The Concept of Change in XP: Kuhn vs Popper

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Background to Research

- Master’s Topic: “Karl Popper's Critical Rationalism as a Basis for Agile Software Development”
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• Thesis argues that many agile principles are strongly endorsed by Popper’s philosophy
Background to Research

- Master’s Topic: “Karl Popper’s Critical Rationalism as a Basis for Agile Software Development”
- Thesis argues that many agile principles are strongly endorsed by Popper’s philosophy
- Why Popper?
  - Leading philosopher of science in the 20\textsuperscript{th} century
  - Theories influenced diverse disciplines
  - Ideas concern not only scientific method but also democratic values and the “open society”
  - Two aspects, \textit{natural and social}, unified in single philosophy: \textit{critical rationalism}
  - Philosophy illuminates values and principles underlying contemporary software development
Agile Software Development

- Traditional methodologies unable to accommodate change during Internet era
- “Lightweight” methodologies emerged as a result
- Manifesto for Agile Software Development, 2001
- 4 central values, 12 supporting principles
  - “Responding to change over following a plan.”
  - “Welcome changing requirements, even late in development. Agile processes harness change for the customer’s competitive advantage.”
- Formation of The Agile Alliance with mission to promote agile values and principles
- Extreme Programming (XP) founded by Kent Beck: established popularity of “lightweight” methodologies
“Extreme Programming Explained: Embrace Change”

- “Stay aware. Adapt. Change. Everything in software changes: requirements, design, business, technology, teams, market time windows…”

- “Tools and techniques change often, but they don’t change a lot. People, however, change slowly but deeply. The challenge of XP is to encourage deep change.”

- Reconcile productivity and humanity

- Part 2 of second edition: Philosophy of XP

- Beck’s views changed between 1st and 2nd edition, arguably from Kuhnian to Popperian approach

- Yet annotated bibliography: Thomas Kuhn, *The Structure of Scientific Revolutions*
**Change** in Kent Beck’s Extreme Programming (XP)

- “Extreme Programming Explained: Embrace Change”
  - “Stay aware. Adapt. Change. Everything in software changes: requirements, design, business, technology, teams, market time windows. . . ”
  - “Tools and techniques change often, but they don’t change a lot. People, however, change slowly but deeply. The challenge of XP is to encourage deep change.”
  - Reconcile productivity and humanity
- Part 2 of second edition: Philosophy of XP
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- Can the philosophy of science illuminate Beck’s ideas of change in XP?
Theories of Scientific Methodology

- Bacon & Logical Positivists (induction and verification)
Theories of Scientific Methodology

- Bacon & Logical Positivists (induction and verification)
- Popper & Falsification (deduction)
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- Kuhn & Paradigm Shift (Scientific Revolutions)
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Theories of Scientific Methodology

- Bacon & Logical Positivists (induction and verification)
- Popper & Falsification (deduction)
- Kuhn & Paradigm Shift (Scientific Revolutions)
- Lakatos & Scientific Research Programmes
- Feyerabend & Relativism ("Against method" and "Anything goes")
Kuhn’s *Structure of Scientific Revolutions* (1962)

(1) \[ \text{normalscience} \rightarrow \text{crisis} \rightarrow \text{revolution} \rightarrow \text{newnormalscience} \]

- Normal science governed by single paradigm
  - lack of criticism of basic assumptions
  - science taught as dogma
- Puzzle solving activity governed by rules of paradigm
- Scientists ignore falsifying instances as “anomalies”
- When anomalies can no longer be ignored, a period of crisis emerges
- Paradigm shift i.e. one paradigm replaces another completely
- Paradigms are incommensurable i.e. cannot be compared
- Choice is irrational, hence relativism
- Paradigm Shifts in Cosmology
  - Ptolemaic: earth-centred
  - Newtonian physics: mechanistic
  - Einstein’s relativity: holistic
Popper’s “Critical Rationalism”

- Philosophy of Science: falsificationism and deduction
- Evolutionary Epistemology: problem-solving process concerned with continuous developments over time
  \[ P_1 \rightarrow TS \rightarrow EE \rightarrow P_2 \]
- Metaphysics: 3 worlds
- The Open Society: piecemeal vs utopian social engineering
## Kuhn vs Popper

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<td>Uncritical</td>
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Kuhn Applied to XP

- Kuhn popular during 60’s and 70’s amongst American students
- Seems to explain change from one software methodology to another: XP as paradigm shift
- 1st edition: Proper XP requires adoption of all XP principles
- Strict adherence to all XP principles is inflexible and uncritical within paradigm
- Suggests that change is not completely rational
- Criticism
  - Presumably Beck would prefer the adoption of XP to be considered rational
  - In reality, there are several competing software methodologies and paradigms
Popper Applied to XP

- Evolutionary epistemology accounts better for changes within XP “paradigm”
- Importance of criticism in XP
  - Test-driven development: search for potentially falsifying evidence
  - Collective ownership of code
  - Iterative and incremental approach to development: early error detection and elimination
  - On-site customer: promotes critical collaboration and error elimination through feedback
  - Pair programming: encourages falsificationism through a critical peer review process
- 2\textsuperscript{nd} edition arguably more Popperian: adopt XP principles incrementally rather than all at once
- Closer to Popper’s evolutionary approach than Kuhn’s adoption of an entirely new paradigm
- Approach towards adopting XP is evolutionary/piecemeal
Conclusion

• Beck was aware and influenced by Kuhn’s philosophy of science

• However, it is arguable that Popper’s philosophy more accurately accounts for change within XP

• Possible synthesis:
  ○ XP can be considered a paradigm shift
  ○ But transition can be considered more rational and evolutionary than Kuhn advocates
  ○ And activity of software developers within XP is more critical and rational than Kuhn would have allowed
Bibliography


• “Manifesto for Agile Software Development.” http://www.agilemanifesto.org

