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A Consideration of Mason's Ethical Framework: The Importance of PAPA Factors in the 21st Century: A Seven-Year Study

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A CONSIDERATION OF MASON'S ETHICAL FRAMEWORK: THE IMPORTANCE OF PAPA FACTORS IN THE 21st CENTURY

A Seven-Year Study

by

Katharine Creevey Brown

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The thesis titled "A Consideration of Mason's Ethical Framework: The Importance of PAPA Factors in the 21st Century: A Seven-Year Study" submitted by Katharine Creevey Brown in partial fulfillment of the requirements for the degree of Master of Science in Computer and Information Sciences has been

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For Frederick, Maxie Grace, and Samantha Abbey

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ABSTRACT

Richard Mason proposed a social framework for addressing the major ethical issues of the information age in his pivotal 1986 article "Four Ethical Issues of the Information Age." In 2006, Alan Peslak validated the framework by measuring the current attitudes of students, IT professionals, and university faculty and staff toward the four key issues proposed by Mason: privacy, accuracy, property, and accessibility (referred to as PAPA). This study continues this inquiry into the seven-year period after Peslak's research. Previously collected data was analyzed for 312 university computing majors taking a senior-level ethics course where Mason was taught and discussed. Demographic influences as well as differences over the period were considered. A single exam question administered consistently over the period was the focus. Results indicate, with Mason's framework as a foundation, computing students can identify all of Mason's ethical issues, selecting privacy as the most relevant issue of concern in their current environment. Age, gender, and computing work experience resulted in no differences in selection of relevant PAPA factors. All genders, all age groups, and all levels of computing work experience select privacy as the most relevant factor for society today. Privacy increased in importance over the seven-year period as the primary ethical issue for computing students. The ever-changing technology environment and new threats to society posed by these changes is discussed, including social networks, data breaches, consumer privacy, internet neutrality, and emerging technologies.

Chapter 1

INTRODUCTION

"Every ethical act begins with the realization that you, the actor, are not the only person in the universe" [Stephan07].

1.1 Context of the Problem

Prior to 1985, the words 'computer' and 'ethics' never were used together as a meaningful term. It was not until James Moor, in his pivotal article "What is Computer Ethics?" written for a special issue of the journal *Metaphilosophy*, offered the notion that because computers are "different from other technology" there are associated "difference(s) in ethical considerations" [Moor85]. Scholars began to debate the arguments put forth by Moor, and the field of Computer Ethics was born. The Computer Revolution created a new societal responsibility toward the use and development of computer technology. This realization placed new demands on the computing professionals as well as the technology users to protect society from unethical behaviors.

Richard O. Mason, considering Moor's arguments, focused on the information rather than the technology as the critical concern for society. In 1986, he wrote of his concerns that those in control of the information are shaping society, and, it is management information systems (MIS) professionals who will face the crucial ethical challenges in the future.

In this age where the information is abundant and easily disseminated, Mason contends it is the responsibility of the society to guard against the threats to intellectual capital. He focuses on four ethical issues: privacy, accuracy, property, and accessibility, generally referred to by the acronym, PAPA. Mason asks these questions of society in consideration of a social contract for the information age: [Mason86]

- Privacy: What information about one's self or one's associations must a person reveal to others, under what conditions and with what safeguards? What things can people keep to themselves and not be forced to reveal to others?

- Accuracy: Who is responsible for the authenticity, fidelity, and accuracy of information? Similarly, who is to be held accountable for errors in information and how is the injured party to be made whole?

- Property: Who owns the information? What are the just and fair prices for its exchange? Who owns the channels…through which information is transmitted? How should access to this scarce resource be allocated?

- Accessibility: What information does a person or an organization have a right or privilege to obtain, under what conditions and with what safeguards?

Mason's privacy discussion is concerned with the ethical issues of sharing personal data: what must be revealed, under what conditions, and with what safeguards? Since it is inevitable the data will be collected, ethical issues arise around the accuracy of the data: who is responsible for the collection, verification, and maintenance of the data, as well as, who is accountable for errors that may arise? Information is a commodity. Therefore, ethical concerns exist with respect to ownership of the data, as well as the rights and privileges of the owner. The transmission of information in this digital environment also requires society consider the ethical issues surrounding the conduits themselves. Lastly, for the society to prosper, access to the information is imperative. For the society to be

literate in the Information Age, its members must have access. A moral society insures its members have access as well as the ability to assimilate information through education.

Nearly twenty years after Mason proposed his four ethical issues of the Information Age, Alan Peslak at Penn State revisited "the current state of information technology ethics by empirically measuring current attitudes toward" Mason's issues. For his study, *PAPA Revisited: A Current Empirical Study of the Mason Framework,* he polled over 200 IT Professionals, university faculty and staff, and his undergraduate university students utilizing an online survey [Peslak06]. Peslak's study validated all the issues continue to be viewed as important ethical issues. The findings revealed "high levels of concerns with all four issues…(with) privacy…viewed as most important followed by accessibility and accuracy…viewed equally, and property…viewed lowest, but still very important" [Peslak06].

1.2 Statement of the Problem

For this thesis, we validated PAPA issues continue to be viewed as important ethical issues despite the ever-changing technology environment. We employed an approach similar to that used by Peslak, by considering responses from undergraduate university students taking a senior-level course where Mason was studied and discussed extensively. Hypotheses similar to those set forth by Peslak were tested using data previously collected in classes taught from 2007-2013. The research problem is three-fold. First, to

confirm Mason's four issues remain relevant during this period. Second, to investigate the effect age, gender, and, computing work experiences have on undergraduate computing majors' opinions of the relevance of PAPA factors today, and, third, to investigate the differences in those opinions over the seven years of the study.

1.3 Significance of the Problem

It is important that we reconsider what developing computing professionals think about the importance of the PAPA factors, because of the dynamic nature of the technological and ethical environment. In the twenty years after Mason's pivotal article and Peslak's work, technological environmental changes were marked by the introduction and assimilation of personal and small business computers interconnected across the Internet, shifting the location and control of information away from central repositories to local databases. In the years since Peslak's work, one of the most significant environmental changes has been the increasing prevalence of social networks empowering each user to create and disseminate information without constraints, as demonstrated by the snapshot of social media facts for 2015 in Table 1. Will the PAPA framework continue to be sufficiently relevant today, to guide the ethical principles of computing professionals?

In 2015, the following facts applied to social media and Internet usage:

- Social media accounts for more than one in every four minutes spent online.
- The average Facebook user has 190 friends and is connected to 80 community pages, groups, and events.
- More than one billion tweets are sent every 48 hours.
- Each minute, 243,055.5 photos are uploaded to Facebook.
- The "like" button is clicked 3,125,000 times every minute on Facebook.
- Fifty thousand links are shared every minute on Facebook.
- Each minute, 150,000 messages are sent on Facebook.
- Five hundred new Facebook accounts are added every minute.
- Five million photos are uploaded to Instagram daily.
- Every minute, Tumblr owners publish approximately 27,778 new blog posts.
- There are approximately 2,083 check-ins on Foursquare every minute.
- Every minute of the day, approximately 571 new websites are created.
- WordPress users publish approximately 347 new blog posts every minute.
- Each day 350 million photos are uploaded to Facebook, which equates to 4,000 photos per second.
- Flickr users upload 3.5 million photos to the site each day.
- Every sixty seconds, 293,000 status updates are posted on Facebook.
- Forty-six percent of Internet users are on Facebook.
- More Facebook profiles are created every second than there are people born (5 profiles vs 4.5 births).

Table 1. IACP Center for Social Media – 2015 Fun Facts [IACP15]

Chapter 2

LITERATURE REVIEW

2.1 Information and Knowledge

Mason postulates the information itself is the key to the advancement or the demise of future societies. "Information is the means through which the mind expands and increases its capacity to achieve its goals, often as the result of an input from another mind. Thus, information forms the intellectual capital from which human beings craft their lives and secure dignity" [Mason86].

Intellectual capital is comprised of an individual's experiences, information, knowledge, and ability to utilize or leverage that information, knowledge, and experience. It is acquired in many ways: through human contact (parents, friends, strangers, teachers), through personal efforts (reading, writing, observing, creating, doing/working/practicing) and by just living life day-to-day.

What is the difference between information and knowledge? I would argue information is the raw data, or from the perspective of the consumer, it is what you may be able to learn or acquire. Knowledge, on the other hand, is a set of information organized in some fashion as to make it useful for a purpose; and it is generally believed to be true, or believable, at least by the bearer, at most by the society.

2.2 Introduction of the Internet

With the introduction of computer technology, and particularly the Internet, access to information can be misconstrued as access to knowledge. Prior to the Internet, there were well-recognized knowledge repositories. One, the Encyclopedia Britannica, was considered a primary source of knowledge, with over 65,000 articles in thirty-two volumes. With the 2012 announcement that Encyclopedia Britannica will no longer publish a print edition [Pepitone12], but will only support an online repository, the demarcation between established sets of knowledge and the wealth of information available online is blurred. Wikipedia, with over 3.9 million articles in English in its first year (2015) [Wikipedia15], is perceived by the technology generations as a primary source of 'knowledge.' However, is it knowledge, or, is it information? Google with a mission statement "to organize the world's information and make it universally accessible and useful" has forever changed the way society views knowledge [Google18].

David Weinberger of Harvard's Berkman Center for Internet and Society, contends that with the Internet we are "losing the sense there is a set of knowledge we can believe" [Wisconsin Public Radio12]. He believes we are in fact returning to the times when debate and discussion were prevalent in defining knowledge.

Weinberger contends the Internet provides a repository for the information, and the true knowledge is in the discussions and disagreements that ensue. In this manner, the Internet more accurately reflects how we learn as humans: presentation of a set of

information (circumstances, facts, etc.), interaction with the information (by discussion, debate, argument, observation of consequences), resulting in a personal evaluation of 'truth', hence knowledge. In the real world, knowledge is the result of a collaborative process. Now, with the Internet, we have returned to a collaborative environment of ideas. To Weinberger, the Internet expresses the reality that knowledge is a "social activity… deeply collaborative… open ended" and never to be finalized [Wisconsin Public Radio12].

The problem with the Internet is not that there is too much information available, but that we are unable to filter the information to build knowledge. According to thehistoryofSEO.com, search engines were created to locate and organize the vast number of distributed files on the World Wide Web [History18]. Early search engines sorted results based on the number of hits, or links to the site, essentially presenting the most often-viewed sites first. Google's early innovative algorithms analyzed and ranked pages based on the "number of times search terms appeared on the web pages" [History18]. Later, Google enhanced its algorithm by analyzing the number of times a site was mentioned on other pages as a factor in elevating a site's ranking [WordStream18]. Since knowledge is a collaborative process, this methodology might seem valid. Recently, search engines are using social networks to enhance search results, whereby sites viewed by your friends have more value in the algorithm than those not visited. The consequence of this strategy is the narrowing of the viewer's scope of results; searches will return sites with information, opinions, discussions with which the viewer already agrees, and the essential debates and discussions will cease to generate the

type of diverse discussions necessary to challenge the status quo and inspire innovative thought.

Additionally, as information filters, web users choose to promote or demote information, based on evaluation of the information contained therein. Due to the ubiquitous nature of information on the Internet, 'bad' or devalued information lingers, which differs from other aspects of our real world. When a piece of information in the real world is considered useless or erroneous, it tends to die out from lack of promulgation. On the Internet, information persists indefinitely. I would argue, it cannot be diminished to the point of disappearing.

2.3 Continued Relevance of PAPA

Numerous studies have been undertaken in the past two decades to reaffirm the validity of Mason's principles as cultural norms are influenced by technology in our society. Two research questions have been studied widely: is PAPA still relevant, and if so, do demographics influence attitudes toward PAPA?

In 2006, Peslak confirmed Mason's principles are still recognized today as important in society. His specific hypotheses were as follows:

1. Privacy is viewed as more important than property (H5)
2. Privacy is viewed as more important than accessibility (H6)
3. Privacy is viewed as more important than accuracy (H7)

4. Accessibility is viewed as more important than property (H8)
5. Accuracy is viewed as more important than property (H9)
6. No significant difference is viewed between accessibility and accuracy (H10)

With no significant difference between students, faculty/staff, and professionals, Peslak's respondents recognized and classified each of Mason's factors as ethical issues. His analysis indicated a rank ordering by importance of the factors to be privacy, accessibility and accuracy, and property, with no significant difference in the ranked importance between accessibility and accuracy.

Peslak proposed four hypotheses to test or confirm the differences in his survey population based on demographics:

1. The Mason factors of Privacy, Accuracy, Property and Accessibility will all be recognized as important ethical issues. (H1)
2. Older individuals will more readily recognize and classify as important PAPA as ethical issues. (H2)
3. Females, more so than males, will more readily recognize and classify as important PAPA as ethical issues. (H3)
4. Faculty, staff, and practitioners, more so than students, will more readily recognize and classify as important PAPA as ethical issues. (H4)

Peslak's results did not vary across age categories or professional experience, whereas gender was influential in two of the four PAPA factors: privacy and accuracy were more significant for females than males.

Harris created a survey instrument of 16 computing-related scenarios reflecting ethical areas of concerns in the current IS environment "roughly developed around Mason's PAPA" [Harris00]. The survey was delivered to undergraduate and graduate students in a variety of majors, including computer science and information systems. His findings indicate increased "sensitivity of ethics" as students mature, with graduate students displaying the highest level of sensitivity to most of the ethical situations presented. Harris attributes this increased sensitivity in graduate students to both work and academic experience. Analysis of gender was inconclusive, with roughly half of the scenarios resulting in gender differences. Females consistently rated actions related to software use with higher sensitivity, regardless of academic level. Harris interjected the respondent into the scenario. Interestingly, he found no differences in sensitivity when the scenarios were personalized using "you" rather than "the student."

Woodward utilized Harris' 2000 survey design ten years later to test its validity in the current environment. According to Woodward, [Harris00] and [Peslak06] are the only two studies prior to hers to use ethical situations related to PAPA issues. The primary objective of her study was to determine if the PAPA framework was still relevant and if any new issues should be added [Woodward10]. Respondents were undergraduate information technology (IT) students from four countries, introducing a cultural factor that may have influenced the results. Woodward's results indicate perceived risk of discovery and level of personal responsibility influence judgement on the ethical interpretation of an action. Clearly, it is the responsibility of the computing faculty (or

incumbent in the educational system) to instill a high level of personal responsibility in students, to create the most responsible professionals possible.

2.4 PAPA in the Age of Social Networking

Mason spoke of the social contract as reflecting the nature of the society at hand. Mason's information age society was more homogenous and compartmentalized than today's. In 1986, information systems societies were distinct in scope, either based on geographic, demographic, political, or economic factors. Social contracts were the responsibility and obligation of those in control of the information, to protect the society and users. Such is not the case today, especially with respect to social networks.

Due to the global nature of information systems in general and social networks in particular, a global social contract is required. This requires defining the society relative to the information systems utilized. To reflect on the society encompassed by social networks is an impossible task, as the society is defined by its users and the cultural attitudes reflected therein. A global culture does not exist; it is in constant ebb and flow. Nowhere is this more evident than in the society defined by social networks.

Mason's concept of a social contract must be reconsidered in light of the advent of social networks, as Parrish contends, they have "changed the face of the information society." Parrish sought to "develop principles (to) provide guidance" for use of social networks

and “to support the establishment of norms (to) allow better definition of the social contract that protects individuals in the information age” [Parrish10].

Donaldson and Dufee’s proposal of an integrative social contracts theory of business ethics integrates a macro-social contract (“a normative and hypothetical contract among economic participants”) and a micro-social contract (“an existing implicit contract that can occur among members of specific communities.”) The macro-social contract affirms the members of the self-defined community will determine a set of ethical norms of ethical behavior. The micro-social contract recognizes the adoption of these norms requires informed consent of the members and the ability to exit the community [Donaldson94]. Social networks provide neither of these moral freedoms.

On this basis, Parrish argues “the elements affecting ethical principles created for information sharing (on social networks) are derived not from the (community/society) but from the information that is shared” concluding the PAPA framework is the “relevant foundation (for developing) ethical principles for information sharing (on social networks.)” [Parrish10]

Parrish proposes four principles for responsible use of social network sites based on the PAPA framework. These principles necessitate individual responsibility for the security and accuracy of information shared on social network sites [Parrish10].

In 1986, those in control of the information were government agencies, educational institutions, and corporate entities, assisted by software developers. Mason addressed the need for these constituents, the "MIS community" to be responsible for the "social contract that emerges from the systems…we design and implement" [Mason86]. With the advent of social networks, the control of the information has been distributed to additional entities, the individual users. In social networks, every user has the ability to control (or lose control of) information. Control is in the hand of every user, requiring each member of the society assume the responsibility. Further, the individuals of the society are not homogenous in their values; they are globally dispersed, as well as morally and culturally diverse. As Parrish succinctly states "…social networking sites (SNS) such as Facebook, mySpace, YouTube, Twitter, and Flickr allow people to publish and share information in ways (they never could before). Additionally, the proliferation of mobile devices…allow for the instantaneous collection of information for sharing on these sites…in almost real time as the events unfold" [Parrish10, p 187].

Using the Multidimensional Ethics Scale (MES) designed by Reidenbach and Robin in 1990, Williamson sought to understand the reasoning students attribute to their determination of Internet-based scenarios as ethical issues relative to the PAPA framework. His results were inconclusive as it appears the students were either unable to recognize any type of ethical issues in the scenarios, or ill equipped to recognize ethical issues at all [Williamson11].

2.5 A More Modern Framework

A virtue ethics approach considers the character of the individual as the critical factor in directing one's ethical actions, rather than a rules-based (deontological) or consequence-based (teleological) approach. The individual possessed of excellence, moral wisdom, and a state of flourishing will make ethical decisions and act accordingly. McBride utilizes a virtue ethics approach to develop a more modern framework for information systems, which "both encompasses and compliments PAPA" [McBride14]. Information systems professionals embracing this framework will develop systems to support the society while respecting the rights of the individual members. The acronym for McBride's framework is ACTIVE, which stands for autonomy, community, transparency, identity, value, and empathy [McBride14].

- Autonomy. To what extent is the user master of his own information and in control of his interactions with an information system?
- Community. How does the information system support and develop the community within which it resides?
- Transparency. Is the derivation and use of the information clear to the users?
- Identity. How does the information system affect the user's identity and purpose?
- Value. How can the information and the owners of the information be valued and respected?
- Empathy. Does the information systems professional understand the effect of the information system on the user and their tasks?

2.6 Other Related Studies and the Influence of Demographic Variables

Demographic factors of age and gender have been inconclusive in most studies. Age has often been viewed as an indicator of work experience or maturity, in attempts to determine if exposure to real-world experiences effects ethical beliefs. Few studies exist using computing students and computing professionals, or exposing subjects to computer-related scenarios, thus leaving the research field open to expanded study.

Athey sought to prove computing students shared the same ethical beliefs as information systems (IS) professionals. In fact, regardless of the student's economic background (or gender), computing students disagreed significantly with the IS professionals in identifying computer-related scenarios as containing ethical actions or problems. If professionals develop ethical opinions through work experience, it may be possible to prepare computing students by presenting real-world scenarios and ethical discussions in the classroom. Athey found no significant differences between genders in identifying ethical scenarios [Athey93].

Glover presented undergraduate business students with business scenarios where action choices were either ethical or economic. Age was not a predictor of ethical decision making, whereas female students made more ethical decisions than males. Years of work experience was inconclusive as a predictor [Glover97].

Hay studied undergraduate accounting students and concluded cultural background (determined by country of origin) has the most significant influence on ethical perceptions in computer-related situations [Hay01]. Previous exposure to a formal ethics course did not influence perceptions, causing him to remark this "perhaps reinforces a commonly held belief that ethics cannot be taught in classrooms" [Hay01]. Previous exposure to additional computing curriculum had a small impact on their perception in computer-based scenarios. Gender did not influence ethical perceptions in computer-related situations.

Chapter 3

RESEARCH METHODOLOGY

3.1 Subjects

The undergraduate course Legal & Ethical Issues in Computing has been taught regularly at the University of North Florida, since 2007. The course, designed primarily for students in their senior year, provides a discussion of legal and ethical issues faced by computing professionals. Requiring as a prerequisite at least two programming courses, students will have used the principles and practices of the programming process to complete numerous programming projects. The course uses the students' experiences in software development as a framework, as well as published opinions from recognized experts in the field of computing to help refine ideas about ethics in computing. The course also examines the enforcement of acceptable practices in the form of the laws as they apply to computing. State and national laws pertaining to computing are discussed. Local and global issues are considered. Examples from a variety of sources are used as material for class discussions. Students are required to give and justify opinions about given computing situations, and to actively participate in class discussions and online forums. The required textbooks for the course are Deborah Johnson's *Computer Ethics: Analyzing Information Technology* [Johnson09] and Stephen Fishman's *Legal Guide to Web & Software Development* [Fishman07]. A sample syllabus with course description appears in Appendix A.

Some data has been consistently collected over the years, while the researcher taught this course. As approved by our Institutional Review Board (IRB), a portion of this data collected by the researcher will be used in this study. A copy of the approval is found in Appendix B. Table 2 indicates the number of computing students enrolled in the course each year, from 2007 to 2013.

Year	Spring	Summer	Fall	Total
2007	[24]	10	--	34
2008	35	[19]	--	54
2009	34	22	30	86
2010	--	31	34	65
2011	--	37	36	73
2012	--	29 [15]	37	81
2013	--	35	[38]	73
Total	93	198	175	466

Table 2. Enrollments in Legal and Ethical Issues in Computing from 2007-2013. (Brackets [ ] indicate students not taught by researcher.)

While 466 computing students enrolled in the course during that period, the researcher taught 370 of these students across twelve sections. Other instructors taught three sections of the course (96 students) during the seven-year period. Only the data collected from the 370 students taught by the researcher were analyzed for this study. Of the 370 original students, eleven either withdrew from the course prior to the exam or had a duplicate record removed, if they repeated the course in a later term. Of the remaining 359 students who completed the exam, forty-three students gave invalid responses or failed to answer the question. A response was considered invalid, if multiple factors were selected or the response did not address the PAPA factors, indicating the student did not

understand the question or did not understand the material. The responses of the remaining 316 subjects were considered.

3.2 Task

In each offering of the undergraduate computing ethics course, students were presented with the page shown in Appendix C as part of the midterm exam, in which they were asked to respond to the following question:

> Q: In class, we discussed Mason's four primary ethical issues of concern in computing. Briefly describe each issue and how each relates to our profession. *Which of these do you feel is most relevant in today's society?* Defend your answer.

Peslak also administered his survey to his undergraduate classes. Where Peslak focused on the "importance people place on … (PAPA) as it relates to them personally," the emphasis of this study was on the subject's opinion of the "relevance" of the PAPA factors in society today [Peslak06].

3.3 Variables

Responses to the essay question were tallied to determine the frequency each factor was chosen. If unclear, the content of the essay was read to insure the frequency count matched the intent of the respondent. If more than one factor was selected, the response was considered invalid. The number of times a factor was chosen was assumed to be a

measure of perceived relevance. The more frequently a factor was chosen, the more relevant the factor.

In addition to the student responses to the question of relevance, demographic data were collected. These data were linked to each student response; therefore, an analysis similar to Peslak's was possible for gender and age. Information on the student's employment status was also obtained and used to identify differences between inexperienced and experienced students as computing professionals. Additionally, as data were collected over an extended period, trend analysis was used to determine if there were changes in attitudes on these issues.

3.4 Hypotheses

The following hypotheses were based on Peslak's original hypotheses: [Peslak06]

H1. All of Mason's factors of Privacy, Accuracy, Property, and Accessibility will be recognized as relevant ethical issues in today's society.

H2. The frequency with which the four PAPA factors will be selected will vary with age.

H3. The frequency with which the four PAPA factors will be selected will vary with gender.

H4. The frequency with which the four PAPA factors will be selected will vary with work experience.

H5. Privacy will be selected more frequently than Property.

H6. Privacy will be selected more frequently than Accessibility.

H7. Privacy will be selected more frequently than Accuracy.

H8. Property will be selected more frequently than Accessibility.

H9. Accuracy will be selected more frequently than Accessibility.

H10. No significant differences in frequency will occur between Property and Accuracy.

An additional hypothesis explored the relationship between the factors chosen and the year in which the data were collected:

H11. The frequency with which the four PAPA factors are selected will change from 2007-2013.

3.5 Data Analysis

Responses to the essay question were evaluated to determine which PAPA factors were selected. Birth year was used to place respondents in the six age categories defined by Peslak. Based on respondents' report of work experience, they were grouped into one of two categories, those with computing work experience and those without.

Descriptive statistics were used to convey the essential characteristics and summarize the data. Measures of frequency and variability were used to determine if hypotheses H1 through H4, and H11 were supported. Paired samples tests were used to determine the degree of correlation and the significant differences between the PAPA factors. The results were used to determine if hypotheses H5 through H10 were supported.

Chapter 4

RESULTS

4.1 Subjects

Of 370 students enrolled in the undergraduate course, eleven withdrew and/or repeated the course, resulting in 359 unique students sitting for the exam. Of these, forty-three gave invalid responses (blank, unrelated, or multiple answers), resulting in their removal from analysis. Four of the remaining 316 valid responses were removed to protect the identities of the respondents, as explained below. The valid responses of 312 unique students were analyzed. The demographics of all 359 students who completed the exam are presented in Tables 3 through 5, in a format similar to Peslak's. The data in the tables confirm the exclusion of the fifty-eight respondents does little to alter the overall demographics of the population analyzed.

4.2 Demographics

The breakdown of the students by age is shown in table 3 utilizing Peslak's six age categories. In this study, only four students fell in the age categories of 51-60 and 60+. For completeness, these four students are included in the demographics, but their responses and age range are excluded from the descriptive statistics. Such a small number increases the odds that an individual response could be identified. In the interest of protecting their anonymity, they were excluded. This exclusion of four, plus the

exclusion of the forty-three students with invalid responses, resulted in a final response set from 312 students in the undergraduate course. Over half of the students were under the age of 25 when they responded to the exam question, and 79% were younger than 31 years of age.

Age Range	N	Frequency	N Used	Frequency Used
18-24	193	53.76%	**168**	53.85%
25-30	88	24.51%	**80**	25.64%
31-40	56	15.60%	**48**	15.38%
41-50	18	5.01%	**16**	5.13%
51-60	2	0.56%		
60+	2	0.56%		
Total	359	100%	**312**	100%
Invalid responses			43	
Excluded Ages			4	

Table 3. Age Demographics

Gender demographics are shown in Table 4. This group has a much smaller female population (13%) than male population (86%), which is below the percentage of bachelor's degrees in computing earned by females (18%) as reported by the National Science Foundation in 2013 [NSF13].

	Gender	N	Frequency	N Used	Frequency Used
	Female	49	13.65%	**43**	13.78%
	Male	310	86.35%	**269**	86.22%
Total		359	100%	**312**	100%
Invalid Responses	Female			5	
	Male			38	
Excluded Ages	Female			1	
	Male			3	

Table 4. Gender Demographics

Classification of students by self-reported computing work experience is shown in Table 5. Peslak studied responses from students, faculty/staff, and IT professionals. This study is concerned only with students in an undergraduate computing course. An effort was made to differentiate the students and simulate Peslak's two categories of students and IT professionals. The students were placed into two groups: those reporting some computing work experience and those reporting no experience. Table 5 indicates two-thirds of the students (63%) reported little or no computing work experience at the time they responded to the study question.

	Work Experience	N	Frequency	N Used	Frequency Used
	No	228	63.51%	**203**	65.06%
	Yes	131	36.49%	**109**	34.94%
Total		359	100%	**312**	100%
Invalid Responses	No			24	
	Yes			19	
Excluded Ages	No			1	
	Yes			3	

Table 5. Work Experience Demographics

4.3 Descriptive Statistics

The study data, shown in Table 6, are described and summarized in this section. The dependent variable, PAPA, is categorical data, also referred to as nominal data. The independent variables of the age of the subjects and the year the response was collected are ordinal, while the subjects' gender and self-reported work experience in the computing field are categorical and nominal in nature.

Variable	Type	Level of Measure	Description
PAPA Factors	Dependent	Categorical/Nominal	Unordered factors to be selected by subject
Age	Independent	Ordinal	Age of subject in Year of data collection
Gender	Independent	Categorical/Nominal	Dichotomous category; gender of subject
Work Experience	Independent	Categorical/Nominal	Dichotomous category; self-reported by subject at time of data collection
Year	Independent	Ordinal	Year subject participated in data collection

Table 6. Description of Study Variables

Ordinal and nominal data that do not adhere to a normal distribution are analyzed using non-parametric statistical tests. Non-parametric tests do not assume the data adhere to a normal distribution, whereas parametric tests make assumptions that the population's mean or standard deviation adhere to a normal distribution.

Chi-square tests are used to analyze nominal data and to compare observed frequencies to frequencies expected under the null hypothesis. Two Chi-square tests are used. The Chi-square goodness of fit determines if one categorical variable fits to an expected distribution, that is, if the difference between the observed and expected outcomes are bigger than the variability expected by chance. The Chi-square test for independence compares two sets of nominal data to determine if a relationship exists and if the strength of the relationship can be used to make inferences to a larger population. A requirement for using Chi-square tests is the sample size must be large enough for the expected values in 80% of the cells to be at least 5, and the generally accepted practice requires all cells to meet this minimum value. An expected count for each cell is calculated based on the

number of cells in the table and the total observations, and reflects the expected outcome in each cell, if by chance. [SPSS13]

The results of statistical tests indicate the probability that the observed outcomes occurred by chance. To test a 95% confidence level in the research results, the significance (or alpha) level of .05 is used to decide when to reject the null hypothesis. In hypothesis testing, probability values (*p* values) are used as evidence to support or reject the null hypothesis. The significance level is compared to the probability value ($p < alpha$) resulting from testing the study data. The smaller the *p* value the stronger the evidence to reject the null hypothesis. Generally, $p < .05$ is considered "significant" and $p < .01$ is "highly significant" [Johnson14].

4.3.1 Goodness of Fit

A goodness of fit test is used to compare the frequency at which students selected the PAPA factors. A non-parametric test for goodness of fit will determine if the students' selection of PAPA factors fits a discrete probability distribution of an equal chance of selection for each factor. Therefore, if the null hypothesis holds and the students were indiscriminate in their selection, the observations for each discrete factor will approximate one-quarter of the total observations in the sample (i.e., 78 for N=312).

4.3.1.1 Hypothesis H1 - PAPA

Table 7 shows the variance between the observed and expected values based on the null hypothesis. The accepted Chi-square assumption that no cell contains a value less than 5 is met, and the variances between observed and expected values are significantly different than would have been expected under the null hypothesis of indiscriminate responding. Privacy was selected more often than expected under the null hypothesis with $p = 0.00001$, which is an indication of being highly significant. Accuracy, property, and accessibility were selected less than expected under indiscriminate responding ($x^2 = 149.308$, $df = 3$, $p = 0.00001$).

	N	Frequency	Expected N (1/4)	Variance	x^2	*df*	*p*
FACTORS:					149.308	3	.00001
Privacy	171	54.8%	78	93			
Accuracy	54	17.3%	78	-24			
Property	39	12.5%	78	-39			
Accessibility	48	15.4%	78	-30			
	312	100.0%					

Table 7. PAPA Descriptive Statistics and Goodness of Fit Chi-square Test

Figure 1 illustrates the variance of the observed responses from the expected responses. This further emphasizes the significance of the differences.

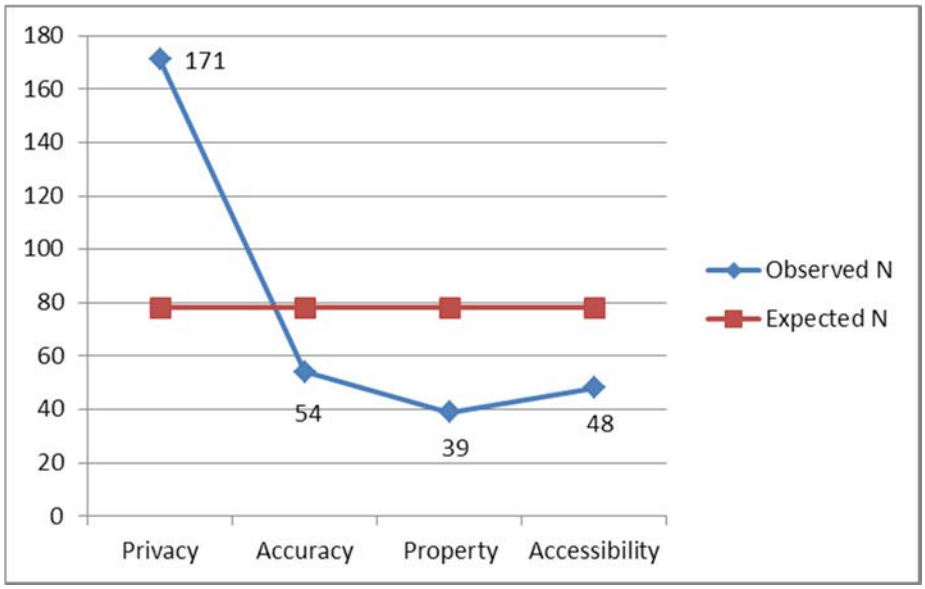

Figure 1. PAPA Factors - Goodness of Fit

4.3.2 Tests for Independence

Tests for independence were used to determine if there was a significant relationship between the PAPA factors selected and the variables of age, gender, and work experience. The Chi-square test for independence indicates associations between categorical variables and reveals the strength of any relationship without inference as to causation.

4.3.2.1 Hypothesis H2 - Age

The observations across the four age categories are summarized in Table 8. Across all four of the age groups, privacy was selected more often than any other factor within the age group (range = 41.6% to 61.3%). The strength of the relationship between age and privacy is tested to determine if there is significance. A Chi-square analysis could not be

used with the four age categories defined, as 3 of 4 cells in the 41-50 year-old group had expected values less than 5.

AGE	18-24		25-30		31-40		41-50		Mean	StDv
	N	Freq	N	Freq	N	Freq	N	Freq		
Privacy	103	0.61310	40	0.50000	20	0.41667	8	0.50000	.507	.080
Accuracy	24	0.14286	15	0.18750	10	0.20833	5*	0.31250	.212	.071
Property	22	0.13095	10	0.12500	5	0.10417	2*	0.12500	.121	.011
Access	19	0.11310	15	0.18750	13	0.27083	1*	0.06250	.158	.090
Total	168		80		48		16		1	

Table 8. Age Summary Descriptive Statistics (*cells with expected values < 5)

With such a small number of subjects in the oldest age category (N = 16), the test was run again after combining the data of the 31-40 and 41-50 age categories to see if this would reveal a stronger relationship. Table 9 shows the results of running a Pearson Chi-square analysis after combining the 31-40 and 41-50 age groups into one category in order to satisfy the Chi-square assumption. The strength of the relationship between the age of the subjects and the factors selected is still not significant, even when the older age groups were combined. The age of the subject is not significant in the selection of PAPA factors (x^2=9.760, df = 6, p = .135).

AGE	18-24		25-30		31-50		x^2	df	p
	N	Freq	N	Freq	N	Freq			
FACTORS:							9.760	6	.135
Privacy	103	61.3%	40	50.0%	28	43.8%			
Accuracy	24	14.3%	15	18.8%	15	23.4%			
Property	22	13.1%	10	12.5%	7	10.9%			
Accessibility	19	11.3%	15	18.8%	14	27.9%			
total	168		80		64				

Table 9. Age Summary Statistics Combining 31-40 and 41-50 Age Categories for Chi-square

Figure 2 clearly represents the relevance all age groups place on the privacy factor. All other factors fall below 31% for any age group. The 18-24 year-old group considers the accuracy, property, and accessibility to be equal in their importance, all below fifteen percent. The variability shown in the 41-50 age group may be attributable to the small size of this group. Fifty percent (n=8) of those in the 41-50 year-old group identified privacy as most relevant; the remaining students selected one of the other three factors, resulting in the violation of the Chi-square test assumption that there be at least 5 in every cell.

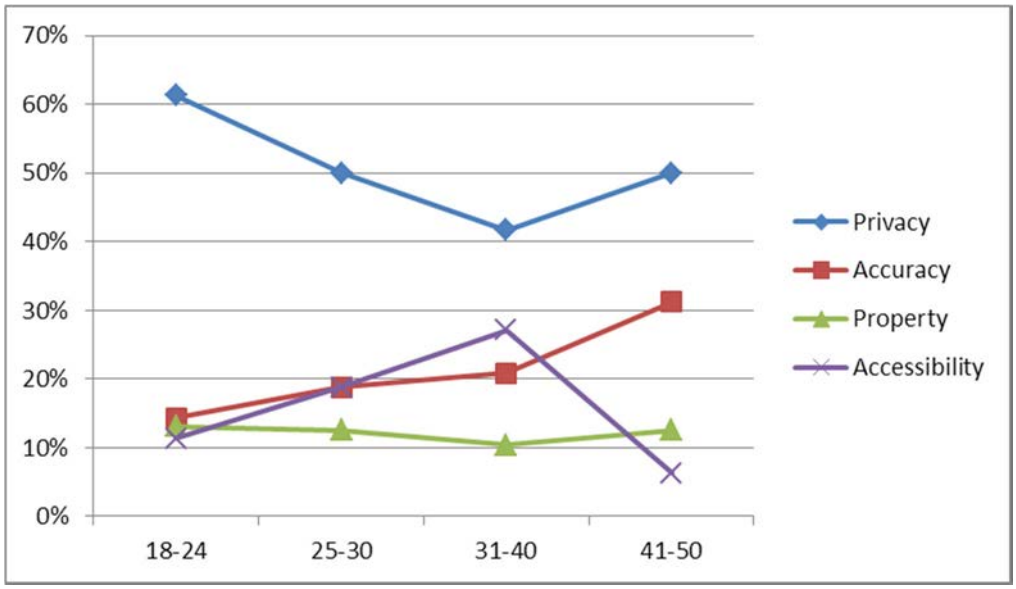

Figure 2. Frequency of PAPA Factor Selection by Age Group

4.3.2.2 Hypothesis H3 – Gender

Table 10 shows more than half of the females (58.1%) and males (54.3%) selected privacy, making it clear the population considered privacy as more relevant.

GENDER	Female		Male		Mean	Std Dev
	N	Frequency	N	Frequency		
Privacy	25	0.581395	146	0.542751	.56207	.027
Accuracy	10	0.232558	44	0.163569	.19806	.048
Property	3	0.069767	36	0.133829	.10179	.045
Accessibility	5	0.116279	43	0.159851	.13806	.030
total	43		269		1	

Table 10. Gender Summary Statistics

To investigate whether there was a difference in the selection of PAPA factors between females and males, a Chi-square statistic was conducted. Assumptions were checked and were met. Table 11 shows the Pearson Chi-square results and indicates that females and males do not vary significantly on their selection of the most relevant factor ($x^2 = 2.8$, $df = 3$, $p = .424$). The frequencies with which each of the four PAPA factors are selected do not vary significantly by gender.

GENDER:	Female		Male		x^2	df	p
	N	Frequency	N	Frequency			
FACTORS:					2.8	3	.424
Privacy	25	58.1%	146	54.3%			
Accuracy	10	23.3%	44	16.4%			
Property	3	7%	36	13.4%			
Accessibility	5	11.6%	43	16%			
total	43	100%	269	100%			

Table 11. Chi-square Analysis of Selection of PAPA Factors by Females and Males

Figure 3 clearly illustrates the similarity between females and males in their PAPA selection.

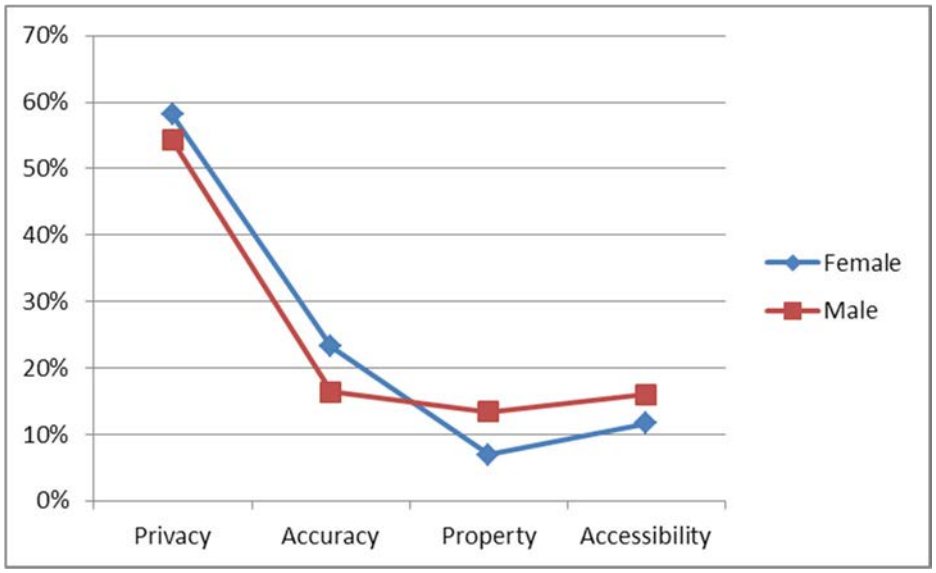

Figure 3. Frequency of PAPA Factor Selection by Gender

4.3.2.3 Hypothesis H4 – Work Experience

In Table 12, more than half of those with computing work experience (55.7%) and those without computing work experience (53.2%) selected privacy over the other factors.

EXPERIENCE	No		Yes		Mean	Std Dev
	N	Frequency	N	Frequency		
Privacy	113	0.55665	58	0.53211	.54438	.017
Accuracy	36	0.17734	18	0.165138	.17123	.008
Property	24	0.118227	15	0.137615	.12792	.013
Accessibility	30	0.147783	18	0.165138	.15646	.012
total	203		109		1	

Table 12. Work Experience Summary Statistics

A Chi-square statistic was used to determine if work experience influenced selection of PAPA factors. Assumptions were checked and were met. Table 13 indicates the Pearson Chi-square results and shows work experience has no significant relationship to the

selection of a factor (x^2 = .491, df = 3, p = .921). Computing students with work experience are no more likely than expected under the null hypothesis to select a particular PAPA factor than those without computing work experience.

EXPERIENCE	No		Yes		x^2	df	p
	N	Frequency	N	Frequency			
FACTORS:					.491	3	.921
Privacy	113	55.7%	58	53.2%			
Accuracy	36	17.7%	18	16.5%			
Property	24	11.8%	15	13.8%			
Accessibility	30	14.8%	18	16.5%			
	203		109				

Table 13. Chi-squared Analysis of Selection of PAPA Factors Based on Work Experience

Figure 4 emphasizes the similarity in PAPA factor selection between these two groups.

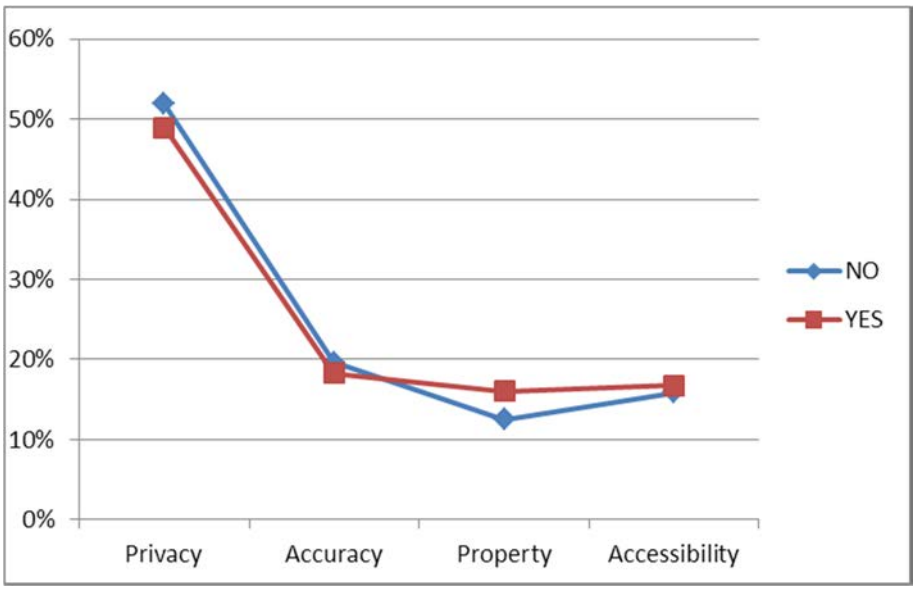

Figure 4. Frequency of PAPA Factor Selection by Work Experience

4.4 Samples Tests

Testing hypotheses H5 – H10 on the selection frequency of each PAPA factor relative to each other factor requires pairing the factors for samples tests. Paired samples can be analyzed using three common tests: the paired sample t-Test, Wilcoxon signed rank test, or the McNemar test.

Paired samples tests compare two means to determine if the difference between them is significance or likely occurred by chance. The paired sample t-Test compares two means from the same group, such as the observations of two of the PAPA factors. The null hypothesis for the t-Test is that the means will be equal; that there will be no difference between the observations except those occurring by chance. Paired sample t-Tests assume the data are normally distributed. If the data are not normally distributed, an alternative non-parametric paired sample test such as the Wilcoxon signed rank test is used. The Wilcoxon signed rank test compares ranks, rather than means. The McNemar test is often used for nominal non-parametric data [Stats18T]. Since Peslak [Peslak06] utilized both paired sample t-Test and Wilcoxon signed rank tests, those tests will be used in this analysis for discussion purposes.

Prior to running paired t-Tests on the PAPA factors, an assessment of the normality of the data was performed. Table 14 shows the results of two well-known tests of normality, Kolmogorov-Smirnov and Shapiro-Wilk. In these tests, a significance value (Sig.) greater than 0.05 indicates the data are normally distributed. Both tests confirmed the

data deviate significantly from a normal distribution (p = .0001). Although the data are non-parametric, the results of the t-Tests will be shown here for discussion purposes.

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
PAPA	.331	312	.000	.736	312	.000
a. Lilliefors Significance Correction						

Table 14. Tests of Normality on PAPA Factors

4.4.1 Hypotheses H5-H10 - Relative Importance of PAPA Factors

Based on the goodness of fit analysis shown previously in Table 7, the PAPA factors ranked in order of relevance are privacy, accuracy, accessibility, and property. To determine the degree of correlation and the significance of differences between the factors, paired sample t-Tests was used. The four factors were paired into the six possible combinations as shown in Table 15 and paired sample analyses were performed. Table 15 contains the descriptive statistics used to compare the choice of each factor relative to each other as part of the whole.

		count	Mean	N	Standard Deviation	Standard Error Mean
Pair 1 (H5)	Privacy	171	.5481	312	.49848	.02822
	Property	39	.1250	312	.33125	.01875
Pair 2 (H6)	Privacy	171	.5481	312	.49848	.02822
	Accessibility	48	.1538	312	.36138	.02046
Pair 3 (H7)	Privacy	171	.5481	312	.49848	.02822
	Accuracy	54	.1731	312	.37892	.02145
Pair 4 (H8)	Property	39	.1250	312	.33125	.01875
	Accessibility	48	.1538	312	.36138	.02046
Pair 5 (H9)	Accuracy	54	.1731	312	.37892	.02145
	Accessibility	48	.1538	312	.36138	.02046
Pair 6 (H10)	Accuracy	54	.1731	312	.37892	.02145
	Property	39	.1250	312	.33125	.01875

Table 15. Testing Difference from Paired Samples Statistics

Table 16 indicates the correlation between each paired score and the significance of each correlation. All the PAPA factors correlated with one another at a significance of $p < .05$. Privacy correlated at the highest degree with accuracy, then with accessibility, and then with property. In order of decreasing correlation are the pairs of accuracy and accessibility, accuracy and property, and property and accessibility.

		N	Correlation	*p*
Pair 1 (H5)	Privacy - Property	312	-.416	.000
Pair 2 (H6)	Privacy - Accessibility	312	-.470	.000
Pair 3 (H7)	Privacy - Accuracy	312	-.504	.000
Pair 4 (H8)	Property - Accessibility	312	-.161	.004
Pair 5 (H9)	Accuracy - Accessibility	312	-.195	.001
Pair 6 (H10)	Accuracy - Property	312	-.173	.002

Table 16. PAPA Paired Samples Correlation

Table 17 provides the analyses to address hypotheses H5 – H10.

H5. Privacy will be selected more frequently than Property.

H6. Privacy will be selected more frequently than Accessibility.

H7. Privacy will be selected more frequently than Accuracy.

H8. Property will be selected more frequently than Accessibility.

H9. Accuracy will be selected more frequently than Accessibility.

H10. No significant differences in frequency will occur between Property and Accuracy.

The differences between paired means for all factors paired with privacy are significant: privacy-property (H5 $p = .0001$), privacy-accessibility (H6 $p = .0001$), and privacy-accuracy (H7 $p = .0001$). Hypotheses five through seven are supported. There were no significant differences found between the pairs of property-accessibility (H8 $p = .335$), accuracy-accessibility (H9 $p = .553$), and property and accuracy (H10 $p = .120$). Hypotheses eight and nine are not supported, while hypothesis ten is supported.

		Paired Differences							
		Mean	Standard Deviation	Standard Error Mean	95% Confidence Interval of Difference		*T*	*df*	*Sig. (2-tailed)*
					Lower	Upper			
P1-H5	Privacy - Property	.42308	.70404	.03986	.34465	.50150	10.615	311	.000
P2-H6	Privacy - Access	.39423	.74045	.04192	.31175	.47671	9.404	311	.000
P3-H7	Privacy - Accuracy	.37500	.76315	.04320	.28999	.46001	8.680	311	.000
P4-H8	Property - Access	-.02885	.52812	.02990	-.08768	.02998	-.965	311	.335
P5-H9	Accuracy - Access	.01923	.57237	.03240	-.04453	.08299	.593	311	.553
P6-H10	Accuracy - Property	.04808	.54472	.03084	-.01260	.10876	1.559	311	.120

Table 17. PAPA Paired Samples Test

To replicate Peslak's analysis, the non-parametric Wilcoxon tests for two related samples were performed on the paired data. Identical results shown in Tables 18 and 19 confirm the significances observed under the paired t-Tests. The differences for all factors paired with privacy are highly significant (privacy-property (H5 $p = .0001$), privacy-accessibility (H6 $p = .0001$), and privacy-accuracy (H7 $p = .0001$).). Hypotheses five through seven are supported. There were no significant differences found between the pairs of property-accessibility (H8 $p = .335$), accuracy-accessibility (H9 $p = .552$), and property and accuracy (H10 $p = .120$). Hypotheses eight and nine are not supported, while hypothesis ten is supported.

			N	Mean Rank	Sum of Ranks
P1- H5	Privacy - Property	Negative Ranks[1]	171	105.50	18040.50
		Positive Ranks[2]	39	105.50	4114.50
		Ties[3]	102		
		Totals	312		
P2-H6	Privacy - Accessibility	Negative Ranks[1]	171	110.00	18810.00
		Positive Ranks[2]	48	110.00	5280.00
		Ties[3]	93		
		Totals	312		
P3-H7	Privacy - Accuracy	Negative Ranks[1]	171	113.00	19323.00
		Positive Ranks[2]	54	113.00	6102.00
		Ties[3]	87		
		Totals	312		
P4-H8	Property - Accessibility	Negative Ranks[1]	39	44.00	1716.00
		Positive Ranks[2]	48	44.00	2112.00
		Ties[3]	225		
		Totals	312		
P5-H9	Accuracy - Accessibility	Negative Ranks[1]	54	51.50	2781.00
		Positive Ranks[2]	48	51.50	2472.00
		Ties[3]	210		
		Totals	312		
P6-H10	Accuracy - Property	Negative Ranks[1]	54	47.00	2538.00
		Positive Ranks[2]	39	47.00	1833.00
		Ties[3]	219		
		Totals	312		

Table 18. Wilcoxon Signed Ranks Test

	Pair 1 (H5)	Pair 2 (H6)	Pair 3 (H7)	Pair 4 (H8)	Pair 5 (H9)	Pair 6 (H10)
	Privacy - Property	Privacy - Accessibility	Privacy - Accuracy	Property - Accessibility	Accuracy - Accessibility	Accuracy Property
Z	-9.109	-8.312	-7.800	-.965	-.594	-1.555
Asymp. Sig. (2-tail)	.000	.000	.000	.335	.552	.120

Table 19. Wilcoxon Test Statistics

[1] In these related pairs samples A – B, negative ranks indicate the number of observations of A.
[2] In these related pairs samples A – B, positive ranks indicate the number of observations of B.
[3] In these related pairs samples A – B, ties indicate the number of observations of neither A or B.

For comparison, the results of the McNemar non-parametric test on the paired nominal data are shown in Table 20, resulting in the same conclusions for hypotheses H5 – H10.

	Pair 1 (H5)	Pair 2 (H6)	Pair 3 (H7)	Pair 4 (H8)	Pair 5 (H9)	Pair 6 (H10)
	Privacy - Property	Privacy - Accessibility	Privacy - Accuracy	Property - Accessibility	Accuracy - Accessibility	Accuracy Property
N	312	312	312	312	312	312
Chi-square	81.719	67.963	59.804	.736	.245	2.108
Asymp. Sig. (2-tail)	.000	.000	.000	.391	.621	.147

Table 20. McNemar Test Statistics

4.5 Hypothesis H11 - Trend Analysis

Hypothesis H11 considers the frequency with which the choice of PAPA factors will change over the years of the study. Table 21 shows the frequency of PAPA factor selection across the seven years of the study. It is apparent from Figure 5 that privacy is consistently chosen more frequently than any other factor.

YEAR	2007	2008	2009	2010	2011	2012	2013	Mean	StDv
	Freq	Freq	Freq	Freq	Freq	Freq	Freq		
Privacy	.4444	.4231	.4348	.6034	.6290	.5000	.7667	.543	.128
Accuracy	.3333	.1923	.2463	.1379	.0968	.2241	.0667	.185	.095
Property	.2222	.0769	.1304	.1551	.1290	.0862	.1333	.133	.048
Accessibility	.0000	.3077	.1884	.1034	.1451	.1896	.0333	.138	.104
N	9	26	69	58	62	58	30		

Table 21. Summary Descriptive Statistics of PAPA Selection over Time

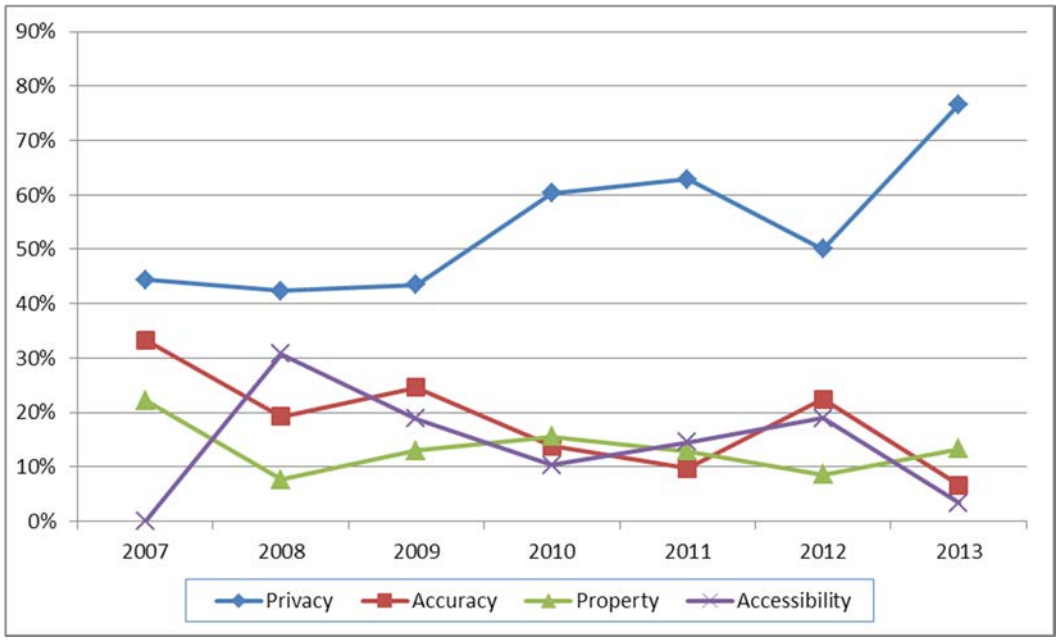

Figure 5. PAPA Selection over Time

Unfortunately, the small size of the observations when separated by year resulted in nine cells with expected values too low to support the results of a Chi-square test. Table 22 shows the results of the Chi-square test reflecting a small but not significant probability value (p = .064, x^2 = 27.875). Hypothesis H11 is not supported.

YEAR	2007	2008	2009	2010	2011	2012	2013	Total	x^2	*df*	*p*
									27.875	18	.064
Privacy	4*	11	30	35	39	29	23	171			
Expected	4.9	14.3	37.8	31.8	34.0	31.8	16.4	171.0			
Accuracy	3*	5*	17	8	6	13	2	54			
Expected	1.6	4.5	11.9	10.0	10.7	10.0	5.2	54.0			
Property	2*	2*	9	9	8	5	7*	39			
Expected	1.1	3.3	8.6	7.3	7.8	7.3	3.8	39.0			
Access	0*	8*	13	6	9	11	1*	48			
Expected	1.4	4.0	10.6	8.9	9.5	8.9	4.6	48.0			
N Total	9	26	69	58	62	58	30	312			
Expected Total	9.0	26.0	69.0	58.0	62.0	58.0	30.0	321.0			

Table 22. PAPA Observed and Expected Values over Seven Years (*cells with expected values less than 5)

Chapter 5

DISCUSSION

5.1 Discussion Overview

The research problem is to investigate whether age, gender, and, work experiences influence undergraduate computing majors' opinions of the relevance of PAPA factors today. The study has multiple goals. First, to confirm Mason's 1986 ethical issues remain relevant during the time of the study. Second, to determine if differences based on demographics are significantly different. The third goal is to determine if differences exist as social media becomes more pervasive over the seven years of the study.

This discussion reflects on the study data collected from 2007 to 2013 and analyzed here. Results are discussed within the context of environmental and social changes that directly address Mason's four ethical issues. Peslak's 2006 results provide the opportunity to discuss earlier environmental influences. A discussion of the potential for future research is included.

5.1.1 PAPA

Peslak showed Mason's issues to be relevant in 2006, in the early adoption stage of social media. Peslak's study employed an "understanding" scale (0 – 4) to rate the "recognition

of importance" to society of each factor which allowed each subject to rate each of the factors. The current study reaffirms Mason's ethical issues of concern remain relevant over the seven years following Peslak's study. The current study required subjects to select only one factor that represented the most relevant to society.

As social media adoption increased in the seven years following Peslak's study, privacy is identified as most relevant to society more than 54% of the time. Each of the remaining factors of accuracy, property, and accessibility were selected as most relevant 12% to 17% of the time. In both studies, privacy was the most selected or highest rated ethical issue of concern. Accuracy and accessibility were the next two factors in both studies. In the current work, accuracy was chosen slightly more than accessibility, whereas in Peslak's study, these two factors were in a "virtual tie" [Peslak06]. In both studies, property was the least selected or lowest rated issue of concern.

5.1.2 Study Comparisons: Demographics

The differences based on demographics of the subjects in both studies were compared. Gender, age, and work experience were compared with Peslak's findings and those of others.

5.1.2.1 Gender

Selection of PAPA factors in the current study did not vary significantly by gender, consistent with several studies. Hay, Larres, Oyelere and Fisher found no gender differences in the ethical perceptions of undergraduate accounting students presented with computer-related situations [Hay01]. Athey found no gender differences in the ethical beliefs of undergraduate and graduate computing students when compared to the beliefs of computer professionals [Athey93].

Other results on gender differences have been mixed. In Peslak's findings, females were more likely to rate privacy and accuracy more important than their male counterparts were. Glover et al. [Glover97] and Glover et al. [Glover02] concluded gender was a strong indicator of ethical behavior in undergraduate business majors, stating "women made more ethical decisions than men at statistically significant levels." Harris developed a survey instrument of scenarios roughly representing Mason's four ethical concerns across several categories of computing areas: data access, changing data, software use, programming abuses, and illegal use of hardware. When administered to undergraduate and graduate computer science, information systems, criminal justice, and liberal arts majors, gender differences were mixed. Females indicated a "higher sensitivity" regarding the actions described in all the software use scenarios, whereas there were no significant differences between genders on the other categories [Harris00].

5.1.2.2 Age

Age had no effect on the selection or rating of PAPA factors in either the current study or Peslak's, consistent with multiple studies by Glover et al. [Glover97] [Glover02]. Other studies showed a variety of results on the influence of age. Athey's college-age computing students had significantly different ethical opinions than the older IT professionals [Athey93]. Although the subjects in Harris' research were all college students, he speculated their level of maturity could be based on academic level, from freshman to graduate. In most situations the highest "sensitivity to ethics" occurred in the graduate students lending some support for "differences as students mature" [Harris00].

Hoofnagle et al. contacted a random sampling of American adults (18 years of age or older) for phone interviews and questionnaires on their attitudes, practices, preferences, and knowledge of legal protections relative to information privacy issues. Six age categories were similar although not identical to the categories used in this study. Hoofnagle found "while young adults tend to be similar to older adults in attitudes, practices, and policy preferences regarding information privacy, they are quite more likely than older adults to be wrong in judging whether the legal environment protects them" [Hoofnagle10].

Williamson et al. divided college students into two age groups: under 26 and over 26 years for analysis. In general, these students were unable to recognize any ethical issues

in the situations presented [Williamson11]. Pei-Hsuan and Tze-Kuang's study of Taiwanese high school students as compared to college students revealed Taiwanese college students to be "more tolerant" of software copying than their younger counterparts [Pei12B].

5.1.2.3 Work Experience

In the current study, experienced and inexperienced undergraduate students select the PAPA factors in similar distributions. Work experience in the computing field had little effect on the selection of factors. Similarly, Peslak's results showed no significant differences in any of the ethical concerns when students were compared to faculty, staff, and IT professionals.

In Athey's research, only 52% of the students had IS work experience. She reasoned the difference between students and professionals in her study might not be a result of their age differences but may be attributable to the fact that the students had less work experience when compared to professionals. Athey suggests follow-up work to study a larger sample of older students to verify any influence of experience [Athey93].
The data set used in the multiple studies of Glover et al. proved inconclusive, indicating "years of work experience correlated with higher levels of ethical behavior" in half of the scenarios presented [Glover97] [Glover02]. Hay et al. determined prior education in any ethics course made no difference in undergraduate accounting students' computer-related ethical perceptions [Hay01].

5.1.3 Study Comparisons: PAPA Factors

Recalling the results of the paired samples tests in Table 17, a comparison of the current hypotheses with those of Peslak is shown in Table 23. In both studies, three hypotheses (H5 - H7) reflect expectations that privacy will be considered more often than any of the other factors, and these expectations are supported.

With the belief computing students during the period of this study would consider ethical concerns of property to be more relevant than those of accessibility, hypothesis eight (H8) differs from Peslak's 2006 expectation that accessibility would be deemed more important than property. Peslak's study supported the hypothesis that accessibility would be viewed as more important than property. This study did not confirm computing students today consider concerns of property to be more relevant than those of accessibility.

As for the pairing of accuracy and accessibility, the current study expected accuracy to be considered more relevant (H9), whereas Peslak expected no difference between these factors (H10). Both studies failed to support these hypotheses. Accuracy and property were expected to be selected at similar rates in this study (H10) while Peslak anticipated accuracy to be viewed as more important (H9). In 2006, Peslak's hypothesis was supported, as is the current assumption that no difference between these factors will be supported.

Brown 2007-2013					Peslak 2006				
		T	*df*	*Sig. (2-tailed)*			*T*	*df*	*Sig. (2-tailed)*
H5	Privacy > Property	10.615	311	.000	H5	Privacy > Property	-5.338	215	.000
H6	Privacy > Access	9.404	311	.000	H6	Privacy > Access	-2.499	213	.013
H7	Privacy > Accuracy	8.680	311	.000	H7	Privacy > Accuracy	2.633	216	.009
H8	Property > Access	-.965	311	.335	H8	Property < Access	-3.555	211	.000
H9	Accuracy > Access	.593	311	.553	H10	Accuracy = Access	.220	212	.826
H10	Accuracy = Property	1.559	311	.120	H9	Accuracy > Property	-3.366	214	.001

Table 23. Comparison to Peslak's Paired Samples Test Results. [Symbols (>, <, =) indicate the first factor is hypothesized to be selected (more, less, or no difference) when compared to the second factor]

5.1.4 Seven-Year Trend Analysis

Privacy was selected more often than any other ethical factor of concern every year. Figure 5 clearly shows no other factor was selected more than privacy in any single year. Accuracy, property, and accessibility vary in second, third, and fourth place rankings in each year. The general trend is a decrease in the importance of these three concerns over the seven years, as these factors are selected less often over time as the selection of privacy increased.

The predominance of privacy begs the question: how does the perceived importance of privacy compare to the combined strength of the other three concerns? Table 24 shows the results of the Chi-square test for independence comparing the observations of privacy

to the combined observations of accuracy, property, and accessibility. There is a significant difference between the selection of privacy and the other three factors combined over the seven years (x^2=14.293, *df*=6, *p*=.027). Due to the single small class in 2007 (N=9) resulting in low expected values for both cells, the Chi-square test was performed excluding data for 2007. The values for all other cells remain the same and the updated statistics are shown in the last row of Table 24 (x^2=13.908, *df*=5, *p*=.016) resulting in the same conclusion.

Year	Privacy		Accuracy + Property + Accessibility		x^2	*df*	*p*
	N	Frequency	N	Frequency			
					14.293	6	.027
2007	4*	44.4%	5*	55.6%			
2008	11	42.3%	15	57.7%			
2009	30	43.5%	39	56.5%			
2010	35	60.3%	23	39.7%			
2011	39	62.9%	23	37.1%			
2012	29	50.0%	29	50.0%			
2013	23	76.7%	7	23.3%			
	171		141				
Excluding							
2007	167		136		13.908	5	.016

Table 24. Chi-squared Analysis of Privacy Compared to Other Factors Combined (*cells with expected values < 5)

A visual representation of this relationship is shown in Figure 6, illustrating privacy begins to emerge in the year 2010 as the dominant choice over the combined selection of the other factors. The mirror image of the graph around the 50% line reflects the complementary nature of the summative data, that is, the frequency of the selection of privacy is equal to the total observations less the sum of the frequencies of the other factors (Privacy = N – (Accuracy + Property + Accessibility)).

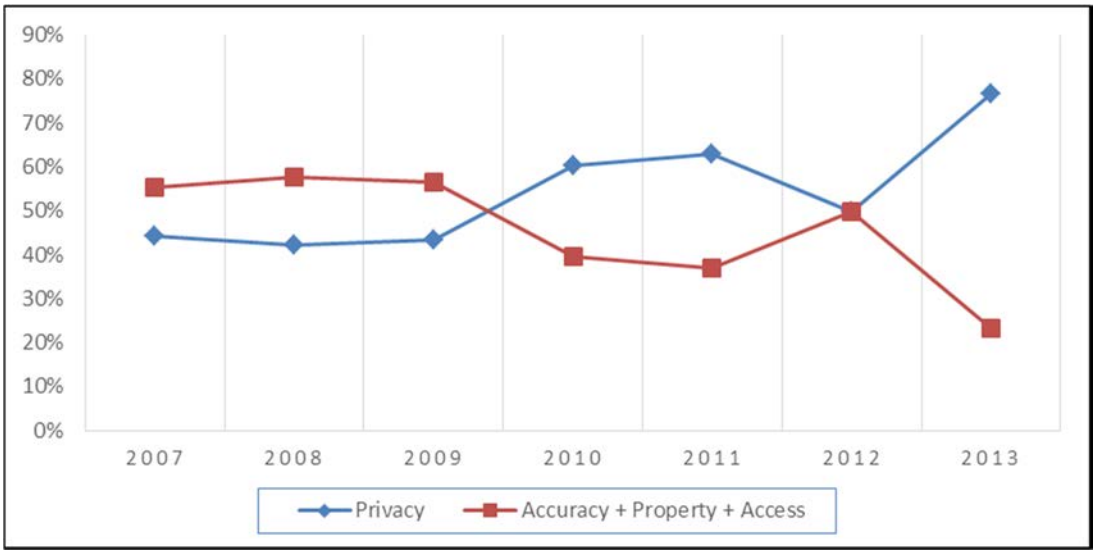

Figure 6. Privacy Compared to All Other PAPA Factors over Time

The data show privacy is the most important ethical concern throughout the seven years of this study. The relevance of information privacy to society in the opinion of undergraduate computing students increases from 2007 to 2013. No other studies look at data over time, which misses an opportunity to look at influences effecting changes in ethical concerns or to determine if these findings are an anomaly. Although this study is not measuring the influence of environmental factors such as social networking or other cultural shifts among the study subjects, the emergence of privacy as the dominant ethical concern cannot be ignored.

5.2 Future Research

The tenants of Mason's framework were mind-expanding at the time they were presented, and they remain foundational to the discipline of computing. As the world relies more and more on information technology to support the global economy, the

burden falls to the computing professional to protect society from the ethical pitfalls Mason identified.

5.2.1 Retesting Computing Students

Gender, age, and computing work experience did not factor into the study opinions of the students in this undergraduate course, therefore other influences should be considered in future research. Within the classroom, possibly the timing of the question influenced the outcomes. Students undertook the reading of Mason's article preceding several class sessions devoted to the discussion of the PAPA factors and their importance to computing professionals. The exam question was administered after these events.

A future research design utilizing an inventory of opinions at three stages: pre-reading, post-reading but pre-discussion, and post-discussion, would yield evidence of the influence of an undergraduate course in computing ethics on future professionals. Particular attention should be paid to pre- and post-discussion results, as persuasive arguments can influence individuals. Although students' personal opinions were encouraged in this study, the need to conform to the group norm is known to be strong in a cohesive group, referred to as "self-censorship of deviations from group consensus" [Hogg, 98]. For more background on groupthink, see Janus' 1972 study on group dynamics and the multitude studies that followed [Janis72].

5.2.2 Testing of Professionals in the "Real World"

The Association of Computing Machinery (ACM) recently made the first changes to the ACM code of ethics since 1992. McNamara et al. studied whether these changes would improve the ethical decision making of students or professionals [McNamara18]. Unfortunately, they found "explicitly instructing participants to consider the ACM code of ethics in their decision making had no observed effect" on either the software engineering students or the professional software developers [McNamara18]. What can educators do to inspire students to incorporate a code of ethics?

Further research is necessary to identify the influences on ethical behavior. It is insufficient to merely impart the knowledge of ethical concerns; ethical behavior must be instilled in those who will develop the software, collect and manage the data, and design the hardware. Studies are needed to follow students after graduation, to assess and monitor changes to their ethical decision making as they experience real-world situations and the consequences of their actions or inactions.

Chapter 6

IMPLICATIONS

A more thorough discussion of the implications of changes such as the rise of social networks and data breaches pose in the information age is presented. A discussion of environmental changes occurring since the end of this study includes present day and future threats to be considered.

6.1 Implications for Future Threats

Changes to the technology environment include more than the hardware and software advances introduced and implemented. The experience and expectations of the users and the society shape the environment as well. James Moor revised his evaluation of the computer revolution in 2001 to propose an additional stage. He states the introduction and permeation stages have been completed, and a new stage has been entered. Moor believes we "recently entered the third and most important stage – the power stage – in which many of the most serious social, political, legal, and ethical questions involving information technology will present themselves on a large scale" [Moor01]. In this stage, users are no longer struggling to learn how to use the technology; they are instead focused on applying the technology "to achieve their ends" [Moor01]. The technology no longer drives the revolution; the users do.

For these reasons, we must look at the changes to the technology environment as including the ways in which the users choose to manipulate the technology for their own purposes. These changes encompass threats to society and to its members. Some of those current and future threats are discussed here in terms of Mason's ethical concerns.

6.1.1 Social Networking 2002-2018

While discussing ethical and legal issues with undergraduate computing students in the classroom, discussions of the increasing influence of social networking on our culture and society are unavoidable. Social networking applications have proved to be the most compelling platforms for disclosure and dissemination of individual personal information, and as such, must be viewed in the context of the ethical concerns raised by Mason long before their existence. In 2010, Sophos's "Security Threat Report 2010" polled over 500 firms, 60% of which responded Facebook was the social network that "posed the biggest threat to security," ahead of Myspace, Twitter, and LinkedIn combined [Facebook18b] [Sophos10]. It is appropriate to consider the development of the most widely used social networking service, Facebook, over the years from Peslak's work to this study.

At the time of Peslak's study, social networking was in its infancy. Friendster, founded in 2002 and based on the "Circle of Friends" social network technique, was the first recognized social networking service to attract one million members [Friendster18]. It was overtaken in 2004 by Myspace, "a social networking website offering an interactive,

user-submitted network of friends, personal profiles, blogs, groups, photos, music, and videos" [Myspace18]. By the middle of 2006, Myspace claimed 100 million members worldwide, and was considered the largest social networking website in the world from 2005-2008. When it was purchased by Rupert Murdoch's News Corporation in 2005, it was used as "a way to capitalize on Internet advertising and drive traffic to other News Corporation properties [Myspace18].

Meanwhile, in 2004, Mark Zuckerberg developed and launched Facebook at Harvard and soon expanded it to other university, college, and school campuses in the U.S. and around the world, registering one million users in its first year. By 2005, Facebook had 6 million registered users [Facebook18a]. In 2006, the social networking service and website added the News Feed and Wall, added support for corporate networks, and doubled the number of users to 12 million. In 2007, Facebook claimed 100,000 business and group pages, and 20 million users. In 2008, with 100 million users, Facebook surpasses Myspace in total users, and by 2009, Facebook is the leading online social network in the U.S. with "102.9 million unique U.S. visitors" [Facebook18b]. Table 25 shows, the growth of Facebook users since inception, according to publicly available Facebook data. In this context, an "active" user is a user with a registered account regardless of activity, whereas a "monthly active" user represents a user who has visited the website in the past 30 days. In 2012, the distinction between "active" users and "monthly active" users changed in Facebook's public reporting [Facebook18a] [Facebook18b].

Date Reported:	Active Users Reported:
December 2004	one million
December 2005	6 million
December 2006	12 million
June 2007	20 million
August 2008	100 million
July 2009	250 million
July 2010	500 million
May 2011	700 million
October 2012	one billion monthly
December 2013	1.2 billion monthly
December 2014	1.39 billion monthly
December 2015	1.59 billion monthly
December 2016	1.86 billion monthly
June 2017	2 billion monthly
January 2018	over 2.2 billion monthly

Table 25. Reported Facebook Users [Facebook 18a] [Facebook18b] [AdWeek08]

In 2015, third party web analytics providers SimilarWeb Ltd. and Alexa Internet Inc. analyzed user activity on the leading social networking sites. With "over 20 billion visitors per month," Facebook was ranked first globally as the "highest-read social network on the web" by SimilarWeb, and, second globally by Alexa [Facebook18b]. In 2018, SimilarWeb maintains Facebook's ranking as the highest-read social network site, second in overall hits in the U.S. behind Google, and third globally behind Google and YouTube [SimilarWeb18]. Alexa ranks Facebook as the third highest-read site in the U.S. and globally, behind Google and YouTube in both arenas [Alexa18].

The phenomenal growth of Facebook since Peslak's work can be contextualized within Everett Rogers' theory of diffusion of innovation. Research in social network analysis often cites Rogers' theory and methodologies. According to Rogers, adoption of an innovation in a social system is a process; it moves through the social system in

recognizable sequential stages. The time it takes to adopt a new product or concept varies by the individual, but follows a general continuum from introduction, awareness, adaptation, to acceptance and assimilation of the innovation. This process within a society approaches a normal distribution within its members based on the length of time it takes to adopt.

Rogers identifies adopters as belonging to one of five categories based on their time-to-adoption. Each category represents a percentage of the individuals in the social system who fall within it. The adopter categories, in order of adoption, are innovators, early adopters, early majority, late majority, and laggards. "Innovators are the first 2.5 percent of a group to adopt a new idea. The next 13.5 percent to adopt an innovation are labeled early adopters. The next 34 percent of the adopters are called the early majority. The 34 percent of the group to the right of the mean are the late majority, and the last 16 percent are considered laggards" [Rogers71]. Because the laggards, the last to adopt, may never choose to participate in the market for the innovation, reaching an adoption level of 75% is considered approaching market saturation [Rogers71] [Rogers03]. Figure 7 is Rogers' diffusion of innovations relative to market share diagram [Rogers12].

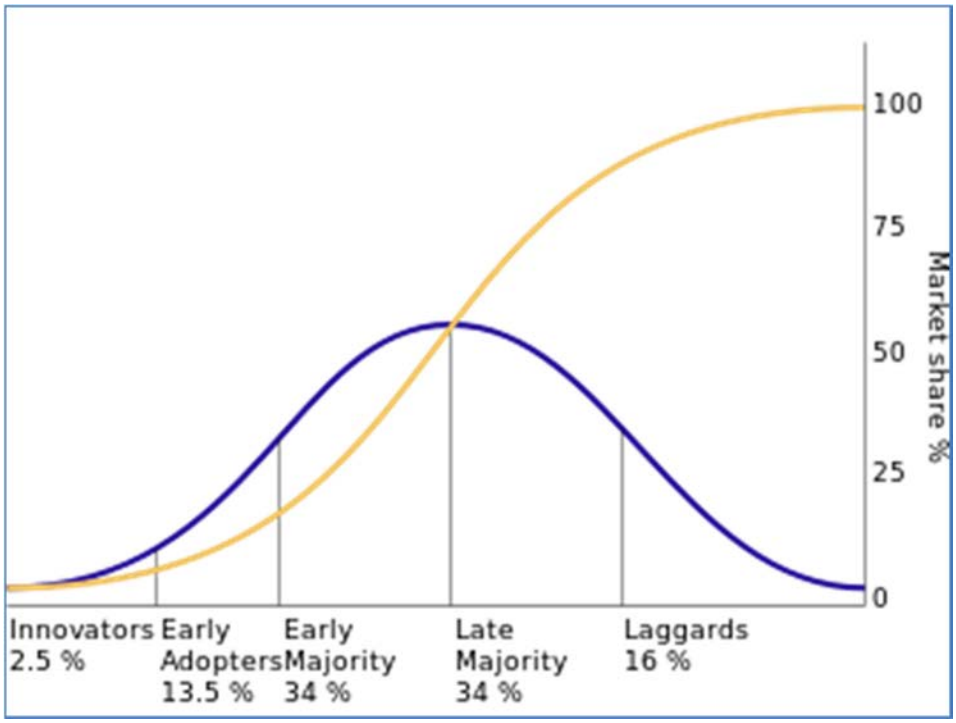

Figure 7. Rogers' Diffusion of Innovation "with successive groups of consumers adopting the new technology (shown in blue), its market share (yellow) will eventually reach the saturation level. The blue curve is broken into sections of adopters" [Rogers12]

According to Eric Eldon's 2011 analysis of the publicly available data sources on U.S. Facebook traffic from 2009-2011, Facebook appeared "to be reaching market saturation among internet users" in 2011 with evidence indicating in some key markets "75% of all U.S. Internet users are now actively using Facebook" [Eldon11]. If we assume Eldon's analysis is correct, total saturation of the market (100%) occurs when the number of Facebook users reached 1 billion in 2012, but we now know since 2012 user growth has increased 235% and it is unclear when it will slow appreciably. Figure 8 illustrates the reality of Facebook's growth mapped over Eldon's analysis of the progress of adoption of this innovation.

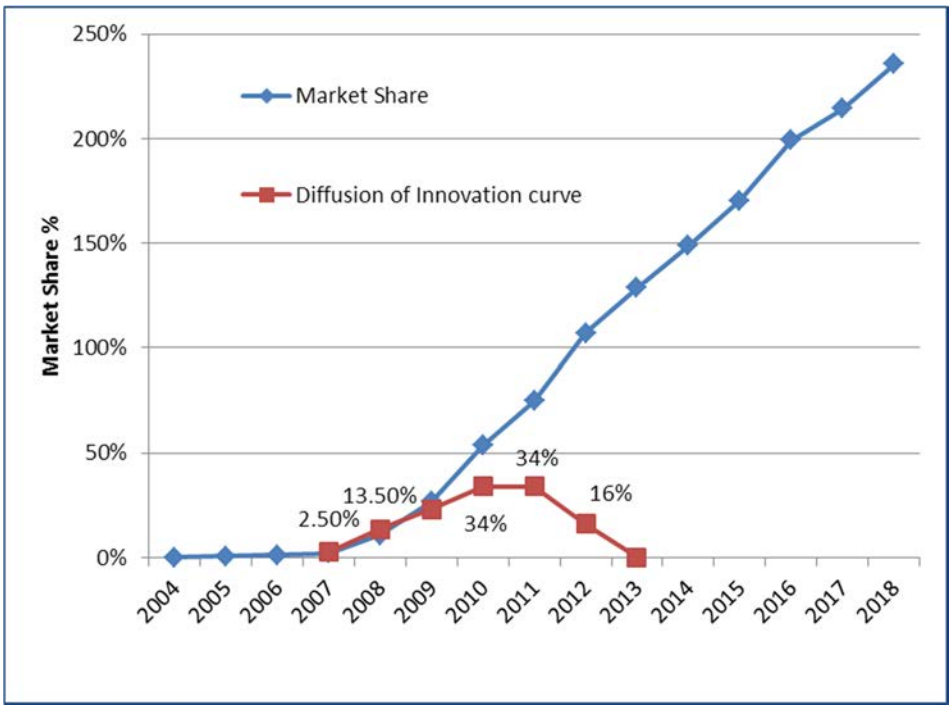

Figure 8. Facebook User Data Applied to Rogers' Diffusion of Innovation Theory Based on Eldon's Analysis in 2011

While it is difficult to say when, or if, Facebook has achieved market saturation, it is illustrative to analyze the study data under the assumption Facebook achieved market saturation in late 2011 or 2012, at one billion users. Under this assumption, it is safe to say at the start of this study Facebook was in an early adopter or early majority phase. It follows the transition from early majority to late majority occurred somewhere in the 2010 timeframe. By the end of the study, market saturation is assumed. Under these assumptions, the study data can be charted across the adoption process as shown in Figure 9. Note the divergence of ethical concerns as privacy increases to the extreme diminution of accuracy, property, and accessibility concerns among computing students. Privacy becomes their primary ethical concern. It could be argued the persistence of social networking influenced the opinion of computing students over these years. Further

research mapping perceived ethical concerns to the stage of adoption of innovation is called for.

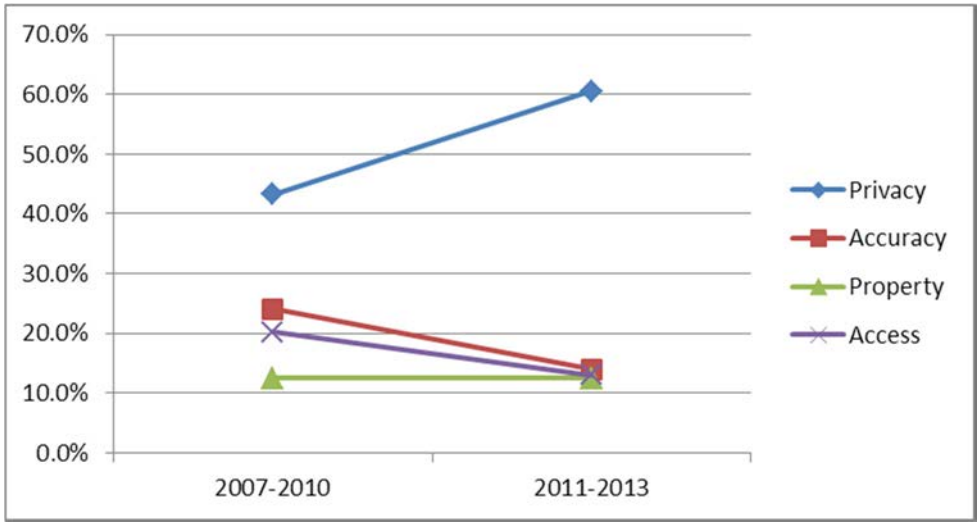

Figure 9. PAPA Data from Early Adoption to Market Saturation of Facebook

6.1.2 Cybersecurity Threats

In 2014, the IT security company Sophos shared its predictions in a report "Security Threat Trends 2015" [Sophos15]. The top cybersecurity threat listed suggests social engineering will likely become the innovative exploitation tactic to avoid the increasing types of mitigation strategies deployed in the industry. Vulnerabilities to data security and opportunities for exploitation by cyber criminals include undetected flaws in older widely-used software, data-rich mobile payments systems in addition to the traditional payment platforms, and, older hardware connected to external environments as the weakest link in an otherwise secured environment. Massive regulatory changes starting in 2015 and continuing currently are exposing the inability of the industry to supply a

sufficient pool of skilled cybersecurity professionals. Universities developing cybersecurity programs are needed.

6.1.3 Data Breaches 2003-2018

Another challenge to Mason's ethical issues comes about as bad actors take advantage of the growing wealth of under-protected data accumulating in repositories accessible on the internet. The increasing number and severity of data breaches occurring prior to and during the seven years of this study might have influenced the opinions of the student respondents.

Table 26 summarizes the largest data breaches reported to date, compiled from lists by IT Governance [Irwin17], CSO Online [Armerding18], and Huffington Post [Ligato15]. Many of those listed between 2003 and 2013 were studied and discussed in class, insuring these students were made aware of the responsibilities of computing professionals to the society at large.

Year	Organization - Breach	Records Accessed
2003-2006	TJX Companies – customer credit and debit numbers	94 million
2005-2012	Hackers from Russia & Ukraine target bank accounts and customer credit card information	160 million
2006-2008	Heartland Payment Systems – credit and debit numbers	130 million
2010	Stuxnet malware targets Siemens systems protecting uranium enrichment centrifuges	984 centrifuges
2011	RSA Security division of EMC – employee records	40 million
2011	Sony PlayStation Network – account information	77 million
2012-2014	US Office of Personnel Management – current and former federal employee information for clearances	22 million
2013	Target – customer credit and debit card information	70 million
2013	Adobe – IDs and encrypted passwords	38 million
2013	Yahoo – user information and passwords (#1)	3 billion
2014	Yahoo – user information and passwords (#2)	500 million
2014	J. P. Morgan Chase – account information from individuals and business accounts	76 million households + 7 million businesses
2014	eBay – user information and passwords	145 million
2014	Home Depot – customer credit and debit information	56 million
2015	Anthem Health Insurance (Wellpoint) – user information and social security numbers	80 million
2015	Ashley Madison – user data stolen; published online	30 million
2016	Myspace – Russian hacker offers to sell old user data	360 million
2016	Adult FriendFinder – 20 years of user information	412 million
2016	Uber – users and drivers' information	57 million users + 600,000 drivers
2017	River City Media – user information and location	1.37 billion
2017	Equifax – users' protected data and credit card information	143 million
2018	Facebook - Cambridge Analytica used harvested data to target political ads in 2016 US election	50 million

Table 26. Summary of Significant Data Breaches

The value of personal information collected, maintained, or transmitted was discussed in class. The social contract between the IT profession and society required discussions of when and under what conditions information must be safeguarded, as well as what must be revealed, and why. The responsibility of the professional to validate and authenticate data collected, stored, or transmitted is essential to this contract. Information ownership

and legal protections and ramifications were supported with case studies of real-time incidents and current events. From software developers to data managers, it was critical to discuss the type and nature of information an organization has the right to obtain and how it must protect the information, whether it is personal data or intellectual property.

6.1.4 Consumer Privacy Protection

Expectations of privacy today diminish daily as more and more systems rely on collecting data in real-time under the auspices of improving the user experience. Tracking shoppers' phone data by retailers under the auspices of offering a better shopping experience also provides the company with data on shopper preferences for a more targeted market for advertising. It is an ethical concern that the data is collected without the shopper's consent and becomes the property of the retailer to be combined with other data to create a detailed but unauthorized profile of the individual. As it becomes easier and easier to accumulate unconnected data about individuals, through social media analysis, phone tracking, web purchases data, less and less of the individual's information is under his or her control. If some of the data is inaccurate or ages out, who is responsible for correcting it, or protecting the individual from harm caused by invalid data?

Helen Nissenbaum's 2015 paper, published in 2018 in *Science and Engineering Ethics*, does not consider current legislation but offers sound reasoning that "contextual integrity offers the best way forward for protecting privacy in a world where information

increasingly mediates our significant activities and relationships" [Nissenbaum18]. She recognizes the importance of a Consumer Privacy Bill of Rights (CPBR) endorsed by the Obama White House in February 2012 particularly pertaining to the principle of "Respect for Context," explained as the expectation "companies will collect, use, and disclose personal data in ways that are consistent with the context in which consumers provide the data" [WhiteHouse12a]. The CPBR provides for individual control over personal data, the ability to access one's data and to insure its accuracy, as well as the need for data processors to be accountable for data security, accuracy, and use, all of which are concerns identified by Mason decades earlier. This bill is the framework at the center of the Obama Administration's Privacy Report *Consumer Data Privacy in a Networked World,* addressing privacy principles in a dynamic commercial internet environment and "consumer data privacy issues as they arise from advances in technologies and business models" [WhiteHouse12b]. The tenants and principles embraced in this report closely resemble those of the General Data Protection Regulation (GDPR) being developed in the European Union during the same period.

In October 2017, the House of Representatives introduced the Consumer Privacy Protection Act of 2017 "to ensure the privacy and security of sensitive personal information, to prevent and mitigate identity theft, to provide notice of security breaches involving sensitive personal information, and to enhance law enforcement assistance and other protections against security breaches, fraudulent access, and misuse of personal information" [Congress17]. This bill is a mere subset of the strong protections provided under the General Data Protection Regulation (GDPR) recently enacted by the United

Kingdom in May 2018, which guarantees the individual's "right to be forgotten" if they choose to withdraw consent from the data controller or data processor to retain one's personally identifiable information [GDPR18]. The full impact of the GDPR on privacy policies worldwide is yet to be seen.

6.1.5 Internet Neutrality

The debates and controversy surrounding regulation of internet providers do not necessarily relate to issues of privacy, but they do address issues of property and accessibility. They revolve around issues of who owns the communication lines and who can control and regulate them, as well as concerns of unreasonable restrictions on accessibility to the information. In the context of fairness, net neutrality regulation views the internet providers as common carriers, mandating they treat all traffic equally. Issues of control of the communication channels also contribute to the limitation of access for those who cannot afford to participate. At a minimum, a level of basic service should be provided in the same way telephone communication is available to all at a minimal cost. In December 2010, the FCC set up regulations to establish internet neutrality with the *Open Internet Order* requiring internet service providers to treat all online traffic equally. The Order required broadband providers to be transparent about their management practices and performance characteristics, prohibited blocking of lawful content, applications or services, and, prohibited "unreasonable discrimination" of lawful traffic [FCC10]. Verizon Communications sued the FCC, and, in 2014, the U.S. Court of Appeals vacated portions of the Open Internet Order stating the broadband providers

could not be regulated as common carriers. The basis for the decision cited the FCC had previously declared in a 2005 policy statement that internet services are "information services" and therefore the service providers could not be regulated under the rules applying to common carriers. "The Verizon court further affirmed the Commission's conclusion 'broadband providers represent a threat to Internet openness and could act in ways that would ultimately inhibit the speed and extent of future broadband deployment'" [Verizon v FCC 14]. Under the Obama Administration, the FCC continued its pursuit of "the right public policy to protect an open internet." In February 2015, they issued a report and order titled *Protecting and Promoting the Open Internet* which opens with the following statement [FCC15]:

> The open Internet drives the American economy and serves, every day, as a critical tool for America's citizens to conduct commerce, communicate, educate, entertain, and engage in the world around them. The benefits of an open Internet are undisputed. But it must remain open: open for commerce, innovation, and speech; open for consumers and for the innovation created by applications developers and content companies; and open for expansion and investment by America's broadband providers.

In this order, broadband internet services are classified as "telecommunications service(s)" and thus, broadband providers are within the scope of regulations for common carriers. Three practices deemed harmful to the public and an open internet are banned: Blocking, Throttling, and Paid Prioritization [FCC15].

Under the Trump Administration, net neutrality rules were rolled back by Congress using the Congressional Review Act in early 2017. The Federal Communication Commission, now headed by a dissenter from the previous commission, in December 2017 repealed the regulations it enacted during the Obama presidency, and limited the power of future FCC

members to re-enact these rules, essentially deregulating Internet service providers and ending net neutrality [NPR17].

A survey by the Program for Public Consultation at the University of Maryland found eighty-six percent of registered voters polled oppose the repeal of net neutrality, including 82% of Republicans and 90% of Democrats [PCC18].

It has been a long-standing principle in America that literacy and access to education are fundamental rights of a developed society. The public library system is the result of that social contract to provide access to books, another form of information. Wisely, our society's desire to improve education and to provide access to knowledge to all members of the society lead to the creation of the publicly funded public library system in the 1800's. Contributions from philanthropists and public taxes established the early public libraries under the belief Americans should have access to books and free education, for the "betterment of the society" [PubLib18]. In the Information Age, free and public access to knowledge requires an open internet.

6.1.6 The Internet of Things

The increased deployment of the Internet of Things (IoT) poses new threats and ethical considerations. The Internet of Things poses unimagined threats to society if ethical concerns are not addressed before large-scale systems are deployed. Sophos suggests the lack of "basic security standards" in IoT devices will inevitably lead to unimaginable

impact to infrastructures, industries, corporations, and, households. By 2014 data encryption is a standard practice to protect against privacy intrusion, creating a security threat by applications where encryption has been poorly implemented as users are exploited due to a heightened but false sense of security [Sophos14].

A 2016 article in The Chronicle of Higher Education warns "The 'Internet of Things' Faces Practical and Ethical Challenges" [CHE16]. The article cites established IoT implementations as examples of some of the challenges. Carnegie Mellon is coupling IoT devices with intelligent systems to allow devices to make predictive decisions for users. The article states, "In a 2014 experiment, a group of researchers at the University of Michigan hacked into IoT infrastructure in a small town in the state and seized control of nearly 100 traffic lights" [CHE16]. Oral Roberts University, stating they are looking for "a correlation between exercise and academic success" requires students to track their activities on Fitbits, leading critics to wonder what they will do with this sensitive information [CHE16]. Although intentions may be laudable, concerns of how much information is being collected, who has access, and how the information will be used evoke Mason's ethical concerns.

Those interested in the legal and ethical implications of IoT should review Spyros Tzafestas' 2018 paper "Ethics and the Law in the Internet of Things World" where he summarizes the ethical concerns of this new technological environment as follows: The Internet of Things (IoT) involves many objects and humans that are connected via the Internet 'anytime' and 'anyplace' to provide homogeneous communication and

contextual services. Thus, it creates a new social, economic, political, and ethical landscape that needs new enhanced legal and ethical measures for privacy protection, data security, ownership protection, trust improvement, and the development of proper standards [Tzafestas18].

6.1.7 Autonomous Computing and Artificial Intelligence

As we look to future, the advances in technology and the increasing reliance on data collection in real-time, Mason's concerns cannot be forgotten. The newest threats to society lie in the autonomous computing and artificial intelligence that provide mechanisms to challenge the protections expected by the society. Drones must collect and analyze data in real-time to accomplish tasks. Who is protecting the privacy of the data? Who owns the data and verifies and maintains the accuracy? Autonomous vehicles can provide great advances in protecting human life, but who develops the rules and protections to make the tough decisions when the systems are challenged? In a collision avoidance situation, how will life and property worth be assessed and weighed against the various options for avoidance? Will the victims' "worth" to society be based on their age, gender, or race?

A recent article on Geek.com describes an "intelligent control system" that will rely on artificial intelligence to detect illegal immigrants as they attempt to cross the border at three ports in the European Union. The computer-animated border agent will use biometrics, passport photos, visa information, and proof of funds documents to determine

how to question each traveler in an effort to detect deception. In the pilot, human border patrol agents will be present and assist with travelers identified as “high risk,” but the ethical concerns inherent in reliance on this system should it become autonomous are monumental [Mlot18].

6.2 Conclusion

In an ever-changing technology environment, the computing professional remains the guardian of our social contract to protect, control, disseminate, monitor, and contribute to the valuable information of society. Today’s computing students will face ethical challenges we cannot yet imagine, and it is the responsibility of educators and professionals to insure they have the knowledge, understanding, and, appreciation to make ethical decisions throughout their careers. This study proves they can assimilate the material, and form opinions as to the relevance of ethical issues as they pertain to society and their role in it. With Mason’s framework as the foundation, computing students can identify all of Mason’s ethical issues, selecting privacy as the most relevant issue of concern today. All genders, all age groups, and all levels of work experience select privacy as the most relevant factor to today’s society. Given the increasing magnitude and scope of computer crimes involving user data, it is not surprising privacy is increasing in importance over the seven-year period as the primary ethical issue for computing students.

As stated by Peslak and reiterated here, Mason's framework has been confirmed for the current culture. There is no indication that these factors will not continue to be part of our social contract. As companies and governments expand data collection and societies increase their interconnectedness, the issues of concern described by Mason in 1986 must continue to shape the global consciousness.

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APPENDIX A

Course Syllabus

CIS4253 Legal & Ethical Issues in Computing

Instructor: Katharine Brown **Email/Phone:**
Office: **Office Hours:**

CATALOG DESCRIPTION:
Prerequisites: COP3530 Data Structures or COP3540/3538 Data Structures using OOP.
This course provides a discussion of legal and ethical issues faced by computing professionals. These issues will be framed in terms of what it means to be a computing professional with topics such as responsibilities, ongoing professional development, and social involvement. The course will use the students' prior experiences in software development as a framework by demonstrating lecture concepts through coding examples and technical situations. State and national laws pertaining to computing will be presented. Students will be required to give and justify opinions about given computing situations. Students will also present an opinion to the class about one specific software development issue.

ADDITIONAL COURSE OBJECTIVES:
Local and global issues will be considered. Published opinions from recognized experts in the field of computing will be studied to help refine ideas about ethics in computing. This course will examine the enforcement of acceptable practices in the form of the laws as they apply to computing.

Additional materials will be distributed electronically during the semester. Examples from a variety of sources will be used as material for class discussions. Current news events, including regulatory and legislative actions, will be discussed. Students will be required to actively participate in class discussions and online forums.

Individual professional development is essential to the computing fields and will be discussed and analyzed, and individual plans of action developed.

Each student will be required to complete formal papers and to collaborate with a group on topics about a professional, ethical, or legal issue in computing. All products will utilize library resources and use a format discussed in class. A group assignment & presentation will be required.

REQUIRED TEXTS:

Computer Ethics, ***4th ed****.* by Deborah Johnson (ISBN: 0-13-111241-4)
Legal Guide to Web & Software Development ***5th ed.*** by Stephen Fishman (ISBN: 1-4133-0532-6)

GRADING:

Exams, Projects &		100 – 90%	A, A-
Research Papers.	75% = 300 pts	89 – 80%	B+, B, B-
Online Participation,		79 – 70%	C+, C
Blogs & HW Assignments.	15% = 60 pts	69 – 60%	D
Class Attendance/Participation		below 60%	F
& Professionalism.	10% = 40 pts		

GROUND RULES: ----------
RESPECT! Expression of ideas in class and in the discussion forums will be required. Each idea and response will be professionally delivered and received. No personal attacks or unprofessional language will be tolerated.
Be prepared. Read the material in the textbooks at least once. You are responsible for important concepts covered in the textbook that may not be covered in class.

ETHICS: You must do your own work. Use of unapproved materials during an assignment will result in a grade of zero for that event and other penalties as allowed. Read and review the *ACADEMIC INTEGRITY CODE* and the *FLORIDA COMPUTER CRIMES ACT.* Do not take these codes lightly. You are a computer professional now… and one function of this class is to adopt proper ethical behaviors.
When expressing ideas in writing, whether on paper on online, ideas from other sources must be acknowledged. Lack of proper citations constitutes plagiarism.

See separate class schedule ("Daily Calendar") posted in Blackboard for exact dates for reading and homework assignments, tests, deadlines, and topics.

Topics, Readings, and Assignments

Wk	Topics	Readings:	HW/Assignments:
1	-Introduction	-Johnson, *Ethics* Ch. 1-3, & 7 -Moor's articles: "What is Ethics?" 1986 "Future of Ethics" 2001	-HW: Introductory Survey -HW: Terms/Definitions
2	-Why be Moral? Theories of Ethics -Developing a Career Portfolio		-HW: Resume -Paper 1: Career Portfolio
3	-Moor: "What is Ethics?" & The Computer Revolution	-ACM & SE Codes of Ethics -Johnson, *Ethics* Ch. 3-6	-Paper 2: Ethical Theories
4	-What is a profession? -ACM & SE Codes of Ethics	-Mason article: "Four Ethical Issues of the Information Age"	-HW: Q: Is computing a profession?
5	- The Information Age - Mason "Four Ethical Issues" (PAPA)	-current blog(s): (articles)	-Paper 3: Professional Development
6	- Mason (con't)	-current blog(s): (articles)	-HW: Google Yourself
7	-Your digital footprint & ethics wrap-up -Wiki: Team project	-current blog(s): (articles)	-Respond to Blogs/Discuss
8	Exam #1	-current blog(s): (articles)	-Respond to Blogs/Discuss
9	- Title 17 & DMCA: History of copyright - Property & the Law	-Fishman, *Legal* Ch. 1-5 -current blog(s): (articles)	-Respond to Blogs/Discuss
10	- Fair Use Do's & Don'ts - Copyright Infringement	-Fishman, *Legal* Ch. 6-13 -current blog(s): (articles)	-Respond to Blogs/Discuss
11	- FL Computer Crimes Act & penalties - Electronic databases	-Florida Computer Crimes Act -current blog(s): (articles)	-Respond to Blogs/Discuss
12	- Legal Ownership - Software Licenses	-Fishman, *Legal* Ch. 14-18 -current blog(s): (articles)	-Respond to Blogs/Discuss
13	- Wiki Presentations		-Respond to Blogs/Discuss
14	- Wiki Presentations		-Finalize Blogs/Discussions
15	Exam #2		-Wiki: Team Report

(Required Institutional Notices removed)

APPENDIX B

UNF IRB Approval

UNIVERSITY of NORTH FLORIDA.

Office of Research and Sponsored Programs
1 UNF Drive
Jacksonville, FL 32224-2665
904-620-2455 FAX 904-620-2457
Equal Opportunity/Equal Access/Affirmative Action Institution

MEMORANDUM

DATE: September 7, 2016

UNF IRB Number: 834224-1
Approval Date: 09-07-2016
Expiration Date: 09-07-2017
Processed on behalf of UNF's IRB

TO: Ms. Katharine Brown, MBA

VIA: Dr. Judith Solano
Computing

FROM: Dr. Jennifer Wesely, Chairperson
On behalf of the UNF Institutional Review Board

RE: Review of New Project by the UNF Institutional Review Board
IRB#834224-1: "A Consideration of Mason's Ethical Framework: The Importance of PAPA Factors in the 21st Century"

This is to advise you that your project, "A Consideration of Mason's Ethical Framework: The Importance of PAPA Factors in the 21st Century" underwent "Expedited" (Categories 5 & 7) review on behalf of the UNF Institutional Review Board. Your reviewer recommended approval without further modifications.

This approval applies to your project in the form and content as submitted to the IRB for review. Any variations or modifications to the approved procedures or documents must be cleared with the IRB prior to implementing such changes. To submit an amendment, please complete an Amendment Request Document and submit it along with any updated documents affected by the changes via a new package in IRBNet. Any unanticipated problems involving risk and any occurrence of serious harm to subjects and others shall be reported by completing this Event Report Form and sending it promptly to the IRB within 3 business days.

Your study has been approved for a period of 12 months as of 09/07/2016. If you would like your project to continue for more than one year, you will be required to provide a completed Status Report and other continuing review documentation to the UNF IRB prior to **08/07/2017.** An extension will be necessary if your study will be continuing past the 1-year anniversary of the approval date. *We ask that you submit your status report and other continuing review information 30 days before the expiration date as noted above to allow time for review and processing.* When you are ready to close your project, please complete a Closing Report Form. Please note that it will be necessary to create a new package in IRBNet in order to submit amendments, status reports, or closing reports in the future. All applicable records relating to this research shall be retained for at least 3 years after completion of the research.

CITI Training for this Project:

Name	CITI Expiration Date
Ms. Katharine Brown	10/28/2016
Dr. Judith Solano	10/13/2017

CITI Course Completion Reports are valid for 3 years. Please note that Ms. Brown's CITI certification will expire next month. Please renew your CITI training before your current training expires. Although CITI sends out reminders 90 days prior to expiration, it is the investigator's responsibility to complete the refresher course when it becomes available. You can access the CITI refresher course by following this link: http://www.citiprogram.org/. Please ensure all key personnel maintain current CITI training. Should you have questions regarding your project or any other IRB issues, please contact the research integrity unit of the Office of Research and Sponsored Programs by emailing IRB@unf.edu or calling (904) 620-2455.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within UNF's records. All records shall be accessible for inspection and copying by authorized representatives of the department or agency at reasonable times and in a reasonable manner.

UNF IRB Number: 834224-1
Approval Date: 09-07-2016
Expiration Date: 09-07-2017
Processed on behalf of UNF's IRB

APPENDIX C

Exam Question

23 pts

In his 1986 article, Mason discussed **four primary ethical issues** of concern in computing.

a. **Name** each. Briefly **describe** each issue and **how** each relates to *<u>our</u>* profession. *[Name = 2 pts; Description = 3 pts each]*

Issue Name:
Description & How issue relates to computing

Issue Name:
Description & How issue relates to computing

Issue Name:
Description & How issue relates to computing

Issue Name:
Description & How issue relates to computing

b. Which of these do you feel is **most relevant** in today's society? *[= 1 pt]*

c. Defend your answer. *[=2 pts]*

VITA

Katharine C. Brown has a Bachelor of Arts degree from Duke University in both Psychology and Design and a Masters of Business Administration and a Certificate in M.I.S. from the University of North Florida. She expects to receive a Master of Science in Computer and Information Sciences from the University of North Florida in December 2018. Dr. Judith L. Solano of the University of North Florida is serving as Ms. Brown's thesis advisor.

Ms. Brown has worked in various capacities at the University of North Florida for over thirty years. While earning her M.B.A. she discovered technology was her passion. She worked for Information Technology Services (formerly Computing Services) for ten years as a Network Administrator before joining the faculty of the School of Computing. For over fourteen years, Katharine was the Lead Advisor for the College of Computing, Engineering, and Construction, and a Senior Instructor in the School of Computing. In 2013, she joined the Center for Instruction and Research Technology as the Assistant Director of Distance Learning Student Services.

Her interests in the computing field focus on the ethical development and use of computing technology and software, and education of all users to become better digital citizens.