Construction Performance and Productivity Improvement

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SEOUL NATIONAL UNIVERSITY

Thoughts

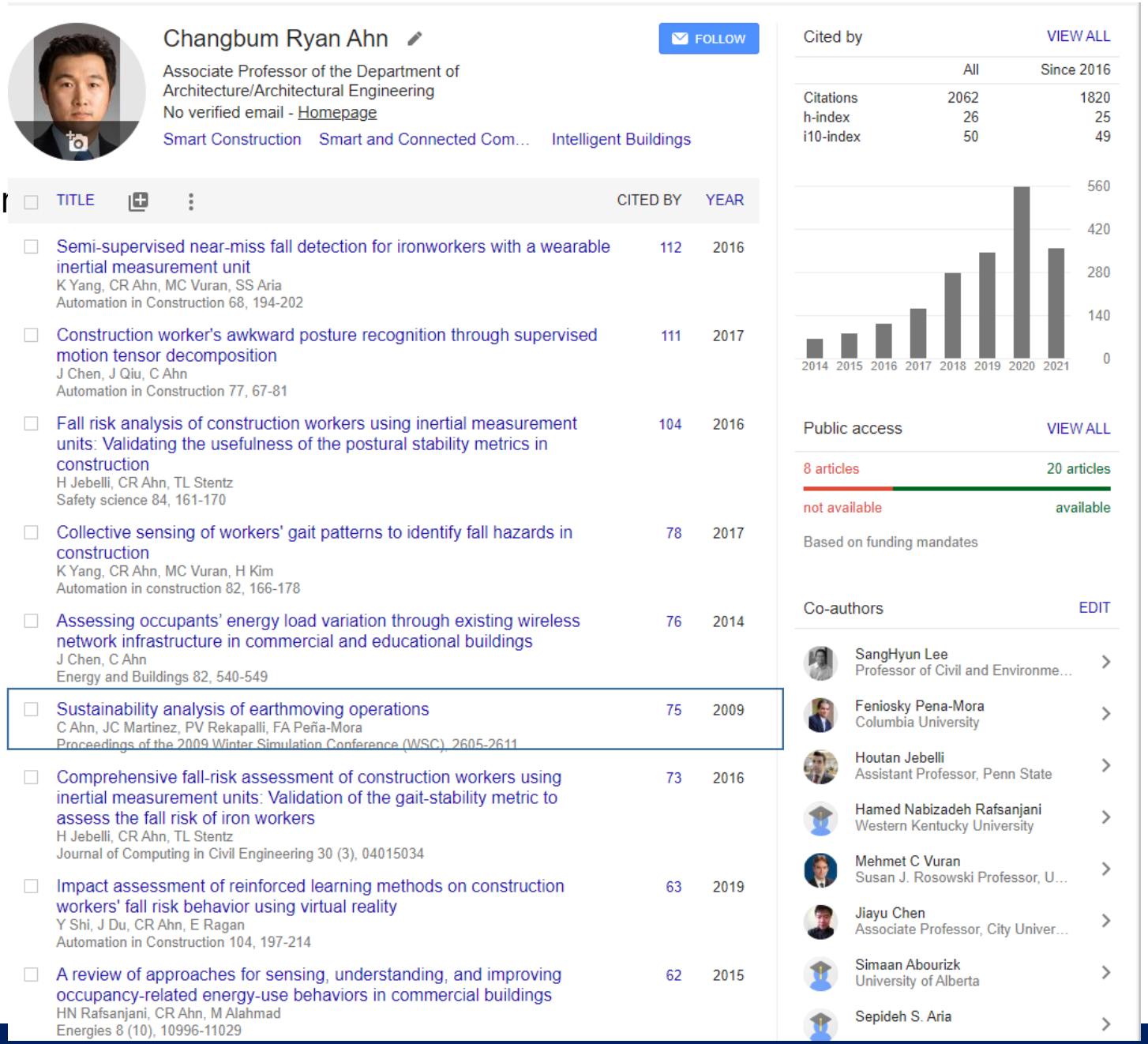
What is the best album of your favorite band?

1~10위				
1위	2위	3위	4위	5위
				
유재하	들국화	신중현과 엽전들	김민기	산울림
사랑하기 때문에 (1987)	들국화 (1985)	신중현과 엽전들 1집 (1974)	김민기 (1971)	산울림 새노래 모음 (1977)
한국 대중음악사상 가장 중요한 단일 작품 훌륭한 노래들의 집합. 지극히 세련된 송라이팅과 고급스런 편곡의 시너지를 혼자서 "제대로" 성취했다.	**어디에도 속하지 않던 그들만의 음악세계** 록 사운드의 야성과 포크적 서정의 등거, 그로부터 태어난 유례없는 들국화만의 음악	**서구 양악과 조화된 우리 정서와 우리 가락** '록의 대부' 신중현이 자신감으로 빚어낸 완전한 우리 정서 기반의 양악, 그 첫 챕터	**시대의 변곡점, 다시 이은 비판과 지성의 맥** 고뇌하는 젊음과 정신을 창작곡으로 만들어 담아낸, 당시 막 싹튼 한국 포크 음악의 길잡이가 된 작품.	**떠나 보냈던 한국의 록, 청춘에게 귀환하다** 대마초 파동 이후 불모지가 된 한국 음악계, 희망의 새 이름에 의해 느닷없이 솟아오른 록 명반
6위	7위	8위	9위	10위
				
어떤날	산울림	한대수	N.EX.T	이상은
어떤날 I 1960 · 1965 (1986)	내 마음에 주단을 깔고 (1978)	멀고 먼 길 (1974)	The Return of N.EX.T Part 1: The Being (1994)	공무도하가 (1995)
스튜디오에서 시작된 자유로운 음악적 실험 방송과 공연 등 공중파 메인스트림과 선을 그은 스튜디오형 언더그라운드의 독자적 문법	**대중음악 패러다임을 송두리째 뒤흔든 파격** 돌연변이에 가까운 파격적 음악스타일은 우리 음악계 발전의 자양분이 되어주었다.	**암울한 시대가 불러낸 한국 최초 히피의 절규** 한국 포크록의 시발점을 알리는 포효와 읊조림, 자유를 거세당한 가인이 전하는 시대의 아픔	**The Return of N.EX.T Part 1: The Being** 아이돌에서 인정받는 싱어송라이터로, 싱어송라이터에서 록 밴드의 리더이자 '마왕'으로	**소리의 경계를 넘어선 보헤미안적 감수성!** 외면과 내면, 흐름과 멈춤이 교차하는 속삭임으로 한국 대중음악사에 영구보존의 영예를 획득하다.

Source : [Fisher 2006]

Thoughts

What will be your best paper in your acader



Changbum Ryan Ahn

FOLLOW

Associate Professor of the Department of Architecture/Architectural Engineering
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Smart Construction Smart and Connected Com… Intelligent Buildings

TITLE	CITED BY	YEAR
Semi-supervised near-miss fall detection for ironworkers with a wearable inertial measurement unit K Yang, CR Ahn, MC Vuran, SS Aria Automation in Construction 68, 194-202	112	2016
Construction worker's awkward posture recognition through supervised motion tensor decomposition J Chen, J Qiu, C Ahn Automation in Construction 77, 67-81	111	2017
Fall risk analysis of construction workers using inertial measurement units: Validating the usefulness of the postural stability metrics in construction H Jebelli, CR Ahn, TL Stentz Safety science 84, 161-170	104	2016
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Assessing occupants' energy load variation through existing wireless network infrastructure in commercial and educational buildings J Chen, C Ahn Energy and Buildings 82, 540-549	76	2014
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Comprehensive fall-risk assessment of construction workers using inertial measurement units: Validation of the gait-stability metric to assess the fall risk of iron workers H Jebelli, CR Ahn, TL Stentz Journal of Computing in Civil Engineering 30 (3), 04015034	73	2016
Impact assessment of reinforced learning methods on construction workers' fall risk behavior using virtual reality Y Shi, J Du, CR Ahn, E Ragan Automation in Construction 104, 197-214	63	2019
A review of approaches for sensing, understanding, and improving occupancy-related energy-use behaviors in commercial buildings HN Rafsanjani, CR Ahn, M Alahmad Energies 8 (10), 10996-11029	62	2015

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Associate Professor, City Univer…

Simaan Abourizk
University of Alberta

Sepideh S. Aria

Source : [Fisher 2006]

Thoughts

Your first paper can be your best paper..

Recap – Titans in CEM Research

- Robert Peurifoy: Founder of the first CM education program (at Texas A&M)
- Daniel Halpin (Purdue): Construction Simulation (Cyclone)
- US Army Corps of Engineers Construction Engineering Research Laboratory (CERL)
- Clarkson Oglesby (Stanford): Using industrial engineering techniques
- Marvin Gates and Robert Carr: Bidding theory
- Jimmie Hinze: Construction Safety
- Howell, Tommelein, and Ballad: Lean Construction
- Raymond Levitt: Organization

Source : [Fisher 2006]

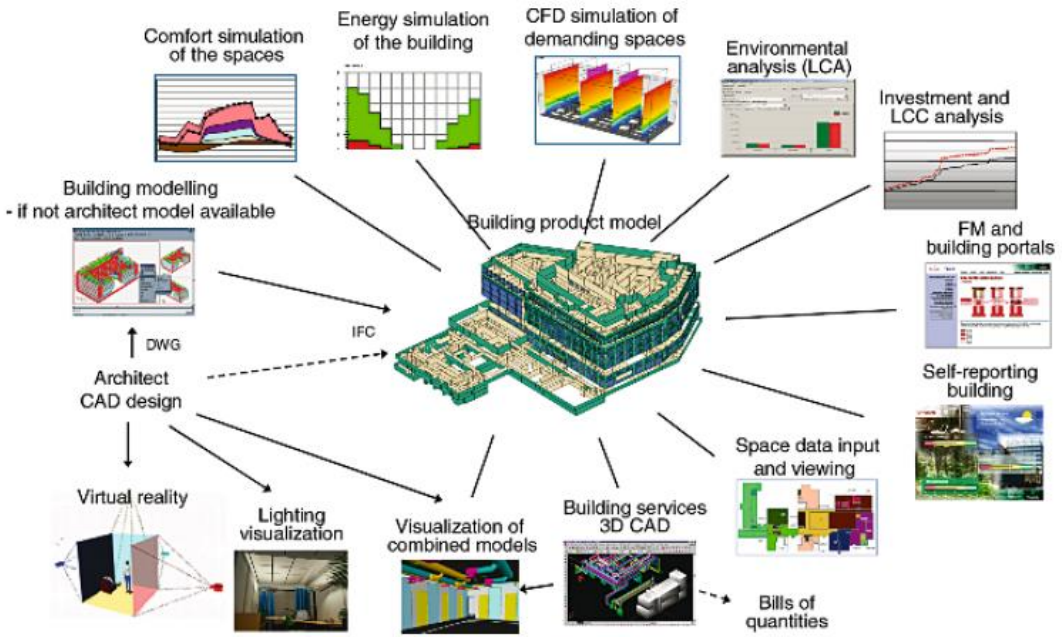
Recap – Titans in CEM Research

- Center for Integrated Facility Engineering (CIFE, Stanford)
  - Martin Fisher, 4D CAD
- Pena-Mora: My advisor
- Julio Martinez and Kamat: Simulation, Halpin's students
- Hendrickson and Horvath: EIO-LCA

Formalizing construction Knowledge

Overview of the paper

- Introducing CIFE's research efforts and 'horseshoe' research method
- CIFE – Center for Integrated Facility Engineering at Stanford University
- Focus on Virtual Design and Construction (VDC)



Distinction of Research efforts in Construction

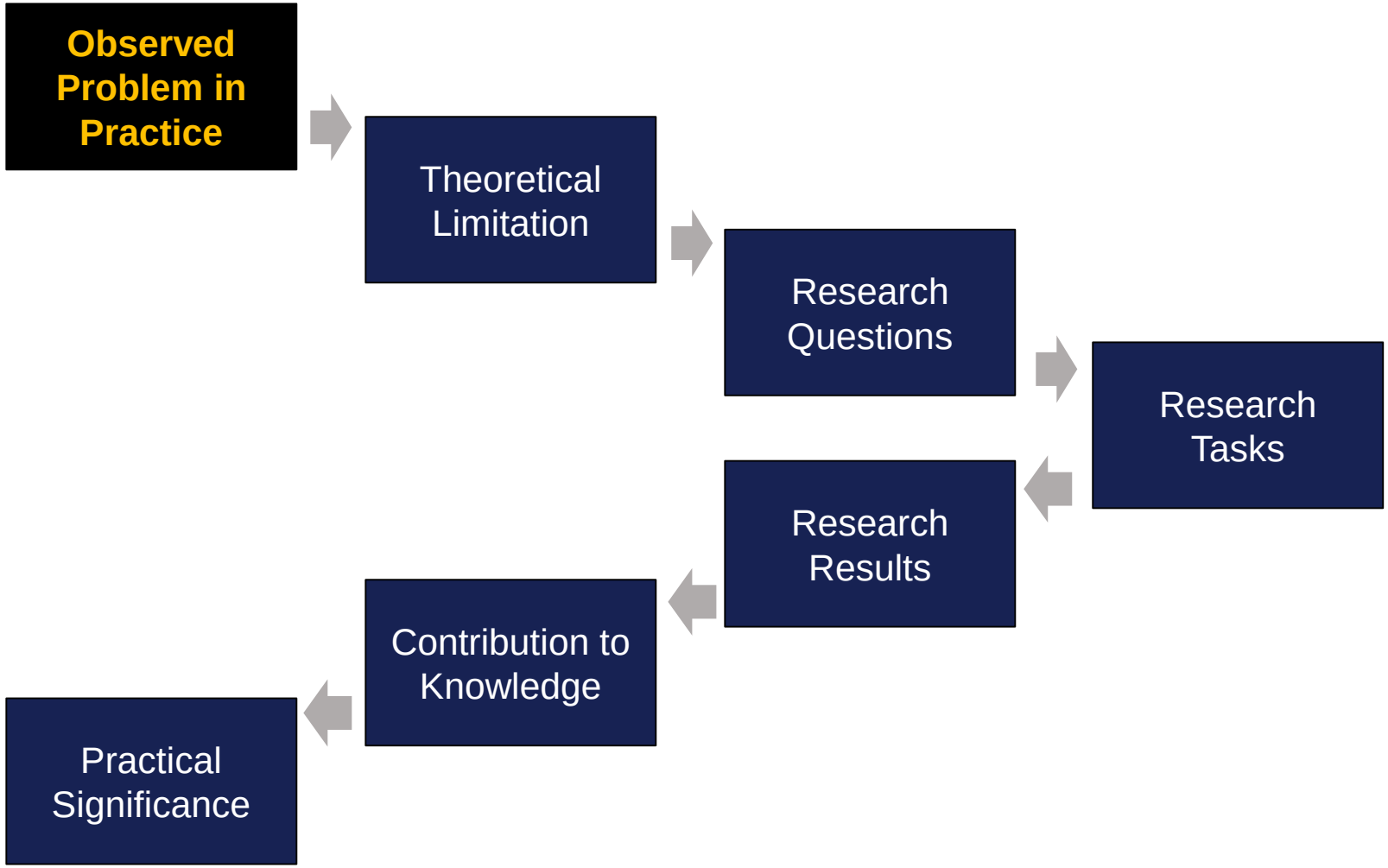
- Exploring new terrain (knowledge) in two ways
  - In practice, through careful participation or observation.
  - In the lab, through rapid prototyping and using test cases.

- Piloting the use of a new method on a real project
  - Learning the value of the new method.
  - Identifying the necessary improvements and addressing them.

- Taking proven methods to widespread use and develop guidelines for implementation

Source : [Fisher 2006]

CIFE ‘Horseshoe’ Research Process



Observed Problem in Practice

- Only well-defined problem definition may lead to a DEFENSIBLE contribution to knowledge
  - Too vague and too broad problem definition: the criteria for success are not clear
- Best starting point : a specific observation of a problem in practice
  - In construction, the ultimate ‘proof’ of research value is in its application in practice.

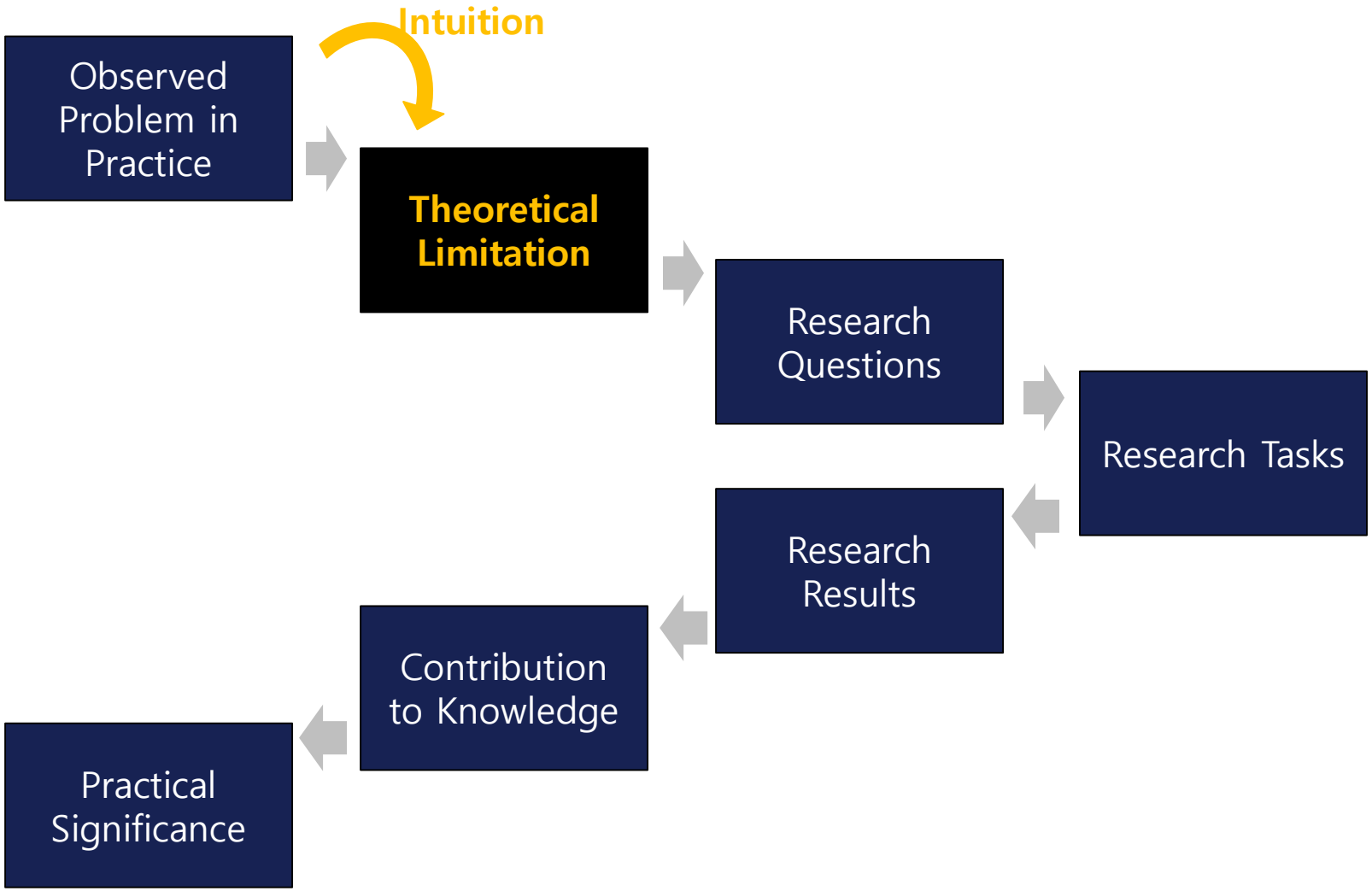
Problem definition

- A good and bad example of a problem statement

  - “4D modeling is too time-consuming”

  - “The construction scheduler cannot generate the 4D model to plan the construction of the lagoon in Disney project fast enough (<1 to 2 hours) to support project teams with the insights about the workflow to build the lagoon and the lagoon and the lagoon work’s interrelationships with work around the lagoon”

CIFE ‘Horseshoe’ Research Process

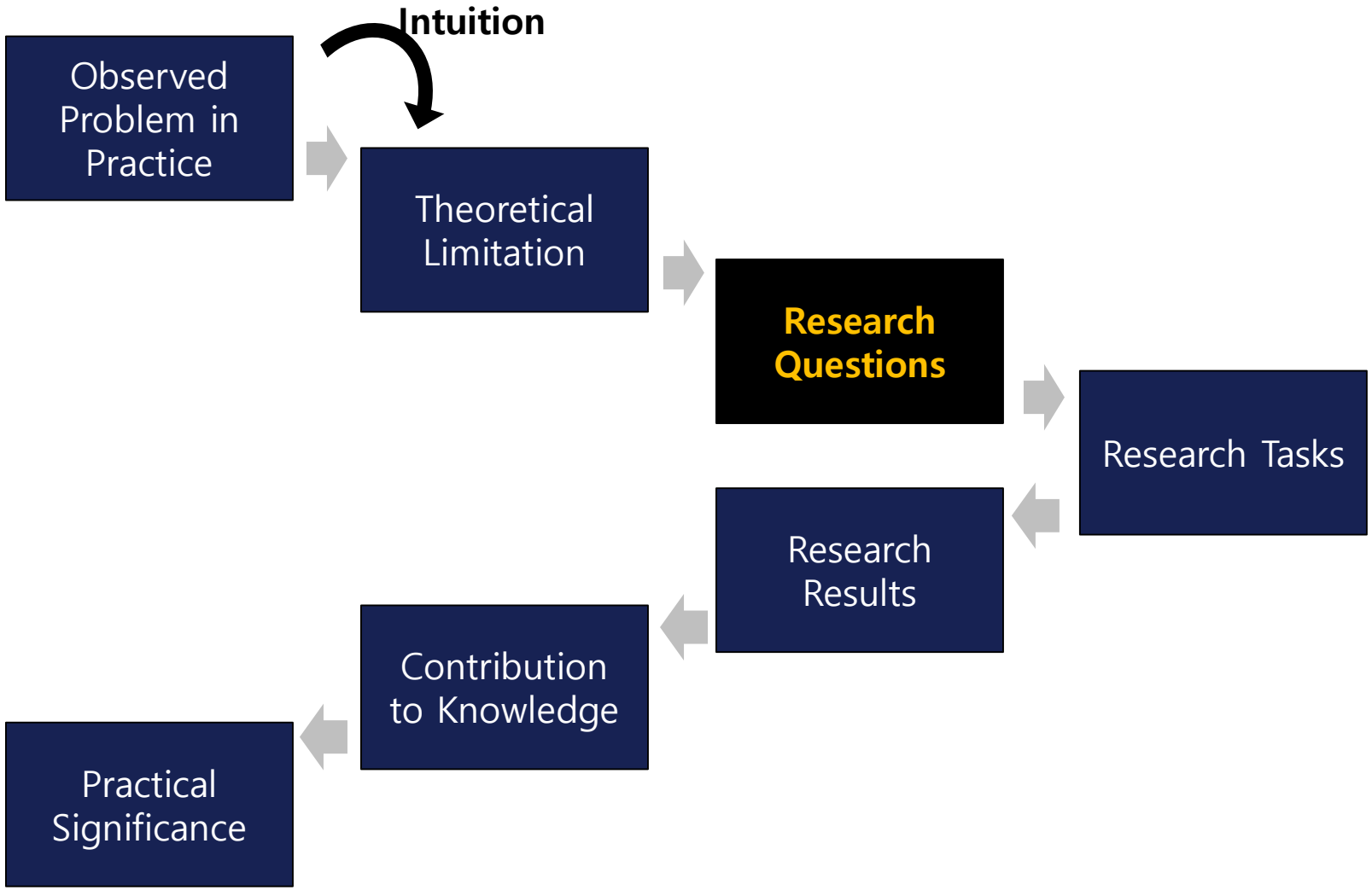


Theoretical Limitations

➢Looking for the theoretical starting point.

- To complement the researcher's observations of practice and find further evidence for the existence
- To identify existing theory that is useful in addressing the problem (Intuition)
- To identify existing theory that is useful in addressing the problem but needs extensions to make it truly useful to help practitioners address the problem

CIFE 'Horseshoe' Research Process



Source : [Fisher 2006]

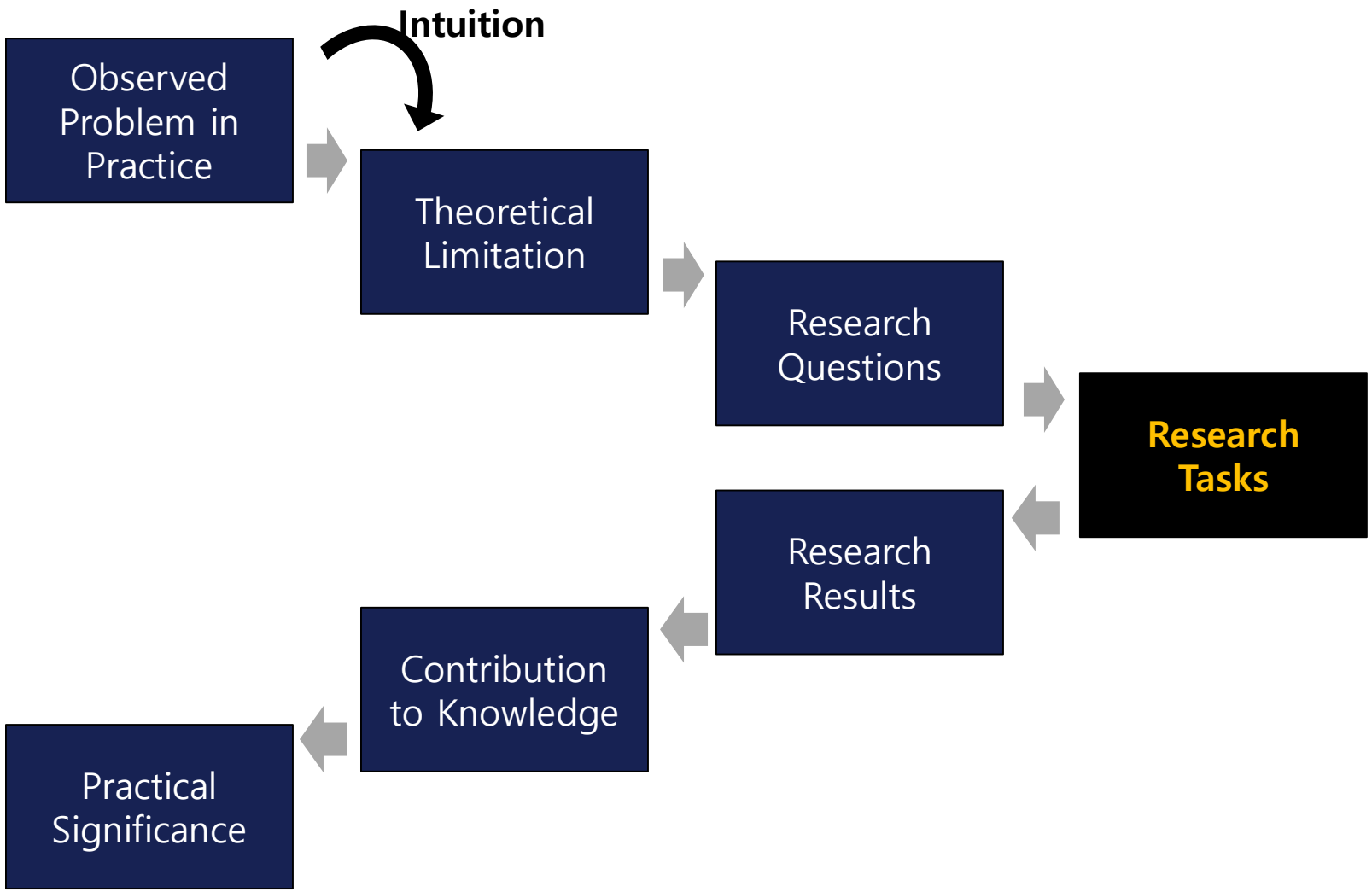
Research Questions

- A key criterion for a good research question
  - Whether it is testable or not.
    - ✓ Generality and power of the answers & Metrics to quantify

- Cannot be answered with a ‘yes’ or ‘no’.
  - The answers should create the foundation for new research

- Formulated in way that makes any finding to the question an interesting answer.
  - If not, the research might be biased toward a specific outcome

CIFE ‘Horseshoe’ Research Process



Source : [Fisher 2006]

Research Tasks (Method and Plan)

- May include further literature study, interviews, surveys, case studies, observations of practice, participation in ongoing construction projects, ontology development, implementation of software prototypes

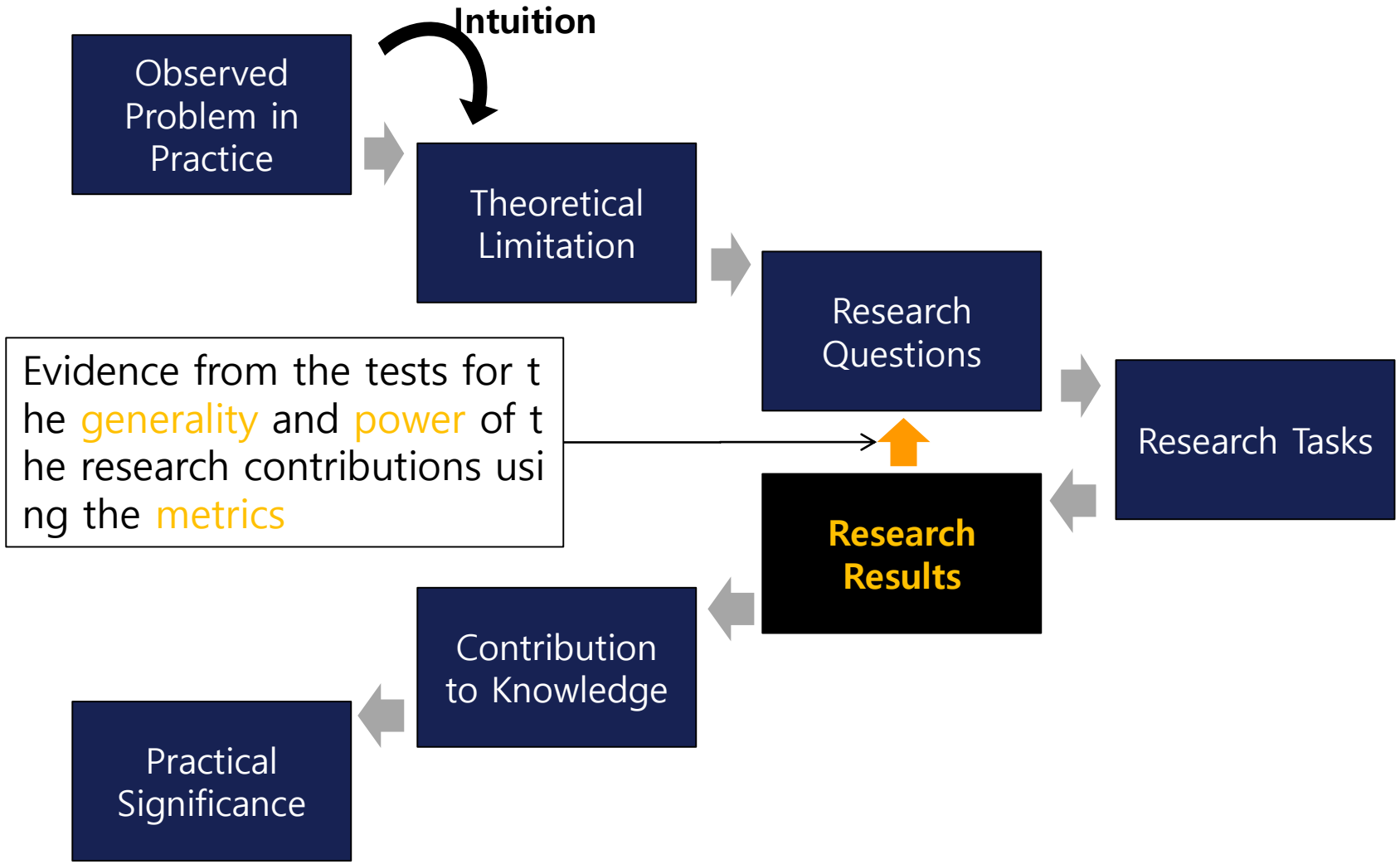
- Determining the number of test cases => the generality of the research result.

- Testing of the research results is typically the most critical research task

Research Tasks (Method and Plan)

- Common test methods
  - Variation studies on retrospective cases. : using past cases
  - Asking an expert panel
  - Charrette tests
  - Prospective or intervention case studies

CIFE 'Horseshoe' Research Process



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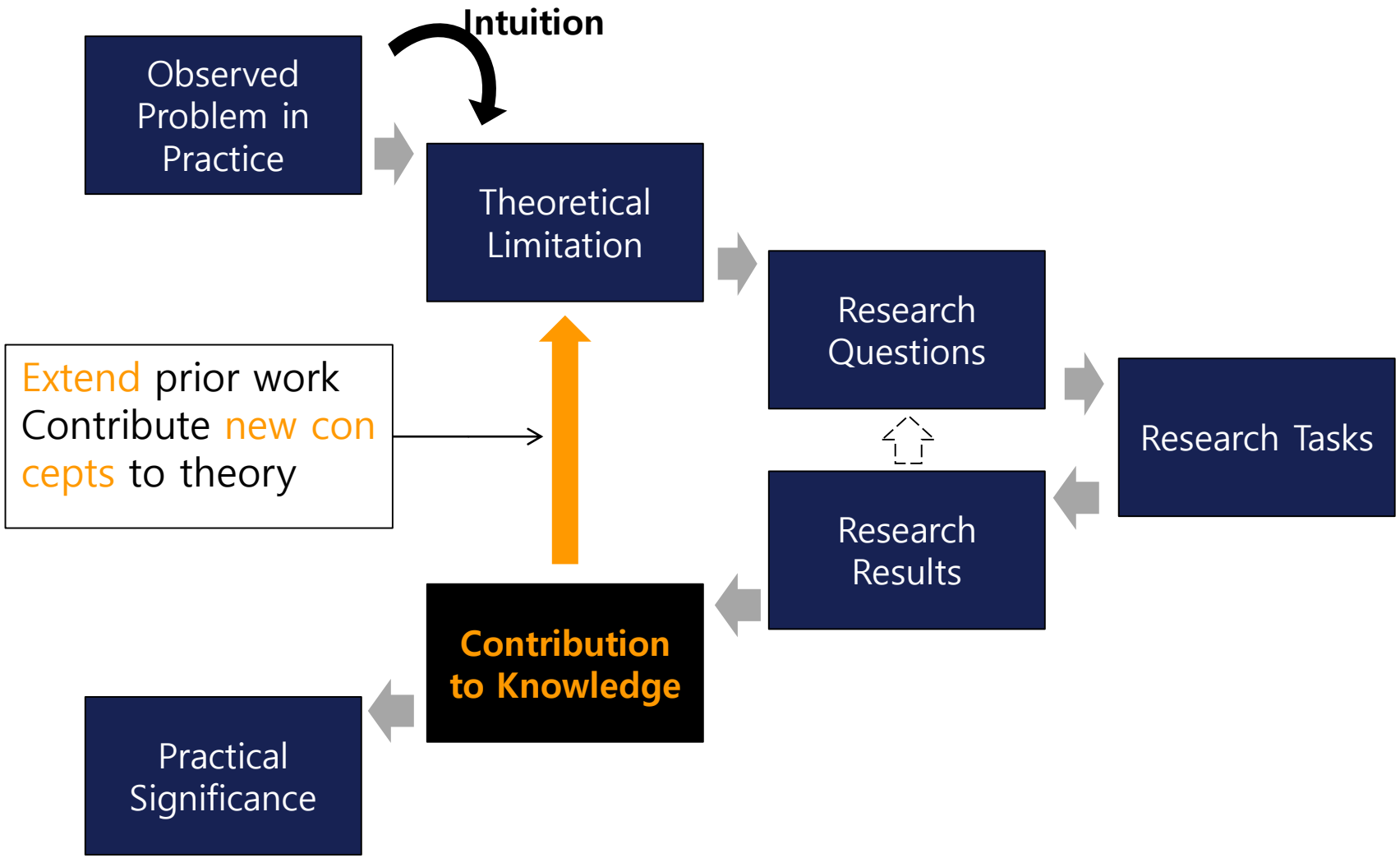

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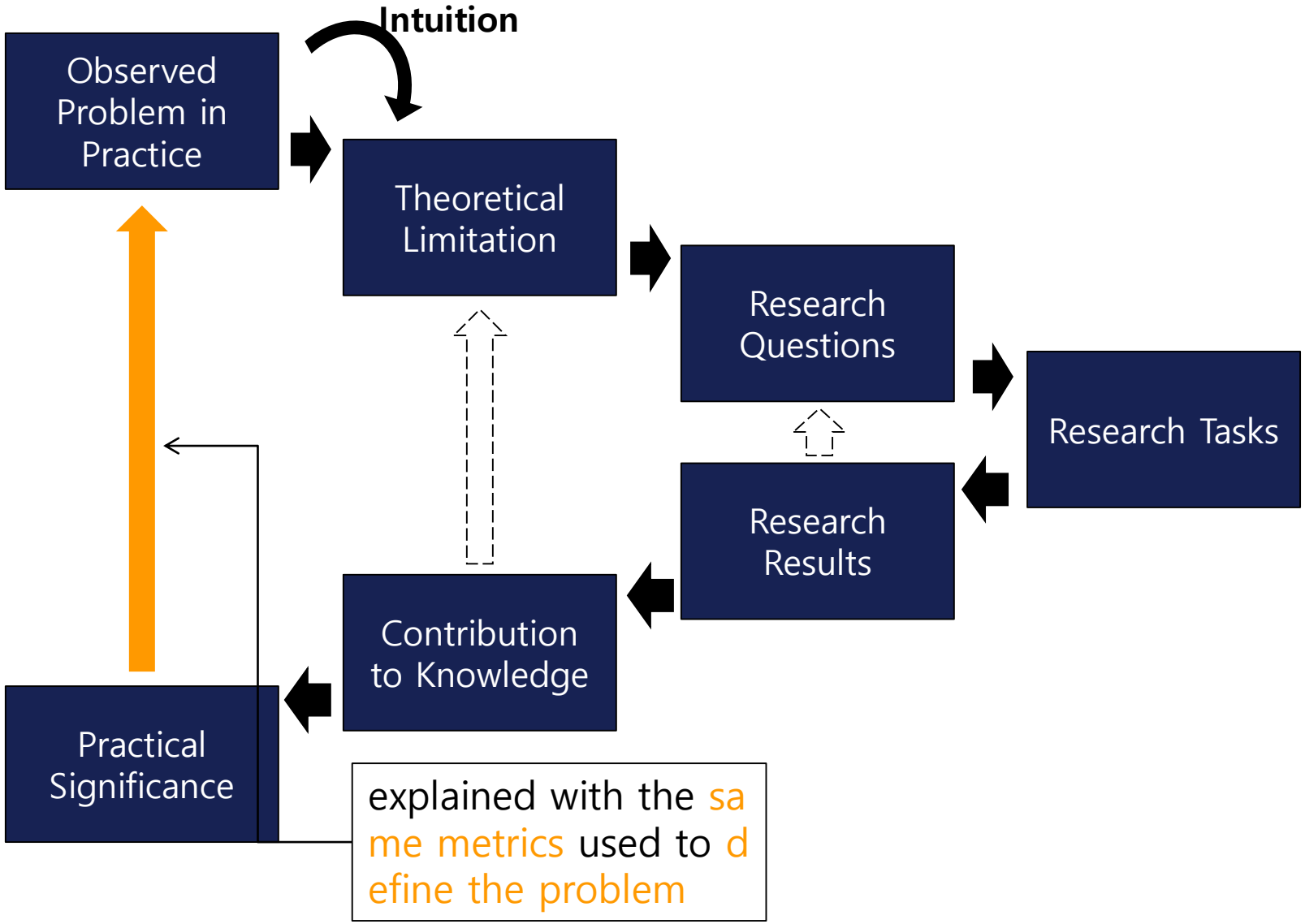
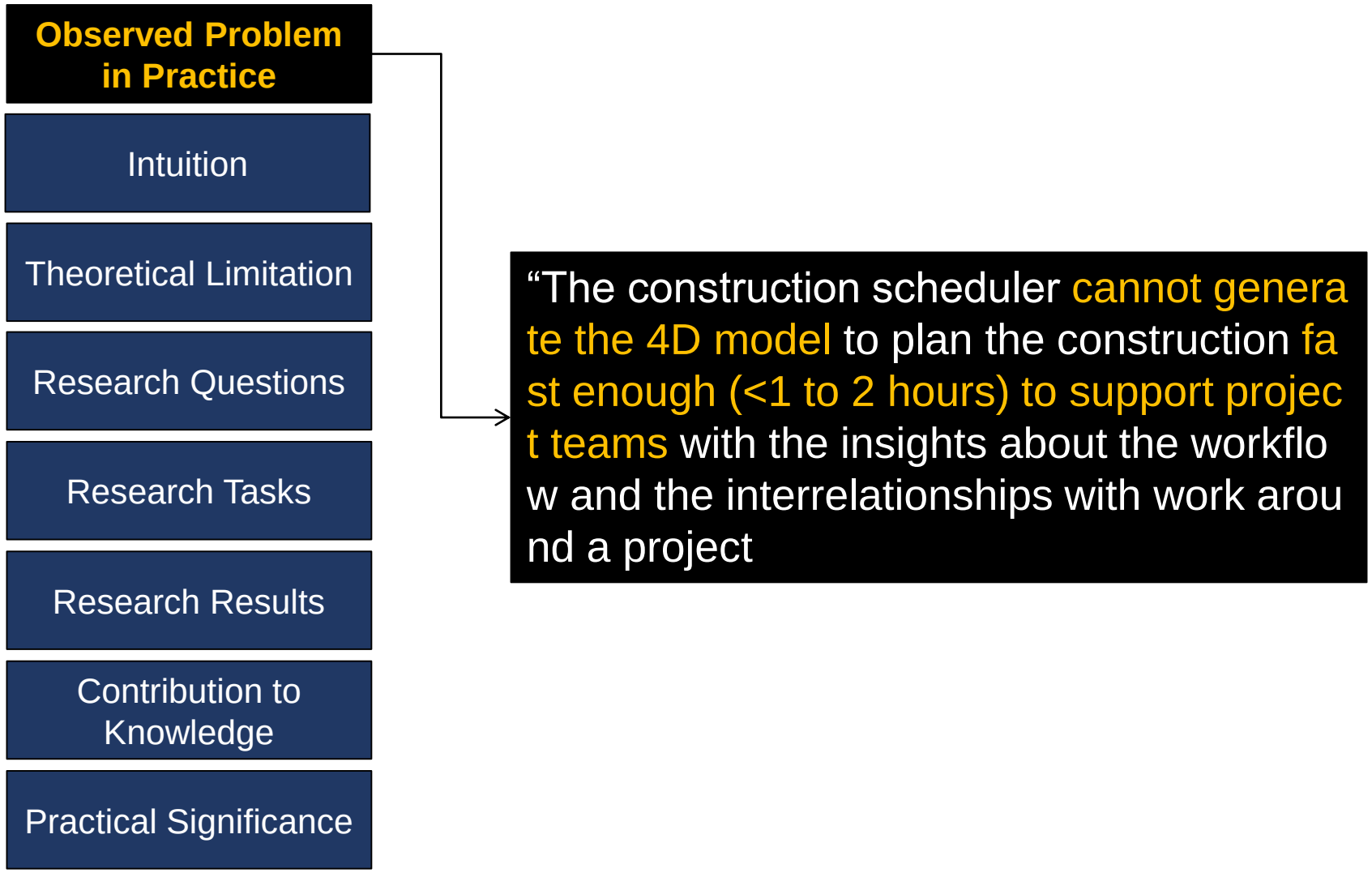


Other Element of Research process

- Discussion:
  - a brief section embed the particular research effort in the larger picture of theory and practice surrounding the research topic
- ‘Maximum anxiety principle’:
  - In all phases, the researcher should advance the thinking on all steps as far as possible and tackle the task that has the greatest uncertainty.

Example: CIFE ‘Horseshoe’ Research Process



Source : [Fisher 2006]

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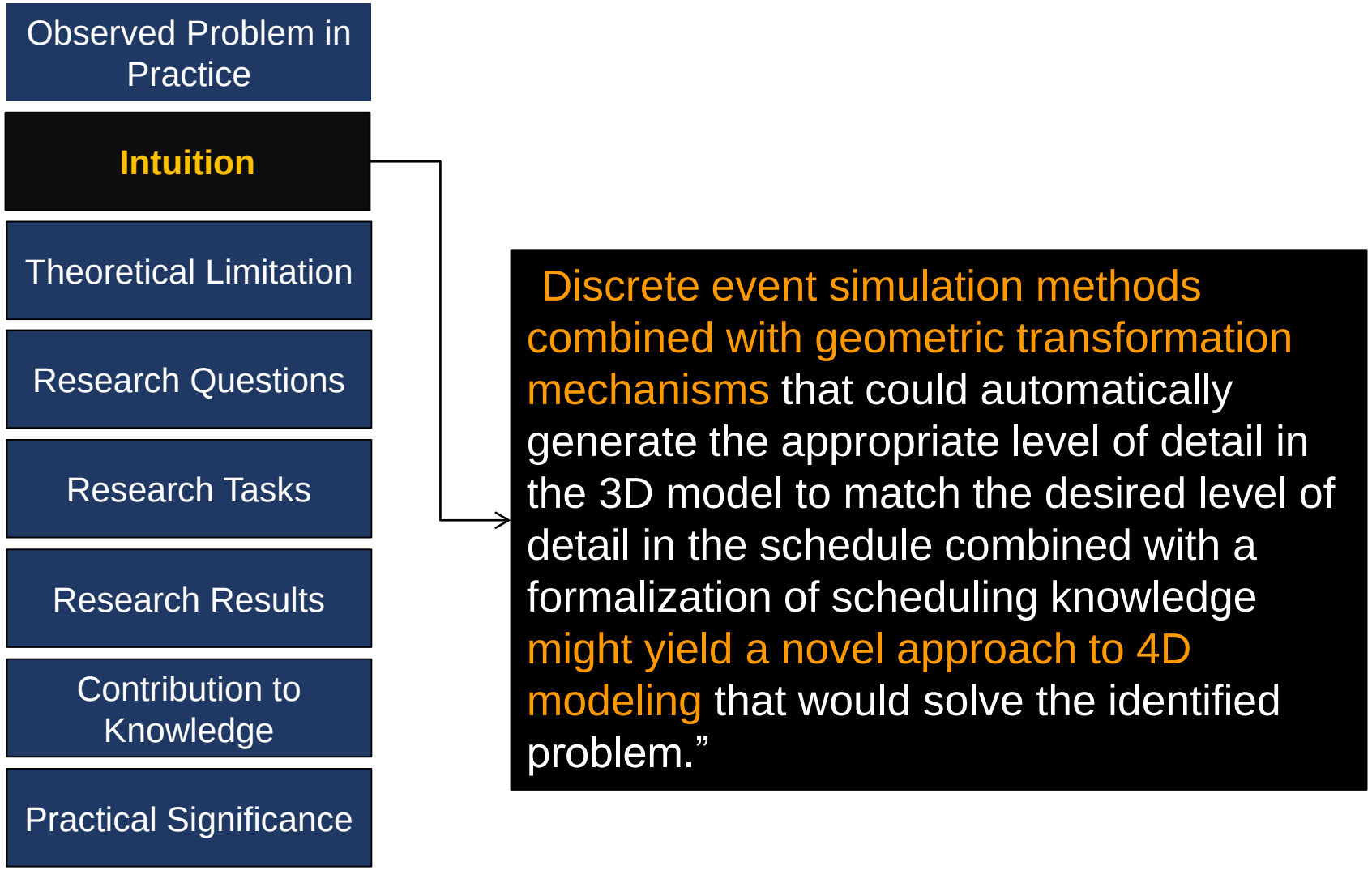

Source : [Fisher 2006]

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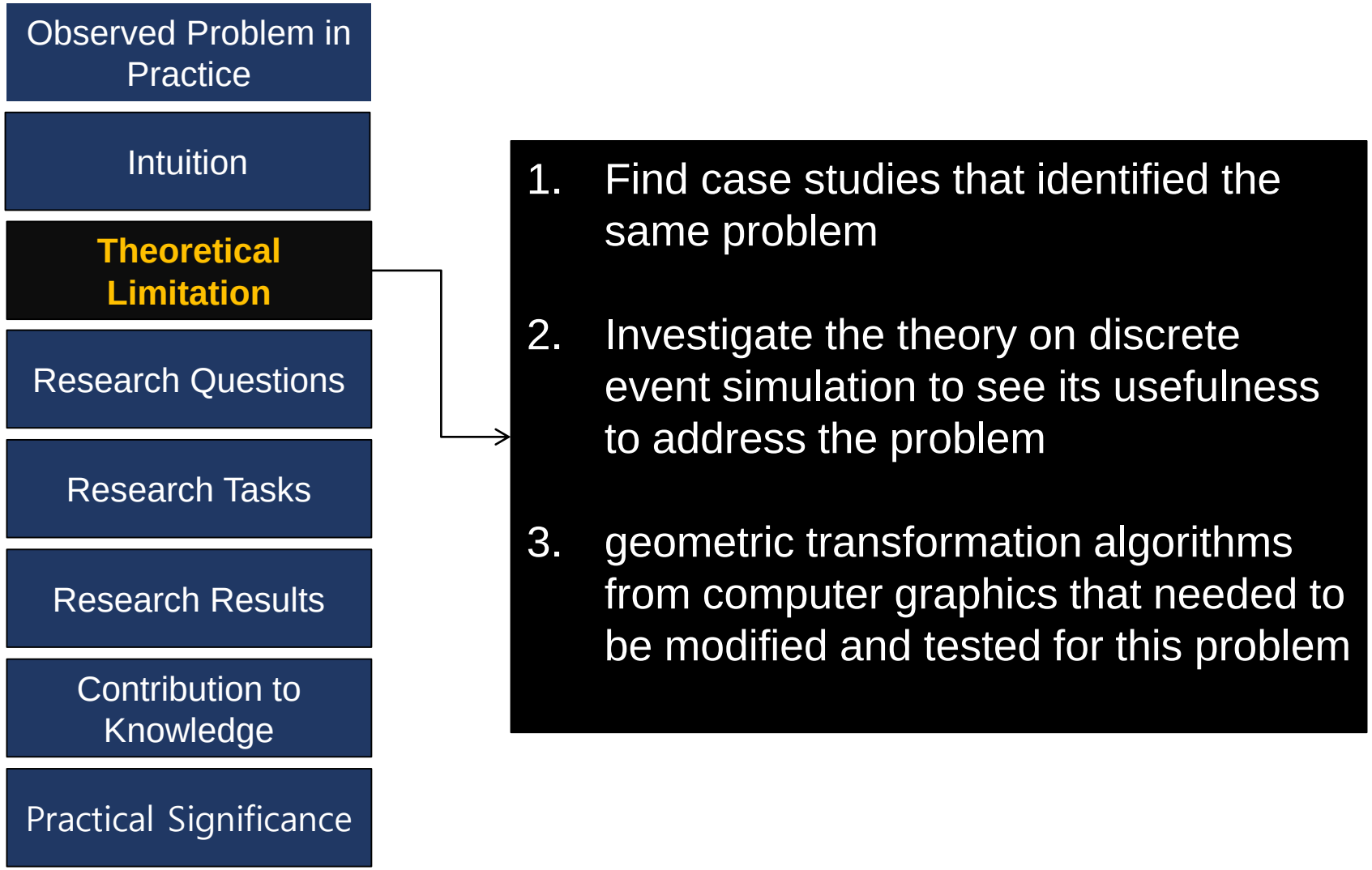
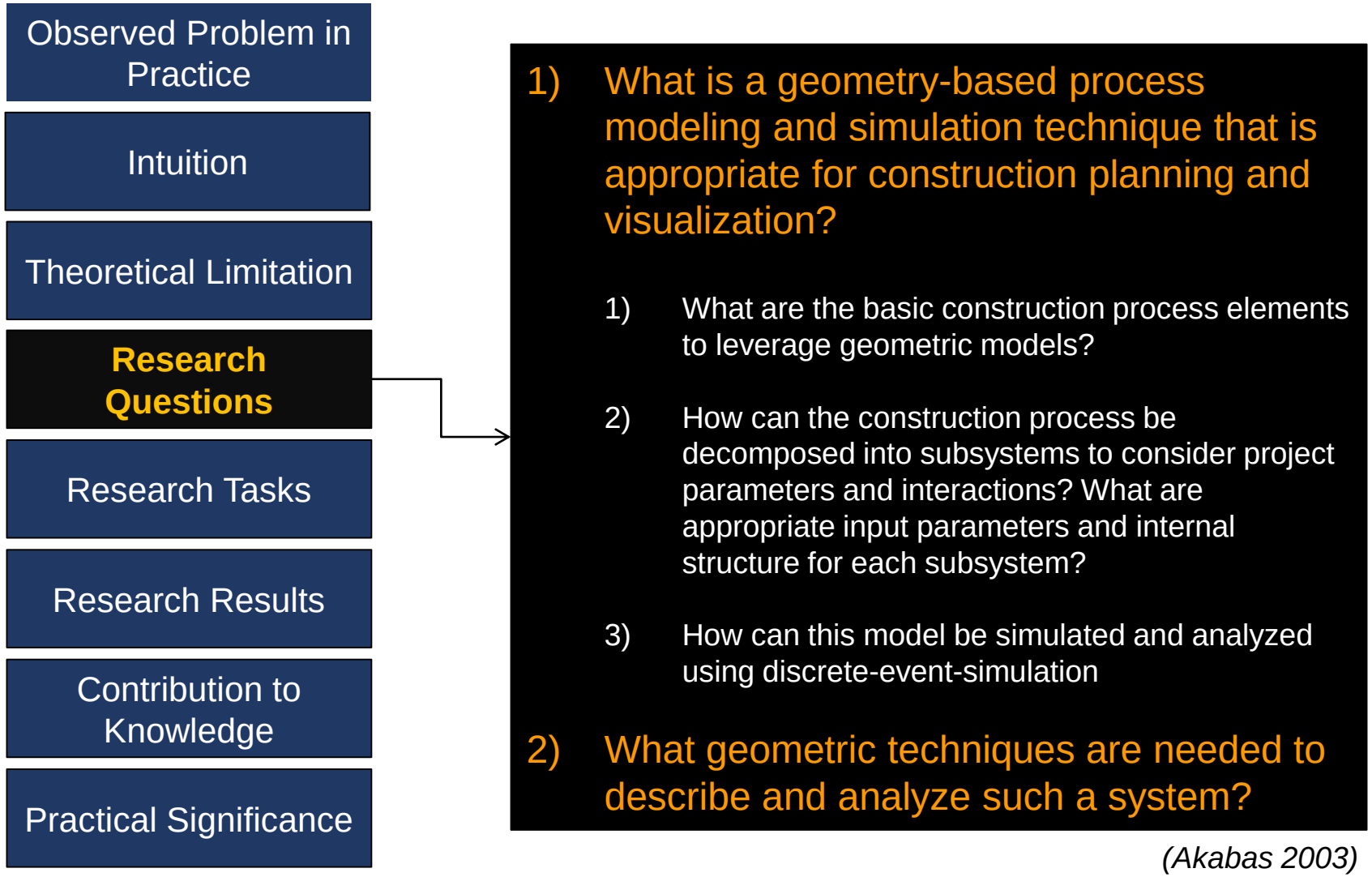


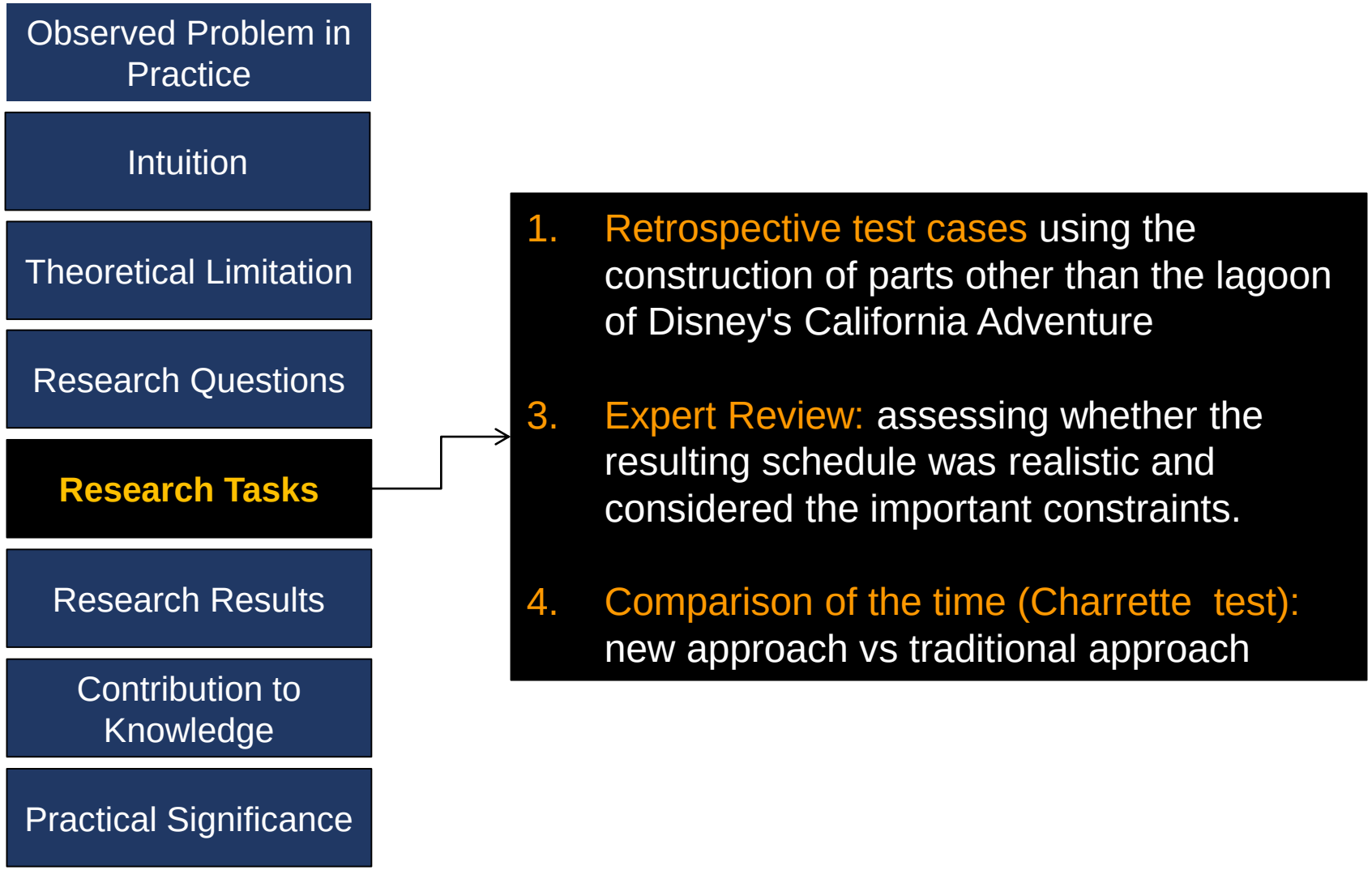
Source : [Fisher 2006]

Example: CIFE ‘Horseshoe’ Research Process



(Akabas 2003)

Example: CIFE ‘Horseshoe’ Research Process



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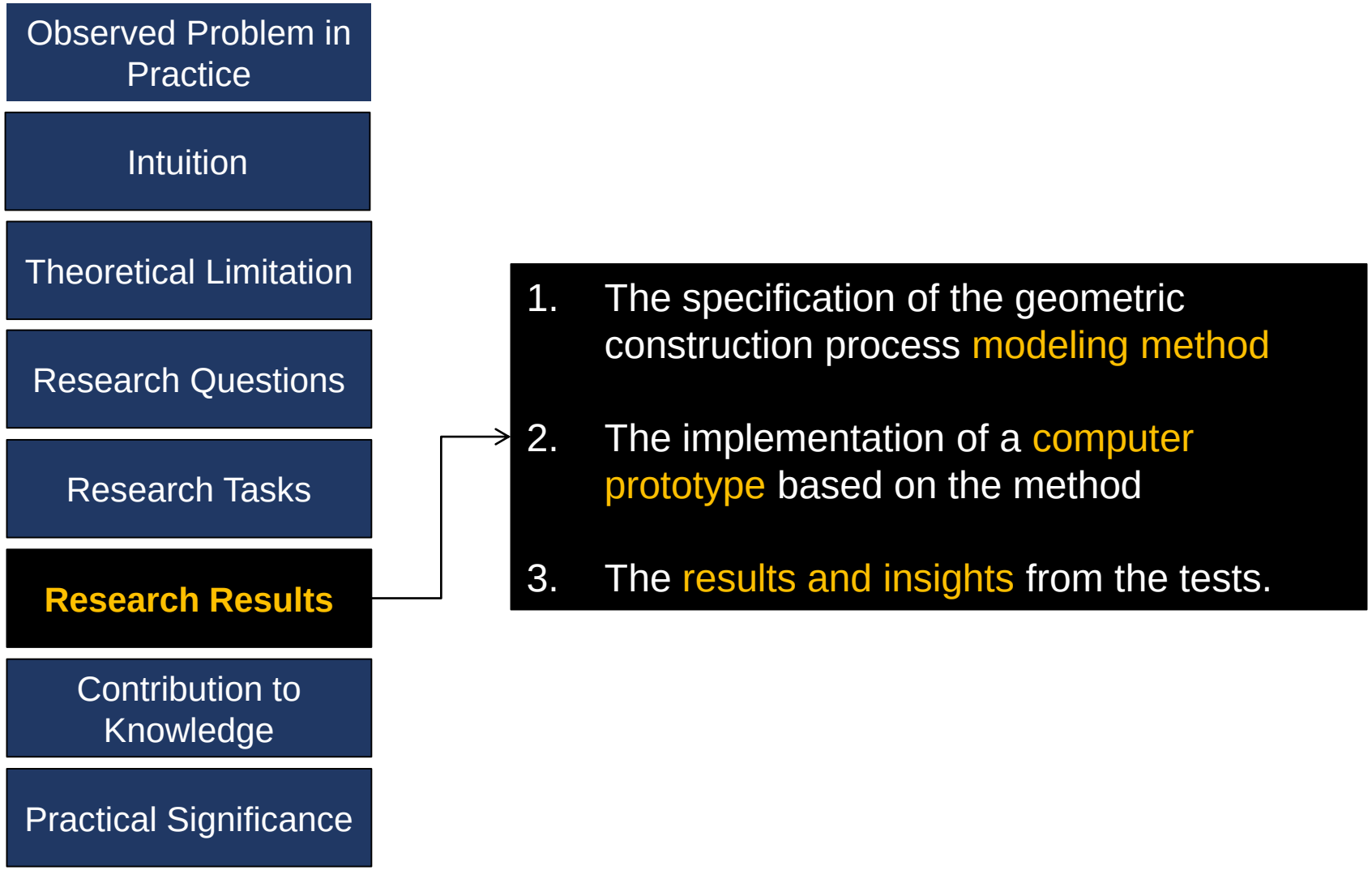

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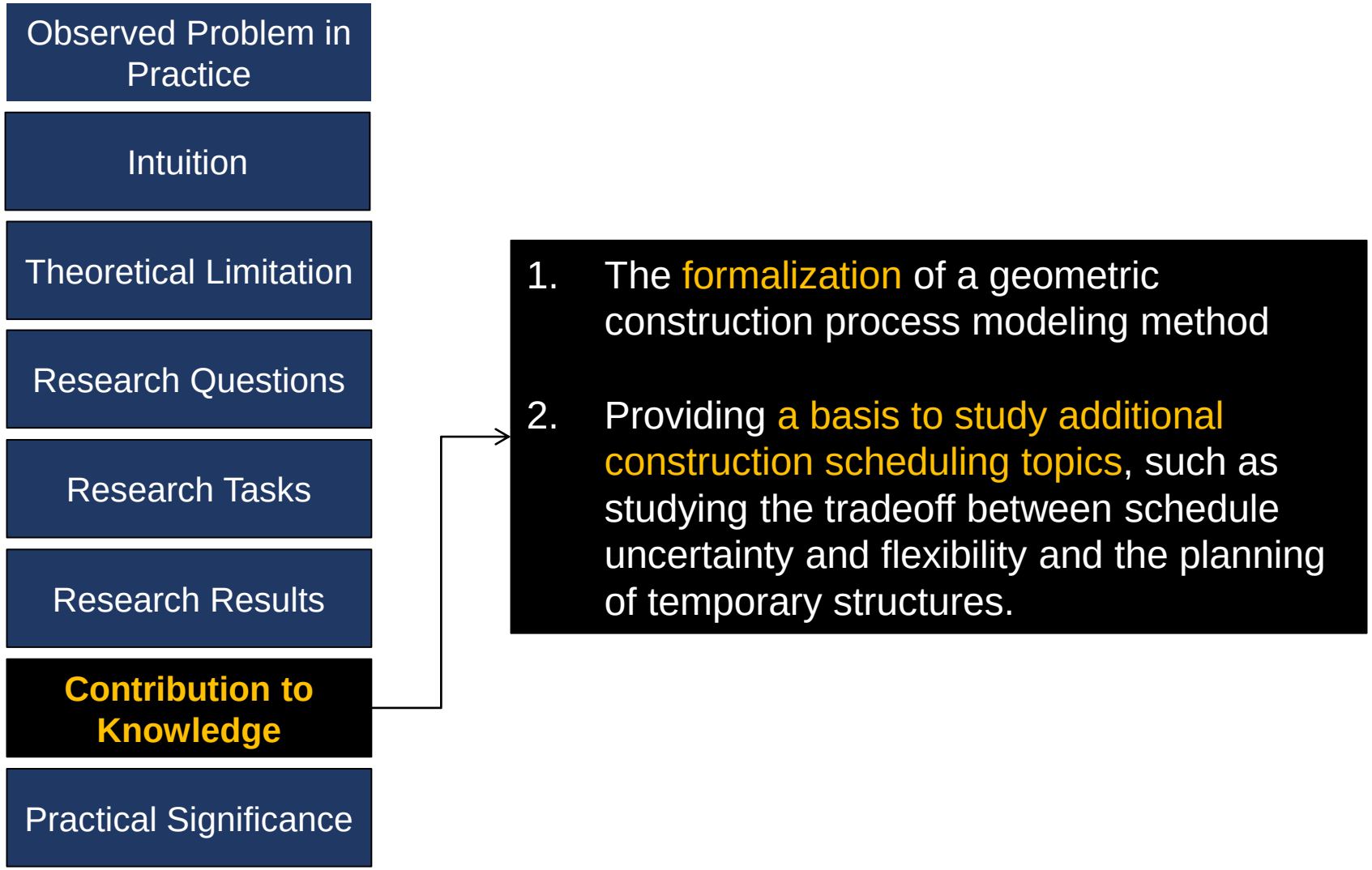

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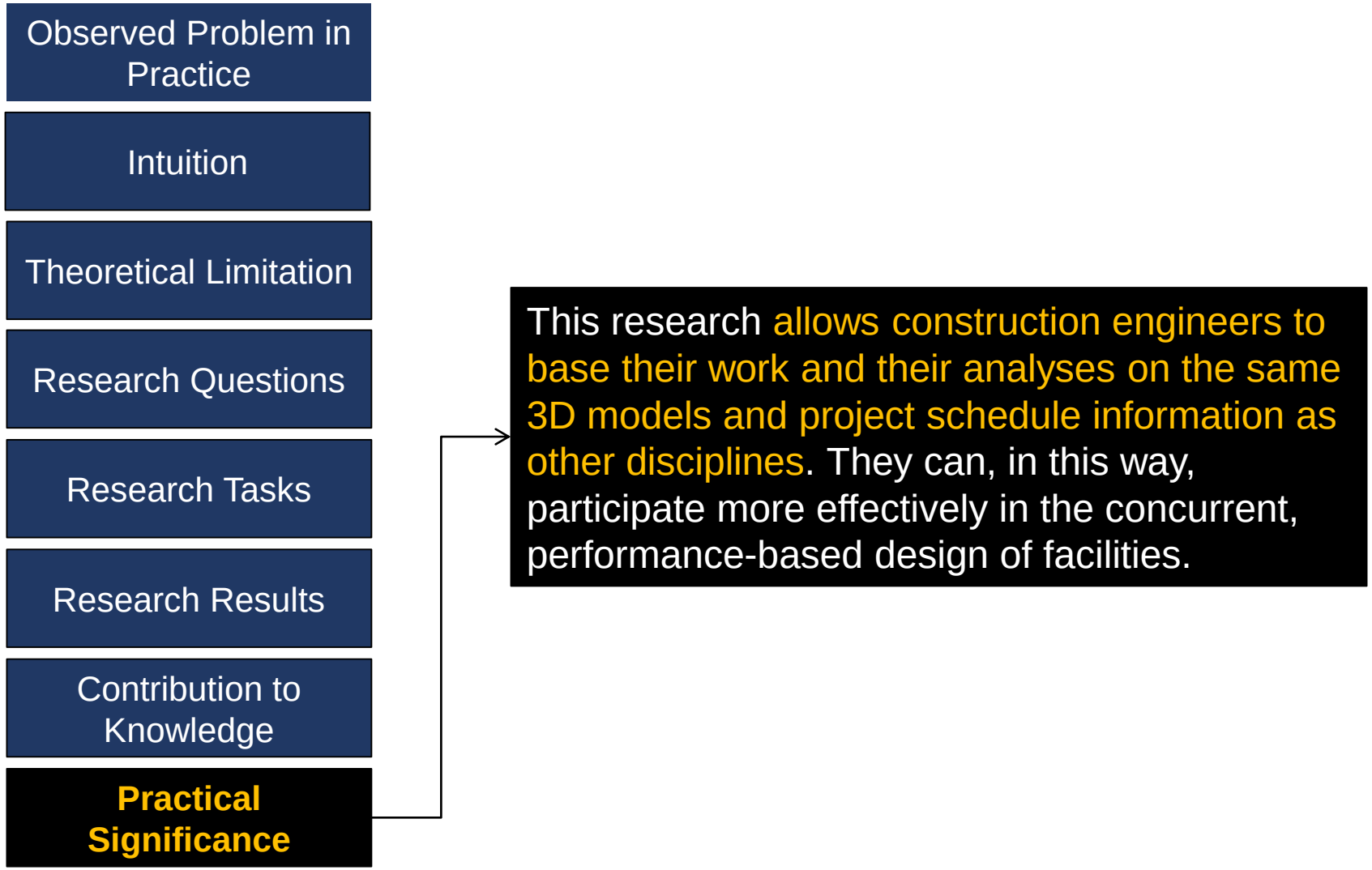


Source : [Fisher 2006]

Summary

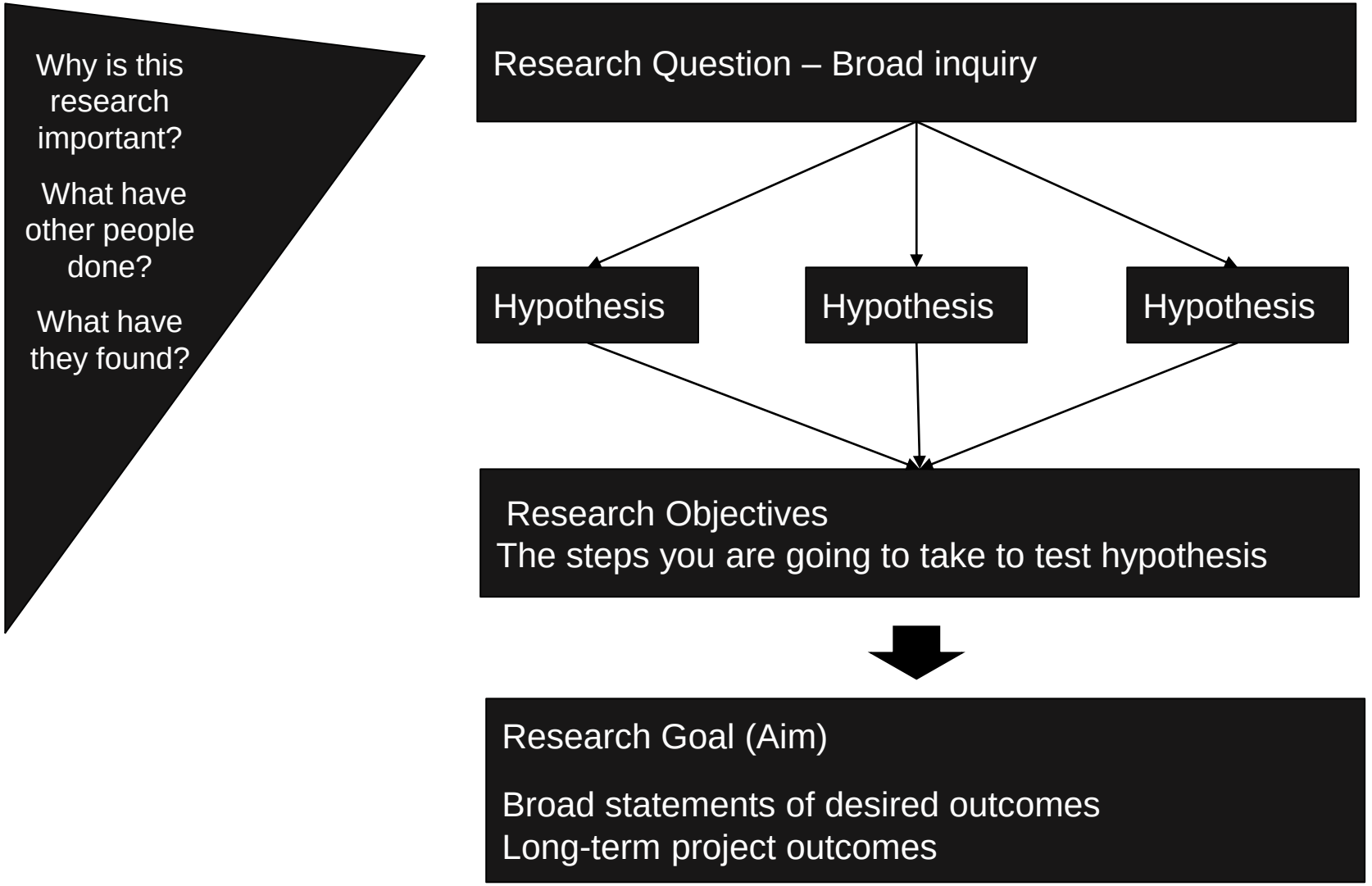
- Research challenge in construction:
  - lab experiments can rarely replicate the situations found in practice. It is difficult to isolate a particular factor and study its effect.
- To address this challenge, researchers need to triangulate results from field observations with theory in related literature with predictions and insights from experts and with descriptions, explanations, or predictions from models developed from the observations, theory, and expert opinions.

Reference

1. Martin Fischer. (2006). “Formalizing Construction Knowledge for Concurrent Performance-Based Design.” Proceedings of 13th EG-ICE Workshop, Ascona, Switzerland, June 25-30
2. Akbas, R. (2003). Geometry Based Modeling and Simulation of Construction Processes. Ph.D. Thesis, Stanford Univ.
3. Van de Ven., A. H. (1989). “Nothing is Quite so Practical as a Good Theory.” The Academy of Management Review, 14(4), pp.486-489.

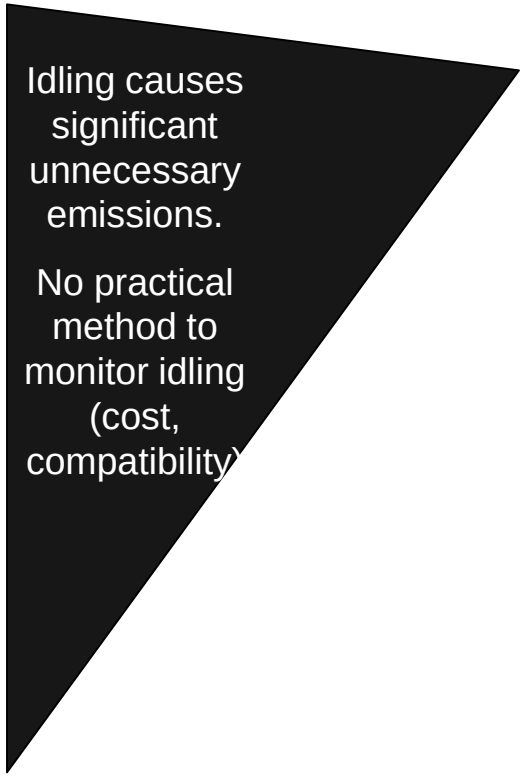
Research Question, Hypothesis, Objective, Goal

Research Process



Source : [theresearchassistant.com]

Example – Equipment Idling Monitoring



Research Question

How can we monitor the engine idling of construction equipment in an economically-feasible way?

Research Hypothesis

Distinguishable power spectral densities measured non-intrusively exist for the idling engine mode of each piece of construction equipment

Research Objective

Conduct a rigorous experiment to test the hypothesis

Research Goal

Realize the economically feasible sensing of the environmental performance of construction operations, by the detection of the duration of the idling of equipment in use.

Assignment

- Please formulate your research question, hypothesis, objective and long-tem goal!

  - Present yours and discuss with peers at the next class

Reference

1. The Research Assistant (2012). “The Relationship Between the Research Question, Hypotheses, Specific Aims, and Long-Term Goals of the Project.” http://www.theresearchassistant.com/tutorial/2-1.asp
2. Bryman&Bell (2012). “Research Project Guide.” http://www.oup.com/uk/orc/bin/9780199284986/01student/project_guide/project_guide/page_11.htm