Elicit Service Customer Needs

Using Software Engineering Tools

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Abstract

Recently, Quality Function Deployment (QFD) has been augmented with new methods to enhance its front end power. Many recent extensions to QFD focus on better prioritization of customer requirements, but not as much attention has been paid to more systematic ways to define those requirements in the first place. This can be especially problematic for service organizations whose product is highly transitory and people dependent. Since service consists primarily of processes, the author has been exploring other process intensive fields such as software engineering for more systematic techniques. This paper looks at use of the State-Transition Diagram, Data Flow Diagram, Event Table, and Event Tree to better define service customer needs. Keep in mind, the goal is not to depersonalize or mechanize service providers, but rather to use the process analysis power of these tools to enhance understanding of how customers interact with providers and how they make buying decisions. Examples are included.

Key words: QFD, Service Quality, Software Engineering, State Transition Diagram, Data Flow Diagram, Event Table, Event Tree.

Introduction

Quality Function Deployment began more than twenty years ago in Japan as a quality system focused on delivering products and services that satisfy customers. To efficiently deliver value to customers, it is necessary to listen to the "voice" of the customer throughout the product or service development process. The late Dr. Shigeru Mizuno, Dr. Yoji Akao, and other quality experts in Japan developed the tools and techniques of QFD and organized them into a comprehensive system to assure quality and customer satisfaction in new products and services [Mizuno and Akao 1994, Akao 1990].

In 1983, a number of leading North American firms discovered this powerful approach and have been using it with cross-functional teams and concurrent engineering to improve their products, as well as the design and development process itself [Akao 1983, Sullivan 1986, King, 1987]. Service organizations have also found QFD helpful. The author used QFD in 1985 to develop his Japanese translation business, **Japan Business Consultants**, and saw revenues increase 285% the first year, 150% the second year, and 215% the third year [Mazur 1993c]. QFD was an important part of **Florida Power & Light**'s successful bid to become the first non-Japanese Deming Prize recipient in 1990 ["Quality System Implementation..." 1988, Webb 1990, Bodziony 1995] and in the 1994 Deming Prize awarded to **AT&T Power Systems**. It has been successfully applied in the U.S. healthcare industry since 1991 at **The University of Michigan Medical Center** [Gaucher 1991, Ehrlich et al 1993, Ehrlich 1994], **Baptist Health System** [Gibson 1994, 1995], and other leading institutions. Interesting service applications also include the author's development of an engineering TQM curriculum at **The University of Michigan College of Engineering** and the application to employee satisfaction and quality of work life at **AGT Telus** [Harries et al 1995]. Each year new applications are being reported in small businesses as well [Mazur 1993c, 1994a]. Since 1990, the author has consulted with other service organizations in distribution, education, food service, personnel, finance, healthcare, repair, and retail businesses.

Early applications of QFD in service organizations in Japan by Ohfuji, Noda, and Ogino in 1981 were for a shopping mall, a sports complex, and a variety retail store [Akao, 1990]. More recently, Kaneko has been integrating QFD, reliability, and quality circle activities in hotels, shopping centers, and hospitals [Kaneko 1990a, 1990b, 1991, 1992].

QFD has been heralded for such benefits as promoting cross-functional teams, improving internal communications between departments, and translating the customer's needs into the language of the organization. Are there other tools and techniques that can enhance QFD's power? Absolutely! This paper looks to software engineering for some new approaches. First, some QFD basics.

What is QFD?

Basically, QFD is designed to improve customer satisfaction with the quality of our products and services. What can QFD do that is not already being done by traditional quality systems? To understand QFD, it is helpful to contrast the differences between modern and traditional quality systems.

Traditional Quality Systems

Traditional approaches to assuring quality often focus on work standards [Love 1986], automation to eliminate people, or in more enlightened organizations, Quality Improvement Teams to empower employees to resolve problems.

As organizations are finding out, however, consistency and absence of problems are not enough of a competitive advantage when the market shakes out suboptimal players. For example, in the automobile industry, despite the celebrated narrowing of the "quality" (read that fit and finish) gap between U.S. and Japanese makers, Japanese cars still win the top honors in the J.D. Powers Survey of New Car Quality.

Nothing Wrong

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Anything Right

Modern Quality Systems

QFD is quite different from traditional quality systems which aim at minimizing negative quality (such as poor service, broken product). With those systems, the best you can get is *nothing wrong* **-** which is not enough when all the players are capable. In addition to eliminating poor service, we must also maximize positive quality (such as convenience, enjoyment). This creates **value**.

Quality Function Deployment (QFD) is the only comprehensive quality system aimed specifically at satisfying the customer. It concentrates on maximizing customer satisfaction (positive quality) **-** measured by metrics such as repeat business. QFD focuses on delivering value by seeking out both spoken and unspoken needs, translating these into actions and designs, and communicating this throughout the organization. Further, QFD allows customers to prioritize their requirements, benchmark us against our competitors, and then direct us to optimize those aspects of our organization that will bring the greatest competitive advantage. What business can afford to waste limited financial, time and human resources on things customers don't want or where we are already the clear leader?

Types of Requirements

To satisfy customers, we must understand how meeting their requirements effects satisfaction. There are three types of customer requirements to consider (see Figure 1) [Kano, *et. al.*, 1984].

Revealed Requirements are typically what we get by just asking customers what they want. These requirements satisfy (or dissatisfy) in proportion to their presence (or absence) in the product or service. Fast delivery would be a good example. The faster (or slower) the delivery, the more they like (or dislike) it.

Expected Requirements are often so basic the customer may fail to mention them - until we fail to perform them. They are basic expectations without which the product or service may cease to be of value; their absence is *very* dissatisfying. Further, meeting these requirements often goes unnoticed by most customers. For example, if coffee is served hot, customers barely notice it. If it's cold or too hot, dissatisfaction occurs. Expected requirements *must* be fulfilled.

Exciting Requirements are difficult to discover. They are beyond the customer's expectations. Their absence doesn't dissatisfy; their presence excites. For example, if caviar and champagne were served on a flight from Detroit to Chicago, that would be exciting. If not, customers would hardly complain. These are the things that wow the customers and bring them back. Since customers are not apt to voice these requirements, it is the responsibility of the organization to explore customer problems and opportunities to uncover such unspoken items.

Kano's model is also dynamic in that what excites us today is expected tomorrow. That is, once introduced, the exciting feature will soon be imitated by the competition and customers will come to expect it from everybody. An example would be the ability to have pizza delivered in thirty minutes. On the other hand, expected requirements can become exciting after a real or potential failure. An example might be when the passengers applaud after a pilot safely lands the airplane in rough and stormy weather.

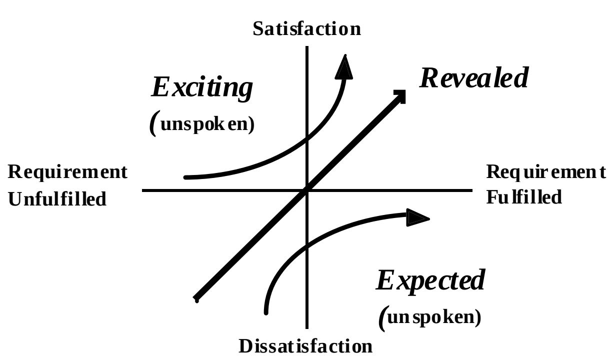

Figure 1. The Kano Model (adapted).
Service businesses must meet all three types of requirements - not just what the customer says.

The Kano Model has an additional dimension regarding which customer segments the target market includes. For example, the caviar and champagne that's exciting on the domestic flight might be expected on the Concorde from New York to London. Knowing which customer segments you serve is critical to understanding their requirements.

Thus, eliminating problems handles expected requirements. There is little satisfaction or competitive advantage when nothing goes wrong. Conversely, great value can be gained by discovering and delivering on exciting requirements ahead of the competition. QFD helps assure that expected requirements don't fall through the cracks and points out opportunities to build in excitement.

In summary, Kano found that the exciting needs, which are most tied to adding value, are invisible to both the customer and the provider. Further, they change over time, technology, market segment, etc. The Japanese creators of QFD developed tools such as the Voice of Customer Tables [Akao 1990b, Ohfuji et al 1990, Nakui 1991, Marsh et al 1991, Mazur 1991a, 1991e, 1992c, 1993a, 1993c] and coupled them to affinity diagrams and hierarchy diagrams to break through this dilemna.

This process works best when the QFD team goes to *gemba (*where the customer interfaces with the service) to observe, listen, and record the problems customers experience and the opportunities they wish to seize. The voice tables provided a structure for recording the data. Going to the gemba can be difficult for those who are used to seeing things from an internal point of view. They tend to see more process problems and solutions than customer needs. Are there more systematic tools that could help the QFD team understand the customer better? See things from their point of view?

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Software engineering tools for service?

Software engineering and its tools grew out of a need for computer system analysts and developers to better understand the often poorly articulated needs of users by looking at things through their eyes. They address the complexities of a process better than the standard flow charts used in service blueprinting. Service processes are complex because both the provider and the customer are people interacting and reacting to each other, and thus each transaction is in itself a new "product." Also, services contain both usability and emotional components [Takasu]. A cognitive understanding of the customer can help us address some of the emotional aspects.

This paper covers a few of the tools and presents a simple example of how they could be used and the benefits that could be gained.

State-Transition Diagrams (STD)

A service can be viewed as a series of sequential and parallel tasks that achieve a certain purpose or function [Mazur 1993c]. (See Figure 2) From this viewpoint, we look at what the provider must do to satisfy the needs of the customer. The logic, thus, is provider oriented. When we go to the gemba, is there a way we can capture the customer's logic? Can we view the service transaction as different states a customer passes through on his way to a satisfying conclusion of the service?

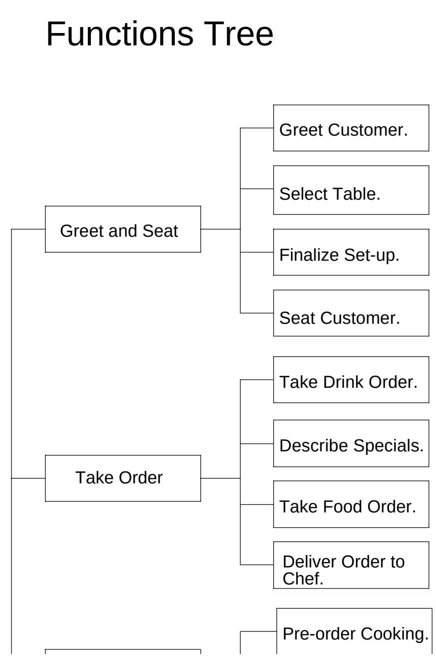


Figure 2. Function Tree for a restaurant. (Baluja et al)

If ... pe ... ri ... va ... tiple transitions among states can occur [Martin] can help.

To understand the STD, let's describe a simple example, that of turning on a light. An STD would look like Figure 3 and contain these items. The current state (light off) and the desired state (light on) in a box, an arrow showing the transition from off to on, the event triggering the change of state (switch on) written above the line and the process that then takes place when the event occurs (flow electrons) written below the line. Put differently, an event (switch on) causes a process (flow electrons) which changes the state from one (light off) to another (light on).

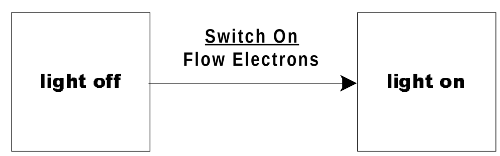


Figure 3. STD for turning on a light.

Let's look at a service example, such as a restaurant. (See Figure 4) We might diagram paying for the meal as a transition from the state of being unpaid to being paid that occurs at the event of the diners are being finished, which causes the payment procedure to be engaged.

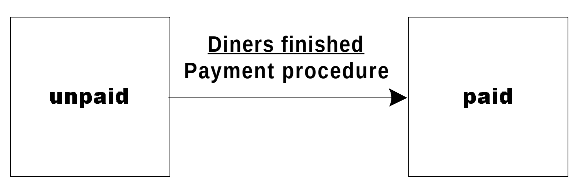


Figure 4. STD for paying a restaurant bill.

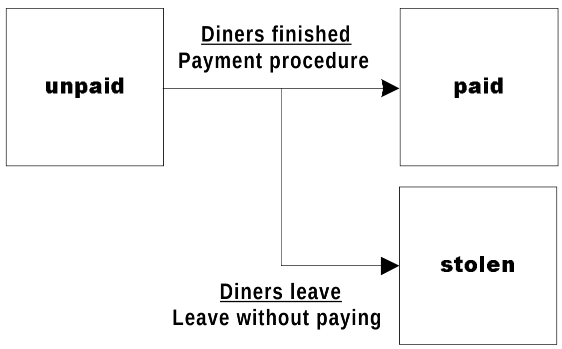
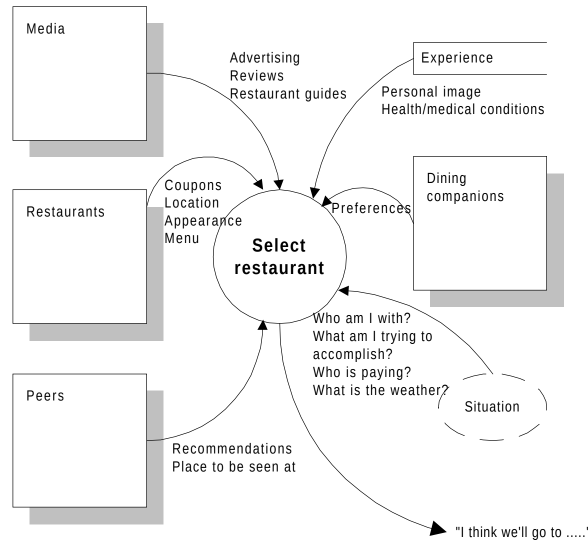


Figure 5. STD with failure mode of payment procedure identified.

This would address the time consuming problem of signaling the waitperson, waiting for the check, and then waiting for the credit card to be brought back. The event of the diners finishing should trigger the payment procedure and the waitperson's responsibility would now be to assist the transition from unpaid to the paid state. A creativity process could then be applied to solving this problem. For example, just like with hotels, a credit card imprint could be taken at the time of ordering and unless there are further charges, a 15% tip could be added and the charge processed automatically. Failure to pay could also be indicated and appropriate countermeasures taken. (See Figure 5)

A series of states could represent the entire service experience. At each transition, we can examine the decision or event that triggers the transition to look for customer needs. We can identify failures of the transition to be made and look for opportunities to save a transaction. (See Figure 6)



Courtesy of Mark McDonald, Andersen Consulting

Figure 7. DFD for selecting a restaurant.

In a comprehensive QFD case where the upfront focus in on the customer's point of view, the STD can be used to identify all the deciding factors that go into a successful and satisfying service transaction. If the purpose of the study is an improvement process, variations to the STD could identify the service provider events, such as those found in the function tree above, and look

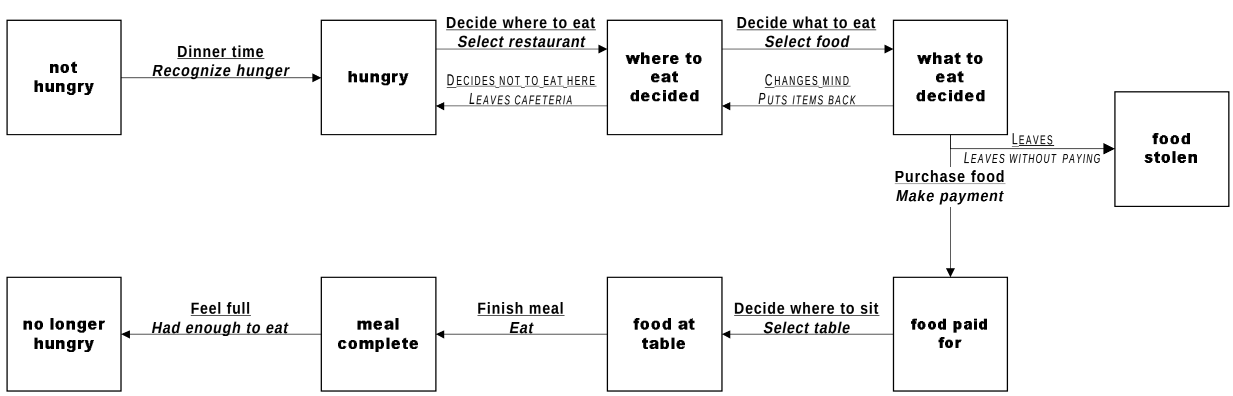


Figure 6. STD for cafeteria. Note some failure modes have been identified.

for service provider processes or tasks that would help move the customer through the transition of the states.

Data Flow Diagram (DFD)

The data flow diagram allows a process to be displayed at a logical level (everything the customer sees) without committing to a constraining physical implementation [Gane and Sarson]. Since customers will make decisions regarding our service based on some knowledge (data), the DFD can help us understand what these influencing factors are, so that the organization can help supply the customer with favorable data. (See Figure 7)

The DFD is constructed with a circle showing double squares which indicate the source or destination of the data, arrows which show the flow of data, a circle which shows the process (which could come from the STD) which uses the data, and an open-ended rectangle which shows a store of data. From this we can begin to capture the complexities of a person making a decision and begin to explore ways to influence that decision in our favor.

Event Table (ET)

Events are defined as time, external signals, internal failures, decisions, etc. An event table can be built from the events in the STD and the decision factors in the DFD. (See Table 1)

Ref. #	Events	Decision Factors
1	Customer determines need to eat	Hunger Time to eat (habit) Prearranged time (appointment) Most convenient time
2	Customer decides where to eat	Advertising Recommendation Coupon Companion's preference Menu (Let's do Chinese) Medical (allergies) Personal image (power lunch) Who's paying (business or personal)
3	etc.	etc.

Table 1. ET for a restaurant.
Courtesy of Mark McDonald, Andersen Consulting

The ET gives a tabular format to the events that move the customer from each state to the next and adds the factors from the DFD that influence the decision. In some QFD cases, we could apply creativity techniques to address these decision factors. Adding another column to the table above would provide some structure. Creative solutions can also be bound by a certain metaphors. *Kansei* Engineering [Nagamachi 1993, 1992, 1989 a,b, Mazur 1991b] techniques can help identify sensorial opportunities to satisfy customers. For example, if the restaurant catered to opera patrons, wait staff could dress in favorite costumes, sing orders, etc.

Event Tree

In one project still under development, the author has successfully used an event tree to develop customer needs for a personal safety product/service combination. Since most customers have never experienced the use of this type of product (and hopefully never will), traditional focus groups and other market research techniques did not give complete enough information for QFD. The Event Tree was used to identify all possible situations and to walk through the sequence of events needed to take place for the product to be successful. As each event was identified, the relevant needs were then extracted.

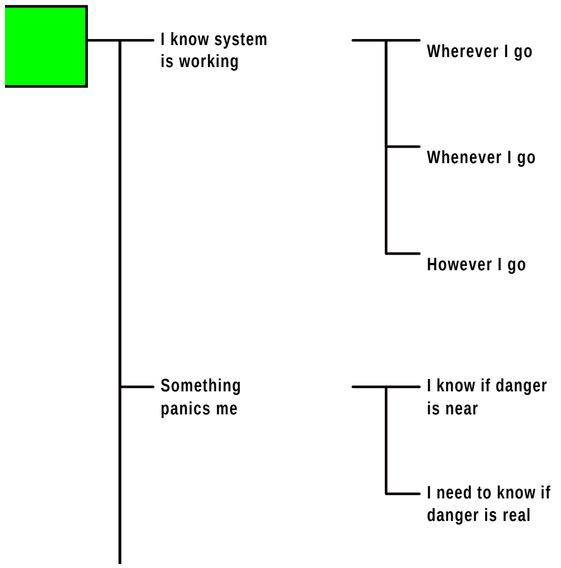


Figure 8. Event Tree for a personal safety prod-

Other SWE Tools

The author is still exploring the use of other software engineering tools for their applicability to services. Suggestions and contributions are welcome.

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About the author

Glenn H. Mazur has been active in QFD since its inception in North America, and has worked extensively with the founders of QFD on their teaching and consulting visits from Japan. His primary focus is in the service industry, as a manager for over 15 years in automobile repair and parts warehousing, as a teacher, and as an owner of a translating and consulting business he started in 1982. He is one of North America's leaders in the application of QFD to service industries, sits on several advanced QFD research committees, and sits on the steering committee of the Symposium on Quality Function Deployment held annually in Detroit. He is also Executive Director of the non-profit QFD Institute and an Adjunct Lecturer of Total Quality Management at the University of Michigan College of Engineering. He lectures and trains in QFD worldwide.

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