

# JOURNAL OF INFORMATION SYSTEMS APPLIED RESEARCH

## In this issue:

4. **A Process for Assessing Voting System Risk Using Threat Trees**  
Alec Yasinsac, University of South Alabama,  
Harold Pardue, University of South Alabama
- 17 **Development of an Evaluation Model for XBRL-enabled Tools Intended for Investors**  
Barbara Clements, Southeast Missouri State University,  
Dana Schwieger, Southeast Missouri State University,  
Ken Surendran, Southeast Missouri State University
- 30 **Factors Influencing People to Use Linux**  
D. Scott Hunsinger, Appalachian State University  
Susanna Fransen, Appalachian State University
- 39 **How Mobile Technology is Changing Our Culture**  
Jamie Pinchot, Robert Morris University  
Karen Pullet, Robert Morris University  
Daniel Rota, Robert Morris University
- 49 **Creating a Framework for Research on Virtual Organizations**  
Bryan Reinicke, University of North Carolina Wilmington
- 57 **The Potential Reality of Service-Oriented Architecture (SOA) in a Cloud Computing Strategy**  
James P. Lawler, Pace University  
Anthony Joseph, Pace University

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# JOURNAL OF INFORMATION SYSTEMS APPLIED RESEARCH

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# Factors Influencing People to Use Linux

D. Scott Hunsinger  
hunsingerds@appstate.edu

Susanna B. Fransen  
fransensb@appstate.edu

Department of Computer Information Systems  
Appalachian State University  
Boone, NC 28608, USA

## Abstract

Linux is a free open source operating system that serves as a viable alternative to using Windows and other operating systems. Significant research has been conducted concerning Linux and why it is a reliable operating system. Yet, the question remains: Why aren't more people using Linux operating systems? To explore this question we researched two theories: the Theory of Planned Behavior and the Technology Acceptance Model, to better understand what factors influence a person's usage of Linux on a desktop or laptop computer. We used these theories to guide our research and limited the scope of our study to college students since they are readily available and will be entering the workforce within the next several years. To determine what factors influence people whether to use a Linux operating system, we conducted interviews (n=15) and a survey (n=168). We discovered that two constructs from the Theory of Planned Behavior (Attitude and Perceived Behavioral Control) and two constructs from the Technology Acceptance Model (Perceived Ease of Use and Perceived Usefulness) are significantly correlated with a person's intention to use a Linux operating system, while the Subjective Norm construct holds less importance.

**Keywords:** Linux, Windows, Theory of Planned Behavior, Technology Acceptance Model

## 1. INTRODUCTION

Operating Systems are essential for everyday computer usage. An operating system (OS) is defined as, "...the computer's master control program" (Operating Systems, 2009). People are beginning to realize that they have a choice in which operating system to use on their computers. Although Windows has the greatest amount of users, Linux has grown in popularity and is considered a successful Open Source Software Development project (Otte et. al, 2008).

Previous studies (Dedrick and West, 2004; West and Dedrick, 2001) have looked at the reasons why companies adopt open source software, but

little research has specifically investigated why individuals use or do not use Linux. The purpose of this paper is to examine the factors that influence college students whether to use Linux on a desktop or laptop computer. Since these students will soon be entering the workforce, they will influence which operating systems to use in their homes and workplaces. This topic is important because both consumers and businesses look for ways to increase flexibility, stability, and performance, reduce the threat of viruses and spyware, and save money. Linux operating systems often offer these advantages.

The rest of our paper is arranged as follows: the Literature Review examines previous research regarding our topic, including several theories

that are applicable to this study. We state our hypotheses in the next section. The Methodology section explains how we used both interviews and surveys to collect data. In the Findings section, we provide the results from our analysis and test each hypothesis. We then discuss the implications of our findings in the Discussion section, which is followed by the Conclusion.

## 2. LITERATURE REVIEW

### Linux Usage

Linux is a free open source operating system originally developed by Linus Torvalds in 1991 (What is Linux, 2007). Linux operating systems can run on a myriad of devices such as desktops, laptops, PDAs, servers, and cell phones (Linux-Friendly Hardware, 2008). Versions of Linux have worked their way into every facet of society from education to government including the most common version of Linux (Fedora), Red Hat, and Ubuntu, one of the newest versions of Linux (What is Linux, 2007). Linux is a versatile and adaptable operating system. For the PC world as of December 2009, Windows holds approximately 92% of the total market share while Linux only holds 1.02% of the market share (Operating System Market Share, 2010). Even though Linux holds a small part of the market for operating systems, there are about 29 million Linux users in the world (The Linux Counter, 2010).

### Economic Value

Money drives decisions. Open source software, such as Linux operating systems, is free. The operating system for a computer is usually included in the overall package price. According to Microsoft.com (2010), the current price for Windows 7 Professional Upgrade is \$199.99. Linux operating systems are usually free to download. For a computer purchase, removing the cost of the operating system saves money. Profit is a big focus for businesses, and consumers like to save money. Linux can run cost-effectively and reliably on larger computer systems (Varian et al., 2003). It is starting to play a bigger role in the business world (Powers, 2008).

### Awareness

One of the reasons Windows operating system use is more widespread than Linux is because

many computer users are unaware of Linux. The majority of computer users are simply operating system choices exist. With the growth of the Internet, awareness of Linux operating systems has increased (West et al., 2001). Linux is gaining more users but does not come close to the number of Windows users because many computer users are unaware that it is an option.

### Flexibility and Quality

Linux operating systems are open source. This means users have access to the source code, which allows them to modify the operating system to fit their needs. Flexibility in an operating system is a preferred quality for some consumers. Users enjoy the ability to control Linux (Varian et al., 2003).

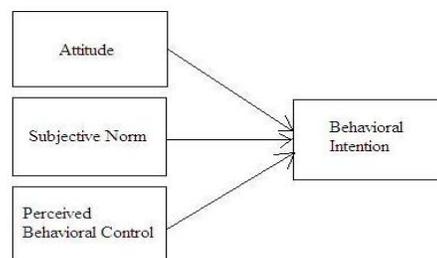
Quality is another important asset to operating systems. Some of the things that computer users look for in an operating system include a consistent interface, system updates, simple applications, and tech support (Powers, 2008). Linux provides these qualities as well as enterprise-grade software bundles with free anti-virus and anti-spyware tools (Powers, 2008).

### Theories

Two theories can be applied to explain what factors influence people whether to use a Linux operating system on a desktop or laptop computer. These theories are the Theory of Planned Behavior and the Technology Acceptance Model.

#### *Theory of Planned Behavior*

**Figure 1: Theory of Planned Behavior (after Ajzen, 1991)**



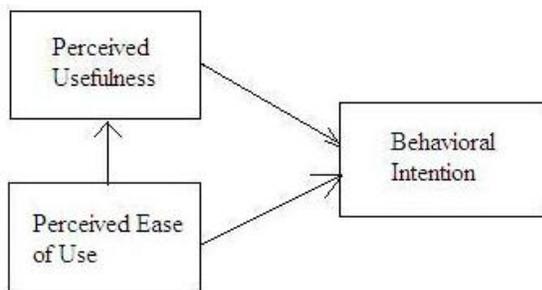
The Theory of Planned Behavior is centered around a person's intention to perform a certain behavior of interest (Ajzen, 1991). Behavioral intention is measured through three factors: Attitude, Subjective Norm, and Perceived Behavioral Control. The stronger the intention to

engage in a behavior, the more likely should be its performance (Ajzen, 1991). The Theory of Planned Behavior is illustrated in Figure 1.

### **Technology Acceptance Model**

The Technology Acceptance Model examines an individual's willingness to accept and use available systems (Davis, 1989). The Technology Acceptance Model uses two factors to measure a person's intention of performing an action: Perceived Usefulness and Perceived Ease of Use (Lee et al., 2003). Perceived Usefulness is defined as, "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989). Perceived Ease of Use is defined as, "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989). The Technology Acceptance Model is helpful in measuring the factors that determine a person's acceptance of certain technology (Davis, 1989). Figure 2 illustrates the Technology Acceptance Model.

**Figure 2: Technology Acceptance Model (after Davis, 1989)**



### **3. HYPOTHESES**

We derived five hypotheses to measure a person's intention to use a Linux operating system on a desktop or laptop computer. Hypotheses one through three are based upon the Theory of Planned Behavior:

**Hypothesis 1:** Attitude is positively correlated with Behavioral Intention to use a Linux operating system on a desktop or laptop computer.

**Hypothesis 2:** Subjective Norm is positively correlated with Behavioral Intention to use a Linux operating system on a desktop or laptop computer.

**Hypothesis 3:** Perceived Behavioral Control is positively correlated with Behavioral Intention to use a Linux operating system on a desktop or laptop computer.

Hypotheses four and five are based upon the Technology Acceptance Model:

**Hypothesis 4:** Perceived Usefulness is positively correlated with Behavioral Intention to use a Linux operating system on a desktop or laptop computer.

**Hypothesis 5:** Perceived Ease of Use is positively correlated with Behavioral Intention to use a Linux operating system on a desktop or laptop computer.

## **4. METHODOLOGY**

To begin our study, we created an interview instrument based upon the Theory of Planned Behavior. After creating the interview instrument (see Appendix), we randomly selected and surveyed fifteen students in the College of Business at our university. Based upon the responses from the interviews, we created and emailed a survey to about 500 College of Business undergraduate students. We hosted the survey through the online site SurveyMonkey. One hundred sixty-eight (168) students started the survey and 158 of them completed it, making the response rate approximately 32%. We based our survey questions on constructs and statements from previous studies using the Theory of Planned Behavior (Ajzen, 1991) and the Technology Acceptance Model (Davis, 1989).

### **Measures**

#### **Behavioral Intention**

We used two statements to measure Behavioral Intention: (BI1) I intend to Linux in the next three months, and (BI2) I plan to use Linux in the next three months. We computed Cronbach's alpha (.958) to test for reliability among the statements for Behavioral Intention.

#### **Attitude**

Three statements were used to measure Attitude: (ATT1) Using Linux is a good idea, (ATT2) Using Linux is a positive idea, and (ATT3) Using Linux is a helpful idea. Cronbach's alpha = .933 for these statements.

**Subjective Norm**

We used four statements to measure Subjective Norm: (SN1) My professors influence me in my decision whether to use the Linux operating system, (SN2) My friends influence me in my decision whether to use the Linux operating system, (SN3) My parents influence me in my decision whether to use the Linux operating system, and (SN4) Other people important to me influence me in my decision whether to use the Linux operating system. Cronbach's alpha = .780.

**Perceived Behavioral Control**

Four statements were used to measure Perceived Behavioral Control: (PBC1) I have the ability to use Linux, (PBC2) I possess enough knowledge to use Linux, (PBC3) I have the resources to use Linux, and (PBC4) I have the time to use Linux. Cronbach's alpha = .805.

**Perceived Ease of Use**

We used four statements to measure Perceived Ease of Use: (PEOU1) Learning to operate Linux would be easy for me, (PEOU2) I would find it easy to get Linux to do what I want it to do, (PEOU3) My interaction with Linux would be clear and understandable, and (PEOU4) I would find Linux easy to use. Cronbach's alpha = .942 for these statements.

**Perceived Usefulness**

Four statements were used to measure Perceived Usefulness: (PU1) Using Linux would enable me to accomplish computer tasks more quickly, (PU2) Using Linux would make it easier for me to use the computer, (PU3) Using Linux would be useful to me, and (PU4) Using Linux would increase my productivity. Cronbach's alpha = .920 for these statements.

**Demographics**

The gender breakdown for our survey is 53% male / 47% female. Students majoring in Accounting (15.5%), Computer Information Systems (8.9%), Economics (3.0%), Entrepreneurship (4.2%), Finance and Banking (6.5%), Healthcare Management (3.6%), Hospitality & Tourism Management (4.2%), International Business (7.1%), Management (20.2%), Marketing (13.1%), Risk Management and Insurance (0.6%), and other non-business majors (10.1%) responded to the survey, along with "undecided" majors (3.0%).

Table 1 shows the breakdown of class rank among the respondents.

**Table 1: Class Distribution**

Year in College	Percent of Total
Freshman	9.5%
Sophomore	15.5%
Junior	24.4%
Senior	48.8%
Other	1.8%

**5. FINDINGS**

Table 2 summarizes the statements used to measure each construct. For all statements other than those for the Attitude construct, we used a seven-point Likert scale in which 1 = Strongly Agree and 7 = Strongly Disagree. The Attitude statements were also measured on a seven-point scale, in which positive responses received lower scores (i.e. 1 = "Very Good" and 7 = "Very Bad" for the first Attitude statement).

**Behavioral Intention**

As shown in Table 2, the average for the two Behavioral Intention questions = 5.01 for BI1 and 5.04 for BI2. This indicates that most students do not intend or plan to use Linux in the next three months. We also found through our interviews that a majority of students do not intend to use Linux. Several students said that would not consider using a different operating system. For example, one interviewee stated, "Mine works perfectly and I know how it works." Another person said, "I'm comfortable with what I have."

**Attitude**

The averages for the three Attitude questions (shown in Table 2) were 3.17 (ATT1), 3.09 (ATT2), and 3.27 (ATT3). These responses suggest that most students believe that using Linux would be a slightly good, positive, and helpful idea. Several of the interviewees who use a Windows operating system expressed frustration or dislike of their current operating system when asked, "How do you feel about your operating system and why?" One interviewee said, "I hate it because there are too many pop-ups and virus scans." This particular

interviewee uses Windows Vista. Another interviewee responded to the same question with, "Vista irritates me a lot because it's slow and has a lot of glitches." Another student summed up the stereotypes related to operating systems by stating, "Macs are for artsy people, Linux is for the computer folks, and Windows is for business and school types of stuff."

**Table 2: Summary of Statements Measuring each Construct**

<b>CONSTRUCT / STATEMENT</b>	<b>AVERAGE</b>
<b>Behavioral Intention 1:</b> I intend to use Linux in the next three months.	5.01
<b>Behavioral Intention 2:</b> I plan to use Linux in the next three months.	5.04
<b>Attitude 1:</b> Using Linux is a _____ idea. (Very good - Very Bad)	3.17
<b>Attitude 2:</b> Using Linux is a _____ idea. (Very positive - Very Negative)	3.09
<b>Attitude 3:</b> Using Linux is a _____ idea. (Very helpful - Very unhelpful)	3.27
<b>Subjective Norm 1:</b> My professors influence me in my decision whether to use the Linux operating system.	4.01
<b>Subjective Norm 2:</b> My friends influence me in my decision whether to use the Linux operating system.	3.88
<b>Subjective Norm 3:</b> My parents influence me in my decision whether to use the Linux operating system.	4.61
<b>Subjective Norm 4:</b> Other people important to me influence me in my decision whether to use Linux.	3.99
<b>CONSTRUCT / STATEMENT</b>	<b>AVERAGE</b>
<b>Perceived Behavioral Control 1:</b> I have the ability	2.49

to use Linux.	
<b>Perceived Behavioral Control 2:</b> I possess enough knowledge to use Linux.	3.86
<b>Perceived Behavioral Control 3:</b> I have the resources to use Linux.	3.42
<b>Perceived Behavioral Control 4:</b> I have the time to use Linux.	3.67
<b>Perceived Ease of Use 1:</b> Learning to operate Linux would be easy for me.	2.94
<b>Perceived Ease of Use 2:</b> I would find it easy to get Linux to do what I want it to do.	3.37
<b>Perceived Ease of Use 3:</b> My interaction with Linux would be clear and understandable.	3.41
<b>Perceived Ease of Use 4:</b> I would find Linux easy to use.	3.44
<b>Perceived Usefulness 1:</b> Using Linux would enable me to accomplish computer tasks more quickly.	3.73
<b>Perceived Usefulness 2:</b> Using Linux would make it easier for me to use the computer.	3.82
<b>Perceived Usefulness 3:</b> Using Linux would be useful to me.	3.51
<b>Perceived Usefulness 4:</b> Using Linux would increase my productivity.	3.92

### Subjective Norm

Depending upon the student, one or more referent groups influenced their operating system choice. The most common responses

from the interviews include professors, friends, and parents. In response to a question concerning whether others influenced their choice of their current operating system, one female interviewee indicated, "My parents I guess because they are the ones that bought my computer for me." The averages from the four survey questions (from Table 2) suggest that none of these groups are very influential in a student's decision whether to use Linux.

### Perceived Behavioral Control

Perceived behavioral control deals with those things that may be outside a person's volitional control. The survey results indicate that most students believe they possess the ability to use Linux (PBC1 = 2.49). The statements about possessing enough knowledge (PBC2 = 3.86), resources (PBC3 = 3.42), and time (PBC4 = 3.67) received lower averages than PBC1. Many of the interviewees were unaware of Linux. The interviewees were aware of Windows operating systems and Mac operating systems. Many of the interviewees had never used a Linux operating system before and were only familiar with Windows operating systems or Macs. In a response to factors that would influence a student to use Linux, one person said, "It simply costs money I don't have." Some respondents are obviously unaware that Linux is a free operating system.

### Perceived Ease of Use

As shown in Table 2, the survey responses for the Perceived Ease of Use construct were slightly positive (PEU1 = 2.94; PEU2 = 3.37; PEU3 = 3.41; PEU4 = 3.44). Many of the interviewees said they would be willing to try Linux if it would be easier to use than their current operating system. When asked if they would consider using a different operating system, one interviewee stated, "Yes, if it was more efficient and easier to use." Several Mac users indicated that they would probably *not* switch operating systems because their current system is easy to use. Most interviewees agreed that ease of use is a quality they look for in an operating system.

### Perceived Usefulness

The survey responses for Perceived Usefulness were also slightly positive (see Table 2 – PU1 = 3.73; PU2 = 3.82; PU3 = 3.51; PU4 = 3.92). Overall, students agreed that Linux would help them accomplish tasks more quickly and increase their productivity. One student stated that they prefer Linux over Windows because,

"It doesn't freeze up as much and my computer hasn't crashed yet." Another interviewee said that would consider using another operating system, "...if there were a better option that could do more and had better functions."

## Correlation Analysis

**Table 3: Correlation Matrix**

	ATT	SN	PBC	PU	PEU
BI	.590**	.086	.378**	.446**	.480*
PEU	.514**	.118	.475**	.368**	
PU	.600**	.311**	.246**		
PBC	.448**	.166*			
SN	.306*				

\* $p < .05$ , and \*\* $p < .01$

We used SPSS 15.0 to compute the correlations among the constructs. As shown in Table 3, ATT = Attitude, SN = Subjective Norm, PBC = Perceived Behavioral Control, PU = Perceived Usefulness, PEU = Perceived Ease of Use, and BI = Behavioral Intention. We tested our hypotheses based upon the correlations in Table 3.

**Hypothesis 1**, Attitude is positively correlated with Behavioral Intention to use Linux operating systems on a desktop or laptop computer, is supported ( $r = .590$ ;  $p < .01$ ).

**Hypothesis 2**, Subjective Norm is positively correlated with Behavioral Intention to use Linux operating systems on a desktop or laptop computer, is not supported ( $r = .086$ ,  $p > .05$ ).

**Hypothesis 3**, Perceived Behavioral Control is positively correlated with Behavioral Intention to use Linux operating systems on a desktop or laptop computer, is supported ( $r = .378$ ,  $p < .01$ ).

**Hypothesis 4**, Perceived Usefulness is positively correlated with Behavioral Intention to use Linux operating systems on a desktop or laptop computer, is supported ( $r = .446$ ,  $p < .01$ ).

**Hypothesis 5**, Perceived Ease of Use is positively correlated with Behavioral Intention to use Linux operating systems on a desktop or

laptop computer, is supported ( $r = .480, p < .01$ ).

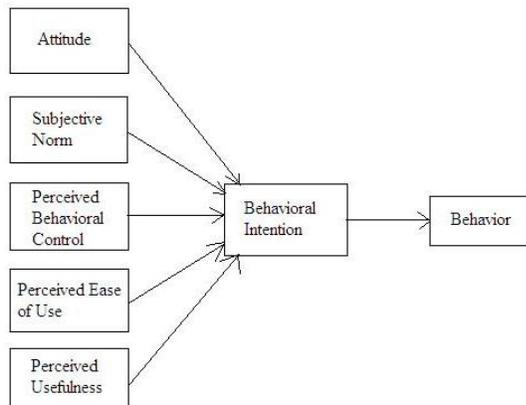
## 6. DISCUSSION

Our interview and survey results indicate that many people do not know much about Linux operating systems. We need to better inform people, especially students, about Linux and the advantages and disadvantages of using it. Several misconceptions and stereotypes about Linux should be clarified, such as Linux's cost and the idea that it is only for "computer people."

Businesses should also be better informed of Linux as an alternative to using Windows operating systems, as Linux offers several advantages over Windows. In today's economy, businesses looking to upgrade computer systems can choose Linux to cut costs.

Our findings show that constructs from both the Theory of Planned Behavior (*Attitude* and *Perceived Behavioral Control*) and the Technology Acceptance Model (*Perceived Ease of Use* and *Perceived Usefulness*) are significantly correlated with Behavioral Intention. We have combined the main constructs from these two theories in Figure 3.

**Figure 3: Combination of Theory of Planned Behavior/Technology Acceptance Model**



We were surprised that a significant positive correlation does not exist between Subjective Norm and Behavioral Intention, as much previous research using the Theory of Planned Behavior (Ajzen, 1991) has discovered significant relationships between these constructs. For future work, we plan to collect more data so that we can further analyze the relationships among the constructs from these

two theories. With additional data, the Subjective Norm construct may show more importance. We also plan to gather and analyze data from professionals instead of students to find out which constructs are most important.

## 7. CONCLUSION

Our research reveals the factors which significantly influence people's intentions to use Linux on a desktop or laptop computer: Attitude, Perceived Behavioral Control, Perceived Ease of Use, and Perceived Usefulness. We believe that Linux operating systems will continue to become more popular as computer users are educated that Windows operating systems are not the only option. Conducting additional research in this area will provide more insight on the factors influencing people to choose to adopt Linux.

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## **Appendix – Interview Questions**

1. Do you use multiple operating systems? If so, which do you prefer and why?
2. Which operating systems are you familiar with? Are you aware of Linux operating systems?
3. Would you consider using a different operating system? Why? Follow up questions about what factors would encourage or discourage them from using another OS.
4. What influences you when choosing an operating system? Do you think about using a different operating system when choosing?
5. What do you know about computer operating system types?
6. What are your thoughts about operating systems?
7. How do you feel about your operating system? Why? (Love it, hate it, irritating, happy with it, etc.)
8. What are some of the things that might make you consider changing operating systems?
9. How did you decide on your current operating system?
10. Did anyone (parent, teacher, friend, co-worker, etc.) influence you on your decision to use your current operating system?