

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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- Why Popper?
 - Leading philosopher of science in the 20th century
 - Theories influenced diverse disciplines
 - Ideas concern not only scientific method but also democratic values and the "*open society*"
 - Two aspects, *natural and social*, unified in single philosophy: *critical rationalism*
 - Philosophy illuminates values and principles underlying contemporary software development

Background to Research (cont.)

- 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

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
 - 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*

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 - 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*
- Can the philosophy of science illuminate Beck’s ideas of change in XP?

Theories of Scientific Methodology

- Bacon & Logical Positivists (induction and verification)

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- Feyerabend & Relativism (“Against method” and “Anything goes”)

Kuhn's *Structure of Scientific Revolutions* (1962)

(1) *normalscience* → *crisis* → *revolution* → *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

(2)
$$P_1 \rightarrow TS \rightarrow EE \rightarrow P_2$$

- *Metaphysics*: 3 worlds
- *The Open Society*: piecemeal vs utopian social engineering

Kuhn vs Popper

	Popper	Kuhn
Progress in science	Evolutionary	Revolutionary
Scientific transitions	Theories can be compared: transition is rational	No rational/logical explanation: akin to religious conversion
Purpose of scientific experiments	Refutation/falsification	Seek confirmations within paradigm
Truth	Objective: criticise theories	Subjective: by consensus
Scientific method	Problem solving	Puzzle solving
Activity of scientists	Scientists seek to refute individual hypotheses	Scientists seek to confirm system of theories (paradigm)
Critical attitude	Emphasises criticism	Uncritical

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
- 2nd 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

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