

# **Modularity (or Not!) and Strategy: The Case of Bicycle Drivetrain Components**

**Sebastian Fixson**

MIT Sloan School of Management  
fixson@mit.edu

**Jin-Kyu Park**

Florida International University  
kyupark@fiu.edu

---

## **Outline**

---

- **The Puzzle: Three Questions**
  - **The Data: The Story of Bicycle Drivetrain Components**
  - **The Analysis: Our Interpretation**
  - **The Outlook**
- 

© Sebastian Fixson

## Background (very brief)

---

- **Study of Technological Change and its Implication has a long history in various Disciplines**
    - Economics, Sociology, and Technology History
      - e.g., *Bijker, 1995; Nelson & Winter, 1982; Rosenberg, 1982; Sahal, 1981*
    - Technology Management and Strategic Management
      - e.g., *Anderson & Tushman, 1990; Henderson & Clark, 1990; Macher & Mowery, 2004; Utterback, 1994*
  - **More recently, the specific role (and effect) of modular product architecture on industry structure and competition has been of particular interest**
    - Baldwin & Clark, 2000; Schilling, 2000
  - **And most empirical studies suggest a general migration towards higher levels of modularity**
    - Baldwin & Clark, 2000
    - MacCormack, Rusnak, & Baldwin, 2004
    - Jacobides 2005
    - Shibata, Yano and Kodama 2005
- 

© Sebastian Fixson

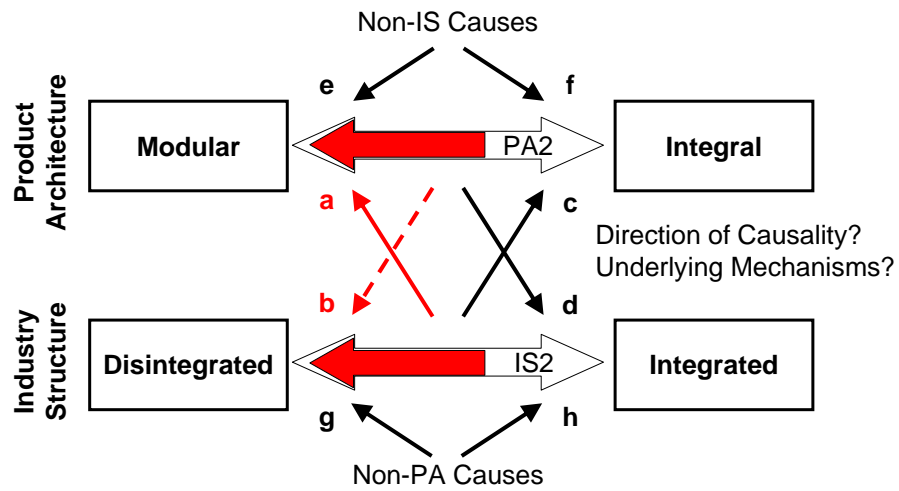
## The Puzzle: Three Questions

---

- **What is the Directionality of Product Architecture Change?**
  - **What is the Directionality of Causality between Product Architecture and Industry Structure Changes?**
  - **What is the Origin of these Changes?**
- 

© Sebastian Fixson

## The Situation – as mostly described



© Sebastian Fixson

## The Data: The Industry Before and After

Fig. A.1.1. Product Architectures and Market shares (Road 1984)

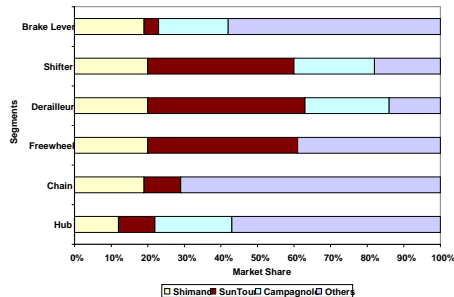


Fig. A.1.7. Product Architectures and Market shares (Road 1990)

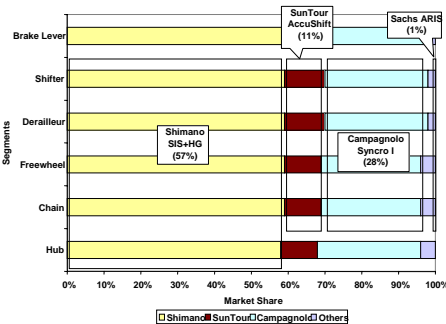
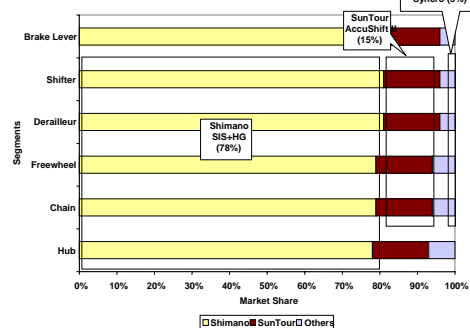
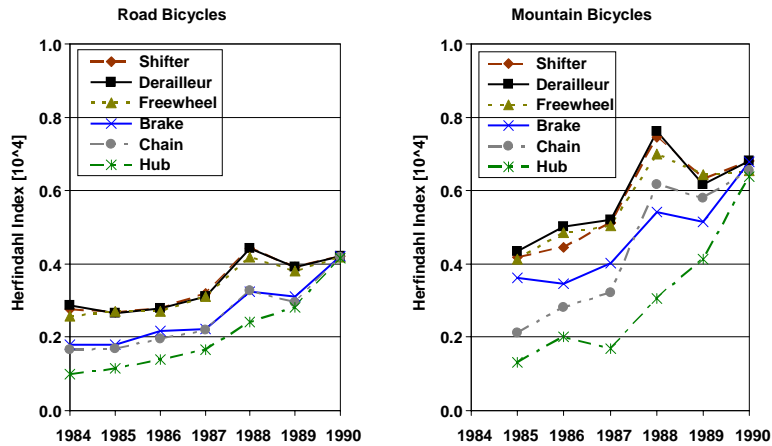


Fig. A.2.7. Product Architectures and Market shares (MTB 1990)

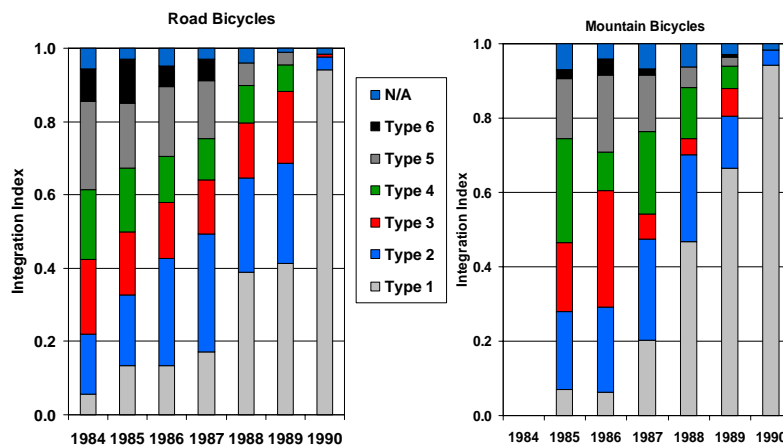


## Industry Data: Concentration within Bicycle Drivetrain Segments

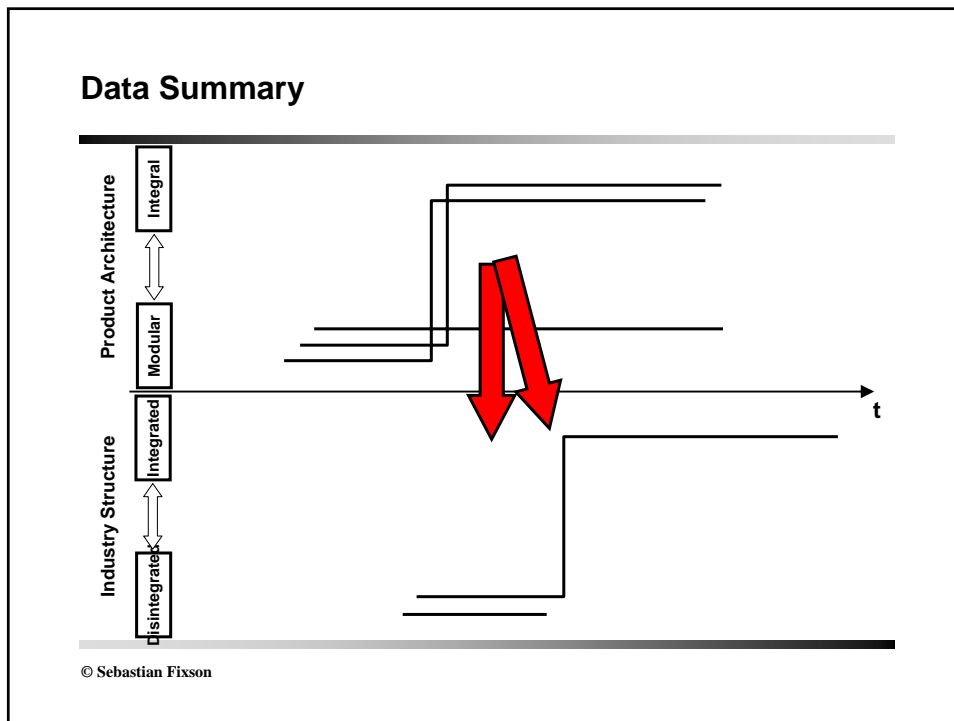
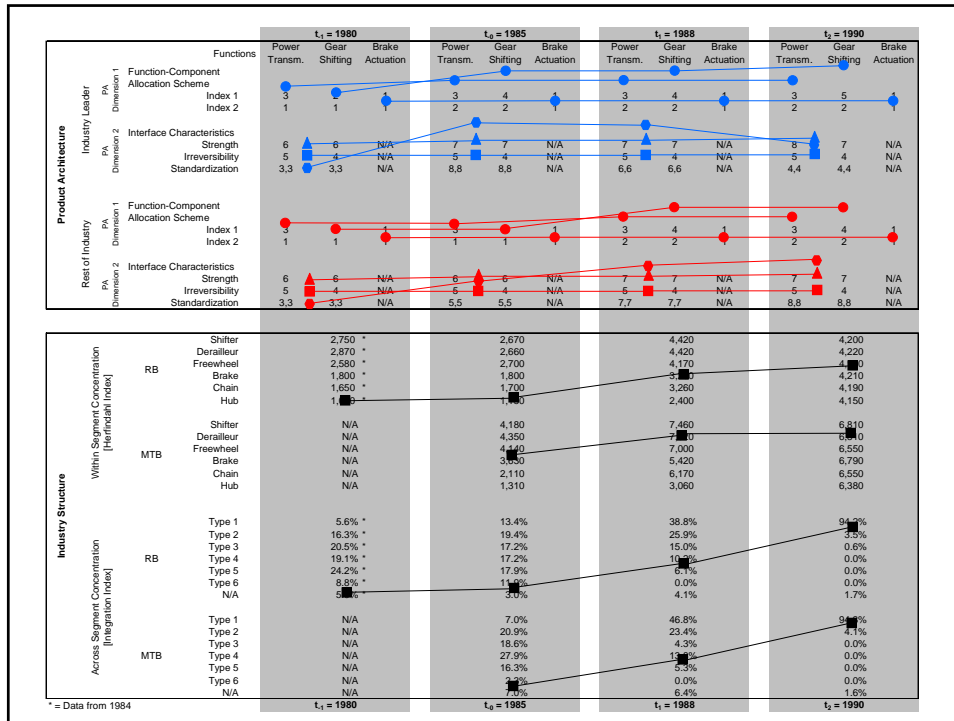


© Sebastian Fixson

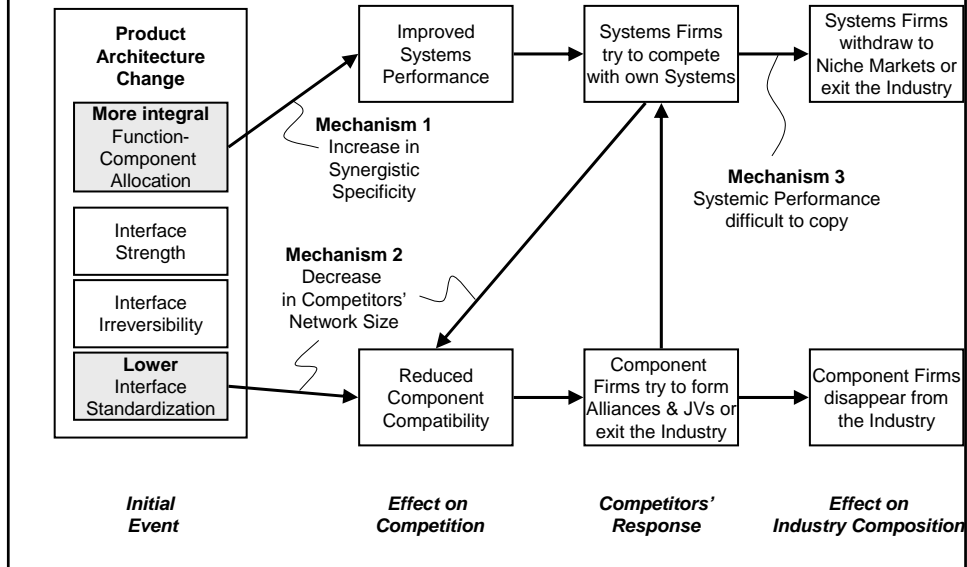
## Industry Data: Concentration across Bicycle Drivetrain Segments



© Sebastian Fixson



## The Analysis: Consequences of Product Architecture Change



## The Analysis: Our Interpretation

- Product Architectures can shift from (more) modular to (more) integral states (at least temporarily)
- If this shift is successful, it can have powerful implications on the nature of competition in an industry (and ultimately on the industry composition)
- It appears as if the existence of cross-module knowledge is beneficial to create integral (systemic) innovation

## The Outlook

---

- **Implications for Industry Studies Research**

- This is one powerful link between Technical Change (in PA) and Industry Structure (Industry Architecture)
- More Data needed to better understand Contingencies
- Importance of Measurements!

- **Implication for Firm Strategy**

- These Decisions are not 'only' Engineering Decisions, they are fundamentally Strategic in Nature!