How Product Intangibility and Its Moderators Affect Perceived Risk in online shopping setting

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ABSTRACT

How Product Intangibility and Its Moderators Affect Perceived Risk in Online shopping setting

Di Fan

Online shopping has become one of the most rapidly growing forms of shopping. Meanwhile, compared with traditional shopping, consumers perceive it as more risky. Previous studies have found that there is a relation between product intangibility and consumers' perceived risk. Since these studies did not use an experimental method to manipulate product intangibility, they could not reveal a causal relationship between product intangibility and perceived product related risk in an online setting.

The primary objective of the present study is to examine the causal relationship of the product intangibility and various types of product risk in an online shopping environment. Online experimental tests based on student samples are designed for this research objective. The study model includes two antecedents: one is product intangibility and the other is shoppers' concern for web security and personal privacy. At the same time, the moderating effect of the concern for web security and personal privacy on the relationship between product intangibility and product related risk is examined.

The result of the research indicates that product intangibility and concern for personal privacy both are reasons of producing product related risk in an online setting. Theoretical and practical contributions to the marketing are discussed.

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Chapter 1 INTRODUCTION

Along with the high-speed development of online shopping, there is a rich academic literature that explores consumers' perceived risk in online shopping environments. Online shopping behavior can be affected and explained by perceived risk (Bhatnagar and Ghose 2004; Forsythe and Shi 2003; Park, Lee and Ahn 2004), which influences the whole process of purchasing behavior due to the uncertainty and consequences of the purchasing decision.

Product intangibility is an important factor that results in consumers' perceived product related risk: the higher the intangibility of a product, the greater the perceived product related risk which would be evoked. This relationship has been focused on academic studies. Laroche, Bergeron, and Goutaland (2001) developed a three-dimensional structure of intangibility, including a physical dimension which means the inaccessibility to the senses, mental dimension which is defined as the lack of a clear idea or experience, and general dimension which refers to how general and/or specific a person perceives a particular product. Continually, Laroche, Bergeron, Goutaland and Yang (2004) applied a paper-pencil questionnaire survey to investigate whether there is the strong correlation between intangibility and perceived risk in an online setting. However, since this study did not manipulate product intangibility, it could not reveal a causal relationship between product intangibility and perceived product related risk in an online setting. So far, there is no research that explores the effects of product intangibility in online behavior by manipulating product intangibility, which is surprising, as online business has grown dramatically over the past years. In the real business world,

many online practitioners use tangibilized methods attaching product pictures, function description, product comparisons, and other consumer's testimony, to increase product tangibility, reducing consumers perceived product related risk. The present study uses an experimental method, in which product physical intangibility and mental intangibility are manipulated to test the impact of product intangibility on perceived risk in an online setting.

All shopping channels involve different degrees of risk, which depend on the mode of purchasing and the shopping interface. Consumers perceive higher risk in online shopping than traditional shopping environments because of the natural drawbacks of the Internet, where personal information can be hacked and there is a general lack of security. A recent industry and government related study (Federal Trade Commission 2000) has declared that web privacy and personal security are primary obstacles to the future growth of online commerce. Moreover, Laroche et al (2004) found that the relationship between product intangibility and perceived risk an online setting is weaker than that in an offline setting. They explained that the different strength of relationship between in online and in offline was likely due to the impact of consumer's concern for web security and personal privacy. However, nobody tested the assumption yet. In the present study, both consumers' concerns for Web security and Personal Privacy are examined as the moderators of the relationship between intangibility and perceived risk in an online purchasing setting.

According to previous studies (Taylor 1974, Cox and Rick 1964), different purchasing channels result in different perceived risk. Therefore, we divide consumers'

online perceived risk into the risk of the channel and the risk of the product. In this study, our conceptualization of channel risk includes concerns for web security and concerns for personal privacy; the product related risk refers to products' performance, time and financial risks.

In sum, the study model includes two antecedents: one is product intangibility and the other is shoppers' concern for web security and personal privacy. At the same time, the moderating effect of the concern for web security and personal privacy on the relationship between product intangibility and product related risk is examined. The main objective of this research is to test the impact of product intangibility and channel risk on product related risks in an online shopping setting. The second objective is to test how to manipulate product intangibility with human computer interface.

Chapter 2 Literature Review

2.1 Perceived Risk:

2.1.1 Concept of perceived risk

Perceived risk is a key construct of marketing science, on which prior studies have primarily focused (Campbell and Goodstein 2001). Firstly, Cox et al (1964) constructed the concept of perceived risk as a function of uncertainty and negative consequences. Cox (1967) then claimed that perceived risk was comprised of four components that are respectively uncertainty caused by "factors inherent in the product and brand," uncertainty resulting from "place of purchase" and "mode of purchase," degree of negative consequences associated with a purchase including the aspect of time and financial, and subjective uncertainty based on individual experiences.

Most research supported that perceived risk has two dimensions, which integrated uncertainty and negative consequences (Bauer 1960; Cunningham 1967; Taylor 1974; Havlena and Desarbo1990). Dowling (1986) described the multiplicative relationship between the uncertainty and its consequences, which means at the two dimensions have a positive interaction function. For example, overall perceived risk decreases as lack of uncertainty and negative consequences, and the overall perceived risk will increase when one of aspect increases. Dowling (1986) also suggested that the perceived risk measurement should include the overall perceived risk and each aspect of perceived risk.

2.1.2 Perceptivity of perceived risk

Previous and current literature has explored some different perspectives of perceived risk, which is affected by personal characteristic, product knowledge, product information choice and the purchasing model.

Taylor (1974) identified that perceived risk was a kind of personal trait, which was subjective and depended on consumers' individual understanding and feedback of the risk, and related personal experiences. Moreover, he also found evidence associating perceived risk to personal traits and tendencies. On one hand, the perceived risks greatly depend on individual characteristics such as whether the consumer is a risk seeker or a risk avoider. For example, a risk avoider tends to perceive a product as riskier than common consumers. In contrast, a risk seeker tends to perceive the product as safer than common consumers (Dowling 1986). On the other hand, they are also associated to an individual's maximum tolerable level of the uncertainty and risk consequences. Consumers often reject a product in purchasing decision process when the product's perceived risk and look exceed their tolerance level. Hence, perceived risk is a subjective perception as the influence of individual characteristic.

Product knowledge is another important factor influencing perceived risk. Dowling (1986) suggested that perceived risk is dependent on the degree of consumer's product involvement and experience. For example, consumers who have little previous product experience and related information will perceive a new product as risky. Cunningham's (1967) and Price's (1981) studies indicated that consumers' experience and involvement would play an important role in individual perception of risk. Moreover, Mitchell and Prince (1993) pointed out that purchase related experiences had more salient

effects on the high value products than on the low value products. Similarly, services generally led to higher consumer perceived risk than tangible product because services tended to be harder to evaluate and build direct experiences and thus, resulted in higher purchase uncertainty (Zeithaml 1981; Murray 1991; Mitchell et al 1993). Moreover, Laroche et al (2003) argued that consumers with high product knowledge would perceive less product risk.

Brand names are always a risk reducer in the purchasing process. Richardson and Dick (1994) found that brand names were one of the most important extrinsic cues, which were product related attributes not involved with the product's physical information. Consumers who have relatively little product knowledge always use brand name as a cue to evaluate the purchasing risk (Dean 1999). Dawar and Parker (1994) demonstrated that brand names are the most important signal across cultures when consumers face uncertainty about products. The most important finding (Huang 2004) disclosed that brand names significantly affected online shoppers' perceived risk by an experimental method. Hence consumers' familiarity of brand names of product should influence the perceived risk in online purchasing processes.

Some researchers who take the purchase choice perspective suggested that product information could reduce the product perceived risk (Wendler 1983, Mitchell 1993). Murray (1991) found that the greater the perceived risk in the pre-purchase stage, the more information consumers would search for; hence, the more information consumers found, the higher their confidence in their abilities to make reasonable decisions and the lesser the perceived risk. However, some researchers argued against this relationship. An example can be give as Gemunden (1985), who posited that there

was no relationship between degree of risk and information research since product risk was not high enough to push consumers to search for information. Conversely, Jacoby, Jacob, Speller and Kohn (1974) argued that more accessible information can reduce the perceived risk at the beginning of the purchasing decision process, but too much information would confuse the consumers and increase their perceived risks.

Other researchers (Taylor 1974; Cox and Rick 1964) explored perceived risk in terms of the mode of purchase or purchase channel. They found that different distribution channels would have different influences on consumer's perception of risk. Generally, the non-store purchasing, such as direct mail, telemarketing and catalog sales had higher perceived risk than traditional in-store shopping. They further explained that the higher perceived risk was due to lack of personal contact and product contacting in those non-store purchasing. Recently, Featherman and Wells (2004) found that e-services 'intangibility affected consumers' perceived product related risk in an online environment (more detail in "Perceived risk in an online setting").

2.1.3 Types of perceived risk

Cox and Rich (1964), first, found two types of perceived risk: financial and social. Cunningham (1967) identified two major categories of perceived risk: performance and psychosocial. Performance risk can be classified into three types: economic, temporal and effort; while psychosocial risk can be divided into two types: psychological and social. Cunningham (1967) further typified perceived risk as having six dimensions that included performance, financial, opportunity/time, and safety, social and psychological risks. Most consumer behavior literature supports the usage of these

risk facets to understand consumer product and service evaluations and purchases. The online setting context does not incur any threat to human life; therefore, measures of safety risk were not included in this study.

Jacoby and Kaplan (1972) suggested that overall perceived risk should include five types of risks, which included performance, financial, physical, time, and psychological risk, and further inferred from Bauer's seminal work (1967) an overall measure of perceived risk. They theorized it as consisting of several independent varieties of risk after a risk tradeoff behavior occurred. For example, a discounted product will reduce financial risk but increase performance risk.

In additional, Stone and Gronhaug (1993) identified six types of risk: performance, financial, physical, social, time, and psychological risk, echoing the result of Cunningham (1967). Murray and Schlacher (1990) reported that all the six types of risks were perceived higher in services than in goods. A summary of the definition of all dimensions of perceived risk is presented in the Table2.1.

Table 2.1: Definition of all dimensions of perceived risk.

Dimension	Definition
Performance Risk	"The possibility of the product malfunctioning and not performing as it was designed and advertised and therefore failing to deliver the desired benefits." (Grewal, Gotlieb, Marmorstein 1994)
Financial Risk	"The potential monetary outlay associated with the initial purchase price as well as the subsequent maintenance cost of the product" (Grewal, Gotlieb , Marmorstein 1994)
Time Risk	Consumers may lose time when making a bad purchasing decision by wasting time researching and making the purchase, learning how to use a product or service only to have to replace it if it does not perform to expectations. (Featherman 2003)
Psychological Risk	The risk that the selection or performance of the producer will have a negative effect on the consumer's peace of mind or self-perception. Potential loss of self-esteem (ego loss) from the frustration of not achieving a buying goal. (Mitchell 1992).
Social Risk	Potential loss of status in one's social group as a result of adopting a product or service, looking foolish or untrendy. (Murray 1990)
Privacy Risk	Potential loss of control over personal information, such as when information about you is used without your knowledge or permission. The extreme case is where a consumer is "spoofed" meaning a criminal uses their identity to perform fraudulent transactions.(Featherman 2003)

2.1.4 Perceived risk in an Online Setting

Although perceived risk in an online setting has similar characteristics with perceived risk in a traditional shopping setting (discussed in more detail in the last section "Perceptive and Type of perceived risk"), it still has some unique features. Personal information disclosure has become a key concern for most consumers (Federal Trade Commission 2000) in online commerce. Although some recent research (Laroche et al 2004) early found this point, they still used the psychological item of perceived risk to describe the concept of concern for personal privacy. They use the item of psychological risk to refer to "a feeling of unwanted anxiety," "experiencing unnecessary tension" and "psychologically uncomfortable." Other research (Forsythe et al 2003) used the term "psychological risk." However, the definition of this item "Do not trust that my personal information will be kept private," is described as the consumers' concern for personal privacy.

Featherman (2003) constructed the dimension of privacy risk and defined it as "concern for the theft of their private information, or simply its misuse by the company collecting it." He firstly used focus group to show privacy risk as a common concern for e-adoption, and then used Confirm a Factor Analysis to demonstrate the item's internal validity. In addition, he used Structure Equation Modeling to explore different dimension's variation contribution to overall perceived risk: performance 99%, financial 98%, privacy 84%, time 79%, psychological 26% and social 6%. Hence, from the research we can conclude that social and psychological dimensions are not as associated with perceived risk as other dimensions in an online setting. This point is also supported

by a study (GVU's 10th WWW User Surveys, 1998) that disclosed web security and personal privacy is the second and the third concern for consumers in online shopping.

Hence, the present study investigates four types of risk: financial, performance, time and privacy risk that have been identified as the most prevalent among Internet shoppers. The first three risks, financial, performance and time are related to the product itself and are therefore called product related risk. The privacy risk only represents part of channel risk as the channel risk included consumers' concern for web security and concern for personal privacy. The items of financial, performance and time risk are extracted from Laroche et al (2004), items of concern for web security and concern for personal privacy see the part "Web security and Personal privacy." All items are designed on 9-point Likert scales.

2.2. Intangibility:

2.2.1 Concept of intangibility

In services marketing, intangibility together with inseparability, heterogeneity and perishability are looked as major distinction between products and services (Zeithaml 1981). Those four attributes make pre-purchase evaluation more difficult for services than for products. Intangibility is considered the differentiating attribute between products and services (Bateson 1979). Levitt (1981) summarized that lack of physical attributes or intangibility was the key factor resulting in service variability, inseparability and perishability. Hence, fully understanding intangibility can help researchers to explore consumers' decision-making process, and help practitioners build marketing plans.

Bateson (1979) explained service intangibility as inaccessible to the senses and services compared with tangible goods or physical substances were physically intangible, and that they cannot be touched, tasted, smelled or seen. Shostack (1977) who first proposed intangibility, argued that tangible meant palpable and material, and that its antonym-intangible meant impalpable and not corporeal. In additional, he described intangible elements as dynamic, subjective, and ephemeral. The intangible attributes cannot be touched, tried on for size or measured, smelled or seen, displayed on a shelf, and are exceedingly difficult to quantify. Tangible objects are easily described precisely, physically examined, photographically reproduced, quantitatively measured, so easily be replicated, modified and duplicated. On the contrary, intangible products are dynamic, subjective and ephemeral, and are hardly replicated.

Berry (1980) defined intangibility as something that could not be touched, impalpable, defined, formulated, or grasped mentally. Van, Doris and Paul (1992)

characterized intangibility as immaterial as services are intangible like acts or deeds, and cannot be seen. Lovelock (2001) defined intangibility as untouched, wrapped or taken away. Bebko (2000) emphasized that intangibility includes another aspect such as lack of physical evidence of process instead of being defined exclusively as lack of physical attributes of services offered. The total degree of intangibility is affected by process and outcome. For example, the physical evidence referred to service delivery environment, interaction environment between service providers and customers, and any tangible commodities to facility the communication between providers and customers. Hence, he concluded that physical evidence could be used to deliver service quality and create service experience.

2.2.2 Perceptivity of intangibility

According to most of previous literature, intangibility dependeds on individuals and is a continuum. First, Hirschman (1980) clustered stimulus attributes into tangible features that were accessible by the senses and are palpable, and intangible features that were not palpable by the senses. She summarized that the tangible attributes came from directly from the product itself, and were detected by at least one of five senses and independent of consumers' mind. However, the intangible attributes depend on individuals' mind rather than physical senses perception. Hence, she further concluded that intangibility was influenced by consumers' product knowledge, socialization processes that include friends, family, school, church, mass media, etc. The tangible attributes are relatively stable compared with intangible attributes, as intangible attributes will be perceived differently by individuals and along varying time. From marketing

practitioners' perspective, intangible attributes have more value than tangible attributes. This is the reason that most practitioners want to augment their products added value rather than product physical attributes.

Second, most researchers (Shostack 1977; Lovelock 2001) agreed that the distinction between goods and services is continuous rather than discrete. It means, in real market, very few products are purely tangible products or intangible products. This point can be explained from two aspects: first, market entity is made up of the tangible attributes or assets and intangible attributes or assets; second, consumers' perception process often transfers from physical senses to mental impressions.

2.2.3 Dimensions of intangibility

At the beginning of intangibility study, Bateson (1979) who treated at tangibility as a multi-dimensional construct defined services as not only physically intangible , but also mentally difficult to grasp , and pointed out that two aspects of intangibility are physical and mental . The two aspects of intangibility are also echoed by the research of Hirschman (1980).

Breivik, Elinar, Troye and Olsson (1998) developed a two-dimensional concept of intangibility, namely, inaccessibility to senses and generality. First, they defined inaccessibility to senses as attributes that were mentally related to the product and that reflected mainly mental construction based on information related to the product rather than a direct dependence on product exposure. They argued that tangible attributes were perceived directly from exposure to the product, while intangible attributes reflect a mental construction based on the information about products. These researchers thought

that inaccessibility to senses was subjectively dependent as it was strong associated with the product more mentally than physically. Second, they defined generality as general attributes leading to general outcome and some specific features with products. For example, consumers may perceive that a certain brand of car is safe or a university education is expensive, etc.

Recently, Laroche et al (2001) constructed the multidimensional structure of the intangibility, which included physical, mental and generality. As aforementioned, the physical dimension of intangibility is the aspect most frequently referred to in services marketing. In fact, Shostack (1977) defined "intangibility" as "impalpable" and "not corporeal". Laroche et al (2001) defined the physical intangibility as "inaccessibility to the sensor".

Laroche et al (2001) defined generality of intangibility as to how general/specific a consumer perceives a particular product, and explained that products were perceived as general if consumers could not refer precisely to identifiable definitions, features and/or outcomes. Inversely, products are perceived as specific if they generate numerous clear-cut definitions, features and/or outcomes in the consumer's mind. The point about generality what to the research of Breivik et al (1998). For example, consumer can perceive a printer as a machine to print document, and consumer can acquire some specific factures about the printers such as resolution, speed, etc. Also he found that the degree of generality is distinct by types of products/services. Some products easily produce generality due to the difficulty of evaluation, the research of Breivik et al (1998) also got the same result.

Laroche et al (2001) defined the mental dimension of intangibility as goods that could be physically tangible, but could not be mentally grasped. Specifically, mental intangibility reflects the fact that physical tangibility does not ensure a clear, mentally tangible representation of an object, especially if the evaluator lacks experience with the object (Finn 1985; McDougall and Snetsinger, 1990). For example, in the mind of most customers, a used car can be mental intangible even if the customers physically touch the car. However, some experienced used-car buyers can mental grasp the used car by reading documentation about the car before they physically touch the car. With the development of the service industry and the popularity of Internet, there are more opportunities to separate physical intangibility and mental intangibility in online setting than in offline setting (See the part "intangibility in online setting" for details).

Also, Laroche et al (2001) found that the mental dimension of intangibility contributed more to the variance of the overall intangibility construct than did the physical and generality intangibility. These results demonstrated that a clear mental product does not necessarily mean it is physically more tangible or more concrete. In fact, some goods are physically tangible and mentally intangible, such as cutting edge consumer electronic products; whereas, some daily services were perceived as physically intangible and mentally tangible, such as express delivery industry.

2.2.4 Intangibility in online shopping

With the usage of the Internet and the development of online shopping, online shopping has taken some impact on intangibility: 1) the online shopping channel is

looked as an intangible channel rather than as the others traditional channel. 2) online shopping makes consumers reevaluate intangibility.

Featherman and Wells (2003) argued that many consumers looked at online systems as not easily embraced and adopted – artificiality, because the online system could not supply physical cues for consumers to evaluate the store. Such as, some consumers are accustomed to performing transactions using tangible paper-based forms rather than e-transactions, and thus prefer personal contact rather than computer interface. Those specific reasons disclose that online shopping as intangible channel give consumers a feeling of fake, unreality and artificiality. The researchers demonstrated that the intangibility of e-services would effect on artificiality, and perceived risk.

Moreover, Laroche et al (2004) found that the relationship between product intangibility and perceived risk in an online setting were weaker than the relationship in an offline setting. They explained the different correlation coefficient between online setting and offline setting is likely due to different intangibility of the two purchasing channel, in which online setting with high intangibility attribute will produce relatively high perceived risk, and offline setting with high tangible attribute would produce relatively low perceived risk.

Online shopping increases consumers shopping opportunity, in which consumer can browse and shop all kinds of products by only sitting in front of a computer screen. However, at same time, online shopping increases products' physical intangibility because online shopping at most supply a few product's picture to meet customers' visual senses, and cannot meet to the other physical feelings such as touch, scent, flavor.

On the other side about mental intangibility, online shopping does not always increase the dimension of intangibility. In some cases, if marketers can fully use the characteristics of Internet such as easily comparing and communicating information, they can decrease customers' mental intangibility. For example, most of online stores have powerful comparison ability that can help customers compare one new product with another old product that consumers have used. This method gives customers a clear mental picture. In another example, some virtual store or web site set up a customer's forum that provide abundant and fresh customers' feedback of products as mental cues to decrease potential customers' perceived risk.. Hence, we have the following hypothesis:

H1a: Physical product intangibility will positively influence consumers perceived product related risk in online environment.

H1b: Mental product intangibility will positively influence consumers perceived product related risk in online environment.

H1c: The impact of mental product intangibility to consumers perceived product related risk will be stronger than the impact of physical product intangibility in online environment.

2.2.5 Manipulation of intangibility

From the previous literature review, there is no research that manipulated product intangibility using the experimental method, which can be explained by many reasons.

First, intangibility is not a purely objective variable. It is a variable mixing objective with subjective influences. Hirschman (1980) concluded that the intangibility of products has unique meaning to every individual; hence, the subjective difference will influence reliability and validity of the manipulation.

Although, in experimental environment, we cannot fully manipulate subjective intangibility of products, we can manipulate the related product information to indirectly control individual's perception of intangibility. The similar method of increasing product tangibility is often used by online practitioners, and we will specifically discuss the method in the part of "Manipulation Method." Moreover, Laroche et al (2003) demonstrated that personal product knowledge would negatively affects the perceived risk of the products; hence our research will measure the participants' product knowledge and product brand name as extraneous variables, which cannot be controlled in the experiment. By measuring product knowledge and brand familiarity as a covariate variable in the research, we may be able to explain more variation of the dependent variable and get a more accurate picture for product intangibility of the treatments effects in the research.

Second, intangibility varies according different kinds of products on different purchasing channels. For example, for most consumers, some new launched consumer package goods products in a supermarket are looked as "no related usage experience" and

too much "uncertainty," although they can closely see and physically touch the products. For another example, most consumers perceive shopping no-digital products in online channel as full of inexperienced, invisible and untouchable elements. However, after Larcoche et al (2001) constructed the multi-dimension scale of intangibility, we can use the two dimensions that are physical and mental intangibility to categorize those different intangibility attributes on various products.

Third, until recently, the popularity of Internet and the appearance of some information technology just created necessary condition to manipulate the level of intangibility. For example, the high-speed access Internet makes digital media more popular, and indirectly produces more video on product introduction and product comparison. Consumers can search and review the products' introduction video by Internet to acquire tangible information and mirror an experience. Moreover, Simulation technology will give consumers similarly real experience on visual and hearing senses. The technology can mimic similar consumption experiences of products and directly increase consumer's mental tangibility.

2.3 Web Security and Personal Privacy

2.3.1 Effect of Web Security and Personal Privacy on Perceived Risk

Online shopping is one of the fastest growing shopping channels, and the growing rate surpasses that of traditional retailing. Forrester Research (2001) reported that in 2000 Internet sales to consumers reached to $48.3 billion, growing at a 46% increase rate. However the perfect sale increase rate cannot cover some key drawbacks of online shopping. According to the study (Shop.org & Boston Consulting Group 2000), there are only 2.8% consumers who visit a website finally buy product from the website. Another study that surveyed 9,500 online shoppers by BizRate.com disclosed that 55% of online shoppers gave up their "shopping cars" before checking out, and 32% of them abandon the purchasing attempt to get them. The interpretation of online purchasing can be attributed to two issues: Web security and Personal Privacy.

These two issues have been looked as the two major concerns and channel risk of online shopping by government and consumer organizations (CNN 2000; National Consumers league 1999). *Personal privacy* is individual information that belongs to personal asset on legal and ethical, but that are collected, transferred and deposited for commercial usage. This impinged privacy behavior mainly included some aspects: unauthorized sharing of personal information, unsolicited contacts from the online retailers or other online marketers, and undisclosed tracking of shopping behaviors (Miyazaki et al. 2001). *Web security* was defined as the extent to which one believes that the World Wide Web was secure for transmitting sensitive information. Web Security, includes concerns about potentially malicious individuals who breach technological data

protection devices to acquire consumers' personal, financial, or transaction oriented information (Miyazaki et al. 2001). Web security emphasizes consumers' concern about disclosure of transaction information as consumers lack special information technology. However, personal privacy focuses on the fact that online retailer or online marketer intentionally use personal information to acquire commercial return.

Moreover, for common consumers, there is not a very clear boundary between the two concepts. Although the two concepts have different perspective fields, they interactively influence each other. For example, high concern for personal privacy will directly produce negative attitude toward web security, and shoppers who lack knowledge about online security and the third party security identification will worry about disclosing personal information during the process of online shopping.

According to the theory of planned behavior (Ajzen 1991), attitudes toward a kind of behavior and subjective norm are determinants of intention to perform the behavior. In previous research about choosing a purchasing channel, consumers' attitude factors have been tested and shown as a significant result. For example, Evans (1996) found that attitude toward shopping had a significance effect on shopping center patronage intentions; Shim, Eastlick, Lotz and Warrington (2001) demonstrated that attitude toward the shopping channel contributes one-third of variation in intention to purchase. The consumers' concerns for web security and personal privacy will increase negative attitude toward online shopping; hence, the concerns will influence perceived risk in online shopping for the same level of product intangibility. The following hypotheses have been formulated:

H2a: Concern for Web security moderates the relationship between physical product intangibility and consumers perceived product related risk in online environment.

H2b: Concern for Web security moderates the relationship between mental product intangibility and consumers perceived product related risk in online environment.

H2c: Web security positively influences consumers perceived product related risk in an online environment.

H3a: Concern for Personal privacy is moderates the relationship between physical product intangibility and consumers perceived product related risk in an online environment.

H3b: Personal privacy moderates the relationship between mental product intangibility and consumers perceived product related risk in an online environment.

H3c: Concern for Personal privacy will positively influence consumers perceived product related risk in an online environment.

2.3.2 Changes of consumers' concerns of Web Security and Personal Privacy

With the popularity of online shopping and appearance of related legislation, consumers' concerns for web security and personal privacy are changing. Recently, legislative efforts are focused on privacy and security issues, attempting to regulate consumer-related e-commerce by requiring certain privacy and security related practices as well as the disclosure of these practices. Presumably, changes in online retailer practices that are deemed to be consumer friendly will build confidence and reduce perceived risk in online shoppers as the shoppers encounter them via increased Internet experiences. The popularity of refund guarantee from credit card companies will decrease

the concern for web security on the financial transaction aspect, and the usage of web site trust guarantees from a third party, including TRUSte, Web Assurance Bureau, CPA Web Trust Will, etc, will lease the worry about the disclosure of personal information.

The decrease of consumers' concerns for Web Security and Personal Privacy can be demonstrated by the latest GVU User's survey, which has accumulated a unique store of historical and up-to-date information on the growth and trends in Internet usage in global field. The North American participants occupied more than 85% of the total survey sample of GVU. The surveys listed judge quality, web security, personal privacy, and easier to buy locally as top four most frequently consumers' concern about online purchasing. Although the latest survey was conducted more than five yeas ago when online shopping environment changed dramatically, the survey still can tell us the basic trend .We intercepted the ongoing data during the last three years and build the Table 2.2:

Table 2.2: GVU Survey Results about online purchasing

Concerned items of online shopping	8th Users Survey (Oct, 1997)	9th Users Survey (May, 1998)	10th Users Survey (Nov, 1999)
Judge Quality	38%	39%	35%
Web Security	43%	39%	29%
Personal Privacy	30%	27%	22%
Easily Locally	20%	27%	17%

From the above table, we can find that "judge quality" is the prevalent consumer concern during their online purchasing process. The reason for this finding is high product intangibility in online purchasing environment and some consumers' subjective factors, which lack enough product knowledge and brand familiarity. The

consumers' concern for "web security" and "personal privacy" is a channel risk which may produce perceived risk in online purchasing.

2.3.3 Online experience effects on concerns of Web Security and Personal Privacy

Miyazaki et al. (2001) argued that online experience would lead to low concerns for web security, but would increase the worry about the personal privacy disclosure in the online shopping process. It is noticed that Miyazaki used the frequency of usage email to evaluate the participants' online experiences. Shim et al. (2001) demonstrated that the past online purchasing experience directly and positively impact online purchase intention. Miyazaki et al. (2001) found that the experience of using remote purchasing would decrease perceived risk of online purchasing.

Hence, in our research, we measure the participants' online purchasing experience to test the impact on concern for "web security' and "personal privacy" of online purchasing. Although our research objective is to explore the impact of product intangibility and the moderators-concerns of web security and personal privacy on perceived risk in online shopping, we still measure the online purchasing experience because we are not sure whether the variance of online purchasing experience on perceived risk can be explained by the concerns for web security and personal privacy or we are not sure whether the two variables could be highly correlated. Hence the following hypothesizes have been developed:

H4a: Participants with online experience will have lower concern for Web security than participants without online experience.

H4b: Participants with online experience will have higher concern for Personal privacy than participants without online experience.

2.4 Hypotheses Summary and Research Model:

H1a: Physical Product intangibility will positively influence consumers' perceived product related risk in an online environment.

H1b: Mental Product intangibility will positively influence consumers' perceived product related risk in an online environment.

H1c: The impact of mental product intangibility as consumers' perceived product related risk will stronger than the impact of physical product intangibility in an online environment.

H2a: Concern for Web security moderates the relationship between physical product intangibility and consumers perceived product related risk in online environment.

H2b: Concern for Web security moderates the relationship between mental product intangibility and consumers perceived product related risk in online environment.

H2c: Concern for Web security positively influences consumers perceived product related risk in an online environment.

H3a: Concern for Personal privacy is a moderator that moderates the relationship between physical product intangibility and consumers perceived product related risk in online environment.

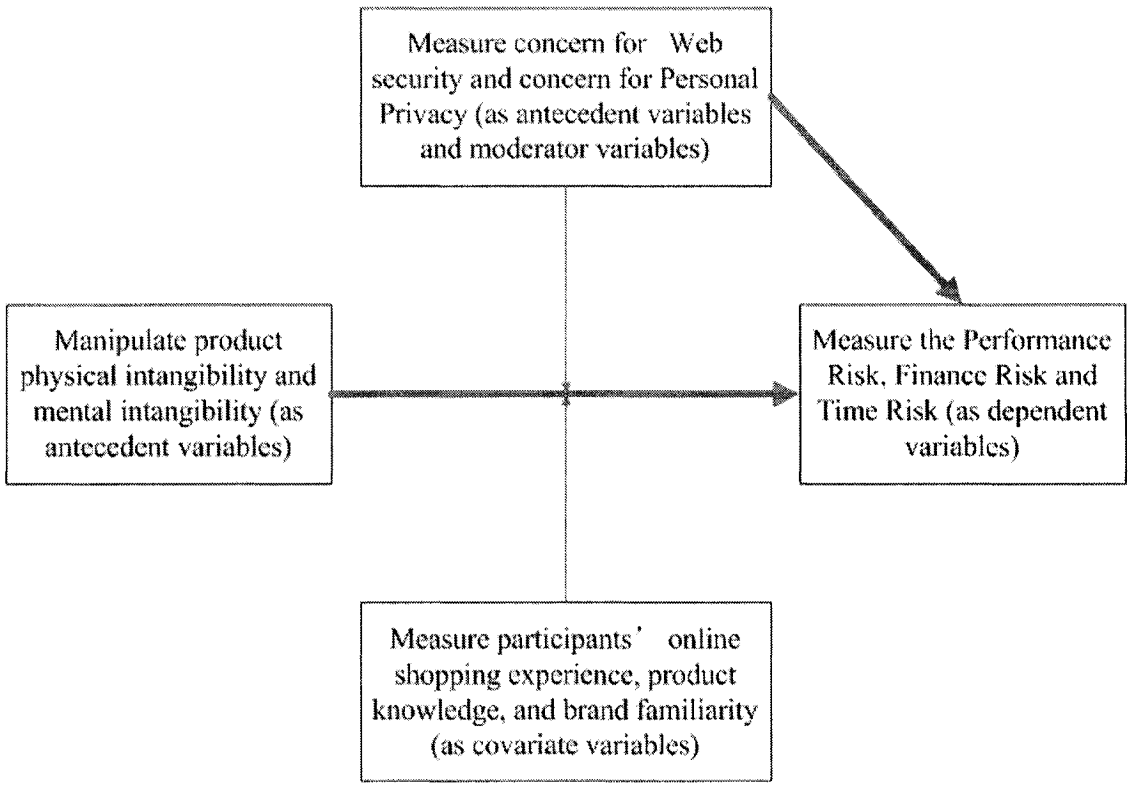
H3b: Concern for Personal privacy moderates the relationship between mental product intangibility and consumers perceived product related risk in an online environment.

H3c: Concern for Personal privacy positively influences consumers perceived product related risk in online environment.

H4a: Participants with online experience have lower concerns for Web security than participants without online experience.

H4b: Participants with have online experience will have higher concern for Personal privacy than participants without online experience.

Figure 2.1: Research model – Online Perceived Risk Model



Chapter 3 METHODOLOGY

3.1 Research design

The research is designed to: 1) test the causality between product intangibility and perceived risk in an online setting, 2) explore the moderating effects of web security and personal privacy on the relationship between product intangibility and perceived risk in an online setting.

In the present study, we use an experimental design to manipulate the independent variable-product intangibility and at the same time hold other variables constant. We want to separately explore the effects of physical product intangibility and mental product intangibility. We use two different groups, one represents to the physical intangibility and the other refers to the mental intangibility to avoid the possible interaction of these two dimensions. In each group, we use a within subjects design, which means that each participant is repeatedly exposed to the both control and experimental condition. In our study, the control condition refers to the basic product information – product intangibility, the experimental condition refers to detailed product information –product tangibility. After participants are exposed to one condition of a product, they are requested to evaluate the related perceived risk about purchasing the product in an online setting by online questionnaire.

For keeping the experimental environment similar to the real online purchasing environment and also guaranteeing all participants are being treated with the same information in the same condition, we use a software to manipulate the whole research process in computer-human interface.

All related product information is digitized into the software and the order of these product information is fixed. Participants review this information according to the fixed order, which is different with the real online purchasing process. In reality, however, consumer can freely choose product information and the order of the information. In our study, fixing the order of information can guarantee that all participants will be treated in the same condition.

Technically speaking, we use DreamWaver to design the manipulation software, which is realized in HTML and CFML form, and hosted on Cold Fusion (Application Server) and MYSQL (Database).

3.2 Experimental Procedure

The whole experimental procedure is made up of three parts, software system test, manipulation check test and formal test. Software systems are tested before launching to ensure that the software can smoothly be installed in target clients' system and that the clients can effectively use the software.

In the present study, the software system test checks the following points: first, the software can be installed in all personal computer systems in JMSB's MSC computer lab and a normal speed of broadcast multimedia product information is supported by the network of MSC computer lab; second, the software can accurately record data when many participants simultaneously use the software; third, the provided information can be understood by participants.

Eight participants simultaneously test the software in MSC computer lab. We assign everyone a specific number, which is from 1 to 8. All participants only fill in their number in all questionnaires using the PC. After the test, we can account the database to check whether the results are the same number as the number we gave to the participants. Moreover, the participants are required to record some contents that they feel are difficult to understand.

3.2.1 Manipulation check

This step ensured that those manipulation methods effectively control product tangibility in participants' mind and guarantee the construct validity of the research. The manipulation check test the convergent validity of the manipulation by checking it against measures of the construct and by ensuring that participants in condition of control or experimental treatment are experiencing different levels of product intangibility.

In total twenty participants are exposed to different intangibility setting for eight kinds of products, and then to measure those participants' intangibility by using online questionnaires.

Ten participants are exposed to the control condition, low product tangible information, and then we measure their perceived intangibility; after that, they are exposed to the experimental condition, high product physical tangible information, and secondly we measure their perceived intangibility. As the control condition, the low product tangible information only includes simple product pictured and product specification and the high level tangible information includes product pictures, video demonstrations, etc. The experimental information always included the control

information. It is noticed that the experimental information vary according to different products as different products category have different products characteristics. We use Paired-sample T tests to compare the two intangibility scores in different manipulation to test the manipulation effectiveness. Another ten participants are tested in the same procedure for another dimension-mental intangibility, and we compare the means of measurement intangibility by Paired-sample T tests.

Table 3.1: Product information for Manipulate condition

Manipulation Condition	**Product Information**
Control condition	Simple product picture, product specification
Experimental condition of physical tangible (group 1)	See manipulation method
Experimental condition of mental tangible (group 2)	See manipulation method

For example, Schwarz and Clore (1983) used a similar method to manipulate a subjective variable and tested the manipulation. They assessed the effectiveness of consumer's mood manipulation by having participants complete a mood measure, and compared the different mood scores in different manipulation settings to test the manipulation.

3.2.2 Formal experimental test

Step 1: We measure the participants' concern for web security and personal privacy, online experience, product knowledge and brand familiarity at the beginning of the research, avoiding product information in the control conditions or the experimental condition to influence variables.

Step 2: We use low product tangible information as the control condition, and high tangible information that includes physical and mental dimension as the experimental condition to manipulate participants' intangibility. To test the impact of physical tangible information, fifty participants, first are exposed to low-level tangible information for one product and we measure their perceived risk accordingly; second these participants are exposed to high-level physical tangible information for the same product and we measure their perceived risk accordingly. Because high-level tangible information has included low tangibility information, the low level stimulus cannot interact with the high level stimulus. Next, the participants are tested on other products. For mental tangibility, another fifty participants repeat the above procedure for the mental tangible information.

For the two dimensions of tangible information, we use between subject designs to avoid the interaction of the two dimensions of tangible information. The formal research needs one hundred participants for the physical and mental dimensions.

After every tangible information exposure, the participants are measured on their perceived risk accordingly. We measured the three dimensions of product related perceived risks (dependent variables) and all dimensions of perceived risks. To reduce order effect, 24 different test orders of products are used for the total of four products. The product order is controlled by the software.

Step3: According to the commitment of Human Research Ethics Committee, the research are total anonymous, excluding participants' age, gender, mother language, and cultural background. After the experiment, participants receive their reward, five (5)

Canadian dollars in cash. The whole research process for each participant takes 40-50 minutes.

3.3 **Research Instrument**

3.3.1 Products selected

The first criterion for selecting products (services) is that we can manipulate on the products intangibility easily in an online setting environment. Under human-computer interface, research should effectively control the product intangibility, and at the same time, participants should quickly perceive the difference in product intangibility. We need to choose products that could have the most significant results in the manipulation check. It mean those products' physical and mental intangibility' T value in Paired-sample T test have relative higher scores than the others.

The second criterion for products selection is that these products have big sales volume in online shopping; thus the research findings may more useful. According to the research (Rose and Howard, 2002), books, CD (music), travel, consumer electronic products and software are some of the best items on the Internet.

The last criterion for product selection is that these products should keep "a relative distance" to our participants, students of Concordia University. The relative distance means that the participants have relatively low product knowledge and brand familiarity about the products, as those extraneous variables might affect the dependent variable, product related risk.

Based on the above criteria and the fact that the research samples are university students in Montreal, we choose eight product categories were used in the manipulation

check: **Digital video, Ski vacation, MP3** (song), **Zoo** (safari), **Car** (purchase), **Car** (rental), **Book** and **MBA** (education). According to the results of the manipulations check, we chose four products for the formal experimental research.

3.3.2 Manipulation method

At the beginning, online practitioners only distributed products' name and specification on the web; next they display the products' pictures to increase products physical tangibility. When consumers see the products and services, they acquire the physical cue of the products. Today, with the development of technological information, some special online web sites have supplied three dimension pictures and auto spin pictures of products to increase consumers' vision sense and more tangible information. Those commerce websites include www.jeep.com , www.honda.com , and www.timex.com.

However, both online practitioners and online shopper are not satisfied with only acquiring products' physical tangible information in an online environment. In the travel industry, some websites use simulation technology to a tangibilize online shoppers' experience. For example, www.strolling.com allows online visitors to become virtual tourists. The site makes visitors wander the whole virtual city by clicking their mouse, a 360-degree surround video of the city, almost giving them a real experience. They could look both up and down, panning in any direction until a particular view appears. These type of websites use virtual presence technology to tangibilize some intangible experience, increasing their customers' mental tangibility.

For some digital products or easily digitized products, commercial websites provide digital free sample to enable shoppers to acquire a clear picture of product in mind. For example www.mp3.com provide free samples of renowned musicians' recordings, allowing it customers to download the sample potion of the CD; www.cinemamontreal.com deliver some movie trailer to give visitors chances to view the movie introduction before entering a real cinemas; www.amazon.com digitize the introduction of books to tell visitors what the contents of the book look like.

For most physical products that could not be easily digitized, commercial websites use product function introduction and specification to describe the products; however, this method is limited to the product knowledge of consumers. If consumers have proficient knowledge of the kinds of products, they will easily get a clear picture about the products; if not, they still feel high mental intangibility about the products. Hence, product knowledge is an important extraneous variable that we cannot control in the experiment but it will influence the dependent variable, perceived product related risk.

Finally, online shoppers often rely on the testimony of other shoppers for all kinds of products. Almost all kinds of commercial websites set up "visitors' book", "user reviews," "customers ranking," "customers BBS" to use previous customers' experience as a reference for the new customers. Moreover some websites often use "expert review" or "Product award" to give shoppers some mental implication of products. There is the manipulation method by product classification in the Table 3.2.

Table 3.2: Manipulation method by products

Product	**Physical tangible information**	**Mental tangible information**
Digital video (physical tangible product)	Picture of the Digital video	Product function description, features, competitor product comparison, user guideline, consumers' evaluation
CD (song) (digital product)	Picture of the CD, ads of the CD	Video sample of the CD, professional evaluation about the CD, introduction of the singers' backgrounds.
Book (physical tangible product, but easily be digitized)	Picture of front cover and back cover of the book	Table of Contents, excerpts of the book , index of the book, customer review.
Car (physical tangible product, hard to be digitized)	Internal and external pictures of the car.	Product function Description, features, competitor product comparison, testimony from a third party, consumers evaluation, Video about driving experience.
Zoo (safari) (service product)	Picture of the destination	Video about other travelers experience on the destination, other travelers evaluation.
Car (rental) (service product)	Picture of the rented car	Company background introduction, office location and contact information, car choose guider, confirmation of car services, transaction of the services.

Table 3.2: Manipulation method by products (Continued)

Product	**Physical tangible information**	**Mental tangible information**
MBA (service product)	Picture of MBA education facility, the Video of MBA class scene (only with background music , exclude any comments)	The ranking of the MBA, the content of the MBA, the video of the MBA students' experience, the video of teaching model, the statistics data about the MBA.
Ski vacation (service product)	Pictures about the natural scene of the ski vacation	Video about the history of the ski vacation and other skier experience, Testimony from a third party, award from the special ski magazine.

It is noticed that the information is exposed to the participants by fixed order rather than by consumers' free choice or clicks. The fixed order of the information ensures all participants in the same group (physical/mental) will acquire the same information on the contents in the same order. However, the fixed order is different from natural online setting, in which online shoppers can freely choose product tangible information in the related websites.

3.3.3Measurement

In this study only online shopping experience is nominal data, other items and variables are ratio data. Those ratio items are design on a 1 to 9 likert scale.

Online shopping experience is used by Shim et al (2003), the items are shown in Table 3.3

Table 3.3: Measure of online shopping experience

Item	Online shopping experience
1	In past 12 months, do you have Internet-shopping experience?(yes /no)

Product Intangibility scales are adopted from Laroche et al (2001), the scales are special for manipulation check. The items are shown in Table 3.4.

Table 3.4: Measures of Intangibility

Dimension of Intangibility	Items(1 representing strongly disagree, 9 representing strongly agree)
Physical Intangibility	1) This item is very easy to see and touch. 2) I can physically grasp this item. 3) This item is very tangible.
Mental Intangibility	1) I have a clear picture of this item 2) The image comes to my mind right away 3) This is a difficult product to think about. 4) I need more information about this item in order to make myself a clear idea of what it is. 5) This is not the sort of product that is easy to picture.

Product knowledge: Scales were constructed by Bearden(1983) and adjusted by Laroche et al. (2001)

Table 3.5: Measures of Product Knowledge

Item	Product Knowledge
1	Compared with my friends and acquaintances, my knowledge of the item is (weaker , stronger)
2	In general, my knowledge of item is ? (weaker , stronger)
3	Would you consider yourself informed or uniformed about the item ? （uniformed, informed）

Perceived Product related risk is classified into financial, performance and time risks. The items are extracted from Laroche et al. (2004).

Table 3.6: Measures of perceived risk

Dimension of perceived risk	Items (1 representing strongly disagree, 9 representing strongly agree)
Performance Risk	1) If I were to purchase *an item* within the next 12 months, I would become concerned that *the item* will not provide the level of benefits that I would be expecting. 2) As I consider the purchase of *an item* soon, I worry about whether it will really "perform" as well as it is supposed to. 3) The thought of purchasing an item causes me to be concerned for how really reliable that product will be.

Table 3.6: Measures of perceived risk (Continued)

Financial Risk	1) If I bought an item for myself within the next 12 months, I would be concerned that the financial investment I would make would not be wise. 2) Purchasing this item could involve important financial losses. If I bought an item for myself within the next 12 months, I would be concerned that I would not get my money's worth.
Time Risk	1) Purchasing *an item* could lead to an inefficient use of my time. 2) Purchasing *an item* could involve important time losses. 3) The demands on my schedule are such that purchasing *an item* concerns me, because it could create even more time pressures on me that I don't need.

*The items are adjusted by a little verbal change in order to fit the questionnaire of the research.

Concern for web security: scales were constructed by Salisbury, Pearson and Miller (2001); the items are shown in Table 3.7:

Table 3.7: Measures of Web security

Item	Web security, Items (1 representing strongly disagree, 9 representing strongly agree)
1	I would feed secure sending sensitive information across the World Wide Web
2	The www is a secure means through which to send sensitive information
3	I would feed totally safe providing sensitive information about myself over the World Wide Web
4	Overall, the World Wide Web is a safe place to transmit information

Concern for Personal Privacy: scales used by Wolfinbarger Mary (2003)

Table 3.8: Measures of Personal privacy

Item	Personal privacy, Items (1 representing strongly disagree, 9 representing strongly agree)
1	I feel my personal privacy are protected in online shopping.

Brand familiarity: scale constructed by Machleit (1990), for keeping consistence with other scale, most of which are 9-point scale, we adjust the scale from 7 to 9.

Table 3.9: Measures of Brand familiarity

Item	Brand familiarity
1	Do you think you are familiar the brand? (unfamiliar, familiar)

Chapter 4 ANALYSIS

4.1 Manipulation check

4.1.1 Data Analysis

After the software systems test, ten participants are invited to participate in the manipulation check for the physical tangibility test, and another ten participants for the mental tangibility test. The participants are undergraduate or graduate students of Concordia University. They are recruited by interception in the downtown campus of Concordia University. Table 4.1 shows the number of participants in the manipulation check test.

Table 4.1: Numbers of participants in Manipulation check

Dimension	Product	Number of participants
Physical tangibility	Book	10
	Car rent	10
	CD song	10
	Digital Camera	10
	Car	10
	MBA	10
	Ski	10
	Zoo	10
Mental tangibility	Book	10
	Car rent	10
	CD song	10
	Digital Camera	10
	Car	10
	MBA	10
	Ski	10

In here, Paired Samples T Test is used to analyze the effects of manipulation check for eight different products. Looking at the Table 4.3 - Manipulation check in the mental tangibility, it is clear that all products are perceived to have significantly differenct product tangibility between control and experimental group if critical P value is

5%. However there are still the car (p=0.025) and digital camera (p=0.025) that have relative higher P value than that of the other products.

Table 4.4 - Manipulation check in Physical tangibility indicates that CD (t= -0.964, *df*=9 , p=0.18) and MBA (t=-1.090, *df*=9, p=0.15) do not have a significant difference in Physical tangibility, if critical P value is 5%. In addition, the car (p=0.42) and digital camera (p=0.43) have relative higher P value than the other four products. Moreover, it is noticeable that all products' P value in the mental group are less than the counterpart' P value in the physical group; hence we can say that manipulating product mental tangibility is easier than manipulating product physical tangibility in an online setting.

3.1.2 Products selection

According to the results of the manipulation check in the mental group, all products fit the criteria of different tangibility level between the control and the experimental conditions. According to the results of the manipulation check in the physical group, CD and MBA there are in further testing because the two products had no significant difference of physical tangibility between control and experimental conditions.

However, CD was kept for the following reasons: (1) the CD product is the best selling product in Internet (Rose and Howard 2002) and it is easy to digitalize in online setting, this has been approved by many online practitioners; (2) the physical intangibility without significance can be explained by the fact that physical tangible attributes are not very important for CD, digitized product.

The product of MBA was deleted because it has low physical tangibility difference and the participants, university students, have deep previous knowledge and

brand concept about what MBA represents, influencing the dependent variables-Perceived Risk. Next, the product of Car was eliminated since there was low difference in both mental and physical groups (p =0.042 in physical group, p=0.025 in mental group).

Six products were used in the main study. However, it is better to use four products because too many products evaluation will fatigue participants and directly influence the results of the research. We chose the product of "Zoo (Safari)" and eliminated the product of "Ski". The two products both belong to service (traveling) products. However, our participants would have more previous knowledge about the product of Ski. Finally, we also erased the product of Car Rent because that the product is not as popular as the other four products in online shopping. The Table 4.2 shows products that will appear in main study.

Table 4.2: Selected Products for the main research

Product	Type	P value of physical manipulation check	P value of mental manipulation check
Book	Tangible product, but easily digitized	0.003	0.000
Digital Camera	Tangible product, and key attributes easily digitized	0.043	0.025
CD	Digital product	0.186	0.010
Zoo (Safari)	Service product	0.026	0.000

Table 4.3: T-Test Results for Manipulation check in mental tangibility

Paired Samples Statistics

product			Mean	N	Std. Deviation	Std. Error Mean
book	Pair 1	control	2.5000	10	1.76558	.55833
		experimental	6.7333	10	1.83114	.57906
carrent	Pair 1	control	4.6667	10	2.57720	.81498
		experimental	7.3667	10	1.32823	.42002
cdsong	Pair 1	control	5.7000	10	2.86938	.90738
		experimental	8.0000	10	.87489	.27666
digitalcamera	Pair 1	control	6.7667	10	2.25010	.71155
		experimental	7.9667	10	1.07094	.33866
MBA	Pair 1	control	5.4000	10	1.84458	.58331
		experimental	8.0333	10	.82327	.26034
ski	Pair 1	control	4.1333	10	2.67683	.84649
		experimental	7.7000	10	.90880	.28739
Zoo	Pair 1	control	4.7667	10	2.95250	.93366
		experimental	7.7000	10	1.14881	.36328
car	Pair 1	control	6.5333	10	2.23441	.70658
		experimental	7.5667	10	1.28668	.40689

Paired Samples Test

	Paired Differences					t	df	Sig. (1-tailed)
				95% Confidence Interval of the Difference				
product	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
book	-4.23333	1.94397	.61474	-5.62396	-2.84270	-6.886	9	.000
carrent	-2.70000	1.75295	.55433	-3.95399	-1.44601	-4.871	9	.001
cdsong	-2.30000	2.52127	.79729	-4.10361	-.49639	-2.885	9	.010
digitalca	-1.20000	1.65701	.52399	-2.38535	-.01465	-2.290	9	.025
MBA	-2.63333	1.61360	.51027	-3.78763	-1.47903	-5.161	9	.001
ski	-3.56667	1.83955	.58172	-4.88260	-2.25073	-6.131	9	.000
Zoo	-2.93333	2.01108	.63596	-4.37197	-1.49469	-4.612	9	.001
car	-1.03333	1.45254	.45933	-2.07242	.00575	-2.250	9	.025

Table 4.4: T-Test Results for Manipulation check in Physical tangibility

Paired Samples Statistics

product			Mean	N	Std. Deviation	Std. Error Mean
book	Pair 1	control	3.4667	10	2.57337	.81377
		experimental	5.1000	10	2.43458	.76988
carrent	Pair 1	control	3.7333	10	2.10115	.66444
		experimental	5.1000	10	2.85038	.90137
cdsong	Pair 1	control	5.2000	10	2.55893	.80921
		experimental	5.7667	10	2.64832	.83747
digitalcamera	Pair 1	control	5.3000	10	2.96252	.93683
		experimental	5.6333	10	3.03661	.96026
MBA	Pair 1	control	3.5333	10	2.04999	.64826
		experimental	3.9667	10	2.15137	.68032
Zoo	Pair 1	control	4.2333	10	2.53397	.80131
		experimental	4.9000	10	2.49469	.78889
car	Pair 1	control	3.5333	10	2.60199	.82282
		experimental	4.4333	10	2.78022	.87918
ski	Pair 1	control	3.2333	10	2.61548	.82709
		experimental	4.5000	10	2.91548	.92195

Paired Samples Test

	Paired Differences					t	df	Sig. (1-tailed)
				95% Confidence Interval of the Difference				
product	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
book	-1.6333	1.45254	.45933	-2.67242	-.59425	-3.556	9	.003
carrent	-1.3667	1.95284	.61754	-2.76364	.03031	-2.213	9	.027
cdsong	-.56667	1.85958	.58805	-1.89693	.76359	-.964	9	.186
digitalcam	-.33333	.54433	.17213	-.72272	.05606	-1.936	9	.043
MBA	-.43333	1.25757	.39768	-1.33294	.46628	-1.090	9	.150
Zoo	-.66667	.94281	.29814	-1.34111	.00778	-2.236	9	.026
car	-.90000	1.46608	.46361	-1.94877	.14877	-1.941	9	.042
ski	-1.2667	1.30337	.41216	-2.19904	-.33429	-3.073	9	.007

4.2 Data preparation

4.2.1 Data cleaning

In traditional surveys or in experiment using paper and pencil, it is quite difficult for researchers to find participants who are not serious about the survey or the experiment and who only rush through the process. However, in the online experimental environment, the database automatically records the time period for all participants in different experimental stages.

In our experiment, the database records the time period according to different product categories that covered different contents and different experimental treatments. The mental experimental treatment needs more time than physical treatment because the mental treatment includes text and video, while the physical treatment only includes product picture. Hence, we can use the length of time as a criterion to find some participants who use an extremely short time compared to most of the other participants to finish the research, and therefore eliminate the one who do not take the necessary time to complete the process.

First, we ran the SPSS-Explore for all period of times for all participants in two dimensions, which are mental and physical. The results are shown in Table 4.5. We can easily find that No42 (42 second), No30 (50 second) participants have the extreme lowest time period for one product in mental test, and that 98 (50 second), 94 (50 second) with lowest time in physical test.

Table 4.5: Extreme values of conduct time by dimension of intangibility

Extreme Values

dimension				Case Number	participants number	time (second)
mental	conductime	Lowest	1	370	42	42.00
			2	322	42	42.00
			3	362	30	50.00
			4	314	30	50.00
			5	178	42	64.00
physical	conductime	Lowest	1	573	94	50.00
			2	524	94	50.00
			3	664	87	53.00
			4	615	87	53.00
			5	675	99	54.00

Second, we run the SPSS-Explore for different product time period for all participants in two dimensions. From the result of Table 4.6, we also find No 42 participant who has one of the lowest time periods in different products tests including Book, CD and Zoo in mental dimension; No30 participant also has one of the lowest time period in different product tests: Digital Camera and Zoo in mental test. Hence, we can conclude that participants 42 and 30 use very short time to finish the test due to their uncooperative attitude rather than their strong product knowledge to overlook the treatment content.

Using the same method, we find that the No98 participant has one of lowest time periods in different product tests that are Digital Camera and Zoo in physical dimension. Therefore we eliminated all related data from participants No30, No42, and No98. By the process of data cleaning, the final sample size of mental group is 48 and sample size of physical group is 49.

Table 4.6: Extreme values by dimension of intangibility and products

Extreme Values

dimension	product				Case Number	participants number	time (second)
mental	book	conductime	Lowest	1	78	36	216.00
				2	30	36	216.00
				3	61	15	219.00
				4	13	15	219.00
				5	82	42	252.00
	cdsong	conductime	Lowest	1	178	42	64.00
				2	130	42	64.00
				3	156	14	192.00
				4	108	14	192.00
				5	153	11	208.00
	digitalcamera	conductime	Lowest	1	274	42	81.00
				2	226	42	81.00
				3	266	30	96.00
				4	218	30	96.00
				5	258	20	111.00
	Zoo	conductime	Lowest	1	370	42	42.00
				2	322	42	42.00
				3	362	30	50.00
				4	314	30	50.00
				5	340	6	108.00
physical	book	conductime	Lowest	1	471	90	67.00
				2	422	90	67.00
				3	470	89	81.00
				4	421	89	81.00
				5	474	93	85.00
	cdsong	conductime	Lowest	1	573	94	50.00
				2	524	94	50.00
				3	574	95	54.00
				4	525	95	54.00
				5	568	89	69.00
	digitalcamera	conductime	Lowest	1	664	87	53.00
				2	615	87	53.00
				3	675	99	54.00
				4	626	99	54.00
				5	650	71	80.00
	Zoo	conductime	Lowest	1	751	74	74.00
				2	702	74	74.00
				3	728	3	88.00
				4	679	3	88.00
				5	763	88	110.00

4.2.2Reliability of the measures

Reliability assessments are made for each of the multi-item measures used in this study. The the **Cronbach's alpha** and the **Strictly parallel** methods were test to test the goodness-of-fit of the multi-items.

Before testing the reliability of the measures, the data file was rearranged. Every participant is exposed to four products and two intangibility conditions, their Perceived Risk structures are evaluated eight (8) times per person. Hence, the sample size for Perceived Risk structure is n=776 (97*8), the sample size for Product Knowledge structure is n=388 (97*4), and the sample size for Concern Web Security is n=97. The related results are summarized in the Table4.7 -Summary of Reliability Measurements.

Table 4.7: Summary of Measurements' Reliability

Construct	Cronbach's alpha	Chi-Square	Degree freedom	Significance	Sample size
PR (performance)	.950	89.775	4	.000	776
PR (financial)	.937	26.282	4	.000	776
PR (time)	.939	27.634	4	.000	776
PR (privacy)	.944	155.607	4	.000	776
Product Knowledge	.966	56.189	4	.000	388
Concern for Web Security	.951	15.522	8	.050	97

From Table 4.7 all construct's alphas are more than 0.9 and P value less than 0.05, so there are satisfactory reliability levels for these measurements. We used each measure's average item score in the subsequent analyses.

4.2.3 Explore the structure of Perceived Risk

In current study, the dependent variable is PR (perceived risk), which has multiple aspects, including, performance, financial, and time. Although a previous study (Featherman, 2003) has proved that those multi-aspects are highly correlated, we still need to re-explore the inner relationship among those different PR aspects in current study. Moreover, further understand the structure of perceived risk, which is hypothesized to have two key components: product related risk and channel risk.

First, a factor analysis was conducted on all means of items that belong to one aspect of perceived risk, including performance risk, financial risk, time risk concern for web security and concern for privacy risk. The factor analysis used principal component extraction and varimax rotation with critical eigenvalue 1, and the results (Table 4.8-Total variance explained) show that exactly two components extracted. The results indicate that the first component highly correlates with "performance risk", "financial risk" and "time risk", which factor loadings are respectively 0.868, 0.925 and 0.863. The second component is attributed to concern for "web security" and concern for "personal privacy" and their factor loadings are respectively 0.851 and 0.862 (See Table 4.8 – Rotated Component Matrix).

It is noticed that the negative correlation between product risk and channel risk does not necessarily mean that the two components have reverse effectiveness on each other. The negative correlation is only due to the different directions between items of concern for "web security/privacy" and items of "performance risk", "financial risk" and "time risk".

From these results, we can conclude that the Perceived Risk can be divided into two components (refer to Figure 4.1- Component plot from Factor Analysis of perceived risk). One component stands for product related risk, which includes product performance –benefits from purchasing, time and financial risk – cost of purchasing. The second component refers to channel risk of online purchasing and almost excludes the product attributes. The total variance explained by the two factors is 77.11%.

Table 4.8: Results of Factor Analysis of perceived risks

Correlation Matrix

		Perform	finance	time	C-privacy	C-security
Correlation	Perform	1.000	.725	.590	-.105	-.063
	finance	.725	1.000	.738	-.136	-.094
	time	.590	.738	1.000	-.192	-.115
	C-privacy	-.105	-.136	-.192	1.000	.478
	C-security	-.063	-.094	-.115	.478	1.000

Total Variance Explained

	Initial Eigenvalues		
Component	Total	% of Variance	Cumulative %
1	2.457	49.147	49.147
2	1.398	27.965	77.112
3	.523	10.456	87.568
4	.404	8.072	95.640
5	.218	4.360	100.000

Extraction Method: Principal Component Analysis.

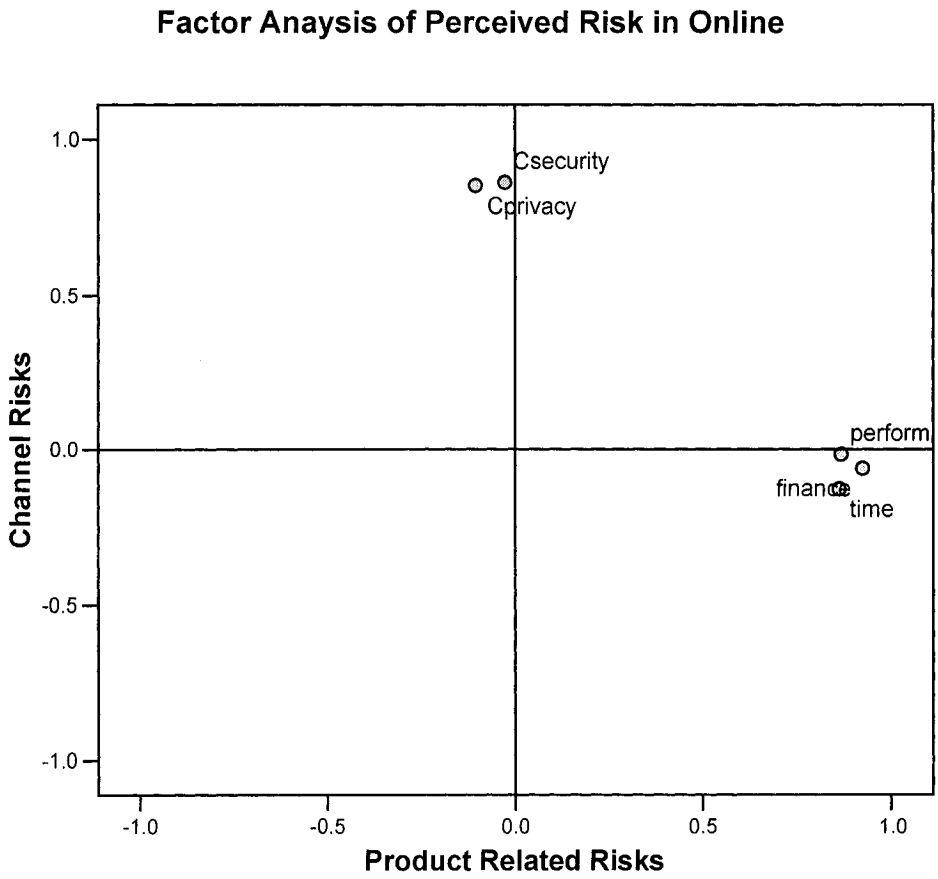
Rotated Component Matrix[a]

	Component	
	1	2
Perform	.868	-.016
finance	.925	-.062
time	.863	-.129
C-privacy	-.105	.851
C-security	-.027	.862

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

Figure 4.1: Factor Analysis of perceived risks in Online



4.3 Hypothesis Testing

Based on the analysis of dependent variables, performance risk, financial risk and time risk have more covariation and the channel risk have more unique attribute. We use multivariate analysis of covariance **MANCOVA** to test the hypothesis that product intangibility and channel risk directly affect product related risk, because MANCOVA can take into account the covariation between PR (perform), PR (financal), PR (time), and also can increase the significance level rather than using ANCOVA respectively (Lattin, Carroll and Green 2003). The theory of the variance analysis is supported by Naresh (2003). The author indicates that to use of MANCOVA tests, the dependent variables should be highly correlated. The three aspects of product risk fit the condition.

Regression tests the moderators' effects of channel risk -concern for web security and concern for personal privacy -on product related risk. This is based on Reuben and David (1986) who demonstrated when the moderators are continuous variables and the antecedent is a categorical variable, regressions can test the moderator effect. In the present research, the moderating variables, concern for web security and concern for personal privacy are continuous variables, and the independent variable, the intangibility condition is a categorical variable.

4.3.1 Direct effects on product related risks

Firstly, the whole data was split by the dimension of intangibility for the MANCOVA test, in which PR (perform), PR (financial), PR (time) are looked as dependent variables, condition of intangibility is incorporated as the main factor, product

knowledge , brand familiarity, concern for web security and concern for personal privacy are considered as covariate variables.

From the results in Table 4.9- Multivariate Tests, the experimental condition of mental intangibility (Wilks's Λ= 0.898, p=0.000) demonstrated that there are significantly different product related risks between the two mental experimental condition at 0.05 significant level. Moreover, from the Table 4.9- Estimated Marginal Means, the performance risk (M=5.559 in intangibility vs. M=3.988 in tangibility), the financial risk (M=5.210 in intangibility vs. M=4.106 in tangibility) and the time risk (M=4.245 in intangibility vs. M=3.385 in tangibility) have lower means of perceived risk in the tangibility condition than in the intangibility condition. Because the research method was to manipulate the main effect – products intangibility, we can conclude that the product mental tangibility will decrease the consumers perceived product related risk in online environment. Hence **H1b (**Mental Product intangibility will positively influence consumers perceived product related risk in an online environment) is supported.

From the results in Table 4.9- Multivariate Tests, the experimental condition of physical intangibility (Wilks's Λ= 0.948, p=0.000) demonstrated that there are significantly different product related risks between the two experimental condition at 0.05 significant level. Moreover, from Table 4.9- Estimated Marginal Means, the performance risk (M=5.799 in intangibility vs. M=4.855 in tangibility), the financial risk (M=5.440 in intangibility vs. M=4.708 in tangibility) and the time risk (M=4.765 in intangibility vs. M=4.214 in tangibility) have lower means of perceived risk in the tangibility condition than in the intangibility condition. We can conclude that the product physical tangibility will decrease product related risks in online environment. Hence **H1a**

(Physical Product intangibility will positively influence consumers perceived product related risk in an online environment) is supported.

About the concern for web security, from Table 4.9- Multivariate Tests, we find that the concern for web security (Wilks' Λ= 0.990, p=0.302 in mental group, Wilks' Λ= 0.998, p=0.824 in physical group) does not significantly influence the product related risk. Hence, **H2c** (Concern for Web security will positively influence consumers perceived product related risk in an online environment) is not supported.

On the contrary, the concern for personal privacy (Wilks' Λ= 0.950, p=0.000 in mental group, Wilks' Λ= 0.958, p=0.001 in physical group) significantly influences the product related risk at 0.05 significant level. Moreover, from the Table 4.9-Parameter estimate, the parameters of concern for personal privacy are almost negative (-0.314 in mental group, -0.011 in physical group) for performance risk, (-0.134 in mental group, -0.088 in physical group) for financial risk, and (-0.210 in mental group, -0.146 in physical group) for time risk. The item of personal privacy is that the anchor of 9 stands for the highest security of privacy in online, the anchor of 1 stands for the highest insecurity in online shopping; hence the negative parameters mean participants who perceived safety about personal privacy will have low a perceived risk. Hence, **H3c** (Concern for Personal Privacy will positively influence consumers perceived product related risk in online environment) is supported.

There is an interesting finding about covariate variables in the present study, product knowledge and brand familiarity. In the mental group, products knowledge (Wilks' Λ= 0.991, p=0.311) and brand familiarity (Wilks' Λ= 0.987, p=0.179) did not significantly influence the product related risks. However, in the physical group,

participants who have different products knowledge (Wilks' Λ= 0.959, p=0.001) or brand familiarity (Wilks' Λ= 0.929, p=0.00) perceived different product related risks. Moreover, from the table 20-Parameter estimate, the parameters of product knowledge are totally negative for performance risk (-0.013 in physical group), financial risk (-0.088 in physical group) and time risk (-0.207 in physical group). Hence, we can say participants' product knowledge can decrease the overall product related risks only in physical tangible information online environment.

Table 4.9-Results of MANCOVA Tests based on the split data by intangibility dimension

Multivariate Tests[b]

dimension	Effect		Value	F	Hypothesis df	Error df	Sig.
mental	Intercept	Wilks' Lambda	.502	124.495	3.000	376.000	.000
	Cprivacy	Wilks' Lambda	.950	6.587	3.000	376.000	.000
	Csecurity	Wilks' Lambda	.990	1.221	3.000	376.000	.302
	knowledg	Wilks' Lambda	.991	1.197	3.000	376.000	.311
	familiar	Wilks' Lambda	.987	1.644	3.000	376.000	.179
	Condition	Wilks' Lambda	.898	14.223	3.000	376.000	.000
physical	Intercept	Wilks' Lambda	.481	138.152	3.000	384.000	.000
	Cprivacy	Wilks' Lambda	.958	5.629	3.000	384.000	.001
	Csecurity	Wilks' Lambda	.998	.302	3.000	384.000	.824
	knowledg	Wilks' Lambda	.959	5.458	3.000	384.000	.001
	familiar	Wilks' Lambda	.929	9.718	3.000	384.000	.000
	Condition	Wilks' Lambda	.948	7.058	3.000	384.000	.000

b. Design: Intercept+Cprivacy+Csecurity+knowledg+familiar+Condition

Estimated Marginal Means by condition

condition

dimension	Dependent Variable	condition	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
mental	Perform	intangible	5.559[a]	.170	5.225	5.893
		tangible	3.988[a]	.170	3.654	4.322
	finance	intangible	5.210[a]	.166	4.883	5.537
		tangible	4.160[a]	.166	3.833	4.487
	time	intangible	4.245[a]	.164	3.922	4.568
		tangible	3.385[a]	.164	3.063	3.708
physical	Perform	intangible	5.799[b]	.146	5.512	6.087
		tangible	4.855[b]	.146	4.568	5.143
	finance	intangible	5.440[b]	.140	5.165	5.716
		tangible	4.708[b]	.140	4.432	4.984
	time	intangible	4.765[b]	.142	4.486	5.045
		tangible	4.214[b]	.142	3.935	4.494

a. Covariates appearing in the model are evaluated at the following values: C-privacy = 4.52, C-security = 4.8021, knowledge = 4.0417, familiarity = 3.53.

b. Covariates appearing in the model are evaluated at the following values: C-privacy = 4.71, C-security = 4.7500, knowledge = 4.1054, familiarity = 3.54.

Table 4.9-Results of MANCOVA Tests based on the split data by intangibility dimension (Continued)

Parameter Estimates

dimension	Dependent Variable	Parameter	B	Std. Error	t	Sig.
mental	Perform	Intercept	5.213	.367	14.215	.000
		Cprivacy	-.314	.079	-3.959	.000
		Csecurity	.065	.079	.820	.413
		knowledg	.065	.069	.942	.347
		familiar	-.108	.059	-1.818	.070
		[Condition=0]	1.571	.240	6.542	.000
		[Condition=1]	0[a]	.	.	.
	finance	Intercept	5.465	.359	15.215	.000
		Cprivacy	-.139	.078	-1.785	.075
		Csecurity	-.054	.077	-.694	.488
		knowledg	-.022	.068	-.330	.741
		familiar	-.093	.058	-1.611	.108
		[Condition=0]	1.050	.235	4.466	.000
		[Condition=1]	0[a]	.	.	.
	time	Intercept	4.675	.355	13.182	.000
		Cprivacy	-.210	.077	-2.732	.007
		Csecurity	-.014	.076	-.189	.850
		knowledg	-.052	.067	-.771	.441
		familiar	-.018	.057	-.318	.751
		[Condition=0]	.859	.232	3.700	.000
		[Condition=1]	0[a]	.	.	.
physical	Perform	Intercept	5.153	.326	15.798	.000
		Cprivacy	-.011	.044	-.245	.807
		Csecurity	.026	.047	.542	.588
		knowledg	-.013	.065	-.203	.840
		familiar	-.089	.060	-1.475	.141
		[Condition=0]	.944	.207	4.567	.000
		[Condition=1]	0[a]	.	.	.
	finance	Intercept	5.243	.313	16.737	.000
		Cprivacy	-.088	.042	-2.064	.040
		Csecurity	-.005	.045	-.104	.917
		knowledg	-.088	.062	-1.412	.159
		familiar	.074	.058	1.282	.201
		[Condition=0]	.732	.198	3.689	.000
		[Condition=1]	0[a]	.	.	.
	time	Intercept	5.125	.318	16.138	.000
		Cprivacy	-.146	.043	-3.380	.001
		Csecurity	-.008	.046	-.173	.863
		knowledg	-.207	.063	-3.271	.001
		familiar	.187	.059	3.185	.002
		[Condition=0]	.551	.201	2.739	.006
		[Condition=1]	0[a]	.	.	.

a. This parameter is set to zero because it is redundant.

Table 4.9-Results of MANCOVA Tests based on the split data by intangibility dimension (Continued)

Tests of Between-Subjects Effects

dimension	Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
mental	Corrected Model	Perform	383.525	5	76.705	13.852	.000
		finance	206.230	5	41.246	7.766	.000
		time	176.566	5	35.313	6.821	.000
	Intercept	Perform	1659.476	1	1659.476	299.691	.000
		finance	1654.478	1	1654.478	311.523	.000
		time	1201.452	1	1201.452	232.054	.000
	Cprivacy	Perform	86.771	1	86.771	15.670	.000
		finance	16.917	1	16.917	3.185	.075
		time	38.649	1	38.649	7.465	.007
	Csecurity	Perform	3.726	1	3.726	.673	.413
		finance	2.561	1	2.561	.482	.488
		time	.186	1	.186	.036	.850
	knowledg	Perform	4.915	1	4.915	.888	.347
		finance	.580	1	.580	.109	.741
		time	3.075	1	3.075	.594	.441
	familiar	Perform	18.302	1	18.302	3.305	.070
		finance	13.790	1	13.790	2.597	.108
		time	.522	1	.522	.101	.751
	Condition(main factor)	Perform	236.986	1	236.986	42.798	.000
		finance	105.910	1	105.910	19.942	.000
		time	70.898	1	70.898	13.694	.000
physical	Corrected Model	Perform	118.770	5	23.754	5.675	.000
		finance	82.088	5	16.418	4.253	.001
		time	139.365	5	27.873	7.026	.000
	Intercept	Perform	1383.655	1	1383.655	330.548	.000
		finance	1375.577	1	1375.577	356.360	.000
		time	1275.251	1	1275.251	321.465	.000
	Cprivacy	Perform	.251	1	.251	.060	.807
		finance	16.452	1	16.452	4.262	.040
		time	45.320	1	45.320	11.424	.001
	Csecurity	Perform	1.231	1	1.231	.294	.588
		finance	.042	1	.042	.011	.917
		time	.118	1	.118	.030	.863
	knowledg	Perform	.172	1	.172	.041	.840
		finance	7.699	1	7.699	1.995	.159
		time	42.442	1	42.442	10.699	.001
	familiar	Perform	9.109	1	9.109	2.176	.141
		finance	6.346	1	6.346	1.644	.201
		time	40.233	1	40.233	10.142	.002
	Condition(main factor)	Perform	87.309	1	87.309	20.858	.000
		finance	52.531	1	52.531	13.609	.000
		time	29.755	1	29.755	7.501	.006

Ran the whole data for the MANCOVA, PR (perform), PR (financial), PR (time) are looked as dependent variables, condition of intangibility, dimension of intangibility, are incorporated as factors, product knowledge, brand familiarity, concern for web security and concern for privacy are treated as covariate variables. The results are shown in Table 4.10.

According to the Table 4.10-Multivariate Tests, the interaction effect of intangibility condition and intangibility dimension is not a significant result (Wilks' Λ= 0.995, p=0.249). However, from the Table 4.10-Tests of Between-Subjects Effects, we find that the interaction of intangibility condition and intangibility dimension are significant for performance risk (F= 19.083, p=0.049) at 0.05 significant level, but it is not significant for financial risk (F= 4.910, p=0.302) and time risk (F= 4.611, p=0.316). It is demonstrated that the interactions are not significant in the overall product related risk, but it is significant for product performance risk. In addition, from the profile plots of Figure 4.2, Figure 4.3 and Figure 4.4 we can find that the mental tangibility slopes are higher than that of the physical tangibility in PR performance, PR financal and PR time. Hence the **H1c,** The impact of mental product intangibility to consumers perceived product related risks will be stronger than the impact of physical product intangibility in an online environment, is partially supported.

Table 4.10- Results of MANCOVA Tests based on the whole data

Multivariate Tests[b]

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Wilks' Lambda	.492	263.311	3.000	766.000	.000
Condition	Wilks' Lambda	.925	20.729	3.000	766.000	.000
Dimension	Wilks' Lambda	.967	8.758	3.000	766.000	.000
Csecurity	Wilks' Lambda	.999	.230	3.000	766.000	.876
Cprivacy	Wilks' Lambda	.973	7.128	3.000	766.000	.000
knowledg	Wilks' Lambda	.986	3.673	3.000	766.000	.012
familiar	Wilks' Lambda	.976	6.276	3.000	766.000	.000
Condition * Dimension	Wilks' Lambda	.995	1.376	3.000	766.000	.249

b. Design: Intercept+Condition+Dimension+Csecurity+Cprivacy+knowledg+familiar+Condition * Dimension

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	Perform	484.723[a]	7	69.246	14.047	.000
	finance	284.849[b]	7	40.693	8.852	.000
	time	373.238[c]	7	53.320	11.636	.000
Intercept	Perform	3112.326	1	3112.326	631.349	.000
	finance	3032.887	1	3032.887	659.767	.000
	time	2489.715	1	2489.715	543.313	.000
Condition	Perform	306.755	1	306.755	62.227	.000
	finance	154.081	1	154.081	33.518	.000
	time	96.467	1	96.467	21.051	.000
Dimension	Perform	64.012	1	64.012	12.985	.000
	finance	33.136	1	33.136	7.208	.007
	time	98.621	1	98.621	21.521	.000
Csecurity	Perform	.075	1	.075	.015	.902
	finance	2.058	1	2.058	.448	.504
	time	.714	1	.714	.156	.693
Cprivacy	Perform	40.860	1	40.860	8.289	.004
	finance	44.892	1	44.892	9.766	.002
	time	96.407	1	96.407	21.038	.000
knowledg	Perform	.699	1	.699	.142	.707
	finance	3.877	1	3.877	.843	.359
	time	28.829	1	28.829	6.291	.012
familiar	Perform	26.659	1	26.659	5.408	.020
	finance	1.165	1	1.165	.254	.615
	time	13.042	1	13.042	2.846	.092
Condition * Dimension	Perform	19.083	1	19.083	3.871	.049
	finance	4.910	1	4.910	1.068	.302
	time	4.611	1	4.611	1.006	.316

a. R Squared = .113 (Adjusted R Squared = .105)

b. R Squared = .075 (Adjusted R Squared = .066)

c. R Squared = .096 (Adjusted R Squared = .088)

Figure 4.2: Interaction of Intangibility dimension and Intangibility condition on Performance Risk

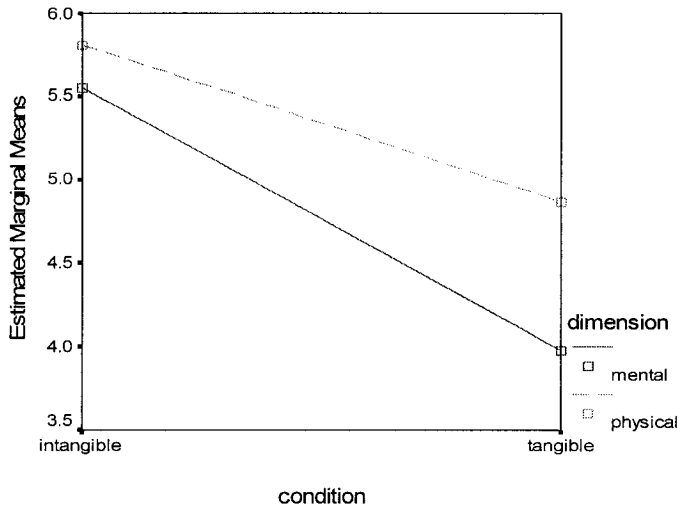


Figure 4.3: Interaction of Intangibility dimension and Intangibility condition on Financial Risk

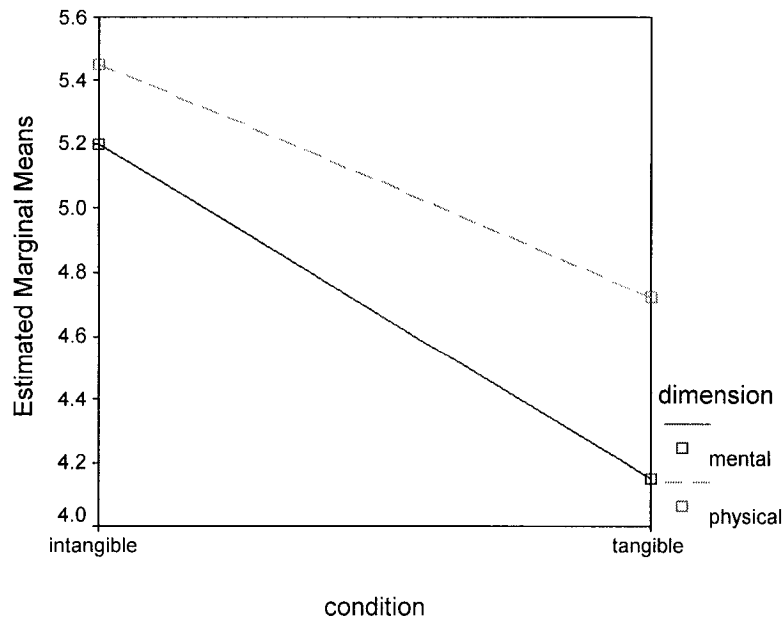
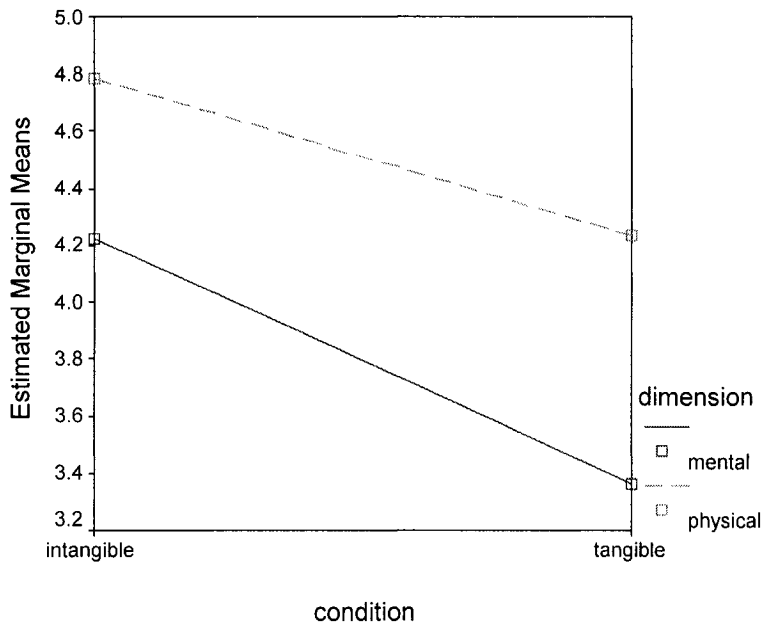


Figure 4.4: Interaction of Intangibility dimension and Intangibility condition on Time Risk



4.3.2 Moderating effects on product related risks

Regressions were used to test the moderating effects of channel risk- concern for web security and concern for personal privacy-on product related risk. The product related risks include three aspects, so three regressions were used to test the moderating effects on the three different risks, including performance risk, financial risk and time risk. From the literature review, it is indicated that the product intangibility and channel risk would influence the product related risks. Moreover the results of MANCOVA test (Table 4.10) have demonstrated this point. The hypothesis model that includes product related risks as dependent variable, and product intangibility and channel risk as the independent variables. According to Kleinbaum, Kupper, Muller and Nizam (1998), the backward elimination procedure in the regression process could be helpful when knowing all independent variables in the model.

In the present case, the backward regression model includes performance risk (financial risk or time risk) as the dependent variable, and independent variables as the following: condition of intangibility, concern for web security, concern for personal privacy , interaction of performance risk and concern for web security and interaction of performance risk and concern for personal privacy. The remove critical value for independent variables in the regression is set at 0.1 to remove critical value.

There is the only significant interaction between the condition of mental intangibility and the concern for personal privacy (B=0.189 t= 1.708, p=0.088) on performance risk, but not on financial risk and time risk (see Table 4.11, Table 4.12 and Table 4.13), which indicates that the interaction between the condition of mental intangibility and personal privacy can positively impact the product performance risk.

However no significant interaction between physical intangibility and concern for web security/concern for personal privacy in the final model on the performance risk, financial risk and time risk.

Hence about the moderating relationship between concern for web security /privacy and mental/physical intangibility, **H2a(Concern for** Web security moderates the relationship between physical product intangibility and consumers perceived product related risk in an online environment), **H2b**(Concern for Web security moderates the relationship between mental product intangibility and consumers perceived product related risk in an online environment) and **H3a**(Concern for Personal privacy moderates the relationship between physical product intangibility and consumers perceived product related risk in an online environment) are not supported. Only **H3b** (Concern for Personal privacy moderates the relationship between mental product intangibility and consumers perceived product related risk in an online environment) are partially supported.

Table 4.11 - Results of Regression Tests on Performance Risk based on the split data by intangibility dimension

dimension	Model		Unstandardized Coefficients		t	Sig.
			B	Std. Error		
mental	final	(Constant)	7.164	.392	18.268	.000
		condition	-2.425	.555	-4.373	.000
		C-privacy	-.355	.078	-4.540	.000
		condition*Cprivacy	.189	.111	1.708	.088
physical	final	(Constant)	5.799	.147	39.506	.000
		condition	-.944	.208	-4.547	.000

Table 4.12- Results of Regression Tests on Financial Risk based on the split data by intangibility dimension

dimension	Model		Unstandardized Coefficients		t	Sig.
			B	Std. Error		
mental	final	(Constant)	6.038	.298	20.269	.000
		condition	-1.050	.237	-4.440	.000
		C-privacy	-.183	.055	-3.358	.001
physical	final	(Constant)	5.889	.236	24.934	.000
		condition	-.732	.198	-3.693	.000
		C-privacy	-.095	.040	-2.361	.019

Table 4.13-Results of Regression Tests on Time Risk based on the split data by intangibility dimension

dimension	Model		Unstandardized Coefficients		t	Sig.
			B	Std. Error		
mental	final	(Constant)	5.278	.292	18.072	.000
		condition	-.859	.232	-3.705	.000
		C-privacy	-.229	.053	-4.277	.000
physical	final	(Constant)	5.535	.242	22.836	.000
		condition	-.551	.203	-2.709	.007
		C-privacy	-.163	.041	-3.947	.000

4.3.3 Effects of online experience on product related risks

ANOVA tested the effects of online experience on concern for web security and personal privacy. The test based on the whole data, included 21 participants without online purchasing experience and 76 participants with online purchasing experience. The dependent variables are respectively the concern for web security and web of privacy, and treated the online experience as main factor.

The online shopping experience (F=2.96, P=0,089; Table 4.14) does not significantly influence the concern for web security at 0.05 significant level. The online shopping experience (F=0.276, P=0,601; Table 4.15) did not significantly influence the concern for personal privacy at the 0.05 significance level.

Table 4.14: Results of ANOVA test for Concern for Web security

Tests of Between-Subjects Effects

Dependent Variable: C-security

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	14.679[a]	1	14.679	2.960	.089
Intercept	1337.478	1	1337.478	269.692	.000
EXPERIEN	14.679	1	14.679	2.960	.089
Error	471.131	95	4.959		
Total	2698.188	97			
Corrected Total	485.811	96			

a. R Squared = .030 (Adjusted R Squared = .020)

Table 4.15: Results of ANOVA test for Concern for Personal Privacy

Tests of Between-Subjects Effects

Dependent Variable: C-privacy

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1.513[a]	1	1.513	.276	.601
Intercept	1352.111	1	1352.111	246.370	.000
EXPERIEN	1.513	1	1.513	.276	.601
Error	521.373	95	5.488		
Total	2592.000	97			
Corrected Total	522.887	96			

a. R Squared = .003 (Adjusted R Squared = -.008)

In summary, the causal relationship between product intangibility and product related risks was demonstrated in online setting. Moreover, the hypothesized impact of the directly and moderating effects of personal privacy on product related risks also was existed. However, the directly and moderating effects of web security on product related risks was not found to be significant (refer to Table 4.16).

Table 4.16-Summary of Results of Hypotheses

Hypothesis	**Research Results**	
H1a: Physical Product intangibility will positively influence consumers perceived product related risk in an online environment.	Yes	
H1b: Mental Product intangibility will positively influence consumers perceived product related risk in an online environment.	Yes	
H1c: The impact of mental product intangibility on consumers perceived product related risk will be stronger than the impact of physical product intangibility in online environment.	Perform	Yes
	Time	No
	Financial	No
H2a: Concern for Web security moderators the relationship between physical product intangibility and consumers perceived product related risk in an online environment.	No	
H2b: Concern for Web security moderators the relationship between mental product intangibility and consumers perceived product related risk in an online environment.	No	
H2c: Concern for Web security influences consumers perceived product related risk in online environment.	No	
H3a: Concern for Personal privacy moderators the relationship between physical product intangibility and consumers perceived product related risk in an online environment.	No	

H3b: Concern for Personal privacy moderators the relationship between mental product intangibility and consumers perceived product related risk in an online environment.	Perform	Yes
	Time	No
	Financial	No
H3c: Concern for Personal privacy influences consumers perceived product related risk in online environment.	Yes	
H4a: Participants with experience have lower concern for Web security than participants without online experience.	No	
H4b: Participants with online experience have higher concern for Personal privacy than participants without online experience.	No	

Chapter 5 Discussion

Based on the results of hypotheses testing, the further discussion of online perceived risk and method of control the perceived risk will follow.

5.1 Structure of Perceived Risk in online shopping

It is clear that the measurements of the three aspects of product related risk have high reliability, and are consistent with the results of other researches (Featherman, 2003; Stone and Gron haug 1993).

The present study innovates by finding the extraction of two key components from the multiple aspects of perceived risk in online purchasing. One stands for the pure product related risk that included performance, financial and time risk of the product itself, which can be attributed to the uncertainty of the products' function, products' cost and products' purchasing time. Interestingly, the findings indicate that the highly correlation among performance risk, time risk and financial risk. The second component, customers' concern for web security and personal privacy during the purchasing process, is the special characteristic of online shopping channel. Most of the variance of can be explained by consumers' attitude to web security and personal privacy protection during the online shopping process rather than products' attributes including product performance and product cost. Hence, in this research, the total perceived risk seem to be approximately equal to the product related risk added to the online channel risk. These findings can also be supported by other studies (Taylor 1974, Cox and Rick 1964), which claimed that different distribution channels would have different influences on consumer's perception of risk.

5.2 Manipulation of Intangibility

The manipulation of the condition of intangibility indicated that the results of manipulation check, for most products, are successful. All the eight products are perceived to be of different mental intangibility, and six out of the eight products are perceived to be of different physical intangibility. The only two exceptions are CD and MBA, for which physical tangibility attributes are not key criteria in the purchasing process. For example, a consumer who purchases CD will listen to the music rather than admire the CD cover; MBA students will require high career return from the reputation of the business school rather than to have a pleasant time on the campus. The results indicate that product intangibility can be manipulated in online environment for academic research.

In addition, it seems easier to manipulate products' mental intangibility than to manipulate products' physical intangibility in an online environment (see Table 5.1). The different manipulative abilities can be attributed to the fact that the Internet channel is inclined to digitize some abstract or mental information including product reputation, purchasing experience and usage of feedback. However, the Internet lacks the ability to digitize products' physical attributes such as touch, smell, part of vision, three dimensions of products, etc. Although, online practitioners use products picture and specification to tangiblize product physical attributes, consumers still are not satisfied. Consumers want to purchase products in the physical store, when the products' key purchasing criteria belong to physical tangible information. Those products include clothing, shoes, furniture, car, perfume, etc.

Table 5.1: Results of the manipulation by intangibility dimension

Product	Type	P value of physical manipulation check	P value of mental manipulation check
Book	Tangible product , but easily be digitized	0.003	0.000
Digital Camera	Tangible product , and not easily be digitized	0.043	0.025
CD	Digital product	0.186	0.010
Zoo(Safari)	Service product	0.026	0.000
Car	Tangible product , difficult to be digitized	0.042	0.007
Car rent	Service product	0.027	0.008
MBA	Service product	0.150	0.001
Ski	Service product	0.007	0.000

The different abilities on the Internet to manipulate product information between mental tangibility and physical tangibility are one of the key reasons for asymmetric success of some product category in online shopping. According to the research Laroche et al. (2003), some products mental tangible information is more important than physical tangible information during the purchasing process. For example, books, music, travel, computer hardware, software, consumer electric products and other information products have more important attributes from the mental aspect rather than from the physical aspect. When the product characteristics fit the Internet manipulation ability, the product categories easily succeed in the online shopping. However, some products that have more key attributes from the physical information aspects will not

easily succeed in online channels. Most consumers prefer to choose products with key physical attribute information in brick and mortar stores, because they cannot acquire enough physical tangible information online.

Vijayasarathy (2002) concluded that products' tangibility attributes had a significant influence on consumer intention to online shop and consumers prefer online shopping for intangible products rather than tangible products. The present indicates that consumer prefers to shop products with mental intangible attributes rather than product with physical intangible attributes online. For example, consumers often shop books, software, electric consumer products rather than clothing, furniture, perfume, etc.

5.3 Factors affecting product related risk

5.3.1 Product intangibility

The total perceived risk in online shopping is decomposed into two key components: the product and the channel related risks. For the *product related* risk, the study showed the causality between product intangibility and perceived product related risk in online shopping. Specifically, product physical intangibility and mental intangibility both increase the perceived product related risks in the online shopping process. Moreover, the causality is separately significant in three different aspects of perceived risk, including performance risk, financial risk and time risk. As demonstrated previously by Laroche et al. (2004) and Featherman et al. (2003), the present study supports the hypothesis that product intangibility lead to perceived risk.

The impact of mental product intangibility on consumers' perceived performance risk will be stronger than the impact of physical product intangibility on performance risk in an online environment. Although the result is not significant for time risk and financial risk, it still has a strong academic contribution and managerial implications. With the complexity of products and the appearance of service products, consumers pay more attention to the mental information of products than to the physical information; more products are positioned by the intrinsic or mental value instead of the surface or physical value (Hirschman, 1980). As expected by Hirschman, the manipulation of the mental information on products is more effective on perceived product risk than that of physical information. In the real business world, online practitioners have created mental tangible information for products, such as product comparison, simulation of consumption experience and customer testimony, decreasing the perceived product risk for consumers.

According to the structure analysis of perceived risk, performance risk, financial risk and time risk are highly correlated. The reason that the findings of mental tangibility are more effective than the physical tangibility only fits the performance risk and does not fit the time risk and financial risk could be attributed to two reasons. Firstly, in an experiment test like this one, participants are only exposed to the product function information and brand names of the products, excluding price information of the products and the specific purchasing scenario. Therefore for participants may have difficulty to evaluate the financial risk and the time risk in an experimental situation comparison to in an real online shopping. Secondly, in the experimental setting, the participants lack the

real financial pressure and time concern during their evaluation of the online questionnaire.

5.3.2 Concern related to web security and personal privacy

For product related risk, the concern for web security does not significantly influence the product related risks, while the concern for personal privacy will do. Concern for web security emphasizes the consumers' concern for disclosure of transaction information as the consumer lacks knowledge of technological information; for example, whether online payment is safe. However, personal privacy focuses on online retailer or online marketers' intention to use the consumers' personal information to acquire a commercial return. The insignificant results of web security are consistent with the findings of Miyazaki and Krishnamurthy (2000) that the consumers' concern for web security are decreasing with the growth of online credit guarantees and the popularity of online technology.

On the other hand, the concern for personal privacy increases product related risks. Ajzen (1991) demonstrated that consumers' attitude to one channel would influence the purchasing of specific products in the channel. Moreover, the finding also indicate us that although online shopping is perceived as safe in technology aspects, which web security does not significantly influence the product risk, online shopping may be perceived to disclose consumer personal privacy information. It means that the cutting edge of Internet technology both protects online financial transaction and, at the same time, easily captures personal privacy information by trailing analysis or cookies bury. In

addition, online retailers always intentionally search for personal privacy information for their own business gains.

Finally, there is an interaction relationship between concern for personal privacy and mental product intangibility on the effects on the performance risk. When consumers acquire sufficient product information (mental information), their concerns of personal privacy will decrease the effectiveness between products' mental information and perceived performance risk of the products. For online practitioners, the finding has an important implications that effective online shopping stores or websites should always protect their customers' personal privacy in the long run; otherwise the stores will not only lose the trust of their customers but also fail to deliver product information to their customers.

5.3.3 Product knowledge and brand familiarity

Product knowledge and brand familiarity are found to significantly influence the product related risk in the physical intangibility group, but not in the mental intangibility group. As the mental tangibility information explained most of the variance of the total product information and has relatively strong relationship with perceived risk compared with the physical tangibility information (Laroche et al. 2001), we can substantiated the findings. When consumers only acquire few or superficial product information, consumers' previous product knowledge and brand familiarity influences the consumers' perceived product risk. However, when consumers obtain further information on the products, their original product knowledge and brand familiarity lose the influence to their product risk. Specifically, product knowledge will decrease the consumers perceived product related risk in the physical tangible information conditions.

5.4 Online shopping experience effects on web security and personal privacy

Online shopping experience does not significantly influence the consumers' concern for web security and concern for personal privacy. While Jarvenpaa and Todd (1997) claimed online shopping experience dissolve consumer concerns regarding the privacy and security of online shopping. Salisbury et al. (2001) found shopping experience did not impact the concern for web security. Therefore, although some consumers are familiar with computers, information technology, and Internet shopping, they are still concerned with the web security and personal privacy during the online shopping process. Hence, the web security and personal privacy issues cannot be resolved only by technological aspects; they required to be envisioned in a whole mindset where technology solution cannot be separated from ethic and consumption protection or law development.

Chapter 6 Conclusion

6.1 Theoretical Contribution

Through this study, an on online Perceived Risk Model is developed which integrated two existing theoretical models. Laroche et al (2003, 2004) *Intangibility* model suggested that product intangibility would lead to consumers' perceived risk. Ajzen (1991) Theory of Planned Behavior model indicated that consumers' previous attitude to one channel or channel purchasing was determinants of the shopping behavior in the channel.

The current study demonstrates the causality between product intangibility and perceived risk in an online setting, which bridge the gap of previous marketing researches. Those previous researches only disclosed the correlation relationship between product intangibility and perceived risk. The demonstrated causal relationship indicates that the increase product tangibility reduces consumers' perceived risk in online environment.

Moreover, the study firstly uses experimental method to manipulate the product intangibility in an online setting. It supplies a useful experimental method for future academic research in related topic in an online setting.

Finally, the current study indicates that *personal privacy* rather than *web security* directly and moderately influence the perceived risk in an online setting. This is due to the increase of consumers' Internet knowledge, and, at the same time, the increase of disclosure personal privacy during online shopping processes.

6.2 Managerial Implication

6.2.1Differentiate products by intangibility

Online shopping does not apply to all service or products. Some products succeed in online channel as the products' key attributes are easily digitized and manipulated by Internet; hence consumers can fully grasp the key function of the products on the Internet. These products include books, consumer electronics products, software, etc. Their key products functions belong to the mentally tangible information. However other products cannot achieve easy success in online shopping, because the Internet cannot deliver the products' key attributes. These type of products include clothing, furniture, fresh food, perfume, for which key purchasing criteria need be evaluated by consumer physical senses only in an offline store.

In reality, online marketers should explore the key functions or purchasing criteria of their products. If these products' key purchasing criteria belong to the mental tangibility information, these products have a high possibility of succeed in online shopping. If the criteria belong to the physical tangibility information, it is not easy for these products either to achieve good sales results or to complete the whole online purchasing process. Specifically, when the new product development is conducted in the stage of Usage and Attitude Test, marketers should find out whether target customers' key purchasing criteria are located in the mental tangible dimension or the physical tangible dimension. According to the dimension of the product purchasing criteria, marketers can design the corresponding sales channels and marketing plans.

Even if the products' key attributes belong to the physical tangible information, it does not mean to give up the online channel totally. Marketers should use the online

channel to distribute the products' mental information to improve customers' mental understanding of the products and provide the offline stores to give customers a specific physical product experience to finish the whole purchasing process. For example, online marketers can create some local stores' information or pictures in the virtual websites to bridge the gap between virtually mental understanding and really physical experience of the product.

6.2.2 Increase products' tangibility

Confirming the dimension of products' key purchasing criteria, marketers should increase the products' tangibility as much as they can. In general, for most products, marketers should supply more mental product information than physical product information, because the mental information more effectively influence the consumers' perceived performance of the products.

During the process of supplying tangible information, online marketers should use multiple methods that include product pictures, text description, sample video, product comparison, and multiple resources to embrace manufacturers of the products, the third party organization and customers' feedback. Different customers have different reading abilities and comparison abilities. For example, some customers prefer products video or picture as those materials will give them a direct impression of the products; some customers prefer text description of products and complex products comparison with numbers as they like quantitative intelligent challenges. Some of customers who access the Internet by high-speed can easily see the video content from the website; while, other customers who access the Internet by dial-up can only review some text or simple

pictures. In addition, information from multiple resources will increase the customers' trust of the information and decrease the uncertainty of the products' information.

Website's architecture should fit the customers' characteristics and demands. When customers have specific product knowledge and sensitive price concern, marketers should use the product-driven website style to deliver product information to their customers, such as www.ca.dell.com. However, if customers do not have enough product knowledge, marketers should use consumer-centric website, such as www.baby.com. Therefore, successful increasing customers' perceived product tangibility does not necessarily mean to simply accumulate product information in websites.

An increase of products mental tangibility in the online environment requires a huge investment on the content production, website maintenance and supply online feedback. Therefore, marketers have difficulty to balance the trade-off between the benefits from the increase and the cost to produce the increase. In the following situations, increasing product physical intangibility will produce similar results than the mental intangibility. When the target customers have high brand familiarity of the products, marketers only supply the brand name and specification of the products. On the other hand, when the target customers have a relatively high prior knowledge of the product category, marketers can supply only text descriptions or product comparisons rather than other multimedia video demonstrations of the products.

6.2.3Make website a security reputation

Customers' concerns for web security and personal privacy have been major obstacles to online shopping. They not only directly influence customers' online risk, but also indirectly produce some negative impact on the evaluation of the products. Although a company cannot change its customers' general attitude to web security and personal privacy during the online shopping process, marketers can establish a good reputation for their websites. For most online stores with relative small business scope, the third–party seals of approval, such as Better Business Bureau online, VerSign and Web Assurance Bureau, are the most common methods to reduceing their customers' web security and privacy concerns. When the customers find a logo of the third–party seals, they will increase their trust on the web site. For a few integrated online stores, marketers can build customer order checking systems and a customer service center. Order checking systems can tangiblize the intangible online purchasing process by showing customers the specific transaction records; a customer service center can give customers a physical cue about the services.

6.3 Limitations

Although the present study has explored the causality between products intangibility and product related risk in online shopping, it is important to recognize its limitations and the improvements for future research.

Firstly, the experimentation cannot guarantee that all participants in the same group are treated completely within the same way due to the limitations of the technology and the software used in our experiment. The website form to connect all product information was the fixed order, but in reality participants may use different times to read the products information according to their individual interests and their reading abilities. For example, some participants spend a lot of time on text description of products; while others spend more time on video samples of the products. The different style of exposure to the products' information will produce different treatment results. In the future research, it would be suggested to use MACROMEDIA to structure all product information because the MACROMEDIA can control the order and time of the whole process of information broadcast.

Secondly, because the experimentation included multiple stimulating information, it is difficult to evaluate which stimulus contributes more variance of the participants perceived product tangibility or which stimulus decreases more variance of the product related risk. In future research, it is suggested to explore the contribution from different contents such as text, picture, video, simulated virtual experience on message effectiveness and tangibility augment. The research topic is far beyond the present study, but it will have strong practical implication with the development of virtual shopping and the popularity of high-speed access to Internet.

Thirdly, the use of a student sample may produce some system bias in the research model. University students have more Internet knowledge and online shopping experience (78.35% of participants have online shopping experience). However, with the popularity of the online shopping in the foreseeable future, people may acquire more Internet knowledge and online shopping experiences; hence, the system bias may give forward-looking results. It is a quite possible that participants in other samples may have different channel risks and different perceived risks. It is suggested to do a similar study based on householder samples or other non-student samples in order to improve the external validity of the findings.

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