

Software Based Disruptive Change Initiatives Require a Culture of Quality

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Abstract

The theme for this year's conference is 2020 vision. Like in optometry, software quality relies on standards and best practices to guide improvement. Frameworks such as Agile, Devops, CMMI, ITIL, ISO 12207, and the PMBOK act like corrective lenses to provide sound development life cycle processes and, in theory, enable better software solutions to be delivered. However, frameworks and rubrics that are designed *a priori* often are deficient in addressing the nuances of emergent phenomenon and constructivist meaning in complex human endeavors, especially in large enterprises. This deficiency may lead to failure of an enterprise project, with the root cause ultimately traceable to implicit bias of the participants involved.

This paper treats software development as an emergent phenomenon and explores how the meaning of quality is dependent on cultural constructs and communities of meaning. The authors believe software emerges in reflection of an organization's culture, engendering a meaning of quality that is contextually dependent on that organization.

As part of Oregon state government's effort to respond to the COVID-19 emergency, the authors have observed the interplay of cultural differences and diverging meanings of quality across the State's different agencies. We conclude that the meaning of quality exists in the context of a community of meanings, and so quality cannot be disassociated from its social environment and context. This conclusion has important ramifications for software quality management, including Agile, and the value of diversity and inclusion.

Biography

Jack McDowell is an Operations & Policy Analyst for the State of Oregon's Statewide QA and E-Government Program. Before this, he was a web developer and the chief editor of a community newspaper in Arlington, Virginia. He was born in Buenos Aires, Argentina where he lived before attending college in the US. He holds a Master's degree in political science from the University of Oregon and a certification in ITIL.

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1 Introduction

The meaning of software quality evolves through time, and many of the systems that were considered state of the art when they were released are now unable to meet business needs. This paper treats software development as an emerging phenomenon and explores how the meaning of quality is dependent on cultural constructs and communities of meaning (Cohen 1989). In a way, quality is existence driven, existing in a time and place, and therefore abstracted frameworks (e.g. Agile, Devops, ISO 12207, ITIL, etc.) or quality metrics (e.g. defect count) and the emerging quality assurance tools which rely upon them such as Test Driven Development and Artificial Intelligence, cannot succeed without first encountering the dimension of culture and the meaning of quality within stakeholder units.

This paper seeks to build on concepts of organizational dynamics and cross-cultural understanding by addressing how software can emerge in reflection of an organization's culture, providing a meaning of quality that is contextually dependent to that organization. While QA in general in the last decade has moved towards Test Driven Development (TDD) and Automation, most recently employing Artificial Intelligence, Quality Assurance in general determines the success of a software product based on whether it meets business needs and meets specifications (Verification and Validation). These criteria are traditionally pre-determined at the outset of a project, setting the specs to which a project must conform. These criteria are then used for estimating, budgeting, planning and ultimately accepting a system. This paper aims to disrupt our understanding of project success and the meaning of quality by expanding our understanding of success to include additional scope. The authors argue that a project cannot be understood independent of its cultural and linguistic environment and that quality is therefore intricately linked to these intangible variables. This paper uses an ontological frame to explain how communities of meaning affect quality, provides examples of situations where communities of meaning affected project outcomes, and provides suggestions for improving inclusivity and therefore project success.

As part of Oregon state government's effort to respond to the COVID-19 emergency, the authors have observed the interplay of cultural differences and diverging meanings of quality across the State's many agencies during the state's response. We conclude that the meaning of quality exists in the context of a community of meanings, and therefore quality cannot be disassociated from its social environment. This conclusion has important ramifications for quality management with respect to diversity and inclusion.

2 Creating meaning through language

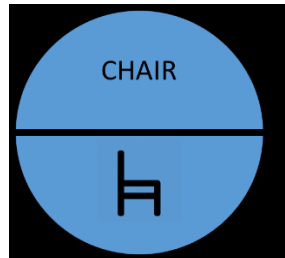
The history of quality assurance treats quality as a measurable and objective thing. Errors and deviations can be measured, modeled, and removed increasing product quality. In effect, much of the quality assurance literature has focused on these types of defect eradication mechanisms, from six-sigma, the Demmings Cycle, to the Toyota Production System. By nature, these models assume that there is an ideal end state to strive towards. For example, the Demming Cycle (Plan, Do, Check, Act) which is at the core of many quality improvement frameworks requires an evaluation (Check) to verify whether a change resulted in an improvement.

The idea that there is something to strive towards, an idealized goal, has its roots in metaphysical concepts dating back to Plato's allegory of the cave, whereby the observable world is a mere reflection of their true and perfect forms. This metaphor, which sets the foundation of western philosophy and culture is the foundation of the western claim to reason. As Jaques Derrida explains, metaphysics is a "white mythology which assembles and reflects Western culture: the white man takes his own mythology (that is, Indo-European mythology), his logos-that is, the mythos of his idiom, for the universal form of that which it is still his inescapable desire to call Reason." (Derrida 1974).

This claim to reason by western thinkers permeates the world of philosophy to our everyday world, and necessarily influences our understanding of "Quality" and the related discipline of "Quality Assurance". For example, when we attempt to produce widgets to a six sigma process, meaning that 99.99966% of all

widgets will conform to an expected outcome, we are presupposing that the expected outcome is an ideal and definable one.

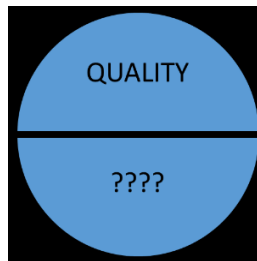
Things to be produced, be they widgets or software, are necessarily described through language. Suppose that instead of widgets, we were attempting to produce chairs; the signifier (word) would be chair, which would be tied to an idealized type of “chair” (object) (Saussure 2011).



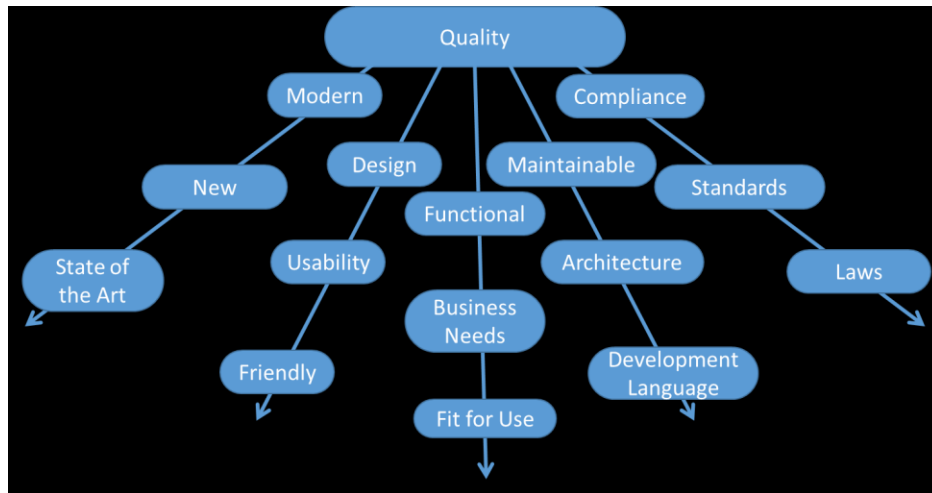
When we think of the quality of a “chair”, we imagine something with four legs, a back, a seat rest, etc. If we were trying to improve the quality of a chair, we would make sure that our chairs were consistently produced in a manner that meets the ideal definition of “chair”. Likewise, when we look at error QA frameworks, these are designed to measure deviation from the standard. In our chair example, if we used six-sigma, we would expect that 99.9999% of chairs produced would have four legs, a back and a seat rest, etc.

However, one can already start to gather that different people have ideal referents for chairs. Some may think that a simple wooden chair is an ideal, some may prefer a more padded office chair, and others may consider a three-legged stool to be the ideal type of chair. That is to say, even with a most basic example of a chair, it would be impossible to create a “quality checklist” that would create a universal chair. These differences may be cultural in a broad sense, or dependent on our experience, such that an office worker will think of an office chair while a waiter will think of a dining chair as their ideal type.

If we think of more abstract concepts such as quality, one finds it harder to even imagine a “thing” that the word quality refers to:

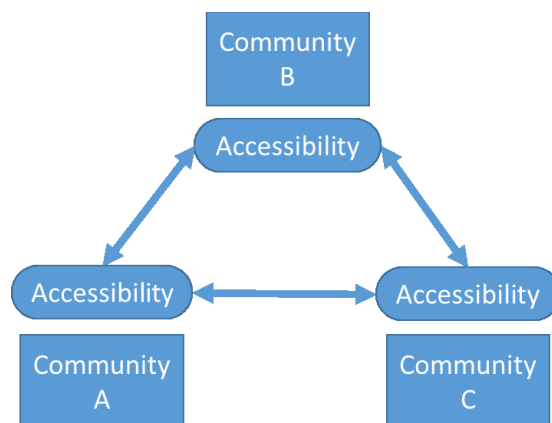


Quality is an abstract concept that can mean a multitude of things, and therefore can be better understood as a chain of signifiers, that is, referent words without a referent thing:



In the diagram above, we can see that each word is related to a different word, without necessary reference to a thing. These words in turn have different meanings depending on the observer. In the words of Derrida, “Speaking frightens me because, by never saying enough, I also say too much. And if the necessity of becoming breath or speech restricts meaning-and our responsibility for it-writing restricts and constrains speech further still” (Derrida 2017). Words are inherently imprecise not because their definitions may vary, but because language itself conjures a chain of related meanings. In speaking, this may be mitigated through conversation, but in written language, such as written requirements or standards, the original meaning is necessarily lost by the distancing between the author and the reader.

If we take the concept of “Accessibility”, which the State of Oregon treats as a website that meets or exceeding WCAG AA standards. While this standard provides an actionable “ideal” set of prescriptions to strive towards, it does not account for diversity of culture and experience. One of the glaring issues with the standard is its Anglo centrism, which treats accessibility based on color contrast, font size, screen reader optimization, etc. Absent from these guidelines are inclusionary experiences and in particular language access. This in turn results in a myopic view of accessibility, which may result in websites that are considered accessible and yet are unreadable by different communities.



People understand their world through linguistic-cultural frames (Fish 2003). We call these frames “communities of meaning”, as they can encompass groups that traverse or intersect national or regional boundaries. For instance, an international maritime lawyer in China and another in Argentina may share a community of meaning around maritime law, where certain concepts and understandings will be well

defined. However, these two individuals will most likely have a different cultural understandings related to their specific communities outside of their shared world view.

The hybridized world in which we live adds an additional layer of complexity, in that to be Chinese or to be Argentine are rarely definable concepts. Consider Gloria Anzaldúa's description of the new mestiza, who learns to be an Indian in Mexican culture, to be Mexican from an Anglo point of view. She learns to juggle cultures. She has plural personality; she operates in a pluralistic mode" (Anzaldúa 2012). The result of these cultural interactions, of mestizaje, is the creation or elevation of communities of meaning. As we become more distant from our mono-cultures, be they Anglo-Saxon, mainland Chinese, etc., we instead form cultural hybrids through our lived experiences. As such, our being-in-the-world evolves, and so do our understandings and values.

While these concepts of thinking through the world through language may have appeared irrelevant to Software Quality, a discipline that strived for measurement and objectivity, we have already seen a striking number of instances where language has adapted to our changing cultural norms. In 2020, the Information Technology community has come to grip with the lack of inclusion in its discourse, in particular the use of the word "Master", such as Scrum Master (Agile), Master branch (git), or Master bedroom (NMLS). Traditionally these instances of the word Master have had a specific contextual meaning. The recent trend, as of mid-2020, to rename many of these instances of the word master to something more universal highlights the importance of this type of thinking in the modern era.

3 Applying the concept of communities of meaning to Software Quality

In their 2019 paper, "Software Based Disruptive Change Initiatives Require a Culture of Quality", Kwong and McDowell provided a framework which highlights the amplification of software risk as uncertainty increases. In this model, we identified three principal scenarios that present increasing uncertainty potential, from simple projects with a well-known to-be state (Scenario 1) to complex project with unknown and unstable to-be states (Scenario 3). While these models captured the perceived complexity of a project from a technical perspective, they do not account for cultural effects.

Software development has not evolved in a vacuum, but in response to the Zeitgeist through numerous paradigm shifts (Kuhn 2012). That is to say, an unemployment insurance system written in COBOL was possibly a huge success when released twenty years ago but is no longer able to adapt to the changing environment of Covid-19 and therefore fulfill its basic mission of providing unemployment assistance.

Expectations related to software development are the groundwork for defining requirements, and these definitions may mean different things to different communities, as with our example of a chair. In the authors' experience, they have observed that cultural understandings within communities of meaning can affect the meaning of quality and the success of a project to a greater degree than typical known risks.

There has been no greater recent coming together of "communities of meaning" in the State of Oregon than the COVID-19 pandemic. In the state of Oregon, the Office of Emergency Management (OEM) and the Oregon Health Authority (OHA) led the response to the crisis; two dissimilar organizations in almost every way. The Oregon Health Authority is led by a culture of providing benefits to the residents of Oregon and is led by experts in Public Health; it is a well-funded agency with broad autonomy within its scope that often leads change within the state. The Office of Emergency Management is a small agency that reports to the Oregon Military Department and is therefore used to working by following the chain of command; most of the crises that the OEM responds to are predictable and recurring emergencies, such as wildfires and floods.

COVID-19 upended the typical emergency response paradigm by placing two agencies in charge of the response, due to the health related nature of the response. With these two disparate agencies also came

along disparate information technology challenges. OEM was used to thinking of information technology as a means to run its internal response, such as ensuring that wildfire fighters had access to communications and that the public could visualize fire progress. OHA on the other hand, in large part due to HIPPA regulations, was used to thinking of Information Technology as a means to assess disease as a way to create public policy.

COVID-19 presented a challenge in that the role of IT needed to satisfy both the traditional internal needs of these agencies and the needs of the public.

4 Websites, Masks, and the Meaning of Quality

The standard COVID-19 dashboard became the ARCGIS Dashboard created by Johns Hopkins University (COVID-19 Dashboard). As such, most states modeled their own websites based on this dashboard. However, the Johns Hopkins dashboard was never meant as a tool of public policy, nor as the standard COVID-19 reporting (Swenson 2020), it just happened to be the most reliable source at a time when data was sparse. From a quality standpoint, we can consider many possible issues with the Dashboard, such as the vast amounts of unqualified data that provide difficult interpretation to the layperson, a lack of mobile responsiveness, the alarmist color scheme, and the list could go on depending on one's perspective.

The State of Oregon rolled out a similar dashboard through the Office of Emergency Management for tracking COVID-19 cases and the distribution of masks, gowns, and other personal protective equipment.

The Oregon Health Authority on the other hand developed a strong social media campaign in order to communicate with the public on the public's terms. Their campaigns were multilingual and included plain language infographics to inform the public. However, where the Office of Emergency management attempted to put out as much information as possible, OHA was much more guarded in order to avoid running afoul of HIPPA or creating more public uncertainty.

Why would two agencies, responding to the same pandemic, have such different responses and understandings of quality? The answers lie in the organizational culture of each responding agency. OEM approached pandemic as a logistical problem, and evaluated its response based on their ability to execute logistically and provide this type of information to the public. OHA on the other hand approached the problem as a communications task and measured their success by analyzing customer engagement and social media feedback.

This paper does not aim to pass judgement or to indicate whether one type of response is better than the other, but to illustrate how "communities of meaning" can set a path and define the meaning of success based on the cultural context of an organization or group. In other words, from the perspective of OEM or OHA, both of their responses can be viewed as a success.

5 Diversity and Inclusion as a means to improve software quality

A "chair" becomes a "chair" when the observer believes it to be one, just as software is of quality when it is observed to meet certain requirements. The problem with quality in information technology is that the dominant paradigms have been created by a largely homogenous group of people, who approach quality from their own discursive "communities of meaning". When 17 white men created the Agile Manifesto in 2001, the idea that SCRUM as the practice of Agile would use terms such as "Master" to define what is a de facto project manager most likely did not raise any eyebrows.

Strategies for improving software quality include understanding the limitations and biases of the frameworks and SDLCs that are used, ensuring that all stakeholders are included in project planning and

requirements gathering, and creating “intersubjective moments” where people from different backgrounds and with different roles can express their opinions regarding their understanding of quality. By creating “intersubjective moments”, where people of from different “communities of meaning” come together to envision the best ways to solve problems across communities, a more inclusive meaning of quality can be achieved. Having people from different backgrounds and communities come together to help guide project requirements and the meaning of success, can reduce the quality challenges associated with divergent understandings of quality.

As the IT world reckons with its Anglo-Saxon roots, it is important to recognize that this is not just an opportunity to use politically correct language. It is crucially important to reflect on the assumptions and, thus, the regime of validity of the guiding frameworks that practitioners take for granted; paying close attention to implicit biases that tend to distort perception and judgment.

6 Implications for Software Development Lifecycles

The questions that we have raised so far regarding the meaning of quality have significant implications for SDLC. If we think of software as building a house, where a series of steps must be completed sequentially, such as planning, foundation work, general construction and finishing, it would be clear that a culturally unaware initial step would create a path dependency which would require significant rework in order to change.

Under the waterfall model, requirements set the foundation for design and implementation, and are then used to validate the quality of the work. Much like building a house, or a chair, if the requirements for developing software are defined for a specific community of meaning, they may be misinterpreted or reinterpreted by developers, testers, or users. For example, to require that a software have a “modern look and feel”, or allow for “ease of login”, are prima facie clear requirements. However, these requirements are clear to us as individuals in a community only because they work as a metaphor in our own understanding. A “modern look and feel” will quickly elicit vivid imagery in the mind of the reader, which upon reflection the reader will come to realize is based upon his or her understanding and experiences.

In order to minimize these miscommunications, the waterfall model has been largely supplanted by agile methodology, which seeks to place the developer in closer proximity to the product owner, and in SCRUM practice goes to pains in order to remove the appearance of formality by renaming the project manager role as a Scrum Master. Although these changes are meant to produce software that more closely approaches the desired understanding of quality, even agile falls short of this task on its own.

6.1 Implications for Agile

The authors of the Agile Manifesto assumed good software developers working in close proximity of well-meaning business users would lead to high quality software. This is true if and only if the following are true:

- developers are not more driven by the profit motive than quality;
- business users embrace change and are empowered to represent the business in bringing about change;
- stakeholders value the benefit of transformative change over potential loss of influence and power after such change.

The authors of the Agile Manifesto likely assumed good software developers would naturally work for good, thoughtful development managers. However, real organizations are imperfect with the effect of culture – organizational and national culture – constantly exerting its “invisible hand” of influence (Qiao 2018). Following our reasoning that meanings are socially dependent and that communities of meaning affect our understanding, the authors have observed the following consequences for Agile practitioners are:

- Organizations or cultures with high power distance between knowledge workers and their management may self-censor ideas. In Chinese and East Asian cultures, it may be unreasonable to expect knowledge workers to openly question their management in public forums, especially in front of contractors.
- Loyalty to the team or the collective and associated “group think” may drown out individual insight. In Chinese and East Asian cultures, knowledge workers may also be expected to make personal sacrifices to meet team objectives such as deadlines, potentially making it difficult for knowledge workers to question unrealistic timelines set by coworkers’ consensus.
- Managers may exploit power distance and team loyalty to take advantage of knowledge workers by adding new scope without increasing development hours. This effectively imposes longer work hours for the same number of workdays.

7 Conclusion

Quality is inherently value(s) driven, in that our values, and the values of our communities of meaning define what Quality is and therefore how Quality Assurance is to be undertaken. It is not enough to tokenize diversity into our existing paradigms. The paradigms themselves may need to be disrupted in order to truly leverage diversity and inclusion. By recognizing inherent biases of our own communities and the frameworks that we preach, a more inclusive meaning of quality can emerge.

The tension between inclusive discourse and power dynamics is one which is difficult to resolve (Kelly 2010), and one that is beyond the scope of this paper. It may be tempting to describe the changes that we’re observing in today’s information technology world with the rise and diffusion of “politically correct” speech as a result of changing power dynamics in the world of IT. The idea of understanding these changes or tensions through power dynamics is not inherently new or western, but the idea of a zero sum outcome is.

In Chinese philosophy, Mengzi (or Mencius, 孟子) believes that human nature is inherently good in the absence of influence by upbringing or environmental factors (人之初, 性本善). Xunzi (荀子), on the other hand, believes that human nature is inherently bad or evil and requires moral cultivation to tend toward good (人之初, 性本惡). Both Mengzi and Xunzi would agree that human beings and human endeavors have the capacity or propensity for good. However, the path or process toward good (or away from evil) would be qualitatively different in the two worldviews (Xunzi 2004). Chinese culture understands the balance and limits of the tension created by a thesis and antithesis, and acknowledges the interplay and inseparability of both extremes as a dichotomy that constantly influences individuals or groups. Inherent to any paradigm shift, or moment of synthesis, is a linguistic interplay which necessarily causes a *mestizaje* of meaning.

As the hegemonic culture, American thought and value systems are proselytized across the world influencing information technology paradigms. In the American paradigm, the meaning of success is meant to be defined and measurable, with a single meaning of truth. As such, even the most cutting edge quality frameworks rely on known and expected outcomes which the software is tested against. In this paper, we have challenged this dominant paradigm, and demonstrated how even the most well-meaning frameworks are necessarily a reflection of dominant American thought. The drawbacks of these Anglo-centric frameworks are numerous, in particular since they do not translate well across cultures, and may produce suboptimal outcomes when software development or software products traverse different cultures and communities of meaning.

Through their practical experiences, the authors have observed how communities of meaning shape understandings of success, and how apparent clear requirements and missions inevitably cause mis-communications, in particular when homogeneous communities of meaning are driving projects. We believe the interplay of competing factors and their dynamic equilibrium and harmonization that we have described have important implications for software quality. Although mis-communication and divergent

understandings can never be truly resolved, inclusion and diversity can act as “corrective lens” for the meaning of quality.

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