Journal of the Association for Information Systems

JAIS

The Yield Shift Theory of Satisfaction and Its Application to the IS/IT Domain*

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Abstract

Information Systems / Information Technology (IS/IT) Satisfaction is a key indicator of IS/IT success. For IS professionals and providers, satisfaction is critical throughout the life of a system because dissatisfied stakeholders can derail implementation, discontinue using an important system, erode IS/IT budgets, or even transfer their entire IT infrastructure to a different organization. The IS literature offers several perspectives on satisfaction, but none yet accounts fully for known satisfaction phenomena. We identify ten observed satisfaction effects, and summarize six existing models for satisfaction, identifying their merits, and the limits of their explanatory power. We then advance Yield Shift Theory (YST), a new causal theory for the satisfaction response that offers a more complete explanation of this phenomenon. YST derives two propositions from five assumptions to propose that variations in the satisfaction response are caused by shifts in yield for an individual's active goal set. We argue the falsifiability and scientific utility of the theory, discuss its relevance to the IS/IT artifact, and suggest a variety of directions for future research.

Keywords: IS Satisfaction, Satisfaction Response, Satisfaction, IS/IT artifact, Yield Shift Theory, IS/IT Success

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1. Introduction

The success of an information system is not assured, and the cost of a system that fails can be high, both in terms of resources sacrificed to build it (Boehm et al., 2000) and in terms of the lost value that organizations might have derived from a successful system. Information systems and information technology (IS/IT) satisfaction is a key indicator of IS success (DeLone and McClean, 1992; Lawrence and Low, 1993). IS/IT researchers, therefore, give satisfaction a great deal of attention (e.g., Chin and Lee, 2000; Lawrence and Low, 1993; Seddon et al., 1999; Rai et al., 2002; Susarla et al., 2003).

The relevance of satisfaction to IS success begins with the earliest stages of systems development. A body of literature shows that, under certain circumstances, user involvement in the design and development phases correlates with higher judgments of system quality and higher user satisfaction when the system is deployed (e.g., Swanson, 1974; Olson and Ives, 1981; Lawrence and Low, 1993).

Satisfaction continues to be of interest throughout the life of a system. Studies show that people who find their initial experiences with an information system dissatisfying tend not to use it in the future (e.g., Bailey and Pearson, 1983; Ives et al., 1983) and that initial satisfaction with a system does not guarantee continued satisfaction (e.g., Khalifa and Liu, 2003) or sustained use (e.g., Reinig et al., 1996). People who feel dissatisfied with a system, even for non-technical reasons, may discontinue its use (Bhattacherjee, 2001; Te'eni and Feldman, 2001). User dissatisfaction can lead to an erosion of IS/IT budgets, making it even more difficult for IS/IT professionals to meet their goals and to provide satisfactory services (Galletta & Lederer, 1989). Users who control their own budgets may choose to transfer their entire IS/IT infrastructure to a different organization if they feel dissatisfied with current results (Lawrence and Low, 1993). For outsourcing providers, satisfaction may be a critical antecedent to customer retention (Patterson et al., 1997; Rust et al., 1995). Therefore, IS professionals often measure satisfaction to improve services (Conrath and Mignen, 1990).

The IS/IT domain is replete with many interdependent artifacts and other aspects that are potential objects-of-satisfaction, among them are technologies, information, development practices, services, IS departments, and technology-supported work practices. The scope of IS satisfaction research has, therefore, been diverse, ranging from a narrow focus on a single technical component (e.g., Slaughter et al., 1995), to a broader look at technology-supported work practices (e.g.,, Alter, 1999; Reinig, 2003), and still broader to an organization's entire IS/IT service infrastructure (e.g., Cats-Baril and Jelassi, 1994). A dissatisfier at any level could be detrimental to IS success.

We began to theorize about satisfaction as we developed and experimented with new IS/IT artifacts. It is customary to report not only the instrumentality of such artifacts toward their design objectives, but also stakeholder satisfaction. However, much of the IS/IT satisfaction research (including our own) was atheoretical. Satisfaction findings tended to be varied, even contradictory. To progress in our work, we needed a better theoretical understanding of satisfaction effects. We found useful clarity in the variety of perspectives on satisfaction in the IS literature, which helped make sense of the complex satisfaction effects we observed in the field. However, there remained a number of satisfaction phenomena for which existing perspectives could not account.

In this paper, we identify ten satisfaction effects that a comprehensive theory of satisfaction should be able to explain. We then summarize the value of six satisfaction perspectives already in the literature and highlight the satisfaction effects these perspectives leave unexplained. We then present the logic of Yield Shift Theory (YST), a new causal theory of the satisfaction response. This work builds on many concepts that precede it to suggest a new formal expression of relationships among causal and consequent constructs to both explain and predict the satisfaction response (Gregor, 2006). Finally, we argue the falsifiability and scientific utility of YST and suggest directions for future research.

2. Satisfaction Effects

This section draws on the IS/IT literature and on observations from our own field experiences to identify ten satisfaction effects for which a theory of satisfaction should be able to account. A *satisfaction effect* is a recurring pattern of satisfaction outcomes.

1. *Goal attainment effects* occur when individuals feel satisfied if their goals are attained and feel dissatisfied if their goals are thwarted. Several authors have reported goal attainment effects (e.g., Briggs et al. 2006; Reinig, 2003). We also have observed, for example, that military decision makers under crisis conditions manifest immediate IS/IT satisfaction upon goal attainment and immediate dissatisfaction upon failure to attain goals. Locke and Latham (1990) reported higher goal attainment effects for challenging goals than for easy goals.

2. C*onfirmation effects* manifest where individuals feel satisfied when outcomes match or exceed expectations or desires and feel dissatisfied when outcomes fall short of expectations or desires (Bhattacherjee, 2001; Rushinek and Rushinek, 1986). Confirmation effects differ from goal attainment effects in that, where expectations differ from goals, confirmation effects can manifest when expectations are met, even when goals are not met. In our own work, we have observed confirmation effects, for example, among individuals in IT problem-solving meetings who expect to and do find only partial solutions to the problems at hand.

3. With *disconfirmation effects,* individuals feel neutral when outcomes match expectations or desires. They feel satisfied when expectations or desires are exceeded and feel dissatisfied when outcomes fall below expectations or desires (see, e.g., Anderson, 1973; Oliver, 1996; McKinney et al., 2002). Disconfirmation effects differ from goal attainment and confirmation effects in that, with a disconfirmation effect, no satisfaction response would manifest upon goal attainment when goals and expectations match. In the field, we have observed neutral responses on goal attainment with respect to many IS/IT artifacts embedded in day-to-day routines, e.g., e-mail systems. We have noted positive disconfirmation effects when routinely-used systems exceed normal performance, for example, after an upgrade. We have observed negative disconfirmation effects when usually reliable systems fail.

4. We use the term *anticipation effects* for positive or negative satisfaction responses that manifest when individuals reflect on desired future states, although current conditions have not yet changed. We have observed anticipation effects in a number of system design meetings when users hear others voice support for desired features.

5. We use the term *nostalgia effects* when individuals feel positive or negative satisfaction responses as they reflect on past successes or failures, even though such reflection invokes no change with respect to current conditions. We have observed nostalgia effects during system requirements negotiation workshops and during post-implementation reviews when stakeholders relate anecdotes of earlier projects.

6. We use the term *differential effect* when different individuals evidence varying levels of satisfaction with outcomes, even though they appear to ascribe equivalent utility to those outcomes. We have observed differential effects among users upon the implementation of new features and functions in success-critical information systems. One might be tempted to attribute these differences to personality differences among the users. However, we have observed that the same users can be on the high side of a differential effect for one project, and on the low side for another project.

7. The term *hygiene effect* means that individuals feel only neutral or negative toward an IS/IT artifact, but never feel positive about it, even when it performs flawlessly (Herzberg, 2003). In such cases, only dissatisfaction with IS/IT manifests, never satisfaction. We have observed the satisfaction ceiling of hygiene effects with a number of well established, frequently used IT artifacts such as LANs and printers.

8. We use the term *mentor effect* when users feel increased or decreased satisfaction with an IS/IT artifact or policy after a conversation with a trusted friend or advisor, even though conditions have not changed. We have observed a number of cases of the mentor effect during the implementation phase for new systems.

9. We use the term *mixed feelings* where users experience feelings of both satisfaction and dissatisfaction with an IS/IT artifact. We have observed a number of cases of mixed feelings during transitions from old systems and work practices to new ones.

10. Finally, we observe that individual feelings of satisfaction or dissatisfaction are not permanent. Regardless of the initial effect, the arousal of a satisfaction response always diminishes over time. We use the term *attenuation effect* for this phenomenon.

Table 1 summarizes the satisfaction responses we have identified from the IS/IT literature or observed in the field for which a theory of satisfaction should account. The next section summarizes several models of IS/IT satisfaction.

Table 1. Observed Satisfaction Effects for Which a Theory of Satisfaction Should Account	
Phenomenon	**Definition**
1. Goal attainment effect	Individuals feel satisfied on attainment of a desired state or outcome. They feel dissatisfied when the desired state or outcome is thwarted.
2. Confirmation effect	Individuals feel satisfied when outcomes match expectations or desires, and feel dissatisfied when outcomes are less than expectations or desires.
3. Disconfirmation effect	Individuals feel neutral when outcomes match expectations or desires. They feel satisfied when outcomes exceed expectations or desires; they feel dissatisfied when outcomes are lower than expectations or desires.
4. Anticipation effect	Individuals feel satisfied or dissatisfied when thinking of future goal attainment, even though goals have not yet been attained or thwarted.
5. Nostalgia effect	Individuals feel satisfied or dissatisfied when thinking about past goal attainment or past failure to attain goals.
6. Differential effect	Multiple individuals manifest differing levels of satisfaction upon the attainment of goals to which they ascribe similar utility.
7. Hygiene effect	Individuals feel only neutral or negative about an IT/IS artifact, but never positive.
8. Mentor effect	Individuals feel more satisfied or dissatisfied after discussions with a trusted advisor, even though current conditions have not changed.
9. Mixed Feelings	Individuals experience both satisfaction and dissatisfaction with the same IS/IT artifact.
10. Attenuation effect	Individuals' satisfaction responses diminish over time.

3. Summary of IS/IT Satisfaction Perspectives

When we surveyed the IS/IT literature, we discovered several useful perspectives of satisfaction. These perspectives differ from one another in their purposes, their degree of theoretical rigor, the relationships they posit, and their predictions. Each contributes value toward understanding satisfaction, but each leaves some questions unanswered.

3.1. Measurement Perspectives

Several authors propose instruments to measure satisfaction with various aspects or features of an information system. These measures call for judgments of whether needs have been fulfilled or requirements accommodated (e.g., Doll and Torkzedeh, 1988; Doll et al., 1994; Ives et al., 1983; McHaney et al., 2002). They ask, for example, about the timeliness, accuracy, and relevance of outputs, or ease-of-use. Measurement models can be classified as analytical and descriptive in that they measure system attributes, but their purpose is implicitly prescriptive (Gregor, 2006) in that they are intended to guide practitioners on how to improve or assure the chances of system success. These models have proven useful to IS professionals who seek to identify issues of importance to their stakeholders, but they are not intended to serve as theoretical explanations or predictions of the onset and variation in the satisfaction response, and would not be useful to explain or predict the satisfaction effects listed in Table 1.

3.2. Attribute Perspectives

Attribute perspectives of IS satisfaction propose typologies of information system characteristics that seem to correlate with satisfaction. They call for users to judge the degree to which certain attributes fulfill needs and meet constraints, and predict that those judgments will correlate with satisfaction. For example, DeLone and McLean, (1992), proposed that satisfaction with a system correlates with system attributes such as flexibility, reliability, and usefulness. Others noted that user satisfaction correlates with attributes of the process by which systems are developed, for example, user involvement and empowerment in the design process (Hirschheim, 1989; Mumford and Henshall, 1979; McKeen et al., 1994; Lawrence and Low, 1993). Like measurement models, these models are descriptive in that they characterize circumstances that seem to correlate with satisfaction, and they are prescriptive in that they serve as guidelines for practitioners to improve the chances of system success (Gregor, 2006). A number of studies find empirical support for attribute models (e.g., Chin et al., 1988; DeLone and McLean, 2003). System attribute models allow an IS professional to answer the important question, "Which parts of my system need attention?"

Attribute models point toward, but do not articulate, theoretical constructs and relationships that may give rise to the correlations they describe (Bacharach, 1989; Sutton and Straw, 1995; Whetton, 1989). They do not explain satisfaction phenomena that manifest with respect to things other than the attributes they catalog, so new models must be developed for every new kind of IS/IT artifact, attribute, or aspect. Thus, they provide limited insight or guidance to IS/IT designers and managers about how new features or deployment strategies might impact user satisfaction. Finally, typologies of attributes are subject to nearly infinite decompositions, and so can quickly give rise to models of such complexity that they are too unwieldy to support scientific enquiry. They do not explain or predict the 10 satisfaction effects identified above.

3.3. Goal Attainment Perspectives

Some authors induce predictive theories of satisfaction (Gregor, 2006) from regularly observed effects, without deriving explanatory logic for such patterns. In this vein, some IS researchers propose models that posit satisfaction as a response to judgments that needs have been met, or that goal(s) have been attained (e.g., Briggs and Vreede, 1997; Reinig, 2003). Using the observed phenomenon as justification, they predicted that users will be satisfied with a system that enables them to attain their goals, and dissatisfied when a system that thwarts goal attainment. Several studies in the IS literature have reported empirical support for goal attainment models (e.g., Reinig, 2003; Briggs et al., 2006). Goal attainment models can account for the confirmation effects where goals and expectations are aligned; however, they could not explain goal attainment effects where goals differ from expectations, nor the other satisfaction effects listed in Table 1.

3.4. Confirmation Perspectives

Confirmation theories are also predictive models (Gregor, 2006) induced from observed correlations. They predict that satisfaction with an information system will manifest when outcomes *match* or *exceed* expectations or desires, and predict dissatisfaction when outcomes fall short of expectations

or desires (e.g., Bhattacherjee, 2001; Rushinek and Rushinek, 1986). Like goal attainment models, confirmation theories describe an effect and predict that it will recur, but do not attempt to explain it. The predictions of confirmation theories only match those of goal-attainment models when expectations and desires match outcomes, but differ where expectations or desires are either higher or lower than outcomes.

Confirmation models of satisfaction have received empirical support in the IS literature (e.g., Bhattacherjee, 2001; Igbaria and Wormley, 1992). However, Confirmation models also offer no explanation for Satisfaction Effects 3 through 10 in Table 1.

3.5. Disconfirmation Perspectives

Disconfirmation perspectives of satisfaction are also predictive theories (Gregor, 2006) induced from observed correlations. Disconfirmation posits satisfaction as a function of the degree to which individuals perceive that realized gains and losses differ from expectations and/or desires (e.g.,, McKinney et al., 2002; Oliver, 1996; Suh et al., 1994; Susarla et al., 2003). Expectations relate to the value one anticipates one is likely to derive from a projected outcome, while desires relate to the ideal value one wishes to derive from the outcome. Disconfirmation theories posit that, when the perceived difference between expectations/desires and outcomes is positive, users will feel satisfied; when the perceived difference is negative, users will feel dissatisfied. If outcomes are perceived to precisely meet expectations or desires, then neither satisfaction nor dissatisfaction will manifest. Disconfirmation theories have received empirical support with respect to IS (e.g., McKinney et al., 2002), IS/IT services (Pitt et al., 1995), and web services (Srijumpa et al., 2002).

Early disconfirmation-satisfaction theorists drew from the consistency theories of attitude change in the social psychology literature to explore the degree to which people's perceptions of disconfirmation matched actual differences between expectations and performance (Peyton, Pitts, and Kamery, 2003). In exploring attitude change, Festinger (1957) posited that when an individual holds two or more dissonant cognitions, it creates an uncomfortable feeling, a mental tension that "gives rise to pressures to reduce or eliminate the dissonance (p.18)." Festinger posited that this might lead people to change their attitudes or to shift their perceptions of circumstances to be more consistent with their attitudes. Anderson (1973) applied the concept of cognitive dissonance to consumer satisfaction/dissatisfaction to examine four theories – assimilation, contrast, generalized negativity, and assimilation-contrast theories – about the degree to which perceptions of disconfirmation differ from actual disconfirmations with respect to products consumers had purchased. Anderson (1973) explained the four theories as follows: assimilation theory posits that consumers will minimize or assimilate any discrepancy between expectations and product performance. Conversely, contrast theory assumes that the customer will magnify differences between the product received and the product expected. Generalized negativity posits that consumers will experience a negative response to any discrepancy -- whether positive or negative -- between expectations and results. Finally, the assimilation-contrast approach maintains that consumers will assimilate small discrepancies between expectations and outcomes, but magnify discrepancies large enough to exceed some threshold of tolerance.

Assimilation, contrast, and general negativity theories received mixed empirical support. Studies of the assimilation-contrast perspective, however, seem to account for the mixed findings for the earlier perspectives (e.g. Anderson, 1973; Peyton, Pits, and Kamery, 2000; Hovland, Harvey, and Sherif, 1957). Thus, individuals may perceive small disconfirmations to be smaller than they actually are, and may perceive large disconfirmations to be larger than they actually are. It is the perception of disconfirmation, however, and not the actual discrepancy between expectations and outcomes, that serves as the causal construct for disconfirmation theories of satisfaction.

In cases where outcomes precisely match expectations and desires, the predictions of disconfirmation models directly contradict those of both confirmation and goal attainment perspectives. However, in all other cases, a disconfirmation model could account for goal attainment and confirmation effects.

Disconfirmation models also suggest explanations for hygiene effects and differential effects. Hygiene effects could occur when expectations and desires are for perfect performance. Thus, when an IS/IT performs flawlessly, such perfect performance would not constitute a disconfirmation, and so would not produce a positive satisfaction response. However, imperfect performance would constitute a negative disconfirmation, and so dissatisfaction would manifest. Differential effects could occur when different individuals have different expectations or desires about IS/IT. Goal attainment would produce different degrees of disconfirmations for each individual, which, in turn, would lead to different satisfaction responses. However, disconfirmation models can only account for satisfaction responses at the time an outcome is realized, and so cannot explain anticipation, nostalgia, mentor, or attenuation effects.

Table 2: Merits and Limits of Existing Perspectives of IS Satisfaction		
Perspectives	**Merits**	**Limits**
Measurement Models	Useful for diagnosing and improving system quality	Posit no antecedents, new measures needed for each new feature, function, or service.
System Attribute Perspectives	Useful for diagnosing dissatisfaction and system quality. Posit antecedents for satisfaction	Tied to specific objects-of-satisfaction. Prone to increasing complexity. Grow more complex with each new feature, function, service, or attribute. Descriptive and predictive but not explanatory.
Process Attribute Perspectives	Useful insights for successful development process	Prone to increasing complexity, do not account for satisfaction of those who become users after completion of development. Descriptive and predictive but not explanatory.
Goal Attainment Perspectives	Predict goal attainment effects	Propositions not derived from underlying assumptions. Cannot explain all observed satisfaction phenomena.
Confirmation Perspectives	Predict confirmation effects	Propositions not derived from underlying assumptions. Cannot explain all observed satisfaction phenomena.
Disconfirmation Perspectives	Predict disconfirmation effects	Propositions not derived from underlying assumptions. Cannot explain all observed satisfaction phenomena.
Aggregate Perspectives	Attempt to explain more satisfaction effects by combining other approaches	All the limits of the models they aggregate, and exploding complexity. May combine approaches with mutually exclusive assumptions and predictions, giving rise to paradox.

Further, disconfirmation theories create a paradox when expectations differ significantly from desires. For example, if one were to hold low expectations but high desires for a system, then an outcome that fell somewhere between the two would constitute both a positive disconfirmation of expectations and a negative disconfirmation of desires, and thus the theory would yield two mutually exclusive predictions.

3.6. Aggregated Models

Several authors have argued the need to integrate various perspectives of IS satisfaction into a single aggregated model to more fully explain satisfaction effects in the IS/IT domain (e.g., Palmer and Griffith, 1998; Khalifa and Liu, 2003; Yoon et al., 1995). However, some of the assumptions of the

source-models for these attempts are inconsistent with one another, which could lead to paradoxical results. For example, one author might assume that satisfaction arises in response to need-fulfillment, while another may assume it only arises when expectations are exceeded. Further, such models could quickly become so complex that they would be too unwieldy to support scientific enquiry. Table 2 summarizes the merits and limitations of each of the perspectives discussed above.

Table 3. The Utility of Earlier Satisfaction Perspectives						
	Theoretical Perspective					
	Measurement	System Attributes	Process Attributes	Goal Attainment	Confirmation	Disconfirmation
Observed Satisfaction Effects						
1. Goal attainment effect				**	*	**
2. Confirmation effect				*	**	*
3. Disconfirmation effect						**
4. Anticipation effect						
5. Nostalgia effect						
6. Differential effect						**
7. Hygiene effect						**
8. Mentor effect						
9. Mixed Feelings						
10. Attenuation effect						
Note: One asterisk in a cell means that a theory explains some, but not all manifestations of an effect. Two asterisks in a cell mean that a theory fully explains an effect.						

3.7. The Need for a New Perspective

Each of the perspectives of satisfaction in the IS literature is useful for some purposes. However, despite the fact that each has received empirical support, none of them offers an explanation for all the satisfaction phenomena identified in Table 1. Table 3 summarizes the extent to which each perspective can account for each observed effect.

Further, none of the existing perspectives is a fully realized causal theory, in that their propositions are not yet derived from underlying axioms or assumptions, and so would not be regarded as defensible under the disciplines of causal epistemology (Popper, 1959). They are descriptive or predictive, but not yet explanatory (Gregor, 2006). In the next section, we advance Yield Shift Theory (YST) to provide an axiomatic foundation for existing perspectives, to resolve the seeming paradoxes among their predictions, to account for seeming conflicts among empirical findings, and to explain more fully the range of satisfaction phenomena listed in Table 1.

4. Yield Shift Theory

In this section, we present the logic of Yield Shift Theory, a formal causal theory (Gregor, 2006) of the

satisfaction response. We begin by defining key constructs to reduce the ambiguity inherent in informal language and to clarify the concepts used in the theory (Grover et al., 2008). We then derive a set of causal propositions from a set of assumptions (Popper, 1959) about cognitive mechanisms that could give rise to the satisfaction response. Taken together, the assumptions and the propositions form a deductive-nomological network of causal relationships (Bacharach, 1989) to explain variations in the onset, magnitude, and valence of the satisfaction response.

4.1. Definitions of Satisfaction

The phenomenon of interest for Yield Shift Theory is the satisfaction response. The definition of the phenomenon of interest in a causal theory should be sufficiently specific to differentiate the construct from other closely related constructs (Straub, 1989). Although satisfaction has been studied extensively in the IS literature, no rigorous definition of the construct prevails. We, therefore, begin by discussing various connotations of the word *satisfaction*. We then define the term *satisfaction response* to demarcate the phenomenon whose variations YST seeks to explain.

Satisfaction as Judgment

The word *satisfaction* has at least two connotations in the IS literature. Although many researchers do not explicitly define satisfaction, some implicitly frame IS satisfaction as a judgment, asking, for example, how well user information needs are being satisfied (Powers and Dickson, 1973), or call for judgments of system outputs in terms of information content, accuracy, ease-of-use, and timeliness (Torkzedeh and Doll, 1999).

Satisfaction as Affect

Other satisfaction researchers implicitly frame satisfaction as an affective response. For example, one study asks executives to rate their enjoyment and satisfaction with an information system (Lucas, 1981). Another asks for a response to the statement, *"All things considered, I am (delighted / disappointed) with using the system"* (Chin and Lee, 2000, p. 559). Briggs, Vreede, and Reinig (2003) asked a set of questions about the degree to which technology users felt good about, felt happy about, or felt satisfied with certain objects of satisfaction.

Mixed Definitions

Some researchers blend judgment and affect into the same definition, for example, Oliver (1996) defined satisfaction with a service as "*a judgment that a service provided a pleasurable level of consumption-related fulfillment.*" Susarla et al. (2003) define satisfaction with application service providers as "*a positive affective state resulting from the appraisal of all aspects of a firm's working relationship with another firm*"(p. 96).

Because judgment is a construct different from emotion, it is useful to distinguish between affective and judgmental connotations of the term satisfaction to avoid confounding of results. For this research, we sought a theoretical explanation of satisfaction-as-affect because we had observed many cases where users abandoned systems they *judged* to be useful and easy to use, but with which they nonetheless *felt* dissatisfied. In one case, an executive team used a group support system to complete an annual strategic planning session in just four hours, when they had expected it would require three days. A senior executive told us he felt dissatisfied with the system. We asked if he found the system difficult to use; he said "No, it was very easy. We didn't even need training." We asked if the quality of results had suffered. He said, "No, we actually got a much better plan than we ever have before." We asked about the root of his discontent. He said, "We just did the work…It was kind of mundane…It didn't *feel* satisfying." The team declined to use the system again. This and similar cases suggest that a better understanding of satisfaction-as-affect could be important to an overall understanding IS/IT success.

4.2. Definition of the Satisfaction Response for YST

The phenomenon of interest that YST seeks to explain is an emotion – the *satisfaction response.* We define the satisfaction response as *a valenced affective arousal with respect to some object that has reference to some state or outcome desired by an individual.* Objects of satisfaction in the IS/IT

domain could include, for example, hardware, software, people, data, information, and procedures.

Herzberg, in his work on job satisfaction, framed satisfaction and dissatisfaction as two different constructs (Dubin, 1976). To explain all the observed IS/IT satisfaction effects, however, we found it useful to define the *satisfaction response* as a single construct that encompasses both positive feelings, commonly called *satisfaction,* and negative feelings, commonly called *dissatisfaction.*

It is important to note that under the YST definition, satisfaction and dissatisfaction are not two ends of a continuum with a neutral point in the middle. Rather, the continuum is from not-aroused to arouse. The valence characterizes the arousal as positive or negative, but does not define its magnitude (Young, 1968). We use this conceptualization because an individual may experience a switch of valence from negative to positive or vice versa without passing through a neutral state of non-arousal.

The labels commonly used to describe a satisfaction response tend to suggest both its magnitude and its valence. A satisfaction response with a positive valence may be labeled as satisfaction, delight, elation, or ecstasy, depending on its magnitude. A satisfaction response with a negative valence might be labeled dissatisfaction, disappointment, frustration, or outrage, depending on its magnitude. Thus, under this definition of the satisfaction response, a theoretical explanation should account for both its magnitude and its valence.

4.3. The Assumptions and Propositions of YST

In this section, we derive the logic of Yield Shift Theory to explain the onset of and variation in the magnitude and valence of the satisfaction response. We express the theory formally as a set of *assumptions*, which suggest mechanisms that could give rise to the phenomenon of interest, and *propositions*, which are functional statements of cause and effect derived from the assumptions by deductive logic. In causal epistemology, a theory's assumptions are advanced as a starting point for the logic that follows. They imply the suppositional question, "What if we were to assume X; would that be sufficient to explain the variations we observe in the phenomenon of interest?"

The propositions of a causal theory are functional statements of cause and effect relationships among constructs. We present the propositions of YST with the convention, "*Y is a function of X,*" where X is a causal construct, and Y is a consequent construct. These statements can be interpreted as meaning, "Changes in X cause changes in Y."

Yield Assessment for a Given Goal

A *goal* is any state or outcome that an individual desires to attain (Locke and Latham, 1990). An individual's goals may be diverse, ranging from the most basic biological needs, like air and food, to esoteric desires like discovery or self-actualization (Maslow, 1954). When individuals use an information system, they may attend to instrumental work-related goals such as sustaining a competitive advantage, or timely access to accurate and complete information. They may also attend to more fundamental goals like food and shelter. Because human cognitive resources are limited, individuals may not be able to attend to all their goals simultaneously.

Because individuals hold many goals, and because human attention resources are limited, individuals must make choices about which goals to pursue and in what order. YST posits cognitive mechanisms that may have evolved because individuals must constantly and effectively make such choices to survive in their environment. Locke and Latham (1990) suggest that affective responses may arise from some automatic, subconscious cognitive mechanism that appraises the degree to which objects of satisfaction further or block the attainment of one's values. In order to explain satisfaction responses, YST starts with assumptions about a set of such mechanisms.

First, for every goal an individual holds, YST assumes:

Assumption 1: **Automatic Utility Assessment**. *A cognitive mechanism automatically and subconsciously ascribes some level of utility to attaining a given active goal.*

By *utility*, we mean a sense of goodness, worth, or value, (Mobley and Locke, 1970; Locke and Latham, 1990), but not just in the monetary sense often connoted by the word. Utility may also be found, for example, in physical, emotional, social, political, and cognitive states or outcomes. Because this mechanism is *automatic*, individuals are incapable of holding goals without subconsciously ascribing some level of utility to their attainment. Every goal that becomes active will have some level of utility ascribed to it.

Not all goals hold equal utility for an individual. For instance, survival goals often (although not always) have higher utility assessments than socialization goals. The utility an individual ascribes to attaining a goal may be fluid, changing in response to new information and experiences. If an individual ceases to perceive utility in attaining a goal, by definition, it ceases to be a goal.

Given that cognitive resources are limited, an individual could choose to pursue higher-utility goals to the exclusion of lower-utility goals. However, that strategy could be detrimental to an individual's survival because some high-utility goals are difficult or impossible to attain. Effort spent pursuing these goals might deter pursuit of lower-utility, higher-likelihood goals that would ensure survival. YST, therefore, makes two further assumptions to explain how utility perceptions may be moderated.

> **Assumption 2**: **Automatic Likelihood Assessment.** *A cognitive mechanism automatically and subconsciously assesses the likelihood that an active goal may be attained.*

Individuals assess some goals as being more likely to be achieved than others. For instance, a system user might perceive that the likelihood of acquiring a new virus scanner for an e-mail system is high, while the likelihood of gaining the budget and time to develop a worldwide community of practice is low.

Next, YST assumes that:

> **Assumption 3: Automatic Yield Assessment.** *A cognitive mechanism automatically and subconsciously generates a perception of yield for an active goal based on the utility ascribed to it, but reduced in inverse proportion to the likelihood assessed for attaining the goal.*

Thus, if an individual were to ascribe high utility to a goal, and were absolutely certain of its attainment, then the subconsciously generated yield perception for that goal would be approximately equivalent to the utility ascribed to it. By contrast, if an individual were to ascribe high utility to a goal, but were absolutely certain that the goal could not be attained; the individual would perceive the goal as having little or no yield, despite its high ascribed utility. Thus, a goal of modest utility but high likelihood could be perceived as having a greater yield than a goal of high utility but low likelihood.

Because a perception of zero likelihood of goal attainment would mean no yield, regardless of utility, and because a perception of full certainty would mean yield perceptions equivalent to utility, we can characterize likelihood as a multiplicative moderator of the relationship between ascribed utility and yield, with assessed likelihood assuming values ranging from zero to one. Under this framing, individuals might decide how to prioritize time and resources based on the perceived yield of goals, rather than solely on their ascribed utility.

Reasoning from Assumptions 1, 2 and 3, YST proposes that:

> **Proposition 1: Perceived Yield**: *At a given moment, the Yield an individual subconsciously perceives for a given goal is a multiplicative* function *of the utility ascribed to the goal and the assessed likelihood of attaining it.*

YST deems Proposition 1 as both necessary and sufficient to explain variations in Perceived Yield. Figure 1 illustrates Proposition 1. Arrows indicate the proposed direction of causation.

Assumption 3 and Proposition 1 are closely related. Assumption 3 posits a cognitive mechanism that performs a certain function. Proposition 1 proposes a cause and effect relationship among constructs

that would follow if the assumptions about the underlying mechanisms hold. Without the underlying assumptions, there would be no basis for proposing that likelihood moderates a causal relationship between Utility and Yield, nor that the posited relationship would have to be multiplicative.
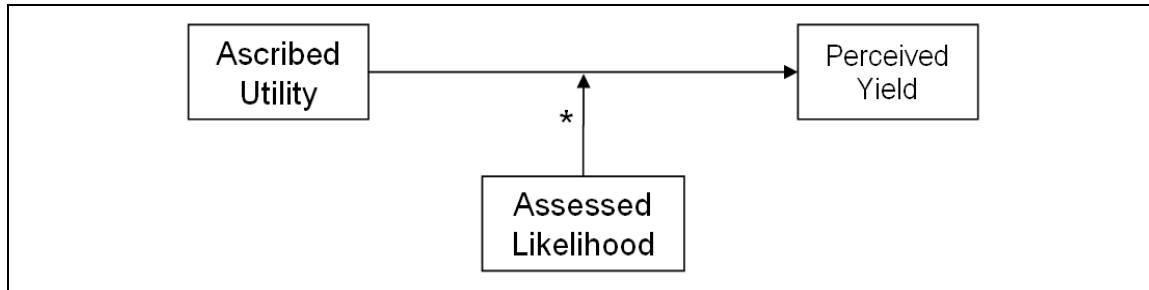

Figure 1. A Diagram of Proposition 1. Perceived Yield is a multiplicative function of Ascribed Utility and the moderating construct, Assessed Likelihood. Arrows indicate the direction of causation.

Contrasting Proposition 1 with Other Multiplicative Cognitive Relationships

Authors seeking to explain phenomena other than the satisfaction response have also posited or observed cognitive functions based on multiplicative relationships. For example, expected utility theorists like Neumann and Morgenstern (1947) demonstrated that actual individual preferences among choices with known risks correspond to a multiplicative function of the *external mathematical probability* and the *external utility* (as measured in monetary units) of each choice. Kahneman and Tversky (1979) advanced Prospect theory to explain variations in *probability valuation*, the monetary value people assign to choices under conditions of risk. Prospect theory posits that the value people assign to choices is a nonlinear multiplicative function of the external mathematical probability of an outcome and its monetary utility. They note that people evaluate alternatives differently depending on whether the outcome is framed as a potential gain or a potential loss. Non-expected utility theorists explain risky choice decisions in terms of a multiplicative relationship between monetary utility and internal judgment of probability, which is similar to the likelihood construct of YST, and they observe asymmetry in this relationship with respect to decision making (Starmer, 2000).

YST, however, seeks to explain variations in the *satisfaction response* based on *perceptions of utility* rather than on external monetary values, and on *internal likelihood assessments* rather than external mathematical probabilities.

4.4. Shifts in Perceived Yield for the Active Goal Set

Human cognitive resources are limited (Gilbert and Osborne, 1989; Miller, 1956). YST assumes that, like conscious working memory, the subconscious mechanisms for the active goal set are also limited in the number of concepts they can process simultaneously. If individuals have many goals, then, at a given moment, they may only be able to assess a subset of those goals. We refer to the subset of goals currently being subconsciously assessed as the *active goal set.* The number of goals in the active goal set could range from zero to some upper limit bounded by the capacity of the mechanism. Thus, once the active goal set is at maximum capacity, a new goal entering the active set would have to displace one or more other goals that had been active until that moment.

At a given moment, the active goal set may contain any newly created, current, or remembered goals. Active goals may or may not also be present in conscious working memory. Goals that reside in working memory are said to be *salient.* When goals move into conscious working memory, YST assumes they also move into the subconscious active goal set. Thus, salient goals constitute a subset of the active goal set.

A change in yield with respect to one or more goals in the active set would constitute a change to the yield for the set as a whole. At a given moment, the yield perception for the active goal set would be

the net of the currently perceived yields for the goals in the set.

To explain the satisfaction phenomenon, YST makes two more assumptions.

Assumption 4: **Yield Shift Detection:** *An automatic, subconscious, cognitive mechanism detects the magnitude and direction of changes in yield for the active goal set.*

Assumption 4 does *not* posit that the individual makes a conscious, point-by-point assessment of the utility and likelihood of each goal in the active set. Rather, it assumes that some subconscious cognitive mechanism detects shifts in yield for the active goal set as a whole.

The notion of subconscious yield shift detection is the most important concept for YST. If the logic of YST holds, then a shift in yield could happen in at least three ways:

1. The utility ascribed to one or more goals in the active set could change. For example, upon using a new system, a user might discover that not only is it more accurate than the previous system, it is much faster as well.
2. The likelihood assessment for one or more goals in the active set could change. For example, a system champion who believes that an organization lacks sufficient funds to build a new capability might learn that an important customer may be willing to fund the upgrade.
3. The mix of goals comprising the active set could change. For example, an accountant who is focused on the moderate-yield goal of pulling a daily report may change focus to a higher-yield goal of cutting the accounts receivable cycle or to a more personal higher-yield goal like job security.

Finally, YST also assumes that:

Assumption 5: Affective Response to Shifts in Yield. *The detection of a shift in yield for the active goal set triggers an affective arousal proportional to the magnitude of the shift in yield, and with a valence in the direction of the shift.*

Thus, if an increase in yield for the active goal set is detected from one moment to the next, an affective arousal with a positive valence will occur. If a decrease in yield is detected from one moment to the next, an affective arousal with a negative valence will occur. The greater the absolute value of the shift detected by the subconscious yield-shift detector, the greater will be the magnitude of the affective arousal.

While the magnitude of shifts in yield may be boundless, however, human physiological and affective responses are bounded. There may be a ceiling, therefore, on the magnitude of affective arousal an individual can experience. Thus, beyond some level of arousal, incremental increases in magnitude of yield shift would give rise to smaller and smaller increases in affective arousal. The relationship between shifts in yield perception and the magnitude of the satisfaction response would thus have to be curvilinear rather than purely linear. Therefore, YST proposes:

Proposition 2: **Satisfaction Response as a Function of Yield Shift.** *The magnitude of the satisfaction response is a curvilinear function with a positive but decreasing slope of the absolute value of a yield shift for the active goal set. The valence of the satisfaction response is equivalent to the sign or direction of the yield shift.*

YST deems Proposition 2, the core proposition of the theory, to be both necessary and sufficient to explain variations in the satisfaction response. Figure 2 illustrates Proposition 2.
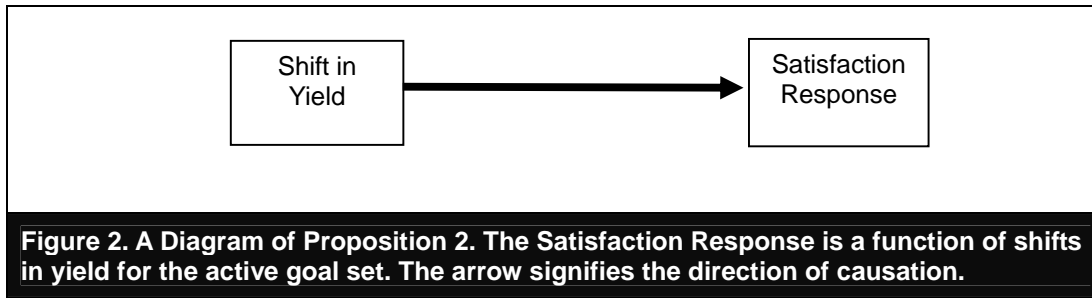
Figure 2. A Diagram of Proposition 2. The Satisfaction Response is a function of shifts in yield for the active goal set. The arrow signifies the direction of causation.

Proposition 2 posits that the satisfaction response is a function of a shift in the yield of the active goal set. When something changes with respect to the active goal set, an affective response may manifest. For example, in a system design meeting, if a user were to learn that others supported the inclusion of features the user deemed important, that might constitute an upward shift in likelihood assessment with respect to goals relating to the system, which would then give rise to a positive satisfaction response. The magnitude of the satisfaction response would be proportional to the magnitude of the shift. For example, if the user's likelihood assessment for the new features shifted from very low to almost certain, that would constitute a larger shift than if the user's likelihood assessment shifted from almost certain to slightly more certain, and so the former would give rise to a larger satisfaction response than the latter.

The magnitude of the shift would be the absolute value of the difference between the subconsciously perceived yield of the active goal set and the yield of the active goal set at the previous moment in time. The sign of this difference would determine the valence of the satisfaction response (i.e., if the difference is positive, satisfaction would manifest, and if the difference is negative, dissatisfaction would manifest).

The propositions offered by YST explain the onset, magnitude, and valence of the affective arousals that constitute the satisfaction response. Table 4 lists and defines the key terms and constructs used in YST. Table 5 summarizes the assumptions and propositions of YST.

Table 4. Definitions of Key Terms for Yield Shift Theory	
Goal	A desired state or outcome
Satisfaction response	A valenced affective arousal with respect to some object that has reference to an individual's goal.
Utility	The benefit or value an individual subconsciously ascribes to attaining a goal
Likelihood	The degree to which an individual subconsciously believes a goal to be attainable.
Yield	A multiplicative function of the utility and likelihood an individual ascribes to attaining a goal or a set of goals
Active Goal Set	The subset of goals currently being assessed by the subconscious mind for changes in yield.
Perceived Shift in Yield	A subconscious perception that the overall yield for the active goal set has changed.

It is important not to confuse the subconscious mechanisms posited by YST with conscious, intentional analyses of potential or obtained outcomes. Conscious analyses may produce cognitive *judgments* about the degree to which needs, wants, or desires have been met, and may even offer rational justifications for satisfaction responses. However, the logic used by YST only holds if we assume these mechanisms to be both automatic and subconscious.

Table 5. The Assumptions and Propositions of Yield-Shift Theory	
Assumption 1: Automatic Utility Assessment	A cognitive mechanism automatically and subconsciously ascribes some level of utility to attaining a given active goal.
Assumption 2: Automatic Likelihood Assessment.	A cognitive mechanism automatically and subconsciously assesses the likelihood that an active goal may be attained.
Assumption 3: Yield Assessment	A cognitive mechanism automatically and subconsciously generates a perception of yield for an active goal based on the utility ascribed to it, but reduced in inverse proportion to the likelihood assessed for attaining the goal.
Proposition 1: Perceived Yield	At a given moment, the yield an individual perceives for a given goal is a multiplicative function of the utility ascribed to the goal and the assessed likelihood of attaining it.
Assumption 4: Yield Shift Detection	An automatic, subconscious, cognitive mechanism detects the magnitude and direction of changes in yield for the active goal set.
Assumption 5: Affective Response to Shifts in Yield Perceptions	The yield shift detector triggers an affective arousal proportional to the magnitude of the shift in yield, and with a valence in the direction of the shift.
Proposition 2: Satisfaction response as a function of yield shift.	The magnitude of the satisfaction response is a curvilinear function with a positive but decreasing slope of the absolute value of yield shift. The valence of the satisfaction response is determined by and equivalent to the sign or direction of the yield shift.

5. Evaluating YST

Having advanced a new theory, one should next develop arguments about both its falsifiability and its scientific utility (Popper, 1959; Bacharach, 1989). This section argues the falsifiability and scientific utility of yield shift theory

5.1. Falsifiability of YST Constructs

For a theory to be regarded as falsifiable, it must be possible to refute its constructs and propositions by experience (Popper, 1959). For causal constructs to be regarded as falsifiable, their definitions should be sufficiently explicit that it is possible for a researcher to devise at least two different experimental treatments that instantiate at least two different values of the causal construct. The key causal construct in YST is shift in yield. The theory suggests at least three strategies by which the yield of the active goal set can be manipulated. Table 6 lists these strategies and proposes two treatments that instantiate different values of the causal construct based on each strategy. Thus, the causal constructs of YST are demonstrably falsifiable.

For a consequent construct (one representing an effect) to be regarded as falsifiable, its definition should, at a minimum, be sufficiently explicit that a researcher can define variables to measure it in an operationally specific manner (Bacharach, 1989). Such variables should be able to measure the construct in ways that distinguish it from other closely-related constructs. YST defines the satisfaction response as an affective arousal with a valence. This definition distinguishes it from satisfaction-as-judgment and other connotations of the word *satisfaction*, and this distinction can be incorporated into scale items for measuring satisfaction. For example, statements like these elicit explicitly about an affective response, and so are consistent with YST:

1. *I feel good about today's meeting process (1 = Strongly Disagree, 7= Strongly Agree). (Briggs et al., 2006, p.603)*
2. *All things considered, I am (delighted / disappointed) with using the system"* (Chin and Lee, 2000, p. 559).

3. *I feel good about today's meeting process (1 = Strongly Disagree, 7= Strongly Agree).* (Briggs et al., 2006, p.603)
4. *All things considered, I am (delighted / disappointed) with using the system"* (Chin and Lee, 2000, p. 559).

Table 6. Theoretical strategies for manipulating Shift in Yield, and for each strategy, an example of two treatments that instantiate two different values of Yield Shift in an IS context.	
Strategy	**Treatments**
1. Change the utility people ascribe to their active goals.	All bank customers are told that their new online banking system will allow them to pay bills online as a free service, eliminating the need to write checks and stamp envelopes. Object of satisfaction: Online Bill-Paying Service. Treatment 1: *Users discover that, while the banking service is free, the vendors from whom they buy also offer a 5% discount for online transactions (a positive utility shift).* Treatment 2: *Users discover that, while the bank does not charge for the service, the vendors from whom they buy charge a 5% fee for online transactions (a negative utility shift).*
2. Change the likelihood people assess for active goals.	Users are told that there is only a 50-50 chance the budget for a new system will be granted. Object of satisfaction: IS/IT Budget Process. Treatment 1: *Users are subsequently told that the CEO has forwarded a recommendation to the board that the plan should be funded (a positive shift in likelihood).* Treatment 2: *Users are subsequently told that the CEO has forwarded a recommendation to the board that the plan should not be funded (a negative shift in likelihood).*
3. Change the goals that comprise the current active goal set.	HR Personnel change to a new ERP system that makes calculations of withholdings more difficult. Object of Satisfaction: ERP System. Treatment 1: *A mentor points out to users that people who use the new system have a far greater chance of getting a promotion than people who continue to use the old system. (add the goal of job promotion to the active set and position the ERP as something that increases the likelihood of achieving that goal).* Treatment 2: *A mentor points out to users that people who use the system also have a far smaller chance of getting a promotion than people who continue to use the old system (add the goal of job promotion to the active set and position the ERP as something that lowers the likelihood of achieving that goal).*

However, the definition of the satisfaction response used in YST would rule out questions that measure satisfaction as judgment such as:

1. *To what extent does the final solution reflect your inputs? (1=Not at all, 5=To a Very Great Extent)* (Green and Taber, 1980, p.102)
2. *What is your overall reaction to the system? (Rigid / Flexible)* (Chin et al., 1988 p. 217)

The definition would also rule out measures like the following that do not distinguish between affect and judgment, and so might produce ambiguous results:

1. *How satisfied or dissatisfied are you with the quality of your group's solution? (1=Very Dissatisfied, 5=Very Satisfied)* (Green and Taber, 1980, p. 102)
2. *"Overall I am (extremely dissatisfied – extremely satisfied) with the online offerings of [this provider]."* (Khalifa and Liu, 2003, p. 230).

Appendix A proposes an instrument derived from YST for measuring the satisfaction response of stakeholders with respect to IS/IT artifacts (referred to in the rest of the paper as the IS/IT Satisfaction Instrument).[1] These examples demonstrate that the definition of the satisfaction response is sufficiently explicit that one can derive variables to measure it, and that one can distinguish it from other closely related phenomena. Thus, both the causal and consequent constructs of YST are demonstrably falsifiable.

5.2. The Falsifiability of YST Propositions

In order for a theory to be regarded as logically adequate, its propositions must not be tautological, but should be framed such that the causal relationships they propose could be refuted by experience (Bacharach, 1989; Popper, 1959).

In YST, Proposition 1 posits that goal yield is a multiplicative function of ascribed goal utility and assessed likelihood of goal attainment. The relative yield of the active goal set (or at least those in working memory) could be measured by asking participants to list salient goals in rank order according to the value they are likely to derive from pursuing each. A researcher could then manipulate perceptions of likelihood and utility (see Table 6 for examples), and participants could be asked to re-rank the goal set. It would be possible for the new goal set rankings to be inconsistent with the multiplicative function posited in Proposition 1. Indeed, it would be possible to produce rankings that were independent of both utility and likelihood. Thus, Proposition 1 could be refuted by experience.

In YST, Proposition 2 posits that shifts in perceived yield for the active goal set cause a satisfaction response. The treatments proposed in Table 6 could be combined with the measurement instrument proposed in Appendix A to form hypotheses that test Proposition 2. A test of any of those hypotheses could produce satisfaction data that differ from the predictions of the hypotheses and from the causal relationships of the proposition. Thus, Proposition 2, and so YST, is demonstrated to be falsifiable.

5.3. The Scientific Utility of YST

For a theory to be regarded as scientifically useful, it should either offer more explanatory power for the phenomenon of interest than was available in the prior literature, or it should offer a more parsimonious model with similar explanatory power to that which preceded it. In this section, we demonstrate that YST offers an explanation for all ten satisfaction effects, that it can predict when each should manifest and when it should not, and that it can reconcile seeming paradoxes within and between existing models of satisfaction.

Although each of the ten effects is distinct, there is substantial overlap in the explanations YST suggests for the effects. If we were to organize this section by effect, therefore, its sub-sections

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[1] We offer the IS/IT satisfaction instrument only as a demonstration of the falsifiability of the consequent construct; not as an empirically validated instrument.

would contain much redundancy. Instead, we organize this section by YST prediction, and in each section we note which aspects of the ten effects are explained by each prediction.

YST and Goal Attainment

YST predicts that, upon goal attainment, positive, neutral, or negative satisfaction responses are possible, depending on conditions. Goal attainment should produce a positive satisfaction response under two conditions. First, if attainment of a goal produces higher utility than the individual had ascribed to a goal, goal attainment would constitute a positive shift in utility. Second, if the individual had ascribed less than full likelihood to attaining the goal, then goal attainment would constitute a positive shift in likelihood assessment from less than 100 percent to a complete certainty. Either of these conditions would produce a positive shift in yield upon goal attainment, and so give rise to a positive satisfaction response upon goal attainment. *These conditions would account for the positive satisfaction responses of the goal attainment and confirmation effects, and could account for the positive satisfaction responses of disconfirmation effects where expectations were lower than outcomes.* By this logic, positive goal attainment and confirmation effects should not manifest when an individual assesses full likelihood of goal attainment or when goal attainment results in less utility than the individual ascribed to the goal. Positive disconfirmation effects should be smaller when individuals ascribe high likelihood to attaining their expectations and desires than when they ascribe low likelihood.

By the logic of YST, goal attainment should be accompanied by a neutral satisfaction response (non-arousal) when goal attainment produces utility similar to the utility ascribed by the individual to the goal, and when the individual ascribed full likelihood to achieving the goal. These conditions would yield no changes of likelihood or utility, and thus no satisfaction response. *This would account for the neutral responses observed in the disconfirmation and hygiene effects.* By this reasoning, the neutral responses of the disconfirmation and hygiene effects should not manifest upon goal attainment when individuals ascribe less than full likelihood to such attainment.

The logic of YST suggests that, upon goal attainment, a negative satisfaction response should manifest when goal attainment produces lower utility than that ascribed to the goal by the individual, which would constitute a negative yield shift, and so invoke a negative satisfaction response. *This would account for the negative satisfaction responses observed in the confirmation and disconfirmation effects.* It is not possible for goal attainment to result in a decreased likelihood assessment, because attainment by definition moves likelihood to a certainty. Negative confirmation and disconfirmation effects should not manifest, however, when an individual ascribes low likelihood and high utility to a goal, and goal attainment results in a modest negative utility shift. Under such circumstances, a strongly positive likelihood shift should overwhelm the modest negative utility shift, producing a positive satisfaction response.

YST predicts that, upon goal attainment, a *differential effect* would manifest when different people who ascribe similar utility to attaining the goal nonetheless assess different likelihoods of its attainment. The person who ascribed the lowest likelihood to attaining the goal would experience the largest upward shift of likelihood when the goal was actually attained, and so would experience the largest yield shift, and so the largest satisfaction response. Likewise, the person who ascribed the highest likelihood to the goal would experience the smallest upward shift when the goal was attained, and so experience the smallest yield shift, and so the smallest satisfaction response. By this logic, differential effects should not manifest when individuals ascribe similar utility and similar likelihood to a goal. Further, differential effects should be larger for high-yield goals than for low-yield goals.

YST and Thwarted Goals

The logic of YST suggests that a perception that a goal is being thwarted is, in fact, a negative shift in likelihood for the goal, which should produce a negative yield shift, and therefore, a negative satisfaction response. *This would account for the negative satisfaction responses observed in the goal attainment and hygiene effects.* By this reasoning, negative hygiene effects should not manifest when individuals ascribe no likelihood to attaining a goal.

YST and Satisfaction before Goal Attainment

The logic of YST suggests that positive satisfaction responses could manifest before a goal is attained or before outcomes are known if something happens to change the likelihood or utility ascribed to the goal either positively or negatively. Such changes would constitute positive or negative yield shifts, causing positive or negative satisfaction responses. *This would account for the satisfaction responses observed in the anticipation effect.* By this reasoning, anticipation effects should not manifest when events do not affect the likelihood or utility an individual ascribes to active goals.

YST and Changes in the Active Goal Set

Sometimes satisfaction responses manifest long after goals have been attained or thwarted. When one reflects on past success or failure, the goals of that time may temporarily displace more current goals in the active goal set. The yield of those past goals may differ from those of the more current goals they displace, giving rise to a positive or negative yield shift for the active set as a whole, and so to positive or negative satisfaction responses. *This would account for observed nostalgia effects.* By this logic, nostalgia effects should not manifest when the yield of past goals is similar to the yield of the goals they displace in working memory.

When one speaks with a trusted advisor or friend, that person may cause one to stop focusing on lower-yield goals and to begin focusing on higher-yield goals. Doing so causes the overall yield of the current goal set to increase, resulting in a positive satisfaction response. A trusted advisor, perhaps hoping to motivate purposeful action, might also cause one to attend to lower-yield goals, reducing the overall yield of the current goal set, producing a negative satisfaction response, perhaps with the intention of motivating additional effort. Further, even without invoking a change of goals in the active set, a mentor with experience and credibility can sometimes induce a change in the likelihood or utility ascribed to an individual's salient goals. *These mechanisms would account for the mentor effect.*

YST and Mixed Feelings

YST predicts a given satisfaction response for any given yield shift. However, sometimes people report mixed feelings – the simultaneous experience of both positive and negative satisfaction responses. Mixed feelings could manifest upon goal attainment under several conditions. First, consider the case where an individual ascribes high utility and low likelihood to attaining a goal, and on attaining the goal, obtains substantially less utility than expected. YST suggests that the positive likelihood shift and the negative utility shift should net out to a positive, neutral, or negative yield shift, producing a positive, neutral, or negative satisfaction response, depending on the relative values of the likelihood and utility shifts. However, individuals may devote their limited attention resources in one moment to only the likelihood shift, and so experience a positive response, and then in the next moment turn their attention to only the utility shift, producing a negative response, causing a sequence of mixed feelings.

Reflection suggests that mixed feelings could also manifest upon the attainment of a goal when an individual is conscious of having had to sacrifice other high-yield goals in order to achieve the success. The individual might alternate between contemplating the several states represented by the sacrificed goals, each of which might compare differently with the current state, producing a sequence of mixed feelings. By this reasoning, however, mixed feelings should not manifest when all yield shifts invoked by events are in the same direction.

YST and Attenuation of Satisfaction

Finally, the *attenuation effect* can also be explained by the yield shift mechanism. At the moment a person experiences a shift, the mechanisms posited by YST detect a difference in yield for the active goal set from the moment before, giving rise to a satisfaction response. As time passes, however, current conditions will increasingly be perceived as status quo rather than as a change. Thus, detected yield shifts will diminish, causing the satisfaction response to diminish. By this reasoning, attenuation effects might be temporarily delayed when an individual is in a turbulent, rapidly changing environment where the goals in the active set change quickly and where each change is quickly followed by significant yield shifts for the new active set. Eventually, however, physical and mental

exhaustion might limit the individual's ability to focus on new goal sets and new yield shifts, and so attenuation effects would be inevitable.

YST and the Paradoxes of Earlier Perspectives

Confirmation and disconfirmation theories both posit satisfaction effects based on a comparison of outcomes to expectations or desires. However, it is possible that one's expectations could be lower or higher than one's desires, and that outcomes could fall somewhere between them. Under these conditions, both confirmation and disconfirmation theories would yield two mutually exclusive predictions of the satisfaction effect, one based on expectations, the other based on desires, creating a paradox. Yield shift theory removes this paradox by framing the causes of satisfaction in terms of utility and likelihood assessments for goals instead of expectations and desires for outcomes. Any combination of changes to utility and likelihood will result in only a single prediction for a satisfaction response, and so no such paradox exists with YST.

YST also resolves the seeming conflicts between the predictions of goal attainment, confirmation, and disconfirmation theories of satisfaction, each of which has received empirical support. As explained above, the logic of YST suggests circumstances under which each of these effects should and should not manifest, and so suggests a way to integrate these mutually exclusive theories and the findings that support them.

6. Discussion

With the arguments above, we have demonstrated the falsifiability of YST's constructs and propositions. We have also demonstrated that YST suggests explanations for each of the ten observed satisfaction effects, and that its logic can be used to predict conditions under which each effect should and should not manifest. YST also explains why researchers could find empirical support for the mutually exclusive predictions of confirmation and disconfirmation models with respect to the case where outcomes match expectations and desires. We have also demonstrated that YST offers a resolution for the paradox of expectations and desires in confirmation and disconfirmation models. Because YST explains more variations of the phenomenon of interest than do its predecessors, its scientific utility is demonstrated.

6.1. YST and the Technological Imperative

The logic of YST suggests that a technological imperative should not be applied to the satisfaction response. One would not be justified in concluding that the use of some class of IS/IT artifacts necessarily leads to or influences satisfaction. There may be a temptation toward the technological imperative because people frequently report higher satisfaction with the better-performing artifacts. Consider, however, a scenario where one group of users sends print jobs to a printer that never fails, while another group sends print jobs to a printer that fails frequently. Suppose users in both groups were asked to print out a large, time-critical proposal that would bring high reward if it could be delivered on time, but no reward if it were delivered late. Suppose further that all printouts were successful, and that users were asked to rate their feelings of satisfaction or dissatisfaction with the printer following the print job. Those who assessed less than full likelihood that the document would print successfully may experience an upward shift in likelihood upon success, while those who assessed full likelihood to the success of the printout may not. Therefore, according to the logic of YST, in this scenario, a counter-intuitive outcome could manifest: users of the unreliable printer may actually rate it higher on the IS/IT satisfaction scale than would users of the reliable printer. Thus, the logic of YST suggests that a technological imperative, where systems or their attributes are proposed as causes or influencers of satisfaction, cannot hold for the satisfaction response.

6.2. Future Directions

The presentation of this theory raises a number of issues requiring further research. The next step for YST could include experimental testing of its propositions. Such experiments should be conducted with a variety of IS/IT artifacts, policies, procedures, and practices under a variety of circumstances to establish that the effects are not restricted to a specific system or situation. A first step in this process

could be to validate an IS/IT satisfaction instrument to further demonstrate the falsifiability of the consequent construct (Straub, 1989). This experimental work could begin by examining the ten observed satisfaction effects listed in Table 1. We used the logic of YST to derive explanations for all ten observed satisfaction effects and to argue that each effect should occur under some conditions, but not others. It will be necessary to derive formal hypotheses that challenge the derived explanations and that instantiate conditions under which the effects should and should not manifest in the IS/IT domain. If such studies produce results that are consistent with the explanations, and if they demonstrate that each of the ten effects can be generated or prevented by experimental treatments, then the findings would suggest that the causal relationships proposed by the theory are a useful model of the satisfaction response, and that the theory could be useful in applied settings.

It may also be useful to take YST into the field using a design-science approach (Hevner et al., 2004; Nunamaker, 1992) to observe if satisfaction responses are consistent with YST's propositions. Such research would serve both applied and theoretical scientific purposes. Because satisfaction is an important construct throughout the IS/IT lifecycle, field observations and theory-based interventions should examine satisfaction during planning and design, development, deployment, operations and maintenance, and phase-out. Field researchers can attempt to use the theory as the basis to derive measurement instruments for practitioners, to amend design and development methodologies, and to create deployment interventions that produce not only sound systems, but also systems with which stakeholders feel satisfied. As the applied field work proceeds, researchers can record observations about the degree to which satisfaction phenomena are consistent with or in conflict with the propositions of the theory. Thus, their work will either provide additional support for, or will refute the theory, perhaps pointing the way toward a better theoretical framing of the satisfaction response.

This stream of research began with an observation that satisfaction seemed to correlate with the continued use or abandonment of information systems. Having derived an explanation for the onset, magnitude, and valence of the satisfaction response, we should next seek to understand change of practice. Further research will be required to determine the causal link, if any, between the cognitive mechanisms of satisfaction and the cognitive mechanisms of choice and of stability or change of practice.

The Boundaries of YST

YST seeks only to explain the causes for the onset, magnitude, and direction of the affective phenomenon that we label the satisfaction response. It does not attempt to explain other phenomena that bear the satisfaction label, for example, satisfaction-as-judgment. Satisfaction-as-judgment is defined as the evaluation individuals make of the extent to which their needs, wants, or desires have been fulfilled, or that their goals have been attained. This construct may also have bearing on the degree to which individuals perceive that their interests and constraints have been accommodated. Goal attainment or need satisfaction models are useful but insufficient to account for the variety of satisfaction responses that manifest. Nonetheless, it seems important that we come to a deeper understanding of satisfaction-as-judgment – its definition, its causes, and the nature of its relationship to satisfaction-as-affect. We suspect that it is more than a linguistic accident that these two constructs bear the same label, but further research will be required to illuminate this topic.

A Potential Link between Affect and System Use

In the introduction to this paper, we noted that the literature reports correlations between satisfaction responses and system use. YST now offers an explanation for the satisfaction response. However, further theoretical research will be required to establish an understanding for those observed correlations of affect and system use. Such studies may need to explore the link between the cognitive mechanisms of affective response and the cognitive mechanisms of motivation, choice, intention, and behavior.

Limitations

Finally, we concur with Orlikowski and Baroudi's (1991) contention about a plurality of epistemological approaches that, *"[an] exclusive view is, in our opinion, always only a partial view…" (p. 7).* We hold that, from a philosophical perspective, causal, interpretivist, and criticalist epistemologies are not only compatible, but interdependent for investigations of socio-technical systems. YST proposes a cause

and effect explanation for the onset, direction, and magnitude of the satisfaction response. Satisfaction, however, manifests in a rich and complex social, political, and cultural milieu. The causal logic of YST offers limited insights about the subjective and intersubjective meanings people may ascribe to their experiences of IS/IT, and how the structure of such socially constructed interpretations might shape the nature and salience of individual goals and influence subconscious perceptions of utility, likelihood, and ultimately of the yield shifts, which YST posits as antecedents to satisfaction responses. Interpretivist enquiry, which seeks to understand how people in a social context interact to ascribe meanings to the actions, words, and symbols that comprise their mutual experiences (Orlikowski and Baroudi, 1991), may be a useful approach to addressing this limitation. Similarly, criticalist enquiry may be useful for exploring the historical, economic, political, and social circumstances that gave rise to existing belief structures relating to the satisfaction response, the role of such structures in developing and reinforcing the current social order, and the degree to which alternatives might lead to greater social equity and justice (Alvesson and Deetz, 2000). A fuller understanding of the satisfaction phenomenon may be achieved through a plurality of epistemological approaches. [2]

7. Conclusions

The yield shift theory of satisfaction uses five constructs arrayed in two propositions derived from five assumptions to build the argument that the satisfaction response is caused by shifts in perceptions of yield for the active goal set. It argues that the yield for a given goal is a function of the utility an individual ascribes to the attainment of that goal, but reduced in inverse proportion to the likelihood an individual assesses of attaining the goal. The logic of YST suggests three strategies for invoking shifts in yield for the active goal set: a) change the utility that people ascribe to one or more goals in the active set; b) change the likelihood people assess of attaining one or more goals in the active set; and c) change the goals that comprise the active set.

For researchers, YST offers a parsimonious theoretical foundation for understanding the satisfaction response. We have argued both the falsifiability and the scientific utility of the theory. It suggests explanations for ten observed satisfaction effects, and it suggests an explanation for conflicting results in the IS/IT satisfaction literature. It also resolves paradoxes left unaddressed in earlier theoretical perspectives. If the logic of YST holds up to future empirical scrutiny, it may provide a solid foundation for those who research user satisfaction, IS success, technology transition, adoption, diffusion, and other related topics. If YST is sustained by empirical validation, it may be regarded as transformative in that it bridges and integrates previous perspectives, providing conceptual coherence that allows us to re-evaluate earlier perspectives in a new light.

YST has significant implications for IT/IS field. It can provide a basis for making choices about how to approach designing, developing, and deploying information systems in ways that are likely to engender positive satisfaction responses among users and other stakeholders. If users feel satisfied, this, in turn, may increase the likelihood that information systems and technologies will succeed in creating lasting value in organizations.

Acknowledgments

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[2] We acknowledge an anonymous reviewer who helped us situate YST within the broader context of epistemologies and philosophies of science.

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Appendix A

A Satisfaction Instrument for IS/IT Artifacts

The table below presents questionnaire items for measuring a stakeholder's satisfaction response with respect to IS/IT artifacts. The items are offered to argue the falsifiability of the consequent construct of Yield Shift Theory, the satisfaction response. YST defines the satisfaction response as an affective arousal with a positive or negative valence. Note that the questions specifically call for reports of affect. They do not call for judgments that needs or constraints have been met. Nor do they leave any ambiguity as to whether they call for reports of affect or judgment. Thus, they demonstrate that the definition of the consequent construct is sufficiently explicit that a researcher can define variables that distinguish it from other closely related constructs, and that it can be measured in an operationally specific manner.

1. I feel satisfied with <the IS/IT Artifact>. (1 = Strongly Disagree; 7 = Strongly Agree)	1 2 3 4 5 6 7
2. I feel good about <the IS/IT Artifact>. (1 = Strongly Disagree; 7 = Strongly Agree)	1 2 3 4 5 6 7
3. <The IS/IT artifact> gives me a feeling of satisfaction. . (1 = Strongly Disagree; 7 = Strongly Agree)	1 2 3 4 5 6 7
4. I feel happy with <the IS/IT artifact>. (1 = Strongly Disagree; 7 = Strongly Agree)	1 2 3 4 5 6 7
5. When I think about the <IS/IT artifact>, I feel positively toward it. (1 = Strongly Disagree; 7 = Strongly Agree)	1 2 3 4 5 6 7

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