Subsumption Ethics

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Abstract: The difference between computers and simple machines is the extent to which computer systems subsume design and development decisions over which users have little or no control. Normally, such decisions are all but forgotten after implementation. Subsumption ethics describes this process.

This paper begins with a discussion of subsumption ethics and describes four axioms of subsumption ethics. Four ethical frameworks with roots in philosophical traditions are used as an ethical framework: The *golden rule*; the *golden mean*; *niskama karma*; and complexity. A matrix is presented that combines the axioms of subsumption ethics with these ethical frameworks. The paper concludes by applying the matrix to some standard problems in software systems development.

Keywords: computer; information; ethics; subsumption; Aristotle; Gita; Rawls; systems; complexity; design; impact; subsumed object; axioms.

1. Introduction

Subsumption ethics is the process by which decisions become incorporated into the operation of information technology (IT) systems, and subsequently forgotten. IT systems, by nature, repeat operations over and over. If those operations have unethical impacts, the system will nevertheless continue to execute them anyway. Unlike a human operator, there is no point in the cycle where the machine pauses to ask, "Should I do this?"

This paper begins with a discussion of subsumption ethics, and describes four "axioms of subsumption ethics." Four ethical frameworks with roots in philosophical traditions are introduced, including: The *golden rule*; the *golden mean*; *niskama karma*; and complexity. A matrix is presented that combines the axioms of subsumption ethics with these ethical frameworks. The paper concludes by applying the matrix to some standard problems in software systems development.

2. Subsumption Ethics

2.1. Subsumption

Subsumption in general is the process of building larger components from smaller ones. In this sense, a cell subsumes DNA function, American common law subsumes judicial decisions, and a hairdryer subsumes an electric motor. Subsumption in computers is different because there is so much more subsumption going on than in simple machines.

In computer systems, small components are developed and tested, and once they are working reliably they are subsumed into larger systems. This is the enabling technique of object oriented programming.

The larger systems, in turn, are subsumed into still larger systems. Once components, subsystems and applications are operating, the subsumed process becomes invisible and *unavailable* to the user, what James Moor calls the "invisibility factor."[1]

From binary storage to the structure of databases to the content of Web pages, IT components are "subsumed" into larger and larger systems. Each component is forgotten as it is subsumed, and requires no further attention unless it fails.

Systems seem like they should be extremely malleable. People tend to think that changes to software should be easy because programming is just a set of instructions, and not like a building made up of hard materials. However, the principle of subsumption makes it clear that changing base components is like moving building foundations, and can require changes to entire systems. The year 2000 problem, for example, is a result of subsumed date processing. There are thousands of layers of subsumption in a typical computer system.

The Greek word *ethos*, from which we derive "ethics," can be translated as "habit." Habit in general is a subsumption process. Aristotle pointed out that habits are the result of accumulated decisions. Therefore, *ethos* and subsumption are closely related, and Aristotle's ethics are easily applied to IT.

Small design decisions lead to small elements within a system. These small elements become subsumed into larger system components, and so on, until the full system operates.

2.2. Systems Development

Design and implementation decisions dictate the structure and operation of systems. Systems ultimately operate according to many such decisions. The decisions become codified into programming code and information content. I call segments of this code and content "subsumed objects" (SOs). Because of the "invisibility factor," subsumed objects cannot be identified retroactively.

Design decisions often have ethical components, whether or not the designer is explicitly aware of them. For example, the tab order of a data entry screen on a "Therac 25" radiotherapy machine was shown to be the cause of injury and death among patients in the late 1980s.[2]

Such seemingly small design decisions can determine the ethical impact of resulting systems. Nevertheless, these decisions are subsumed into systems as objects. Moreover, systems grow in complexity over time. I call this process *Subsumption Ethics.*

I do not mean here that the system makes ethical judgments, or that we can hold computers ethically responsible for their actions. But I do suggest that:[a]

1. The impact of IT is determined by the operation of its subsumed objects;
2. Subsumed objects have a determinate moral value;
3. The ethical impact of an IT system is the responsibility of the people who designed, developed and use it.

For example, people tend to buy more items from the first computer screen that appears. If products, such as airline tickets, are presented alphabetically, then the system has a bias. The U.S. Justice Department sued Microsoft in May 1998 in part because Microsoft insisted that its Windows 98 operating system initially display only Microsoft-approved icons – strongly encouraging user bias toward certain products.

2.3. Organizational Policy Drives IT Development

There is a close relationship between computer systems and organizational policy. For example, state motor vehicle registries have sold EZ-Pass[b] data to private companies. The data is usually used for marketing purposes. While IT enables the practice, the policy raises the ethical concerns.

Because of subsumption ethics, such policies become subsumed into systems. Here's how it works:

1. IT enables a function that was not possible before (like selling detailed commuter data)
2. A policy decision is made to proceed with the practice (the data is sold)
3. Engineers and managers seek ways to implement the policy efficiently
4. An automated process is set up that implements the policy (commuter data is transmitted automatically to buyers at regular intervals)
5. The process runs without user intervention. At this point, the policy has become a subsumed object, and it would take work to discontinue the practice. Once the original decision-makers, systems designers and developers move on to other projects, the subsumed process is largely forgotten as a matter of course. The process will be reviewed again only if problems or complaints arise.
6. The SO gets subsumed into other practices, such as the general databases of the registry data purchasers.
7. The process repeats.

2.4. Axioms of Subsumption Ethics

There are four axioms of subsumption ethics:

A. Information systems subsume design, policy and implementation decisions in programming code and content. Code segments and content become "subsumed objects." While it is demonstrable that systems are built from subsumed components, it is less easy to show exactly how decisions are subsumed. This axiom posits that the decisions themselves, including many subtle factors, are incorporated into systems operation.

B. Subsumed objects have determinate moral value. Anecdotally, we can see the moral value of subsumed objects. A windowing system that can only display certain colors, thereby excluding users with certain visual disabilities, has a negative moral value for those users.

C. Subsumed objects have a high "invisibility factor." Subsumed objects are invisible to most users. It is not possible, for example, to know all the calculations that mortgage eligibility software might use without seeing the source code. Such software could systematically discriminate without a user's knowledge.

D. Subsumptive complexity increases over time. As systems are developed, components become subsumed more and more deeply. For example, in the EZ-Pass example above, purchasers of the registry data will subsume its use into much larger processes, which might incorporate home ownership, family and estimated income information.

2.5. Ethical Framework

Subsumption ethics implies a need for continuous ethical analysis during systems design and development. An ethical framework is required for this analysis.

Any number of ethical frameworks can be applied to the process of subsumption ethics. In order to be effective an ethical framework must be 1) coherent 2) applicable and 3) widely accepted.

I propose that four ethical principles that have roots in antiquity to provide a framework for ethical IT decisions.

1. The first is "the Golden Rule" found in the Bible, in Kant's categorical imperative and many other world traditions: "Do unto others as you would have them do unto you" – empathize with those impacted by IT decisions. The Golden Rule means systematically evaluating a project from the perspectives of stakeholders: shareholders, users, management, customers, vendors and the affected community.
2. The second is "the Golden Mean" as explicated by Aristotle. In his view, happiness could be found by choosing the middle way between extremes. One needs knowledge and understanding in order to make informed, balanced decisions. Aristotle's Golden Mean requires informed, rational judgment.
3. The third is "action without desire or aversion" (*niskama karma* in Sanskrit) and comes from the philosophy of the East, both Buddhist and Hindu. Some of the clearest explication of *niskama karma* is found in the *Bhagavad Gita.* Desire and aversion are two sides of a coin. Desire and aversion interfere with perception, they cloud the mind. Decisions based on desire and aversion lead to failure because they are not based on knowledge, and do not lead to informed, balanced decisions. Effective systems development requires making decisions based on empirical reality, not desire and aversion.
4. The fourth principle is "ethical complexity." The ethics of complexity are expressed clearly in the work of philosopher John Rawls. Simply stated, an ethicist's work is never done – the ethics of every situation must be worked out, since every situation is unique. IT projects are complex. Small design changes can have major ramifications. This complexity must be controlled. Chaos theory shows that small changes in initial conditions have major implications on outcomes. IT professionals must bring experience, training and an ethical eye to the details of their projects.

2.5.1. First Ethical Principle: The Golden Rule

The golden rule is expressed directly in Matthew 7:12: "So in everything, do to others what you would have them do to you."[3] The message appears as one of Jesus' ethical admonitions during the Sermon on the Mount. It is a doctrine that has found expression by many philosophers and religious traditions around the world. It is also expressed in the simple moral principle of empathy and compassion: pay attention to the effects of your actions.

Kant's "categorical imperative" is conceptually similar. He said, "Act in such a way that it is possible for one to will that the maxim of one's action should become a universal law."[4] Therefore, act as though each action is what you would want anyone to do under the same circumstances. Kant expressed the moral implication of the first statement as, "Act always so as to treat humanity, in your own person or in that of another, as an end in itself, never merely as a means."[5]

The utility of the golden rule is limited: It is an insufficient analysis tool for complex situations, and it is but one useful ethical approach to many social issues.

An alternative formulation of the golden rule is the negative, as in: "Do not do unto others as you would not have them do unto you." This formulation is the basis of liberal legal systems, which provide prohibitions on certain behaviors, and then allow liberty to do anything else. Such a formulation might keep me from stealing something, because I would not want someone else to steal from me.

The negative structure is useful as far as it goes. However, it does not provide a positive force for the consideration of others which is implicit in the golden rule. The golden rule goes beyond prohibition, it recommends positive action. However, taken to extremes, "doing" the right thing for others can carry a great burden; one might work all ones life to do unto others, and find that no amount of doing is satisfactory.

There are other criticisms of the golden rule. It can be presumptuous to think that what you would want is what another might want. Thus, doing unto others can actually be harmful. The rule can also lead to a martyrdom or guilt-complex. For example, if I am nice to someone only because I want her/him to be nice to me, I may expect behaviors out of her/him that are motivated out of my own selfishness. If s/he does not do what I want, I may be even nicer, or make her/him feel guilty for not conforming to my expectations. Being too nice to someone, serving as a crutch, could actually weaken that person over time.

A police officer probably would not want to be arrested. However, s/he must arrest suspects. At first blush, this activity violates the golden rule, but in the context of a civil society, perhaps the officer *is* doing to the suspect what they would want to have done in general, even to her/him, under the same circumstances.

All these criticisms are valid, and perhaps a different formulation of the rule is required. Nevertheless, there is a positive motivation in the golden rule that I am loath to discard. For the sake of liveable societies, we should do more that just avoid hurting people. We should seek to help them.

The golden Rule has two primary implications for IT:

1. That all stakeholders should proactively strive to develop IT systems that are beneficial to the common good (however defined) and that
2. Because of subsumption ethics, the impact of design and development decisions must be considered at all levels and at all stages.

Following these principles requires effort, but doing so results in systems that are widely accepted, eminently useable,

and largely above reproach. In other words, doing so helps all stakeholders, including, ultimately, corporate shareholders.

2.5.2. Second Ethical Principle: The Golden Mean

Aristotle is credited with the concept of the "golden mean." Quite different from the *golden rule,* the *golden mean* is a route to happiness and virtue through informed, reasoned balance. One must learn about a subject, then identify extreme responses. Only then can one apply reason to make a deliberate decision that seeks the mean between extremes. By consistently taking action from deliberate decisions which achieve balance, a person can find happiness. But that happiness is not static – balance must be actively maintained and each situation must be worked out as it arises. As with a skier or figure skater, balance shifts continuously. Balance one moment, a fall the next.

The mean is "some intermediate between excess and deficiency."[6] Virtue is to be found in the mean.[7] Extrapolating from Aristotle, then, virtue is the mean between too much food and too little, too much wealth and too little, too much automation and too little.

Reason is required in order to achieve virtue. As Aristotle puts it, "Decision involves reason and thought."[8] So, in the end, Aristotle recommends finding a mean between extremes of excess and deficiency by a process of reason and thought. After Aristotle, I assume that by and large, informed, balanced decisions tend to be ethical decisions.

Of course different people will have various ideas on where to draw the mean, and what scale should be used. This is where Rawls' ideas about reason carried out in public political debate can be brought to bear on the situation (see below). Reason in this sense involves discipline and attention – a habit of thinking carefully about complex issues.

One has to apply one's ethics within the context of an end goal or philosophical structure. For Aristotle the goal was "happiness," although the term is a conceptual placeholder. It comes from the Greek *Eudaimonia,* meaning "well-power" or "good-flowing." One could also translate it as "the good," "inner-peace" or even "self-realization."

Aristotle wrote, "Since every sort of knowledge and decision pursues some good.... What is the highest of all the goods pursued in action? As far as the name goes, most people virtually agree [about what the good is], since both the many and the cultivated call it happiness, and suppose that living well and doing well are the same as being happy."[9] Happiness, then, comes from good *ethos.*

One must work to understand issues and examine them within the context of the golden mean. Reason must be applied, and informed decision must be made between extremes. This leads to virtuous action, which in turn leads to happiness.

2.5.3. Third Ethical Principle: Niskama karma

Like Aristotle, the Eastern traditions of both Buddhism and Hinduism also deplore avarice. They point to worldly desire (lust/greed/avarice), aversion (hatred) and ignorance as the main sources of all human misery. The Sanskrit term *Niskama karma* is an ethical principle that translates as "action without desire."

According to these traditions, reincarnation (also known as rebirth and transmigration) ceases when an individual becomes unified with God (*Brahman*). This unification means release from desire, and hence release from misery. The long-term goal of the practice of *yoga* is to achieve *Nirvana,* or release from the cycle of rebirth. Non-desirous action, (or *niskama karma*) is one of the *yoga* practices leading to *Nirvana.* Therefore, in these traditions, desire and aversion lead toward rebirth and away from happiness.

If we remove the idea of reincarnation from the equation, the *yoga* of non-desire still applies, although its impact may be diminished. Taken as a metaphor, the notion of rebirth can mean that we are bound to repeat our mistakes in *this* lifetime, unless we determine and remove their causes. In this sense, desire and aversion still lead us away from happiness because they distract our attention from learning and growing. It is a fact that desire is not sated long. Each conquest quickly fades, and desire is reborn.

Desire and aversion represent two extremes, a balanced approach practices neither. Balance here is similar to Aristotle's golden mean, although the goal in Buddhism and Hinduism is to transcend the entire structure of desire and aversion.

In the Buddhist and Hindu traditions, ignorance (*Maya* in Sanskrit) is the avoidance of knowledge. Hubris relates closely to ignorance – it is the presumption of knowledge without actual knowledge. Ignorance and hubris are vices because they lead away from *Nirvana,* knowledge and inner peace. Here again we find a parallel to Aristotle's philosophy. According to Aristotle, decision must be made based on careful examination of available information – knowledge. Ignorance and hubris specifically avoid seeking knowledge and understanding.

One should live free from desire and aversion because they represent imbalance which prevents happiness. In the sections which follow I will explore the sources of these ideas in more detail.

2.5.3.1 The Bhagavad Gita

The *Bhagavad Gita,* part of an ancient Hindu text called the *Mahabharata,* discusses desire at length. Like the Western Bible, the authorship of the *Gita* is not clear. It is probably a recording of a Sanskrit oral tradition.

The *Gita* is a discussion between the archer Arjuna and the god Krishna. Arjuna is about to go into battle against people he knows and loves. Most of the text contains Krishna's responses to Arjuna's quandary over whether to kill his friends,

teachers and relatives in the opposing army, or to walk away from the battle.

2.5.3.2. We are compelled to action

Krishna tells Arjuna that we have no choice but to act. It is not possible to refrain from action, even for a minute: Our hearts beat, we breathe, we eat and otherwise interact with our world.

Nor is it possible to live without using and acting on information. From the moment we are born we are bombarded with data, faces, words, information we will later assimilate and use in a more or less coherent way. By the time we are adults we have a large vocabulary, a driver's license, a television set, and most likely, a computer. We are compelled to action.

Similarly, the rise and fall of ethical issues is like breathing – it is inescapable. As P.N. Srinivasachari[c] puts it, "The *Gita* does not ordain absolute *inactivity*, but only insists on *unattached activity*; freedom *in* action and not *from* action."[10]

We must make choices. Ethical issues arise constantly. The trick is to make informed, balanced decisions. If we are driven by desire for a self-interested outcome, or lost in ignorance, our decisions are less likely to be balanced and ethical. Srinivasachari writes, "By far the most distinctive contribution of the *Bhagavad Gita* to ethical thought is the idea of *niskama karma*" or *action without desire.*[11]

It is not possible not to act. But, according to the *Gita*, when one acts with conscious attention, one is able to achieve balance. Conversely, action with desire results in misery.[d] The *Gita* says, "He who is disciplined in Yoga, having abandoned the fruit of action, attains steady peace; the undisciplined one, attached to fruit, is bound by actions prompted by desire."[12]

2.5.3.3. Non-injury

Mohandas Gandhi's notion of non-injury, or *ahimsa*, arose out of the notion of action without desire. He understood the battle narrative of the *Gita* as a metaphor for the internal struggle between good and evil. For Gandhi, the good arose from non-injury, evil from attachment and desire.

A point of clarification is required here: The word "detachment" has a narrow definition in Sanskrit. In English, "detachment" can mean aloofness, boredom or even depression. By contrast, the meaning in translation from Sanskrit is closer to *dispassionate, non-desirous*, or *keeping perspective,* but always with active attention. So the detached member of a meeting is paying very close attention, and contributing her skill, but not allowing her desire to cloud her judgment. As the *Gita* puts it, "The mind is unsteady and difficult to restrain; But by practice.... And by indifference to worldly objects, it is restrained."[13]

2.5.4. Fourth Ethical Principle: Complexity

In his seminal book, *A Theory of Justice*, John Rawls presents the view that fair political processes lead to justice.[14] According to Rawls we will never develop a written ethics that gives clear guidelines for all situations. It is far better, and far more realistic, to establish political structures that allow situations to be worked out as fairly as possible in each case.

This is a pragmatic ethics. It is not a lofty principle of right or wrong, but an observation that ethical decisions need to be made on an ongoing basis to deal with very difficult issues, from the best economic policies to the most effective punishments for murderers. According to Rawls, the best political systems are those that provide forums for public decision-making. These forums must not only allow debate, they must use a language in which citizens can fully participate. Informed people can then make careful, deliberate decisions.

This notion of process is consistent with Aristotle's idea that ethical decisions require informed deliberation. Aristotle also said that ethical decisions need to be made as situations arise, and that a simple, universal statement of ethics is not possible. Although Aristotle's discussion focuses more on virtue and the goal of happiness, his conclusions are similar to Rawls: Ethics must be worked out in each situation, and the specific circumstances are key to determining what is ethical in each situation.

Rawls' idea of *justice as fairness* is also consistent with the golden rule. Rawls uses the term "reciprocity" to indicate that each person should treat others as they would like be treated.

The guidance that we should avoid desire is also consistent with Rawls' notions of fairness. He says that economic inequalities should inure to the benefit of the least advantaged.[15] Desire, and the stratification of wealth it produces, hurts society. In balance, "All citizens must be assured the all-purpose means [money] necessary for them to take intelligent and effective advantage of their basic freedoms."[16]

Note that Rawls argues strenuously that a political system (what he calls a "political conception") must *not* be based on a religious or philosophical doctrine (a "comprehensive doctrine") if the system is to persist over time without falling into tyranny. As he puts it, "A continuing shared understanding of one comprehensive religious, philosophical or moral doctrine can be maintained only by the oppressive use of state power."[17] Political systems, in order to be just over time, must allow pluralistic ideas to coexist peacefully. Rawls, reinforcing complexity theory, embraces the notion that ethical issues need to be continuously worked out as new situations arise.

Ethical complexity is similar to mathematical complexity. Both deal with unpredictable outcomes and underlying patterns. Both explain processes that are iterative, where the

results of one operation determine the possibilities of the next.

Justice, ethics and fairness all arise out of the way we live and the decisions we make – our habits or ethos. It is within this context that I now apply subsumption ethics.

2.6. Philosophical Frameworks Applied to Subsumption Ethics

Subsumption ethics suggests that ethical processes should be applied continuously during systems development. Simon Rogerson and Don Gotterbarn have developed a process for doing this, called "Software Development Impact Statement," (SoDIS). SoDIS adds an impact analysis to the traditional work breakdown structure (WBS) for software development projects, improving their outcome within a prescribed ethical context.

Impact analysis should be used by all the members of a project team, including users, management, systems architects, programmers and project managers. The following section describes how the four ethical principles used in this paper can be applied during systems design and development.

2.6.1. The Golden Rule

Project team members should consider the impact of decisions on stakeholders. Gotterbarn and Rogerson describe stakeholders as "individuals or groups who may be directory or indirectly affected by the project and thus have a stake in the development. Those stakeholders who are negatively affected are particularly important regarding ethical sensitivity because they are often the ones overlooked."[18]

Application of the golden rule means reviewing each stakeholder's needs as decisions are made. While this process is time-consuming, the result is more successful projects, since the completed systems have the respect of a broad constituency.

2.6.2. The Golden Mean

Virtuous decisions require informed balance between extremes. The team must actively seek understanding of many issues, on continua from stakeholder analysis to technical limitations. In order to apply the right knowledge to the right problem, a development methodology is required. Gotterbarn and Rogerson use a matrix of eight ethical principles against a ten-step methodology. At each developmental step they ask whether the intersecting ethical principle is applicable. If so, then the team must examine both the technical and ethical impacts of their decisions. Within this framework, ethical impacts become clear.

2.6.3. Niskama karma

The best decisions are made by teams that keep a detached perspective on systems design and development. A trial jury in the U.S. is always selected based on disinterested perspective on a case. Office politics, vendor relations and favor peddling, which usually originate in desire, aversion or ignorance, are frequently part of systems development, and are almost always hindrances to success.

Effective systems development should incorporate many perspectives. Allowing many voices often requires willingness to be flexible. Philip Brey argues that this requires "a democratic process of social negotiation, that should yield a distribution of responsibilities that is fair to all parties involved, and that satisfies the criteria of practicability, efficiency and effectiveness."[19]

2.6.4. Complexity

Systems are complex, both in their operation and in their relationship to organizations. Complexity requires evaluating the impact of design and development decisions from many perspectives, from compatibility with other systems to fault-tolerance requirements to the thoroughness of estimates. The project team must focus on complexity early, and establish effective strategies. Moreover, complexity must be continually addressed throughout the project lifecycle.

The overall complexity of a project can be determined by systematically applying SoDIS to the WBS, and evaluating each task as a function of complexity, experience and knowledge. Areas of inexperience or insufficient knowledge should be addressed quickly and thoroughly. This process should be iterative as the project matures.

2.7. Subsumption Ethics Matrix: Implications for Action

It is useful to apply each of these ethical principles to the axioms of subsumption ethics. The matrix of Table 1 describes the implications for action in each axiom\framework cell.

2.8. Subsumption Ethics Applied to Systems Developement

The ethical impact of IT falls into three major categories: 1) Policy, such as privacy and property concerns; 2) Access and education; and 3) Systems development. The analysis that follows applies subsumption ethics to issues in each of these categories. The analysis applies the appropriate action(s) from the matrix above to each case. The actions (table cells) are indicated by their column and row, for example, cell B:3 would be the "Golden Mean" \ "Invisibility Factor" cell. Many of these statements will seem obvious, but the purpose here is to systematize ethical evaluation.

For example, take the problem of commercial software development.

A:1 Designers should consider the software's impact on a wide range of stakeholders; B:1 Technical limits on functions and features should be balanced with stakeholder impacts; A:2 Each subsumed object (SO) should serve as many stakeholders as possible; B:2 User values should be part of every SO analysis; D:2 The impact of commercial software

should be routinely evaluated by its developers; A:3 Stakeholders should be informed of how SOs within the system will affect them; D:3 IT decision-makers have significant responsibility in creating SOs on behalf of stakeholders; C:4 Software should be routinely evaluated to determine whether its operation is meeting stated SoDIS goals; D:4 Commercial software should be regularly subjected to an impact review process.

For another example, take the problem of Privacy:

Privacy issues come up in many cells in the subsumption ethics matrix because the problem is both subtle and pervasive.

A:1 Designers should consider the privacy impact of SOs on a wide range of stakeholders; B:1 Technical limits on privacy control should be balanced with stakeholder impacts; A:2 SOs should maintain individual privacy as appropriate; B:2 Privacy values should be part of every SO analysis; C:2 Privacy is particularly important in the acquisition and deletion of information; D:2 Privacy impacts of SOs should be routinely evaluated; A:3 Informed consent requires that stakeholders understand the privacy component of SOs within the systems they use. This is a highly complex requirement; B:3 Stakeholders must look out for their own privacy protection; C:3 Stakeholders often have limited control over their privacy; D:3 Stakeholders are compelled to entrust their privacy to IT professionals; A:4 Stakeholders must be educated in order to maintain their privacy; D:4 The privacy impact of full systems should be routinely evaluated.

For a third example, consider intellectual property/ownership:

D:1 Intellctual property/ownership policy and code must be simple to be enforceable; C:2 stakeholders must work to understand the intellectual property issues and balance their uses of systems. For example, many systems prevent digital audio tapes from being copied, protecting property but limiting utility; D:2 Systems evolution is forcing rapid change in intellectual property policy. Balance is needed between property creation and property protection; A:4 Stakeholders must be continuously educated about intellectual property on the Web; D:4 Systems should be regularly reviewed for their impact on intellectual property.

Table 2 (p. 36) provides a structure for applied subsumption ethics.

3. Conclusion

There is something more at work here than just accumulating information. There is a knowledge component. Computer systems themselves are not sentient, however, they provide an organization of available knowledge and information fed by the intelligence of millions of people. They change, evolve, grow, and collectively are not under anyone's control. In some sense the IT itself is alive, and it grows through subsumption. IT can be a creative or destructive force, depending on how it evolves. Hence the need for subsumption ethics.

Subsumption ethics pushes ethical considerations into the heart of all technology decisions. The Amish are a community that has taken such questions seriously.

Table 1: Subsumption Ethics Matrix

Axiom \ Framework	A. Golden Rule	B. Golden Mean	C. Desire/Aversion	D. Complexity
#1. Code segments and content are "subsumed objects" (SOs)	Evaluate impact on a wide range of stakeholders	Balance technical and application requirements with stakeholder impacts	Base SOs on needs and specifications, not wishful thinking or fear	Keep SOs as simple as possible
#2. Subsumed objects have determinate moral value	Eash SO should serve the needs of a wide range of stakeholders	Evaluate each SO for its impact within a determinate moral context	Examine SOs which acquire or discard information particularly closely	Regularly review the impacts of SOs
#3. Subsumed objects have a high "invisibility factor"[20]	Inform stakeholders of the inpacts of SOs within their systems	Stakeholders must work to understand and balance their use of systems	Stakeholders have varying levels of control over the behaviors of their systems	Significant technical, business, and ethical decision-making is delegated to IS professionals
#4. Subsumptive complexity increases over time	Continuously educate stakeholders	Achieve balance between evolving needs and rapid obsolescence	Regularly review system goals against actual operation	Regularly subject systems to an impact review process

When Amish community member Michael Stoltzfus wanted to buy a phone, he raised a whole series of questions about the effect it would have on his community, family and psyche. Finally, the bishop allowed him to put a phone in a shed where he couldn't hear it ring. Writing for *Inc.*, Jerry Useem says, "The Amish feel if they can hear a phone, it will govern their lives."[21] Unlike corporate America, "the taboos on technology cultivate a bare-bones approach among the Amish."[22] The Amish, it turns out, care about the ethics of even simple machines.

Most technology wizards in the United States feel that if they miss the latest technology release, they will be left behind. In certain industries at the heart of the high-tech marketplace, they are right.

Only, it is never enough. As with desire in general, satisfaction is short-lived.

So on to the next conquest. The "more is better" mentality dominates, and the question, "Should I really do this?" falls by the wayside, a casualty of the need for more and more technological gratification. In all of this activity, attention to impact analysis is often lost.

Rushworth Kidder[e] points out that in the Challenger disaster,[f] the Orange County debacle,[g] and the collapse of Barings Bank,[h] "you find one or a handful of individuals making unethical decisions that get leveraged into immense issues."[23]

Technology amplifies the actions of individuals, and subsumption ethics further describes the complex impacts of poor judgments in each of these cases. The Challenger disaster and the ValueJet crash are examples of modern systems failures, and are not easily attributed to an individual or one particular, bad decision. They are a result of the subsumption of poor decisions in policy, design and implementation.

Complex systems have always failed — complexity itself makes such failures inevitable. Inattention to subsumption ethics makes them more likely. ◆

Notes

a. See 2.4, Axioms of Subsumption Ethics

b. E-Z Pass data is collected by automatic toll booths that deduct tolls from a user's account without the user having to stop. The data includes the user's account information, the date, time and place of the toll, and (usually) an image of the rear of the car is taken.

c. P. N. Srinivasachari, M.A. is a *Gita* scholar and retired principal and professor of philosophy at Pachaiyappa's College, Madras.

d. Interestingly, the words misery and miser have the same root.

e. Rushworth Kidder was a journalist with the *Christian Science Monitor* until founding *The Institute for Global Ethics* in Camden, Maine.

f. On January 28, 1986 the space shuttle Challenger exploded after lift-off, killing all 7 crew members.

g. Losses on investments in stock derivatives caused Orange County, California to declare bankruptcy in December, 1994.

h. A single trader, working with derivatives, lost so much of Barings Bank's assets that it was forced to close on February 25, 1995 after more than 200 years of business.

Table 2: Applied Subsumption Ethics Actions

Issue	Subsumption Ethics Actions
1. Policy Issues	
E-mail	A:3; B:3; C:3; D:3; A:4; C:4; D:4
Software Licensing	A:1; B:1; A:2; B:2; D:2; A:3; D:3; C:4; D:4
Security/Encryption	A:1; B:1; A:2; B:2; D:2; A:3; B:3; C:3; D:3; D:4
2. Social Issues	
Access to technology	A:1; A:2; B:2; B:3; A:4; B:4
Education	B:3; A:4
3. System development issues	
Commercial apps	A:1; B:1; C:1; D:1; B:2; C:2; D:2; D:3; C:4; D:4
Custom apps	All cells apply
Project management	A:1; B:1; C:1; D:1; D:2; A:3; B:3; D:3; A:4; B:4; C:4; D:4

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