The Hidden Perils of Addressing Complexity with Formal Process
A Philosophical and Empirical Analysis

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Formal Process *as* Technology

- Philosophy of Technology
  - Technology as more than means to end, not value neutral
  - Martin Heidegger – *The Question Concerning Technology*
    - Technology conceals or reveals the truth of being
    - Modernity characterized by *enframing* or the framing of all beings, including *human* beings, as resources-at-hand
  - Don Ihde – effects of technology on experience (phenomenology). E.g., microscope, telescope

- Labor Studies
  - Karl Marx – automation, deskilling, class conflict, power
    - Alienating effects of new technologies
  - Shoshona Zuboff – *informating*
    - New technologies can expand the scope of knowledge/ understanding of production process

Controlling Complexity with Formal Process

- Quality control paradigm from manufacturing
  - Statistical Process Control (SPC)
    - Product defects
    - Common/special causes of variation

- Software Development
  - Capability Maturity Model (CMM)

- Systems Engineering
  - Capability Maturity Model Integration (CMMI)

Research Questions

- If we consider CMMI, as a formal process, a technology, then what effects does its introduction have on the experience of work and labor relations?

- Setting
  - Defense contracting company
  - U.S. Navy Trident submarine launch control systems
  - Adoption of CMMI – product defects measured in peer reviews

- Ethnographic data gathered
  - At time of CMMI implementation
  - Then 5 years later

Analysis

- First phase themes
  - Adopted for legitimacy
  - No change to how work is done
  - Additional overhead to gather artifact
    - Potential to shift priorities away from primary goals
    - *"I would say that the drive for the artifact could compromise the quality of the product because you spend more of your normal working day producing artifacts rather than developing the system that would really work. And while you need a certain amount of best practice, there's a line. You can have too much of a good thing. You can have control for control's sake rather than having tools in place to enable engineers to work together more effectively."*

Analysis

- Second phase themes (5 years later)
  - Failed Product Design Review (PDR) with customer
    - "death by a thousand paper cuts"
    - Management attributed to lack of commitment and moving engineers frequently between roles (lack of understanding/ expertise)
    - CMMI introduction an alternative explanation?

Analysis

- Second phase themes (5 years later) (cont.)
  - Shift in breadth of understanding
    - *"There was a lot of cases back on some of the other programs where you had a software designer that, the only way he could write the software, because the spec. doesn't go down to the pimple on the gnat's butt like they are today for software requirements – he would have to deal with a level of interpretation, and they'd go back and talk to the spec. writer and it would all get interpreted eventually, and by the time you got done, if someone went back and asked that software designer, 'how does this work?', they could give you an answer almost as good as the systems engineer. I'm not sure you can do that today."*

Analysis

- Second phase themes (5 years later) (cont.)
  - Shift in responsibility/accountability from group toward the individual
    - *"If you have an artifact to produce and regardless of where your true commitment falls, when somebody draws a line in the sand and says you have to get something done by a particular point in time and then there's something else that really should be done by a particular point in time but doesn't directly reflect on that artifact, where do you place the priority? You prioritize based on what you're being measured to when push comes to shove. If what you really needed to do was take the time to work with somebody else to work out a critical interface, … let me back up. It promotes more self-interest. If individuals are being measured with milestones rather than measuring the crew, you know, based on what they really accomplish, people are going to act individually."*

  - Shift in credit/blame for success/failure from engineers to management
    - Formal process – resource management
    - Explicit non-reliance on "heroes"

Conclusions

- Philosophy of Technology
  - Formal process as a technology
    - <u>Worker</u>: Validation of modernity's shift toward framing workers (beings) as *resources* as formal processes are modeled after the quality control paradigm
      - Formal process strengthens this dynamic
    - <u>Product</u>: Truth of being is not an individual psychological construct about an existing object, but rather a social construct of technical, social, and political expectations of a system-to-be
      - Centrality of socio-technical *understanding*
      - Formal process shifts/narrows this understanding

Conclusion

- Labor Studies
  - <u>Deskilling effects</u> – formal process defines boundaries of knowledge/understanding instead of informal culture
  - <u>Alienating effects</u> – credit for success shifted away from the worker/group toward those who implement/own the formal process (i.e., management)

- Implications for framing <u>formal process</u> as an automating technology that makes machine-like assumptions about workers and therefore ignores the importance of the social facets of the production process (i.e., responsibility, accountability, status, and socio-technical understanding) in complex environments