How to Avoid I Never Would Have Thought of That?

The Joys and Sorrows of Diverse Teams

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Hypothesis

- Software development, in that it is partially about problem solving, benefits from a diversity of perspectives on the development team.

- This diversity of perspective includes the following aspects:
  - Cultural
  - Gender
  - Intellectual

- Exploiting this diversity requires strategies for balancing the need for efficiency with the need for innovation and creativity.

STATING THE OBVIOUS

- I can't know really what things are like in situations I can not be in or have never been in before…
  - Paraphrasing a male colleague "You have no idea how miserable all male teams can be".
  - How many Europeans in particular do not understand the racial dynamics in the US
  - How many Americans in particular do not understand the relationship between the English and the French
  - How many people in the developing world do not understand the notion of veterinary care for pets
  - How I will never know what it feels like to win an Olympic medal … in anything. ☺

- I can’t solve a problem or resolve an issue with a tool, technique, or process that I don’t know about or with a skill I don’t have.
  - I have no idea how helpful, say, quantum mechanics might be to me
  - I might eventually be trained to get something useful out of pictures
  - I seriously doubt I can ever really learn to draw
- Unlike the previous list, I can potentially do something about these – I can learn.

- I can't understand someone who is talking in a language I don't understand.
  - How many definitions of "vector" can you list?
  - I can barely understand Spanish. I am hopeless in any other languages except perhaps English.

- Again, I can improve on this.

SOME EXAMPLES WE CAN LEARN FROM

The Structure of Scientific Revolutions

- A scientific discipline includes
  - A vocabulary
  - A view of what constitutes appropriate problems to explore
  - A set of tools, methods and approaches to problems in the discipline
- Paradigm shifts occur when a sufficient weight of data contradicting current theories accumulates
- Very often the new organizing theory comes from individuals outside the discipline or new to the discipline
- Not surprising, since individuals in a discipline are trained in the same vocabulary, tools, and approaches.
- Plate tectonics is a classic example (training in Astronomy and Biology).

What about assumptions?

- Disciplines have a set of accepted facts, but these can change across paradigms.
- Within a discipline, scientists may not realize the extent of the assumptions underlying their problem solving.
- While disciplines are forming or re-forming, problem solving reverts (close to) first principles. Everything must be described and defined because there is no shared base of assumptions.
- Stereotypes and analogies serve a similar purpose to assumptions.
- Justifying their use and documenting when the situation deviates from the stereotype can help mitigate the risks arising from improper assumptions.

Inter-disciplinary teams

- Computational medicine, mathematical biology, computer animation
- All these draw from diverse intellectual traditions
- Becoming increasingly common
- There's much software developers can learn from these teams

And what about Genetic Algorithms and Programming?

- Genetic algorithms/programming
  - Characterize the desired outcome and then evolve the program
  - Evolution through selection, mutation and crossover operators
  - Careful design of the objective function can remove biases
  - Some evidence that pre-seeding answers has a negative impact
- Genetic algorithms/ programming examples
  - Wing design
  - Core quantum computations
- Both cases resulted in counter-intuitive solutions

ALL THESE APPLY TO TEAMS AS WELL

- We have different roles on teams for a reason.
  - Different activities require different skills – we get this part.
  - Even in the case of the more generalist Agile teams.

- We use different approaches for different problems.
  - Trying to reason with an adult is much more effective that trying to reason with a two year old.

- So how can we use these observations to improve productivity of software development teams?

Inter-disciplinary Research

- Inter-disciplinary research highlights the need for patience in resolving differences in vocabulary.
- True inter-disciplinary research is about advancing the scientific understanding of both disciplines through the collaboration, not just using computers to solve a biology problem.
- Conclusion: the different perspectives are peers in these collaborative teams.

Evolutionary Computation

- Genetic algorithms' and genetic programming's successes provide evidence that well-defined success criteria that do not imply implementations can result in novel solutions.
- Seeding the solution too early dramatically limits the search time but can also lead to local optima.
- The diversity of perspective and background of the team are analogous to the function the genetic operators play in genetic programming.
- Brainstorming and good team collaboration provides the equivalent of the environmental interaction.

Scientific Revolutions

- Scientific disciplines work because they have a shared context
- Innovation often results in the absence of too much shared context
- We must balance the efficiency of problem solving within a shared context with the creativity and inspiration arising from its lack
- The distance between the perspectives could not be too
- Conclusion: Team composition should reflect the problem dynamics

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Conclusion

- Characteristics to consider on teams:
  - Nature of problem to be solved
  - Degree of Innovation needed to solve the problem
  - Representation of diverse perspectives present
  - Past team history

- Resulting teams are fun places to be!

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No–one knows whether or not Hanna has any family now.

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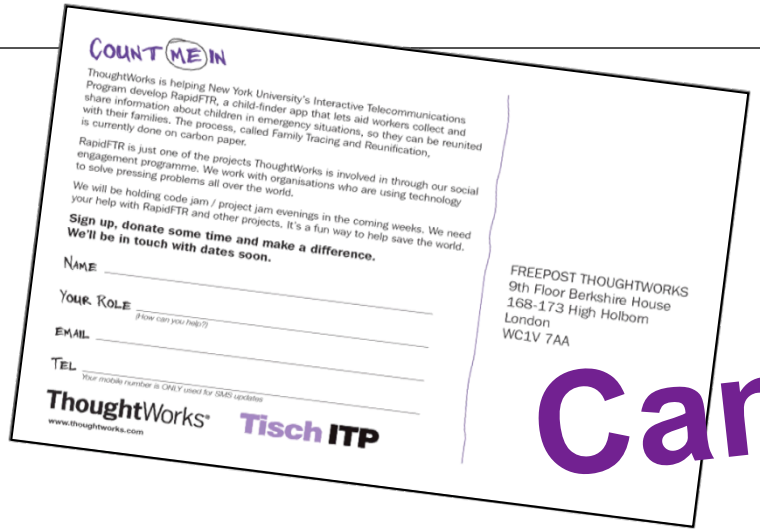
Tisch ITP

We thought there should be an app for that.



Can we count you in ?