Good computing: a pedagogically focused model of virtue in the practice of computing (part 2)

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Abstract

Purpose – The purpose of this paper is to present a four component model of ethical behavior that integrates literature in moral psychology, computing ethics, and virtue ethics as informed by research on moral exemplars in computing. This is part 2 of a two part contribution, part 1 having appeared in Vol. 6 No. 3.

Design/methodology/approach – This psychologically based and philosophically informed model argues that moral action is grounded in relatively stable personality characteristics, guided by integration of morality into the self-system, shaped by the context of the surrounding moral ecology, and facilitated by morally relevant skills and knowledge.

Findings – The model seeks to explain the daily successful (and unsuccessful) performance of moral action by computing professionals and to provide groundwork for a pedagogy that emphasizes ethically effective performance.

Practical implications – The model has significant implications for how ethical action to computer professionals and other design professionals might be taught. It also makes recommendations about what need to be measured to construct a complete picture of sustained ethical action in a profession.

Originality/value – Most accepted models of ethical behavior are unidimensional, emphasizing either principled reasoning or a simplistic model of integrity/character. This model brings together a variety of disparate literatures in the light of its emphasis on sustained moral action in the profession. It thereby provides researchers and educators with a picture of what is needed to construct a complete understanding of moral action in the profession.

Keywords Ethics, Psychology, Personality, Skills

Paper type Conceptual paper

> [. . .] we are inquiring not in order to know what virtue is, but in order to become good, since otherwise our inquiry would have been of no use (Aristotle, 1942).

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The goal of the two parts that make up this contribution is to propose a model that helps us understand how computer professionals sustain ethical action in their careers. Its focus is broader than ethical judgment or decision making, since it takes its cue from the extended performances of moral exemplars in computing in their careers, careers that are shaped by differences in personality, in moral commitments, in skills, and in the moral ecologies (MEs) that support or thwart them.

In psychological terms, we are interested in how individuals achieve sustained excellence in ethical behavior in the field of computing. In philosophical terms, we are interested in how individuals attain the virtues needed to achieve the virtuous practice of computing. As the quote from Aristotle suggests, our goal in this enquiry is not simply to understand these influences on moral careers, but to learn how we might prepare ourselves and our students to use them in building their own moral careers. Thus, in each component of the model we have paused to reflect on the implications for pedagogy. These reflections cannot yet form a detailed pedagogical plan, but they can suggest directions for our educational efforts.

The model that emerges from this effort is a model of sustained moral action in social context (PRIMES). The model we present here grounds moral action in relatively stable *Per*sonality characteristics, guides moral action based on the *I*ntegration of *M*orality into the self-system, shapes moral action by the context of the surrounding *M*oral *E*cology, and facilitates moral action with morally relevant *S*kills and knowledge (thus the PRIMES acronym). The model seeks to explain the daily performance of moral action of computing professionals and to illuminate ways that computing professionals might be trained to be more active, ethically committed, and ethically effective in their daily performance, across the lifespan of their careers.

In part 1 of this contribution, published in Vol. 6 No. 3, we covered the components of personality and integration of morality into the professional self. We found that different personality characteristics might shape the way professionals construct their moral careers and goals (rather than shape *whether* they are moral or not). And we reviewed evidence for the multiple (and pluralist) moral commitments that computer professionals might make, and how these commitments might be integrated into their conception of "the kind of engineer I am." In this part, we will look at the influence of the surrounding ME on how moral careers are constructed and review proposed lists of skills that professionals need to acquire in order to be effective in their moral careers. All this, again, will be done with an eye on what we might learn about teaching the skills and preparing for the MEs.

We began part 1 with the story of Nathaniel Borenstein who, after a lifetime of commitment to pacifism, found himself in the halls of NATO helping to design training systems for tactical nuclear missile launchers. His story reminds us that simply making one decision, or committing to one principle, does not make for a moral career. Though Borenstein had assiduously avoided the ME of the military he found himself compelled by principle to help them better a dangerous design. In order to do so he had to recognize an opportunity, make a decision (indeed, a long series of decisions), learn the new ME of defense consulting, and skillfully champion a better design.

Moral ecology

Victor and Cullen (1988, p. 101) claim "there is a growing belief that organizations are social actors responsible for the ethical or unethical behaviors of their employees."

This belief is based on the current consensus that situational influence can enhance both moral (Oliner and Oliner, 1988; Colby and Damon, 1992; McAdams, 1993) and immoral behavior (Milgram, 1974; Zimbardo, 2007). MacIntyre (1981/2007) builds the case that ME is more than simple social influence, and that communities, their practices and their values, provide the menu of goods from which their members select those that fit into their personal narratives. Both Appiah (2008) and Doris (2002) emphasize the importance of the social surround on the judgments and actions of individuals, but also the ability of individuals to choose and to influence their social surround. Underemphasizing the complexity of ME is a common failure of many character-based approaches (thus Appiah's (2008) and Doris' (2002) critique).

Taking ME seriously produces a profoundly social vision of the good life with members both cooperating and competing but sharing at least overlapping visions of the good. Rohan's (2000) distinction between personal (an individual's values), social (a person's beliefs about a group's values), and group value systems (the actual values endorsed – in some fashion – by the group) captures this complexity of ME.

First, a cautionary note. The *perceived* ME is likely to be as important as the actual ME in shaping behavior. At the individual level of analysis, what is most influential on a person's actions and thoughts is not the objective ME, but rather how the person subjectively experiences it (Victor and Cullen, 1988). Of course, the ME can exert influence independent of a person's perception as other actors in the ecology act on their perceptions. And, as in the case of whistleblowers, individuals can act in spite of their perceptions of a ME that does not support them. Still, much of even the "objective" ME is driven by the values, beliefs, commitments, and intentions of the members of that ecology. The complex subjective nature of ME is part of what poses difficulties for actors in the ME, and is also a significant difficulty for those who would like to measure ME.

As with the other components of the model, the ME usually does not determine the behavior, but is influential in shaping it. And as in the other components of the model, it varies in shape and strength across times and situations. Thus, some situations (as in some versions of Milgram's (1974) obedience experiments) may be so powerful and persuasive as to produce near unanimity in wrongdoing, and other situations may allow for differences in personality, moral commitment, or skills to assert themselves. This component shares one additional complexity with the others: it both influences the individual and is influenced by the individual.

It is this complexity that has led us to call this component *ME*. Situational influence (Zimbardo, 2007) makes the influence sound narrowly unidirectional, in addition to limiting the focus to influence, ignoring underlying values, goods, procedures, roles, and other aspects of what Mumford (2003) has called the socio-technical system. Organizational culture (Leidner and Kayworth, 2006; Hofstede, 2003) allows for the complexity we mention, but its disadvantage is similar; culture is at times treated as monolithic, and its influence on the individual as unidirectional. Organizational climate (Alavi *et al.*, 2006) has the advantage of suggesting how flexible and adaptive influence can be and also encourages the analysis of macro- vs micro-climates (or other slices). But again it shares the disadvantage of a unidirectional causality.

The term ME encourages us to consider the complex web of relationships and influences, the long persistence of some factors and the rapid evolution of others, the variations in strength and composition over time, the micro-ecologies that can exist within larger ones, and the multidirectional nature of causality in an ecology.

The term ecology was first used by Haeckel (1878) to describe the natural world of plants and animals and the competition for survival, adaptation, cooperation, and influence among plants and animals. Haeckel revised the unidirectional and hierarchical concept of "food chain" to describe the interlinked, interwoven, and interdependent lives of plants and animals.

It was not until the 1920s that a member of the Chicago school named Robert Park used the term to refer to the spheres and environments in which humans exist (Park, 1952). Park coined the phrase *social ecology* and applied terminology that had previously been saved for plants and animals to humans. These social ecologies are both shaped by their inhabitants and actively influence and shape their inhabitations. Park viewed this complex interaction as mediated by morality, custom, and law – unlike the ecologies of all other animals (but see Goodall, 1988, and DeWall, 2006). Human behavior, especially that of professionals who work under corporate and professional expectations, is always in response to nuanced and complex situations in which motives conflict with one another, needs and desires have to be balanced, and obligations to the self are mediated against obligations to society (Donnelley, 1995; Fiske and Tetlock, 1997). Our focus here is on those aspects of the social ecology that interact with moral judgment, commitment, and action; thus, *ME*.

We will review here three different literatures that are relevant to ME: the organizational culture literature, work on the structure and effects of ethics codes, and work on diversity in organizations.

Organizational moral ecology

The ME a company creates and maintains clearly affects the practical constraints, moral attitudes, and working conditions for its employees. However, often the ME is not determined by a written code or set of principles as much as it is influenced by the *unwritten* expectations and restrictions the company has for its employees (Weiss *et al.*, 2002). Work on organizational ethical climate (OEC) provides the beginning of a taxonomy of ethical climates, or in our terminology, MEs (Bommer *et al.*, 1987; Treviño, 1986; Cullen *et al.*, 1989; Harrington, 1996). Treviño (1986) identified nine theoretical types of climate, and Victor and Cullen (1988) narrowed these to five types of climate and developed questionnaires measuring which climate type an individual perceives as dominant in their institution: caring, law and code, rules, instrumental, and independence (Cullen *et al.*, 1989; Harrington, 1996). A caring ethical climate refers to a company that ranks service to its customers as of primary importance. Of secondary importance is a responsibility to "workers, management, and the community" (Cullen *et al.*, 1989, p. 51). Of least importance in this climate are financial returns. The laws-and-codes climate refers to the tendency of an organization to use externally drafted statements such as professional codes or laws to choose the ethical path. The rules climate refers to using internally generated codes to make decisions. The instrumental climate means that self-interest and profit are the key motivators. Lastly, the independent climate refers to industries in which individuals are supported in following their own moral beliefs. Overall, this questionnaire determines a mean score for each of these five climate types, and the highest mean score determines the dominant perceived climate type or ME. The OEC helps identify what issues employees believe are given priority at their institutions and what management wants employees to consider when making ethical decisions. It also allows researchers to determine what

criteria employees use to decide on a course of action when presented with ethically ambiguous situations (Cullen *et al.*, 1989).

But the climate metaphor is still somewhat misleading. There are likely multiple moral climates in different parts of the organization and a single project may experience different climates during different stages of product development.

Weiss *et al.* (2002) provide an example of this complexity in the social and ME within which nurses practice and how insurance and governmental policies influence the ME. Overwhelmingly, they found that institutions influence employees' basic conceptions of good, responsibility, and concern and that institutions can either promote or discourage morality. Weiss *et al.* (2002) interviewed exemplary nurses about their knowledge, skills, resources, education, the institutional impediments they encountered and the strategies they used to overcome impediments and maintain a practice of moral nursing. These nurses repeatedly affirmed that nursing practice, like any other practice that takes place in a larger organization, is heavily influenced by the decision making at the top. They said that as members of an institutionally based profession they rely on top management to create institutional structures that support the caring functions that constitute good nursing practices.

The nurses interviewed by Weiss *et al.* (2002) mainly worked under compliance-based codes that set forth minimal requirements for nurses (Paine, 1994; Weaver and Treviño, 1999). The exemplary nurses noted that these minimalist codes left the impression that going beyond them (e.g. spend more time with a patient than required) might be criticized by management as less efficient.

Management that stressed the importance of getting patients in and out as quickly as possible with the fewest staff and use of resources made the expression of morality or the integration of care with skillful practice much more difficult and anxiety-ridden for nurses (Weiss *et al.*, 2002). Nurses felt they were being asked to treat their patients as production units and not as people. This tension can be understood as one between two overlapping MEs of production (from the business side) and of engagement (from the professional nursing side). This tension is increased when information technology chooses to emphasize one side or the other (Gerdes, 2008; Vuokko, 2008). Similarly, our computing moral exemplars (Huff and Rogerson, 2005; Huff and Barnard, n.d.) consistently talked about the tension between efficient work and the need to know and work with one's stakeholders (while affirming that good design required work with stakeholders). Thus, ME is dynamic; different levels of the socio-technical system (Mumford, 2003) change at different paces and influence each other. But research has been able to find some patterns in organizational MEs, and this provides leverage for understanding its effects on moral action within the ME.

Ethics codes and moral ecology

The prominence and pervasiveness of ethics codes is increasing because they are thought to clarify responsibility and deter unethical behavior (Harrington, 1996). The origins of ethics codes reflect the complexity of the ME that spawns them. Some codes are issued by the profession or promulgated by governmental agencies or a board of professionals. Others are stipulated by a specific organization's management or board. The advantage of research on ethics codes for our purpose is that they provide one index of the complexities in MEs.

There is very little literature that actually assesses the effect of *professional* codes on the behavior of professionals. Fleischmann and Wallace (2005) provide evidence that professional codes are occasionally used as reasons in the arguments of computing professionals for or against particular design choices. Interestingly, in our interviews with moral exemplars in computing (Huff and Rogerson, 2005; Huff and Barnard, n.d.), we found no mention of the role of professional ethics codes at all among our 24 exemplars, even though several of them had been on panels to draft codes. These open interviews lasted for more than three hours each, and gave ample opportunity to bring up the influence of codes – all were explicitly asked to identify influences on their behavior. We will see this mixed pattern of the effects of codes in the literature on organizational ethics codes.

Organizational ethics codes are primarily formal statements concerning the organization's stance on ethical issues. They delineate general principals and procedures, and some have clear rewards, sanctions, or punishments (Flores, 1998). There is a great deal of variability within this category (Harrington, 1996). For instance, Marnburg (2000) identifies 16 main values that organizational ethics codes tend to incorporate and breaks them down into four main categories: reliability (keeping promises and meeting expectations), integrity and equality, capability (producing as much as possible of value), and/or protecting the future (caring for the environment and future generations). Codes vary widely on each of these dimensions, and so too, perhaps, do MEs vary significantly from one another.

Larger firms or organizations more frequently have ethics codes in comparison with smaller organizations (Marnburg, 2000). Only 25-33 percent of organizational ethics codes have formal enforcement procedures for breaches of the code (Harrington, 1996, p. 259). It is not surprising that the effects of these codes on behavior may be different than the effects of those without any formal consequences. These compliance-based codes (Paine, 1994; Weaver and Treviño, 1999) tend to focus on controlling the behavior of their employees in order to decrease the frequency of *un*ethical behavior. They achieve this control through careful monitoring and discipline. However, anything not explicitly delineated as forbidden is often interpreted as permitted (Weaver and Treviño, 1999; Fairweather, 2001).

On the other hand, value-based codes place their emphasis on supporting ethical striving and aiding the moral efforts of their employees (Weaver and Treviño, 1999). They are often drafted in a participatory manner, after work to identify common values through discussion. These codes tend to be more abstract and tend to list values such as honesty and integrity. Value-based codes that support ethical aspirations are associated with more desirable, longer-lasting impacts on their employees' actions (Paine, 1994; Weaver and Treviño, 1999). In fact, Weaver and Treviño (1999) found that value-based codes are associated with:

> [1] employee integrity and [2] commitment, [3] willingness to deliver bad news, [4] the perception that better decisions are made because of the ethics program, [5] ethical advice seeking, [6] decreased unethical behavior in the organization [. . .] [and 7] ethical awareness (Weaver and Treviño, 1999, p. 333).

Compliance-based codes are only associated with outcomes 4-7.

However, it is again important to remember that compliance- and value-based codes need not be mutually exclusive. Within the same code different sections may be categorized as one or the other, and within the same organization different employees

may perceive different degrees of these orientations within their respective departments.

Codes have no effect. A great deal of controversy surrounds the question of the efficacy of organizational ethics codes, with significant empirical support on both sides of the debate (Harrington, 1996). Many propose that organizational values, as stated in codes, will lead to different sorts of behavior and a higher frequency of ethical action such as sharing, openness, and honesty. However, many others are calling for a more systematic study to determine if codes have this effect or if some codes do and others do not. If the latter is the case, it is important to determine how these codes consistently vary from one another (Alavi *et al.*, 2006).

Kaun (1994) found more lying about the frequency of unethical behavior in organizations with ethics codes (and little evidence of increased ethical behavior). This resulted in management having a less realistic view of the behaviors of their employees in organizations with an ethics code (Kaun, 1994; Farrell *et al.*, 2002). It appears that codes do not impact employees' behavior in the intended ways. Thus, when an organization has a code, employees have more clarity about what is expected of them but apparently are no more likely to behave ethically than they would without the reduced ambiguity (Farrell *et al.*, 2002).

If the intent of ethics codes is to lower instances of unethical practices, then arguably they often fail (Kaun, 1994; Farrell *et al.*, 2002; Marnburg, 2000; Banerjee *et al.*, 1998). However, perhaps ethics codes are useful in other ways. Codes appear to be useful for building morale and idealism as they give employees something to strive for (Farrell *et al.*, 2002). Ethics courses can look at organization's codes as restatements of what values are important to the practice and need to be taught. Furthermore, ethics codes may help limit legal responsibility for the organization and allow an organization to present a certain image to their stakeholders (i.e. the community, press, and consumers; Marnburg, 2000). Even having considered these other ways ethics codes may be useful, Marnburg (2000) concludes that codes are ineffective and superfluous for three reasons. First, there is no reason for corporations to state their ethics because too often they draft codes that only contain common-sense rules. Second, codes tend to be nothing more than duplicates of rules and norms that already exist either in the society's laws or values. Thirdly, because employees tend to consider themselves more ethical than their colleagues, they see the codes as there to improve and inform others' behaviors but not their own.

Even though these researchers assert that ethics codes are ineffective at managing ethical behavior, they are not denying the importance of environment or the effect of ecology on one's behavior. Instead, they all affirm the influence that one's ecology can have on behavior (Banerjee *et al.*, 1998; Schwartz, 1998). They just do not believe that codes clarify or change the perceived organizational environment in any meaningful way. Farrell *et al.* (2002) did find that 60 percent of the variation in 40 identified ethical behaviors could be explained by the presence of a larger social-ethical culture beyond the organization.

Codes have some effect. Ethical conduct is indeed influenced by an organization's reward systems, rules, and internal norms for behavior (Treviño *et al.*, 2001; Schwartz, 1998). But codes play an important role in shaping an organization's value systems and in influencing employee attitudes (Weaver *et al.*, 2005). One way in which codes do this is by providing important internal arguing points (Fleischmann and Wallace, 2005).

When an employee does something that is explicitly discouraged in the ethics code, management can hold the employee accountable and have firmer ground on which to base their conversation. On the other hand, employees can have a reference point when deciding whether or not to engage in internal whistleblowing or the exposing of a colleague's or another manager's unethical behavior. Professionals, given the risks they face to their jobs and reputation if they engage in whistleblowing, need ethics codes that provide support for professionals who witness violation of ethical or professional standards and speak out about the conduct (Unger, 1994).

Harrington (1996) and Fleischmann and Wallace (2005) provide the most convincing argument that organization's ethics codes do affect judgments and intentions of some information systems (IS) personnel. Harrington (1996) found that employees who already had a tendency to assume responsibility for their actions were only marginally influenced by ethical codes. On the other hand, the judgments and intentions of IS personnel who tend to deny responsibility *were* influenced by ethical codes. Harrington (1996) used Schwartz's (1973) responsibility denial (RD) scale to classify employees and found that codes make it harder to rationalize irresponsible actions for those high in RD. Thus, ethics codes have different effects on different people, but they do at least seem to positively influence the behaviors and attitudes of those high in RD. Fleischmann and Wallace (2005) found that the values held by an organization influence the problem context, model structure, model realization, model assessment, and model implementation stages in IS design.

The ME component encourages us to look beyond the unidirectional effect of codes on behavior, and to consider how codes are enmeshed in the ME of the organization, how they reflect and influence values and conversations about values, and the multiple roles they serve as public relations tools, internal arguing points, value anchors for dissidents, and communication tools for management.

Moral diversity and relativism

Within a ME different individuals will have different moral priorities (Martin, 2000; Walzer, 1994; Mannix and Neale, 2005) and even one individual can have conflicting moral priorities (Taylor, 1985). Managers and engineers care about meeting deadlines, lowering costs, ensuring customer satisfaction, and providing high quality, safe products. Professionals often have to decide between budget or time constraints and extra precautions to ensure safety. What should occur when an individual's conscience is at odds with the directives of employers, or with other desires of the conscience? Should the professional value conformity or self-direction more (Schwartz and Bilsky, 1990; Martin, 2000)? And when an engineer has to choose between working extra hours in hopes of a promotion or going home to family and friends, how should they choose between achievement and prosocial values (Schwartz and Bilsky, 1990; Huff, 2008)?

To resolve these value conflicts, moral thought has often tried to homogenize the moral (Taylor, 1985). The homogenization of the moral is often done using cost-benefit analysis in which competing or conflicting values are put on one scale (often a fiscal, efficiency, or utilitarian scale; MacLean, 1998). However, this attempt to get values on the same scale distorts and misrepresents the moral values (MacLean, 1998). To believe that there is one single, internally consistent domain of the moral is to ignore the fact that there are different moral goals that are not completely compatible with one another (Taylor, 1985; Mannix and Neale, 2005; Fiske, 1990). For instance, the values of

power and benevolence often conflict, and a cost-benefit analysis cannot always resolve this dilemma nor approach it with enough sophistication (Schwartz, 1994; Taylor, 1985; MacLean, 1998). Even a single individual's loyalty is often divided by worthy but incommensurable values, ideals, and principles.

Any particular ME will in fact have multiple moral values and commitments represented within it. How does this moral diversity influence individual and corporate moral decision-making and action? There is already a literature on how diversity, broadly construed, influences group decision making, corporate internal decision structure, team productivity, creativity, efficiency, and effectiveness (French, 1984; Mannix and Neale, 2005). At least a portion of the effects of diversity comes from the moral diversity that different class, racial, gender, etc. experiences produce.

Groups composed of individuals who have the same moral priorities have often been praised for their solidarity but criticized for their tendency to engage in group think or their failure to appreciate other points of view. Many have bemoaned the fact that this agreement in intent is more difficult to obtain in diverse groups (Feinberg, 1970, p. 235; May, 1996). Furthermore, empirical studies have found that diversity can create social divisions and hinder productivity and performance (Mannix and Neale, 2005). Surface level social category differences such as race, gender, and age tend to have negative effects on many of these indexes of group performance. Fiske and Haslam (1998) and Fiske and Tetlock (1997) have specifically identified the ways that moral diversity can lead to relationship tension and angry misunderstanding. They have identified four categories of moral relations (communal sharing, authority ranking, equality matching, and market pricing) and shown that mismatches among these approaches can produce angry incomprehension and mutual recrimination.

However, diversity is correlated with performance *advantages* when the underlying differences concern background, education, and personality (Mannix and Neale, 2005). Indeed the logic that underlies the representation of different groups on institutional research ethics committees (IRBs) and IRB consultation with outside experts and communities is based on the strength that comes from moral diversity (Dickert and Sugarman, 2005). Thus, moral diversity within an ecology can be an asset if it is of the right type and if it is used well. Of course, some agreement in values and goals is crucial (as in the case of IRBs). In the engineering context, attention to moral diversity may be more important in the early, conceptualization stages of projects than in later implementation stages (Henderson *et al.*, 2007). Little empirical research has been done on moral diversity in groups and what has been done emphasizes the negative role moral mismatches can play (Fiske and Tetlock, 1997). Future research should examine how moral diversity influences MEs and team cohesiveness, productivity, problem-solving ability, communication, social integration, conflict, commitment, and ability to define goals, prioritize, and develop plans.

The call for valuing moral diversity in a ME does not entail endorsing cultural relativism. One can recognize that there are multiple, sometime incompatible, moral goods, and even cultivate this moral diversity, without concluding that each good is simply relative to the culture that endorses it (Taylor, 1985). Valuing moral diversity is compatible with a suitably thoughtful cultural relativism, but it does not require it. One can also claim that it is simply the human condition that there are multiple moral commitments, and that it is better to recognize and attempt to reconcile them as best one can rather than to pretend that there is some (illusory) larger scheme that will

homogenize them and allow easy choice (Taylor, 1985). Instead, what is needed is a better understanding of moral diversity and its effects in MEs.

The pedagogical challenge of this component of the model is that it may set the student adrift in the extreme complexity of potential MEs students can face in their careers, while emphasizing the lack of control the individual has over these ecologies. The literature on ethics codes helps us to find some structure in the complexity, even if that structure is one of a pluralist list of things that are valued.

Pedagogy

How do we help students with different personality constellations, different kinds of moral motivation (i.e. different patterns of incorporation of moral concerns into self), and different moral skills navigate within particular MEs? We have little control over the MEs in which our students will practice, but the work on organizational climate begins to give us an (admittedly simplistic) typology of ecologies; and we can list a range of strategies for working within (or against) MEs. For instance:

- Individuals can *enter and leave* MEs if they find them attractive or unacceptable. Our moral exemplars in computing consistently talked about decisions to join or leave organizations or units within an organization. They were also quite explicit about the constraints that tenure, expertise, and demand made on their ability to make these choices (Huff and Rogerson, 2005; Huff and Barnard, n.d.).
- Individuals can *shape* MEs from within, even to the extent of struggling against them (as in ethical dissent and whistleblowing). Many of the moral exemplars we studied spent considerable time in influence projects within their organizations.
- They can *construct* micro-ecologies of mentorship and team environment. Most of our craftsperson exemplars intentionally constructed groups of people with common interests in designing products to help people (Weaver *et al.*, 2005).
- The ACM code of ethics explicitly addresses itself to organizational leaders and the effects they can have on their organizations. Many of our reform moral exemplars spent considerable energy in *influencing* organizations to adopt new values and to realize avowed but unimplemented values.

We can view these strategies as the personal projects of actors in a ME or as dimensions on which personal projects might vary. The work on codes gives us the beginning of a taxonomy of types of MEs in which each of these strategies may be differentially effective (also depending on the skills, etc. of the actor). Davis (1998, p. 119) provides a similar taxonomy of organization types and influence strategies. Research that focused on how these strategies are incorporated into personal projects and on their effectiveness in each of the five types of ME would help us prepare students for moral action in the different MEs.

An important implication of this model is that our pedagogy itself resides within a ME. Students learn from more than the instructor's lecture and learn more than what is printed on the syllabus. The ME of the classroom, of the other classes the student takes, and of the student's peers and expected peers all likely influence the perceived importance of moral issues and the integration of moral themes into the student's personal projects. Faculty and students can influence (and be influenced by) the ME of the classroom or degree program.

Measurement

ME is subjective and multifaceted even within one organization. It is clearly shaped by many factors including – but not limited to – codes, management attitudes, national culture and regulation, the examples set by colleagues and role models, and competing personal projects. Thus, much of the measurement of ME will necessarily rely on self-report questionnaires and interviews. However, the subjective interpretation of one's ecology shapes one's actions, and thus reliance on self-report is not necessarily a cause for alarm. The perceived ME is as or more important than the objective ME. Methods like those used by Christiansen *et al.* (1998) and Farrell *et al.* (2002) allow for some check on the inter-subjective agreement of perceptions, and may show important agreement (and disagreement) among various constituencies in a ME.

Measurement of codes. Harrington (1996) used questionnaires to assess awareness of the code, its content, its aims, and the general importance of the code in influencing their daily actions or decision making at work. Furthermore, the questionnaire could include several brief vignettes of ethically ambiguous situations that may plausibly occur in the institution and could ask management how they would like their employees to respond and also ask employees' perception of how management would like them to respond. So even in questionnaire methods, there are ways of checking on inter-subjective agreement. Harrington (1996) also used the Schwartz (1973) RD scale (finding a differential effect of codes dependent on RD score). The use of theoretically relevant personality or individual difference measures helps to unpack the complexity of the influences of codes, while at the same time offering some validation of the questionnaire methods used to obtain the data.

Others have used more objective measures of codes (and their effects). Marnburg (2000) coded the language of ethics codes to determine dimensions of value on which they vary. Others (Weaver and Treviño, 1999; Harrington, 1996, Paine, 1994) have measured the size and sector of organization, the presence or absence of codes, and whether the codes have enforcement clauses, etc. Fleischmann and Wallace (2005) have incorporated an awareness of codes and their effects into research not focused primarily on codes.

Defining issues test. One of the most commonly used measurements for looking at decision making in ethical dilemmas is the defining issues test (DIT; Rest, 1974, 1979, 1986; Rest and Narvaez, 1994; Harrington, 1996). This questionnaire consists of several dilemmas (which can be adapted to computing concerns such as privacy) and considerations for respondents to rate and rank according to how important they are for making a decision regarding a course of action. Of particular interest is a sub-scale within the DIT called the *d*-score that measures principled reasoning (Rest, 1986; Rest and Narvaez, 1994; Harrington, 1996).

There is some literature (Sprinthall, 1994) that as people become more integrated into a corporate structure, their *d*-score decreases (presumably to reflect the consensus about moral reasoning within the ME). It would be interesting to replicate this effect with more careful measurement of ME. Indeed, one might be able to use individual *d*-scores of people at various levels of the hierarchy, and varying levels of tenure, to obtain a measurement of the kind of moral reasoning found within a ME. Since it takes almost an hour to complete, the DIT is a cumbersome tool for this kind of measurement task. OEC seems to be a more tractable, yet still reasonably valid, measure of this sort, though (for good or ill) it does not have the theoretical underpinnings of the DIT.

Organizational ethical climate. The OEC questionnaire measures how an individual perceives their ethical culture from their position within a company (Bommer *et al.*, 1987; Treviño, 1986; Cullen *et al.*, 1989; Harrington, 1996). Overall, this questionnaire determines a mean score for each of five climate types, and the highest mean score determines the dominant perceived climate type or ME. Rather than simply yielding a single "moral climate score," this instrument might be used to track the internal complexity of a ME since it can provide scores for multiple types of climate among multiple subgroups.

Personal projects measurement. Given that management's attitudes and ethics codes shape the ME, which in turn either encourages or inhibits the ability and motivation of people to engage in moral behavior, how specifically does this effect occur? Work in personal projects (Little, 1983; see the section on the self in part 1 for more detail) provides a measurement tool that allows one to track this process. One of the most important factors influencing personal projects is the environment in which the person exists (Christiansen *et al.*, 1998). A person's personal projects always take place in some environment that encourages, competes with, or inhibits the ability to complete those projects. One individual's personal projects interact with each other and either encourage one another or compete for the agent's time, energy, effort, and commitment (Christiansen *et al.*, 1999). It is important to people that others perceive their goal-related endeavors to be important and worthwhile. In fact, Christiansen *et al.* (1999) found that when people felt that others did not view their goals as worthwhile or attainable, they tended to have higher levels of depression.

While personal projects are heavily related to personality and individual differences, they are also helpful in linking the individual's particular goals to their context-based behavior and their well-being. This measure may be particularly important in uncovering which goals employees feel are supported by their organization and which are in conflict with it. Instead of, or in addition to, standard environmental rating scales, personal action construct measurement provides a more in-depth analysis of the way ME affects the work of people, the strategies they use to deal with that influence, and the counter-influence they exert in the organization.

Conclusions

The PRIMES model of moral action is different from most character-based accounts because it takes ME seriously. ME is instantiated in a variety of ways, including policies, procedures, codes of ethics, moral climate, etc. indeed, in all the parts of a socio-technical system (Mumford, 2003). It changes over time and from one part of an organization to another. Students need to be prepared to confront this complexity, to identify it, and to plan strategies to succeed within the MEs in which they find themselves. Acquiring the skills to do this is the topic of the final component of the model.

Skill sets

Nathaniel Borenstein (see part 1, published in Vol. 6 No. 3) had the complexity of moral thinking and the moral commitment to peace to decide that consulting for NATO was his best choice. But without the ability to understand how the military thinks, or without the persuasive skills and technical knowledge to cogently argue for his position, he would have been ineffective in his role. The highest praise we might muster for the morally committed incompetent would be "well-intentioned" rather

than "virtuous." Skills and knowledge are essential to the effective practice of virtue. Arguably this component of the model holds the greatest hope for pedagogy precisely because skills and knowledge are more mutable than the other three aspects of the model and under more personal control than other components.

Continued moral action requires skills such as recognizing opportunities for ethical responses (Bebeau and Brabeck, 1994), generating creative solutions to moral challenges, persisting despite constraints, and reasoning logically about ethical difficulties (Lapsley and Narvaez, 2005). It also requires what Bebeau and Thoma (1999) call intermediate knowledge. Keefer and Ashley (2001) have shown that experts in the field of computing ethics use intermediate level knowledge constructs (e.g. intellectual property, software safety) as their primary tools in resolving ethical cases in computing. Borenstein needed knowledge about software safety issues, skill to recognize when that knowledge was relevant, and other knowledge and skills to suggest alternative solutions and to advocate for them. We call these combinations of skills and knowledge *skill sets* because the knowledge and the skill are intertwined in supporting ethical action.

Can we legitimately call these skills sets *moral*? Blasi (1980, 2005) asserts that skills are morally neutral. For instance, one may be determined to obtain revenge for an insult or injury and remain determined despite the risk of getting caught and persevere even when several plans are thwarted. Whether an act of revenge is moral is thus to some extent independent of the skill with which the act is carried out. By remembering the morally committed incompetent, we can recall that skills are not sufficient for moral expression, but in most cases still necessary. In other words, while the ability to persevere despite setbacks can be used toward immoral ends and is not enough to make a person moral, it is likely a necessary component of successful moral performance in one's profession. Thus, we call them moral skills and moral knowledge because they are relevant to, and even necessary for, moral action.

Candidates for moral skills and knowledge

If psychologists, philosophers, and engineers could compile an agreed upon list of skills that aid the expression of moral decision making and performance, then these skills could be taught in undergraduate and graduate classes and measurements for these skills could be designed to objectively measure one's mastery of them. However, this has proven more difficult than it sounds. Many have recently contributed to the discussion concerning skill sets, and their respective lists of skills differ from one another both in structure and content, despite many common themes. Blasi (2005, p. 70) notes that lists of skills tend to be "invariably long . . . easily extended, and are largely unsystematic." Even where two authors agree on some of the same skills, they categorize them differently and use different terminology to describe the same skill.

This difficulty in determining a canonical set of skill sets is understandable, once one recognizes the variety of personalities, roles, and MEs that influence moral action. Different people with different personalities, different modes of integration of morality into the self-system, and in different ecologies will need different skills to achieve their goals. Thus, it is doubtful that a canonical list of skill sets could be created or that it should even be attempted. To do so would be to diminish the important role of the other three components of the model.

However, even though a canonical list should not be expected, it is still possible to systematically identify some skill sets that are relevant to most people in most MEs.

Our goal here is to gather candidate skills mentioned by various authors and researchers, integrate them into a more systematic model, and suggest methods for the measurements of these skills. These candidates come from multiple literatures and use multiple methods to identify skills. Thus, this initial list is somewhat of a grab-bag of concepts and methods for identifying candidate skills and knowledge.

Self-control, willpower, and self-regulation. Self-control (alternatively self-regulation or willpower) has frequently been cited as a skill that enables and promotes moral behavior (Bandura, 1999; Muraven and Baumeister, 2000; Blasi, 2005). Self-control is defined as the controlling and altering of one's behavior, thoughts, or feelings (Muraven and Baumeister, 2000). In terms of moral action, self-control involves refraining from immoral behavior (which is more than passive inaction) as well as proactively deciding to behave morally even when circumstances allow for diffusion of responsibility (Bandura, 1999). Moral behavior is made possible through the ability to be self-reflective about ones actions and through modification of one's conduct to act in accordance with social or personal (and even self) sanctions. Circumstances often make it easy to avoid self-regulation and to avoid a feeling of responsibility for one's actions. Bandura (1999) presents as skills the ability to short-circuit RD, to refrain from minimizing one's role in events or the consequences of one's actions, and to value the dignity and rights of others. Muraven and Baumeister (2000) also describe self-control as a skill that must be practiced and as muscle-like in that it can be strengthened over time but is depleted in the short term after demands are placed on it. They provide numerous careful empirical studies to support this analysis of self-control as a skill that can be acquired and a resource that can be depleted. The athletic analogy works well here. There are individual differences in ability, but all can improve with practice. Individuals differ in the amount of self-control they can exert at anytime (Carver, 2005), but it is possible through practice to increase one's capacity for self-control by exercising it. It can be concluded that self-control should be conceived of as a skill that aids moral action and helps people resist temptations towards immoral behaviors. Muraven and Baumeister (2000) have also shown that it can be taught and that practice can increase individuals' capacity.

Blasi (2005) also lists self-control as a moral skill, but suggests some of the cognitive skills that underlie and enable self-control (Table I). These include the ability to transform goals into plans, to monitor one's own actions, and to think in terms of the future and distance oneself from the present (Blasi, 2005, p. 75). Self-control provides another example of interaction among the components of the model: there are clear individual differences (Carver, 2005), but most individuals can improve with practice. We have strong evidence that self-control is skill-like in that it can be decomposed into component knowledge and skill components (Blasi, 2005) and that practice can improve performance. Careful experimental work has provided this candidate for a supporting skill.

Moral exemplars and role models. One of the most obvious ways to determine what skills are essential to moral computing or engineering is to ask those who have been identified as moral exemplars in their profession what skills they believe have helped them conduct themselves in an ethical manner. Unfortunately, for researchers, moral exemplars and role models tend to humbly dodge questions relating to their own qualities (Tangney, 2002; Pritchard, 1998, Huff and Rogerson, 2005). But they are willing to talk about what skills they would like to see in their colleagues and what they think enables others to behave morally (Pritchard, 1998; Weaver *et al.*, 2005).

Lower-order virtues	
Empathy	Obedience
Compassion	Law-abidingness
Politeness	Civic-mindedness
Respectfulness	Honesty
Thoughtfulness	Conscientiousness
Kindness	Truthfulness
Generosity	Fairness
Altruism	Justice
Friendship	Courage
Loyalty	Humility
Higher-order virtues	
Will cluster	*Integrity cluster*
Perseverance	Responsibility
Determination	Accountability
Self-discipline	Self-consistency
Self-control	Sincerity
Willpower	Integrity
	Principledness
	Transparency to oneself
	Honesty with oneself
	Autonomy

Table I.
List of moral virtues

Source: Blasi (2005, p. 71)

Alternatively, Bodker *et al.* (2000) have observed computer engineers work and had them reflect aloud on the skills they were using as they engage in projects.

Pritchard (1998) used interviews with engineers to identify a list of reoccurring skills (Table II). Bodker *et al.* (2000) used observation to name five reoccurring skills that contribute to moral, responsible engineering. Pritchard (1998) explicitly states that

S. No.	
1	Integrity
2	Honesty (perhaps even candor)
3	Cooperativeness ("good team player")
4	Courage (to speak up, to "stick to one's guns")
5	Ability to communicate clearly and effectively
6	Habit of documenting work thoroughly and clearly
7	Openness to correction (admitting mistakes, oversight)
8	Willingness to compromise (but not one's integrity)
9	Commitment to quality
10	Perseverance
11	Creative engineering imagination
12	Willingness to make self-sacrifice, or even take personal risks
13	Not being too personally ambitious (or too anxious to move into management)
14	Caring about engineering *per se*
15	Macro- as well as microscopic vision
16	Civic-mindedness

Table II.
List of virtues/skills

Source: Pritchard (1998)

none of the skills he identified by interview sufficiently alone promotes moral behavior, but together they encourage and allow it.

Bodker *et al.*'s (2000) observational interviews helped identify five practice-orientated skills including being able to work with users and hear their needs, rethink the design process, be a good team member, and be visionary and flexible. Bodker *et al.*'s (2000) list is more concrete, while Pritchard's (1998) list has some quite abstract entries (e.g. integrity). This may in part be a function of the difference in method. But despite these differences, items such as creative imagination, being visionary, openness to correction, and being able to rethink the process all appear in some form in each list. Another interesting component of both lists is that intermediate-level skill sets (e.g. documentation, organizational skill, design process) are at least as well represented as more abstract, traditional virtues (e.g. honesty). These skills seem to contribute not only to one's professional, minimalist competence, but also to one's ability to behave morally or exemplary. Bebeau and Thoma (1999) offer further examples of intermediate-level skills including professional autonomy, respecting informed consent, knowing how to protect confidentiality, and whistleblowing and assert that these skills guide action in more concrete ways than, for example, promoting integrity and honesty. Thus, these researchers all assert that intermediate-level skills are at the heart of good work in any profession.

Weaver *et al.* (2005) similarly identified a list of commonly reoccurring skills that engineers' role models possess. Role models tend to be interpersonally caring, hardworking, helpful, positive, and accepting, they hold high expectations for themselves in terms of honesty, humility, and integrity, they take responsibility, are self-sacrificial, fair with others, and articulate ethical standards clearly with uncompromising, consistent ethical vision. Notice again the correspondence with Pritchard (1998) and Blasi (2005) in that they all mention honesty, humility, and integrity as important virtues. This catalogue is more abstract, and this may be an artifact of an interview method that encouraged the reporting of personality-like characteristics.

Other candidates.

Whistleblowing. Bebeau and Thoma (1999) list whistleblowing as an intermediate-level skill. Professionals who encounter unethical behavior tend to face great ambiguity regarding what an appropriate response is (Greene and Latting, 2004; Near and Dworkin, 1998; van Es and Smit, 2003; Li *et al.*, 2006). What's more, professionals who confront management on policies they do not agree with or colleagues on practices they find immoral face social and professional risks (Greene and Latting, 2004; Near and Dworkin, 1998; van Es and Smit, 2003). Whistleblowing involves recognizing unethical actions of co-workers or irresponsible company practices and initiating and maintaining action to correct those practices, first within the company, and failing that, by going to outside interests (government, press, professional agencies) to exert pressure. Relatively few employees or former-employees actually blow the whistle when they see wrongful practices (US Merit systems Protection Board, 1984, cited in Greene and Latting, 2004). So what skills promote the expression of this moral choice?

Greene and Latting (2004) assert that whistle-blowers generally possess a strong sense of social responsibility, are better able to resist conformity, are self-reflective and aware of their own attitudes and beliefs, and "keep well-documented records of what they perceive to be abuse and waste" (p. 221). In addition, successful whistleblowers know the appropriate steps to take despite the fact that literature on advocacy provides insufficient guidance on what the appropriate channels and steps are

(Greene and Latting, 2004, p. 223; Near and Dworkin, 1998). Finally, because there are both internal and external channels available to whistle-blowers, they need to be able to determine which venue is appropriate (van Es and Smit, 2003). Here again, intermediate-level skills support moral practice.

Dealing with ambiguity. Whistleblowing is just one of many things shrouded with ambiguity within IT MEs. Most of the decisions that system designers make are difficult because of numerous conflicting interests. Designers aim to please people who often have disparate wishes. They have responsibility to a variety of stakeholders, including their employer, their client, the user, those whose data will reside in the system, and to the general public (Smith and Hasnas, 1999). Dealing with this ambiguity has long been recognized by teachers of professional ethics, and was incorporated into the early recommendations of the 1980 Hasting Center report (Callahan, 1980).

Empathy. Empathy is defined as the ability to take the perspective of another and understand their thoughts, feelings, and actions. Davis *et al.* (2004) found that people had different natural tendencies toward taking the perspective of others but that straightforward instruction could increase people's tendency to empathize with the target. The natural differences help in conceiving of empathy as a skill that is possessed to varying degrees by people, and the fact that directions can increase observers' empathy provides hope that it can be taught. In a world of engineering where the product will be used by people both near and far, it could be essential that engineers have the ability to place themselves in the shoes of their users and imagine what it would feel like to be a layperson using the technology for the first time. Huff and Frey (2005) and Rest (1979) provide some indications of the component skills and knowledge that support empathy.

Accurate self-knowledge. Burson *et al.* (2006) found that those who perform better on a task also more accurately estimate their performance and that the bottom quartile of performers consistently over-estimate their performance and ability. Accurate assessment of one's performance could be important for setting goals, itemizing work, meeting deadlines, etc. Accurate self-knowledge may well be a component of the virtue that Pritchard (1998) lists as openness to correction.

Systematic approaches to skills

One of the first people to attempt to design a model that would identify skills and virtues that aid morality and relate them to one another in meaningful ways was Rest (1974, 1986). Rest proposed a four-component model and emphasized that each component interacted with the others. Within Rest's (1974, 1986) model were the components *moral judgment*, *moral sensitivity*, *moral motivation*, and *moral character*. The component of *moral judgment* involves recognizing the many courses of action that are available and the competing demands upon oneself. In the midst of a situation with many choices, the skill is in being able to recognize which option is the most just, ethical, and responsible. This aspect of the model is where Kohlberg began and ended his consideration of the skills and cognitions that lead to moral behavior (Narvaez, 2005; Bebeau and Thoma, 1999) and there is clear evidence that students can improve in this area with training.

However, Rest's (1974, 1986) model extends beyond moral judgment to incorporate affective and behavioral components. Skill in *moral sensitivity* is the ability to interpret situations as having potential for ethical responses. *Moral motivation* involves

marshalling the variety of available motivators, in the face of competing concerns, to choose and maintain moral action. *Moral character* is the ability to plan and carry out actions that support the moral choice. In his descriptions of these components, Rest (1974; 1986) mentions a few concrete skills (e.g. moral character involves the skill of avoiding distraction), but the only component with any real detail that might guide pedagogy is the Kohlberg-driven component of moral judgment. The model remains abstract. Thus, while Rest (1974) was revolutionary in terms of bringing the cognitive, behavioral, and affect components of morality together, what has been sorely needed since are adaptations of the model to make it specific so that it may inform ethics education (Bebeau *et al.*, 1993).

Skill as expertise. Narvaez and Lapsley (2005) have provided just such a list of skills by adapting Rest's (1983) model to support the teaching of virtues to children (Table III). Each of Rest's (1983) four components are broken down into seven more detailed subheadings that themselves have another three divisions for a total of 21 additional subcomponents for each of the four main components. This pedagogically focused approach generated the list of skills by combining those mentioned in prior educational literature with the comments and revisions suggested by a panel of teachers.

Narvaez and Lapsley (2005) break moral judgment into reasoning about solving problems, seeing the core components of dilemmas, and efficiently processing situations with ethical ambiguity. To Rest's (1986) component of moral motivation they add the importance of seeing *the self as moral* and attempting to maintain the sense of being a moral individual. Lastly, since moral character has been somewhat assimilated into moral motivation, they add the category of ethical action and again mention focus and superior ability to complete ethical courses of action. This ability comes from well-developed intermediate-level skills and skills "in conflict resolution, assertiveness, leadership, and planning" (Narvaez and Lapsley, 2005, p. 31). Their work in implementing this model in schools in Minnesota (Narvaez *et al.*, 2004) provides evidence that these skills can be taught in schools and that competency in them is associated with successful moral behavior.

A model of moral expertise in computing. Huff and Rogerson (2005) have proposed a group of four skill sets that support the performance of moral action in the field of computing. Their skills list is based on interviews done with moral exemplars in computing in the UK and Scandinavia. Its primary difference from the four component model of Rest (1986) or of Narvaez and Lapsley (2005) is that it is specifically designed for computer professionals who are designing artifacts for others to use. Thus, it focuses on those skills needed to recognize the needs of the stakeholders, to design creatively in response to those needs, to advocate for the appropriate design, and to persist in action in response to changing circumstances. This focus on moral action in the design of artifacts means that this approach specifically highlights moral creativity. But it also borrows skills from work in other areas of computing, such as human-computer interaction and systems design (Bodker *et al.*, 2000).

The proposed model here has four components, but they differ in emphasis from those of Rest (1994) (Table IV). Still, there is considerable overlap between many of the skills mentioned by Narvaez and Lapsley (2005) and the skills listed here.

Moral imagination. Moral imagination involves projecting oneself into the perspective of others including other colleagues, management, and stakeholders including stockholders, users, and community members (Davis *et al.*, 2004). This involves an active seeking after the needs of the stakeholders and of other people

Sensitivity	
ES-1: Understand emotional expression	Identify and express emotions
	Fine-tune your emotions
	Manage your anger and aggression
ES-2: Take the perspective of others	Take an alternative perspective
	Take a cultural perspective
	Take a justice perspective
ES-3: Connecting to others	Relate to others
	Show care
	Be a friend
ES-4: Responding to diversity	Work with group and individual differences
	Perceive diversity
	Become multicultural
ES-5: Controlling social bias	Diagnose bias
	Overcome bias
	Nurture tolerance
ES-6: Interpreting situations	Determine what is happening
	Perceive morality
	Respond creatively
ES-7. Communicate well	Speak and listen
	Communicate non-verbally and alternatively
	Monitor communication
Judgment	
EJ-1. Understanding ethical problems	Gathering information
	Categorizing problems
	Analyzing ethical problems
EJ-2. Using codes and identifying judgment criteria	Characterizing codes
	Discerning code application
	Judging code validity
EJ-3. Reasoning generally	Reasoning objectively
	Using sound reasoning
	Avoiding reasoning pitfalls
EJ-4. Reasoning ethically	Judging perspectives
	Reason about standards and ideals
	Reason about actions and outcomes
EJ-5. Understand consequences	Attending to consequences
	Predicting consequences
	Responding to consequences
EJ-6. Reflect on the process and outcome	Reasoning about means and ends
	Making right choices
	Monitoring one's reasoning
EJ-7. Coping	Apply positive reasoning
	Managing disappointment and failure
	Developing resilience
Motivation	
EM-1. Respecting others	Be civil and courteous
	Be non-violent
	Show reverence
EM-2. Cultivate conscience	Self command
	Manage influence and power
	Be honorable

Table III.
Four skill components

(*continued*)

EM-3. Act responsibly	Meet obligations
	Be a good steward
	Be a global citizen
EM-4. Help others	Cooperate
	Act thoughtfully
	Share resources
EM-5. Finding meaning in life	Center yourself
	Cultivate commitment
	Cultivate wonder
EM-6. Valuing traditions and institutions	Identify and value traditions
	Understand social structures
	Practice democracy
EM-7. Develop ethical identity and integrity	Choose good values
	Build your Identity
	Reach for your potential
Action	
EA-1. Resolving conflicts and problems	Solve interpersonal problems
	Negotiate
	Make amends
EA-2. Assert respectfully	Attend to human needs
	Build assertiveness skills
	Use rhetoric respectfully
EA-3. Taking initiative as a leader	Be a leader
	Take initiative for and with others
	Mentor others
EA-4. Planning to implement decisions	Thinking strategically
	Implement successfully
	Determine resource use
EA-5. Cultivate courage	Manage fear
	Stand up under pressure
	Managing change and uncertainty
EA-6. Persevering	Be steadfast
	Overcome obstacles
	Build competence
EA-7. Work hard	Set reachable goals
	Manage time
	Take charge of your life

Source: Narvaez and Lapsley (2005)

Table III.

within the organization. In the context of software design this sort of imagination is helped by understanding the socio-technical systems in which systems are embedded, and thus moral imagination is likely helped by participatory design processes that are widespread in human-computer interaction literature. Knowing these techniques and being able to use them involve both knowledge and skill components (Bodker *et al.*, 2000).

Moral creativity. Moral creativity is the ability to generate unique solutions to moral challenges while responding to multiple constraints. While moral creativity is mentioned as a subheading in Narvaez and Lapsley's (2005) list, it takes on more relevance when we are considering people who are creating artifacts that must respond to multiple constraints, including time, budget, organizational culture, etc.

Moral imagination. Projecting oneself into the perspective of others	
Skills	Constructing the relevant stakeholders in a socio-technical system; data collection about stakeholders; understanding stakeholder perspectives
Knowledge	Specific knowledge about the domain (e.g. privacy, safety, equity); knowledge of socio-technical systems; knowledge of methods to investigate stakeholder perspectives
Moral creativity. Generating solutions to moral challenges while responding to multiple constraints	
Skills	Identifying value conflicts in a socio-technical system; constructing and evaluating solutions under constraint
Knowledge	Specific knowledge about domains (e.g. privacy, safety, equity); technical knowledge of constraints and opportunities; knowledge of socio-technical systems
Reasonableness. Engaging in reasoned dialogue with openness	
Skills	Constructing data-based and reasoned arguments; engaging in reasoned dialogue, gathering relevant evidence, listening to others, giving reasons, changing plans/positions based on reason
Knowledge	Specific knowledge about domain (e.g. privacy, safety, equity); technical knowledge of constraints and opportunities; knowledge of ethical argumentation
Perseverance. Planning moral action and responding to unforeseen circumstances while keeping moral goals intact	
Skills	Constructing and revising implementation plans based on organizational constraints. Negotiation within complex organizational environments
Knowledge	Specific knowledge about domain (e.g. privacy, safety, equity); knowledge of socio-technical systems; knowledge of ethical dissent and whistleblowing

Table IV.
Skills

Source: Huff and Rogerson (2005)

Pritchard (1998) and Huff and Rogerson (2005), in their interviews of moral exemplars in the field of computing, repeatedly found that these individuals, when faced with complex, complicated problems, found creative responses in order to balance the often competing needs and desires of the stakeholders. This may be one of the harder skills to teach, but creative design and puzzle solving is at the heart of all good engineering work. Some knowledge about negotiation and conflict resolution (Pruitt *et al.*, 2003) may help in discovering underlying interests and values of differing parties and helping to craft solutions that reconceptualize and then respond to these. Knowledge and practice in this kind of creative invention (Perkins *et al.*, 2003) can be taught as a part of the problem solving tools of a profession. Strategies of creative problem solving, including the creative solution of ethical design puzzles, seem a natural candidate for inclusion in curricula.

Reasonableness. Reasonableness refers to the ability to engage in reasoned dialogue with others while maintaining an attitude of openness. This understanding of reasonableness is taken from Pritchard (1996) and is not about a narrow devotion to logic-chopping, but instead a commitment to flexible, thoughtful, dialogue with others, in the context of commitment to moral principles. Thus, it involves skill and knowledge, but also requires an attitude of openness. The skill component includes gathering relevant evidence, listening to others, giving explanations for one's actions, and the ability to change and adapt plans based on judgment. This requires being able to analyze and understand ethical problems, reason objectively and ethically, understand consequences, and reflect on the process and its outcomes. In turn, this requires some knowledge base about ethical reasoning, and particularly ethical reasoning using the intermediate concepts relevant to the particular problem.

Perseverance. Finally, perseverance is the ability to plan moral action and continue on that course by responding to circumstances and obstacles while keeping ethical goals intact. While perseverance was a subcomponent of both judgment and action in the Narvaez and Lapsley (2005) model, here it encompasses not only the ability to be steadfast and overcome one's own inertia, but the ability to operate in complex and changing organizational environments. Knowledge of the particular organization is crucial to this, but also expertise-related knowledge of the area of application in which the problem arises (e.g. equity, safety, etc.) Note also the Burson *et al.* (2006) notion that accurate self-knowledge could be a skill that fits well with perseverance. Not only will perseverance be worth it if the end goal is in fact feasible, but with accurate self-knowledge engineers will be more able to foresee obstacles and know how to address them when they arrive.

These four skill sets were designed to be relevant to a profession in which the primary activity is the design of artifacts. In other MEs, other skill sets may be more relevant. It is likely this difference in ME that explains the differences in the lists that Narvaez and Lapsley (2005) and Huff and Rogerson (2005) have generated.

Pedagogy

Still, can these skills be taught, and if so, how? Narvaez and Lapsley (2005) have adopted an expertise model of moral pedagogy that provides us with relatively straightforward instructions for teaching skills to the level of expertise. All skill sets or domains of activity can be conceived as existing along a continuum from novice to expertise. Experts, in contrast to novices, have a large, rich, well-connected knowledge base that is often tacit, perceive different opportunities and constraints than do novices, are less quickly overwhelmed by information (because they chunk it differently), and have a large repertoire of cognitive and behavioral responses to the patterns and problems they see. From this literature on expertise, Narvaez and Lapsley (2005) derive several recommendations for the pedagogy of moral skills.

First, to acquire these skills, the skills should be practiced within a controlled environment, and teachers and mentors should take the role of a coach providing frequent, immediate feedback (Lapsley and Narvaez, 2005; Narvaez and Lapsley, 2005). The point regarding practice cannot be overstated. It may require as much as ten years to become an expert or master of these skills (Narvaez and Lapsley, 2005).

College courses cannot hope to provide practice that is this extensive, but they can lay a foundation for the student to continue in practice when in the field (assuming the local ME can support such practice). This extensive, guided practice provides students with a "richer declarative and procedural knowledge base that increases processing speed, [and] directs attention" (Narvaez and Lapsley, 2005). The more often this skill is exercised, the more proficient one will be at recognizing the opportunity for its expression and the more efficient one will be at discerning options.

Such skills and supporting declarative knowledge networks can, over time, become so well practiced that the person executes them automatically, with little conscious awareness of the "insight" process underlying them (Haidt, 2001, 2008; Narvaez and Lapsley, 2005; Neal *et al.*, 2006; Moors and De Houwer, 2006; Logan, 1985). Eventually, one does not think about the fact that they need to creatively devise alternate plans of action and evaluate them, but instead one engages in this skill without consciously deciding to do so.

This conclusion about automaticity fits well with what Pritchard (1998) and Huff and Rogerson (2005) found in talking to moral exemplars. Moral exemplars frequently report that their decisions were not the result of careful, drawn-out deliberative processes. Instead, they identified the right course of action quickly and were then free to focus on the unique aspects of the situation to shape an appropriate and skillful response. Just because moral behavior is governed by implicit processes does not mean it cannot be the object of education or be developed by training. The whole point is to educate morals in professionals (Huff and Frey, 2005; Hogarth, 2001). In fact, "moral character may depend upon a kind of socialization that inculcates highly routinized action sequences, scripted interpersonal procedures, and patterns of discrimination and judgment" (Narvaez and Lapsley, 2005). The literature on expertise and initial attempts to use an expertise model to teach moral skills (Narvaez *et al.*, 2004) lead us to believe that this approach to moral pedagogy is likely to be successful.

Measurement

The most widespread, most commonly used way of measuring moral reasoning involves presenting an ethically ambiguous case and asking an individual to provide their reasons for their decisions on how to act in the situation. This is what Kohlberg and Kramer (1969) advocated and it describes the fundamental components of Rest's (1974, 1986; Rest and Narvaez, 1994) DIT. The DIT consists of several dilemmas and considerations for respondents to rate and rank according to how important they are for making a decision regarding a course of action. Thus, the DIT measures the nature and kinds of moral reasoning the respondent endorses in response to various scenarios. These are cognitive categories, and the theoretical basis of the DIT (with reasonable empirical evidence in support) is that some of these categories are more cognitively complex than others, and that the ability to think with this additional complexity predicts (modestly) actual moral behavior. The DIT may well serve as one general measure in the skills and knowledge component of the PRIMES model. However, this sophisticated measurement focuses on one aspect (giving reasons) of one category (reasonableness) of the skills and knowledge relevant to successful moral action. Better, though, would be skill and knowledge measurement that was specifically targeted to the issues and needs of professional action.

Bebeau (1994) made important adaptations to Rest's DIT and devised what they call an intermediate concept measure (ICM) for a specific profession, dentistry. The ICM is designed to be a part of an ethics curriculum in this profession and to track knowledge

and use of the important ethical intermediate concepts in that profession. The cases, action choices, and action justification choices are developed with input from experts, administered to experts, and their choices are compared against the choices of novices. This provides us with a model of how a version of the ICM specific to computing or other engineering professions might be developed.

An expert panel following this model in computing ethics might help resolve some of the difficult issues in identifying important intermediate concepts and skills. However, a computing specific ICM would only be helpful in measuring the relevant intermediate concepts, and would not address the skill aspects of the skill sets. Still, an expert panel might also provide baseline evidence of skill in assessing cases, crafting solutions, and making reasonable arguments (as in the work of Keefer and Ashley, 2001) against which the work of students might be assessed.

Conclusions

Moral skill sets comprise the most straightforwardly teachable component of the PRIMES model. Taking them seriously as skills requires a pedagogy that is active, with students practicing the skills in situations that closely approximate their anticipated work environments.

General conclusions

We have presented here a four-component model of factors that influence the successful performance of virtues in the profession of computing. The model is pedagogically focused: it divides the components in a way that allows us to see what can be taught and to be aware of those things that are less under the control of the instructor and student. It suggests ways that the components can be measured independently and that interactions among the components can be investigated. Thus, it provides both a pedagogical and an investigative agenda.

The model's focus on performance makes it clear that Pritchard's (2006) engineering virtues cannot be conceived of as simple internal dispositions to behave in particular ways. Moral commitment and the skills and knowledge to enact that moral commitment are essential. Both are necessary, but neither alone is sufficient for virtuous performance: enactment cannot take place in a vacuum. ME and personal characteristics both shape the performance. In this conception, virtue is not a thing one has, but rather it is a thing that one does consistently well, with one's own particular gifts and personality, and within the current circumstances.

Interactions among the components

Our presentation separates the components for the sake of exposition, but in each section we have tried to make it clear that the components interact with each other. Measuring the components separately makes it possible to track the interactions among them. For instance, Little *et al.* (1992) have shown that individuals high on conscientiousness can construct a way to enjoy even projects that are imposed on them. We expect that these sorts of interactions between personality and personal projects are part of what produces the tendency for our moral exemplar reformers to be more extraverted (Huff and Barnard, n.d.). But the distinction between reformers and craftspersons may itself be modified by the ME in which people must operate. Reports of engineering ethical cases (Frey and O'Neill-Carillo, 2008) in cultures with significant

corruption and bribery appear not to separate into reform and craft types. Perhaps in a ME of corruption, one must take a reform stance even to be able to do good craft work. Another example of interaction of the components is the relationship between ME and moral reasoning as measured by the DIT. Sprinthall (1994) has found that accountants score lower in moral reasoning as they move into higher ranks of accountancy firms. In a similar effect of ME, Sheilds and Bredemeier (2005) show that prisoners score lower on moral reasoning when considering dilemmas that address prison life, but not for dilemmas for the outside world.

Altering one's ME is more effective in changing a habit than is simply exerting willpower to make the change (Wood *et al.*, 2005). Role models available in the ME have their influence through changes in knowledge and self-definition of those who admire them (Bandura, 1999), through internalization of values and stories (McAdams, 1993), and through providing or priming behavior scripts (Christiansen *et al.*, 1998). Even explicit rules, orders, instructions, or guidelines have their effect in interaction with, at the least, personality variables like RD (Harrington, 1996).

Investigative agenda

Investigating the four components will require reliable and valid measurement devices. We have suggested some validated measurement instruments, though most of these will need to be adapted (and re-validated) for work in any specific profession. More narrowly tailored instruments will be needed for all three components other than personality. These can likely be constructed using similar methods to those employed for the instruments we list. But developing and validating these instruments is essential to any further research that takes the components seriously.

The interactions we mention above, and other unexpected interactions that are likely to emerge, are a strong argument that research focusing on only one or two components will be limited in its applicability. Initial development of measurement capacity will of necessity need to be limited to individual components, but even measurement validation will be enhanced by attempts to expose the instrument to the contextual influence of other components.

The ability to measure each domain will facilitate the tracking of individuals across time, as they gain skill and knowledge, as they participate in (and shape) different MEs, and as they change their moral commitments. Longitudinal and cross-sectional studies can thus enhance measurement at the same time as they help us understand moral action in context.

Research that takes seriously the four components will allow us to understand more than moral action by the individual computer scientist or engineer. The measurement of personal projects, for instance, can track the influence of MEs on those projects. Measuring the extent of congruence among projects may allow us to observe how different MEs affect the performance of projects that are (and are not) congruent with values of the ME. This allows a level of analysis that goes beyond the individual actor to the effects and workings of the larger ME.

Though we have listed numerous empirical demonstrations of interactions among the components, the model itself makes few predictions about the exact nature of the relationships among the components. But it does predict (and research bears out the prediction) that the components interact dynamically. This means that any understanding of the ethical computer scientist or engineer will need to take into account all the components and their interactions.

Pedagogical agenda

One clear implication of the model is that pedagogy itself occurs within a ME. Pedagogy is about learning and social influence in the context of the personal projects and goals of the student, the teacher, the educational institution, and the profession. Students come to the educational task with their own personalities, with some skills and knowledge, and with an already established, but malleable (Rest and Narvaez, 1994) integration of morality into the conception of the self. Their personal projects in the process of education are shaped by the ME of the classroom, the university, and the expected work environment. Once appropriate measurement is established, we can measure the influence of the pedagogical ME on the personal projects of the student as the student moves from beginner to advanced status and eventually to the status of full professional.

The model has several clear pedagogical implications. First, if the desire is to produce computer scientists and engineers who can do good computing and engineering (in both senses of the word good), then ethics pedagogy needs to concentrate on more than just knowledge about ethical issues in computing and engineering. The Hastings Center (Callahan, 1980) has already expanded ethical education goals to the arena of some skills, such as "dealing with ethical ambiguity." The ImpactCS report (Martin *et al.*, 1996) from the mid-1990s expanded this list of skills with specific application to the area of computing. Huff and Frey (2005) provide another take on the skill and knowledge sets needed in ethical education for computing. In this paper, we have compared some of those lists with others generated from the psychological literature (Narvaez *et al.*, 2004) and have made what still must be counted as exploratory suggestions for a list. Once we have measurement tools to track these skills and knowledge, we can then begin to assess their effect on students' and professionals' changing moral commitment and moral performance.

One important point to take from the literature on moral psychology is that training in these skills, and use of the knowledge, cannot be seen as a simple "mastery of knowledge" task. Instead, pedagogy will need to focus on ways to provide the sort of extensive coached practice with immediate feedback and theory-based guidance taken from the research in expertise. Certainly, this sort of practice can happen with cases, but the implication of this approach is that *practice* with the cases needs to be a focus of the pedagogy rather than an occasional exercise. The approach also lends itself to project-based courses like those taught by Gorman *et al.* (2000a, 2000b). The projects can range from analyzing existing systems (Huff, 1996) to applied interdisciplinary research (Gorman *et al.*, 2000a, 2000b). The model does not require a complete reshaping of the ethics course, but rather encourages a sharper focus on precisely what is being taught, and what is being learned. Again, measurement tools will allow us to assess this.

Another contribution of the model is the more precise phrasing of what we might mean by education in "professional values." This does not simply mean *informing* students of the values of the profession (as a sociologist of science might do), but giving them the opportunity to undertake projects that participate in those values, exemplifying those values in the way system design is practiced and taught, and in other ways offering students the opportunity to *appropriate* those values in some way into their own understanding of themselves as computer professionals or engineers. In the end, the student must act to integrate moral commitment into their professional

sense of self. But the ME of education can make that appropriation more (or less) enticing.

Generalizability

Because our data are drawn from the study of moral exemplars in computing, we have primarily talked about the application of the model to computing, and by some extension to engineering. We (Huff and Barnard, 2007) have been exploring the implications of the model in other professions, including nursing, social work, business, and music. We expect that the four components can likely remain the same when generalizing across professions. Within the components, however, we think significant adjustment may need to be made. Certainly, the particular skills and knowledge necessary for social work (Council on Social Work Education, Inc., 2004) or nursing (Weiss *et al.*, 2002) will not be the same as for other professions. And the structure of the ME is also quite likely to be different from one profession to another. Some personality characteristics (e.g. empathy) may be more relevant to some domains than others.

We are less optimistic about the application of this model more broadly to "character education" or to education for virtue in daily life. At least within the professions (even such loosely structured ones as music), there is some agreement on values internal to the profession. The PRIMES model might at least make it easier to identify disagreement and agreement in goals for broader character education.

Final comments

Let us return for a moment to Nathaniel Borenstein's story. There are two shifts in thinking about the moral action at the core of the story that this model encourages. They both depart from a "quandary ethics" framing (Pincoffs, 1971) which focuses on the correct application of universal decision rules. First, it encourages us to see his consultation for NATO as part of a broader pattern of planned action across time rather than as a singular "moment of decision." Thus, understanding the psychology of Borenstein's actual response shifts us toward an emphasis on the agent and how his or her moral aspirations are advanced through skilled action.

Secondly, because we see Borenstein's action in the context of his personality, long term commitments, personal projects, moral surroundings, and skill at guiding design teams, his cognitive processes at any particular decision point become less central than they would be in quandary ethics.

In the end, the PRIMES model situates the development and performance of virtuous action in a balance among many tensions. Situational pressure is balanced with moral commitment. The influence of the mentor and coach is balanced with the freedom to appropriate or reject professional values. Skills and knowledge are tempered by the limitations of personality. It is the complex interaction of these factors that underlies the performance of virtue in the professions. Identifying and measuring them will, we hope, help us to understand and eventually encourage moral action.

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