QUALITY CONTROL IN LARGE SYSTEM DESIGN:

Human Fallibility as the Dominant Steering Factor

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Abstract

A massive literature discusses the design of large systems; be they information systems, health-care systems, control systems, etc. A predominant attribute of this literature is the emphasis on methodology for carrying out such designs, with occasional evaluations of the results in specific cases and recommendations for further work. Rarely is human fallibility even mentioned as a factor in steering the design processes. Instead the implicit assumption is present that the human being is competent to implement the methodologies. The predominant method for controlling quality is the well-known Six-Sigma method promoted as an extension of the Deming statistical approach to quality control.

Standing off to the side, so to speak, there is a modest literature based in philosophy, psychology, large-scale systems engineering test results, and one systems science offering which represents the point of view that human fallibility should be the dominant factor in quality control of system design. This point of view is elaborated, and it is suggested that it should be so regarded, or at least incorporated in system design.

Large-Scale System Design

By large-scale system design is meant the following: an action program initiated as a consequence of some envisaged problematic situation ***S**,* leading a group of people to identify a set ***A*** of action options chosen to resolve a set ***P*** of problems, all of which are anticipated to occur in the future, in the absence of any appropriate action program. Implicit in this definition is the view that if the set ***P*** is properly defined, and if the action options ***A*** are well-chosen, those options will be carried out, and will be adequate to resolve the problematic situation ***S***, thereby justifying the system design ***D***.

In short, large-scale system design is the search for ***D{P,A}*** to resolve ***S***. With this curt language, it is possible to discuss human fallibility both as a qualitative factor and as a quantitative factor, involving some modest precision.

Human Fallibility

The subject of human fallibility can be discussed under these headings as origins:

- Philosophy
- Psychology
- Experimental results from large-scale systems engineering
- The aggregation and integration of the foregoing in a form of systems science (Warfield, 2006).

Philosophy. Two philosophers have emphasized fallibility as a human trait: Charles Sanders Peirce and one of his admirers, Sir Karl Popper. Both of these philosophers are highly regarded as philosophers of science. Peirce listed the following as what amount to obstacles that are placed on the way to arriving at proper results, and these obstacles can be seen as manifestations of fallibility:

- Blocking inquiry–by whatever means

- Asserting that some proposition is absolutely certain
- Asserting that something can never be known
- Asserting that something is so fundamental that it need not be explored more deeply
- Asserting that some idea has attained its final and perfect form
- Allowing the control of the scientific enterprise to become subject to direction from an outside source

Of these, today it appears that the last one is most prominent. A number of small societies have formed that have essentially cut the links to the scientific heritage. These may be called "paradigm villages". Typical examples are those societies based in cybernetics and systems engineering. Each rejects by implication the concept of hypothesis-based investigation and pays, at best, lip service to the scientific tradition. The cybernetics societies seek to maintain academic status, while the systems engineering societies seek to promote and perpetuate very large government programs. Word banditry, i.e., language pollution, and linguistic control, e.g., "systems of systems", are heavily used to sustain or enhance individual and group status. Continuity of logic is foregone, since it is impossible to sustain in an environment that foregoes scientific foundations.

Psychology. Empirical studies of human behavior in the second half of the 20th century have demonstrated behavioral pathologies which can be thought of as lying in a nested arrangement

{organization{group{individual}}}

so that *the individual behavioral pathology propagates into the group and both of them propagate into the organization* (Warfield, 2002). These pathologies are all symptomatic of human fallibility. The scholars who contributed to the nature of these pathologies, and citations to their work, are pictured and identified, respectively, in Appendix 1 of (Warfield 2006).

Experimental Results from Large-Scale Systems Engineering. The reasons for the failure of large-scale systems engineering designs were studied empirically by Dr. George J. Friedman (Warfield, 2002), and demonstrated to lie within the domain of the empirical studies from psychology.

Aggregated Results. The foregoing components have been aggregated into an introduction to systems science (Warfield, 2006). A highly-detailed example of the successful design of an enterprise information system illustrates the means of overcoming human fallibility by incorporating sensitivity to human fallibility in the science and, more specifically, into the action component of the science called The Work Program of Complexity (WPOC) (Staley and Warfield, 2007), formerly Interactive Management.

The WPOC is intended, among other things, to work against the most common eruption of human fallibility: people relying on individual intuition, who have attained the role of public intellectual in positions of high authority, who take actions which, had they been based in sound analysis, would involve many more variables than the human mind can encompass.

Prevalent Quality Control Activities

The widely-used quality control procedures known as Six-Sigma (cf., e.g. Wikipedia) represent a typical example of a practice that is based in pseudo-science. This practice begins at a distance remote from scientific foundations, but appears to be scientific in its use of statistical methods.

As the comprehensive design example (Staley and Warfield, 2007) demonstrates, to construct a design which will last, it is most appropriate to anticipate the problems that the design should resolve; and in order to do this, it is best to involve a widely-representative group of people with a panoply of experience in defining those problems. Then those people should be involved in choosing the options that will constitute the design to resolve those problems. Once those activities are carried out, the numerical values to be sought may well involve Six-Sigma, but the most important design factors may not even be quantitative at all; as the design practice may bring out. Hence the Six-Sigma activity may only account for a modest portion of the quality control practices. Regrettably, overemphasis on Six-Sigma may provide a false sense of security, where unwarranted. Emphasis on Six-Sigma does nothing to draw out the relative proportion of a design that is dependent for quality upon the absence of human fallibility, but rather appears to assign the entire onus of quality upon meeting quantitative measure during manufacturing operations.

Summary

Quality control in system design is dependent on human behavior. It is easy enough to imagine that quality will depend on two factors: human fallibility and control of tolerances. Present large-system design practice typically ignores human fallibility and focuses on Six-Sigma. By ignoring human fallibility, design quality leaves already well-documented human fallibility as a chance factor in large-scale system design, with the documented result that cognitive factors are the major cause of large system failure. A well-documented system design that incorporates recognition of human fallibility in design practice, using the Work Program of Complexity, has persisted in enterprise use since 1996, testifying to its efficacy, while design practices that do not follow this regimen are still described in today's literature as unsuccessful.

References

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