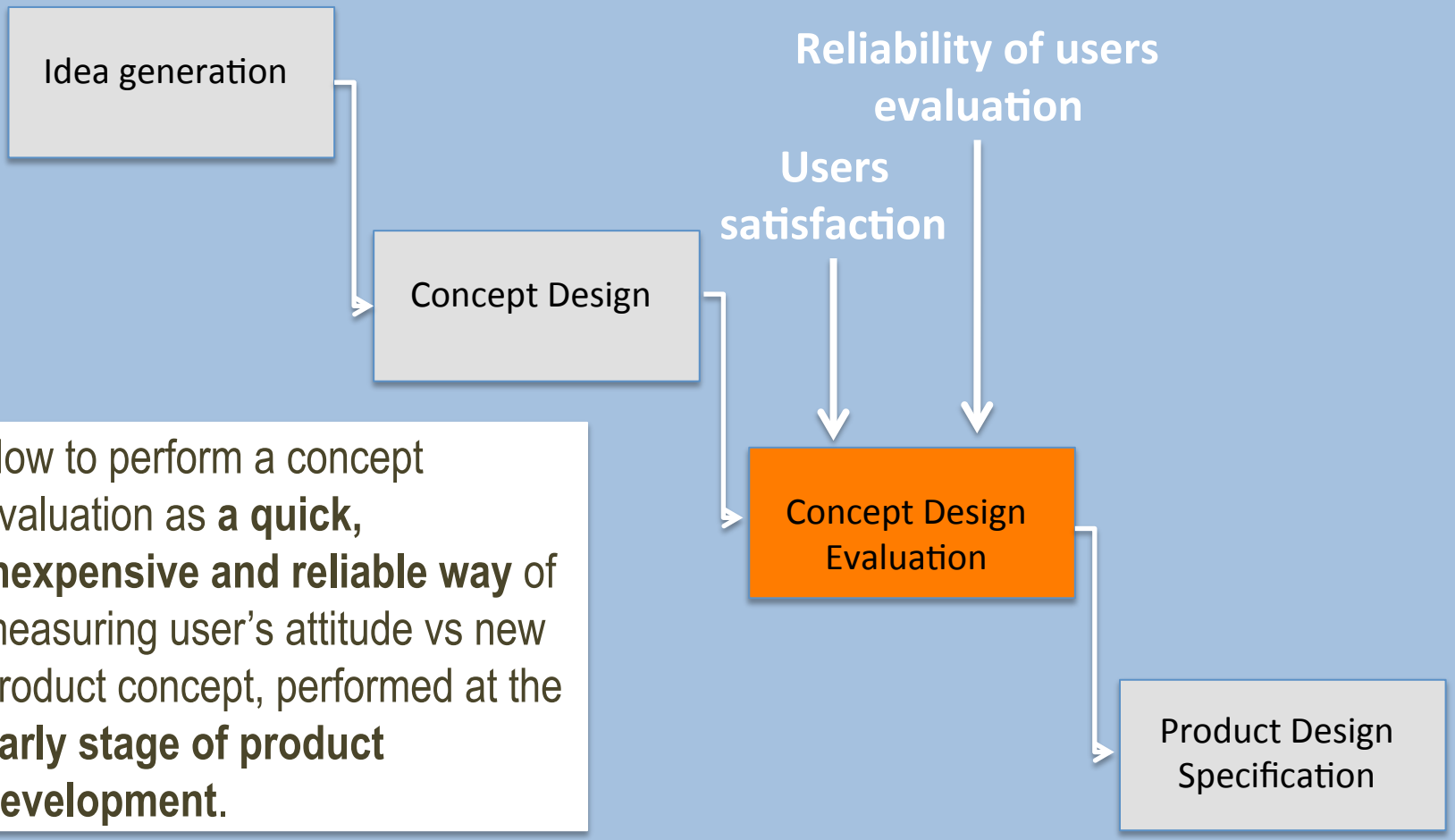
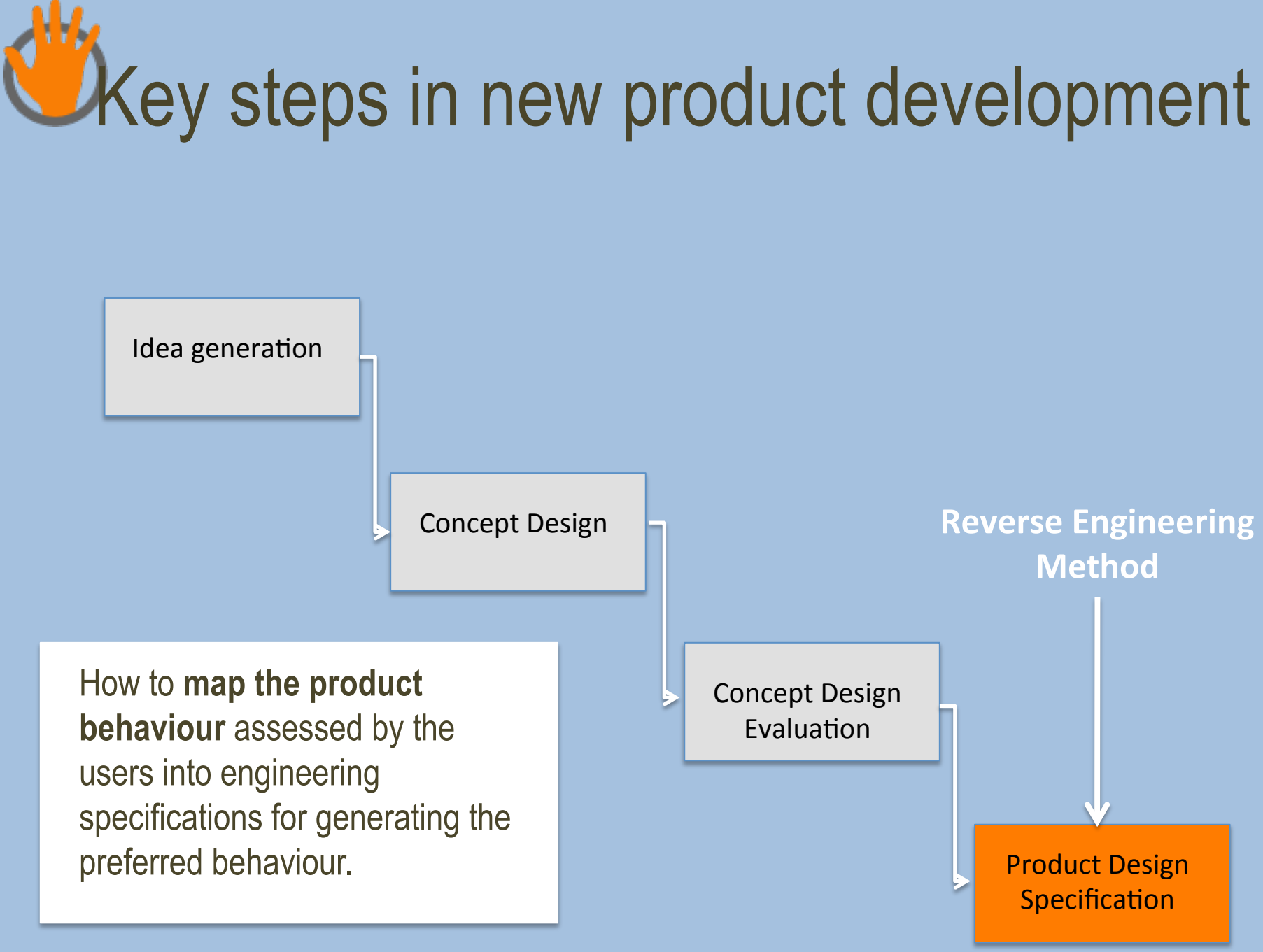
Key steps in new product development



How to perform a concept evaluation as **a quick, inexpensive and reliable way** of measuring user's attitude vs new product concept, performed at the **early stage of product development**.

Key steps in new product development



How to **map the product behaviour** assessed by the users into engineering specifications for generating the preferred behaviour.

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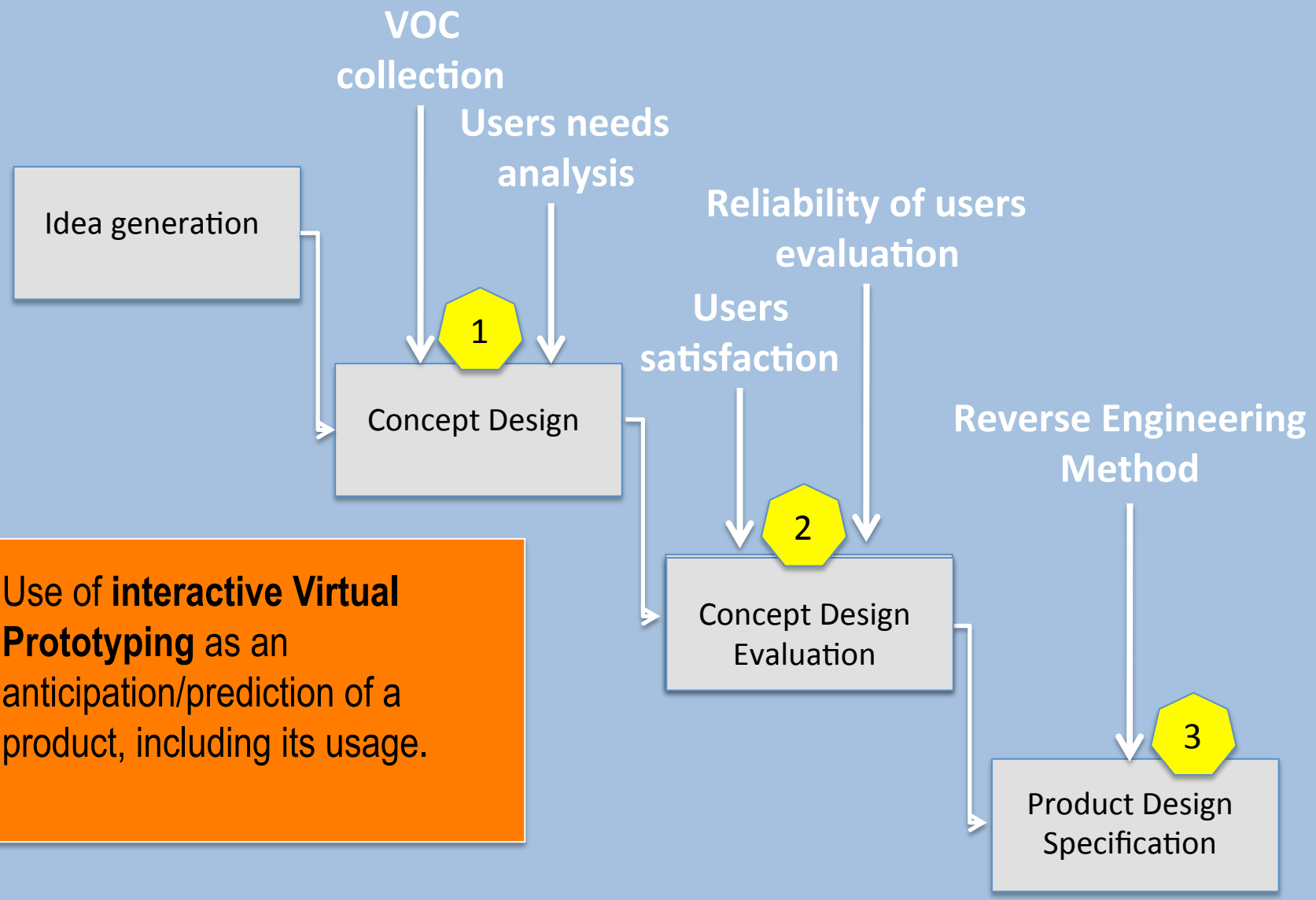
Proposed Methodology: iVP



Use of **interactive Virtual Prototyping** as an anticipation/prediction of a product, including its usage.

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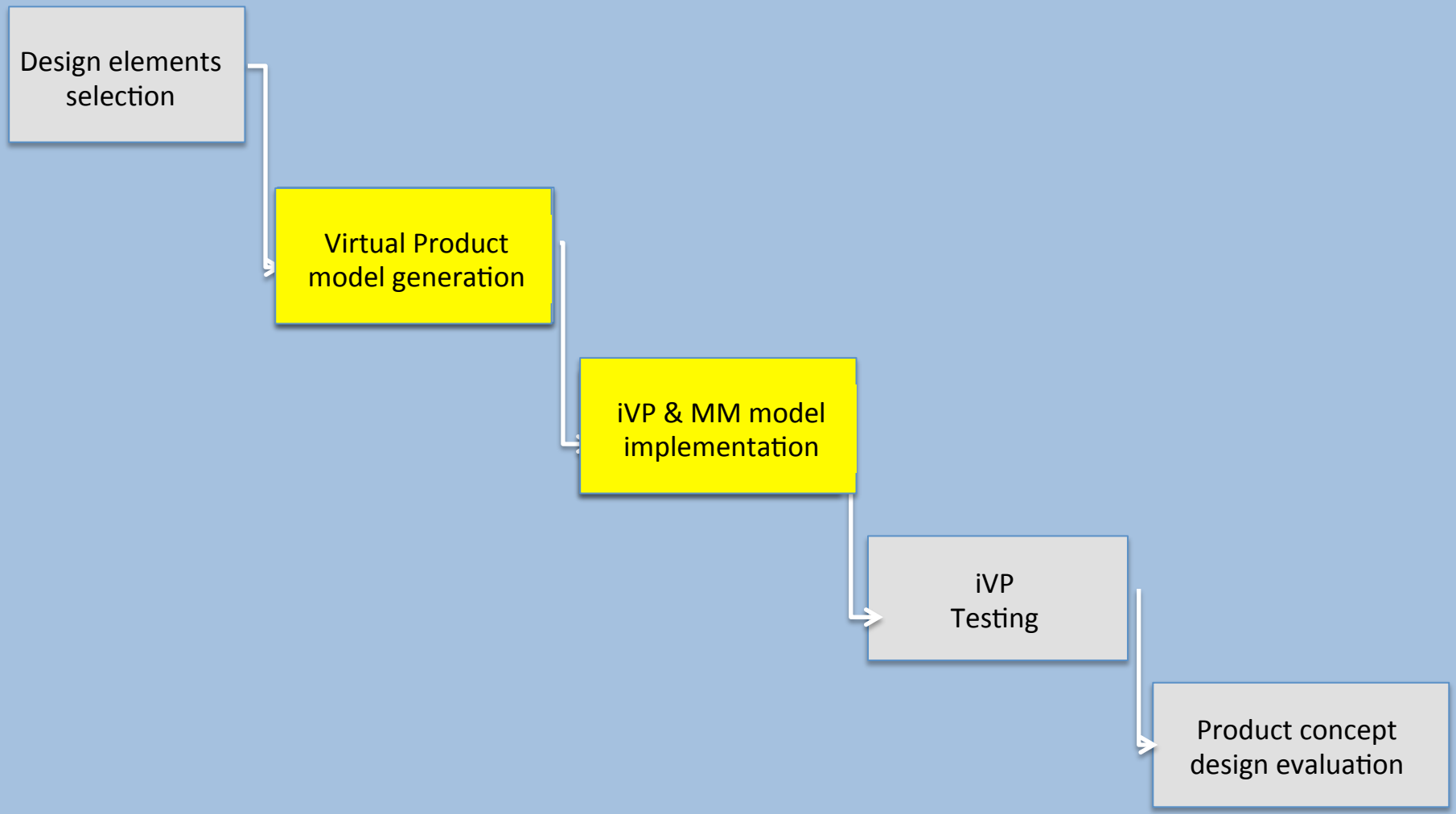
interactive Virtual Prototyping: what it is

- Anticipation of a product
  - VP creates stimulus material that enables users to experience a new product well before it exists in reality
- iVP allows **experience prototyping**, which is a method that focuses on how a task or a situation is experienced with the main purpose
  - to gain understanding of users and their experiences in a **real/ realistic** world context and
  - to evaluate and **communicate design** ideas
- iVP is an extremely **powerful methodology&tool** in gaining user insights early in the design process

interactive Virtual Prototyping – iVP methodology



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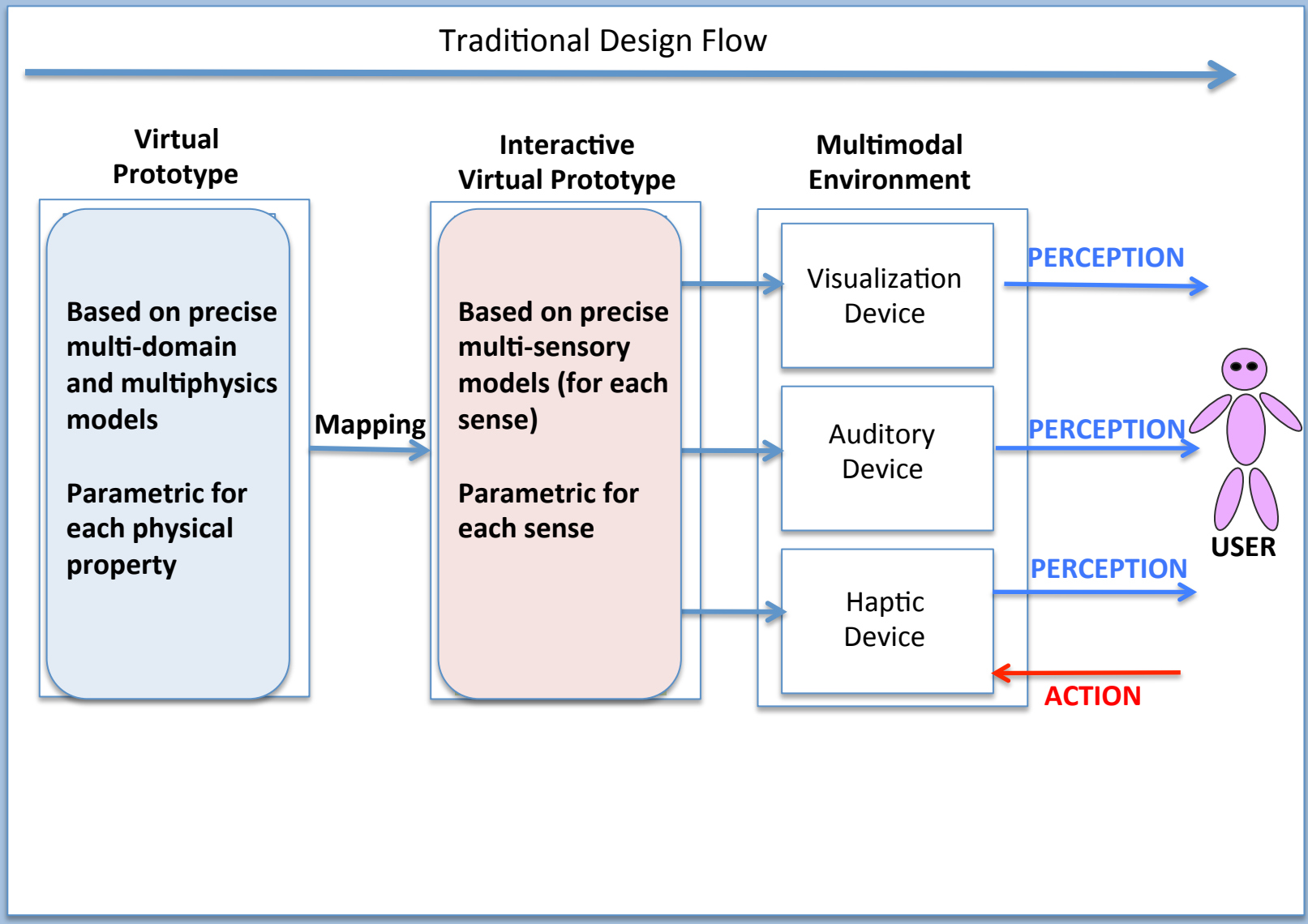
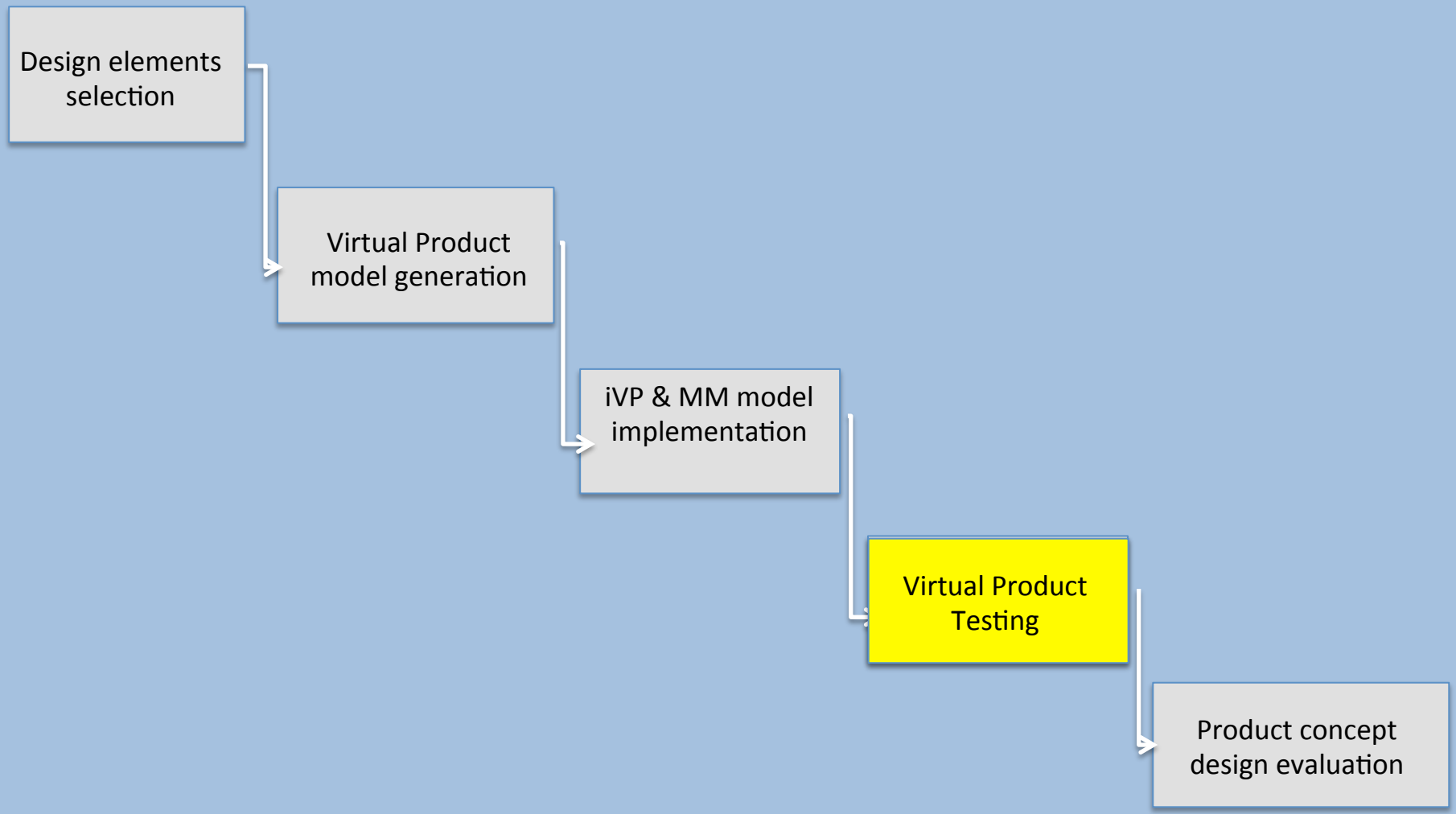

Traditional Design Flow
Virtual Prototype
Based on precise multi-domain and multiphysics models
Parametric for each physical property
Mapping
Interactive Virtual Prototype
Based on precise multi-sensory models (for each sense)
Parametric for each sense
Multimodal Environment
Visualization Device
Auditory Device
Haptic Device
PERCEPTION
PERCEPTION
PERCEPTION
USER
ACTION

iVP methodology



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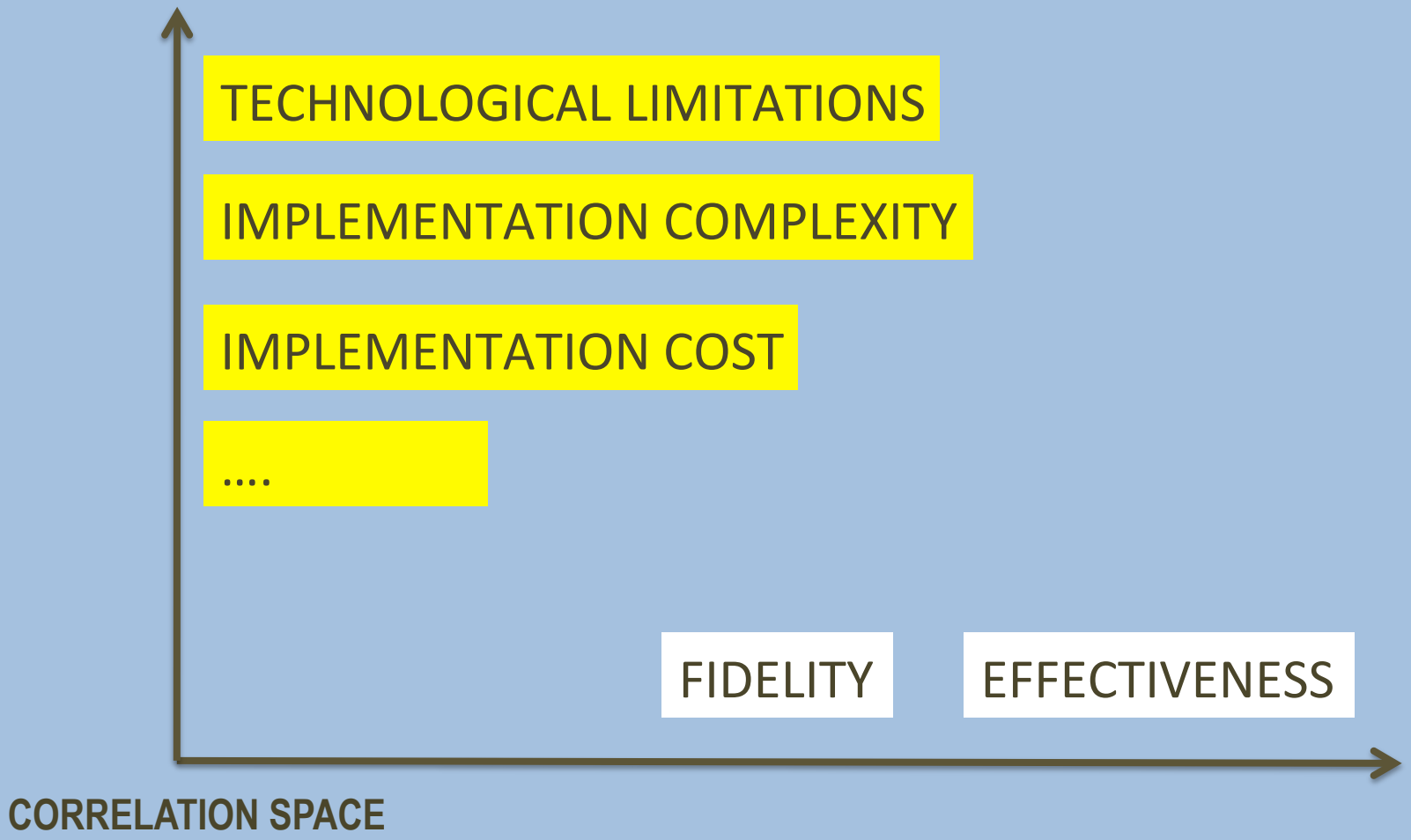
Virtual Product Testing



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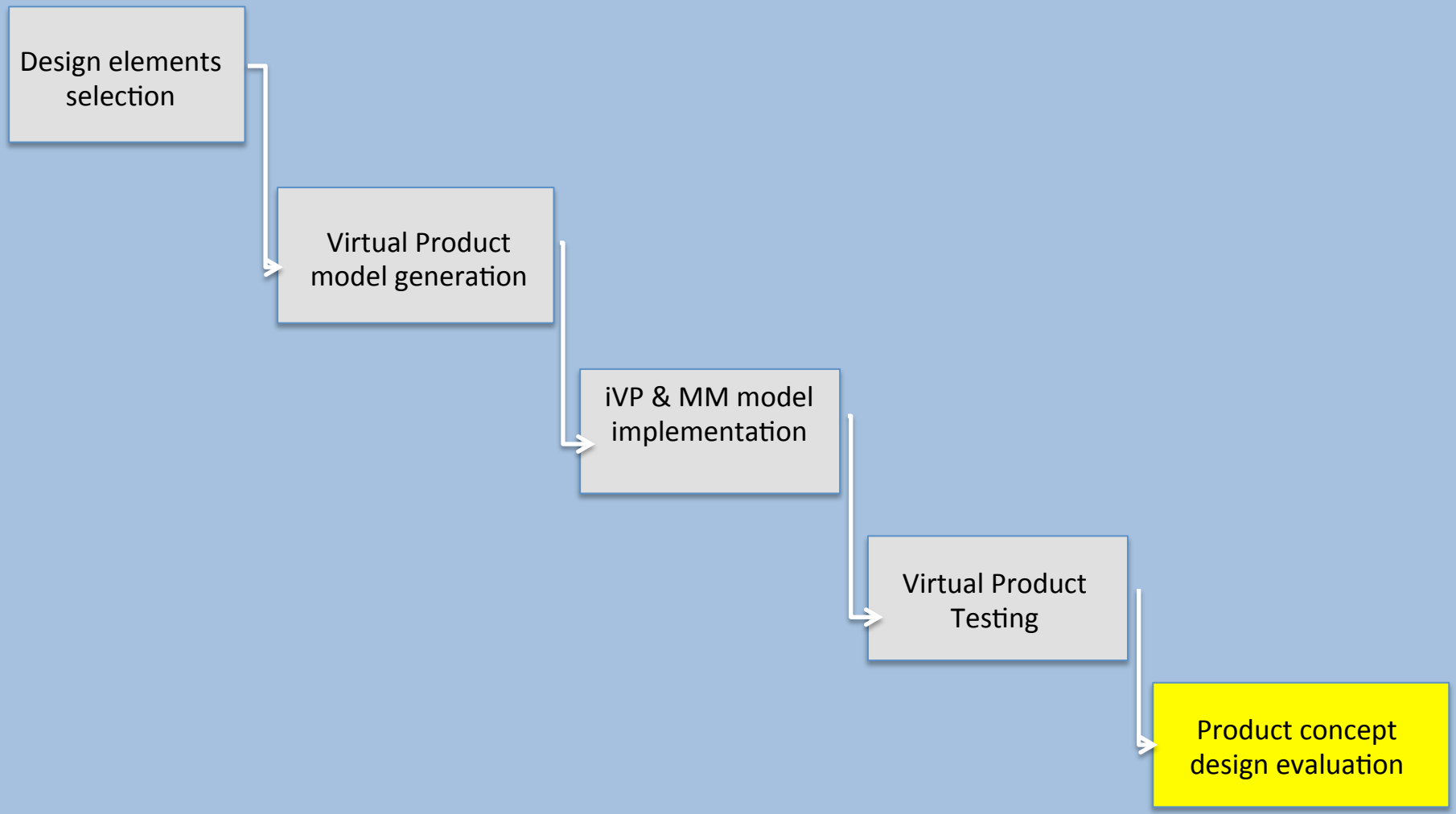
iVP methodology



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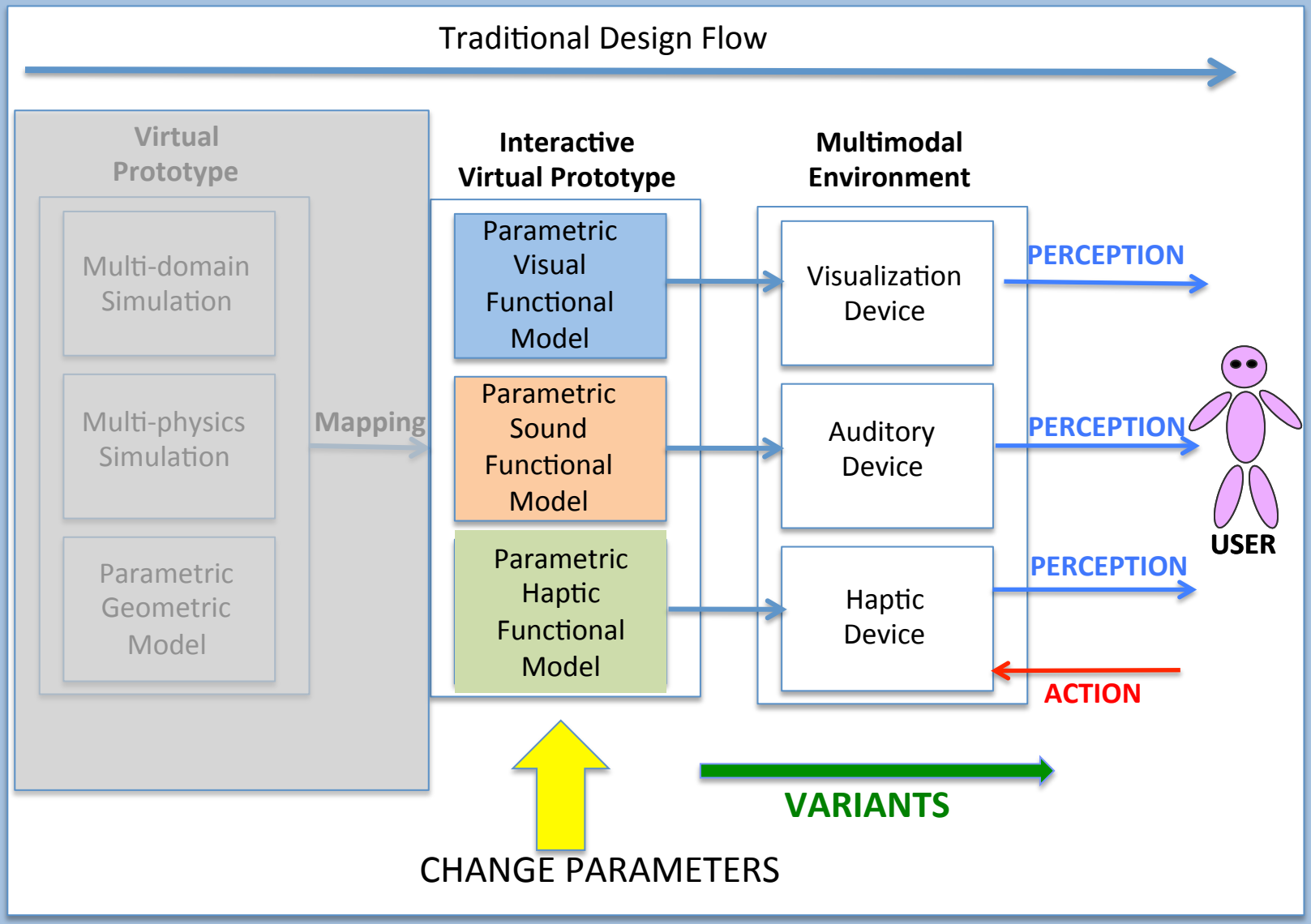

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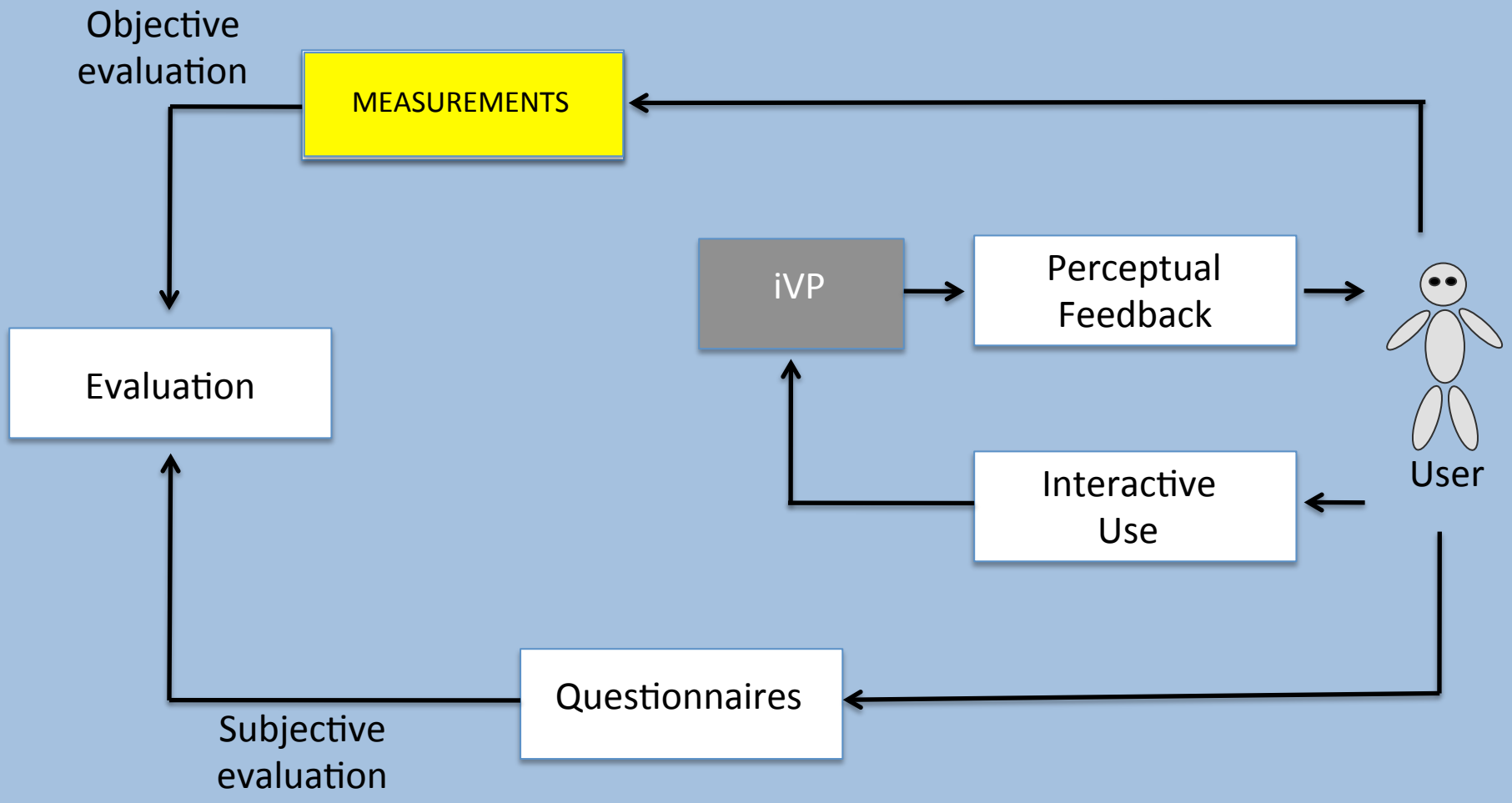
Evaluation Protocols

- What influences the **Performance**
  - Skill level
  - Task performance
  - Learning efficiency
  - Usability
  - Reliability
  - Comfort
- Potential Customers **Impressions**
  - Satisfaction
  - Feelings
  - Emotional involvement/ engagement
  - Empathy (emotional relationship)
  - Perceived product quality
  - Expectations satisfaction

Evaluation methodology



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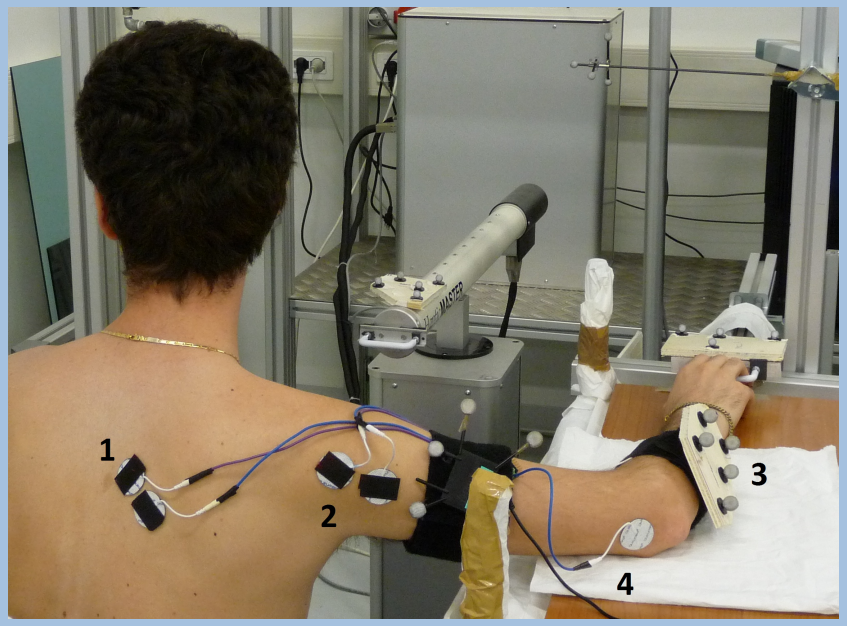
Measurement methods: Performance



Behavioral data: pressure, posture, movements

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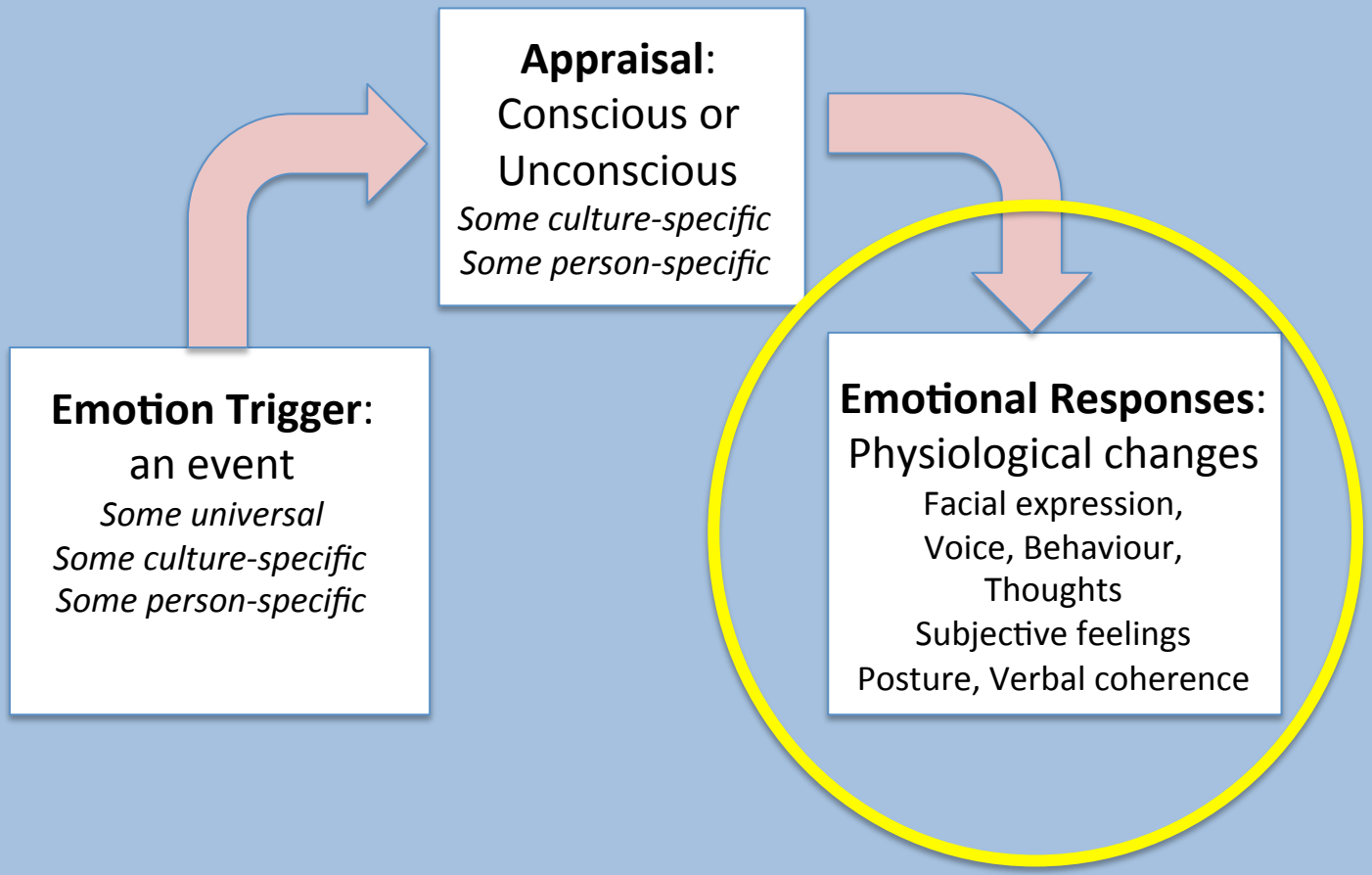
Measurement methods: Emotional engagement



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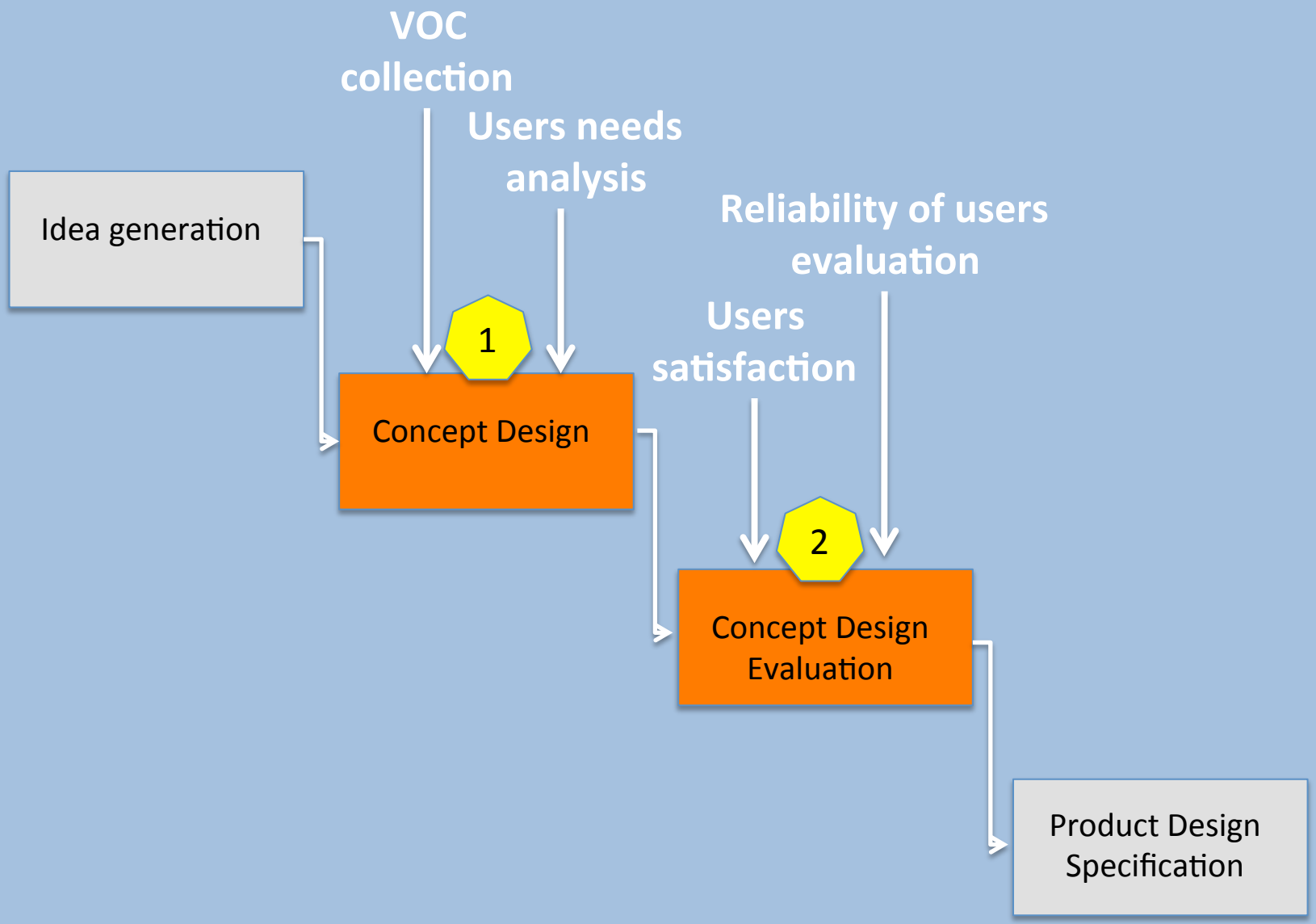

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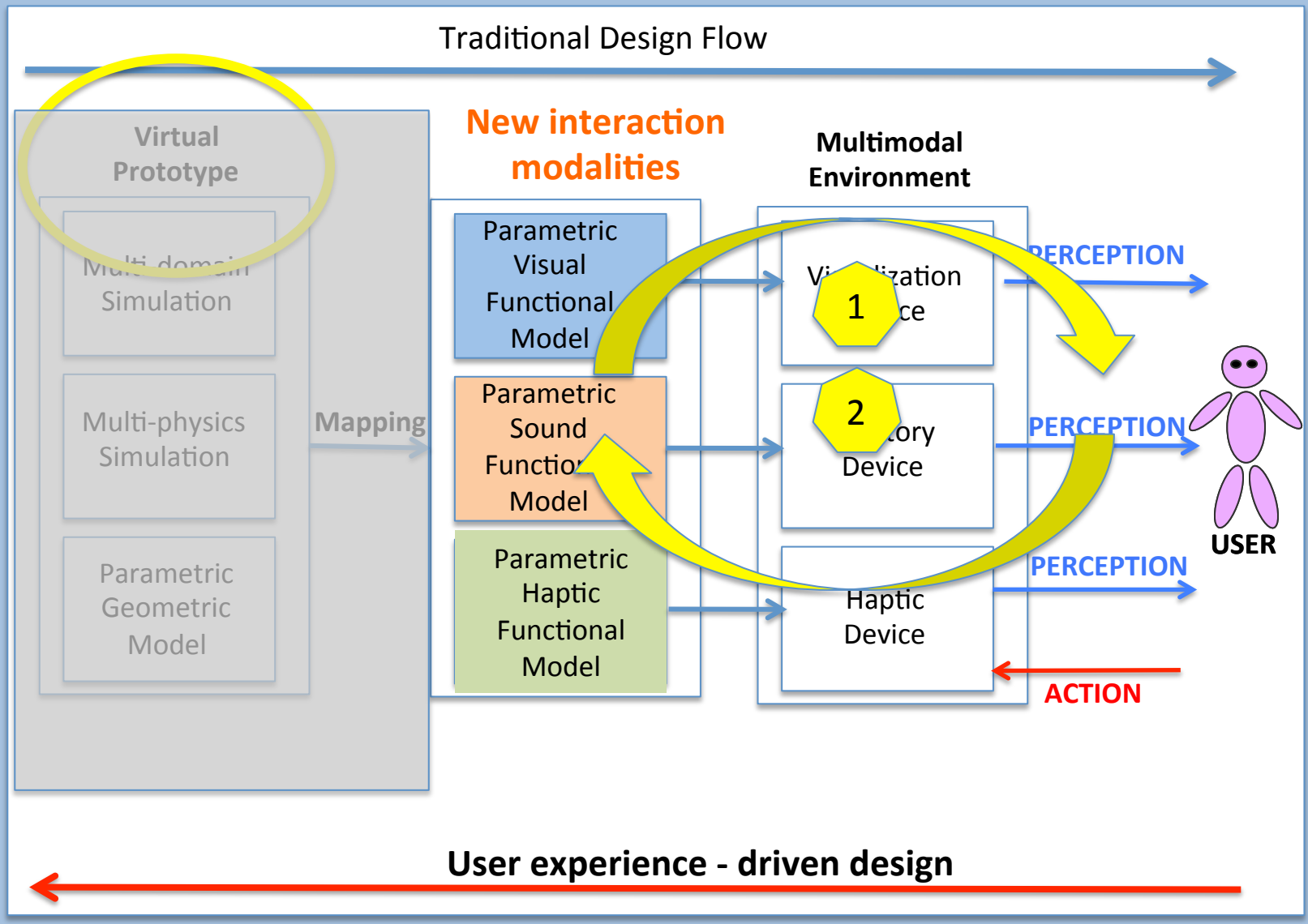
iVP: answers to questions 1 - 2



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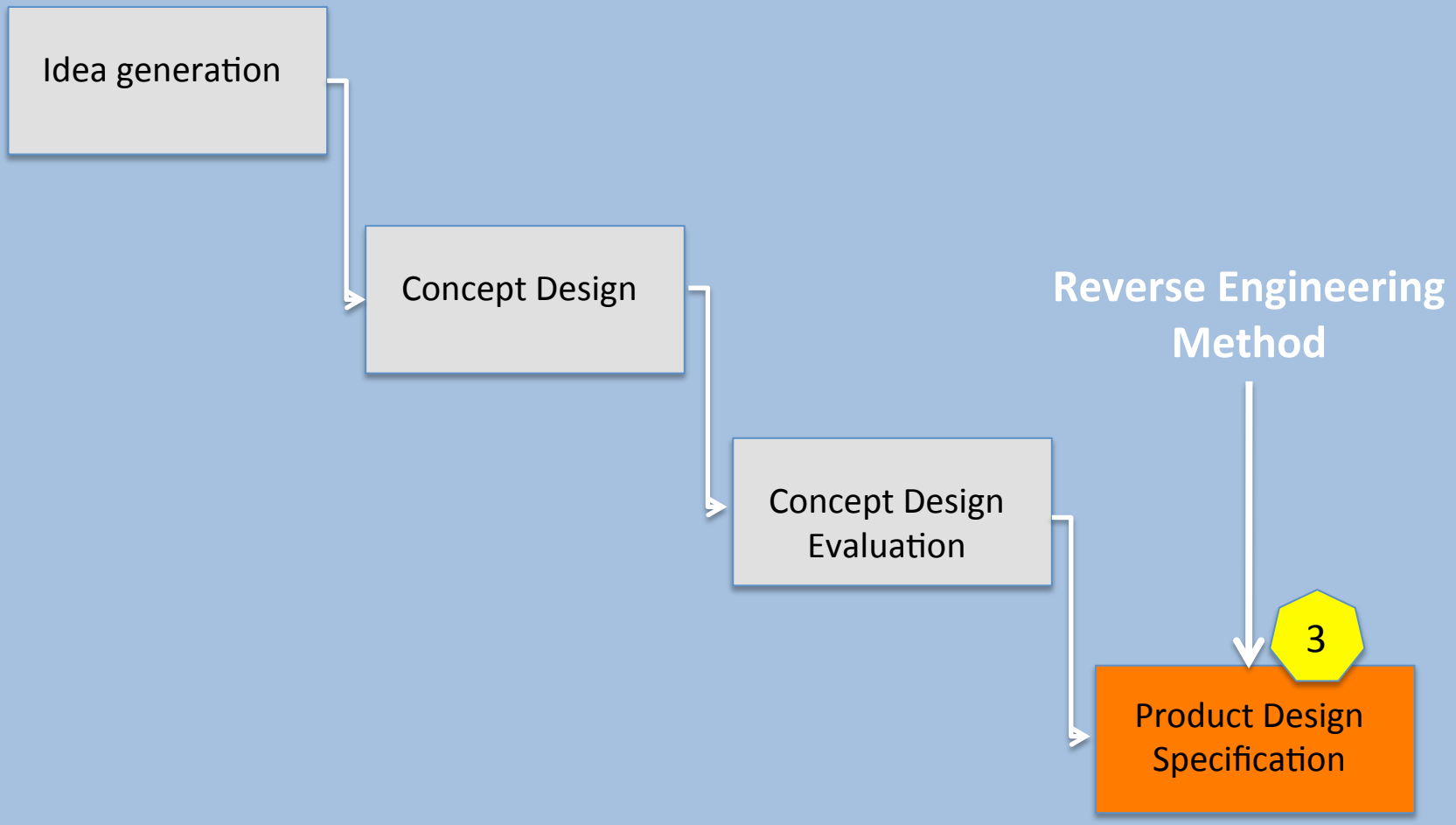
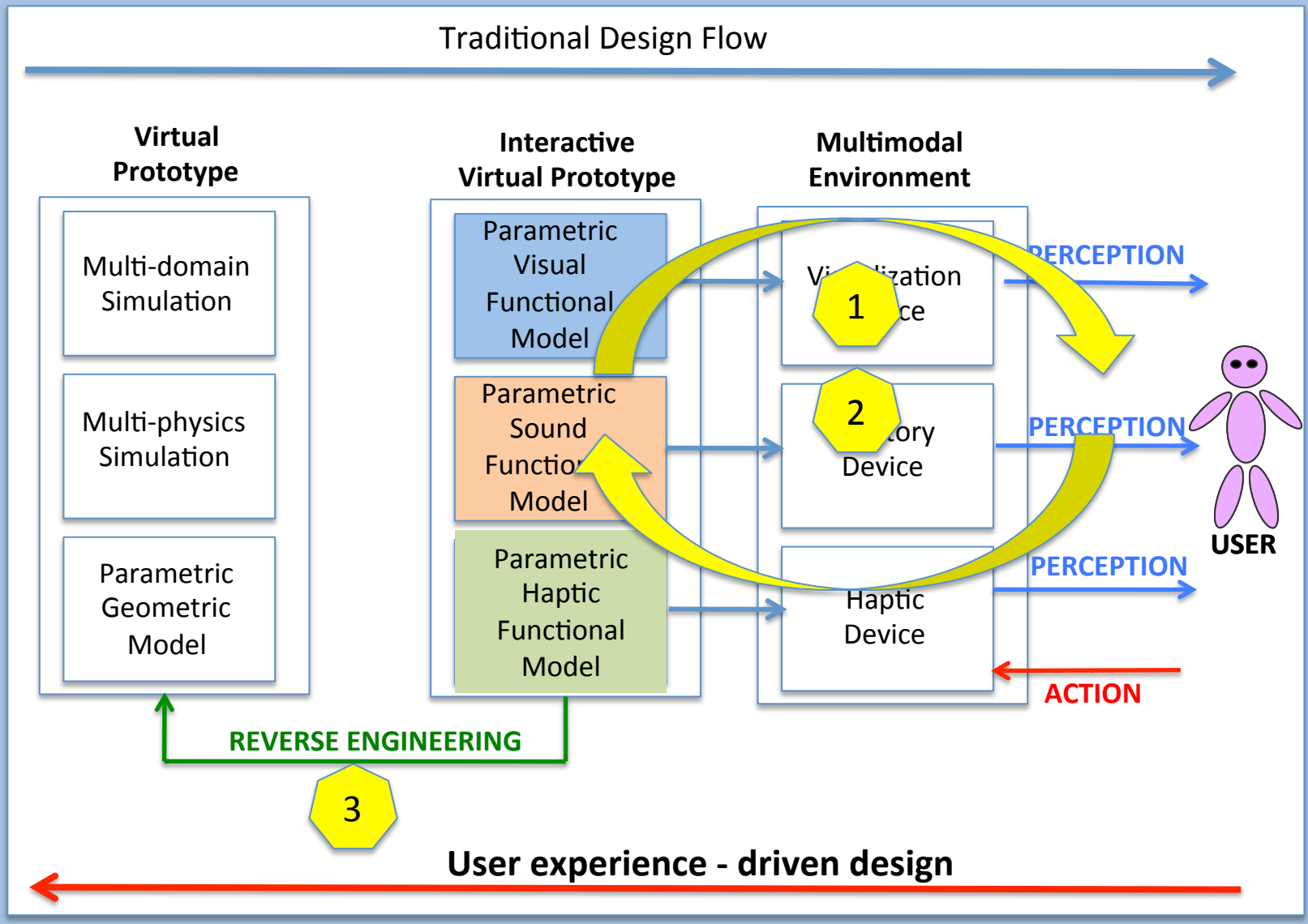


iVP: answers to question 3



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Case Studies

References

- Ferrise, F., Bordegoni, M., Lizaranzu, J.: Product design review application based on a vision-sound-haptic interface (2010) Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 6306 LNCS, pp. 169-178.

- Bordegoni, M., Ferrise, F., Lizaranzu, J.: Use of interactive Virtual Prototypes to define product design specifications: A pilot study on consumer products (2011) ISVRI 2011 - IEEE International Symposium on Virtual Reality Innovations 2011, Proceedings, art. no. 5759592, pp. 11-18.

- Ferrise, F., Bordegoni, M.: Fast prototyping of virtual replica of real products (2011) Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 6774 LNCS (PART 2), pp. 318-326.

- Ferrise, F., Ambrogio, M., Gatti, E., Lizaranzu, J., Bordegoni, M. Virtualization of Industrial Consumer Products for Haptic Interaction Design (2011) ASME WINVR 2011 - ASME 2011 World Conference on Innovative Virtual Reality, Proceedings.