

Artificial Intelligence, Blockchain, e Criptovalute nello Sviluppo Software

Lezione 8: Change (in SW Development)

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Structure of the lecture

- Change (in Software Engineering)
- The experiment of Belyaev
- Understanding Change



Relevance of Change in Software Engineering

- Change is an overarching problem in software development given:
 - the infancy of the discipline
 - the uncertainty of requirements
 - the constantly evolving technology
 - the intrinsic lock-ins
- However, while there are:
 - technical approaches supporting change and
 - strong advocacies that change is essentialstill there is not an established approach to manage change into processes and people



Change Management in Software Engineering

- Preventing change via detailed requirements
- Anticipating change via, for instance, domain analysis and variation points
- Managing change, especially via maintenance
 - Corrective maintenance
 - Perfective maintenance and refactoring
 - Adaptive maintenance
 - Preventive maintenance



The concept of change in history (1/4)

- From a anthropological perspective, changing is an important ability of the humankind
 - the ability to “change” has allowed us to survive and prosper for millenniums.
- Change has been part of the culture of the human kind
 - the religion of the ancient Greece was nurtured by a constant change of the divinity and the humanity:
 - see for instance the μετεμψύχωσις
 - or the the Eraclitean statement πάντα ῥεῖ.



The concept of change in history (2/4)

- The same concept was present in the Roman culture, just think at the poet Ovid who wrote a poem about the always changing word, the Metamorphoses:





The concept of change in history (3/4)

- Several Eastern religions are rooted in the concept of circularity and permanent change
- Still, change is also present in western religions:
 - Ebraism is rooted in change, as exemplified by the multiple “Exodus”
 - Christianity has as a center on the μετάνοια (“metanoia”), see St. Augustin
 - in Islam also the concept of “Tawbah” تَوْبَة (“Tawbah”) plays an important role, together with repentance



The concept of change in history (4/4)

- Also several philosophers have interpreted the human life as a constant change, whether circular or evolutionary
- In the middle age we could remember, among many:
 - Gioacchino da Fiore (1135–1202) with, among other concepts, the theory of the **three ages**
- and then among many others:
 - Giovan Battista Vico (1668–1744) with the concept of the **historical cycles**
 - Friedrich Hegel (1770–1831) with the **phenomenology of spirit**
 - Karl Marx (1818–1883) with the **dialectical materialism** (with Engels)
 - Friedrich Nietzsche (1844–1900) with the **eternal return**



Change as a “magic” buzzword (1/6)

- It has been often used interchangeably with **renewal**.
- Using the positive connotation given to the term “change,” it has been used to pass *negative* concepts, as a kind of anchoring:
 - This has well been explained by Schopenhauer in his essay on the art of being right, proposition 12
 - “If the conversation turns upon some general conception which has no particular name, but requires some figurative or metaphorical designation, you must begin by choosing a metaphor that is favourable to your proposition. For instance, the names used to denote the two political parties in Spain, *Serviles* and *Liberales*, are obviously chosen by the latter. [...]”

Source of the content: <http://coolhaus.de/art-of-controversy/erist12.htm>.



Change as a “magic” buzzword (2/6)

- After Schopenhauer
 - This has been properly described in the blog of Sylvain Timsit
 - “Strategies of manipulations. [...] 6. Appeal to the emotion rather than to the reflection. [...]”
 - Indeed, this takes advantage of the typical heuristics of the human mind
 - Naom Chomsky has expressed a similar approach in his work, see for instance a collection of his essays: “Language and Politics,” edited by C. P. Otero

Source of the content: <http://www.syti.net/Manipulations.html>.



Change as a “magic” buzzword (3/6)

- Obama calls for renewal:



Source of the content:

<https://sojo.net/articles/transcript-obamas-2006-sojournerscall-renewal-address-faith-and-politics>.



Change as a “magic” buzzword (4/6)

- Renewal and change in South Africa:



Source of the content: <https://www.youtube.com/watch?v=sg5Wi3BFiWs>.



Change as a “magic” buzzword (5/6)

- Rinnovamento Italiano:



Source of the content: https://it.wikipedia.org/wiki/Rinnovamento_Italiano.



Change as a “magic” buzzword (6/6)

- Il bolscevico – Change Italy:



Source of the content: <https://www.calameo.com/read/000726878e48538138235>.



Beware of change and renewals!

- Change can be simply used as a buzzword to handle undesired actions
- Remember also some statements about change:
 - “If we want that everything remains as it is, we need to change everything,” Giuseppe Tommasi di Lampedusa in his roman “The Leopard”
 - “[the king] has avoided the civil war and has allowed to insert in the tired arteries of the parliamentary constitution the new, impetuous fascist flow, which has emerged from the war and has been exalted by the victory,” Benito Mussolini in his speech at the Lower Chamber of the Parliament, 1922



The focus of our work

- We have reviewed a few situations where the word “change” or his very synonym “renewal” could be found
- We will now pose the attention to a fundamental question:
 - Is change possible?
- And we will focus our analysis to a well defined context, the most challenging for changes:
 - Is change possible **in development processes?**
- *which amount to ask:*
 - Is it possible to **change how people use their individual and their collective minds** to develop software?
- *and also:*
 - Are **cognitive architectures immutable?**



The experiment of Belyaev (1/3)

- Researcher: Dmitry Belyaev
- Goal: to breed foxes with the behaviour of friendly dogs
- Location: Institute of Cytology and Genetics, Siberia
- Years: 1958 - now
- Structure
 - Foxes originally bred for fur were tested for friendliness toward the human being
 - just inserting a hand in the cage, nothing more
 - those who were friendly were kept and mated
 - this was repeated for generations after generations
 - the six generation provided a huge surprise

Source of the content: Lyudmila Trut, Lee Alan Dugatkin "Wild Foxes Can Be Transformed into Pets in a Few Generations," Scientific America, May 1, 2017 –
<https://www.scientificamerican.com/article/wild-foxes-can-be-transformed-into-pets-in-a-few-generations/>.



The experiment of Belyaev (2/3)

- At the sixth generation foxes appeared that had a very “dog-like” behaviour:
 - being very friendly to humans, and seeking their contact,
 - wagging tales,
 - whining and whimpering,
 - licking,
 - recognizing their names.



Source of the content and of the picture: Lyudmila Trut, Lee Alan Dugatkin “Wild Foxes Can Be Transformed into Pets in a Few Generations,” Scientific America, May 1, 2017 –

<https://www.scientificamerican.com/article/wild-foxes-can-be-transformed-into-pets-in-a-few-generations/>.



The experiment of Belyaev (3/3)

- and this is not the end:
 - the percentage of tame foxes increased generation after generation
 - after a while also the morphological features of the tame foxes changed:
 - floppy ears,
 - black and white colours,
 - bushier tails, and once
 - barked!

Source of the content: Lyudmila Trut, Lee Alan Dugatkin “Wild Foxes Can Be Transformed into Pets in a Few Generations,” Scientific America, May 1, 2017 –
<https://www.scientificamerican.com/article/wild-foxes-can-be-transformed-into-pets-in-a-few-generations/>.



Toward Cognitive Restructuring

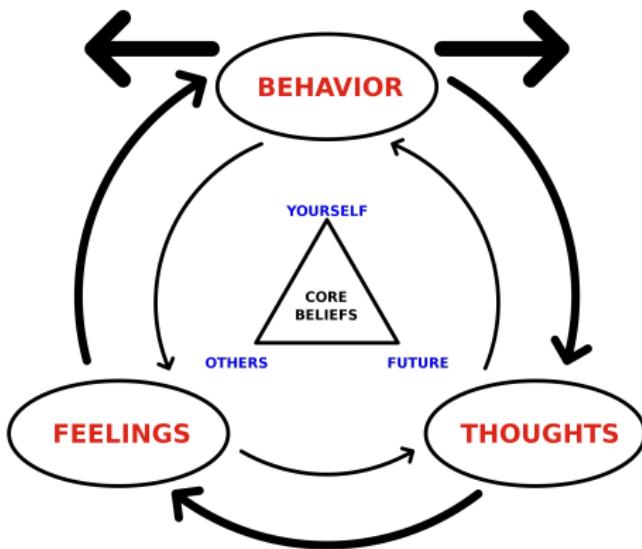
- How can we translate this into software engineering
- Psychology has focused on changing the behaviour of people for decades
- We have found that an approach for treating people could be effective also in enacting positive changes of processes
 - especially those related to agile methods, methods emphasizing cognitive architectures and collective intelligence
- Cognitive restructuring has been advocated as an approach
- Cognitive restructuring is strongly related to the dual impulsive/reflective model

Source of the content: https://en.wikipedia.org/wiki/Cognitive_restructuring.



Cognitive Behavioural Therapy (1/2)

- Cognitive restructuring is at the root of Cognitive Behavioural Therapy



Source of the content: https://en.wikipedia.org/wiki/Cognitive_behavioral_therapy.



Cognitive Behavioural Therapy (2/2)

- Centered on removing altered beliefs on the reality
- It is a talk therapy
- Based on the following steps (copied verbatim from wikipedia):
 - Assessment or psychological assessment;
 - Reconceptualization;
 - Skills acquisition;
 - Skills consolidation and application training;
 - Generalization and maintenance;
 - Post-treatment assessment follow-up.

Source of the content: https://en.wikipedia.org/wiki/Cognitive_behavioral_therapy.



Cognitive Restructuring (1/2)

- Cognitive restructuring focuses on eliminating problematic “**automatic thoughts**,” which we can consider kind of **heuristics**
- We can perceive here the presence of the dual model **Impulsive/Reflective**
- Four steps in cognitive restructuring
- (*Again copying almost verbatim from wikipedia*)
 - Identification of automatic thoughts
 - Identification of the cognitive distortions in automatic thoughts
 - Rational disputation of automatic thoughts with the Socratic method
 - Development of a rational rebuttal to the automatic thoughts.

Source of the content: https://en.wikipedia.org/wiki/Cognitive_restructuring.



Cognitive Restructuring (2/2)

- There is a taxonomy of automatic thoughts
- (*Again copying almost verbatim from wikipedia*)
 - Self-evaluated thoughts
 - Thoughts about the evaluations of others
 - Evaluative thoughts about the other person with whom they are interacting
 - Thoughts about coping strategies and behavioral plans
 - Thoughts of avoidance
 - Others
- Thoughts may be elicited and recorded via **Thought Records**

Source of the content: https://en.wikipedia.org/wiki/Cognitive_restructuring.



Example of “Thought Record” in CBT

THOUGHT RECORD					
Directions: When you notice your mood getting worse, ask yourself, "What's going through my mind right now?" and as soon as possible jot down the thought or mental image in the Automatic Thoughts column. Then consider how realistic those thoughts are.					
Date	Situation	Emotions	Automatic Thoughts	Alternative Responses	Outcome
11/1	<i>Partner came home from work and did not spend time with me before going to bed.</i>	<i>Sad – 90% Frustrated – 50%</i>	<i>My partner does not like talking or spending time with me anymore. (90%) {mind-reading}</i> <i>He must be starting to lose interest in me. (100%) {jumping to conclusions}</i>	<i>I have asked my partner if he has lost interest, and he denies it. (80%) {evidence}</i> <i>Partner was recently promoted, and he has been given more responsibilities than before, which has been stressful for him. (95%) {alternative explanations}</i> <i>If my partner has lost interest in me, there are things that I can do to rekindle that interest or move beyond the relationship. (90%) {implications}</i>	<i>Sad – 20% Frustrated – 10%</i>
(1) What is the evidence that the automatic thought is true? What is the evidence that it is not true? (2) Are there alternative explanations for that event, or alternative ways to view the situation? (3) What are the implications if the thought is true? What's most upsetting about it? What's most realistic? What can I do about it? (4) What would I tell a good friend in the same situation?					
Possible Distortions: All-or-none Thinking; Overgeneralizing; Discounting the Positives; Jumping to Conclusions; Mind-reading; Fortune-telling; Magnifying/Minimizing; Emotional Reasoning; Making "Should" Statements; Labelling; Inappropriate Blaming					

Source of the content: Ezawa ID, Hollon SD. Cognitive restructuring and psychotherapy outcome: A meta-analytic review. Psychotherapy (Chic). 2023 Mar 13, Fig. 1.



Effectiveness of Cognitive Restructuring

Forest Plot

Study name

Schmidt et al., 2019

Strunk et al., 2007

Gómez Penedo et al., 2020^a

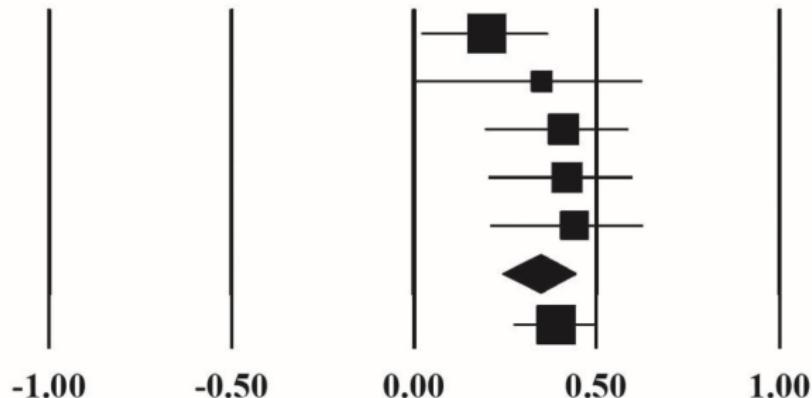
Gómez Penedo et al., 2020^b

Strunk et al., 2010

Total (random effects)

Ezawa & Strunk, 2022

Correlation and 95% CI



Source of the content: Ezawa ID, Hollon SD. Cognitive restructuring and psychotherapy outcome: A meta-analytic review. *Psychotherapy (Chic)*. 2023 Mar 13; Fig. 2.



Applying cognitive restructuring

- Cognitive restructuring is most effective if the target of it understand its cognitive model:
 - Frontal instruction
 - Active modeling
 - Role playing with feedback
 - Supervision
- Start with negative automatic thoughts, especially in specific situations
- Then, extend to core beliefs

Source of the content: https://en.wikipedia.org/wiki/Cognitive_restructuring.



FYI – Specific practices related to CR

- Helping identifying, challenging, and correcting wrong negative thoughts, and thus:
 - Treating several disorders, including depression, anxiety, social anxiety, obsessive-compulsive disorder, and posttraumatic stress disorder.
 - Applying it to foster cognitive change and subsequent symptom improvement
- Problems of biases with marginalized populations.
- Recall that the goal is **not to minimize existing threats** but rather **to get an accurate sense of what threats might be.**

Source of the content: https://en.wikipedia.org/wiki/Cognitive_restructuring.

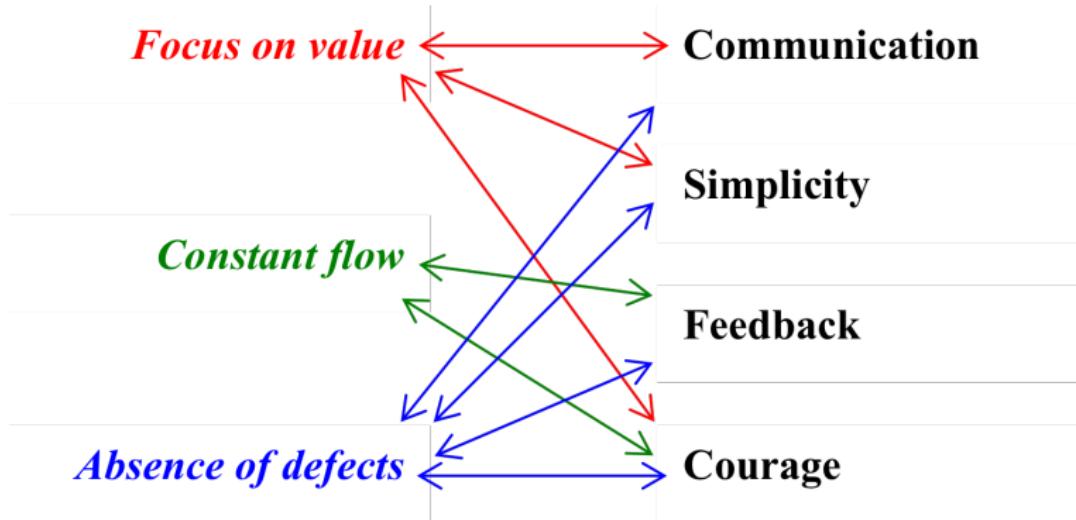


XP and Cognitive Restructuring (1/3)

- Extreme Programming (XP) is one of the **most relevant agile methods**
- We can clearly see a neat application of CR and CBT in its structure:
 - XP is structured in **Values**, **Drivers**, and **Practices**
- 4 **Values**:
 - Simplicity
 - Communication
 - Feedback
 - Courage
- 3 **Drivers**:
 - Focus on value
 - Constant flow of activities
 - No defects



XP and Cognitive Restructuring (2/3)





XP and Cognitive Restructuring (3/3)

Practices:

- Planning game
- Short releases
- Metaphor
- Simple design
- Test-driven development
- Refactoring
- Pair programming
- Collective code ownership
- Continuous integration
- 40 hours working week
- On-site customer
- Coding standards



Extreme Programming – Embrace Change

Extreme Programming Explained

Embrace Change

Kent Beck



ADDISON-WESLEY

Boston • San Francisco • New York • Toronto • Montreal
London • Munich • Paris • Madrid
Capetown • Sydney • Tokyo • Singapore • Mexico City

Source of the picture: Front cover of: Beck, K. (1999). Extreme Programming Explained: Embrace Change. Addison-Wesley Publishing Company.



Questions?

End of lecture eight.